International In-Market Analysis of the METS sector for the MIW METS SME Export Hub

Prepared by CRU Consulting

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Workshop presentation

Introduction

CRU Consulting were engaged to conduct research & analysis on international METS markets as part of ongoing development of the MIW METS Hub's **Export Strategy and Implementation Plan**.

CRU began this work in November 2020 and initially identified a shortlist of target markets to focus on for the remainder of the study. Following discussion with the MIW team and other relevant stakeholders, **3 target markets** were selected: **Canada, Chile & Indonesia.**

The report focusses on **three existing strengths of the region** to be leveraged in the Export Strategy, namely: **bulk material handling, automation & robotics, innovative sensor devices and data analysis tools.**

The structure of the final report is as follows:

- **Executive Summary:** key takeaways, recommendations & actions for development of the MIW Export Strategy.
- **Shortlisting of target markets:** identifying the most prospective target markets via a number of criteria.
- **Overview of target markets:** investment environment, mining industry & policy, Australia's trade relationships & the Covid-19 response.
- **Supply side dynamics & cost analysis:** mined supply outlooks, analysis of cost competitiveness / drivers & potential METS opportunities.
- **Insights from existing exporters in the MIW region:** insights & advice from MIW companies with existing successful export businesses.
- **Target market stakeholder interviews:** market advice, strategies & potential METS opportunities in the identified target markets.
- **Appendices:** further analysis & information to support the report and conclusions.

Summary of CRU's target market identification process

Scoring by category: 3 2 1

The table below summarises our shortlisting process by using a semi-quantitative approach to rank each potential target market:

Country	Major existing producer of core commodities?	Medium term supply side growth?	Longer term upside supply potential?	Strength in other mined commodities?	Existing survey results	Other market considerations*	OVERALL SCORE
Canada	3	1	3	2	2	3	14
Chile	2	3	2	1	3	3	14
India	2	3	1	2	2	1	11
Indonesia	2	3	2	2	3	2	14
Peru	2	2	2	2	3	2	13
South Africa	1	2	1	1	1	2	8
USA	3	1	2	3	2	3	14

Note: * Qualitative considerations based on CRU's knowledge of international mining markets e.g. mining safety standards, price sensitivity, business culture, etc.

Selected target markets

Scoring by category: 3 2 1

Following further conversations with RIN and the MIW METS SME Export Hub Project Advisory Group members, alongside feedback from relevant TIQ trade commissioners, we selected the following target markets as the focus of this study:

- **Canada**
- **Chile**
- **Indonesia**

Country	Major existing producer of core commodities?	Medium term supply side growth?	Longer term upside supply potential?	Strength in other mined commodities?	Existing survey results	Other market considerations*	OVERALL SCORE
Canada	🟢	🔴	🟢	🟡	🟡	🟢	14
Chile	🟡	🟢	🟡	🔴	🟢	🟢	14
Indonesia	🟡	🟢	🟡	🟡	🟢	🟡	14

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Stakeholder interviews in the selected target markets

CRU completed 19 interviews for this study across the 3 target markets. Stakeholders were identified **across a variety of the major mined commodities**, along with **supporting industries** including consulting/engineering services, banking, events, R&D institutions and intermediaries. More interviews were conducted in Indonesia due to limited experience for the MIW region in this market.

The following section summarises the key takeaways from interviews with stakeholders in the companies detailed below. The structure of the results broadly follows the semi-structured questionnaire that was agreed upon with the MIW team.

Canada		Indonesia		Chile	
Company	**Focus**	**Company**	**Focus**	**Company**	**Focus**
Allegiance Coal	Met coal	**Adaro**	Coal	**CAP**	Iron ore
Capstone	Cu	**Amman (AMNT)**	Cu & Au	**CEMIN Holding Group**	Cu
Minerai de Fer Quebec	Iron ore	**Antam**	Ni, Bx & coal	**Minera Tres Valles**	Cu
New Gold	Cu, Au & Ag	**Archi Indonesia**	Au	**SCM Minera Lumina Copper Chile**	Cu
Ausenco	Consulting & engineering	**Merdeka**	Cu & Au	**Emere**	Intermediary
		Nickel Mines	Ni		
		Bank Mandiri	Bank		
		Jakarta Mining Club	Networking & event organiser		
		MIND ID	Holding company, R&D		

Specific opportunities identified during the interview programme

"aiming to be the early adopters"

newgold

"keep the mine at the forefront of the industry"

Material handling, logistics & rail freight expertise

adaro MINING

"we are a small company that like to be efficient…we are forward looking"

MINERAI DE FER QUÉBEC
QUEBEC IRON ORE

"seen as an energetic company in Quebec by research organisations & universities"

Archi Indonesia

Potential for regular consumable products such as bucket teeth & haul truck tyres

LUMINA COPPER CHILE

Caserones typically in the 3rd or 4th cost quartile. "Efficiency is a key aspect in our business..."

CEMIN HOLDING MINERO

"We must implement a strong digitization program with a focus on operational technologies"

MINERA TRES VALLES

"There is not good knowledge in maintenance and operation, and there is an important lack of spare parts in Chile."

Other companies happy to discuss further:

MIND ID · MERDEKA COPPER GOLD · antam · AMMAN MINERAL · Ausenco · Capstone MINING CORP · EMERE

Identified opportunity areas

General

- If METS providers can partner with the OEMs, then their products can be procured at the same time as the OEM equipment.
- Ore sorting technology is being developed at present, with pilot plants underway at a number of Canadian operations.
- Investing in technology generally requires scale – very small producers will not have budget for high end equipment/services.
- New technology must be a significant step change to be considered – can improvements be guaranteed?

Canada

- Battery powered equipment to reduce GHG emissions and carbon footprint.
  - OEMs are not servicing this well as yet.
  - LNG trucks also being trialled by Teck to replace diesel
- Bulk material handling
  - “untapped potential in handling & systems”
  - Conveyors can be utilised more effectively
- Automation
  - Particularly for the less popular equipment brands & models. Companies tend to only be good at the most popular e.g. F150 trucks.
- Rising ESG awareness
  - GHG emissions, water usage, reducing waste

Chile

- Efficiency
  - Productivity optimization is one of the main issues faced by small-medium size mining companies. Therefore, equipment or technology that address a more efficient use of resources will be a clear opportunity.
- Automation
  - Although some larger companies have already implemented automation and monitoring technologies (inc. remote systems), there is a gap in the small-medium mining sector that can be filled.
- Water efficiency / usage
  - ESG awareness as a whole has been increasing in the industry; nonetheless, water usage has become a critical problem as most mining companies are located in areas with high level of water scarcity.
- Switch in UG mining techniques
  - Old methods have been replaced by block caving which requires different mining equipment & expertise.

Indonesia

- Battery powered trucks for UG use, to reduce diesel fumes & ventilation issues. Looking for suitable providers as technology is still relatively new.
- Small companies have limited internal expertise, so they do require assistance with engineering, metallurgy, etc.
- Sensor devices for safety e.g. fatigue.
- MIND ID & mining entities are committed to research & innovation – collaboration opportunities?
- Collaboration with the 2 major equipment suppliers: PT United Tractors (~20 branches; Komatsu) and PT Trakindo (CAT).
- Potential opportunity for regular consumable products (e.g. bucket teeth) – domestic dealers tend to only offer most expensive options.
- UG mine expansion support services.
- Bucket sensors, operational databasing systems.
- Material handling & logistics expertise.
- Pumping support to mitigate against high rainfall at primarily OP operations.

Existing MIW exporters – **strategies for success**

A number of MIW METS companies already have **established and successful international businesses**. Through discussions with these organisations, we have identified a **number of success strategies** for the various stages of new market development:

Marketing & advertising

- **Case studies and relevant data** in marketing material
- **TIQ and Austrade** support for initial approaches, small grants and trade missions
- **Conferences and trade shows** to improve awareness
- **LinkedIn and digital advertising** to increase market reach

Market entry

- **Collaborate** with other companies to share knowledge and reduce business costs – particularly important for SMEs
- **Integrate** technologies into equipment design of OEMs
- **Partnership programmes** with OEMs or distributors (exclusive local / country rights)

Building reputation

- **Invest in technical support** and ensuring products work for the customer
- **Local presence** with technical expertise and product understanding – representatives or regional office
- Provide **high level of service** to improve reputation through word of mouth
- **Conferences and technical trade shows** to widen network

CRU's recommendations for developing MIW's Export Strategy

We have **identified potential opportunities for MIW METS providers** in all 3 of the target markets. Each market has similarities and differences to Australian mining and business practices and therefore must be approached in different ways, as summarised in the next section. Below we provide some **recommendations and advice to MIW companies** to assist in **development of the MIW METS Export Strategy:**

- **Focus the export strategy by target market:**
  - For example, aim for higher value added and innovative products to Canada, whereas Indonesia would benefit from less advanced technologies and some general engineering / operational services.
  - Exporting labour and other services can be complicated due to local employment laws (e.g. Indonesia) or existing domestic capability (e.g. Canada). **More success is likely with innovative, cutting edge products and technologies.**
- **Marketing material:**
  - Using the current RIN Capability document as the base, **develop a new version of the capability document specifically for the MIW METS SME Export Hub**, including only those product areas targeting exports (e.g. sensor devices, data analytics, bulk material handling, automation and robotics). This should include clear sections focussed on different areas of expertise / capabilities / product areas. This will enable prospective customers to find providers more easily and showcase the unique capabilities of the region.
- **Other support for potential exporters:**
  - Using the insights generated in this study and leveraging RIN/MIW's existing expertise, the Export Strategy should include **advice and recommendations** to companies who are looking to enter new export markets.
- **Pitching new products / services and approaching new contacts:**
  - Take time to **tailor approaches** to the specific client / commodity. Ensure the **data, capability and case studies** are relevant to the client and that they can **understand the value add** of the offering.
  - Mining companies receive many approaches from providers, so MIW companies need to **be personal and stand out.**

CRU's recommendations for developing MIW's Export Strategy

- **Identify 'champions' across MIW's successful exporters to drive best practice**
  - There are already a number of MIW companies that have developed successful businesses in international markets. These should be used as **'success stories'** to support new exporters; collaboration should be encouraged across the MIW region. This has already been seen in Chile with Vayeron and 2Censor collaborating, learning from each other and now using the same distributor.
  - If they are willing, then some of the successful companies could **share their knowledge and experiences** through seminars (or as export ambassadors) to educate other MIW members. This will prevent companies making the same mistakes as those before them.
- **Understand cultural and business practices:**
  - Each market has unique aspects to consider. It is important to **take time to understand** these and adjust your approach as necessary.
  - Regulations and processes (government approvals, imports duties, taxes, etc) will differ vastly across markets. A **local representative and good market relationships** will simplify market entry. MIW companies and their representatives should **work closely with existing support** in each market, such as governments, TIQ, local organisations, etc.
  - Domestic representation will **mitigate against ongoing Covid travel restrictions**, which could continue beyond 2021 in some regions.
- **Routes to market:**
  - Many companies **use their existing network to find products and services**, so building a network and expanding market reach should be a priority.
  - **LinkedIn** is a useful tool to generate interest and increase awareness.
  - Attend / sponsor technical **trade shows and conferences**.
  - Advertise or submit articles to **industry magazines and publications**.
- **Partnerships:**
  - Identify partners to **collaborate**, **develop** new products, **share** ideas, **leverage** networks and **access** new markets and opportunities.

