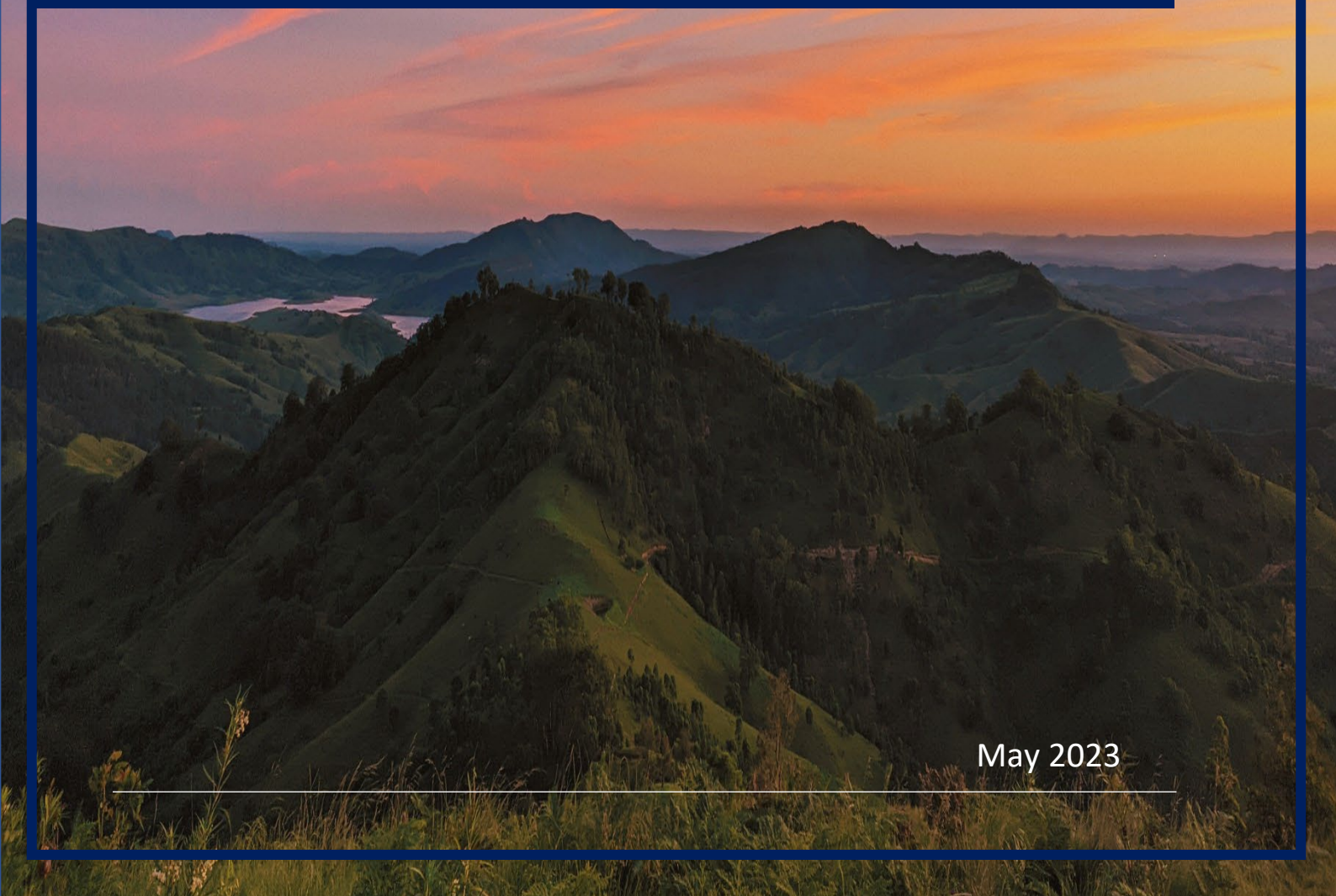
ENERGY & RESOURCES KNOWLEDGE HUB

NSW RESOURCES AND METS SECTOR REPORT



May 2023

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Introduction

NSW has a proud history in mining and METS, with a highly prospective underlying resource base, existing world class projects, an innovative industry that draws on collaboration between research and industry, and necessary infrastructure to sustain and grow the industry well into the future.

The mineral composition in NSW underpins a suite of enabling metals essential to the development of new energy markets, that meets a broad range of end use and application to modern society. Many of these commodities enjoy long term demand and supply fundamentals, which unlocks an exciting opportunity for innovation and growth in NSW.

NSW minerals and energy commodities are known as high-quality products, produced from technically sophisticated operations that are reliably supplied to international markets through established and robust infrastructure networks. A range of NSW operations have embraced automation and underground remote operations, through digital and resource technology applications.

With an ambition and roadmap to net-zero emissions, NSW resources will play an increasingly important role as a commodity supplier to achieve a lower emission future. Many operators within the state are delivering on this ambition as they embark on decarbonisation programs for their current and future projects, embracing electrification and exploring other new innovative applications to improve fuel and energy use such as battery and hydrogen mobility. The sector is exploring and participating in credible assurance frameworks and demonstrating responsible production practices including contribution to the United Nations Sustainable Development Goals (SDGs).

In NSW, world leading research institutes and partnerships between industry and research are assisting the sector to address current and future industry challenges across a range of specialised fields including beneficiation, geomechanics, automation and remote and off-earth mining. NSW also enjoys a strong reputation for technical excellence in geotechnics along with deep mining and ventilation practices. A modernised industry has demonstrated leadership in the application of advanced longwall operations, equipment automation, and novel mining methods.

NSW has for a number of years sustained a steady and significant place in the national METS sector landscape with an industry that contributes over 25% to the national GVA, enjoys well established export market success exporting to almost all global mining destinations.

Resources NSW has prepared this report to showcase NSW's strengths in resources, METS and research excellence. The report aims to further support investment attraction efforts to mining and METS and position NSW as a leading place for specialised, high value, sustainable and responsible production and suppliers of resources and METS products and services to meet the needs of the modern world.

Resources NSW is an initiative of the NSW Energy and Resources Knowledge Hub and acknowledges the support of the NSW Office of the Chief Scientist and Engineer. It exists to enable knowledge sharing and support innovation and growth of the NSW resources and METS sectors.

An Overview of Mining in NSW

NSW Mining

Mining is a significant and developed sector and is the State's largest export industry. NSW is host to an abundance of minerals necessary to meet the needs of the modern world and is a key contributor to the economic prosperity of many regional communities across the State. The State also has several established world-class mining operations. Commodities hosted and/or extracted include thermal and metalliferous coal types, metalliferous ores such as gold, copper, silver, lead and zinc, cobalt and lithium, scandium, cobalt, titanium, zirconium, and other critical minerals. Industrial minerals include mineral sands, clays and limestone.

Output and contribution

The mining and resources industry is considered a significant industry to the State and plays an especially important role to the fabric of regional NSW, as a major employer and industry cornerstone of many regional communities. According to NSW Government[1], in 2018/19 the sector supported around 29,000 direct jobs and an additional 115,000 mining related jobs, including services businesses, resulting in $2.1 Billion in royalty to the State.

The NSW mining industry includes around 40 operating coal mines[2], 12 major metals operations and industrial mineral sands operations. Geographically the bulk of the mining activity in NSW is mostly concentrated in the Lachlan Fold belt for gold and base metals and the Sydney-Gunnedah Basin for coal. Regional infrastructure and services to the sector are well established and geographically located to service current mining activity.

While NSW mining output is dominated by coal, NSW also has an abundance of metalliferous and critical mineral projects and resources. The State has an active and comprehensive exploration and development program, with 32 coal and metals projects[3] currently proposed for development, with metals projects representing 13 of these.

With established resource operations in NSW and a pipeline of new projects there is an ongoing appetite for efficient and cost-effective mining practice. NSW is home to a range of innovative and productive mining techniques, that have fostered world class operations and service providers. The State also has some of the most highly skilled workers that embrace world-leading safety and environmental standards.

[1] Source: Invest in NSW – Online Minerals Prospectus, Available online at: https://meg.resourcesregulator.nsw.gov.au/sites/default/files/2022-11/invest-in-nsw-online-minerals-prospectus.pdf accessed 01/05/2023
[2] Source: https://www.coalservices.com.au/mining/statistics-2/ accessed 01/05/2023
[3] NSW Minerals Council, "Resources for Recovery", August 2021

Export Capability

When considering the NSW Resource sector through the lens of exports, the output is mostly high-quality thermal coal, primary mineral ores and concentrates. Coal is NSW's largest export earner in value terms, worth around $13 billion in 2021[4]. The projected growth in global demand for critical minerals and high-tech metals along with the supply chain rebalancing is providing a once in a generation opportunity for NSW to grow its metalliferous minerals sector export base including possibilities of downstream processing and advanced manufacturing outputs.

The NSW Government is taking strategic and deliberate action to support the growth of exploration activity and metalliferous production through initiatives such as the NSW Minerals Strategy to secure a long-term pipeline of projects that is expected to support the sector into the future.

Exports of coal, copper ore and concentrates, aluminium, gold, are among the leading resources that combined with other ores and concentrates contribute to NSW export values[5]. Export market demand from Asian markets, including Japan, China, Korea and Taiwan is high and growing rapidly, particularly for critical and high-tech minerals.

NSW is host to the largest export coal port in the world and an established world-class supply chain to support existing and future export developments. These factors combine to create a significant opportunity for NSW to capitalise on the global opportunity to supply mineral resources and metals to the world as well as develop mining related solutions, downstream and advanced industries to support the state's economy into the future.

