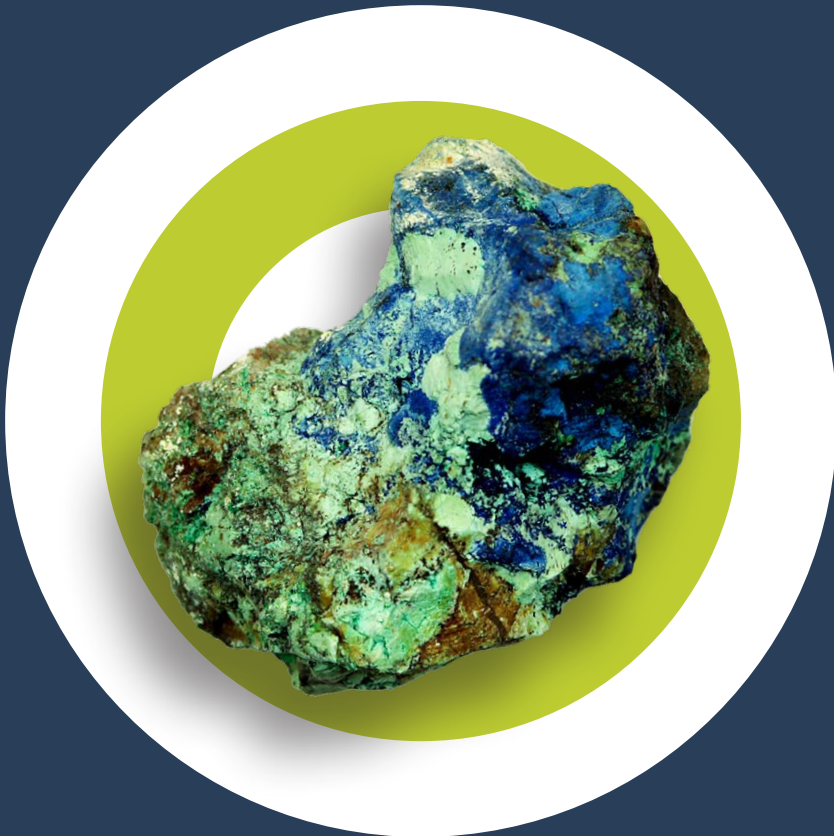


**MINERALS COUNCIL OF AUSTRALIA
& COMMODITY INSIGHTS**



COMMODITY DEMAND
Outlook
2030



Maximising growth opportunities

As the world economy recovers from the impacts of the COVID-19 pandemic, the global trends that have driven growth in mineral and energy commodity demand through the last 20 years will not only continue, but accelerate.

Commodity Demand Outlook 2030 outlines the long-term prospects for key mineral and energy commodities produced by Australia and how global trends will shape opportunities for the Australian economy. It draws on analysis and forecasts from industry experts Commodity Insights, consultants commissioned by the MCA.

This report highlights how the technology-led productivity growth that has lifted the incomes and improved the living standards of millions of people in highly populated economies will be a driving force of higher commodity consumption.

Coupled with rising urbanisation rates, this will drive higher demand for industrial commodities such as steel, zinc and copper to build high density housing, new manufacturing plants and connect cities with larger transport infrastructure networks.

As incomes rise, consumption of household electrical appliances, consumer electronics and packaged food in these economies will grow, supporting increased aluminium demand.

Ongoing innovation will see smaller, more powerful circuits and processors which rely on rare earth elements, copper and silver to enhance their performance.

The transition to zero emissions energy will accelerate in the next decade. This too will rely on new metal-intensive electricity generation and transportation technologies such as renewable energy, nuclear power and electric vehicles that will create higher demand for lithium, uranium, copper and nickel.

The MCA supports the Paris Agreement and reaching global net zero as soon as possible through technology.

A final trend that will continue shaping global financial systems is the growing reliance of governments on expansionary monetary policy and debt-financed public spending to drive economic growth. Increases in money supply and low yields on bonds will continue to push investors towards alternative low-risk, physical assets such as gold and silver bullion.

Inside

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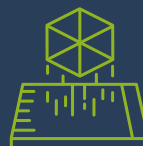
INDUSTRIAL COMMODITIES



- 6 Iron ore
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- 10 Aluminium
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- 14 Copper
- 16 Nickel
- 18 Rare earth elements
- 20 Lithium



for Australia

The Australian mining industry is a world leader in the exploration geoscience, processing technologies and environmental management systems needed to sustainably meet the world's growing mineral and energy commodity needs over the next decade.

The MCA and the minerals industry are working with communities, stakeholders, investors and governments to maximise Australia's potential role in future supply chains and continue to deliver the investment, jobs and support for local businesses that benefit all Australians.

A handwritten signature in yellow ink that reads "Tania Constable".

Tania Constable
Chief Executive Officer
Minerals Council of Australia



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ENERGY COMMODITIES



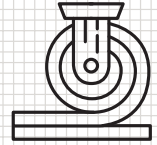
- 22 Thermal coal
- 24 Uranium

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PRECIOUS METALS



- 26 Gold
- 28 Silver



Infrastructure

Iron ore makes the steel used to build the roads, bridges and ports that keep the world moving.

868Mt

EXPORT VOLUME

Australia was the world's largest iron ore exporter in 2020.

\$117b

EXPORT REVENUE

Iron ore was Australia's largest source of export revenue in 2020.

70k

EMPLOYMENT

The industry was a significant employer in regional Australia in 2020.

\$7.8b

ROYALTIES

Iron ore's contribution to state government revenue in 2020.

51Gt

RESOURCES

Australia has the world's largest economically demonstrated resource (EDR) of iron ore.

\$396m

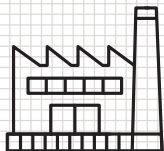
EXPLORATION

Exploration expenditure by the iron ore industry in 2020.



Construction

From houses to stadiums to skyscrapers, more than half of the world's steel is used in construction.



Manufacturing

Steel is the backbone of manufacturing and it starts with the machinery on the factory floor.

The **Q1 Tower** in Surfers Paradise stands 322.5 metres tall and required more than 9300 tonnes of steel in its construction.



Iron ore

minerals.org.au

Iron ore

INDUSTRIAL
COMMODITY



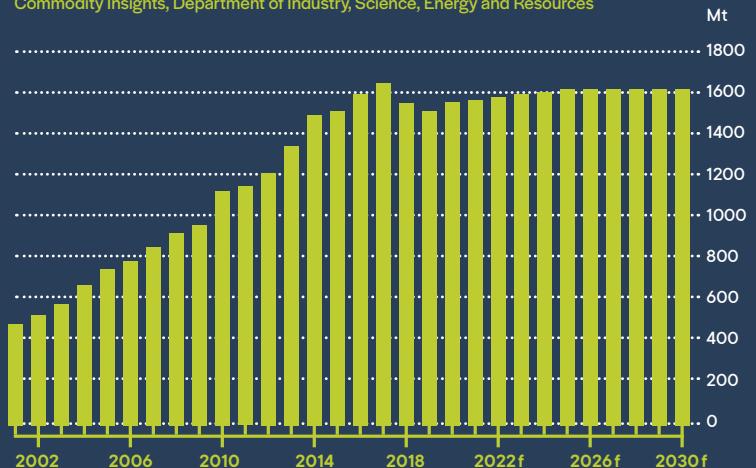
Outlook to 2030



**STEEL IS THE
FOUNDATION OF
21ST CENTURY
ECONOMIES**

Seaborne iron ore trade

Commodity Insights, Department of Industry, Science, Energy and Resources



Rising urbanisation rates in highly populated Asian economies and their continued industrial expansion will drive growing steel demand to 2030 (and beyond).

The stock of steel in these highly-populated developing nations remains less than half that of OECD economies and will grow substantially over the next decade as new high-density housing, transport infrastructure and manufacturing plants are built.

Ongoing growth in steel use is expected to support robust demand for high-grade iron ore, such as mined ores in Australia, which requires less energy per unit of steel and produces fewer carbon emissions.

Commodity Insights forecasts seaborne iron ore demand to rise moderately to 2030, from 1504 Mt in 2019 to 1616 Mt in 2030. This represents overall growth of 8 per cent over the forecast period, or at a compound average growth rate (CAGR) of 0.7 per cent per annum.

In China, the world's largest steel producer and consumer, Commodity Insights forecasts demand for high-grade seaborne iron ore to remain high, but ease slightly in the second half of the next decade due to greater utilisation of recycled steel.

Steel production in India is forecast to continue rising to 2030. However, India is likely to mainly use its own domestic iron ore resources to support its steel industry. India's resources tend to be lower grade and steel mills may look to higher grade iron ore imports to improve their operating efficiency.

Japan, South Korea and Taiwan are projected to remain key markets for seaborne iron ore, but lower steel production in these advanced economies is expected to result in reduced demand for iron ore.



OPPORTUNITY FOR AUSTRALIA:

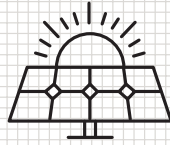
Robust demand for high-grade iron ore in Asia's steel mills.



RISK: Rising competition from prospective mines in Africa and South America.

Metallurgical Coal

minerals.org.au



Renewable energy

Metallurgical coal makes the steel used to build and distribute low emissions green energy, such as solar, hydro and wind power.

172 Mt

EXPORT VOLUME

Australia was the world's largest metallurgical coal exporter in 2020.

\$5 b

COAL ROYALTIES

All coal's contribution to state government revenue in 2019-20.

40k

EMPLOYMENT

Combined thermal and metallurgical coal jobs in Australia in 2020.

\$27 b

EXPORT REVENUE

Australia is the world's largest exporter of metallurgical coal.

\$6.3 b

INVESTMENT

Capital expenditure at coal projects across Australia in 2020.

\$289 m

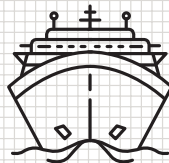
EXPLORATION

Exploration expenditure by the coal industry in 2020.



Rail lines

Australia has 33,000 km of heavy rail and 291 km of light rail. To withstand the extreme conditions without cracking, tracks are made from quality carbon steel alloys and undergo very high heat treatment.