Specific recommendations and actions

- New technologies must **provide a significant step change** to support investment – need to clearly **present the value proposition**.
- **Invest in local technical support** to ensure new products / technologies work effectively for the customer and provide optimum value. Also ensure timely access to spare parts and backup equipment.
- Consider the use of **performance-based contracts / guarantees** to **demonstrate confidence** in efficacy and quality of products and services.
- Broad interest in **battery-powered equipment and ESG aspects** – consider **how MIW expertise can leverage** these market themes.

CANADA

- Important to be **first to the market** with new technologies to compete with a number of innovative companies.
- Ensure a **targeted approach** to avoid facing competition from existing advanced providers.
- Engage with forward looking miners who are willing to **collaborate and invest** in cutting edge technologies (e.g. Quebec Iron Ore and New Gold)
- **Knowledgeable local support** is critical.
- Technology must be **continually developed** and improved.

CHILE

- Identify companies to **partner** with for product development and distribution – this will also assist with **market access and language barriers.**
- Major miners already using advanced techniques, but **opportunities with small to medium producers** for improvements. Government want to ensure they are not left behind.
- **Local presence less critical** than other target markets, but small to medium sized producers rely heavily on **timely access to spare parts and technical support.**

INDONESIA

- Important to **present value for money** as often price sensitive to foreign providers.
- Processes and approvals will take time – **be patient**. Regulations differ to Australia and other markets.
- **Consider expertise level** at each mining company and adjust approach for each.
- Need to **embed in organisations** and build profile and reputation.
- **Procurement is heavily regulated** by the government, particularly for foreign and 2nd hand goods. Having a local PT entity can assist with this.

SWOT analysis: **Canada**

Strengths

- Similar mining practices to Australia with long history in a number of commodities.
- Well developed mining sector with large number of companies (of varying sizes) & development projects. Strong growth potential for IO & coal.
- Trusted market for METS exports from Australia, with good political and industry relationships.
- Well regarded on mining policy & investment attractiveness.
- Similar business culture to Australia.

Weaknesses

- Challenging operating conditions (snow, ice & elevation) in some parts of the country.
- Logistics routes are complex for remote operations.
- Some language barriers in French speaking regions, but high level of English in general.
- Limited local/government bodies for mining sector/trade support.

Opportunities

- Some small to medium sized producers who are innovative & forward looking – interested in further discussions with MIW companies.
- Production across the core commodities in the MIW region, as well as a major producer of Ni & Au.
- Interest in digitisation, automation & battery-powered equipment.
- Potential for bulk material handling & logistics improvements.

Threats

- Existing METS capability & provision due to advanced mining sector – high level of competition.
- Some of the larger mining companies (e.g. Teck) have advanced internal capabilities in mining technologies.
- Risk of numerous technologies not communicating and providing non-actionable data.
- Australian providers may have limited experience in complex & challenging Canadian environments.
- Some restrictions on foreign labour hire e.g. construction workers in Quebec.

SWOT analysis: **Chile**

Strengths

- Strong mining market, particularly in copper and associated base metals, with robust outlook.
- Digitization, automation and new technologies are being implemented in large mining companies and small and medium mining companies are also showing great interest in this matter.
- Mining policies are well defined and investment attractiveness is at the same level as in Canada.

Weaknesses

- Volatile labour market with powerful unions leads to operational risks & instability.
- Language barriers, particularly in small to medium sized companies where English is limited.
- Time zone difference with Australia could be an issue if there is not 24 hour support or a local presence.
- Some local organisations for support, but limited use by domestic miners.

Opportunities

- Some Chilean operations are already installing automation and monitoring technologies indicating a budget for innovative mining products & services.
- All interviewees are willing to purchase from Australian METS companies, although there is lack of knowledge.
- Chilean mining has historically been mostly open pit. Now migrating to underground mining where MIW METS companies have extensive experience.
- Larger companies use advanced technologies, but small-medium companies need support to develop.

Threats

- Some of the larger mining companies already have advanced in-house capabilities in mining technology.
- Limited awareness of Australian providers at some companies – need to network effectively to improve this.
- Chile will be drafting a new constitution that could generate some uncertainty for the mining industry. Nonetheless, no major changes are expected.
- A new ‘Glacier Protection Law’ is being debated in Congress. If approved, a 20-25% reduction in Cu production is estimated.

SWOT analysis: **Indonesia**

Strengths

- New national Mining Law in 2020, albeit uncertainty about how successful changes will be.
- Large number of Australian expats across mining operations who are supportive of Australian METS.
- English generally well spoken.
- Indonesia already a major market for Australian METS.
- Major thermal coal producer & exporter.
- Strong growth forecast for copper & nickel supply.

Weaknesses

- Volatile mining history with a number of multi-national companies exiting in recent years due to government and policy issues – low policy & investment attractiveness.
- Ore export bans & requirement for downstream processing risk the economics of operations & projects.
- Bauxite production dominated by small-scale & privately owned mines that flex to demand conditions.
- Coal production can be volatile as low margins force producers to adjust production through price cycles.

Opportunities

- Major coal, copper and nickel producer.
- Labour rates expected to rise in medium to long term which may support shifts in automation & technologies to improve productivity / bulk material handling efficiency
- Currently limited use of advanced mining technologies, with standard mining methods generally employed.
- Domestic organisations (e.g. MIND ID & Jakarta Mining Club) may be able to assist with market entry.
- Potential opportunities identified in support services, sensors & safety devices, equipment parts & logistics.

Threats

- Labour & bulk material efficiency low priorities due to wage rates – little incentive to reduce FTEs.
- Domestic contractors hired for majority of operations.
- Some supply chains dominated by Chinese stakeholders (e.g. Ni) – limited METS opportunities.
- Large scale mines (e.g. Grasberg & Batu Hijau) already use some advanced techniques – block caving.
- Price sensitivity to non-domestic providers; govn. restrictions on foreign & 2nd hand procurement; preference for local business entity; complex processes.

Outline

1. Executive Summary
2. Shortlisting of target markets
3. Overview of selected target markets
4. Supply side dynamics & cost analysis
5. Insights from existing exporters in the MIW region
6. Target market stakeholder interviews
7. Appendices

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1 Executive Summary

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Existing MIW exporters – **strategies for success**

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Market entry

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Key conclusions from supply and cost analysis: **Canada**

Key commodities

Iron ore
- Annual production of 57 Mt in 2019.
- 10% of Canada's mineral production.

Metallurgical Coal
- Annual apparent production of 34 Mt in 2019.
- 14% of Canada's mineral production.

Copper
- 10th largest producer, production of 530 kt in 2020.
- Most copper mines also produce gold and silver.

Weaknesses

High labour and consumables cost
Canada's total labour costs are significantly higher than in Australia.

Low machinery efficiencies
Low loading and haulage fleet efficiency in coal mining.

High maintenance cost
Compared to Australia, Canada's maintenance costs are significantly higher.

Opportunities for MIW METS

Bulk material handling and automation
Potential opportunities for METS to improve material movement efficiency and reduce labour costs.

Services
Higher level of automation or better management of current machinery may help optimize efficiency.

Technology
Technology to monitor the condition of mines and diagnose potential issues may reduce maintenance costs.

SWOT analysis: **Canada**

Strengths

- Similar mining practices to Australia with long history in a number of commodities.
- Well developed mining sector with large number of companies (of varying sizes) & development projects. Strong growth potential for IO & coal.
- Trusted market for METS exports from Australia, with good political and industry relationships.
- Well regarded on mining policy & investment attractiveness.
- Similar business culture to Australia.

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- Some language barriers in French speaking regions, but high level of English in general.
- Limited local/government bodies for mining sector/trade support.

Opportunities

- Some small to medium sized producers who are innovative & forward looking – interested in further discussions with MIW companies.
- Production across the core commodities in the MIW region, as well as a major producer of Ni & Au.
- Interest in digitisation, automation & battery-powered equipment.
- Potential for bulk material handling & logistics improvements.

Threats

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- Some of the larger mining companies (e.g. Teck) have advanced internal capabilities in mining technologies.
- Risk of numerous technologies not communicating and providing non-actionable data.
- Australian providers may have limited experience in complex & challenging Canadian environments.
- Some restrictions on foreign labour hire e.g. construction workers in Quebec.

Key conclusions from supply and cost analysis: **Chile**

Key commodities

Copper

- Largest copper producer globally.
- Produced 4,228 kt of mined copper concentrate in 2020.

Iron ore

- Annual production of 18 Mt in 2019.
- Compañia Minera del Pacífico (CAP) is the sole producer in Chile.

Weaknesses

Low machinery efficiencies

Low loading and haulage fleet efficiency in iron ore mining.

Copper operations becoming deeper and more complex

Near surface deposits depleting and ore grades continue to decrease.

Labour issues

Strong labour unions and frequent strikes leads to operational instability.

Opportunities for MIW METS

Technology services

Sensor and data analytics could be applied more widely in to monitor and optimize equipment efficiencies.