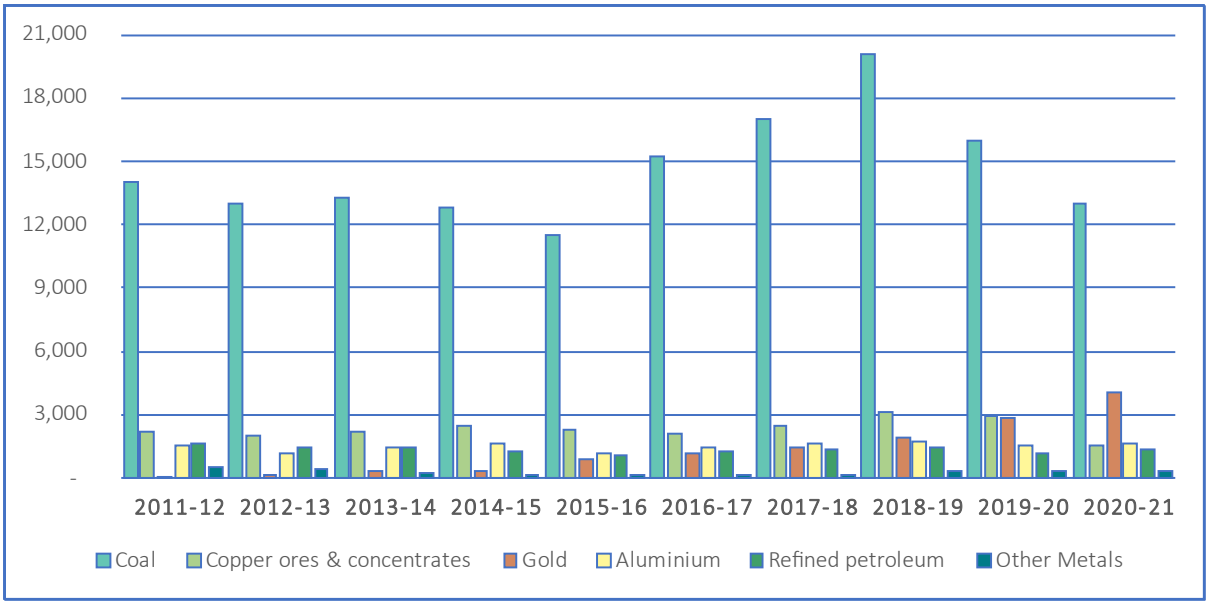

Figure 1: 10-year value trend of NSW trade exports for key mineral commodities ($millions).[6]

[4] Source: Department of Foreign Affairs and Trade, State by country and SITC pivot table 2011-12 to 2020-21, Feb 2022, https://www.dfat.gov.au/about-us/publications/trade-statistical-pivot-tables accessed 01/05/2023

[5] Mining and resources | Invest Regional NSW accessed 01/05/2023

[6] Department of Foreign Affairs and Trade, State by country and SITC pivot table 2011-12 to 2020-21, Feb 2022, https://www.dfat.gov.au/about-us/publications/trade-statistical-pivot-tables accessed 01/05/2023

NSW is well equipped with a unique commodity suite complemented with the necessary supporting infrastructure to meet current and projected resource demands.

High quality thermal coal currently represents the dominant commodity type but this is facing a structural shift over the long term given global trends toward decarbonisation and the uptake of renewable energy generation.

According to NSW Government[7] around 80 per cent of the State's electricity is currently generated from a thermal coal feedstock. This represents around 15 percent of coal produced in NSW with the remaining production exported to the markets of Japan, China, South Korea and Taiwan.

NSW produces or has the potential to develop a range of metalliferous mining products including copper and gold, rare earth elements (REEs), platinum group elements (PGEs), cobalt, lithium, titanium and zirconium. The attractive suite of commodities in NSW are key inputs to future industries such as renewable energy solutions, industrial and mobility applications, electrification and energy storage and smart devices.

A summary of key minerals in NSW are presented as follows:

Key Minerals	Stats
79 **Au** **Gold** [8]	• NSW has a gold endowment (past production and identified resources) exceeding 3,347 t (107.6 Moz) • Ranked 2nd largest producer in Australia • Gold production is sourced from a variety of mineral deposit types producing 37 tonnes in 2021 at a value of $2bn • The State is considered to remain under-explored, with a range of opportunities for new discoveries.
29 **Cu** **Copper** [9]	• New South Wales has a copper endowment (past production and identified resources) exceeding 20.2 Mt. • Ranked 2nd largest producer in Australia • FY21 copper production 220,000 tonnes • Copper is either the principal commodity or a significant credit in a diverse range of deposits. • The state remains under-explored, with a range of opportunities for new discoveries
3 **Li** **Lithium** [10]	• There is a moderate potential for lithium-bearing deposits in New South Wales. • The most likely host to lithium-rich deposits occurs northwest of Broken Hill

[7] Source: Strategic statement on Coal exploration and mining in NSW
[8] Gold opportunities in New South Wales, Australia (nsw.gov.au) accessed 01/05/2023
[9] Copper opportunities in New South Wales, Australia (nsw.gov.au) accessed 01/05/2023
[10] lithium (nsw.gov.au) accessed 01/05/2023

Key Minerals	Stats
28 **Ni** **Nickel** [11]	• There are currently no operating nickel mines in NSW but several deposits of nickel are being explored near Young, Condobolin and Broken Hill. Within NSW nickel tends to occur in polymetallic deposits along with cobalt and scandium.
82 **Pb** **Lead** 30 **Zn** **Zinc** [12]	• NSW is a significant producer of lead and zinc and home of the iconic Broken Hill Line of Lode. • Ranked 3rd in Australia's based on value of exports for Lead and Zinc • Other major deposits include the Woodlawn and Endeavor deposits. • The total endowment identified in NSW is >26.9 Mt of lead (past production and identified resources). • The total endowment identified in NSW is >31.3 Mt of zinc (past production and identified resources). • NSW currently produces around 100,000 tpa of Lead • NSW currently produces around 170,000 tpa of Zinc • There are considered excellent opportunities for the discovery of major new deposits and for development of existing resources.
27 **Co** **Cobalt**	• There are no cobalt mines operating in NSW, but 2 projects are under development developed and several deposits of cobalt are being explored near Young, Condobolin and Broken Hill.
47 **Ag** **Silver**[13]	• NSW is a major producer of silver and home of the iconic silver-rich Broken Hill Line of Lode. Other major deposits with significant silver include the world-class Woodlawn and Endeavor deposits • The total metal endowment (total production + total resources) for NSW exceeds 39,039 t (1,251 Moz) of silver • NSW produced over 110 tonnes of silver last year • Excellent opportunities exist for the discovery of new deposits and for the development of existing resources.

[11] Cobalt and Nickel in NSW - Industry sectors accessed 01/05/2023
[12] Lead and zinc opportunities in New South Wales, Australia (nsw.gov.au) accessed 01/05/2023
[13] Silver opportunities in New South Wales, Australia (nsw.gov.au) accessed 01/05/2023

Key Minerals	Stats
Mineral Sands[14]	• The Murray Basin of New South Wales (NSW) is a world class heavy mineral (HM) sand province. • Major mines are in production, with several projects under development. • There is outstanding potential for the development of known resources and for the discovery of large HM sand deposits.
Rare Earths Elements (REE)[15]	• The potential for rare earth elements in NSW is largely untested with 2 projects with potentially significant resources having been identified. In 2020, Australia is estimated to host 3.5% of the world's REE resources and 7% of global production. • Rare earth elements comprise a series of 15 natural metallic elements ranging in atomic number from 57 (lanthanum) to 71 (lutetium). Also generally included for geological purposes are yttrium (which behaves as a rare earth element), scandium and thorium. • Compounds of rare earth elements have numerous uses, such as in the production of automotive catalytic converters, optical lenses, lighting, and magnets.

[14] Heavy mineral sands opportunities in New South Wales, Australia (nsw.gov.au) accessed 01/05/2023
[15] Rare earth elements opportunities in New South Wales, Australia (nsw.gov.au) accessed 01/05/2023

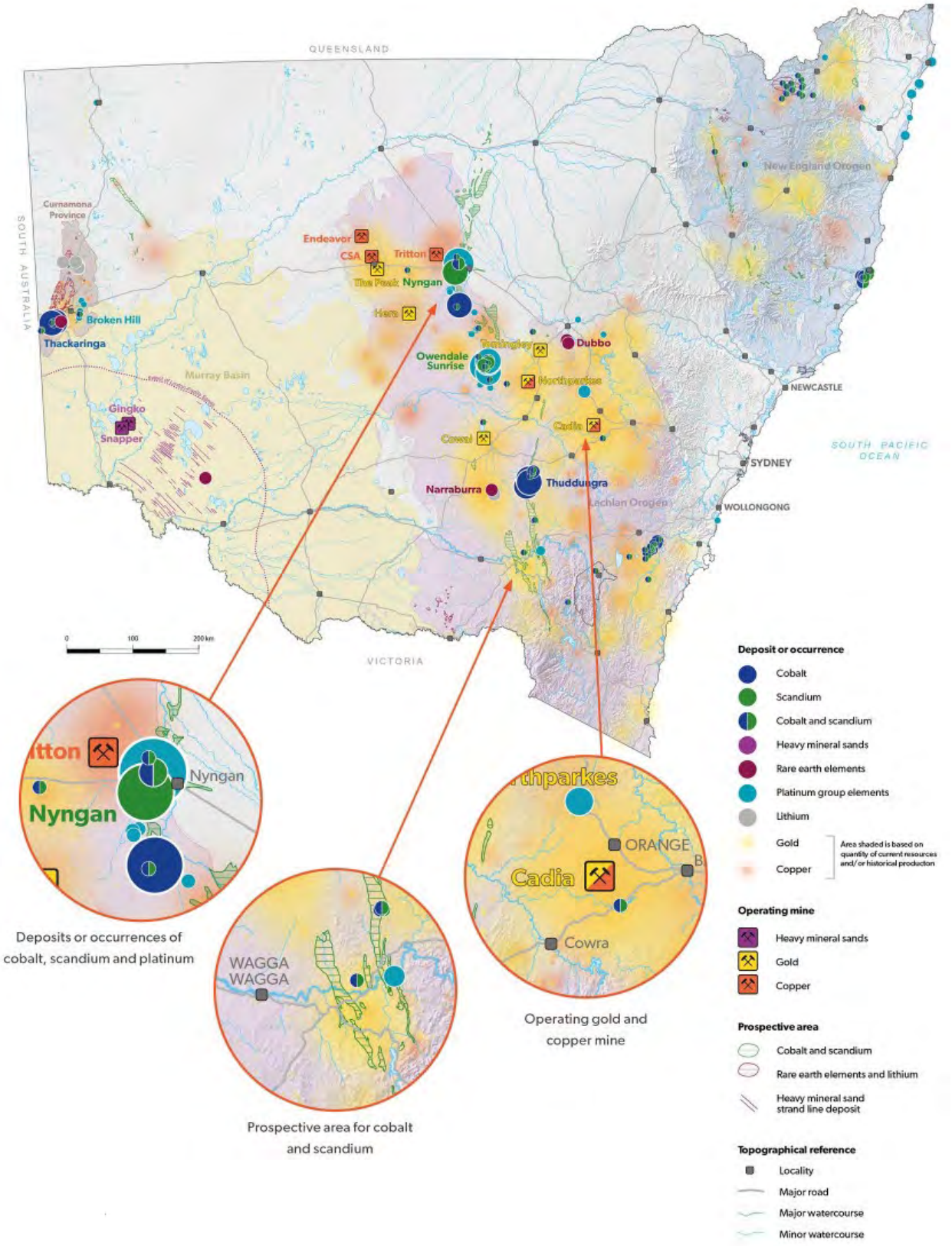

Figure 2: Map of high-tech metals in NSW[16]