Shipping

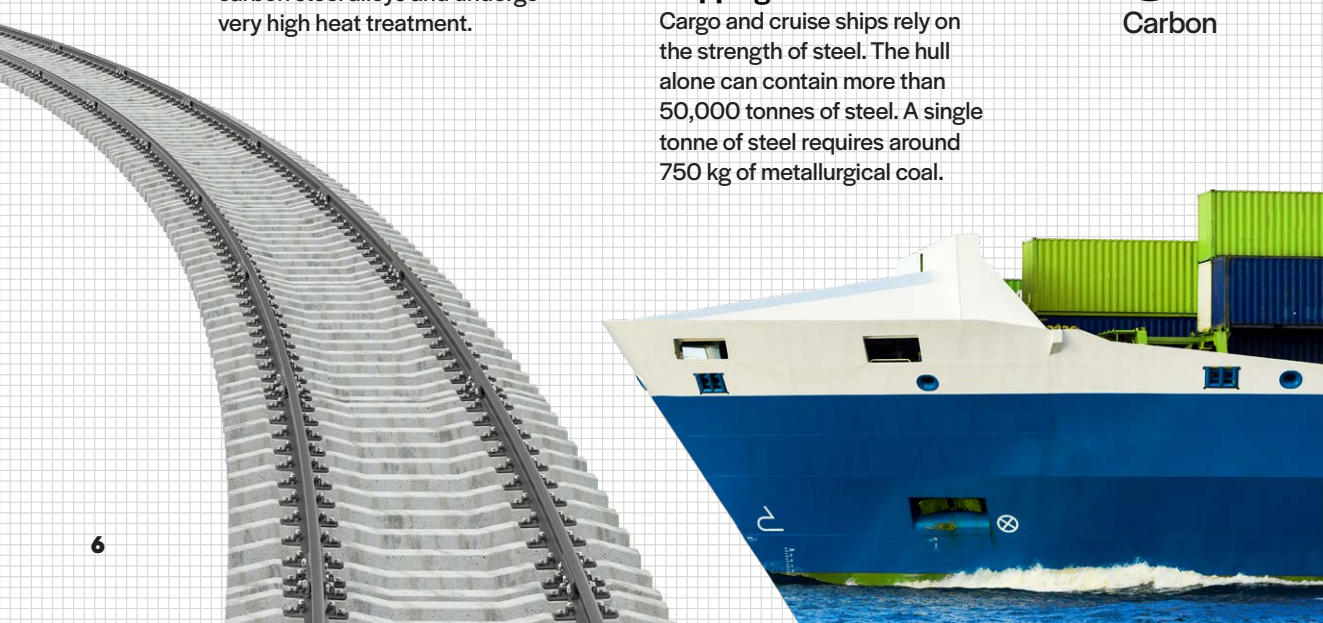
Cargo and cruise ships rely on the strength of steel. The hull alone can contain more than 50,000 tonnes of steel. A single tonne of steel requires around 750 kg of metallurgical coal.



6

C

Carbon



Metallurgical coal

INDUSTRIAL
COMMODITY



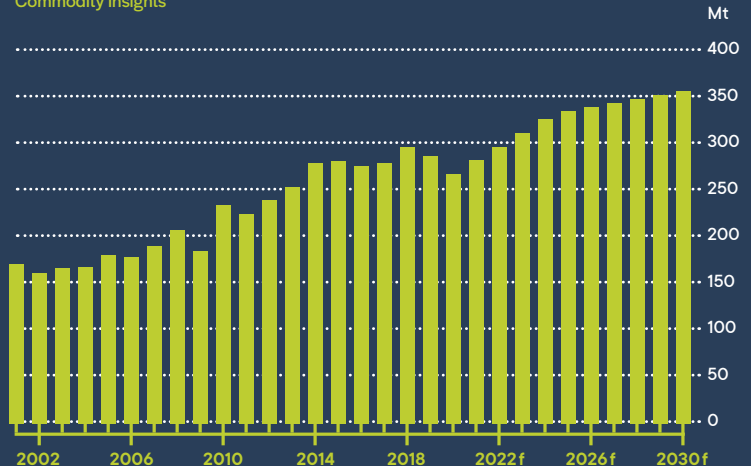
Outlook to 2030



**70% OF WORLD
STEEL PRODUCTION
RELIES ON COAL**

Metallurgical coal trade

Commodity Insights



Steel demand in emerging economies is set to rise through new high density housing, transport infrastructure and industrial machinery.

Commodity Insights forecasts seaborne metallurgical coal demand to rise steadily to 2030, from 295 Mt in 2019 to 365 Mt in 2030. This represents overall growth of 24 per cent over the forecast period, or a CAGR of 2 per cent per annum. This demand will be partly offset by a shift towards greater use of scrap steel among OECD nations.

Demand will primarily be driven by India and South East Asia, economies that not only have strong population growth but a rapidly growing appetite for steel in infrastructure, cars and consumer goods. Demand for imported metallurgical coal in these markets will be high as their domestic coal resources are not suited to steel production.

China's seaborne imports will rise initially and then slowly decline due to the increased utilisation of

scrap in the steel production process. Japan and South Korea are projected to remain key markets for metallurgical coal over the next 10 years, but with demand declining in line with lower steel production.

European demand will recover slowly from COVID-19 and declines in the traditional western European steel-producing nations will be offset by growth in Turkey, so overall demand in 2030 will be in line with 2019.

Zero emission, or green steel, technologies are under development around the world. However Commodity Insights does not see this technological development as materially impacting metallurgical coal demand for steel production during the forecast period.

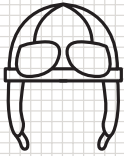
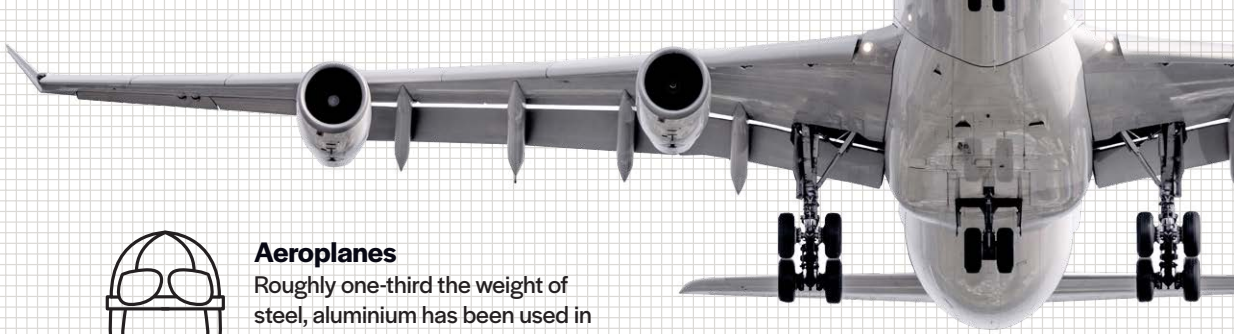


OPPORTUNITY FOR AUSTRALIA:

Growing demand for high-quality coal that reduces steel industry carbon emissions.



RISK: Growing competition from new metallurgical coal mines in Russia and Mongolia.



Aeroplanes

Roughly one-third the weight of steel, aluminium has been used in aviation since the Wright Brothers took flight in 1903.



\$11.9b

EXPORT REVENUE

Aluminium was Australia's 7th largest export in 2019-20.

104Mt

BAUXITE PRODUCTION

Australia's is the world's largest producer of this raw material.

20.8Mt

ALUMINA PRODUCTION

Australia is the world's 2nd largest producer of this intermediate product.

17k

EMPLOYMENT

Employment in Australia's aluminium industry in 2020.

\$2b

WAGES

Aluminium industry wages are nearly triple the manufacturing average.

\$5b

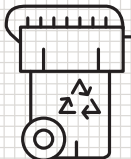
LOCAL SPEND

Annual spend by the aluminium industry on local supply chains.



Household appliances

Rust-resistant aluminium is used to make household goods, such as fridges and dishwashers. Infinitely recyclable, around 75 per cent of all aluminium ever produced is still in use today.



Softdrink cans

Over two billion aluminium cans are recycled every year in Australia, but that still leaves 900 million cans that end up in landfill. The scrap metal value of those buried cans? \$15 million.



Aluminium

minerals.org.au

13

AI
Aluminium



Aluminium

INDUSTRIAL
COMMODITY



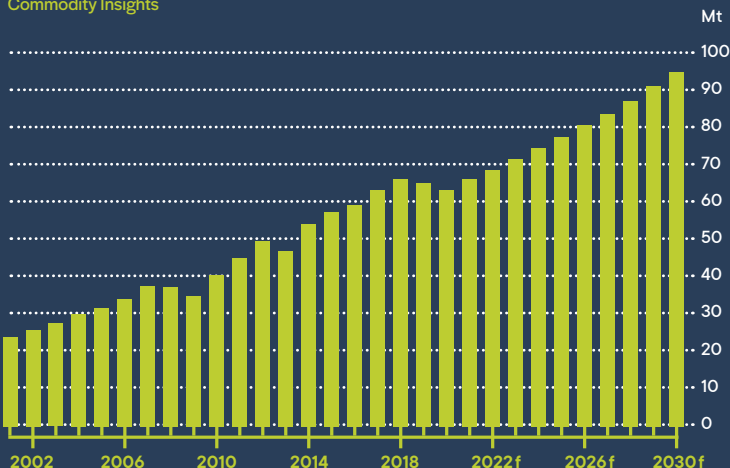
Outlook to 2030



**WORLD ALUMINIUM
CONSUMPTION IS
UP 165% OVER THE
LAST 20 YEARS**

Aluminium consumption

Commodity Insights



Aluminium is a strong, lightweight metal ideally suited for use in food packaging, construction and vehicles.

World consumption of aluminium has increased substantially over the last 20 years, underpinned by rapid demand growth from higher incomes, rising urbanisation and greater car ownership in emerging economies in Asia.

These same trends will continue in the long-term and spur even higher aluminium consumption by 2030.

Despite two decades of high economic growth rates, aluminium consumption per capita in China (13 kg per person), India (1 kg per person) and Association of Southeast Asian Nations (10 kg per person) remains significantly lower than the US (46 kg per person) and Japan (43 kg per person).

Commodity Insights forecasts primary aluminium demand to rise rapidly – from 65.1 Mt in 2019 to

94.7 Mt by 2030. This represents overall growth of 45.5 per cent over the forecast period.

Aluminium is infinitely recyclable – a process which uses only 5 per cent of the energy required to produce primary aluminium metal.