Shift to underground

METS companies in the MIW region are experts in UG mining and can potentially help with the change in mining methods.

Rise in automation?

With recurring labour and union issues, operations could turn to more automation to reduce operational risks and slowdowns.

SWOT analysis: **Chile**

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- Chilean mining has historically been mostly open pit. Now migrating to underground mining where MIW METS companies have extensive experience.
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Threats

- Some of the larger mining companies already have advanced in-house capabilities in mining technology.
- Limited awareness of Australian providers at some companies – need to network effectively to improve this.
- Chile will be drafting a new constitution that could generate some uncertainty for the mining industry. Nonetheless, no major changes are expected.
- A new ‘Glacier Protection Law’ is being debated in Congress. If approved, a 20-25% reduction in Cu production is estimated.

Key conclusions from supply and cost analysis: **Indonesia**

Key commodities

Thermal coal

- Annual production of 411 Mt in 2019.
- Indonesia's largest commodity by production volume.

Copper

- Annual production of 370 kt in 2019.
- Grasberg is one of the largest copper mines globally.

Weaknesses

Low machinery efficiencies

Low loading and haulage fleet efficiency in coal mining.

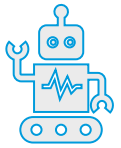
Low labour productivities

Less skilled labour and lack of advanced mining technology.

Wage inflation

Currently labour costs are still competitive due to low wage rates, however expected to rise in medium to long term.

Opportunities for MIW METS



Bulk material handling and automation

Potential opportunities for METS to improve material movement efficiency and reduce labour costs.

Services

Higher level of automation or better management of current machinery may help to optimize efficiency.

SWOT analysis: **Indonesia**

Strengths

- New national Mining Law in 2020, albeit uncertainty about how successful changes will be.
- Large number of Australian expats across mining operations who are supportive of Australian METS.
- English generally well spoken.
- Indonesia already a major market for Australian METS.
- Major thermal coal producer & exporter.
- Strong growth forecast for copper & nickel supply.

Weaknesses

- Volatile mining history with a number of multi-national companies exiting in recent years due to government and policy issues – low policy & investment attractiveness.
- Ore export bans & requirement for downstream processing risk the economics of operations & projects.
- Bauxite production dominated by small-scale & privately owned mines that flex to demand conditions.
- Coal production can be volatile as low margins force producers to adjust production through price cycles.

Opportunities

- Major coal, copper and nickel producer.
- Labour rates expected to rise in medium to long term which may support shifts in automation & technologies to improve productivity / bulk material handling efficiency
- Currently limited use of advanced mining technologies, with standard mining methods generally employed.
- Domestic organisations (e.g. MIND ID & Jakarta Mining Club) may be able to assist with market entry.
- Potential opportunities identified in support services, sensors & safety devices, equipment parts & logistics.

Threats

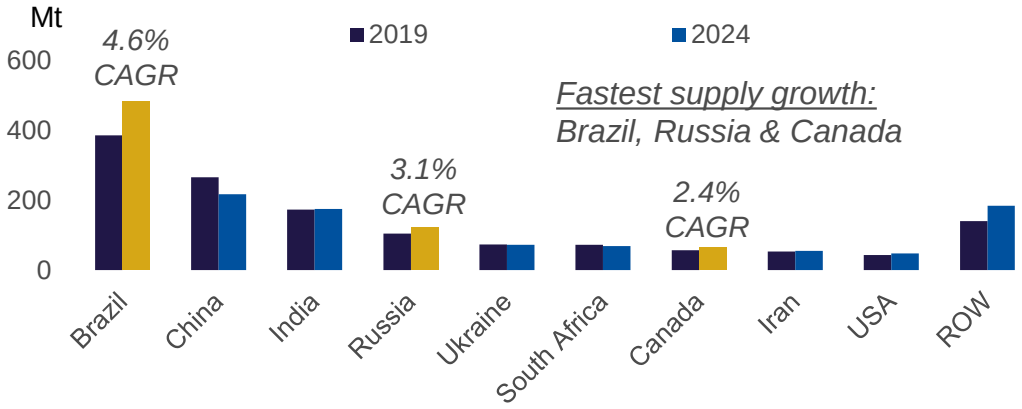
- Labour & bulk material efficiency low priorities due to wage rates – little incentive to reduce FTEs.
- Domestic contractors hired for majority of operations.
- Some supply chains dominated by Chinese stakeholders (e.g. Ni) – limited METS opportunities.
- Large scale mines (e.g. Grasberg & Batu Hijau) already use some advanced techniques – block caving.
- Price sensitivity to non-domestic providers; govn. restrictions on foreign & 2nd hand procurement; preference for local business entity; complex processes.

② Shortlisting of target markets

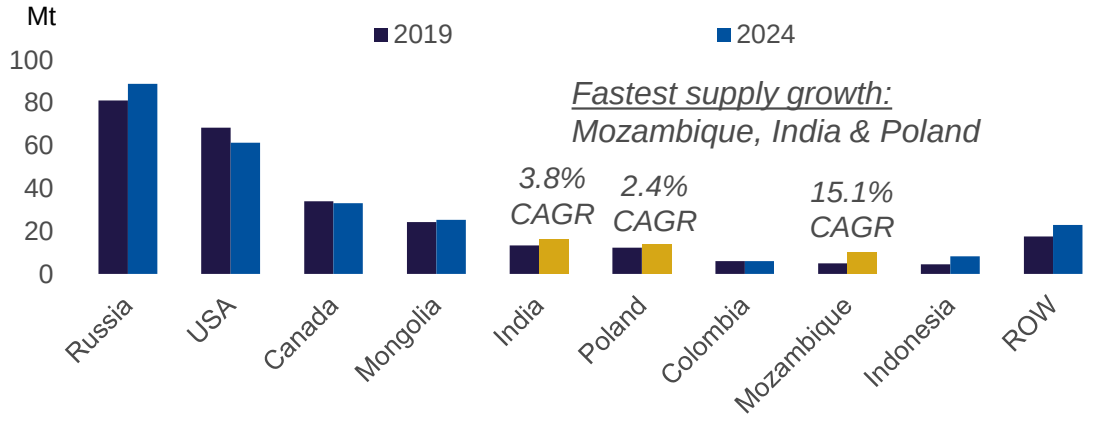
1st filter: identified major producers across core commodity expertise

MIW METS companies have existing expertise in the bulk commodity (iron ore & coal) and base metals (primarily copper) markets. In the first stage of filtering markets, the **major producers of each were identified and ranked**, with a review of our medium term supply growth forecast.

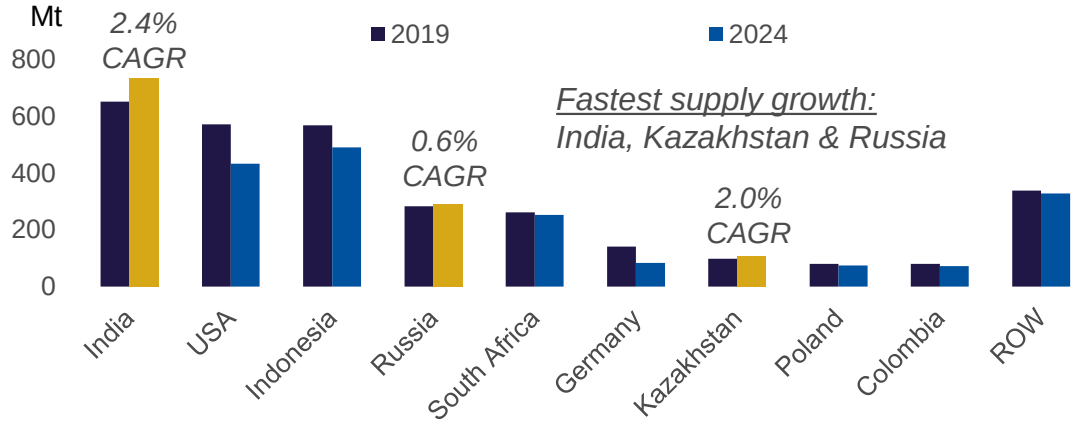
Iron ore production (ex. Australia)



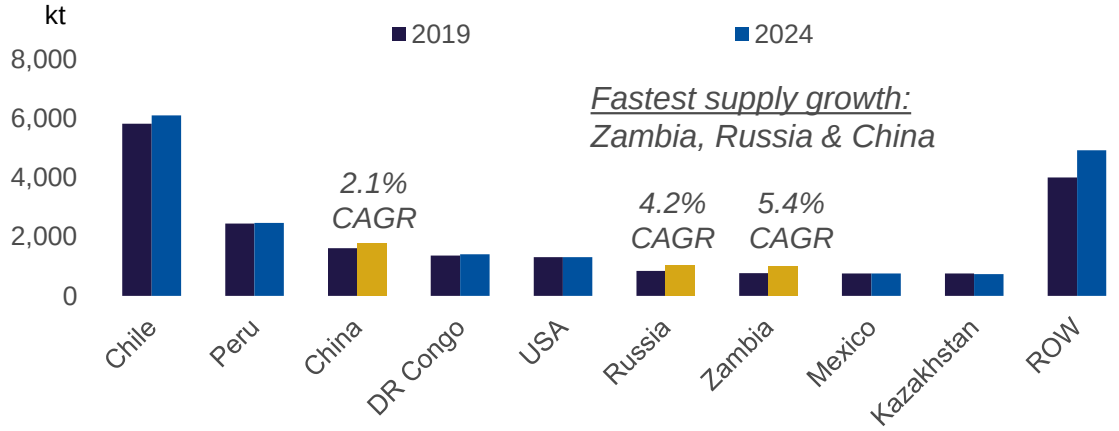
Metallurgical coal production (ex. Australia & China)



Thermal coal production (ex. Australia & China)