[16] Regional NSW – https://www.resourcesregulator.nsw.gov.au/sites/default/files/2022-06/NSW-Minerals-Strategy-2019.pdf accessed 01/05/2023

An Overview of Policy Frameworks in NSW

A range of policy settings underpin the planning and regulatory framework for the resources sector in NSW. Frameworks also exist for gas and opals however these are not addressed in this report. The three key strategies for NSW are as follows and are further detailed in this section:

- NSW Minerals Strategy
- NSW Strategic Statement on Coal Exploration and Mining
- NSW Critical Minerals and High-Tech Metals Strategy

NSW Minerals Strategy

Global demand for precious commodities such as gold and silver is expected to be relatively stable while the demand for base and speciality metals such as copper, lithium, cobalt, scandium and rare earths, platinum group metals, titanium and zirconium is expected to increase significantly.

This increase for base and specialty metals is being driven by advanced technologies and the energy transition - including smart devices, electric vehicles, renewables, batteries and energy storage.

According to the International Energy Agency (IEA) [17] a typical electric car requires six times the mineral inputs of a conventional car and an onshore wind farm requires nine times more mineral resources than a gas-fired power plant of comparable output.

NSW Mineral Strategy was developed to foster growth in investment in mineral exploration and mining in NSW, and position the state as a major global supplier of metals for future industries.

Key pillars of the NSW Minerals Strategy are as follows:

1. Providing data and information
   The strategy provides for improved mapping of resources and areas of high prospectivity, and making geoscientific and historical exploration data more readily available to explorers, investors and other stakeholders.

   Under the NSW Minerals Strategy, the NSW Government is providing A$16 million in funding to support the Mineral Exploration Cooperative Research Centre's (MinEx CRC)

[17] IEA (2021), The Role of Critical Minerals in Clean Energy Transitions, IEA, Paris https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions accessed 01/05/2023

National Drilling Initiative in the state's central and far west to determine whether economically valuable alkali mineral systems lie deep beneath the Earth's surface.

This important ten-year program is the largest initiative and aims to map regional geology and structure and define the potential for Group 1 minerals in less explored areas around Cobar, Broken Hill (Mundi), Dubbo and Forbes.

For reference, Group 1 minerals are metallic minerals that include:

Antimony, arsenic, bismuth, cadmium, caesium, chromite, cobalt, columbium, copper, galena, germanium, gold, indium, iron minerals, lead, lithium, manganese, mercury, molybdenite, nickel, niobium, platinum group minerals, platinum, rare earth minerals, rubidium, scandium and its ores, selenium, silver, sulphur, tantalum, tin, tungsten and its ores, vanadium, zinc, zirconia.

2. Improving authorising services

The efficient and effective processing of mining-related applications is crucial for a growing minerals industry. The government is committed to improving the transparency and level of service for exploration and mining authorisations, including through digitisation of title applications and processing.

3. Promoting investment in NSW

NSW is well positioned to attract investment into this sector. Since 2010, NSW's share of Australian mineral exploration has more than doubled from 5.3 per cent to 11.7 per cent. However, exploring for minerals is a high-risk investment activity with long lifecycles that can exceed 20 years. The NSW government aims to work with the Commonwealth and industry to promote NSW as an attractive place to invest and with a view to growing greenfields exploration and seeding secondary industries.

4. Ensuring best practice regulation

The NSW government has committed to reviewing the applicable legislation and policies to improve transparency and efficiency and encourage growth and community participation.

5. Improving communication and engagement

Given the diverse range of industry and community stakeholders that have an interest in the minerals sector, NSW aims to improve engagement and consultation with stakeholders.

6. Supporting a skilled and diverse workforce

An increasingly skilled and diverse workforce is required to enable a growing minerals industry in NSW with improved participation rates from regional and under-represented groups. This includes promoting mining and geological disciplines through public outreach and support for science education and STEM disciplines.

Further information including a high-tech metal maps and further resources can be found at: https://www.regional.nsw.gov.au/__data/assets/pdf_file/0007/852505/NSW-Minerals-Strategy-2019-02.pdf

NSW Strategic Statement on Coal Exploration and Mining

The NSW Strategic Statement on coal exploration and mining was released in June 2020 and aims to recognise importance of coal to the NSW economy and provide greater certainty to stakeholders amidst the effects of a global transition to a low carbon future on the sector. The Strategic Statement sets a framework for new coal-based development in NSW including extensions of existing projects or new projects in specific locations.

The Strategic Statement on Coal Exploration and Mining in NSW outlines a four-point action plan built around:

1. Improving certainty about where coal mining should not occur including a map showing where coal exploration and mining will be prohibited in the future.
2. Supporting responsible coal production in areas that are suitable
3. Reducing the impact of coal mining including addressing concerns related to emissions, rehabilitation, and closure
4. Supporting diversification of coal-reliant regional economies

Further information can be found at: https://www.regional.nsw.gov.au/meg/nsw-resources/coal

NSW Critical Minerals and High-Tech Metals Strategy

The NSW Critical Minerals and High-Tech Metals Strategy was released in November 2021. It sets a vision to promote exploration, activate supply chains and attract investment focussing on critical minerals and high-tech metals for future industries.

The state has known endowments of 17 of the 24 minerals identified in the Australian Critical Minerals Prospectus 2020, with a number of advanced projects and emerging opportunities for scandium, cobalt, zinc, antimony, heavy mineral sands (titanium and zirconium rare earth elements), magmatic zirconium, platinum group elements and tungsten.

The NSW Critical Minerals and High-Tech Metals Strategy focusses on supporting growth across the critical minerals and high-tech metals value chain, through investments in exploration, mining, processing, downstream industries and recycling. The focus on the entire supply chain is a shift from a traditional model of exporting raw materials in various forms, with a view of capturing a greater share of the value created and catalysing the development of new high-tech industries such as advanced manufacturing, renewable technologies, and energy storage.

Critical minerals and high-tech metals are identified due to their strategic or industrial applications where there exists a lack of substitutes creating the potential for significant disruption if supply is curtailed. The demand for critical minerals and high-tech metals is being driven by global megatrends towards electrification and decarbonisation as they are essential inputs to a range of advanced technologies and clean technologies. NSW has a significant resource base of critical minerals and high-tech metals in addition to an established metalliferous mining industry. This is widely considered to represent a significant opportunity for economic growth and development for the state.

The shift in geopolitics and recent Covid events have exposed the complexity and fragility of critical minerals and high-tech metals supply chains. There is an unprecedented opportunity for NSW to capitalise on this by supporting further onshore value-adding and manufacturing, both within NSW and across Australia to ensure security of supply for ourselves and our regional partners.

Consumers are increasingly conscious of the origins of goods, and the impact of their choices. NSW can play a significant role to meet the demand for reliable and responsible mining practices. With regional locations such as Parkes positioned as the central hub for two rail corridors and access to four major ports, provides a reliable gateway to fifteen Australian critical minerals projects.

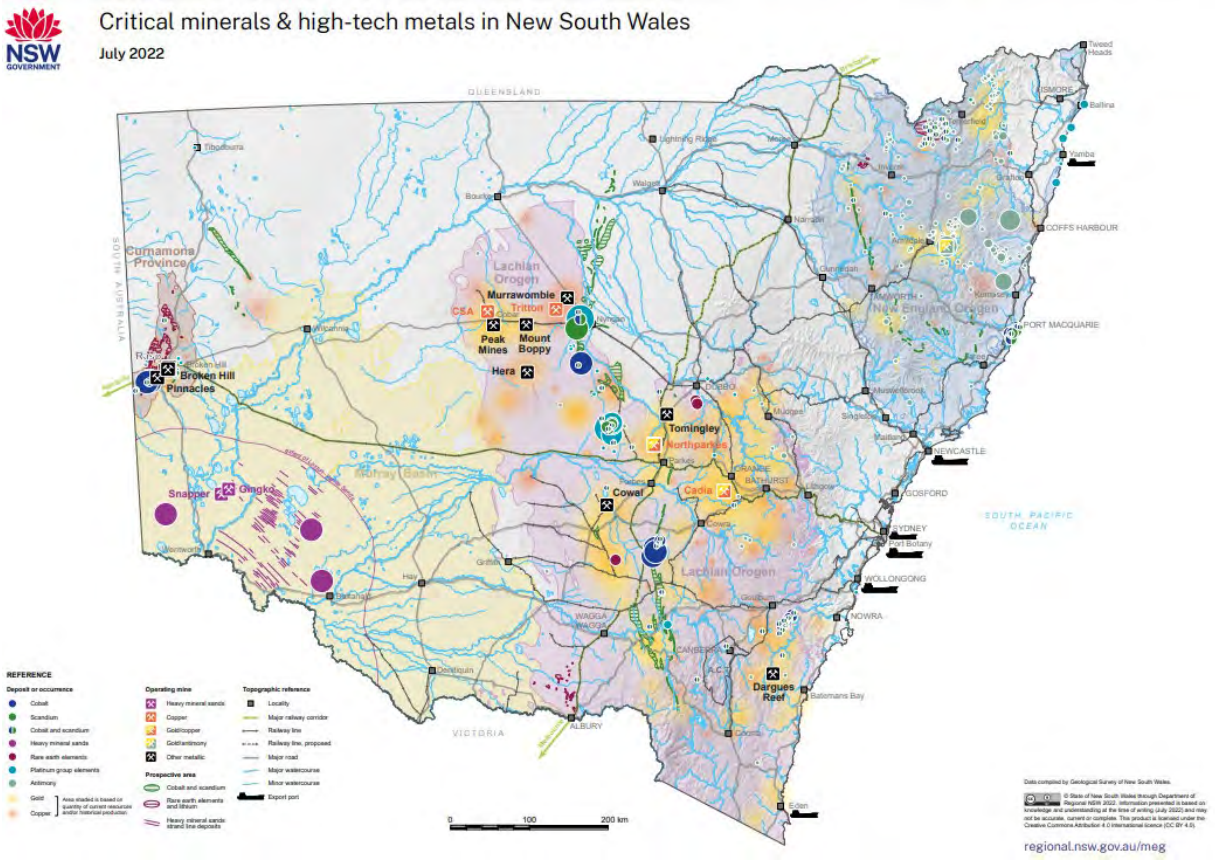

Figure 3: Map of NSW critical mineral projects, July2022[18]

A significant initiative resulting from the NSW Critical Minerals and High-Tech Metals Strategy is the announcement of Australia's first Critical Minerals Hub in the Central West region of NSW. A Critical Minerals and High-Tech Metals Hub will be a central feature in an integrated supply chain, connecting the locations of critical minerals and high-tech metals across Australia which are used for mining, as well as being a central focal point for collaboration and aggregation with the surrounding established and potential mining developments in the region including the Central and Far West of NSW. It will also be a centre for creating renewable energy to assist with downstream critical minerals refining and reprocessing.