While recycling is expected to increase over the outlook period, the forecast significant growth in demand will drive higher primary metal production. This in turn will support significant growth in upstream demand for bauxite and alumina.

Based on Commodity Insight's aluminium forecast, world alumina demand will increase from 125.5 Mt in 2019 to 180.2 Mt by 2030. Similarly, world bauxite demand will grow from 363.4 Mt in 2019 to 521.9 Mt by 2030.



OPPORTUNITY FOR AUSTRALIA:

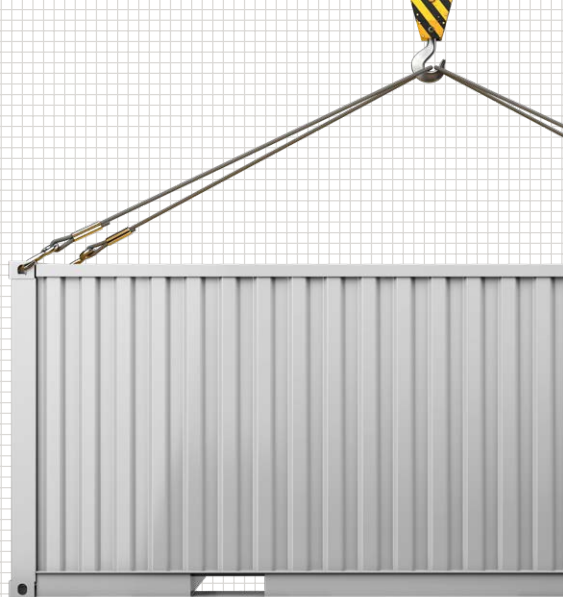
Growing world demand for green aluminium to support zero emissions objectives.



RISK: High tax rates and energy prices that make Australia less attractive for investment.

Zinc

minerals.org.au



1312 kt

ZINC PRODUCTION

Australia was the world's 3rd largest zinc producer in 2020.

\$3.2b

EXPORT REVENUE

Australia generated \$3.2 billion of zinc export revenue in 2020.

20

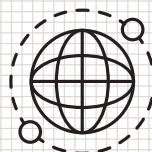
ZINC MINES

Zinc is produced at 20 operating mines across Australia.

68.9 Mt

ZINC RESOURCE

Australia has the world's largest EDR of zinc.



Shipping containers

Shipping containers are the servants of the sea, transporting around 95 per cent of the world's cargo. A zinc coating helps to protect containers against corrosion.

27%

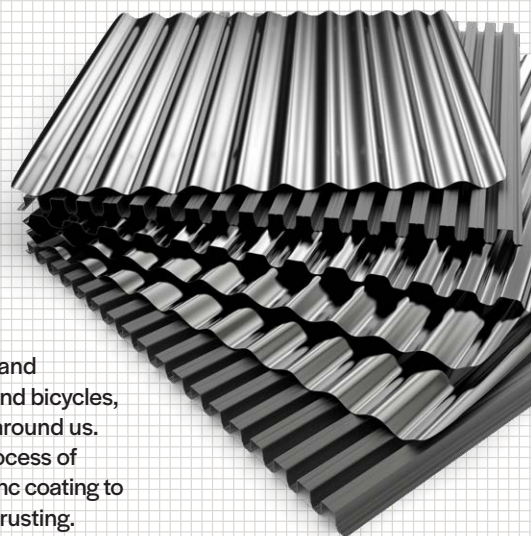
WORLD SHARE

Australia has 27 per cent of the world's zinc resources.

\$51.3m

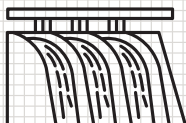
EXPLORATION

Expenditure in 2020 to secure future zinc production in Australia.



Galvanised steel

From farm equipment and fencing to car bodies and bicycles, galvanised steel is all around us. Galvanisation is the process of applying a protective zinc coating to iron or steel to prevent rusting.



Water infrastructure

Water – potable water, waste water, even desalinated water – is stored, treated and moved efficiently through communities using pipes, tanks and valves made of galvanised steel.

Zinc

INDUSTRIAL
COMMODITY



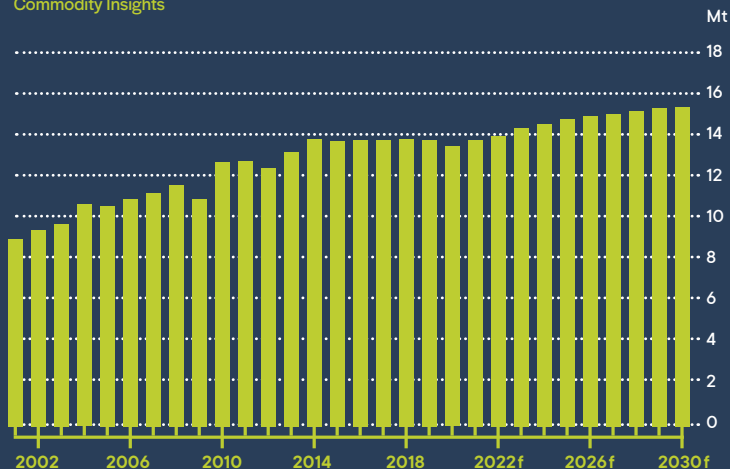
Outlook to 2030



**NEW ZINC MINES
ARE NEEDED TO
SUSTAIN WORLD
DEMAND**

Zinc consumption

Commodity Insights



Zinc's primary use is galvanising steel – a process that applies a protective zinc coating to steel products to prevent rust from forming.

The outlook for zinc is therefore closely linked to growth in galvanised steel products. This includes steel used in bridges, high-rise buildings and ships that is exposed to the weather and cannot risk having its structural integrity compromised.

Commodity Insights forecasts world zinc consumption to rise gradually over the outlook period – from 13.7 Mt in 2019 to 15.3 Mt in 2030. This forecast represents 12 per cent growth over the forecast period (or a CAGR of 1.0 per cent per annum).

Rising urbanisation in highly populated Asian nations will be the main trend supporting increased use of galvanised steel over the next decade. Taller apartment buildings with higher steel intensity,

larger cities with more apartments to house their growing populations and increased government spending on transport infrastructure to connect them will require greater zinc to manage corrosion risks.

Partially offsetting this growth will be lower use of zinc in the automobile industry. Internal combustion engine-based vehicles use more zinc in their components than electric vehicles; therefore, the commitment from most major car manufacturers to shift towards greater production of electric vehicles will reduce their zinc requirements.

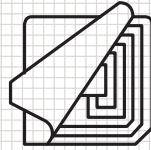
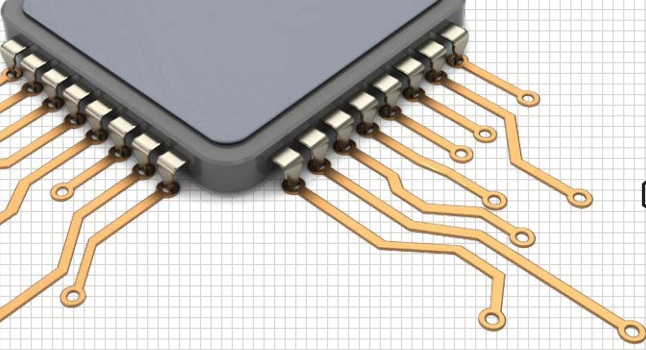


OPPORTUNITY FOR AUSTRALIA:

Demand for galvanised steel in high-rise buildings and transport infrastructure.

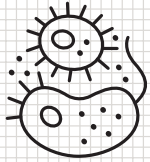


RISK: Long lead times to develop new mines in Australia.



Computing power

Superior electrical conductivity makes copper the metal of choice for tech manufacturers. Copper is used in everything from cables to connectors, circuit boards to computer chips.



Kills bacteria

Copper kills viruses and bacteria by destroying the membranes that it comes in touch with. Not even the SARS-CoV-2 virus can resist the microbial fighting power of a copper surface.

93 Mt

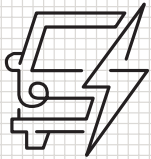
RESOURCES

Australia has the world's 2nd largest EDR of copper.

\$10.4b

EXPORT REVENUE

Copper was Australia's 8th largest export in 2019-20.



Electric vehicles

Copper is a major component of EVs. Battery EVs contain around 60kg of copper compared to a conventional car which has around 8-22 kg. And a battery-powered bus can contain up to 369 kg.

885 kt

PRODUCTION

Australia was the 6th largest copper producer in 2019-20.

\$333m

EXPLORATION

Exploration expenditure by the copper industry in 2020.

43

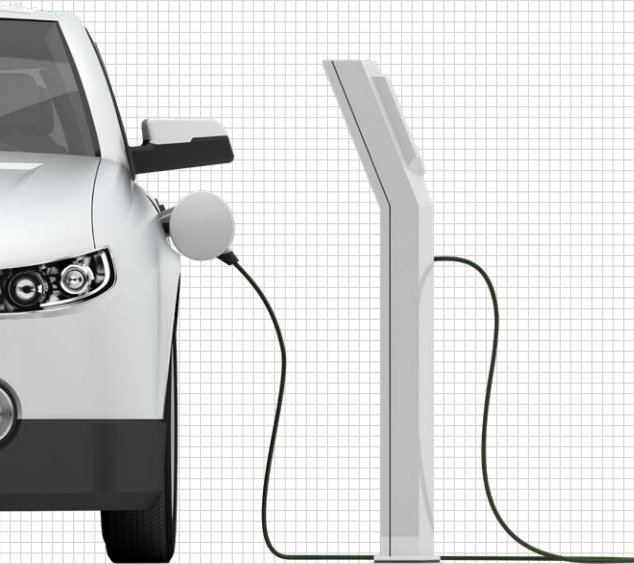
COPPER MINES

Australia had 43 operating mines producing copper in 2019.

24 Mt

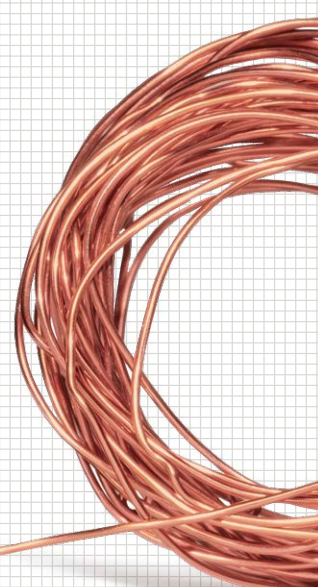
WORLD DEMAND

In 2020. World copper consumption doubles every 25-30 years.