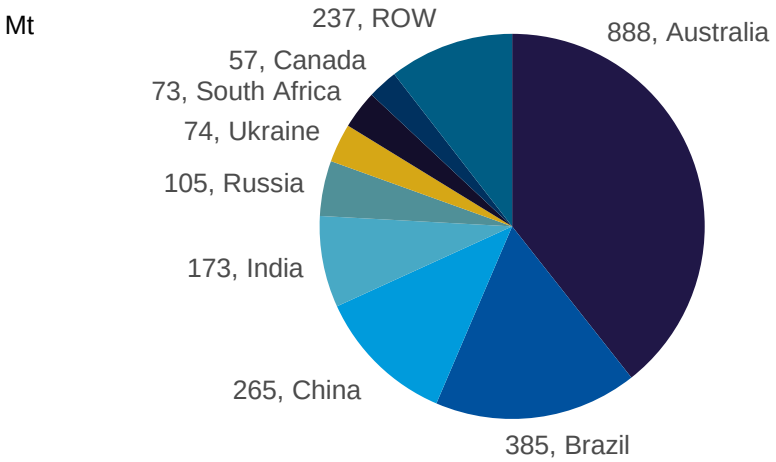
Copper production (ex. Australia)



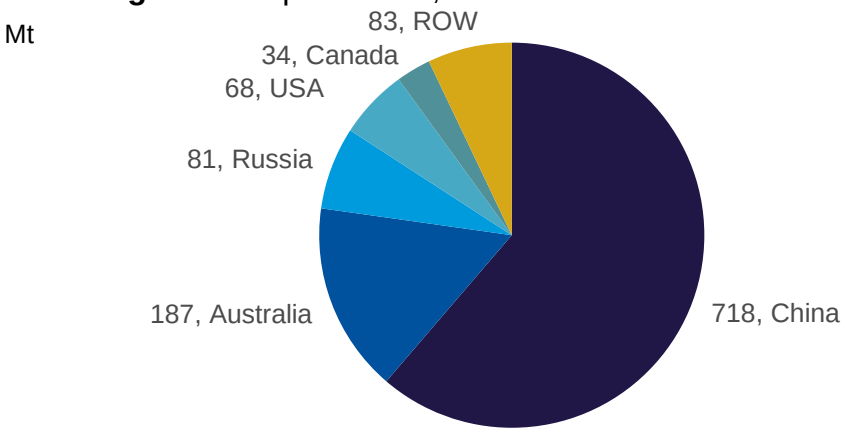
Note: Only top 10 producing countries shown. China excluded from charts for metallurgical and thermal coal. Australia excluded from all charts.

1st filter: also considered the scale of potential markets & opportunities

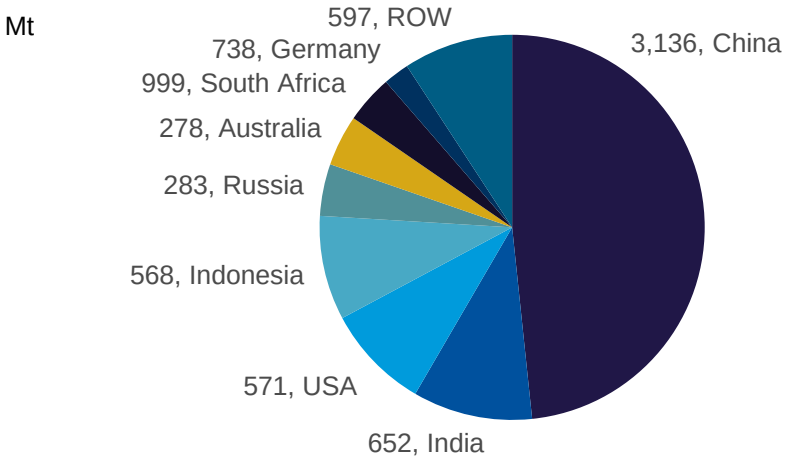
Iron ore production, 2019



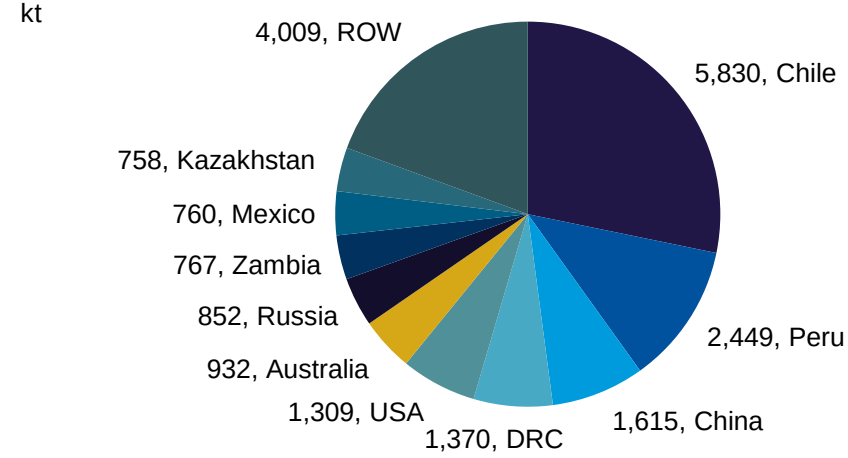
Metallurgical coal production, 2019



Thermal coal production, 2019



Copper production, 2019



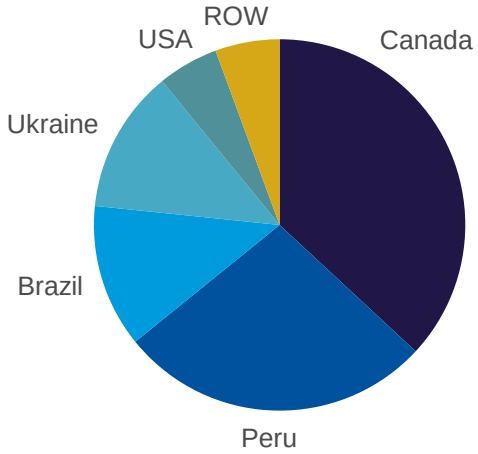
- In addition to the ranking of the major producers of each commodity, we also considered scale to assess likely market opportunities for MIW.
- Iron ore and met coal (and to a lesser extent thermal coal) are **dominated by a small number of countries** that produce at a large scale – many with potential for MIW exports.
  - Brazil is a major producer of iron ore, but this is dominated by Vale (~90%) where there are likely to be less opportunities for METS companies.
- However, **copper production is much more diverse** with 9 countries making up around 75% of production and 42 small scale producers making up the remaining quarter. There are many smaller scale countries likely meaning less opportunities for MIW.

2nd filter: identified markets with the most supply side growth potential

The next step was to identify markets with the most **upside growth potential**. CRU's supply forecasts use an objective methodology* to determine the potential for future supply. However, some projects are not included in the medium term view and therefore indicate the potential for **additional longer term growth**. The charts below show the volume of total (inc. the base case) potential projects for each country.

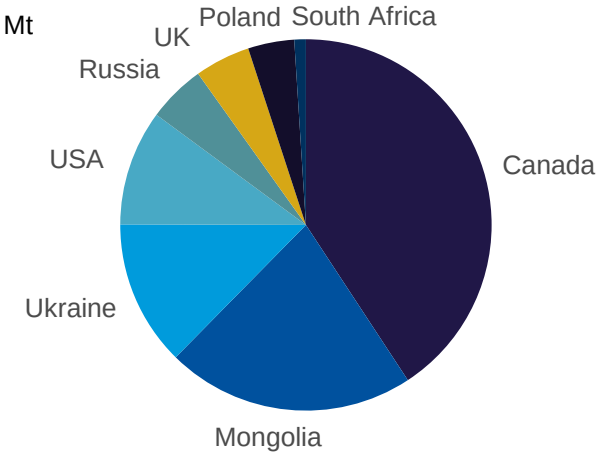
Iron ore (IO) potential projects

Mt



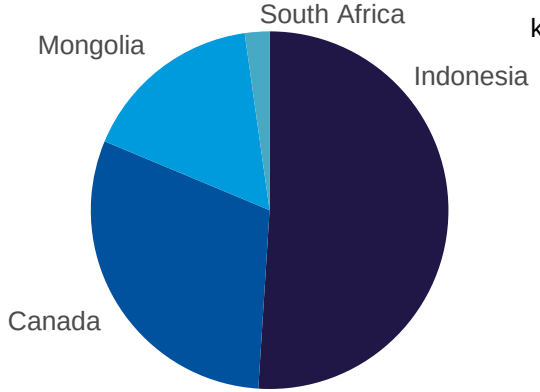
Metallurgical coal (MC) potential projects

Mt



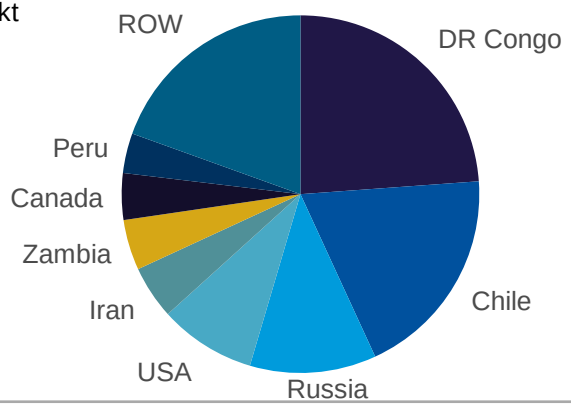
Thermal coal (TC) potential projects

Mt



Copper (C) potential projects

kt



Of those highlighted on the previous slide (top 10 producers & fastest supply growth), a number of countries/regions also have significant development project potential:

- **North America:**
  - Canada (IO, MC, TC & C)
  - USA (IO, MC & C)
- **South America:**
  - Brazil (IO)
  - Chile (C)
  - Peru (IO & C)
- **Asia:**
  - Indonesia (TC)
- **Africa:**
  - DR Congo (C)
  - South Africa (MC & TC)
  - Zambia (C)
- **CIS:**
  - Russia (MC & C)
  - Ukraine (IO & MC)
- *Also China & India – not included in projects data.*

→ 13 countries identified from the 1st and 2nd filters

Note: excluding Australian, Chinese & Indian projects. * Data shown for Probable, Possible & Speculative projects – categories explained further in the Appendix .

3rd filter: identified variables which are negative for export potential

Of the 13 countries, each was ranked by their 2019 production volume and then by the average ranking across the four core commodities, as shown in the table on the right.

For the next stage of filtering, a number of variables were considered which could **negatively impact** the export potential for MIW METS companies:

Limited production across all of MIW's core commodities

Geopolitical considerations

Market access / lack of established trade partnerships

This resulted in 6 countries being removed from the list, as highlighted in the table.