[18] Regional NSW, https://meg.resourcesregulator.nsw.gov.au/invest-nsw/nsw-mineral-resources/critical-minerals accessed 01/05/2023

In an indication of the importance of ESG in the strategy (and the development of the Hub in particular), the Hub is intended to provide access to renewable energy generation and transmission facilities and aims to promote a circular economy by creating potential pathways for end-of-life e-waste.

In addition to the creation of the Hub, several aspects of the NSW Critical Minerals and High-Tech Metals Strategy are designed to position NSW as a premier location for critical minerals and high-tech metals exploration and mining. For example:

- A commitment to redirect the State's Geological Survey to focus more on NSW's critical minerals endowment as well as releasing further data from prior surveys including high-tech metals maps – refer below:

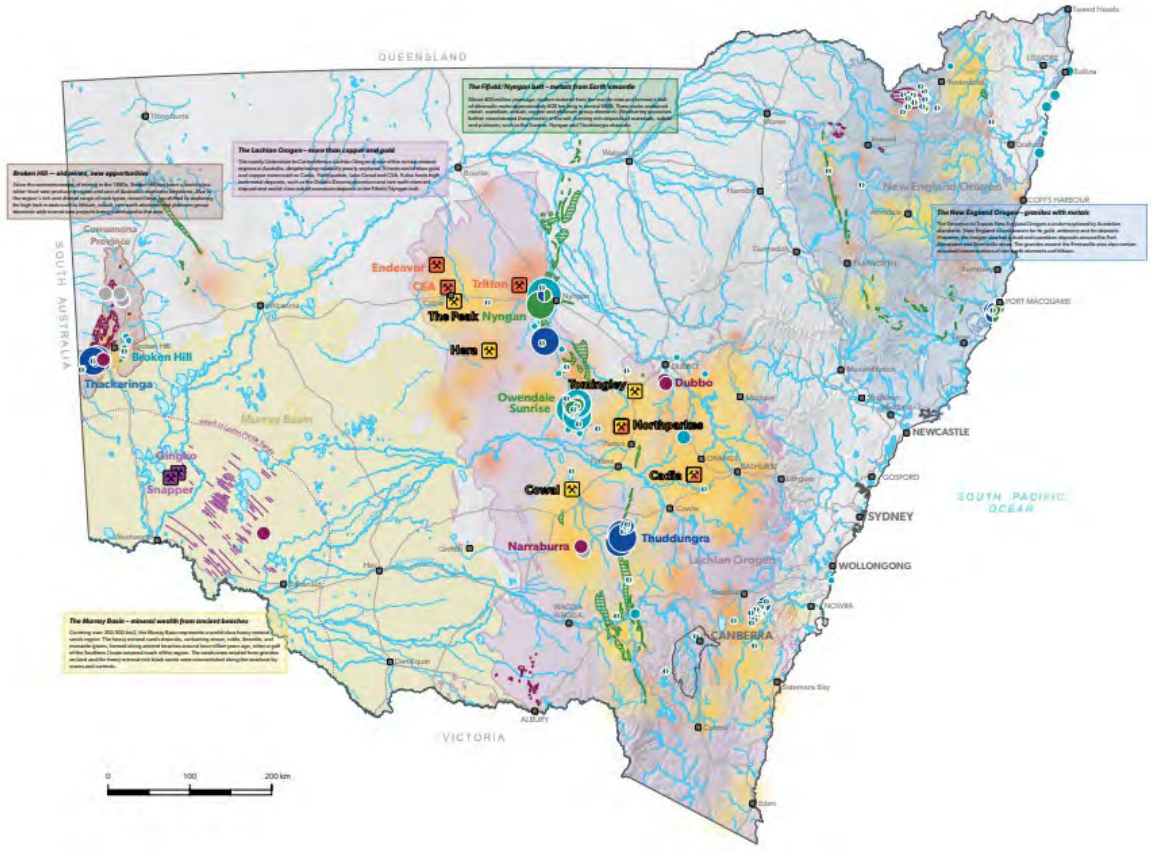

Figure 4: High Tech Metals Resources of NSW [19]

- The establishment of a dedicated Mining Concierge Service; and
- A dedicated function within the Mining, Exploration and Geoscience division of the NSW Government to support attracting international investment into the critical minerals space in NSW.

Further information can be found at: https://www.nsw.gov.au/criticalminerals

[19] Regional NSW, https://www.regional.nsw.gov.au/__data/assets/image/0019/1304128/metalsmap.jpg accessed 01/05/2023

An Overview of NSW Mining Equipment, Technology and Services (METS)

The Mining, Equipment, Technology and Services (METS) sector represents firms and companies that provide specialised solutions to the mining and minerals industries. METS companies are diverse in size, scope and services and work across a range of mineral types, production methods and stages of the mining life cycle. While METS firms typically service the mining and minerals sector, their services may also transfer to other industries.

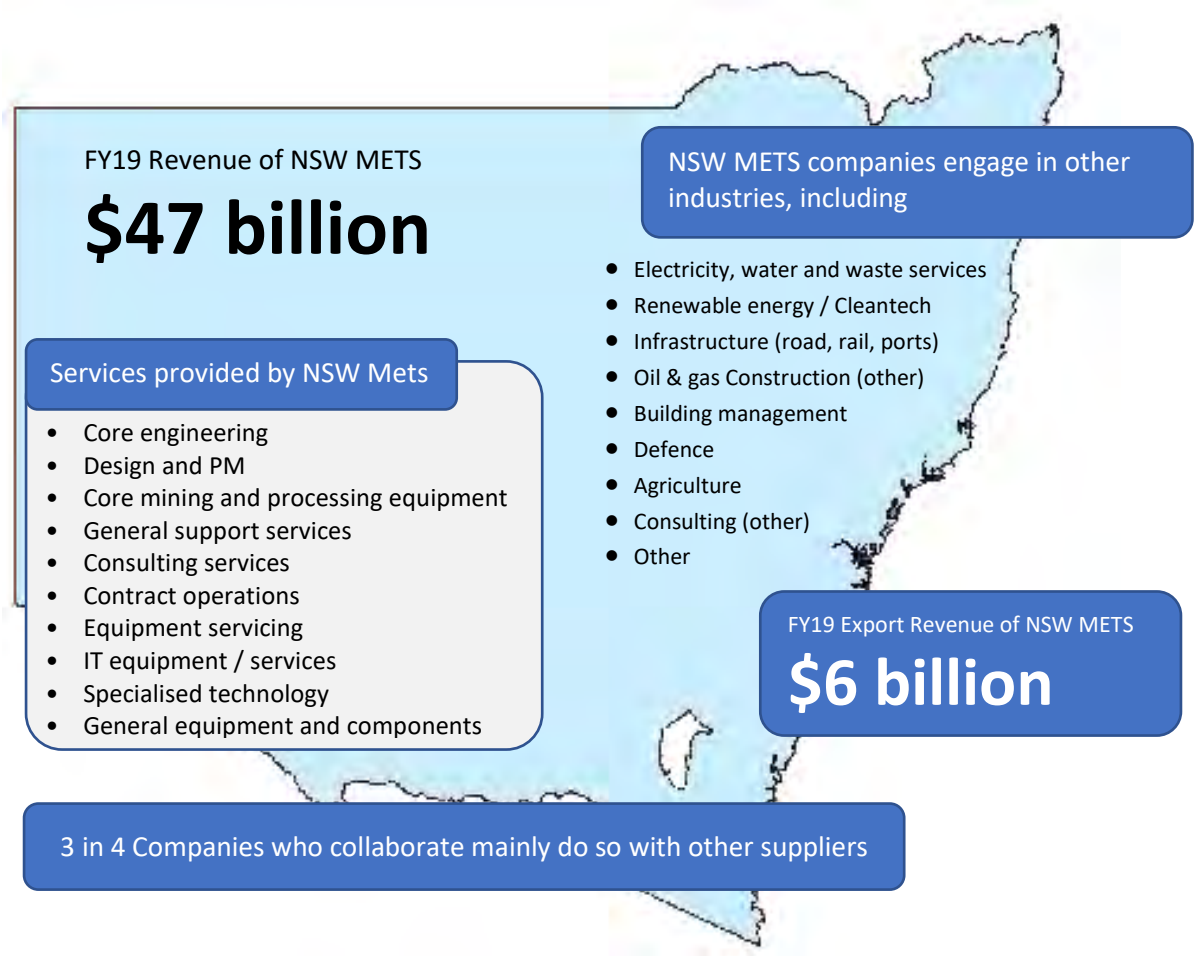

Figure 5: Contribution and services offered by NSW Mets companies - information adapted from Austmine Nov 2020 report.

NSW has some of the most competitive extractive and export supply chain operations in the world. In addition to its world class operations, NSW has one of the world's most innovative METS sectors, one that has supported a strong, innovative mining supply chain, and supports jobs in the State.

Innovation and applied technology development has been at the forefront of some of NSW's most important mining developments including remote communications and automation, sensing and airborne technologies and energy-efficient mineral processing. The sector is investing heavily in new energy technologies and applications to minimise waste to deliver world leading safety and environmental performance.

