SINGAPORE-AUSTRALIA GREEN ECONOMY AGREEMENT

AusIMM Submission

Department of Foreign Affairs and Trade

23rd December 2021

About AusIMM

The Australasian Institute for Mining and Metallurgy (AusIMM) is the peak body for resources professionals, with over 13,000 members across more than 110 countries. Established in 1893 and operating under Royal Charter, we represent professionals across all levels of the mining industry, working from exploration through to delivery and in disciplines ranging from mining engineering to geoscience, health and safety, finance, Government, and academia.

We lead the way for people in resources, supporting professionals to provide enduring benefits for the community. We are committed to upholding ethics, codes and standards in resources and delivering the highest quality of professional development to the sector.

As the trusted voice for resources professionals, we exercise shared leadership to for the benefit our sector and in the interest of all members of the global community. We advance our sector's continued technical and professional leadership on the world stage, champion community understanding and support for the industry, and work with governments to design, implement and maintain regulatory frameworks that facilitate the continued economic and social contributions delivered through mining.

Executive Summary

The mining industry has long been a crucial part of Australia's economy and has been powering Australia's economic recovery from the COVID-19 pandemic through record revenue from exports of iron ore, gold, and copper.[1]

The mining sector long and continuous contribution to Australia's economic growth and development through sophisticated production techniques and highly skilled labour capitalising on Australia's unique comparative advantage in mineral endowments. The supply infrastructure activities of the mining equipment, technology, and services (METS) sector further enhance Australia's national account, GDP and employment.

The resources sector directly employs 278,800 people and indirectly over 1.2million (May 2021), with employment growth over the last 5 years of 27.1%.[2] Employment is expected to increase on the back of growing demand for mined materials and strong commodity prices.[3] Demand is predicted to be strong thanks to the expected continuation of iron ore exports to China, and opportunities to supply other East Asian countries with essential commodities.[4]

The Singapore-Australian Green Economy Agreement provides a framework to consider the advancement in technologies in the global move to net-zero by 2050. The five-priority area all focus on technology driven elements that are heavily reliant on inputs from the Australian resources sector.

The latest World Energy Outlook emphatically presented the International Energy Agency's resolute position that the energy sector as critical to a solution to global climate change challenges.[5] The shift to net-zero requires a global move into a new energy era, led by a technology focused approach to maintain energy security in the region and drive economic growth. As the worlds forth largest energy exporter the resources across tradition and new energy sources are inextricably linked to the resources sector.

World Bank Group report, "Minerals for Climate Action: "The Mineral Intensity of the Clean Energy Transition," argued that global mineral production of graphite, lithium and cobalt, could increase by nearly 500% by 2050, to meet the growing demand for clean energy technologies. It estimates that over 3 billion tons of minerals and metals will be needed to deploy wind, solar and geothermal power, as well as energy storage, required for achieving a below 2°C future, a key element of a green economy.

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[1] Mining export revenue leads Australia's economic recovery | Minerals Council of Australia

[2] "Mining Export Revenue Leads Australia's Economic Recovery," Minerals Council of Australia, accessed on September 13, 2021, https://www.minerals.org.au/news/mining-export-revenue-leads-australia%E2%80%99s-economic-recovery

[3] "Regional Industry Data: Mining," Labour Market Information Portal, accessed on September 13, 2021, https://lmip.gov.au/default.aspx?LMIP/GainInsights/IndustryInformation/Mining

4"Mining Export Revenue Leads Australia's Economic Recovery," Minerals Council of Australia, accessed on September 13, 2021, https://www.minerals.org.au/news/mining-export-revenue-leads-australia%E2%80%99s-economic-recovery

5 World Energy Outlook 2021

Covid-19 Impact

While Covid-19 has been a challenge that has impacted every industry, the resource sector's impact has varied across commodities. The resource sector's impact has varied across commodities, regions, and sections of the workforce. The sudden disruption to global trade created swift challenges in emergency measures, regional regulations/restrictions, and considerable supply chain disruption.

The pandemic rapidly shifted demand for technology altering the skills and capability required across sectors

The immediate risk to workers health and safety saw the swift suspension of nonessential travel and transition to work from home (WFH) arrangements. Scaled-down production and changes to the operating policy were all implemented through pandemic management plans to protect employees from transmission risks. COVID-19, as a disruption event has been too large and too pervasive in its impact for the industry to be able to revert entirely back to a pre-pandemic 'normal'. COVID-19 has been the catalyst for entrenching new operating models, with WFH and virtual service models becoming standard practice.

COVID-19 has been a unique disruption for the resources industry. Lasting longer than most short-term shocks, such as major accidents, the Pandemic has moved faster and more abruptly than longer-term trends, such as trade wars or next-gen technology. The mining industries capacity to manage disruptions effectively is considerable compared with other industries due to the high risk/safety thresholds. With the advancement of the sector's remote operations and intelligent infrastructure, the human capital element is advanced in managing and mitigating disasters.

The deployment of better communications technology has enabled and justified remote working operations. However, the increased acceptance of flexible work is unlikely to be a binary shift. The importance of corporate knowledge transfer and collective learning is going to sustain a hybrid model. The one lasting change from the Pandemic is going to be on the need for travel. Travel has been an accepted necessity of mining operations globally with geographically dispersed and often remote assets and operations. The Pandemic had eroded the implicit cultural acceptance of travel in situations where video conferencing is available. Whilst this will impact, there is still a significant demand for onsite workforces to retain considerable FIFO demand.

The Pandemic has proved to be a significant shock to the long and complex existing supply chains of the international mining industry. The disruption to the supply of minerals shipments has created increased pressure for the State to solidify their reliable access through bi-lateral and multi-lateral agreements. The increased demand has driven significant regional engagement for Australia, with key regional partners concentrated on developing, securing, and operating ongoing partnerships in critical minerals.[6]

[6] https://www.dfat.gov.au/news/news/Pages/transforming-australia-into-a-major-exporter-of-critical-minerals-products

The mining industry has long been a crucial part of Australia's economy and has been powering Australia's economic recovery from the COVID-19 pandemic through record revenue from exports of iron ore, gold, and copper.[7] The AusIMM 2021 Professional Employment Remuneration Survey revealed that although COVID-19 had an impact on employment and sector operations, the industry has largely recovered or remained stable. The sector continues to show almost full employment, with redundancy rates falling sharply and respondents expressing optimism about the future of employment in the sector.

Despite social attitudes moving away from some mined commodities, such as coal, in the medium to long

term future the sector will remain strong to support the global shift to new technology, including playing an essential role in transition to zero-emission technology. With demand growing and job roles evolving, this is creating a significant challenge for employers to access the required number of skilled workers.