→ 7 countries (those not highlighted) remain after filtering and are included in CRU's 'longlist'

	2019 production ranking (1=largest)				Ranked by avg.
Country	**Iron ore**	**Met coal**	**Th. coal**	**Copper**	**Average**
China	3	1	1	3	**2**
DR Congo	n/a	n/a	n/a	4	**4**
Russia	5	3	5	7	**5**
USA	**10**	4	3	5	**6**
Zambia	n/a	n/a	n/a	8	**8**
Peru	15	n/a	n/a	2	**9**
Canada	8	5	13	11	**9**
India	4	7	2	34	**12**
Ukraine	6	13	17	n/a	**12**
Indonesia	21	11	4	13	**12**
Chile	14	n/a	27	1	**14**
South Africa	7	15	7	27	**14**
Brazil*	2	n/a	33	14	**16**

Note: * Brazil is a very large scale producer of iron ore (2nd only to Australia), but its limited production of other core commodities and dominance by Vale (~90% of Brazil's output) weakens its position relative to other markets.

Overview of the market potential of the 7 countries in CRU's 'longlist'

2019-24 production delta (Mt IO & coal / kt Cu)

Country	Iron ore	Met coal	Th. coal	Copper
Canada	+7.2	-0.9	-7.4	+6.9
Chile	-3.8	n/a	+0.4	+282.9
India	+1.7	+2.7	+82.8	+24.9
Indonesia	-3.3	+3.8	-77.7	+532.8
Peru	+7.3	n/a	n/a	+23.6
South Africa	-3.5	+0.3	-8.6	+19.3
USA	+4.7	-7.1	-138.1	-0.7

Potential project volumes* (Mt IO & coal / kt Cu)

Country	Iron ore	Met coal	Th. coal	Copper
Canada	47.4	20.3	9.5	119
Chile	0.0	n/a	0.0	545
India^	n/a	n/a	n/a	19
Indonesia	0.0	0.0	16.0	8
Peru	35.0	n/a	n/a	102
South Africa	0.0	0.5	0.7	25
USA	6.8	5.0	0.0	247

- **Canada:** strength across all key commodities; particular upside for iron ore & copper.
- **Chile:** very strong copper market with further upside potential; minor iron ore & thermal coal.
- **India:** strength across the bulk commodities, particularly thermal coal; limited visibility of development projects.
- **Indonesia:** relatively steady across iron ore & met coal, but thermal weaker; strong copper industry growth expected.
- **Peru:** strong and developing copper market; upside potential for iron ore.
- **South Africa:** declining bulk commodity output; copper strong, with upside potential.
- **USA:** declining supply across the board; strong copper potential.

Of countries presented:

Highest

2nd highest

Note: * Data shown for Probable, Possible & Speculative projects – categories explained further in the Appendix. ^ Project data not available for India.

We have also considered other markets to expand MIW's export base

As well as MIW's core commodities (coal, iron ore and copper), the region is also hoping to diversify its customer base by exploring other markets where their expertise and technologies can be applied. Given the diversity of technology options, many of which can be applied in both open pit and underground settings, the region has a variety of potential markets to explore. We have identified a selection of traditional mined commodities here to assess the potential for further export opportunities into other analogous markets.

The table on the right shows the share of 2019 global production for the 7 'longlist' countries:

- **Canada:** significant producer of both nickel and gold, and to a lesser extent zinc.
- **Chile:** minor gold producer, primarily as a copper mining by-product.
- **India:** significant producer of zinc, along with lead and bauxite.
- **Indonesia:** very large scale nickel producer; minor bauxite and gold.
- **Peru:** substantial zinc and lead producer, a combination of primary mines and the by-product of copper mining.
- **South Africa:** minor producer of a number of commodities – gold is the largest.
- **USA:** major producer of gold and phosphate rock, also with significant supply of lead and zinc.

Share of 2019 global mined production (%)

Country	Nickel	Lead	Zinc	Bauxite	Gold	Phos. rock*
Canada	6.9%	0.5%	2.6%	-	7.7%	-
Chile	-	-	-	-	1.5%	-
India	-	4.5%	5.6%	4.5%	-	0.5%
Indonesia	32.8%	-	-	4.7%	3.5%	-
Peru	-	6.6%	10.2%	-	2.2%	1.9%
South Africa	1.9%	1.0%	0.9%	-	5.7%	0.9%
USA	-	5.8%	6.2%	-	9.9%	11.3%

Note: * Phosphate rock.

Existing survey results support the countries in CRU's 'longlist'

METS EXPORT HUB Mackay | Isaac | Whitsunday

With Lytton Advisory

MIW Capability and Supply Chain Study by Lytton Advisory, November 2020

- Austrade identified the best export markets as: **Latin America**, China, **India**, Russia, New Caledonia, PNG, Africa, **Indonesia** and Mongolia.
- Nearly 75% of companies are not currently exporting.
  - 50% do not plan to export in next 3 years.
  - 22% do intend to export in next 3 years.

TIQ Trade Commissioner Feedback, November 2020

- Desire to invest in Australian METS: **India, Chile and Indonesia**.
- Key areas of interest: technology to improve productivity and efficiency; automation; robotics; improve safety; environmental solutions.

TIQ Trade & Investment Queensland AUSTRALIA | Queensland Government

AUSTMINE Smart Mining

Austmine National METS Survey, November 2020

- Coal, iron ore and copper are most important to QLD METS companies.
- Highly skilled staff is a key competitive advantage nationally. Seen as more important in QLD (significantly higher than national average).
- Top export destinations for QLD: **USA**, PNG, **Chile**, South Africa, **Indonesia**, **Canada**, NZ.
- Key destinations for new exporters or expanding exports: **USA**, NZ, **Indonesia**, **Canada**, PNG and **Chile**.
- India was not well regarded as a potential export destination, with only 8% of companies planning to expand to this market.

Summary of CRU's target market identification process

Scoring by category: 3 2 1

The table below summarises our shortlisting process by using a semi-quantitative approach to rank each potential target market:

Country	Major existing producer of core commodities?	Medium term supply side growth?	Longer term upside supply potential?	Strength in other mined commodities?	Existing survey results	Other market considerations*	OVERALL SCORE
Canada	3	1	3	2	2	3	14
Chile	2	3	2	1	3	3	14
India	2	3	1	2	2	1	11
Indonesia	2	3	2	2	3	2	14
Peru	2	2	2	2	3	2	13
South Africa	1	2	1	1	1	2	8
USA	3	1	2	3	2	3	14

Note: * Qualitative considerations based on CRU's knowledge of international mining markets e.g. mining safety standards, price sensitivity, business culture, etc.

Selected target markets

Scoring by category: 3 2 1

Following further conversations with RIN and the MIW METS SME Export Hub Project Advisory Group members, alongside feedback from relevant TIQ trade commissioners, we selected the following target markets as the focus of this study:

- **Canada**
- **Chile**
- **Indonesia**

Country	Major existing producer of core commodities?	Medium term supply side growth?	Longer term upside supply potential?	Strength in other mined commodities?	Existing survey results	Other market considerations*	OVERALL SCORE
Canada	🟢	🔴	🟢	🟡	🟡	🟢	14
Chile	🟡	🟢	🟡	🔴	🟢	🟢	14
Indonesia	🟡	🟢	🟡	🟡	🟢	🟡	14

Note: * Qualitative considerations based on CRU's knowledge of international mining markets e.g. mining safety standards, price sensitivity, business culture, etc.

3 Overview of selected target markets

Comparison of target markets: Fraser Institute metrics

Country	National / provincial	Policy Perception Index (PPI), 2019		Investment Attractiveness Index (IAI), 2019	
		Score	Rank	Score	Rank
Chile	National	86.86	15 of 76	77.72	17 of 76
Indonesia	National	47.74	64 of 76	73.09	27 of 76
Canada	Quebec	83.57	21 of 76	77.49	18 of 76
	Ontario	82.46	24 of 76	79.29	16 of 76
	British Columbia	71.80	36 of 76	77.47	19 of 76
	Saskatchewan	90.25	9 of 76	81.75	11 of 76

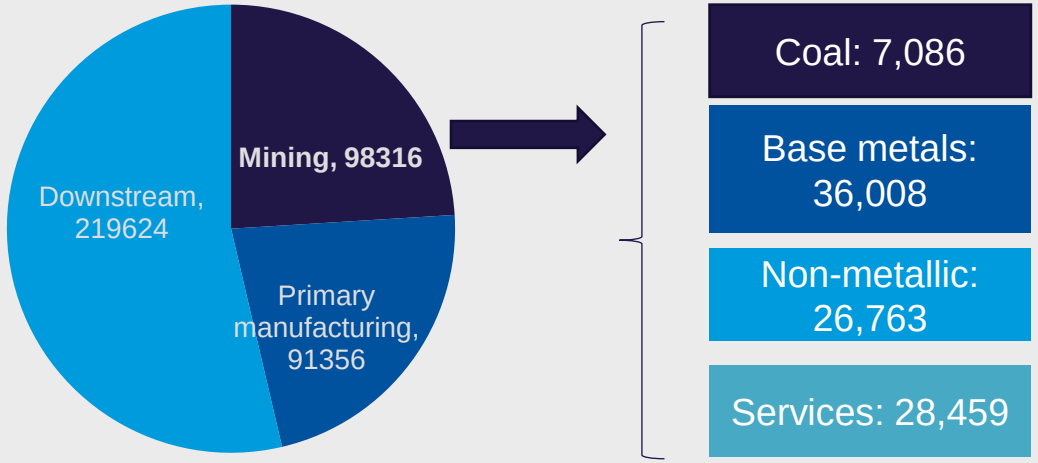
Data: Fraser Institute, Survey of mining companies 2019 and 2018. Further information on methodology can be found in Appendix D.