Today, global mining sector priorities including the application of technologies and the transition to a low carbon future present the NSW METS sector with an unparalleled opportunity to build on this foundation.

According to Australia's METS peak industry body Austmine the METS Sector in Australia continues to be a powerhouse of the Australian economy generating over $100 billion in revenue annually, employing thousands of people and exporting to every corner of the globe. It is driven by a culture of innovation and has a sharp focus on technology now and as a future opportunity.

In November 2020 Austmine released the findings of a survey of 619 METS companies around the country which alongside data sourced from METS Ignited concludes the sector:

- Generates a Total of $114 billion in revenue
- Employs almost 300,000 direct employees[20]
- Globally focus, with 65% of companies exporting their products and/or services
- Strong innovation and R&D culture with 90% of respondents considered innovation to be important factor for growth

The Australian METS sector is the backbone of our world-class mining industry, providing products and services that make mines safer and more efficient since mining began in Australia.

NSW is a leading supplier of innovative METS solutions for the resources industry, and many products and services used in the global sector were developed in NSW. As an example, these include longwall mining equipment, hydraulic roof support systems, mineral processing technologies, advanced mining technologies, mine planning and evaluation software.

Austmine identified that NSW is the highest revenue generating METS state nationally and is host to the second largest number of METS headquarters in 2020. NSW was estimated to generate $49 Billion in gross revenue, which is 41.2% of the national total. NSW companies consistently make up a significant share of national revenue. The sector is highly export oriented with NSW generating one third ($6bn) of the national export revenue ($18bn).

According to Austmine 74% of NSW METS companies are Australian owned. 33% of METS companies were established in the last 10 years with the median company age recorded in the survey being 17 years. This indicates a highly entrepreneurial sector with great potential for growth as the smaller companies mature into larger organisations.

NSW is underpinned by a resources and METS sector that that has demonstrated capability for success, a diverse operating landscape and a pipeline of proven and further exploration projects. As such it is well positioned and has the opportunity for further development of the sector into the future.

NSW METS should continue to draw on the strength of Australia's largest economy, established and growing infrastructure, a highly skilled and productive workforce, and its strategic location in industrialised centres and access to global markets.

[20] METS Ignited, https://metsignited.org/australian-mets-sector/, accessed 30 March 2021

Case Study –Ampcontrol – A leading Hunter METS company

Founded in 1968, Ampcontrol was established with the belief there was a long term need for Australian manufacturing capabilities. Through diversification and expansion, Ampcontrol has grown into a company that now has national and international offices providing parts and services to all parts of the world[21]. Maintaining its history in Newcastle, Ampcontrol employs over 1,000 people worldwide[22]and is frequently engaged to find solutions to complex operational challenges where others cannot.

Ampcontrol activity engages in the delivery of innovative solutions to support the next phase of growth. This is demonstrated by the company's recently announcement that it had entered into a strategic partnership and collaboration agreement with emerging hydrogen company LAVO[23] and standalone power system company Boundary Power[24].

With innovation and collaboration as a pillar of Ampcontrol's business model, Ampcontrol continues to adapt and grow to meet the challenges of an evolving energy market. As a NSW based company producing Australian products for the domestic and export markets, Ampcontrol's foundational belief that there is a need for Australian manufactured products, continues to position the company for continued growth over the long-term.

For more information on Ampcontrol visit: https://ampcontrolgroup.com

NSW METS Sector Capabilities

The strength of valued partnerships and being known for reliable quality solutions, is commonly identified as central to the identity of the Australian METS sector. NSW METS companies are known for their standard of service and capacity to deliver long-term support, as well as superior products.

[21] Ampcontrol History, https://www.ampcontrolgroup.com/wp-content/uploads/2016/09/Ampcontrol-History.pdf, accessed 01/05/2023
[22] Ampcontrol, https://ampcontrolgroup.com/about-us/, accessed 1/05/2023
[23] Ampcontrol, https://ampcontrolgroup.com/leading-the-way-to-produce-one-of-the-most-sought-after-products-in-the-renewable-energy-consumer-sector-the-lavo-hydrogen-energy-storage-system/, accessed 1/05/2023
[24] Ampcontrol, https://ampcontrolgroup.com/stand-alone-power-systems/, accessed 1/05/2023

Australia is recognised globally as the market leader in Mining Equipment, Technology and Services across many different technology platforms and commodity segments. The combined METS-Mining Sector in Australia contribute an estimated 15% of GDP, supports over 1.1 Million jobs, almost 10% of all full time employment - including regional and remote communities[25].

According to the 2020 Austmine survey, the NSW METS sector reports activities that including engineering services, project management, professional services and logistics management. They rated skilled staff as a key competitive advantage behind the quality of the product or service provided and ahead of customer relationships.

Collaboration and Innovation

Meaningful collaboration and strong partnerships are the basis of a thriving, resilient and innovative METS sector. The mining industry is becoming increasingly more complex and challenging and will require the on-going adoption of evolving and step-change technologies.

Collaboration enables technology providers to connect and combine their individual solutions into merged offerings to solve industry challenges and provides an important conduit to the deployment of innovation in a practical context.

The Australian mining and METS sector participate in a range of innovative partnerships with research bodies. These include Cooperative Research Centres (CRC's) the Australian Coal Industry's Research program (ACARP), and AMIRA Global – which facilitates mining R&D.

The positive outcomes from collaboration are numerous and include benefits to mine safety, automation, energy efficiency, low emissions technologies and sustainability practices.

Mining, METS and research organisations are increasingly working closely together to develop and accelerate the adoption of innovation into global mining supply chains.

METS Ignited is an industry-led, government-funded, Growth Centre for the mining equipment, technology and services sector. The Industry Growth Centre initiative focuses on areas of competitive strength and strategic priority, with the goal of enabling national action on key issues such as regulation reform, skills, collaboration and commercialisation.

It is vitally important to promote and celebrate collaboration in the METS sector because Australia's competitive advantage in this space depends on our ability to work collectively to solve industry challenges.

[25] METS Ignited, http://www.metsignited.org/australian-mets-sector , accessed METS Ignited, http://www.metsignited.org/australian-mets-sector , accessed 01/05/2023

Case study - 3ME Technology - Collaboration and Innovation:

Based in NSW's Hunter Region, 3ME Technology is an Australian heavy-vehicle battery manufacturer designing and producing energy-dense, lithium-ion battery systems in a modular format to power mining and military electric vehicles (EV) and equipment[26].

In 2019, the company rebranded and refocussed after a decade of developing battery electric vehicle systems, to focus specifically on the mining, military and marine markets[27]. Since this time, 3ME Technology have led the way in electrifying heavy-duty vehicles and machines operating in mission critical environments. The company's developed a cell-level battery management system, where individual cells can be monitored, predictive analysis completed in real time and a battery shut down remotely if a cell is not performing as expected. This pioneering technology is being applied across the mining, defence and aerospace sectors[28].

In 2021, 3ME Technology was ranked the most innovative company for agriculture, mining and utilities in Australasia by AFR BOSS Most Innovative Companies. "We're at the forefront of an emerging Australian industry," says 3ME Technology CEO Justin Bain. "There's a big opportunity to scale up production because we're solving safety and environmental problems that apply across a range of industries, not just mining [29].

In 2022, 3ME Technology was named as a winner of the *2022 Charge on Innovation Challenge*, with the company providing a purpose-refined version of its battery system to fit the requirements of haul truck operations. This innovative system is scalable to fit varied truck sizes, composed of the optimum chemistry, cost-effective and compliant with proposed charging infrastructure, as well as enabled to capture and analyse critical data that will help improve operations going forward[30].

A key to 3ME Technology's success is its focus on partnering with world leading companies ensuring their battery systems remain cutting edge, including global company PWR Advanced Cooling Technology[31] and Urban Mobility Systems[32] in The Netherlands.

"We are finally seeing Australian technology companies being recognised in their own right, as the engine room of our industry and the future of our economy," said Adrian Beer, METS Ignited[33].

For more information on 3ME Technology visit: https://3me.technology/

[26] 3ME Technology, https://3me.technology/, accessed 1/05/2023
[27] International Mining, https://im-mining.com/2019/02/25/energetique-mining-vehicles-changes-name-focus-to-3me/ , accessed 1/05/2023
[28] Australian Business Growth Fund, https://abgf.com.au/case-study_01/, accessed 01/05/2023
[29] Ibid.
[30] Charge on Innovation Challenge, https://chargeoninnovation.com/winning-technology-innovators-announced/, accessed 1/05/2023
[31] 3ME Technology, https://3me.technology/2021/07/06/3me-technology-collaborate-with-pwr-advanced-cooling-technology/, accessed 01/05/2023
[32] Urban Mobility Systems, https://urbanmobilitysystems.nl/en/partnership-with-3me/, accessed 01/05/2023
[33] METS Ignited, https://metsignited.org/3metechnology-mostinnovativecompany/, accessed 01/05/2023

NSW Resources and METS Research – World Class Research Addressing Industry Challenges

Universities

NSW is home to a number of Australia's leading research institutes that are advancing mining and metals related research including refining and processing. These universities have a strong track record of collaboration with industry to optimise success for new innovation to be piloted and commercialised. They also have a strong focus on industrial education and skills development which will underpin the mining and METS sector of the future.

University of Newcastle

The University of Newcastle is one of the largest regional universities in Australia. Its enrolment exceeds 39,000 students with nearly 3,000 staff[34]. The University's research priorities are underpinned by the mantra "enriching our regions" and specific research priorities include "Next Generation Resources" and "Growing Industries"[35]. Other research priorities include new energy sources such as Hydrogen and renewable storage research which is relevant to the resources sector decarbonisation efforts.

Further information can be found at: https://www.newcastle.edu.au/

Case Study – ARC Centre of Excellence for Enabling Eco-Efficient Beneficiation of Minerals

The ARC Centre of Excellence for Enabling Eco-Efficient Beneficiation of Minerals develops transformational technologies for a competitive and environmentally sustainable future for Australia's mineral industries through reduced environmental footprint, reductions in energy and water use, high resources recovery as well as support future leaders for the sector.

The Centre is led by Laureate Professor Kevin Galvin and will see the University of Newcastle collaborate with researchers from seven Australian universities, CSIRO, industry partner organisations, as well as leading international researchers.