Universal circumstances, including a lack of labour mobility and willingness to be located regionally, are negatively impacting the pipeline of workers entering the resources sector. Industry-specific challenges are also affecting supply, such as challenging perception of the industry among young people. These challenges are strongly evident in engineering occupations: mining engineers, metallurgical engineers, and geotechnical engineers. Using these three occupations as a case study, this report seeks to examine the factors impacting supply and demand, forecast the growing disparity between the two, and identify opportunities to increase supply.

[7] Mining export revenue leads Australia's economic recovery | Minerals Council of Australia

The sector plays a vital role in creating employment for Australians, assuring economic growth and resilience, in generating new technology, fostering talent, and improving technical processes. In 2019-20, Australian mining accounted for 60% of the Nation's export revenue, generating more than $283 billion in export earnings. Australian mining export revenue is forecast to grow to a record $296 billion as the global economy continues to rebound from the impacts of the COVID-19 Pandemic.[8]

8 Australian Bureau of Statistics (AB S), January 2021, 'International Trade in Goods and Services, Australia', Cat. No 5368, Canberra: available at: https://www.abs.gov.au/statistics/economy/international-trade/international-trade-goods-and-services-australia/latest-release.

Mining in APEC

APEC is the peak regional body for economic cooperation in the Asia Pacific region. APEC member economies account for approximately 70 per cent of all mining output and consumption, including most of the world's bauxite, copper, iron, nickel, silver, tin and zinc.

Australia's resources sector underpins trade, energy, science, technology, innovation, and metrology trade with APEC partners.

The mining, mineral and metal industries are critical in the APEC region, occupying close to 75 per cent of all global mining trade and investment9. As direct opportunities and downstream operations expand into the region, particularly in developing economies, there will be increased risk and occurrences of serious incidents.

Having a consistent response framework and a network of experts to assist when mining operations have problems is a leadership role Australia could take up in the region. With the expert knowledge, resources, and professional development already standard best practice in the mining industry, developing this into a regionally capable response function would be a small investment to have the ability to provide a considerable regional engagement tool.

Singapore

Singapore's long-term challenge resulting from structural constraints of limited national resources has driven government efforts to build a value-adding economy based on trade, innovation, technology, and digitalisation. Recent bilateral efforts have been focused on the digital economy and green economy, the next frontiers of economic opportunity according to the Singapore government.

"Green Plan 2030" articulates the Singapore vision for the state's net-zero emissions goal, part of securing a resilient future for the island nation, vulnerable to sea levels and extreme weather events. The government position to placing sustainability at the centre of all activities including their pandemic recovery. The government is taking a proactive approach to lead and drive sustainability models into the actions off all economic actors and in doing so develop a green finance, carbon trading and sustainability consultancy sector. Bain and Company have already suggested that the Southeast Asia green economy could provide more than US$1trillion annually by 2030.[10] Asia's ability to transition to a green economy requires mobilisation of private capital to finance transitions across industry and secure the fundamental inputs to new and emerging technologies.

[9] https://www.apec.org/Groups/SOM-Steering-Committee-on-Economic-and-Technical-Cooperation/Mining
[10] https://www.bain.com/insights/southeast-asias-green-economy-pathway-to-full-potential/

Australia-Singapore

Singapore and Australia's significant bilateral relationship was fortified in the struggles of World War II when nearly 2000 Australian's lost their lives defending Singapore. One of the first nations to established diplomatic relations since Singapore's independence in 1965, the two nations have built close ties based on shared history as Commonwealth nations, with similar strategic outlooks. Both highly sophisticated, educated, and prosperous nations fostering cooperation and ties in defense, security, trade, education, tourism and regional politics has been the enduring nature of Australia's closest and most comprehensive relationships in Southeast Asia.

Singapore is Australia's largest trade and investment partner in ASEAN and sixth overall in two-way trade. Despite the pandemic disrupting trade, exports to Singapore managed to rise, to $12.5 billion in 2020 (iron ore accounting for $3.2 billion and gold amounting to $1.4 billion), up from $12 billion (2019).[11] Over the same period, Singaporean investment in Australia grew to $116.5 billion in 2020 (from $100 billion in 2019), representing 2.9% of the total stock of foreign investment.

The two nations comprehensive strategic partnership, free trade agreements and ten-year plan, aim to enhance collaboration in strategic, trade, economic and people to people links, to drive further integration of the two economies, fostering collaboration through innovation, science, research, and technology. As the region continues to dominate global economic growth and consumption the economic integration and collaboration in a significant opportunity for both states.

Australia's CSIRO and Singapore's A*STAR [Agency for Science, Technology and Research], innovation landing pad in Singapore, has provided a platform for Australian start-ups to team with Singapore-based industry and capital, delivering increased commercial benefit from innovation, particularly for the METS sector. METS provide a wide range of technology and services mining companies require across the resources value chain (transportation, equipment manufacturing, project management, communication services, design systems, technology mining support services, chemical manufacturing and processing, AI, IOT connection and remote operational infrastructure). Foreign investment is essential to Australia's capital-intensive mining and METS sector due to scale and technologically advanced nature of projects. The sector access to funds, technology, skills, and international trade market are reliant on foreign direct investment from key partners such as Singapore, who have acted as a mining and marketing hum for Australia's resources sector.

11 https://www.exportfinance.gov.au/resources-news/country-profiles/asia/singapore/bilateral-relations/

Australia’s Resources Sector

Australia's leading role in mining globally is derived from the high regard and respect, stemming from its commitment to advancing and leadership in developing industry best practices. The mining industry is a significant part of Australia's thriving economy, accounting for eight per cent of the gross domestic product (GDP). The Australian mining industry amounts to 75% of the country's exports, contributes significantly to employing Australia's workforce, and increases Australia's living standard through higher incomes and flourishing economic conditions.

Australia has a robust mining equipment, technology, and services (METS) sector with leading developments in innovation servicing the industry. Mining contributes billions of dollars to federal and state governments each year in taxes and royalties. This funding assists all industries in Australia, making way for new schools, infrastructure, roads, hospitals and more. Major companies in the resources sector donate funding to support community programs and scholarships across our country. Through the METS sector and supply chains, the mining industry employs over 1.2million professionals in Australia.

The scope of the Australian mining industry is a genuinely national endeavour with operations across the country. The mining industry occupies a vital role in employing, training, and expanding opportunities for Australia. The sector's support for diversity, particularly in Indigenous communities and women, has supported skills development and professional opportunities. The options across Australia are viable and create a significant opportunity to develop case studies and facilitate regional engagement through sister city relationships and embedding bi-lateral arrangements within State mining industry operations.

Evaluating the depth of the sector by region provides a unique consideration of the scale of activities in Australia. The different regional focuses support parallel lines of dialogue and engagement to widen the discussion in deepening strategic regional relationships through needs-based access to minerals and Australia's highly skilled mining professionals.