3 Overview of target markets – Canada

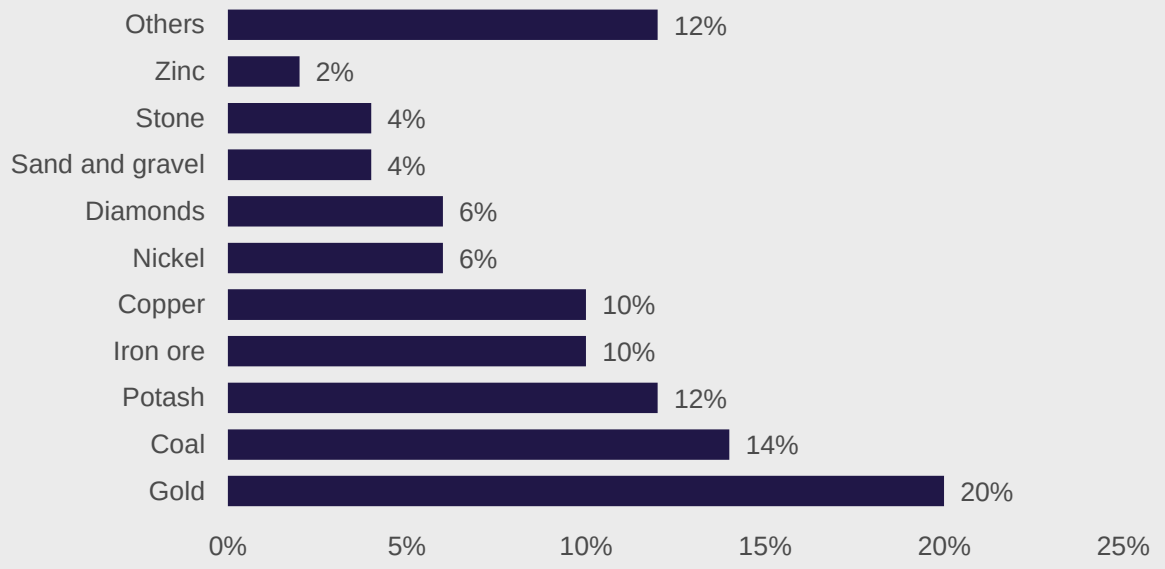
Overview of Canada's mining industry

- In 2018, Canada's minerals sector directly contributed $72.4 billion to Canada's gross domestic product (GDP), which represented 3.5% of total GDP. The indirect impacts added a further $25.4 billion to GDP, for a total impact of $97.7 billion (4.7% of GDP).
- In terms of value production, gold was the top-ranked commodity in 2018 with a value of $9.6 billion, accounting for around 20% of Canada's mineral industry. Together with coal, potash, iron ore and copper, the five major commodities combine for more than 60% of the country's mineral production.
- The four major mining provinces are **Ontario, British Colombia, Quebec and Saskatchewan**. These four provinces accounted for more than 75% of Canada's total production in 2018.

Minerals sectors direct employment by subsector, 2018



Production value by commodity, 2018

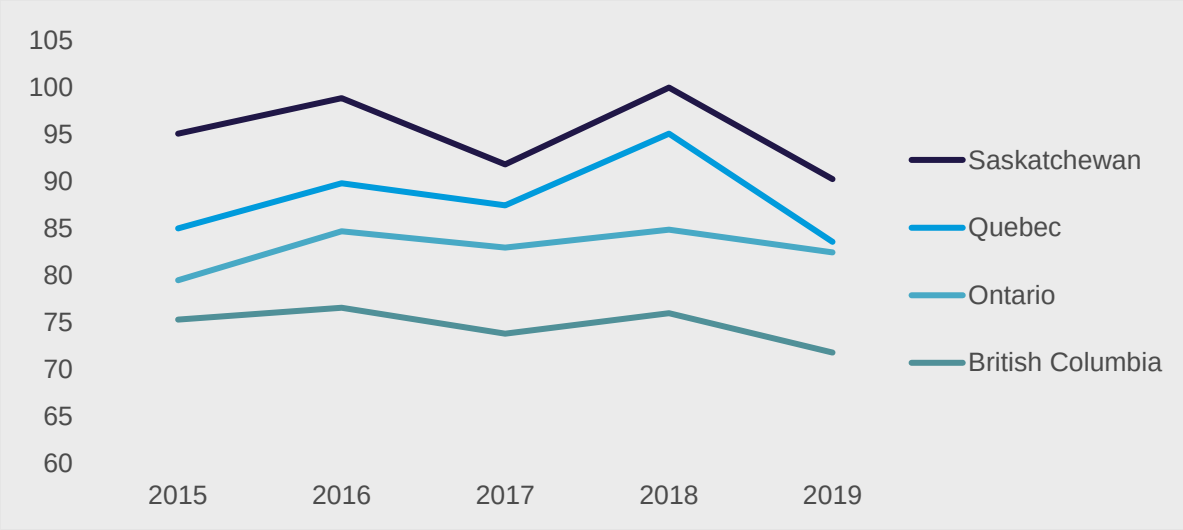


Source: Government of Canada

Policy environment in the mining & resources industry

- The policy perception index (PPI) by the Fraser Institute captures the opinions of local executives on the effects of policies in the area they are familiar with. In 2019, the four major mining provinces in Canada rank 4th, 22nd, 31st and 41st out of the 109 selected mining jurisdictions globally.
- Despite Canadian provinces' rankings being slightly lower in 2018, the overall historical performance of major Canadian mining jurisdictions remained relatively stable over 2015 to 2019, suggesting a stable political environment for mineral investments.
- Despite a medium rank globally, British Columbia has a relatively low ranking inside of Canada with respondents expressing increased concern over the availability of labour/skills. Other than that, uncertainty concerning disputed land claims and environmental regulations also hamper the score.

Policy perception index by province, Canada



Data: Fraser Institute, Survey of mining companies 2019

PPI global ranking: British Columbia's ranking is impacted by labour availability

Canada PPI global ranking by province	2015	2016	2017	2018	2019
Saskatchewan	9	1	3	2	4
Quebec	21	10	9	17	22
Ontario	24	30	20	26	31
British Columbia	36	44	36	41	41
Global sample size	**76**	**83**	**91**	**104**	**109**

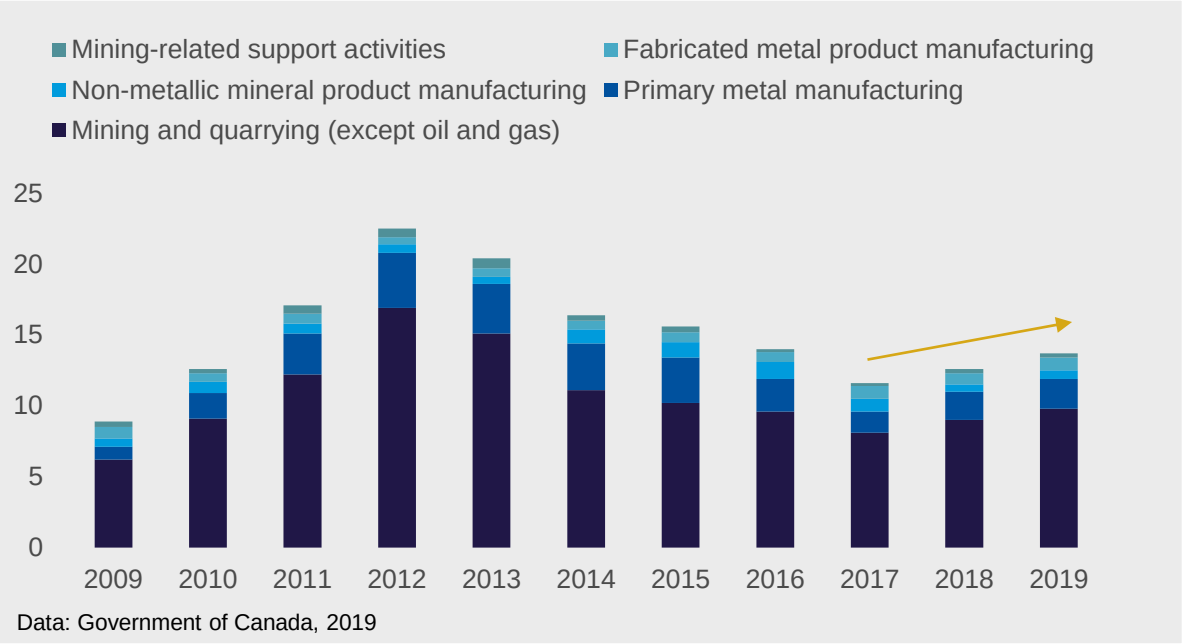
Data: Fraser Institute, Survey of mining companies 2019

Data: Fraser Institute. Further information on methodology can be found in Appendix D.

Investment attractiveness & CAPEX in the mineral sector

- Under the methodology of the Fraser Institute, PPI (policy perception index) and BPI (best practice mineral potential index) together forms the IAI (Investment Attractiveness Index). Due to high geological attractiveness, Canada has a high BPI, which helps lifting the overall IAI higher for Canadian mining jurisdictions.
- Based on the IAI, Canada is the **third most attractive region in the world** for mining investment after Europe and Australia.
- Canada's mineral sector CAPEX in the past ten years witnessed the business cycle of investment. From 2017 to 2019, mineral CAPEX increased from US$11.9 billion to US$13.0 billion. Investment in mining and quarrying takes the highest share of ~71%, based on the ten-year average.