The Centre will develop transformational technologies for enabling a competitive and environmentally sustainable future for Australia's minerals industry through:

- reduced environmental footprint
- significant reductions in energy and water use
- higher resources recovery
- future leaders to support the sector

This Centre will transform the minerals industry, establishing a new generation of research leaders to support the innovation needed in creating a green economy for future generations.

Further information can be found at: https://coeminerals.org.au/

[34] University of Newcastle 2021 Annual Report, https://www.newcastle.edu.au/our-uni/governance-and-leadership/annual-report accessed 01/05/2023

[35] University of Newcastle, Sustainable Development Goals, Progress Report 2021, accessed online at https://www.newcastle.edu.au/__data/assets/pdf_file/0011/790616/SDGs-UON-Progress-Report-2021.pdf accessed 01/05/2023

Newcastle Institute for Energy & Resources (NIER)

The Newcastle Institute for Energy & Resources (NIER) was established in 2010 as an Australian Government initiative funded by $30 million from the Education Investment Fund and a further $2.2 million funding from the NSW Government.

NIER is driven by a clear objective, to build a world-class facility as well as a critical mass of leading researchers across a range of disciplines to undertake innovation research for next generation energy solutions and minimising energy usage in the resources sector.

NIER is located on a 3.8 hectare precinct at the University's Callaghan campus, and comprises extensive mineral, chemical and related technical laboratories, industrial-scale pilot plant workshops, demonstration units, and office accommodation for over 400 staff, students and industry partners. The site has historical importance as BHP's former Newcastle Technology Centre, one of the first industrial facilities in Australia where international research in chemistry, chemical engineering, coal and ore beneficiation, and metallurgy was advanced. NIER is proud to continue this legacy of innovation.

NIER provides a multidisciplinary model which connects academia and industry through a common platform for transformational research in the core areas of energy and resources. The model facilitates collective capacity and joint branding of industry partners and research groups, enabling them to engage significant national and international research collaborations. The model also enhances client relationship management through a single governance structure, which offers one point of contact for the implementation of master agreements, research contracts and the resolution of high-level issues. Key operational strategies of the Institute include:

- Using a 'client relationship model' to garner industry engagement
- Forecasting emerging trends to provide clients with relevant, leading research
- Establishing and operating interdisciplinary teams from a neutral territory
- Embedding consultative management and governance practices into the Institute's operations.

Spotlight: NIER Research Resources Roadmap

Research Resources Roadmap Key Findings

NIER recognise the Australian resources sector is rapidly expanding with rising global demand for modern technology and renewable energy solutions requiring new resource development, skills and enabling technologies.

Achieving the sustainability of the Australian minerals industry requires higher product recovery while reducing costs and environmental impact. Expanding markets and securing supply chains during periods of rapid change and uncertainty, growing and supporting the health and safety of the resources workforce, and identifying solutions to improved environmental and social outcomes, presents challenges and opportunities for the sector.

Next Generation Resources for Future Mining

Shifting from a carbon to a metals-based economy brings with it important challenges for the sector. The need to accommodate this demand while addressing declining grade of the most accessible ore bodies, and the increased need for minerology and extracting ores from deeper mines will require a transformational shift in thinking and practice.

The University of Newcastle is seeking to advance a sustainable and competitive future for Australia's minerals and metals industries through the delivery of transformational technologies and a new generation of research leaders to support the sector.

Health, Safety & Environment

The Australian minerals industry is a world leader in workplace health and safety and lists workplace safety as the sector's number one priority. Good environmental stewardship is also fundamental to responsible business practice and industry is working across the mining lifecycle to reduce environmental impact.

Researchers at the University of Newcastle are developing effective health, safety and environmental programs based on the industry and community core values. Preventive measures are being implemented regarding workplace culture, mental health, hazards and planning to support mine closure and rehabilitation.

Resource Recovery & Circular Economy

Waste and resource management practices are shifting in Australia and globally. The value of resources and embodied energy in waste is now recognised. There is an economic opportunity and growing desire to recapture resources and recirculate them within the economy. The vision of developing a circular economy is gathering pace, as community reaction against waste hardens, and bans on export of some of our waste places communities under extreme pressure.

NIER offers a collaborative platform to deliver increased productivity and sustainability for industry through innovation in resource recovery and waste management. Researchers are working across industry, local governments and businesses, and across the supply chain in areas including waste characterisation, the development of new applications for resource recovery and re-use, handling and remanufacturing. We measure our impact through increased sustainability by reducing energy and water consumption while maximising resource recovery and product grade and delivering sustainability, efficiency and productivity gains.

Case Study – Mine Rehabilitation Using Tailings for Topsoil

In partnership with Muswellbrook Shire Council, Bengalla Mining Company, Jord International, MACH Energy and Australian Coal Association Research Program (ACARP), NIER researchers at the Centre for Bulk Solids and Particulate Technologies are advancing a "Tailings to Topsoil" project. This project is exploring alternative solutions to tailings disposal in mining operations by transforming suitable tailings into a soil additive for developing high-performance biomass production.

Using innovative technologies, the project aims to convert raw mine tailings into topsoil that can be used to grow crops for mine rehabilitation, energy or biofuel production. PhD students at the Advanced METS Doctoral Training Centre are also assessing the cost effectiveness of the technology for farmable topsoil addition and germination and plant growth techniques.

Evaluating tailings and soil blends to optimise germination and plant growth and to further improve the qualities of tailings samples is occurring through greenhouse trials at NIER, and field trials at mine sites.

The flow on benefits of the project include the creation of additional pathways for agribusiness on mined land, improving fertility through carbon availability, and water retention on marginal lands.

For further information on this project please contact NIER:
https://www.newcastle.edu.au/research/centre/nier

UNSW

UNSW has a highly ranked school of Minerals and Energy Resources – 3rd in the world (QS World University Rankings, 2022), and 8th in the world (Academic Ranking of World Universities, 2022).[36] The school is at the forefront in creating opportunities for those interested in working towards a sustainable future through several new and emerging fields. Areas of focus include CO_2 sequestration; improving efficiencies through digital rock analysis; generating clean energy through geothermal engineering; and research into space mining. Facilities at UNSW include a 3D Virtual Reality theatre to explore everything from open cut mines to NASA rovers.

Key research areas

UNSW sets out to deliver high-impact research that supports a future of clean energy and sustainable resources.

The school of Minerals and Energy resources works in close collaboration and partnerships with industry and external partners, locally and internationally to drive the national agenda across the sector. Research areas cut across three themes that aim to advance the knowledge of extractive industries whilst reducing footprint and developing efficient energy storage solutions. This unique approach brings together expertise from both academia and industry, to address the grand challenges around future energy and minerals supplies and thus, achieve sustained economic development. Key themes include:

[36] https://www.unsw.edu.au/engineering/our-schools/minerals-and-energy-resources-engineering/about-us accessed 01/05/2023

Geomechanics - A focuses on fundamental and applied geomechanics related to the mining and oil & gas industries.

Transformative technologies - A focus on integrating advanced technologies and operational excellence to accelerate the transformation of the minerals and energy resources sectors.

Geoenergy - Research in geoenergy and technologies that improve recovery and provide new insights into the production of natural gas.

Case Study – UNSW and the Future of Mining: Space

The team at the UNSW Australian Centre for Space Engineering Research (ACSER) is looking for ways that Australia can leverage remote mining expertise as part of plans to expand space mineral exploration operations.

Since its inception, NASA has proposed a vision of human exploration that involves missions and outposts in Earth orbit, the lunar surface and Mars, with supplies delivered from Earth's surface. When in-space resources are considered, they are assumed to be derived from the surface of the moon or Mars, with some consideration of Phobos and Deimos.

The UNSW ACSER plays a key role in developing Australia's capacity to participate in the human exploration and colonisation of space, and draws on the experience and leading-edge expertise developed by Australia's mining industry to enhance the country's growing space industry. Professor Andrew Dempster, director of ACSER at UNSW, believes that Australia is uniquely placed to carve itself a niche in the global space industry by exploiting its position of strength in mining expertise.

"Australia has a natural advantage for off-Earth mining – we have some of the very best mining research, technology and automation tools in the world, and the largest mining companies," Professor Dempster said.

Recognising this, UNSW will be hosting a discussion with Dr Robert Jedicke from the University of Hawaii to discuss the future of near-Earth object (NEO) mining and space exploration and Australia's place in the growing space economy.

NEO resources are a cost-effective approach because they contain available, exploitable extra-terrestrial materials that are delivered to the inner solar system by gravitational perturbations from the planets, they have been naturally pre-processed into objects the ideal size for industrial operations, and they contain critical materials for cost-effective, self-sustaining activities in space.

Space mining is closer than you think, and the prospects are great (unsw.edu.au)

University of Wollongong – (UOW)

UOW is a relatively young University, located in the Illawarra, a region that has a long history of mining and metals processing. It is globally recognised for delivering impactful research that drives positive change. UOW ranks 6th among the world's universities for social and economic impact in the Impact rankings, which are benchmarked against the United Nation Sustainable Development Goals.

The UOW Engineering Materials Research Centre (EMRC) is strongly associated with the Steel Research Hub which co-ordinates research of specific relevance to the steel industry.

The EMRC's objectives include conducting world-class research in the design, synthesis and characterisation of advanced materials for engineering applications and ferrous metallurgy.

NUW Alliance

The NUW Alliance between four Universities (Newcastle, NSW, Wollongong and Western Sydney) was established to explore, develop and deliver collaborative opportunities where the benefits are greater than the sum of each University working separately.

The Alliance seek out the big collaborations that make a difference, collaborations that unlock new value, impact and benefit for communities across NSW and is guided by strategic priorities to:

- Deliver impact for NSW by focusing efforts on the challenges faced by the state;
- The pursuit and execution of opportunities for collaboration that a single Alliance partner cannot pursue alone;
- Enabling collaboration for the Alliance by building and strengthening frameworks between partners that encourage, foster, embed and celebrate collaboration;
- Removing barriers to collaboration faced by our partners and potential partners in industry, government and the community by establishing a framework for access;
- Prioritising collaborations that contribute to excellence in research, teaching and the student experience; and
- Ensuring collaborations are underpinned by the sustainable development goals.