Mining in Western Australia

Western Australia (WA) is the epicentre of Australian mining and a significant player in the international mining industry. It hosts substantial high-grade resources and hosts some of the largest operational mines in the country and the world.
WA is the world's largest iron ore supplier, with multiple iron ore projects, especially in the Pilbara region in the north of the State.

New mineral exploration is constantly underway in WA, with a new spotlight on lithium and vanadium to meet the growing demand for green energy alternatives and new battery technologies.
WA is ranked by the Fraser Institute as the top region in the world for mining investment.

- **The State hosts 98 per cent of Australia's iron ore.**
- **Approximately 60 per cent of Australia's gold reserves can be found in WA.**
- **The sector directly employs more than 20,000 people.**

Mining in South Australia

South Australia (SA) exports many essential commodities to the world, including copper, uranium and zircon. The State is ranked as one of the most attractive regions globally for mining investment.
BHP's Olympic Dam is Australia's largest mine and the world's largest single deposit of uranium.

- **Iluka's Jacinth-Ambrosia in SA is the largest zircon mine in the world.**
- **SA hosts 25% of Australia's gold resources.**
- **The resources industry directly employs more than 10,000 people.**

Mining in Victoria

Victoria (VIC) has played a significant part in Australia's mining history and still provides the potential for mineral exploration today. VIC is known for producing gold, antimony, and brown coal.
VIC is home to large mining companies, including an innovative mining equipment and technology sector (METS).

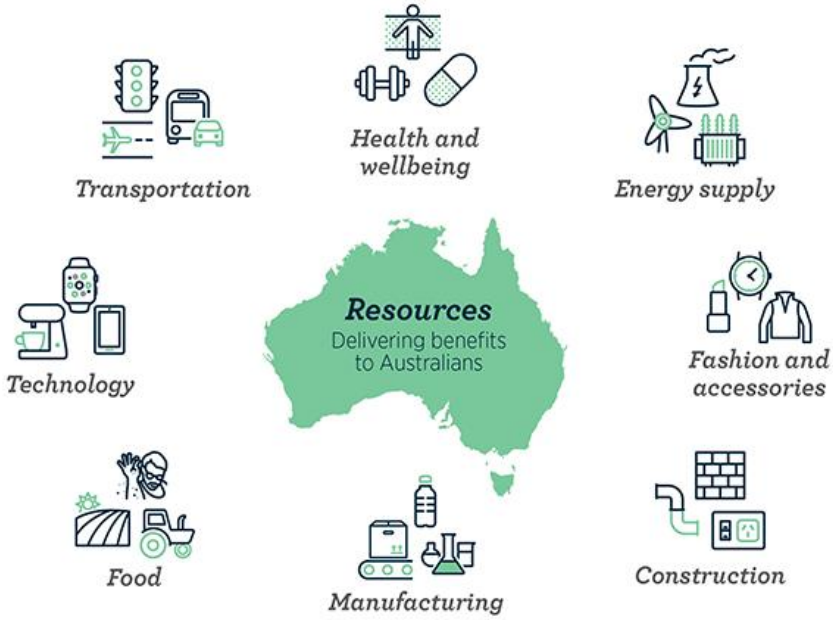
- **Mining contributes more than $13 billion to the State's economy and creates 121,000 jobs.**
- **In 1851, gold was discovered in Ballarat, starting the gold rush that made Melbourne one of the wealthiest cities in the world.**
- **Melbourne-based firms accounted for 65% of the Australian Stock Exchange 100 (ASX100) mining stock in 2018.**

Mining in Queensland

Queensland (QLD) is a significant mining state, with many of Australia's coal mines located in the Bowen Basin. QLD is also the world's largest supplier of silver.

Growing demand in the State has led to new exploration and projects found in the northwest and east, focusing on creating jobs for the future. The QLD mining sector is well-poised to be an essential player in strategic and critical minerals, including those used in new technologies such as electric vehicles

- **The mining sector provides more than 50,000 jobs for QLD.**
- **In 2018-19, mining contributed nearly $75 billion to the state economy.**
- **Despite its vast contribution, the sector takes up only 0.1% of QLD's land surface area.**
- **QLD hosts some of the highest-grade graphite in the world, as well as the world's highest grade rhenium deposit.**



Mining in New South Wales

New South Wales (NSW) is rich in coal, gold, copper, silver, lead and zinc, cobalt, and lithium. Significant coal deposits were found in the Sydney-Gunnedah Basin. The Cowal open-pit gold mine in the Central Western Plains region is the biggest in NSW.

NSW has many projects in the pipeline that, once underway, will significantly boost the State's economic and employment performance.

- **Mining in NSW offers 40,000 jobs across the State.**
- **Mining provides almost $2 billion worth of royalties to the state government.**
- **Newcastle exports 160 million tonnes of coking coal per year and is the world's largest coal export port.**

Mining in Tasmania

Tasmania (TAS) has been a significant mineral producer for over a century and boasts solid geological diversity. TAS hosts iron, copper, lead, zinc, tin, high-grade silica, and tungsten.

- **The primary three mining operations in TAS are Rosebery, Savage River and the Renison Joint Venture.**
- **In 2016-17, the resources sector produced $1.8 billion worth of value to the State.**
- **The Renison mine on the West Coast of TAS is Australia's largest tin deposit.**

Mining in the Northern Territory

The Northern Territory (NT) is rich in world-class minerals, including zinc, copper, lead, tungsten, lithium, vanadium, phosphate and potash, gold and uranium. There are currently seven high-quality mines operating.

Being located so close to Asia, the port at Darwin gives the NT a geographical advantage for mineral exports and strong relations with major markets in China, Korea, Japan and India.

- **NT's mining and manufacturing industry is valued at more than $4 billion.**
- **Groote Eylandt, in the Gulf of Carpentaria, hosts the world's largest manganese mine.**
- **One-third of Australia's known uranium reserves are in the NT.**

Employment

Working Group on the Resources Industry Future Workforce

The AusIMM *Working Group on the Resources Industry Future Workforce* is an evidence-based approach initiative collating data from universities and industry to model the supply and demand and map gaps in the Australian resources sector. The Working Group comprises key personnel representing industry and academia.

There is a substantial opportunity to strengthen and project Australian leadership in the region through programs focused on expanding access to careers in the resources sector. In particular, the APEC Women in STEM Principles and Actions is an opportunity to increase engagement through scholarships, forums and further research addressing the barriers and opportunities for women in the mining sector and creating a regional focus on developing the skills and qualifications of women. As women in the region have more exposure to expanding their professional opportunities, there will likely be a significant shift in economic activity.

It is enhancing professional development opportunities for women in the region not only assists in ensuring the sector's future workforce but also contributes to increased standards of living and economic independence. Although growing women's workforce participation in Australia is a priority of the Government, it should also be considered a regional engagement opportunity.