Mineral sector CAPEX in Canada, US$ billion: CAPEX has recovered since 2017



Data: Government of Canada, 2019

IAI global ranking: Canada is performing well and stable for past 5 years

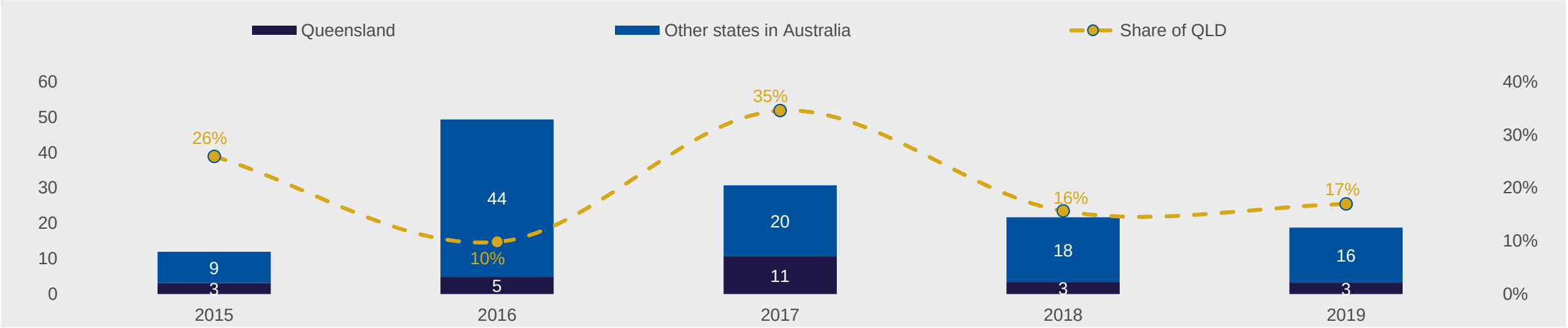
	2015		2016		2017		2018		2019	
	PPI	IAI	PPI	IAI	PPI	IAI	PPI	IAI	PPI	IAI
Quebec	21	8	10	6	9	6	17	4	22	18
Ontario	24	15	30	18	20	7	26	20	31	16
British Columbia	36	18	44	27	36	20	41	18	41	19
Saskatchewan	9	2	1	1	3	2	2	3	4	11
Global sample size	**76**		**83**		**91**		**104**		**109**	

Note: Country level score and ranking is not available for Canada due to jurisdiction definitions.

Trade relationship between Australia & Canada

- Unlike Indonesia, mining policy in Canada has been relatively stable in recent years. As such, we have focused on trade relationships here instead of a detailed review of policy changes.
- Currently there is one FTA (Free Trade Agreement) between Canada and Australia, which is the **CPTPP (Comprehensive and Progressive Agreement for Trans-Pacific Partnership)**. The CPTPP eliminates tariffs on key Australian minerals, petroleum and LNG exports and lock them in at zero.
- Under the agreement of CPTPP, Australian manufacturers and exporters of mining equipment benefit from **duty-free access** for exports into Canada.
- In 2019, Australia exported US$1,522 million of goods to Canada, with around US$19 million of METS exports (METS accounts for ~1.2% of total export). On average, Queensland's export accounts for around 21% of these METS exports from Australia to Canada.

Australian METS export to Canada in value, by state, US$ million

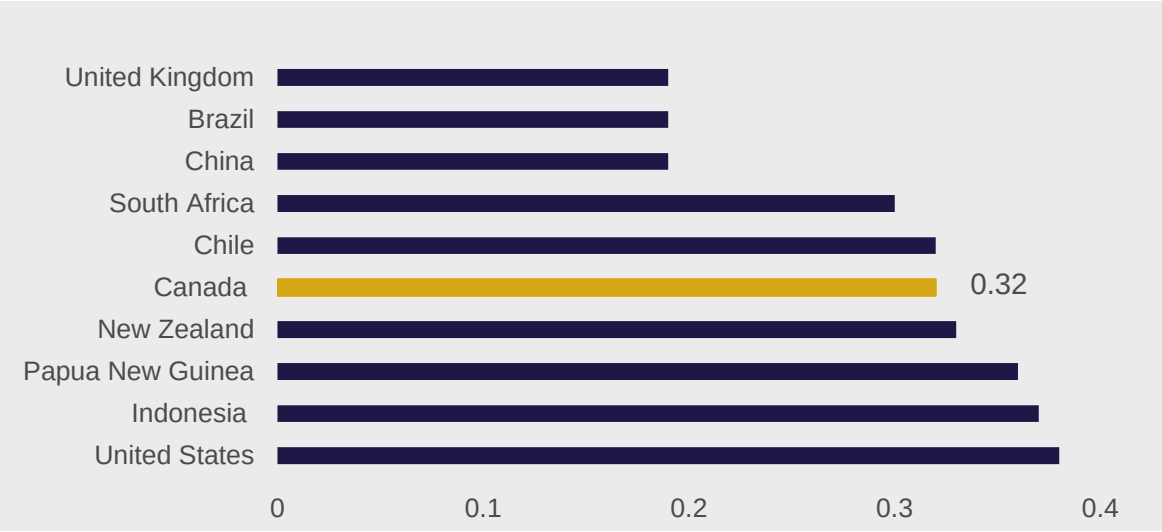


Data: IHS Markit

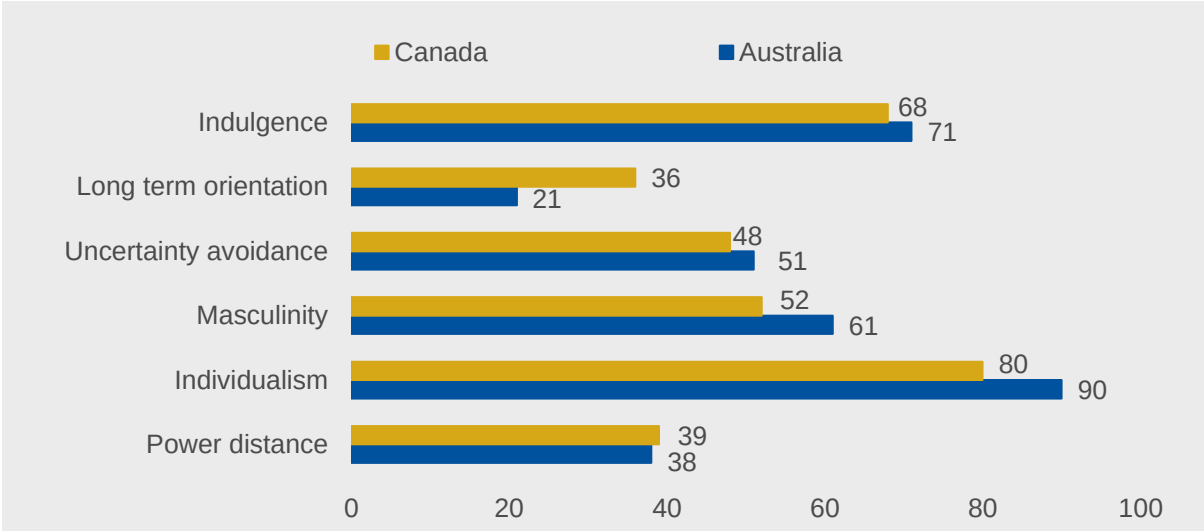
Business environment

- According to the Hofstede Cultural Dimension Model*, Australia and Canada are similar in power distance, uncertainty avoidance and indulgence, which provides an advantage for Australian companies to enter Canadian market.
- With similar cultural and business backgrounds, Canada has traditionally been a very prospective export market for Australian businesses. According to Austmine's national METS survey in 2020, Canada is the **5th export destination** of Australian companies – 32% of companies in the sample say they are exporting to Canada. 29% of these companies are from Queensland.
- Moreover, Canada is seen as the most desirable destination to expand current export activities to, with 22% of surveyed companies expressing willingness to expand exports to Canada.
- According to LTA Research, **77% of Canadian companies from the METS sector desire to improve their business strategy via technological investment**, which creates opportunities for technologies and innovation from the MIW region.

Top 10 export destinations METS companies



Similarities between the two cultures provides advantage in trade relationships



Note: Referred from the LTA research and the Hofstede Insights: https://www.hofstede-insights.com/country-comparison/australia,canada/

COVID impacts & responses

	Provincial governments' responses to COVID-19 regarding mining activities
British Colombia	Mineral production and mineral exploration/development are listed as essential services. Businesses may maintain ongoing operations despite other restrictions.
Ontario	Mining businesses have been permitted to continue full operations (subject to compliance with health and safety orders and recommendations) but many have voluntarily shuttered operations in mid 2020 to protect employees.
Québec	Mining operations were declared as essential services from April 2020 and the government allows mining operations in the province to resume, subject to compliance with health and safety orders and recommendations.
Saskatchewan	Production, processing and supply from the mining sector has been allowed to continue.

Data: LTA research, OSLER

	Fiscal stimulation and subsidies to business
US$7.5-billion infrastructure plan	The US$7.5-billion (equivalent C$10 billion) plan targets projects that can be started more quickly. The infrastructure bank suggests that the initiative will spur the creation of 60,000 jobs.
Emergency Business Account	Part of the Economic Response Plan, these are interest-free loans of up to C$40,000 to small businesses and not-for-profits, to help cover their operating costs during a period where revenues have been temporarily reduced.
Northern Business Relief Fund	Short-term support for ongoing operational costs to small- and medium-sized territorial businesses in the form of a non-repayable grant ranging from C$2,500 to a maximum of C$100,000. Funding will cover a maximum period of 4 months, retroactive to April 1, 2020.

Data: PDAC

IP legislation, recognition & protection

- Canada is a member of international agreements for the protection of IP rights as administered through the **World Intellectual Property Organization**. The Canadian Intellectual Property Office (CIPO) is the government agency overseeing most of Canada's IP system. Plant varieties, or Plant Breeder's Rights, are administered by the Plant Breeder's Rights Office.

Trademarks

- Like Australia, Canada has a "**first to use**" rule for obtaining trademark rights.
- Trademark registrations may be removed from the register if they are not used over a period of three or more consecutive years after registration.

Patents

- Applications may be made directly to CIPO or can enter through national phase entry via the Patent Cooperation Treaty (PCT).
- Applications can be made for "standard" patents only. Canada does not have a utility model ('mini patent') system.
- The Global Patent Prosecution Highway (GPPH) may be used by Australian applicants to speed up the examination process for corresponding patent applications filed in Canada.