Copper at home

Electrical wiring, plumbing and appliances are common uses of copper in the home. The average Australian home contains 90kg of copper.



Copper

minerals.org.au



Copper



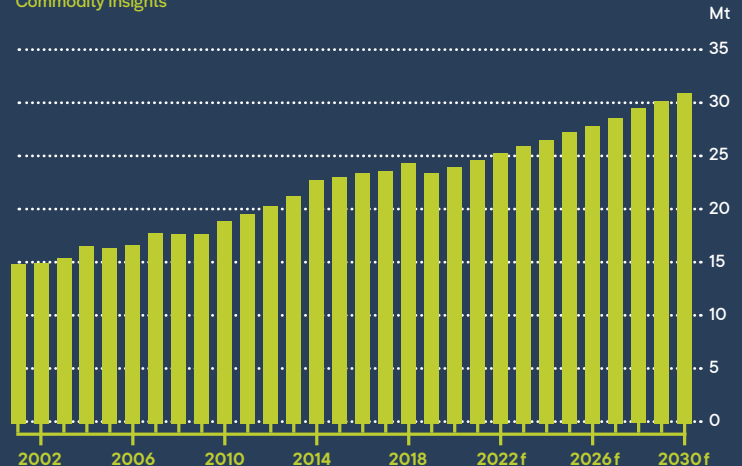
Outlook to 2030



**“COPPER IS
THE NEW OIL”**
JEFF CURRIE
GOLDMAN SACHS

Copper consumption

Commodity Insights



Copper is widely used in modern life, from advanced electronics to electricity generation, and will play a critical role in the transition to a zero emissions economy.

The phrase ‘Doctor Copper’ is widely used by economists and market analysts. While copper has strong antimicrobial properties (it can even combat COVID-19), this phrase is used more to express copper’s role in nearly every aspect of modern economies.

Growing incomes, increased access to electricity and rapidly advancing technology have driven large increases in world copper demand over the last 100 years. In fact, world copper consumption has, on average, doubled about every 25 to 30 years. And this pattern is set to accelerate with copper-intensive goods and infrastructure set to play an increasing role in the global economy.

Commodity Insights forecasts global demand for refined copper to rise steadily to 2030, from 23.5 Mt in 2019 to 31.1 Mt in 2030.

The shift towards zero emissions energy sources in both the electricity and transportation sectors, increased spending on consumer electronics in emerging markets and higher urbanisation rates will support growth in world copper demand.

Nearly all major automobile manufacturers have committed to producing a higher proportion of electric vehicles over the outlook period. This transition, coupled with rising vehicle ownership in highly populated emerging economies, will drive large increases in copper consumption as electric vehicles require four times as much copper as comparable models using internal combustion engines.

In addition, electric vehicles will require larger electricity networks to support widespread re-charging stations and access points.



OPPORTUNITY FOR AUSTRALIA:

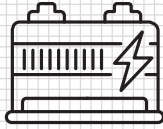
Not enough copper mines under development globally to meet growing demand.



RISK: Australia needs more greenfield copper exploration to find the mines of the future.

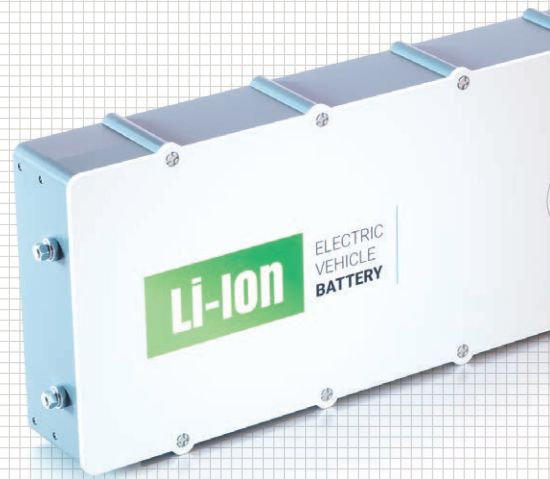
Nickel

minerals.org.au



Electric vehicle batteries

Nickel packs more energy into EV batteries to deliver a longer range. A 60kWh Li-ion battery uses 39 kg of nickel, 6 kg of lithium and 5 kg each of cobalt and manganese.



Skyscrapers

Tough, strong and corrosion-resistant, nickel alloys are widely used in the construction of skyscrapers.

169 kt

PRODUCTION

Australia was the world's 6th largest nickel producer in 2020.

\$2.6 b

EXPORT REVENUE

Australia generated \$2.6 billion of nickel export revenue in 2020.

10

NICKEL MINES

Australia has 10 nickel mines and several major projects in development.

21.2 Mt

NICKEL RESOURCE

Australia has the world's largest EDR of nickel.

24%

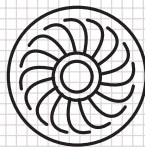
WORLD SHARE

Australia has 24 per cent of the world's nickel resources.

\$181.2m

EXPLORATION

Exploration expenditure by the nickel industry in 2020.



Jet engines

The aerospace industry uses nickel alloys to make turbine blades and jet engine parts. Nickel's high melting point, hardness and erosion resistance is called on when stress needs to be minimised.



Stainless steel

Two thirds of global nickel production is used to produce stainless steel. Stainless steel is used in industrial food processing as well as home kitchens, and is favoured for its durability and hygienic properties.



28
Ni
Nickel

Nickel



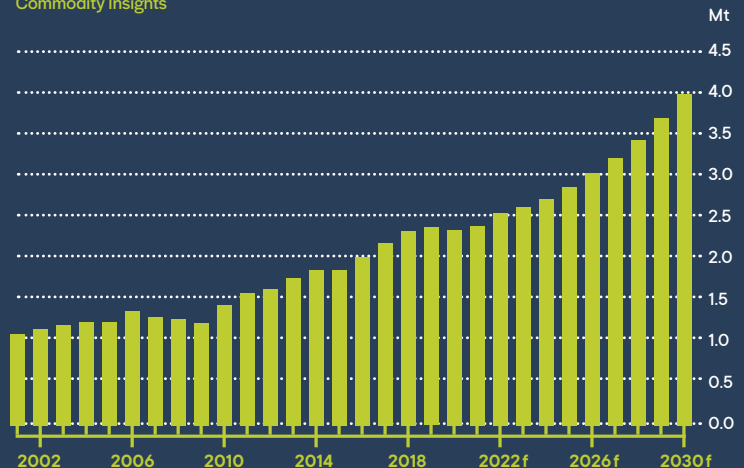
Outlook to 2030



RISING BATTERY MARKET WILL SUSTAIN WORLD NICKEL DEMAND

Nickel consumption

Commodity Insights



World nickel demand has already more than doubled since 2001. But it will be rising demand for batteries that will spur future growth.

In 2019 around 75 per cent of world nickel consumption was in the production of stainless steel – with China accounting for more than half of this demand.

Nickel demand for the production of stainless steel is expected to remain robust over the next decade – the global trends of growing urban populations, rising city population density and greater infrastructure investment will continue to require high-grade steel to build taller buildings and safe transportation networks.

But this market use of nickel is set to shift significantly in the next decade as the result of rising demand for battery-grade nickel.

The high energy density of nickel makes it ideal for use in the cathode of both electric vehicle and grid batteries. While different battery chemistries exist, nickel is a key component in many of these.

According to Commodity Insights, the battery industry's market share of nickel consumption will rise to 26 per cent by 2030 with the sector consuming more than 1 Mt of nickel per year. This will underpin nickel demand growing from 2.4 Mt in 2019 to 3.9 Mt in 2030 – growth of 67 per cent over the forecast period.

Meeting this projected demand growth over the next decade will be a significant challenge for the mining industry – particularly as supply chains increasingly focus on accessing sustainably sourced nickel. Australia, as a leader in this area, is well positioned to supply growing world nickel demand.



OPPORTUNITY FOR AUSTRALIA: Strong demand for ethically sourced nickel in the growing battery industry.



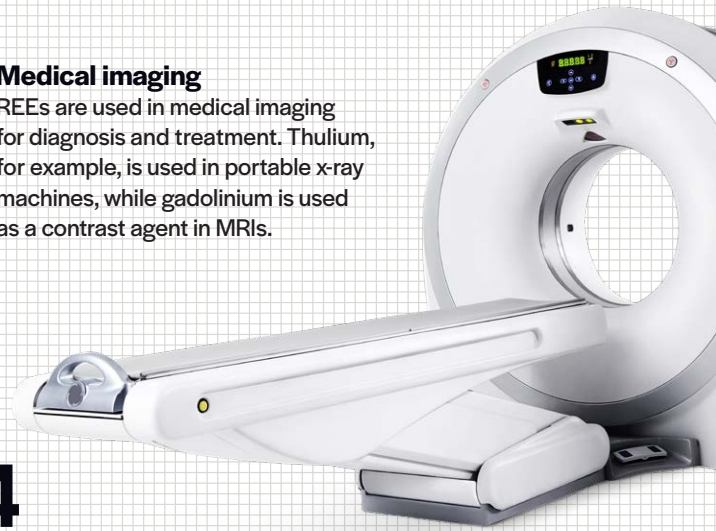
RISK: Significant competition for mine investment from lower cost suppliers around the world.

Rare earth elements (REE) are used to make powerful permanent magnets.



Medical imaging

REEs are used in medical imaging for diagnosis and treatment. Thulium, for example, is used in portable x-ray machines, while gadolinium is used as a contrast agent in MRIs.



23 kt

REE PRODUCTION

Australia's production of rare earth elements in 2020.

No. 4

WORLD RANK

Australia is the world's 4th largest producer of rare earth elements.

Sound systems

Neodymium is a rare earth element you're probably carrying around in your back pocket. From ear buds to car radios to home theatre systems, neodymium magnets drive sound in speakers.



208 kt

GLOBAL PRODUCTION

Global rare earth element production in 2019 – up 327 per cent since 2010.

4.03 Mt

REE RESOURCE

Australia has the world's 6th largest EDR of rare earth elements.



58%

CHINA REE

China's share of world rare earth elements mine production.



Internet of Things

5G promises a global wireless ecosystem that can sustain billions of devices. Cisco forecasts 3 times more devices than humans on earth by 2023. But building the network is dependent on access to REEs.