Future Workforce: A Critical Moment

The supply and demand of mining, *metallurgical and geotechnical engineers in the Australian resources industry* was explored by AusIMM's Working Group on the Resources Industry Future Workforce has identified that a shortfall in the supply of graduate engineers exists and is worsening. In developing this report, the Working Group has examined the challenges facing the industry's future workforce, specifically relating to its talent pipeline. To best understand these challenges, the focus of this report is on mining, metallurgical and geotechnical engineer job roles.

The report ultimately comprised three key areas of enquiry:

An overview of previous research – Previous research has identified that whilst some solution-oriented discussion and initiatives have occurred, largely the same issues presented 20 years ago are still present now. Some new issues have also emerged in that time. Four key themes emerged from the previous thought leadership pieces that were examined, namely:

- The benefits of alignment between university offerings and the needs of employers. The strong perception is that graduates are well trained theoretically and technically.

However, other aspects of job readiness may need to be more strongly included such as 'people skills' and practical experience.

- Greater collaboration needs to be encouraged in the university sector. In the past, there have been positive outcomes from initiatives that encourage university collaboration. However, the university business model is seen as a barrier, given the way universities are incentivised encourages competitive behaviour over collaboration.
- Micro-credentialing and alternative pathways present opportunities to create additional entry points into these job roles. These are generally targeted short courses that offer an alternative pathway into job roles from other professions. Micro-credentials can, therefore, broaden the talent pool and reduce barriers to entry. Another popular alternative are associate degree programs which can provide significant practical experience. While increasing utility, some have cautioned that quality must not be comprised by introducing new pathways.
- Greater government participation is needed to work with all stakeholders to solidify the future of mining. Challenging issues include an emerging antimining perception and changes to school curricula. Governments are seen to have a key role to play in supporting universities with targeted initiatives and spreading awareness of the industry's central role in the transition to a clean economy future.

Demand and supply forecast scenarios – Forecasting conducted as part of this report shows an increasing disconnect between employment demand and supply of graduates over time. Where the National Skills Commission (NSC) forecasts strong growth in all three occupations to 2025, the Working Group sought to forecast demand out to 2040. To account for industry variables, forecasts were developed against four scenarios:

- Upside scenarios for both coal and minerals demand;
- Upside scenario for coal demand, downside for minerals;
- Upside scenario for minerals demand, downside for coal;
- Downside scenarios for both coal and minerals demand.

Forecasting places total employment across the three occupations between 5,623 (worst case) and 7,786 (best case) by 2040.

This is against the backdrop of declining graduate supply. Universities are experiencing a decline in enrolments, reflecting difficulty in attracting people into mining career pathways. This may be explained by a combination of, amongst other factors: shifting public perception of the resources industry, lack of willingness to work regionally, and limited exposure to relevant careers in schools.

This report focuses on graduate supply but acknowledges that a fuller picture of supply would also incorporate other positive supply factors (e.g. skilled migration, upskilling from within the industry) and negative supply factors (e.g. workforce exit, retirement).

Challenges facing universities - Low enrolments, which lead to low graduate numbers, pose a critical challenge for mining engineering programs. This report highlights that the enrolment numbers for university programs are currently at a level that is below the critical mass required to keep those courses sustainable. Without a positive change in these numbers, courses will be closed or absorbed into broader offerings. The report finds that it would be difficult to bring these courses back in the future once they are gone and that would fundamentally impede Australia's ability to develop a domestic talent pipeline.

The reasons for low graduate supply are not all fully controllable by universities and collaboration with industry and government is required to improve numbers. The findings of this report have led the Working Group to make four key recommendations:

1. Establish an improved and consistent method for data gathering and reporting: A significant barrier to effective industry workforce planning in the resources industry is the lack of detailed, accurate and readily available data. Existing relevant data, such as that published by the National Skills Commission (NSC), is not sufficiently detailed, often reporting at the level of job clusters (rather than individual job roles). These data sources also do not easily allow the user to test the impact of various assumptions (e.g. commodity demand) on forecast employment growth.
2. Encourage greater collaboration between industry and Higher Education: The closer alignment of these stakeholder groups is critical. Clearer formal channels of communication ought to be established to address the supply issue faced by the industry. Greater collaboration is required in relation to the development of engineering course content, and to promote shared responsibility for progress towards job-ready graduates (e.g. through more opportunities for work-integrated learning).
3. Conduct targeted public education to foster greater understanding of the resources industry: Decline in public perception towards the resources industry is largely informed by an incomplete understanding of the breadth of the industry and its contribution to green economy initiatives. Better public understanding may encourage uptake of mining courses, particularly by young Australians.
4. Invest in alternative pathways into the industry: Investing in alternative training and education pathways is crucial to relieving pressure on universities, broadening and deepening the talent pool. Reviews into the current alternative pathways, and time spent developing these accreditations, or creating new ones, will help to stem the decrease in graduate supply. A focus on continuous improvement will enable piloting and refinement of alternative approaches.

Australia's Competitive Advantage

The global shift to tech, data, and the cyber economy is disrupting how we live and the governance systems and structure in effect. Likewise, it creates demand for a host of critical minerals, thus increasing the geostrategic relevance and opportunity to advance Australian interests through the resources sector.

Technology is fundamentally disrupting how business operates and the tech race is contingent on access to critical mineral resources

As the global demand for technology increases, States are moving to secure their critical mineral supply chains. This rapidly developing opportunity for Australia in the bilateral engagement of regional geopolitical architecture. The demand shift will require skills development to ensure future workforce requirements can sustain the industry's operations.

The rising intensity of the global technology race has, for example, created an acute supply strain for technologies used in computers, smartphones, tablets, cars, televisions, LED lights, household appliances like washing machines, microwaves, and a host of another consumer, commercial and defence technologies.

The 5G and AI deployment is another element of the tech race stimulating demand in the international minerals market. The geopolitics of a future low-emissions economy is of serious regional concern, with developing economies focused on access to low-emission energy technologies. The Pacific-Island Nations are particularly vocal on environmental impact and deepen ties with regional actors whose exports and support are vital in a carbon-constrained future.

The future success of the global renewable energy industry is entirely dependent on the mining sector and the vital resources it supplies for technology. The key to securing a lower carbon future is through minerals and mining operations. Yet, the industry is starved of easy access to capital as public perception condemns mining to be part of the problem. The ability of professionals to bridge the gap with public trust will be through the industry standards and best practice re-establishing the confidence to ensure the sustainability of the sector's social licence to operate.

Trends

Community Sentiment and Industry Reputation

Currently one of the largest issues in the resources sector is the lack of positive community sentiment towards the industry, and the industry's reputation. According to the Innovation: State of Play report, released by consulting firm VCI last year, the largest proportion of Australian mining professionals surveyed listed the industry's association with the "fossil fuels industry" as the basis of negative perceptions in society.[12]

This limited view of mining has eroded public pride in the capability and contribution of the sector to jobs, growth, and substances used in everyday products, mined within Australia.