Energy and Resources research is a key activity for the Alliance that includes NUW Energy representing more than 200 discrete areas of world-class energy research capability and access to 30 distinct, world-leading research facilities, centres and institutes of research and innovation in NSW.

For more information: www.nuwalliance.edu.au

University of Sydney – Australian Centre for Field Robotics

The Australian Centre for Field Robotics (ACFR) at the University of Sydney is one of the largest robotics centres in the world. The centre's mission is to undertake research to develop new field robotics and intelligent systems theories and methods, and apply them in industrial, social and environmental settings. The Centre has produced a number of ground-breaking innovations and has produced several start-ups

The Centre hosts the Rio Tinto Centre for Mine Automation (RTCMA) which is a collaborative research project in partnership with Rio Tinto spanning over a decade. Key areas of focus are planning and optimisation, ore body modelling and autonomous vehicles.

Research conducted at the Centre brings together multiple highly technical academic disciplines and the output has resulted in several major research advancements, in both fundamental and applied areas, as well as technologies that have transitioned into operating mines.

University of Technology (UTS) – Sydney

Future Industries and Sustainability are key research themes within the UTS research portfolio. Its Centre for Clean Energy Technology focuses on the development of efficient devices for energy harvesting, storage, and conversion. The Centre for Green Technology takes a multi-disciplinary approach in the following research areas:

- Vehicle emissions and air quality
- Renewable energy generation and storage
- Waste valorisation and environmental decontamination

Case Study: Institute of Sustainable Futures – Resource Stewardship – UTS-ISF

The Institute of Sustainable Futures – Resource Stewardship (UTS) work with organisations to identify and evaluate opportunities to avoid, reuse and recover waste and adopt new circular economy business models.

Resources are fundamental to our society and wellbeing yet increasing demand places huge pressure on our natural resources, degrading fragile ecosystems, and adversely affecting human health. At the same time, societies are becoming increasingly wasteful, pollution from plastic waste is a pressing global environmental problem and our resource recovery systems for discarded packaging, organics, textiles and e-waste are failing.

UTS-ISF do not see this as a simple waste-management problem. The research team takes a 'circular economy' approach that creates a new vision for sustainable economies, where products, processes and systems are redesigned to avoid waste and to maximise the value of resources through actions to: reduce, repurpose, reuse, remanufacture and recycle.

For further information visit: https://www.uts.edu.au/isf

Supporting Skills for the Future

NSW has world-class capabilities in resources and energy sectors that provide a strong foundation to remain a significant position in mining and METS value chains. However, just like the numerous pathways that exist in existing and future resource value chains the skills required may also be diverse.

There are a range of careers on offer including high-skilled jobs in the resources sector. According to NSW Mining37 there are more than 40,000 people working in mining jobs across NSW. And there are thousands more working in businesses that support and service the industry. Skills and careers range from chemical engineers and drone pilots to software engineers and lab technicians. Environmental scientists and business analysts to mining engineers, transport operators and safety professionals. These are the high-value roles that are vital to a strong mining industry in NSW and the economic benefits mining creates.

The foundational technical skills evident in the resources industries in NSW are well equipped to meet the future operational and technology needs of the future.

NSW GOVERNMENT | TAFE NSW	**TAFE NSW** is the leading provider of vocational education and training in Australia, and is a strong and trusted brand that has been delivering training for more than 130 years. Supporting more than 430,000 students enrolments in courses and training per year. TAFE NSW aims to skill the workforce for the future through high quality, personalised education and training and enjoys a reputation for industry and business partnerships. TAFE NSW offers a range of resource sector related courses to support pathways into large company environments, or niche skillset in extraction, machinery, project management or instrumentation and control. For more information: https://www.tafensw.edu.au/
NSW GOVERNMENT	**Training Services** is part of NSW Department of Education and works to improve training outcomes for the people of NSW. It supports apprenticeships and traineeships, smart and skilled, and adult and community education. The vocational training gives people practical skills and knowledge for the workplace. The programs can help people entering the workforce for the first time, improving their skills, or developing a new career and supports economic and regional development. For more information: https://www.nsw.gov.au/nsw-government/departments-and-agencies/department-of-education/training-services-nsw

[37] NSW Mining - https://www.nswmining.com.au/education-and-careers

Coal Services	**Coal Services** is a specialised Health and Safety Scheme that provides an integrated suite of services to help identify, assess, monitor and control many risks inherent in the NSW coal mining industry. Our preventative and responsive services in the areas of workplace health and safety, workers compensation, emergency response and training help to deliver on our purpose, 'to protect'. Coal Services is owned by industry for industry, through the NSW Minerals Council and the Mining and Energy Union. The purpose, vision and values are aligned to focus on the safety and health of our industry and its workers. For more information: https://www.coalservices.com.au/
NSW GOVERNMENT	**Testsafe** enjoys over 50 years' experience keeping workers safe through rigorous testing of equipment and workplaces, not only in Australia, but around the world. The organisation tests workforces or workplaces to assess risks on chemical exposure - or certification for the Australian or international market. For more information: https://www.nsw.gov.au/testsafe
HUNTERNET the power of many	**HunterNet Career Connections and Future Leaders Program** exists to support business growth, build a quality, skilled workforce and ensure the Hunter region's current and future success. We do this by taking on the job of acquiring and developing fresh talent and empowering them to work safely, be their best every day, and reach their career potential. For more information: https://hunternet.com.au/

Mining and METS in NSW – Organisational strength, collaboration and diversity

Key Organisations

The growth of the resources and METS industry in NSW requires a culture of collaboration, information sharing across sectors, and partnerships between industry, researchers, government, and community. There are a range of stakeholders relevant to the sector that are aligned to the objectives of Resources NSW to drive innovation, foster connections, accelerate technology to market and promote jobs growth.

A summary of collaborative networks business and industry groups include:

ENERGY & RESOURCES KNOWLEDGE HUB	The **Energy & Resources Knowledge Hub** (ERKH) is a collaborative knowledge platform established in 2014 that supports the NSW energy and resources sector. ERKH is an initiative of the NSW Government and works to facilitate engagement between industry, research organisations and government. It also supports NSW business by sharing knowledge, giving SMEs the resources needed to overcome challenges, thrive in their local region and be competitive in global markets. Led by the Newcastle Institute for Energy and Resources (NIER) and harnessing the power of key stakeholders from industry, research and government, the Hub provides access to new tools, services and pathways to accelerate technology and business development. The Hub is focussed on growing NSW businesses by connecting state-wide and national networks that gives SMEs the support and resources needed to thrive in their local region and be competitive in global markets. The Hub seeks to break down geographical barriers to collaboration and innovation, to help businesses connect, collaborate and share information and resources to find economical solutions that will promote business growth For more information: www.energyinnovation.net.au
Hosted by: ENERGY & RESOURCES KNOWLEDGE HUB	The objective of **Resources NSW** is to foster relationship between key stakeholders under a collaborative platform to share information and deliver initiatives to boost the productivity, efficiency, and international competitiveness of the Resources sector in NSW. Focus areas include: • Mining Equipment, Technology and Services (METS) that provide innovative solutions for the optimisation, efficiency, productivity, and sustainability of the resources sector. • Future Mining – the application of new technologies and resource strategies to support efficiency and enterprise improvements across the minerals value chain. • Resource Recovery – development and deployment of technologies and strategies to support sustainable communities. For more information: www.energyinnovation.net.au/resources-nsw

Industry Associations and Groups

AUSTMINE Smart Mining	**Austmine** is the leading not-for-profit industry association for the Australian Mining Equipment, Technology and Services (METS) sector. For over 30 years Austmine has advocated for Australia's METS sector and works to provide opportunities for members to build relationships, understand industry needs, boost industry profile and access domestic and international supply chains. Austmine works to collectively enhance Australia's position as the global hub for mining innovation, drive the sustainable transformation of mining and expand to new markets beyond current horizons. Austmine's membership represents over 630 METS companies nationally from large contract miners, engineering companies and technology consultancies; to start-ups, research organisations and professional services firms. For more information: https://www.austmine.com.au/
BUSINESS HUNTER	Formed in 1886, **Business Hunter** is the voice of business in the Hunter region. Its members are part of a network of more than 3,700 business across the region. In all sectors of industry, from micro businesses to ASX 100 listed corporates Business Hunter members power Australia's strongest regional economy. Business Hunter members benefit from our strategic affiliations with Business NSW and Business Australia, which extends its reach and enhances the range of services that can be offered. For more information: https://www.businesshunter.com/
HUNTER JOINT ORG.	The **Hunter Joint Organisation** (JO) is a collaborative body that brings together the ten councils in the Hunter region to provide a united and local voice for the community. As the hub for local intergovernmental collaboration, Hunter JO statutory mandate includes identifying key regional strategic priorities, advocating for these priorities, and building collaborations around these priorities with other levels of government, industry and community. Member Councils include: Cessnock City Council, Dungog Shire Council, Lake Macquarie City Council, Maitland City Council, MidCoast Council, Muswellbrook Shire Council, Newcastle City Council, Port Stephens Council, Singleton Council and Upper Hunter Shire Council. For more information: https://www.hunterjo.com.au/
HUNTERNET the power of many	**HunterNet** is widely recognised within Australian manufacturing and academia as the most successful industry 'cluster' of its type nationally. Incorporated in 1992, HunterNet is a network of manufacturing, engineering and specialist services companies located in the Hunter and Central Coast Regions of NSW. Formed as a non-trading, not for profit Co-Operative, it involves over 200 companies, active in national and international infrastructure & asset management, energy & resources, defence and advanced manufacturing supply chains. HunterNet provides members numerous business support programs and the opportunity to take part in activities including training and development, networking, joint marketing initiatives, joint project bids, focused task forces, trade missions and tendering. For more information: https://hunternet.com.au/