Rare Earth Elements

minerals.org.au

Rare earth elements

TECHNOLOGY
COMMODITY



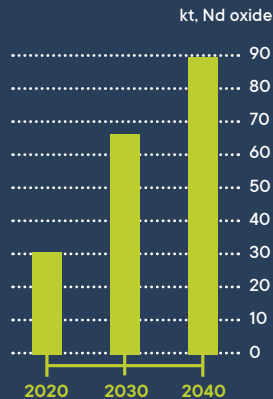
World outlook



RARE EARTH ELEMENTS ARE VITAL TO ADVANCED TECHNOLOGIES

Neodymium consumption

International Energy Agency



What are the REEs?

Rare earth elements comprise the 15 lanthanide elements, and yttrium and scandium.

Cerium (Ce)	Praseodymium (Pr)
Dysprosium (Dy)	Promethium (Pm)
Erbium (Er)	Samarium (Sm)
Europium (Eu)	Scandium (Sc)
Gadolinium (Gd)	Terbium (Tb)
Holmium (Ho)	Thulium (Tm)
Lanthanum (La)	Ytterbium (Yb)
Lutetium (Lu)	Yttrium (Y)
Neodymium (Nd)	

Rare earth elements have a broad set of applications ranging from polishing car windscreens, to powerful permanent magnets and even phosphors in tv screens.

The consumption of rare earth elements has increased substantially with greater demand for more powerful electronic devices and renewable energy. Over the next ten years, demand growth is expected for most rare earth elements however this will mainly be supported by rapid increases in the manufacturing of permanent magnets deployed in offshore wind turbines and in the drive trains of most electric vehicles.

In its recent report *The Role of Critical Minerals in Clean Energy Transitions*, the International Energy Agency (IEA) forecast demand for neodymium to rise significantly over the next decade. The IEA projects demand for neodymium to increase between 73 per cent and 113 per cent between 2020 and 2030. That is, 31 kt in 2020 will rise to between 54 kt and 66 kt in 2030.

China produces more than 50 per cent of mined rare earth metals which has long been identified as a supply risk. Although implementation of strategies to reduce dependency on Chinese supply has gathered pace since mid-2019, with direct investment by the United States, European and Japanese consumers, China remains the dominant global supplier.

Global manufacturers have the opportunity to diversify their supply through investment in Australia. Australia has large resources of rare earth elements and is already a proven producer with Lynas Rare Earths' Mt Weld mine one of the largest sources outside of China.

Several projects in Australia are at advanced stages of development and ready to feature prominently in the growing supply chains of critical minerals.



OPPORTUNITY FOR AUSTRALIA: Growing global supply chains increasingly demanding sustainably sourced resources.



RISK: Access to project finance is challenging many rare earth element producers.

Lithium

minerals.org.au

233kt

PRODUCTION

Australia is the world's largest lithium producer with four mines.

\$1.1b

EXPORT REVENUE

Australia generated \$1.1 billion of lithium exports in 2020.

No.1

LARGEST MINE

WA's Greenbushes is the world's largest and highest grade lithium mine.

No.1

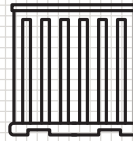
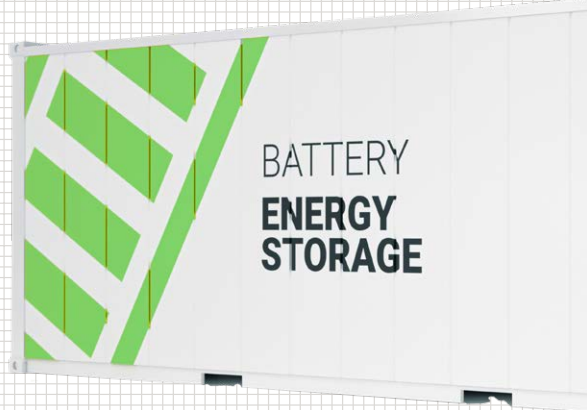
LARGEST REFINERY

Albemarle's (WA) lithium refinery will be the world's largest when completed.

5702kt

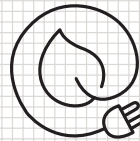
LITHIUM RESOURCE

Australia has the world's 2nd largest EDR of lithium (29 per cent).



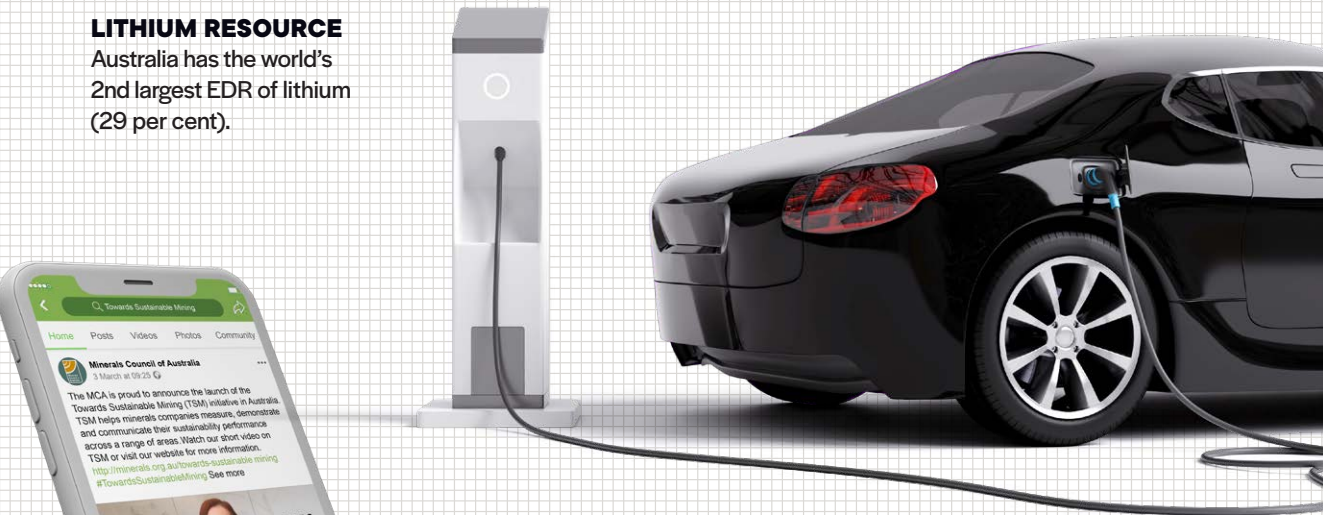
Grid battery

Large grid-scale lithium-ion batteries are ideal for balancing demand and supply in electricity grids as more renewable energy sources are deployed.



Electric vehicles

Lithium's high density to weight ratio makes lithium-ion and lithium polymer the preferred batteries in modern EVs. Every EV battery contains around 10 kg of lithium.



Consumer electronics

Lightweight, rechargeable power for laptops, tablets, smartphones and other digital devices is made possible with lithium-ion batteries.



³Li
Lithium

Lithium

TECHNOLOGY
COMMODITY



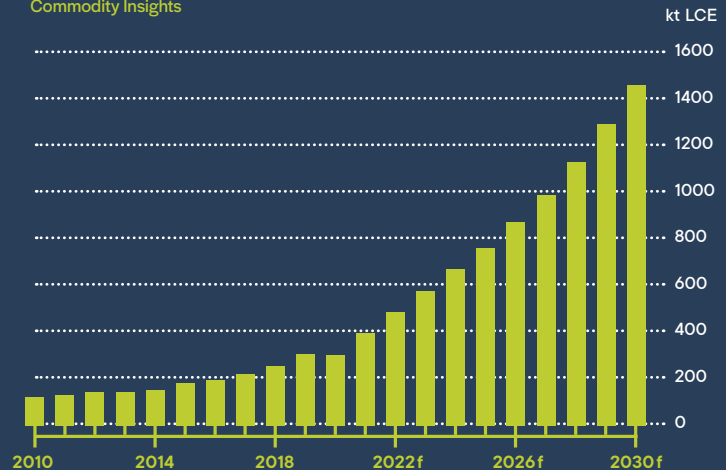
Outlook to 2030



**ELECTRIFICATION
OF TRANSPORT IS
DRIVING DEMAND
FOR LITHIUM**

Lithium consumption

Commodity Insights



Lithium is the material underpinning the battery revolution and the global energy transition. It is vital to future energy storage systems.

While there are many competing battery technologies, lithium-ion batteries have been the clear front runner in electric vehicles for their higher energy density and specific energy. In addition, lithium batteries are light in weight making them ideal for use in modern transportation technologies.

Lithium batteries already have a key role in the modern economy, powering portable consumer electronics devices such as smart phones, tablets and laptop computers. Lithium consumption is likely to grow further as rising incomes in emerging economies provide improved telecommunications access to millions of people.

However, the main driver of a forthcoming surge in demand for lithium ion batteries over the next decade will be car manufacturers releasing more electric

vehicle models and the rising use of renewable energy requiring greater use of energy storage technology.

As a result of this energy transition, Commodity Insights forecasts lithium demand to rise rapidly to 2030, from 313 kt of lithium carbonate equivalent (LCE) in 2019 to 1,465 kt LCE by 2030. This forecast represents overall growth of 368 per cent over the period or a CAGR of 15.1 per annum.

This projection is based on an assessment of car manufacturers' current plans to convert to electric vehicle production. If these plans accelerate, potentially due to higher consumer demand and more government incentives to develop electric vehicles, the outlook for world lithium consumption could be considerably higher.



OPPORTUNITY FOR AUSTRALIA:

Surging lithium demand from all corners of the globe for electric vehicles.



RISK: Strong competition from lithium suppliers in lower cost mining regions around the world.

Thermal Coal

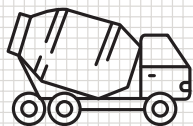
minerals.org.au



6

C

Carbon



Concrete production

Concrete is used more than any other man-made material on earth. The cement required to make concrete foundations in buildings is heated to +1300°C using thermal coal.



199Mt

EXPORT VOLUME

Australia was the world's 2nd largest thermal coal exporter in 2020.

\$16.6b

EXPORT REVENUE

Australia is the world's 2nd largest thermal coal exporter.

40k

EMPLOYMENT

Combined thermal and metallurgical coal jobs in Australia.

\$5b

COAL ROYALTIES

All coal's contribution to state government revenue in 2019-20.