Unlike other professional stakeholders in the mining industry, AusIMM advocates for the professional capabilities of the workforce. A renewed focus on employment, expertise, and the contribution mining professionals make to not only the Australian sector, but across the globe is important to combat the lack of positive

public sentiment. This includes the expertise of professionals in the resource's environmental science space and areas such as mine rehabilitation. The resources sector is broader than fossil fuels and coal, and there should be a renewed focus on the use and contribution of Australian minerals in day-to-day life.

AusIMM research into student attitudes towards the sector has revealed that not only are students impacted by the negative sentiment towards the industry, but there is a distinct lack of knowledge about the industry and opportunities available to individuals in the sector.[13] This trend is most apparent among young people from metropolitan locations as opposed to regional areas, although the trends are similar.

This has led to a notable decrease in students studying courses that would see them enter the mining sector. The University of New South Wales has gone from having over a hundred students enrolled in Mining Engineering to having only five this year. It is the belief of the AusIMM that even if this number doubled, tripled, or quadrupled, the pipeline is still unsustainable. Whole of industry collaboration on this critical issue has been limited given the makeup of the tertiary education sector, and the drive to compete for students and funding. There has been little support or attention given to this issue by government thus far and it appears the industry alone is incapable of fixing the problem.

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[12] Ingram, T., 2017, 'Australian miners worry fossil fuels are contributing to a bad reputation', Australian Financial review, https://www.afr.com/business/mining/australian-miners-worry-fossil-fuels-are-contributing-to-a-bad-reputation-20170619-gwubn6

[13] Australian Mining Sector must work harder to promote industry careers, 2018, http://www.minerals.org.au/news/joint_media_release_australian_mining_sector_must_work_harder_to_promote_industry_careers

Australian expertise in the Mining and METS industry currently has a first-class reputation, but Australia risks losing this standing without the appropriate local personnel. International investment can be encouraged by having a ready and capable workforce, and currently there are enormous concerns around the future pipeline.

It is the view of AusIMM that knowledge of the mining sector starts in primary school and secondary school, which in turn influences the courses that young people go on to study. There are currently only small organisations operating in silos on these issues with little coordination.

The AusIMM provides ongoing professional development but there is room for micro-credentialing and upskilling of the workforce, particularly as the nature of work in the sector transforms to remote and digital operation. There is unnecessary concern by some that the depth of work will dry up as the industry becomes more digitised. The workforce will change; however, the skills of the workforce can also grow with the appropriate support in place.

The industry needs to diversify to adjust with this workforce transition, and policy support is required in this space. The growing but still low rates of women in the industry are often hindered by issues around childcare policy and its incompatibility with fly-in-fly-out (FIFO) work, and the common lack of facilities on site for health and wellbeing. Mental health doesn't receive the attention needed at mining sites and the isolation of the locations is a contributing factor. Although much has been done nationally in the mental health space by the government and not for profits to raise awareness, there are still gaps within the resources sector.

There is currently a haphazard approach to employment tracking nationally. Although AusIMM conducts a professional survey of its members' employment status and renumeration annually, the content is still limited. A national approach to this would ensure that much of the misinformation around the "mining-bust" and the availability of jobs and stable salary within the industry could be combatted.

COP26 & NET ZERO

Australia's resources sector is well acquainted with traversing the pressure to achieve meaningful emissions reductions whilst maintaining operational scale and sustaining economic activity essential to the national and state economies.

COP26 reflects global shifts to embrace a net-zero future. The call for emissions reduction targets and increased energy efficiency will naturally draw attention to the energy and emissions intensity of operations. However, the major miners are already self-regulating in this regard increasingly developing renewable energy sources near major operations to provide energy security and cost controls.

Rio Tinto, the global leader in Iron Ore production made early moves to announce a 50 per cent reduction in emissions by the end of the decade, almost tripling its previous target. Rio's moves to not only decarbonise their operations but looking to the broader role in industry is built on their commitment to developing and deploying new technologies. Rio's Pilbara (WA) operations account for 4 to 4 million tonnes of carbon emissions annually, one million from gas-generated

power and the remainder from diesel use in mine machinery and trains connecting 16 active mining operations to the port of Karratha. Rio's corporate shift is led by company commitments to cease purchasing diesel fuelled heavy mobile equipment from 2030, triggering $10 billion dollars of investment by the end of the decade developing the technology required to meet their decarbonisation commitments.

Oz Minerals is endeavouring to be carbon neutral on its new West Musgrave project that has requires the company to completely rethink how they design the mine site. The copper-nickel mine site if planning eventuates will be 100 percent powered by an on-site renewable power plant and will operate with a zero-emissions fleet.

In the shift to net-zero the global demand for critical minerals has skyrocketed with a rapid acceleration towards electric vehicles, battery use, renewable technologies and technology driven solutions.

Fortescue Future Industries (FFI), a subsidiary to, Fortescue Metals Group (FMG) is seeking to produce 15 million tonnes annually of green hydrogen by 2030 rising to 50 million tonnes annually by 2040. FMG currently consumes one billion litres of diesel annually across it's Pilbara mining operations and is seeking to replace that fuel source with its green hydrogen enterprise.

The role of financial institutions and government in bridging the funding of the net zero transition will shift the ESG and green finance scope with ramifications on carbon pricing mechanisms and associated compliance costs.

BHP is among the major mines targeting the net zero opportunity and has set internal standards to reduce its emissions by 30 per cent by 2030, hitting net zero by 2050. Over 80 per cent of BHP's London based investors (totally 42 per cent of total shareholders) voted in support of the company's strategic vision.

The rapid shift of political settings on decarbonisations have triggered cost-competitive settings in renewables that were unimaginable half a decade ago. The shifts in industry are placing downward pressure on supply chain participants to reduce their emissions to remain in the enterprise and meet the ambitious commitments of the leading industry players.

Future Aspirations

Critical Minerals

Critical Minerals are vital in driving global development, are essential ingredients for emerging energy, defence, communications, and transport technologies, and are crucial for regional security and supply chain resilience. Australia's Resource professionals have the experience to develop Australia's opportunity as the potential global leader in the sustainable exploration, extraction, production, and processing of critical minerals.

Australia's Competitive Advantage

The Investment settings of low cost and low sovereign risk combined with State government project facilitation services enabled Australian resources to develop as an investment-ready industrial complex.