	Orana Opportunity Network (O2N) is a membership-based organisation that supports resources investment and economic development in the Orana (Central West) region of NSW. The O2N membership base incorporates all industries and every sized firm from the Orana and Central West regions, which encompasses the major mining centres of Cobar, Dubbo, Mudgee, Orange, Peak Hill, Parkes, Condobolin and Lightning Ridge. The aim of the network is to support the development of businesses across the region into growth and exports, improve sustainability and increase investment and connectivity for business. O2N will promote collaborations including the hosting of events, forums and training seminars throughout the Orana and Central West. The network provides member companies with the opportunity to take part in activities previously out of reach of smaller enterprises including training and development, knowledge sharing, networking, joint marketing initiatives, joint project bids, focused task forces, trade missions and tendering. For more information: https://www.o2n.org.au/
	Illawarra Innovative Industry Network (I3net) is a membership-based organisation industry-based companies (manufacturers, engineering service providers and industrial suppliers) working from the Illawarra. The network was established to promote the collective capability of industry to local, national and international markets providing members with a collective vehicle for fostering relationships and strengthening Illawarra business capabilities. For more information: https://i3net.com.au/
	Ai Group (Australian Industry Group) is a peak national employer organisation representing traditional, innovative and emerging industry sectors. They have been acting on behalf of businesses across Australia for 150 years. Ai Group and partner organisations represent the interests of more than 60,000 businesses employing more than 1 million staff. Their membership includes businesses of all sizes, from large international companies operating in Australia and iconic Australian brands to family-run SMEs. Members operate across a wide cross-section of the Australian economy and are linked to the broader economy through national and international supply chains. For more information: www.aigroup.com.au
	Central Coast Industry Connect (CCIC) is an umbrella organisation for manufacturing and related industry sectors on the NSW Central Coast. CCIC fosters collaboration and connection between Industry and Business. It aims to interface with all levels of government, education providers and the community to create growth opportunities in the region and add value to its social fabric. CCIC focus is on specialisations in Advanced Manufacturing, Food and Beverage production and the Circular economy with a goal to make the Central Coast a Centre of Innovation Excellence across these areas. For more information: https://centralcoastindustryconnect.com.au/

	The **NSW Minerals Council** is the leading industry association representing the state's minerals industry, providing a united voice for its members. As the peak industry body, the NSW Minerals Council promotes the important role mining plays in society, the good things mining brings to NSW and the contribution of our members and mining families. The NSW Minerals Council works closely with governments, industry groups and business and community leaders to so that its member companies can continue to operate within an effective regulatory framework as part of a strong, responsible, profitable and sustainable mining industry in NSW. It champions innovation and leading practice in the industry to help improve the health and safety of its people and minimise our impacts on the environment. For more information: https://www.nswmining.com.au/
	METS Ignited is part of the Australian Government's Industry Growth Centres Initiative from the Department of Industry, Science, Energy and Resources (DISER). METS Ignited works with Australian suppliers to the mining industry, global miners, research organisations and capital providers to improve the global competitiveness and productivity of the Australian METS sector. METS Ignited works across five areas of strategic focus to help strengthen the global competitiveness of the Australian METS sector including: • The development of a shared vision • Strengthen collaboration in the mining innovation system • Address gaps in the Mining- METS ecosystem • Raise the profile of Australian METS • Promote world class clusters For more information: https://metsignited.org/about/
	The **NSW Smart Sensing Network** (NSSN) was established in July 2016 with funding from the NSW State Government through the Office of the Chief Scientist & Engineer. It was founded on the premise that the economy and people of New South Wales face key challenges in energy, resources, manufacturing, the environment, transport, agriculture, space and health that cutting-edge research in smart sensing could play a critical role in solving. The market for smart sensing across a broad range of industries is immense and growing. The NSSN brings together the world class research taking place in NSW universities with state government agencies and industry to develop innovative solutions to these key challenges and, at the same time, position NSW as a leader in sensing technology. For more information: https://www.nssn.org.au/
	Narrabri Industrial Network Inc (NIN) is a member driven, non-for-profit organisation connecting like-minded businesses with resources, facilities and opportunities for members to connect, innovate, adapt and prosper. NIN ensures the region continues to diversify, grow sustainably and benefit from major investment, and invests in activities that: • Advocate for major investment and infrastructure development to support regional growth and diversity within the region. • Promote the benefits of living, working and investing in the Narrabri Area. • Grow a community, skilled and future workforce. • Advocate for the region with all levels of government. For more information: https://narrabriindustrial.com.au/

Circular Australia	**Circular Australia** is an independent not-for-profit company accelerating the transition to a circular economy. Circular Australia has grown from NSW Circular, a NSW Government Research & Innovation Network established by the NSW Office of the Chief Scientist & Engineer and hosted by UNSW Sydney. The mission is to deliver a zero-carbon circular economy by: • Providing transparent and open data to the market • Helping deliver new circular economy markets, infrastructure and services • Working collaboratively with businesses, government, researchers and individuals to remove barriers and scale the circular economy • Empowering people to promote circular behaviours and change For more information: https://circularaustralia.com.au/

Government

Australian Government Australian Trade and Investment Commission	The **Australian Trade and Investment Commission** (Austrade) is the Australian Government's international trade promotion and investment attraction agency. Austrade generates market information and insights, promotes Australian capability, and facilitates connections to customers, investors and intermediaries through its extensive global network. For more information: https://www.austrade.gov.au/
NSW Government | Planning, Industry & Environment	**NSW Department of Planning and Environment** (DPIE) serves the people of New South Wales by developing well-connected communities, preserving our environment, supporting our industries and contributing to a strong economy. DPIE has offices and teams across the State who are working on long-term planning, planning assessments, infrastructure priorities, natural resources, the environment, energy and growing the State's industries. DPIE collaborates and consults to deliver great places for you to live and work and to develop smart ways to support innovative and prosperous industries. DPIE works to make the NSW planning system simpler and more transparent while delivering better outcomes for communities. For more information: https://www.planning.nsw.gov.au/
NSW Government | Regional NSW	**Regional NSW** is the largest, most diverse regional economy in Australia. The Department of Regional NSW is a central agency for regional issues, building resilient regional economies and communities, strengthening primary industries, managing the use of valuable regional land, overseeing the state's mineral and mining resources and ensuring that government investment into regional NSW is fair and delivers positive outcomes for local communities and businesses. For more information: https://www.regional.nsw.gov.au/

Mining, Exploration and Geoscience (MEG)	**Mining, Exploration and Geoscience (MEG)** is committed to delivering outstanding service and high-quality products and outcomes, to support the State's vision of minerals and petroleum resources generating prosperity for the people of NSW. NSW MEG includes: • Mining, Exploration and Geoscience • A division to support the promotion of mineral resource potential of the state to Australian and international investors • The acquisition, interpretation and delivery of quality geoscientific data • Development and oversight of strategic policy for the state's mineral resources • Provides a trusted minerals and petroleum titles assessment service delivering certainty for industry • The delivery of strategic and geoscientific advice and analysis to inform government decision making, especially for land use planning • Management of environmental and social risk associated with legacy mine sites For **more** information: https://www.regional.nsw.gov.au/our-work/meg
Australian Government Geoscience Australia	**Geoscience Australia** is Australia's pre-eminent public sector geoscience organisation. It serves as a trusted advisor on the geology and geography of Australia and applies science and technology to describe and understand the Earth for the benefit of Australia. For more information: https://www.ga.gov.au/
W B Clarke Geoscience Centre & Drillcore Library	The **Londonderry Drillcore Library** is part of the W B Clarke Geoscience Centre located in Londonderry, NSW. The drillcore library is modern and highly mechanised with an efficient retrieval system. It has 1.13 million metres of drillcore comprising 50% from metalliferous exploration, 40% from coal exploration and 10% from other drilling programs such as geotechnical drilling. The core library is open for inspection and sampling of drillcore by industry and research geoscientists. For more information: https://www.regional.nsw.gov.au/meg/geoscience/minview/londonderry-drillcore-library
ANSTO	**Australian Nuclear Science and Technology Organisation** (ANSTO) is a leading research organisation and an international player in the field of nuclear science and technology. ANSTO has provided the mining and minerals processing industries with consultancy, process development and research services for more than 40 years. It has extensive testing faculties and world leading minerals processing expertise. For more information: https://www.ansto.gov.au/
CSIRO	The **Commonwealth Science and Industrial Research Organisation** (CSIRO) is Australia's national science agency and innovation catalyst. It aims to solve the greatest challenges through innovative science and technology. CSIRO works with industry, government, and the research community to turn science into solutions to address Australia's greatest challenges, including food security and quality; clean energy and resources; health and wellbeing; resilient and valuable environments; innovative industries; and a secure Australia and region. CSIRO's Mining and Resources business unit aims to deliver breakthrough innovation to create a more productive, sustainable and globally competitive mining and mineral resources industry for the benefit of Australia and the world. For more information: https://www.csiro.au/en/

Australian Government export finance australia	**Export Finance Australia** (EFA) is a specialist financier that delivers simple and creative solutions for Australian businesses – to enable them to secure contracts, grow internationally and achieve export success. As the Australian Government's export credit agency (ECA), EFA plays an impactful role in financing Australian exports and interests, including overseas infrastructure development. EFA achieve its purpose by fulfilling legislated functions, which are to: • support SMEs, corporates and governments to realise export opportunities • help finance sustainable infrastructure in the Indo-Pacific region and beyond • provide defence export finance through the Defence Export Facility • support the critical minerals sector through the Critical Minerals Facility • enable broader government objectives by supporting other Commonwealth entities. For more information: https://www.exportfinance.gov.au/

Conclusion

The New South Wales resources industry is home to some of the most historic, complex, and advanced mining operations in the world. As an international destination for energy and resources investment, the sector is rapidly developing new and exciting projects in critical minerals and high-tech metals, that have the potential to underpin significant employment and industry opportunities for years to come.

This report highlights the strength of the sector throughout NSW, with strong leadership in the supply of specialised equipment, components, solutions, technology and services that drive efficient and safe operations in the state, and beyond. The NSW METS sector has strong export credentials and a high capacity to assist operations across the globe to find the right solutions to reduce costs, optimise resources recovery and improve environmental outcomes.

To realise further potential and to capitalise on the nature and scale of activities in NSW, the sector requires significant financial, technical, and human capital. Facilitating the delivery of these enablers will require broad engagement, along with cross industry stakeholders, yielding long term economic benefits that will reach far and wide throughout the State.

Resources NSW will continue to leverage the strong existing relationships between key stakeholders to provide a collaborative platform to share information and deliver initiatives required to support the productivity, efficiency and international competitiveness of the resources and METS sectors in NSW.

Engage with us at https://www.energyinnovation.net.au/resources-nsw

Hunter Valley, NSW

ENERGY & RESOURCES KNOWLEDGE HUB

An Initiative of the NSW Government – Office of Chief Scientist and Engineer