\$6.3b

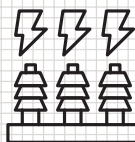
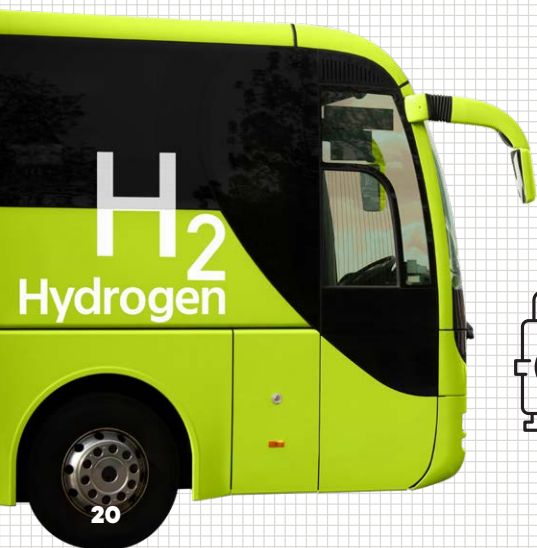
INVESTMENT

Capital expenditure at coal projects across Australia in 2020.

\$289m

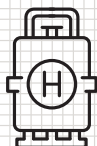
EXPLORATION

Exploration expenditure by the coal industry in 2020.



Electricity

Coal-fired power plants produce 58 per cent of the electricity that powers Australian homes and businesses. Carbon Capture and Storage (CCS) will provide significant reductions in emissions.



Hydrogen fuel

Thermal coal with CCS can produce hydrogen to fuel the future. Hydrogen can be used in internal combustion engines or fuel cells and its only significant emission is water.



Thermal coal

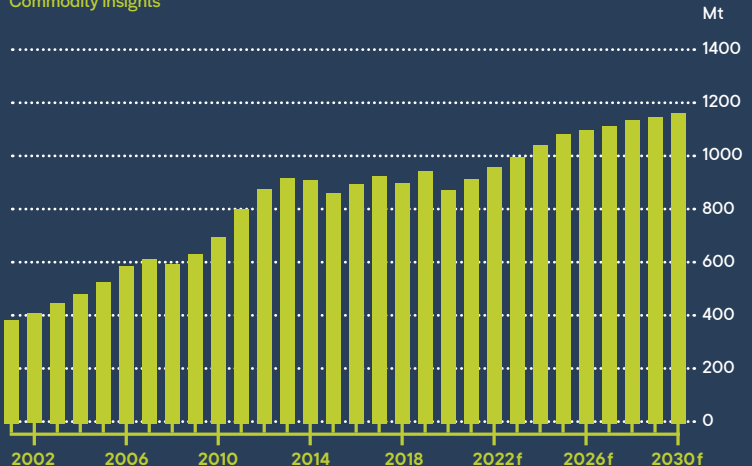
Outlook to 2030



THERMAL COAL PROVIDES 36% OF THE WORLD'S ELECTRICITY

Seaborne thermal coal trade

Commodity Insights



World electricity demand has grown rapidly in the 21st century, underpinned by robust economic growth in highly populated nations in Asia.

Coal has been the main fuel source powering this expansion, but competition from zero emissions energy sources has reduced the rollout of coal-fired power stations in recent years.

The global seaborne thermal coal market was almost 950 Mt in volume in 2019 and is predominantly a Pacific Basin market, with Asian markets accounting for more than 80 per cent of seaborne thermal coal demand led by China, India and Japan, with Southeast Asia also growing rapidly.

Commodity Insights forecasts demand for imported coal to increase 23.5 per cent by 2030 – from 947 Mt in 2019 to 1170 Mt in 2030. Seaborne thermal coal demand growth will be driven by growing economies in Asia, where low-cost supplies

of electricity will be required to support ongoing expansion in energy-intensive heavy industries.

This forecast for seaborne thermal coal demand should not be confused with global thermal coal consumption, which is more than 5 Gt and is expected to decline by 2040 according to the International Energy Agency's *World Energy Outlook*. This is primarily due to declining demand in North America and Europe as they transition into natural gas and renewables.

Strong seaborne thermal coal demand, particularly in the Asian region, also underscores the importance of ongoing development of zero emissions technologies, such as carbon capture, usage and storage. Such development and deployment will be critical for meeting the goals of the Paris Agreement in the decades ahead.

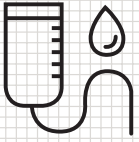


OPPORTUNITY FOR AUSTRALIA:

Demand for high quality coal to power supercritical power plants across Asia.

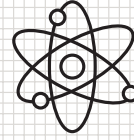
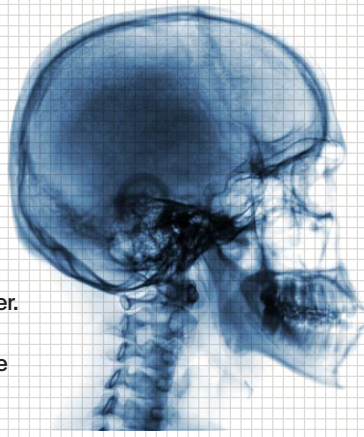


RISK: New mine investment directed to other jurisdictions with lower quality coal.



Health care

Nuclear medicine diagnoses and treats illnesses such as cancer. ANSTO's OPAL reactor in Lucas Heights (NSW) is the centrepiece of Australia's nuclear medicine and research program.



Zero emissions energy

Nuclear reactors operating in 31 countries saved 2.2 billion tonnes of global CO₂ emissions in 2020. Australia is the only G20 country that prohibits nuclear power.

7195 t

EXPORT VOLUME

Australia was the world's 3rd largest uranium exporter in 2019-20.

\$688m

EXPORT REVENUE

Australia's uranium export revenue in 2019-20.

36 GW

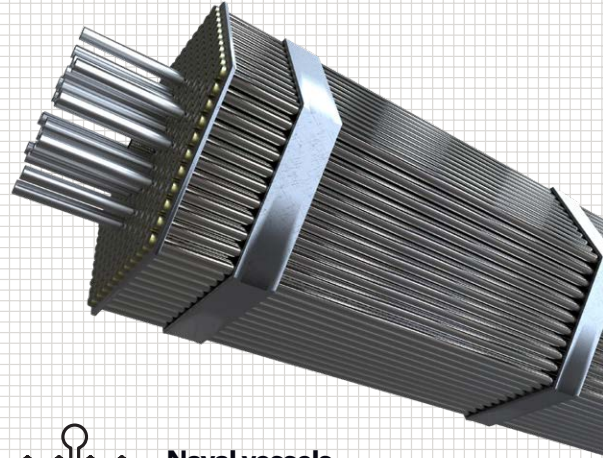
POWER PLANTS

The capacity of reactors that could be fuelled by Australia's uranium.

290 TWh

ELECTRICITY

Zero emissions electricity generated by Australia's uranium exports.



109%

DOMESTIC USE

Australia's uranium exports could generate 109 per cent of our electricity.

1.1 Mt

RESOURCE

Australia has the world's largest EDR of uranium (31 per cent).



Naval vessels

Aircraft carriers, submarines and icebreaker ships operate on the high seas safely and for long periods of time using advanced nuclear technology.

Uranium

minerals.org.au





Uranium

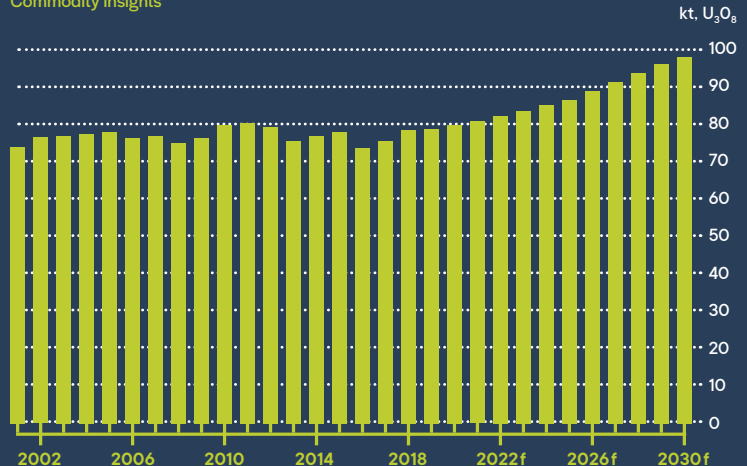
Outlook to 2030



NUCLEAR PROVIDES 10% OF THE WORLD'S ELECTRICITY WITH ZERO EMISSIONS

Uranium demand

Commodity Insights



Millions of the world's citizens across 31 countries already benefit from low cost, zero emissions nuclear power. The opportunity for Australia's uranium is immense.

Electricity provided by nuclear energy is low cost and can meet the needs of industrial and household consumers 24/7.

Global nuclear power plant investment is recovering, particularly in developing economies, and is expected to accelerate over the next decade as both baseload power requirements and climate change concerns continue to increase.

Commodity Insights forecasts global uranium demand to rise steadily to 2030, from 79.7 kt in 2019 to 99.5 kt in 2030. Growth will be largely driven by China, which has recently outlined plans to increase nuclear generation installed capacity to 70 GW by 2025, up from 51 GW at the end of 2020,

and Japan, which is slowly restarting its nuclear fleet and plans to increase nuclear output to approximately three times the 2019 level by 2030.

Europe is currently a large consumer of uranium, particularly France which has the second largest fleet of nuclear power plants in the world. The European Union is now re-evaluating whether nuclear power should also be considered a source of green energy and eligible under its sustainable financing initiative.

If this occurs it will result in higher European demand for uranium. While this is likely to occur later in the outlook period, the shorter development time associated with new small modular reactors could lead to increased uranium demand before 2030.

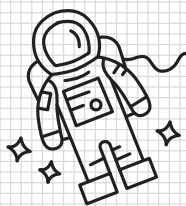


OPPORTUNITY FOR AUSTRALIA:

Demand for zero emissions, low cost energy will drive investment in nuclear energy.



RISK: Outdated regulations in some states that restrict uranium exploration and mine development.



Gold

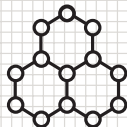
minerals.org.au



79
Au
Gold

Aerospace

Gold has long accompanied humans on space missions. It coats the visors of astronauts, shields satellites from solar radiation and is widely used in onboard electronics.