The competitive advantage of Australia's resources sector is fundamentally driven by the quality of the professionals within the industry. The enable investment consideration to have deep confidence to secure projects due to Australia's reputation for:

- ✓ Highly educated and skilled workforce
- ✓ World-class pre-competitive geoscientific data
- ✓ The global industry leader in environmental and social standards
- ✓ Stable & transparent regulatory framework
- ✓ Industry-led and Government supported innovation
- ✓ Considerable Export Infrastructure

The resources sector can build on a substantial minerals endowment and world-class research, training, engineering, and technical capabilities to move up the value chain into the advanced manufacturing of battery precursor chemicals and finished battery products. Australia is the World's largest producer of lithium concentrates and mine and process other battery metals, including nickel, cobalt, aluminium, vanadium, graphite, manganese, uranium, and rare earth elements.[14]

Demand for critical minerals is a unique opportunity to create stable, well-paid jobs for Australia's workforce

[14] Best, A and Vernon, C, 2020, 'State of Play: Australia's Battery Industries as at March 2020', CSIRO, Australia.

The global battery and energy commodities market is forecasted to increase by 25% per annum through 2028.[15] Currently, Australia realises only 0.53% of the lithium value in the lithium-ion battery value chain by exporting metal concentrates.[16] In a rapidly developing, politically complex, global market, the opportunity to capture a significant proportion of this growth is not only substantial but time-sensitive.

There is a substantial opportunity to build on Australia's minerals endowment and industrial capacity to attract continued capital investment and create growth in the Australian export market. AusIMM believes Australia can expand domestic minerals processing and value-added manufacturing through the resources sector. We also recognise an opportunity to adapt innovations within Australian mining for use in other sectors, such as defence and space, in turn helping Australia capture more significant shares of the global market for these products.[17]

Leveraging Australia's leading technical and professional expertise to develop a strategic White Paper series addressing these and other opportunities in the region. The ability to export best practice operational management and training and skills development in the region creates increased opportunities for engagement and bilateral cooperation through the whole life cycle usage within the region. That driving demand for critical and rare earth minerals globally will force alliances around the supply, access, and control of these essential minerals.

Underinvestment in digital technologies has led to upstream and downstream challenges in Australian industry. Focus on financial performance has led Australian industry to adopt lean approaches to investment in new technologies with a true end-to-end view of their operations. The rapidly emerging opportunity in critical minerals in a chance to resent to Australian resources sector approach with the ability to attract and develop value adding processing to the mining enterprise.

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[15] Casson, B, Lewis, C and Martin, K, 2021, 'Outlook for Selected Critical Minerals: Australia 2021', Office of the Chief Economist, Australia; Department of Industry, Science, Energy and Resources, 2020, 'Responsible, Reliable, Ready for the Future: Australia's Global Resources Statement', Australian Government, Australia; Department of Industry, Science, Energy and Resources, 2021, Resources Technology and Critical Minerals Processing National Manufacturing Priority Road Map', Australian Government, Australia.

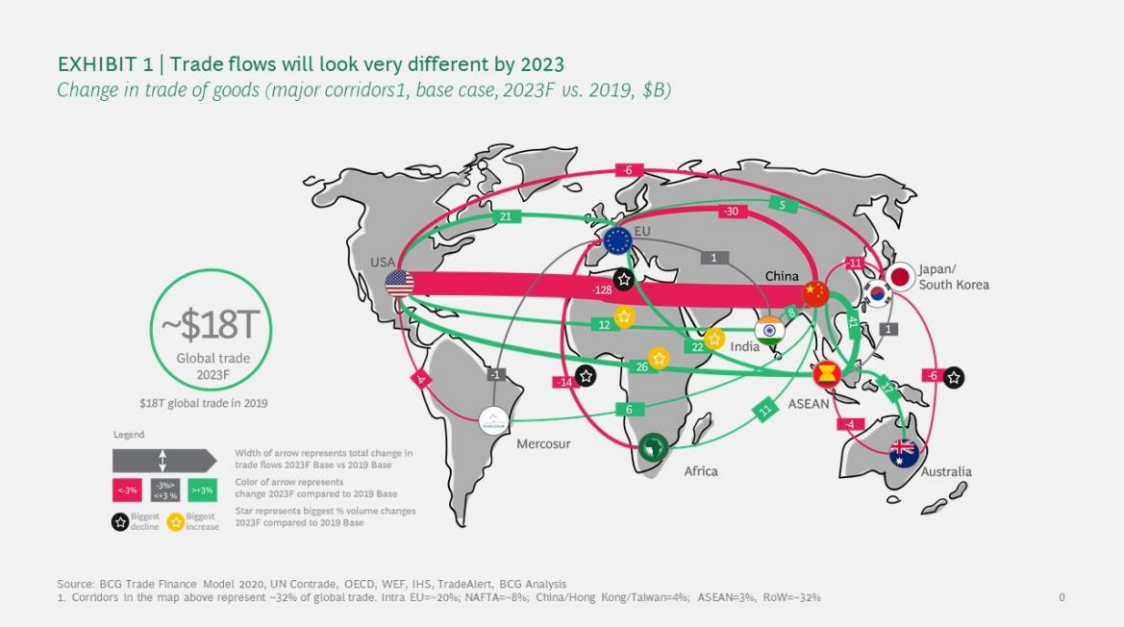
[16] The Lithium-Ion Battery Value Chain – New Economy Opportunities for Australia, AusTrade, December 2018, Figure 31.

[17] See for example Australian Government, 2021,'Resources Technology and Critical Minerals Processing National Manufacturing Priority Road Map', available at: https://www.industry.gov.au/sites/default/files/March%202021/document/resources-technology-and-critical-minerals-processing-national-anufacturing-priority-road-map.pdf.

Supply Chain Resilience

The Covid-19 Pandemic has escalated supply chain tensions due to restrictions on imports and exports and reduced operational capacity required to mitigate the effects of the virus and protect public health. The order lag times for the mining sector highlighted the ongoing need to have enterprise inputs easily accessible from various sources, including domestic operations. The precarious supply chains for materials and labour have forced the mining industry to consider its operational approach more broadly. Despite the general success and agility of the sector's management throughout Covid-19, several prominent Australian miners attributed missing productions targets due to the supply chain disruptions and access to labour shortages.

The general uncertainty of access to resources has become a considerable focus for the sector. It will create deep consideration about the enterprise value of having downstream processing near operations. The proximity value of colocations comes with significant investment needs, and Government supported facilitation settings to manage corporate risk in establishing new operational endeavours.



A recent BCG report into building resilience for Australian companies, 43 per cent of companies are planning to make permanent changes to their supply chain structures due to the risk or disruption from their lean, just-in-time efficient but not resilient sully management, that was strained by the pandemic. With resilience linked to a strategic view and investment in digital technologies there is a rapid developing opportunity for local business to fill the gap increasing the small business workforce demand in the future.