Advanced medicine

Gold nanoparticle technology is being used to target and deliver antibodies into cancerous tumors. They are also being engineered to attach to cancer-related proteins to aid earlier detection.

\$27b

EXPORT VALUE

Australia's gold industry achieved record export revenue in 2020.

327t

GOLD PRODUCTION

Australia's gold production was at a record high in 2020.

>35k

EMPLOYMENT

Gold industry jobs at more than 60 gold mines across Australia.

10,795t

GOLD RESOURCES

Australia has the world's largest gold EDR, followed by Russia.

<80t

GOLD HOLDINGS

Australia's Government is ranked 40th for world gold holdings.

\$1.3b

EXPLORATION

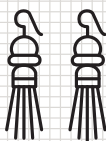
Record exploration in 2020 has Australia set for another gold rush.



Investment asset

The global finance system moved off the gold standard in 1972, but more than 78,500 tonnes of gold are still held by investors in vaults around the world.

World Gold Council



Jewellery

Jewellery is the largest market for gold. In 2019 more than 68 million ounces of gold were purchased to be fabricated into jewellery.



Gold

PRECIOUS
METAL



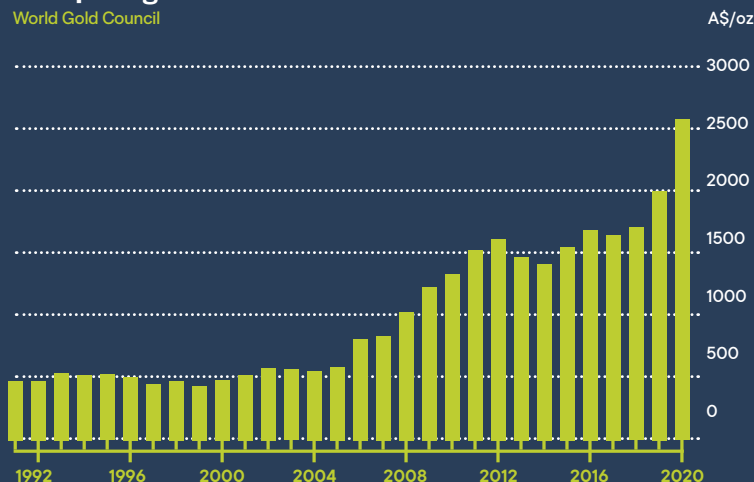
Prospects to 2030



**GOLD HAS BEEN
A PROVEN STORE
OF VALUE FOR
CENTURIES**

Gold price growth

World Gold Council



Australia was built on the gold rushes of the 1850s. Today, record gold exploration investment is positioning Australia for a new gold rush.

Gold is one of the most remarkable metals in the history of human civilisation. Its scarcity and aesthetics have seen it worshipped as a gift from the gods, used as the basis of international monetary systems and worn as a status symbol in the form of jewellery.

Gold prices, and consequently investor demand, have been driven higher by expansionary monetary policies over the last 15 years. Consumer price inflation has so far been avoided during this period of rapid growth in money supply; however, nearly all OECD nations have experienced growing asset price inflation – exemplified by rising house and share prices even during the COVID-19 pandemic recession. This period has also resulted in significant increases in the price of gold – culminating with record high gold prices in most currencies in 2020.

Once considered purely a safe haven asset, gold is now delivering superior long-term investment returns to bonds and a number of other asset classes. In fact, recent analysis from the World Gold Council has shown the average Australian super fund portfolio would have achieved higher risk-adjusted returns and lower drawdowns if 2 per cent, 4 per cent or 10 per cent of funds were allocated to gold.

The strategic value of gold is not limited to private investors. Official government gold reserves have been growing for several years – particularly in China, Russia, Turkey and India.

Monetary expansion, and the government debt that underpins it, is likely to continue for some time – supporting higher gold prices and investor demand.



OPPORTUNITY FOR AUSTRALIA:

Growing global demand for strategic investment assets such as gold.



RISK: Policy uncertainty that contributes to long gold mine development times in Australia.

Silver

minerals.org.au



47
Ag
Silver



1334t

SILVER PRODUCTION

Australia was the world's 7th largest silver producer in 2020.

\$222m

EXPORT REVENUE

Australia's exports of refined silver bullion in 2020.

31

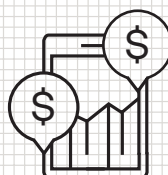
SILVER MINES

There were 31 operating mines producing silver in Australia in 2019.

90kt

SILVER RESOURCE

Australia has the world's 3rd largest EDR of silver.



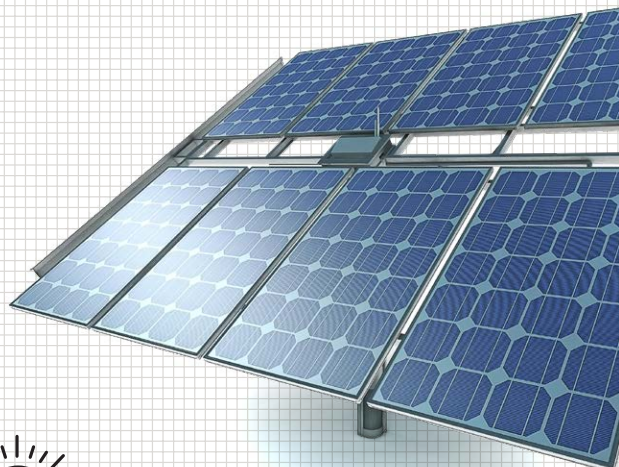
Investment asset

London Bullion Market is the world's largest silver market. Each day around 660 million ounces worth \$18 billion are bought and sold by investors.



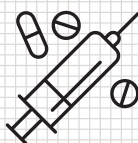
Telecommunications

The electronic components that enable 5G technology are reliant on silver. Silver's high conductivity speeds up the processors in mobile phones and communications networks to deliver us faster wireless internet.



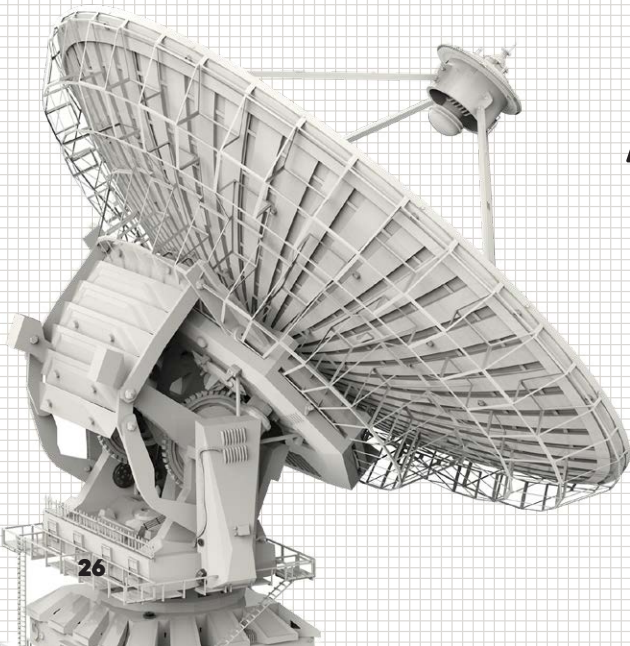
Solar panels

Each year more than 96 million ounces of silver are used in the manufacture of solar panels. Silver's strong conductivity enhances the panels' efficiency at converting light into electricity.



Advanced medicine

Silver has been used in medicine for centuries. Today, Australian scientists are trialling a world-first brain cancer therapy that involves injecting nanoparticles laced with silver into inoperable brain tumours.



Silver

PRECIOUS
METAL



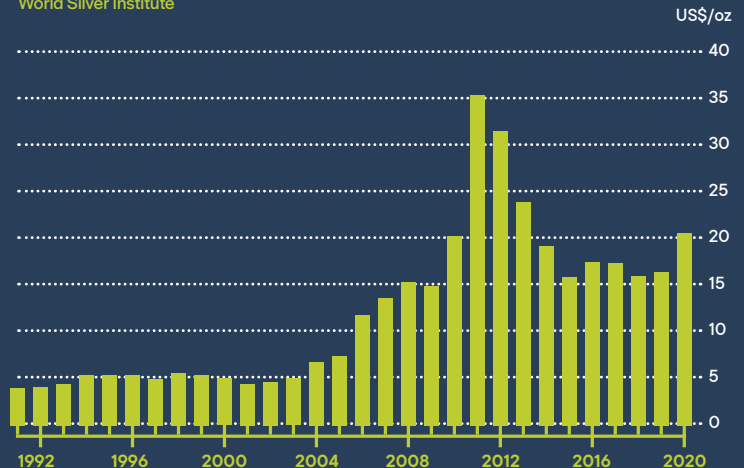
Prospects to 2030



SILVER IS INCREASINGLY PROVING ITS VALUE AS A TECH METAL

Silver price

World Silver Institute



Silver has underpinned financial systems for centuries. While financial systems have evolved, emerging technologies are increasingly reliant on silver.

Monetary policy trends driving higher gold prices and investment are also creating increased investor demand for silver.

According to the Silver Institute, global investor silver holdings increased by over 45 per cent in 2020 – accompanied by silver prices surging by 27 per cent. Rising government debt accompanied by low and potentially negative interest rates over the next decade is expected to provide further stimulus for higher silver demand among investors seeking to hold stable assets as a hedge against inflation.

Industrial demand for silver is also expected to rise to 2030. Silver's high electrical conductivity makes it perfect for use in advanced electronics that are increasing in performance while diminishing in size.

Growing incomes in highly-populated emerging economies are creating new markets for consumer electronics while technology advances, particularly the roll out of 5G, are creating demand for new high performance processors that are more reliant on silver.

Silver is also used extensively in the manufacture of solar PV cells. The IEA has forecast world solar PV capacity to triple in its *2020 World Energy Outlook*, from 603 GW in 2019 to 3125 GW in 2030. While this will drive additional silver demand, anticipated efficiency in the use of silver per PV panel will likely moderate the growth in silver consumption.



OPPORTUNITY FOR AUSTRALIA:

Growing use of silver globally in electronics, energy and health care.



RISK: Long mine development lead times discourage prospective mining companies.



Notes on outlook

Background

The Minerals Council of Australia (MCA) commissioned Commodity Insights to provide demand forecasts for a range of commodities to 2030.