Regulatory Framework

Mutual Recognition

Measures to enhance professional recognition and mobility of professionals working across the resources industry, creates greater ability to attract, retain and grow the expertise and global leadership of Australian industry in upholding professional standards and best practice. The professional and technical excellence of the Australian resources workforce is key to our industry's future. The Australian resources sector has transformed dramatically over recent decades and this trend of innovation will only accelerate as we move into the future. The nature of work is changing, as are the skills demanded across all parts of the resources industry, making the sustainable supply of a skilled workforce a challenge of paramount importance.

Key benefits in measures to enhance professional mobility in resources:

- People working in resources will be better equipped to respond to the continuously evolving nature of work in our industry and access sustainable employment opportunities
- Industry will have greater access to skilled workers, particularly critical in the resources sector given operational requirements vary over both the course of each mining project and at an industry-wide level over the long-term

AusIMM believe registered professionals must uphold the highest professional and ethical standards. This is critical to protect the public interest, which is the core rationale underlying professional registration. AusIMM therefore submit that Australia's mutual recognition scheme must balance the efficiency of deemed automatic registration with appropriate regulatory safeguards.

Continuous regulatory co-ordination

A sound legislative framework is an important enabler for an effective mutual recognition scheme, but AusIMM emphasise that ongoing coordination is required across jurisdictions, and with peak professional associations, to mutual recognition is effectively operationalised and maintained.

Regulators must adopt an agile approach to keep pace with emerging areas of professional practice, respond to changes in the broader regulatory landscape, and avoid the gradual accretion of undue regulatory burden.

Aligning registration requirements

AusIMM emphasise that the alignment of underlying registration frameworks across jurisdictions is particularly important to support an effective mutual registration scheme. This is true for professional areas of practice that are already subject to registration requirements, such as

engineering and mine management, as well as areas such as environmental assessment, social performance, and geology.

Where appropriate, the alignment of broader regulatory frameworks for resources and other key industry areas would facilitate operationalisation of the mutual recognition scheme.

Aligning registration with professional codes and standards

Upholding standards and promoting best practice is a key focus for AusIMM. By promoting the highest professional and ethical standards, we support industry and government to advance mining innovation and excellence for the benefit of the resources workforce and wider community.

We play a leading role in the development and promotion of globally recognised professional codes, participate in key national and international technical forums, provide industry leadership through our Code of Ethics and Social Responsibility Framework, and deliver an ongoing Chartered Professional Program covering several core disciplines within the resources sector.

Commitment to the highest professional and ethical standards must underpin all professional registration schemes and recommend that both current and future registration requirements be benchmarked against industry codes, standards, and professional schemes.

Sustainable resources workforce

These mutual recognition reforms form part of a suite of initiatives already being considered in various forms across all levels of government to grow the skilled resources workforce, create opportunities for increased jobs in resources and adjacent industries. Aligning the framework across accreditations globally will support the continued contributions of the essential resources industry to Australia's social and economic prosperity.

Industry Standards

The Organisation for Economic Co-operation and Development (OECD) has estimated that standards, which set out minimum specifications, procedures, and guidelines for developing products, services and systems, impact 80 per cent of all global trade.[18] The Commonwealth Department of Industry, Science, Energy and Resources facilitates Australia's export growth by supporting and leading international standards development. Multi-lateral engagements such as the APEC Sub-Committee on Standards and Conformance (APEC SCSC) are crucial drivers of exporting best practices and fostering shared learning and skill development. This leadership enhances Australia's global trade and provides consistency in management practices that enables ease of movement for professionals operating across jurisdictions in the mining sector.

Professional and technical excellence in mining strengthens Australia's global standing, to attract research and project investment

Our resources professionals are amongst the most highly skilled globally, and our reputation technical and ethical leadership supports Australia's broader standing on the world stage.

AusIMM Under the Royal Charter, the AusIMM upholds standards and promotes professional best practices globally. The respect for Australian mining professionals, codes and standards, professional development and training sustains high demand for our skilled professionals. It strengthens opportunities for global dialogue and deepening strategic relationships through the resources sector.

Globally respected mining codes and standards

The demand for Australian mining experts reflects the global recognition of Australian mining standards, expertise and experience. This international recognition is core to the global position and competitive strength of Australian mining, and AusIMM exercises a leadership role in developing and promoting the highest ethical and professional standards through a range of codes, standards and professional frameworks, including:

[18] OECD, 1999. Regulatory Reform and International Standardisation. Available at: https://www.oecd.org/tad/benefitlib/1955309.pdf

- The AusIMM Code of Ethics, which ensures mining professionals uphold and enhance the global standing of mining professionals, has been translated into Mandarin and is supported by an established governance framework including By-Laws and Professional Conduct Regulations.
- The AusIMM Social Responsibility Framework, discussed above, also outlines professional standards to support the sector's environmental, social, and financial sustainability.
- JORC Code, the entire denomination of which is the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves, which AusIMM co-parent with our partners at the Australian Institute of Geoscientists (AIG) and Minerals Council of Australia, and has been translated into Mandarin;
- VALMIN Code, or Australasian Code for the Public Reporting of Technical Assessments and Valuations of Mineral Assets, also co-parented with the AIG.

The global mining community has demonstrated engagement efforts to align with Australian standards of professionalism and technical excellence. This global leadership position plays an essential role in supporting Australia's broader international standing.

Australia's best practice frameworks

The global mining community seeks opportunities to discover best practice upskilling practices from the respected Australian mining sector. AusIMM plays a crucial role in increasing the worldwide recognition and uptake of mining best practices, offering a wide range of globally recognised courses and training services to meet this demand.

More than 40% of the AusIMM flagship Professional Certificate in JORC Code reporting enrolments are outside Australia and New Zealand. A further example lies in our work with the Global Mining Association of China in 2020 to deliver a five-day training program on the JORC Code in China.

The deepening interest in Australian practices and innovations across crucial themes shaping the future of the global mining industry:

- Technology and innovation: operational efficiency, waste reduction and environmental performance.
- Health and safety: Australia leading progress towards a zero-harm industry.
- Sustainability: social responsibility and performance of the sector.
- Provides a mechanism for Australia's development and leadership and role of the mining sector to attract investment opportunities, strengthening the economy and prospects for professionals.

AusIMM invites the Government to collaborate on championing mining regulations, norms, codes and standards across the Indo-Pacific region. Facilitating these efforts through existing regional forums, including, for example, the APEC Subcommittee on Standards and Conformance and ASEAN Regional Mining Forums, provide a significant regional leadership opportunity for Australia.

AusIMM Resources Education Collaboration Summit

The AusIMM Resources Education Collaboration Summit, co-hosted by AusIMM with the Victorian Government, is working to address these areas through several initiatives with industry, Government, and education partners.

The National Resources Workforce Strategy outlines various policies and programs to support a sustainable future resources workforce. This strategy is essential to ensuring the skills and talent needed to sustain the industry are met and provides a forum to address

The Government role in supporting the future of the resources workforce reflects the broader responsibility of the Government to drive growth in Australia's economy and support job creation through the Nation's major industries. The nature and scope of the resources sector will provide a unique opportunity to enhance regional connectivity through professionals. As Industry 4.0 substantially drives job demand across sectors engaging in digital transformations and operations to meet demand, Australia will require increased skills migration. As the Columbo and New Columbo plan have demonstrated, people's movement in engaging in study and work provides a unique connection that builds enduring ties. The framework model has been used to significant effect in developing meaningful soft power diplomacy.

Approaching future planning and considerations of the sector industrial landscape and operational construction establishes the need for regional engagement on deepening strategic treaties and sovereign agreements to develop new and more accessible pathways of mobilising the skilled professionals in the region.

ESG

Social responsibility and performance

Environmental, social, and governance factors are fundamental to the sustainability and financial viability of the global mining industry, including in Australia.[19]

Australia's resources sector strong global reputation in ESG best practice and standards, underpins investor confidence

ESG has a profound impact on sources, availability, time frames and costs for project financing.[20] Mineral resource development opportunities are likely to be severely constrained unless projects and unavoidable legacies are agreed upon as acceptable by affected landholders/custodians in advance.[21] AusIMM is taking a global leadership position in ensuring resources professionals meet the highest social responsibility and performance standards.

The AusIMM is developing leadership in ESG through a comprehensive Social Responsibility Framework, consisting of a Social Responsibility Statement, our Royal Charter and Code of Ethics, a Chartered Professional Program for environmental and social performance professionals, and Professional Certificate in ESG and Social Responsibility to lift awareness, understanding and competency across the mining sector.

AusIMM submits to the Committee that measures such as these are fundamental to attracting continued investment into the Australian resources industry and supporting its ongoing role as the number one source of export revenue for the Australian community.

The resources sector is now measured by:

- Environment considerations: biodiversity, ecosystems, water management, mine waste / tailings, air, noise, energy, pollution (carbon footprint, greenhouse gas), hazardous substances, mine closure, rehabilitation, supply chain emissions and product usage
- Social: human rights and modern slavery, supply chain integrity land use, resettlement, exploitation of vulnerable people, diversity and inclusion, gender equality, labour practices, worker/community health & safety, security, artisanal miners, mine closure / after use, workforce maintenance through boom-and-bust cycles

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[19] AusIMM Social Responsibility Statement, available at: https://www.ausimm.com/about-us/governance/social-responsibility-framework-and-statement/.

[20] AusIMM, 2019, 'Social Licence Policy Development Forum Summary Report', available at: https://www.ausimm.com/globalassets/advocacy/slto_forum_report_final.pdfd;
PwC, 2020, 'Aussie Mine 2020: Resources the Recovery'; Mackenzie, S, Everingham, J and Bourke, P, 2020, "The Social Dimension of Mineral Exploration", SEG Discovery No 121. April 2020, pp. 16-28;

[21] Lebre, E., Stringer, M., Svobodova, K., Owen, J., Kemp, D., Cote, C., Arratia-Solar, A., Valenta, R., 2020, 'The Social and Environmental Complexities of Extracting Energy Transition Metals', *Nature Communications,* available at: https://www.nature.com/articles/s41467-020-18661-9.pdf.

- Governance: legal compliance, ethics, anti-bribery, and corruption (ABC), transparency, moral obligations, social license to operate and benefit/return to the community.

ESG has developed into a comprehensive framework that provides and economic rational and value proposition driven by increasing demands from investors on ESG matters and data.

Within the industry accepted codes and standards there is also internal risk consideration where companies must consider the potential ESG risks that could impact ability to raise capital, obtain permits, community engagement and working relationships, regulatory environment, cost to operations and efficiency measures and manage return on investment.

AusIMM recommends the government partnership with AusIMM to advance geostrategic leadership through the regional uptake of the AusIMM Social Responsibility Framework. The AusIMM Chartered Professional Program and course offerings provide skills development throughout the region and is an opportunity to deepen discussions in strategic forums to engage regional partners in a dialogue about Australia's leadership on ESG and social responsibility in mining.

Green Financing

Australia's "green finance" market is rapidly growing in line with activism investment globally rising in response to environmental challenges. Capital and investment market's ability to direct resources towards green projects, sustainability causes, or ESG-centric performance measures has forced a commercial mind shift in business about how and what they continue as part of their commercial operations.

Investors are focusing their attention beyond financial statements to operational and growth resource allocations and long-term enterprise outlook. As green finance continues to grow into an economically viable scale, companies will increasingly prioritise green investments strategies over business-as-usual growth investments. The "greening" of existing infrastructure, mobilizing additional/new assets has changed the investment scope of key sectors, establishing new industries in clean energy, pollution prevention/control. sustainable transport, natural resources, ecosystems and biodiversity management and sustainable tourism/fashion. The ADB institute research into developing Asia modelled annual investment of $1.7 trillion annually pre the pandemic to meet growth needs, all now requiring a net-zero lens.[22]

[22] https://development.asia/explainer/green-finance-explained

Conclusion

The strength of the resources sector in 2021 saw unemployment (as indicated PERS 2021) at a low of 1.6 per cent, reflecting almost full employment. Unemployment in the sector is well below the broader Australian workforce, with seasonally adjusted unemployment in October 2021 at 5.2 per cent.[23]

This fundamental role of technical and professional leadership is a critical driver of the resource sector's economic and social contributions in Australia and across the region. The status and credibility of the economic contributions of Australian sector, provides a unique agility to respond to major disruptions.

AusIMM analysis shows that since 2015 the resources sector has consistently outperformed the Australian unemployment rate, pointing to the sector's important role in providing high paying, stable employment. As the industry expands into emerging markets, commodities, and supply chains, AusIMM analysis indicates both continuing demand for existing skilled professionals as well as growing demand for new skillsets to support technology advancements.

The rapidly growing opportunities in emerging areas of mining such as critical minerals and automation highlight the shifting requirements, with the variety of operations requiring multiple technical and engineering competencies across the STEM field. The rising demand for minerals and metals provides economic opportunities for resource-rich developing countries and capital rich investment nations like Australia and Singapore respectively to embrace the significant challenges likely to emerge in the responsible and sustainable transition to net zero.

The significant bilateral engagement between Singapore and Australia is a unique value prospect to enhance Australia's emerging opportunities in critical minerals and green energy technologies. The freedom of trade and movement of people facilitated through fortified government to government agreements and the synergies between the two nations makes Singapore an important future partner. The technologically advanced Singapore industry and leading education and research infrastructure has the ability to expand Singapore as a significant resource for the technical skills professionals required for Australia to realise its immense ability to advance and expand its resources enterprise.

[23] https://www.abs.gov.au/statistics/labour/employment-and-unemployment/labour-force-australia/latest-release