The agreed commodities covered in the forecast report are:

1. Iron ore
2. Metallurgical coal
3. Aluminium
4. Zinc
5. Copper
6. Nickel
7. Lithium
8. Thermal coal
9. Uranium

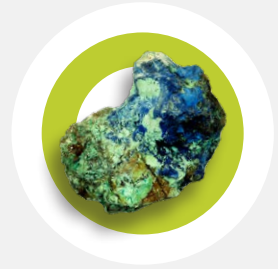
In addition to the outlook for these commodities, the Minerals Council of Australia has provided coverage on the future prospects for rare earth elements based on analysis by the International Energy Agency, the importance of precious metals (gold and silver) as well as economic indicators on Australia's mining industry.

Assumptions

For each of the nine commodity demand forecasts provided by Commodity Insights, the following key inputs and assumptions have been applied:

- Demand is forecast independently of commodity supply or price considerations
- The recovery from COVID-19 is generally expected to be V-shaped, supported by massive government stimulus packages globally
- Key policy settings that impact general demand for most commodities and mostly seaborne demand for bulk commodities (i.e. carbon and emission reductions, e-mobility and sustainability)
- Economic settings that impact commodity demand (i.e. GDP growth, population and industrial production and consumption trends). These macro indicators have been sourced from the World Bank and use United Nations population forecasts to analyse consumption intensity for each commodity.

Although exogenous shocks across the forecast period are likely to disrupt or alter the global flow of commodities temporarily, these are difficult to forecast and as such, are not included in the outlook.



Methodology

Commodity Insights' approach to the demand forecast is outlined below.

- **Identification of end markets:** This involves clearly defining the key sectoral markets for each commodity demand globally.
- **Macro-level consumption drivers:** Applies a combination of macro assumptions and sectoral demand drivers including governmental policy. The relationships between these drivers will enable a demand trajectory to be generated while incorporating structural influences.
- **Commodity level consumption drivers:** Commodity Insights has identified structural changes that will be key inputs into the demand forecasts (e.g. the rise of electric vehicles and renewable power, carbon and climate policy, the growth profile in SE Asia). These will be quantified and incorporated into the models.
- **Commodity intensity by end use:** Commodity Insights' proprietary model will estimate intensity of commodity consumption by key demand sectors that will drive the demand forecasts (e.g. copper intensity in electric vehicles).
- **Inter-related demand models:** The combination of the first four steps above provides the key inputs to the commodity demand models.

Due to 2020 being an abnormal year, 2019 is the base year for all commodity demand forecasts. Actual figures (or best estimates) have been utilised for 2019 and 2020. It is notable that demand for some commodities (e.g. iron ore, copper) seemingly continued growing uninterrupted during 2020, while demand for others (e.g. thermal coal, nickel) were sharply affected.

Summary of methodology





Key themes

Several critical structural themes emerged from Commodity Insights' research and analysis in preparing these forecasts. These inter-related themes will drive commodity demand patterns to 2030 and probably beyond.

01

Energy transition

Action on climate change is driving rapid shifts in global electricity systems to reduce carbon dioxide emissions. This transition is moving quickest in the European Union and North America's developed economies, but also now in the other regions, with government policy increasingly facilitating technology pathways to net zero emissions.

Countries have long term ambitions – China, net zero by 2060; Japan and South Korea, net zero by 2050 – as well as immediate policies that will affect demand over the ten years covered in this forecast. At the time of writing countries are also implementing government stimulus packages which contain specific spending related to reducing emissions, which may adjust the short-term outlook as they are enacted.

The forecast here is not based on a whole-of-economy emissions reduction prediction, rather it is an examination of seaborne and traded demand in the face of rapidly changing policy and operational environments.

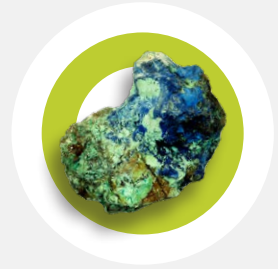
The MCA supports the Paris Agreement and the goal of transitioning to net zero emissions as soon as possible.

02

Asian predominance

The Asian century continues, with the region being the major demand engine for most commodities over the forecast period. For some commodities such as thermal coal, Asia accounts for all the demand growth. Conversely, for other commodities such as iron ore, a slowdown in Asian growth will weigh on the global demand outlook as steel production rates slow and increased scrap utilisation displaces iron ore and metallurgical coal.

While Asia will be slower than other regions in some respects (e.g. transition away from thermal coal), its sheer scale, demographics and population projections ensure that it is the most significant region in changing commodity demand patterns. China remains the dominant market within Asia. On its own, it accounts for half or more of global consumption for many commodities in this study – iron ore, copper, nickel, and aluminium.



03

Substitution

A cost-cutting theme will focus on advancing a wide range of materials and technologies. In particular, technological innovation and research will enable some commodities to be substituted in and out of processes due to a combination of economic and environmental drivers.

In the steel complex, the increased availability of scrap feedstock in China is expected to result in lower Chinese demand for iron ore and metallurgical coal. Steel consumption in electric vehicles is being reduced by the use of aluminium, a lighter alternative. In Europe and the United States, thermal coal is being substituted out of the electricity generation mix for natural gas and renewables. Battery chemistry and technology will also be an important driver for lithium and nickel demand.

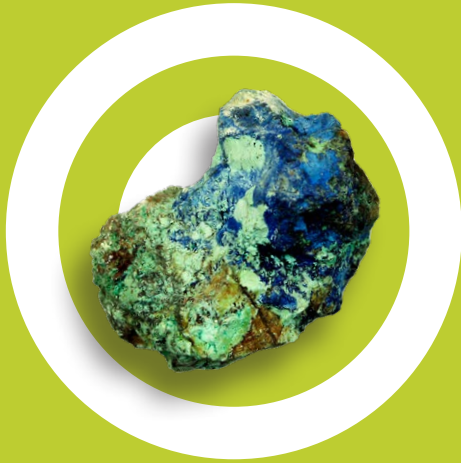
Some commodity substitution may also be driven by supply concentration. This will either accelerate supply developments in other regions or push technology towards substitution into other materials.

04

E-mobility

Driven by increasingly aggressive government targets and policies particularly in Europe and China targeting 40 per cent of new vehicle sales being electric by 2030, electric vehicle CAGR is forecast to range between 20-30 per cent across the period. This will result in accelerated demand for battery metals such as nickel and lithium, increased consumption of copper and rare earths in drivetrains and increased demand for aluminium due to the 'light-weighting' of vehicles.

Commodity Insights notes that the transition to electric vehicles will also boost electricity demand, possibly above current forecasts, which in turn may result in higher than expected demand for baseload electricity generation fuels such as gas, uranium and even thermal coal (i.e. with energy demand moving from oil to electricity).



COMMODITY DEMAND
Outlook
2030

FORECASTS

Commodity Insights

Commodity Insights is a niche advisory group serving the minerals and mining sector. It has a strong track record of helping energy and commodity market participants address the challenges they face and has supported investors, utilities, primary producers and exploration, traders and commodity consumers in managing their risks, improving their processes and systems, enhancing their strategy and delivering robust transactions.

NOTE

No person should rely on the contents of this publication without first obtaining advice from a qualified professional person. The Minerals Council of Australia, and the authors, editors and any consultants accept no liability (including liability in negligence) and take no responsibility for any loss or damage which a user of this publication or any third party may suffer or incur as a result of reliance on this publication, and in particular for:

- a) Any errors or omissions in this publication
- b) Any inaccuracy in the data and information on which this publication is based
- c) Any interpretations or opinions stated in or inferred from this publication.

DATA SOURCES

Iron ore Department of Industry, Science, Energy and Resources; Australian Bureau of Statistics; Government of Western Australia; Geoscience Australia.

Metallurgical coal Department of Industry, Science, Energy and Resources; Government of Queensland & Government of New South Wales; Australian Bureau of Statistics.

Aluminium Department of Industry, Science, Energy and Resources; Australian Bureau of Statistics; Australian Aluminium Council.

Zinc Department of Industry, Science, Energy and Resources; Geoscience Australia; Australian Bureau of Statistics.

Copper International Copper Study Group; Department of Industry, Science, Energy and Resources; Australian Bureau of Statistics; Geoscience Australia.

Nickel Department of Industry, Science, Energy and Resources; Geoscience Australia; Australian Bureau of Statistics.

Rare earth elements Geoscience Australia.

Lithium Department of Industry, Science, Energy and Resources; Albemarle; Geoscience Australia.

Thermal coal Department of Industry, Science, Energy and Resources; Australian Bureau of Statistics; Government of New South Wales & Government of Queensland.

Uranium Department of Foreign Affairs and Trade; Vimy Resources; Geoscience Australia.

Gold Australian Bureau of Statistics; Surbiton Associates; Geoscience Australia; World Gold Council.

Silver Department of Industry, Science, Energy and Resources; Geoscience Australia.

There's more to
**Australian
Mining**

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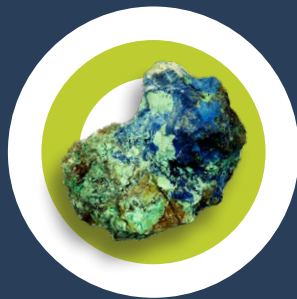
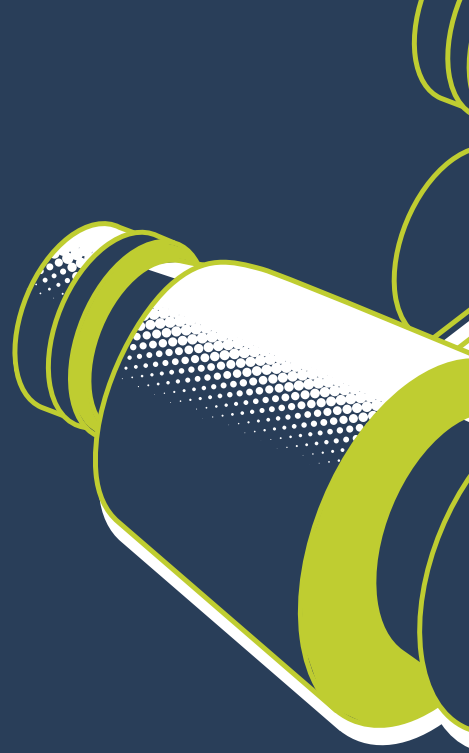
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