Copyrights

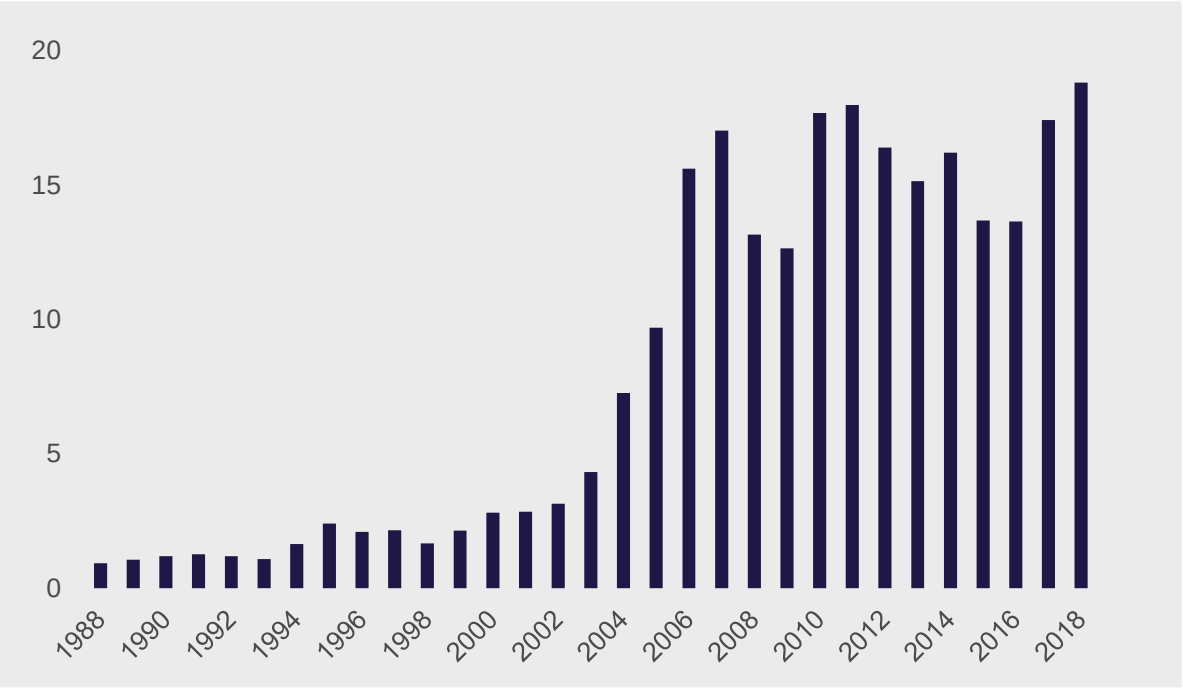
- Like Australia, copyright arises automatically at the time of creation of an eligible work.
- However, CIPO operates a voluntary registration system under which copyright owners may record their copyright and receive a certificate of registration for a fee.

3 Overview of target markets – Chile

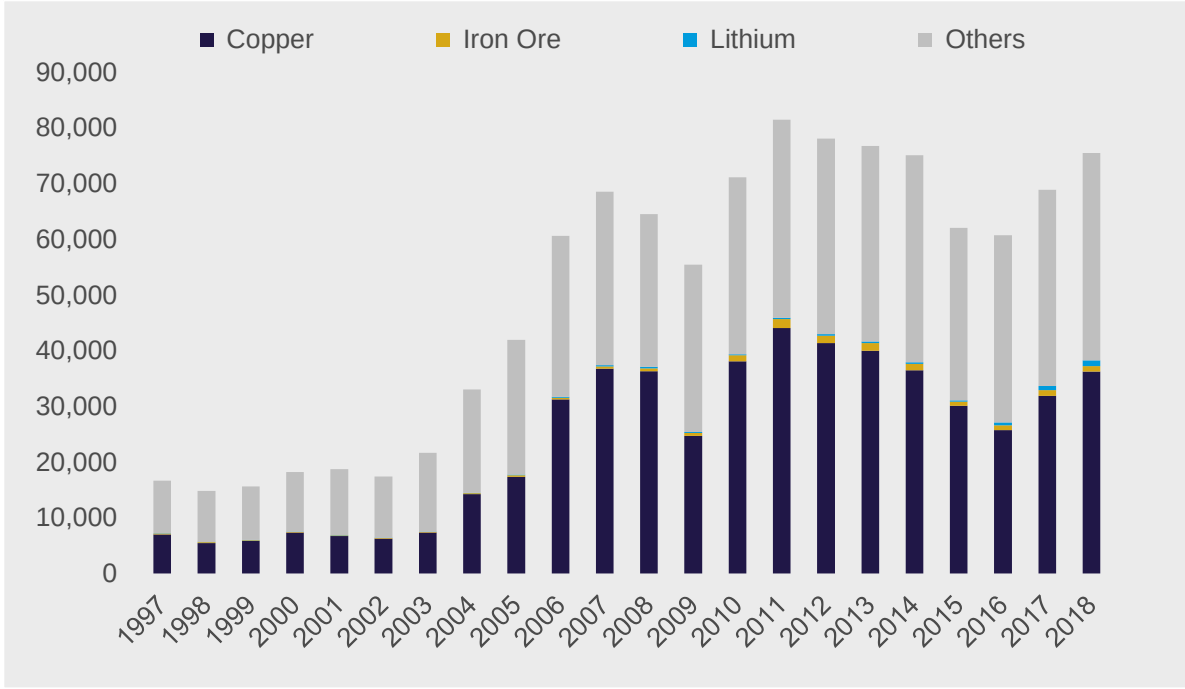
Overview of Chile's mining industry

- Chile's mining GDP has grown at an 11% CAGR in the last 30 years – however, most of this growth occurred pre-2006. In 2019, mining GDP represented 9% of the country's total GDP.
- Between 35 to 58% of Chilean exports have been linked to mining, with copper representing the vast majority by value. Other product exports such as iron ore and lithium are small in comparison.
- Since 2008, over 65% of the mining GDP has come from the first three northern regions[1]. These same regions have also seen an increase in construction activity linked to the development of mining projects.

Chile's mining GDP, US$ million



Chilean exports, US$ million



Data: Banco Central de Chile. Note: 1) Chile is divided into 15 regions. The three northern regions, numbered 1-3 are Tarapacá, Antofagasta & Atacama.

Policy & mining regulations

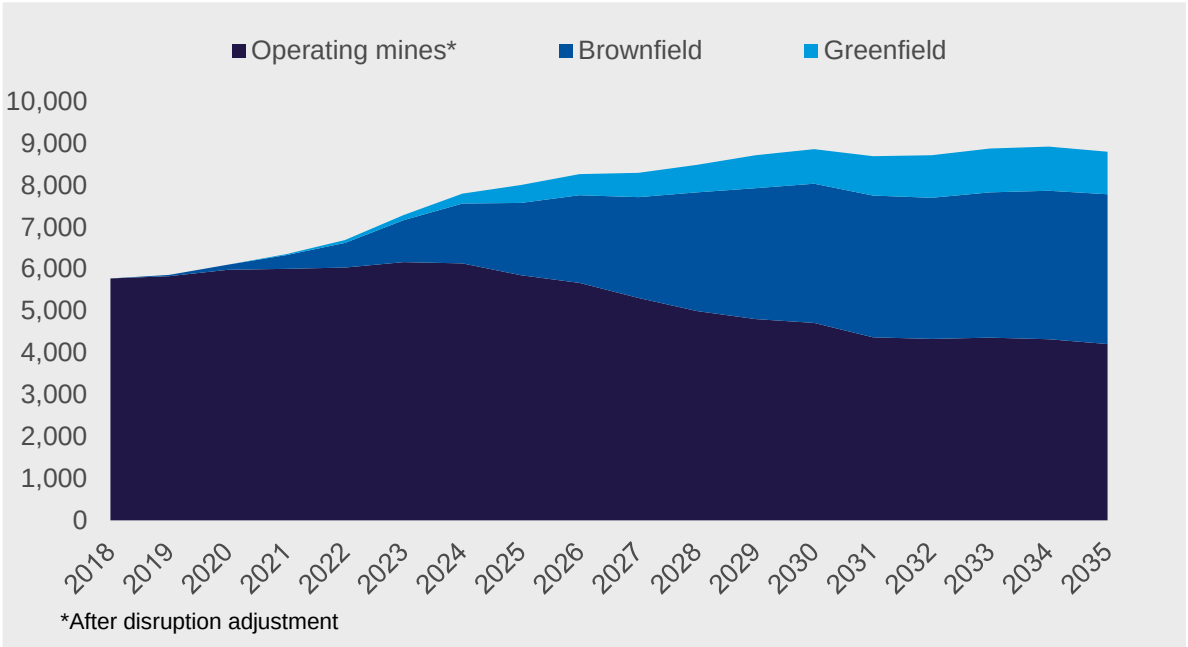
In Chile, mining laws and regulation are dictated by the **Ministry of Mining** with the collaboration and technical assistance of the **Geology and Mining National Service** (SERNAGEOMIN). Other Ministries such as the Ministry of Justice and the Ministry of Environment can also have an important impact in the industry due to the cross-industry nature of their laws.

- The 1980s Constitution declares: *"The state has absolute, exclusive, inalienable and imprescriptible control of all mines"*, although the next paragraph opens the possibility of granting land for the exploitation and extraction of minerals through judicial sentence. Only two years later, the law N°18.097 granted the ability for private investors to acquire mining concessions. Then finally, in 1983, the **Mining Code** established a new regulatory frame to allow foreign investments in the Chilean mining sector.
- During the 1990s, the need to establish a regulation over the environmental effects of different industrial activities gave birth to the law N°19.300 or the **Environmental General Framework** by the Ministry of Environment. This framework regulates: human health, gaseous and liquid emissions, decontamination plans, public participation, among others. Also, the Environmental Impact Evaluation System (or SEIA in Spanish) is created, which is the main tool for environmental management in the country.
- In 2004, the **Regulation of Mining Safety** (decree N°132) was published. The objective of this decree was to update industry standards in accord to technological advances in order to establish human health and safety and mining infrastructure as a top priority to ensure the continuous operation of mines and refineries.
- The **Royalty II** was established in 2005. This corresponds to a 5% tax over operational utilities of mining companies that produce over 50,000 tonnes of refined copper annually.
- The **Regulation of the Closure of Mine Sites and Mining Facilities** was published in 2012. The main objective of this regulation is to protect the life and health of people and to mitigate the effects of the mining industry on the environment. It also highlights the importance of identifying the Economic Costs and technical requirements of the necessary actions to take in order to safely close mining operations.
- In the future, new laws and institutions could have an impact on the mining industry. One of these is the **Glacier Protection law**, that seeks to protect environments which, in some cases, are being or might be in future affected by mining projects.
- Chile approved the writing of a new Constitution during 2020 – the document will be approved or rejected during 2022.

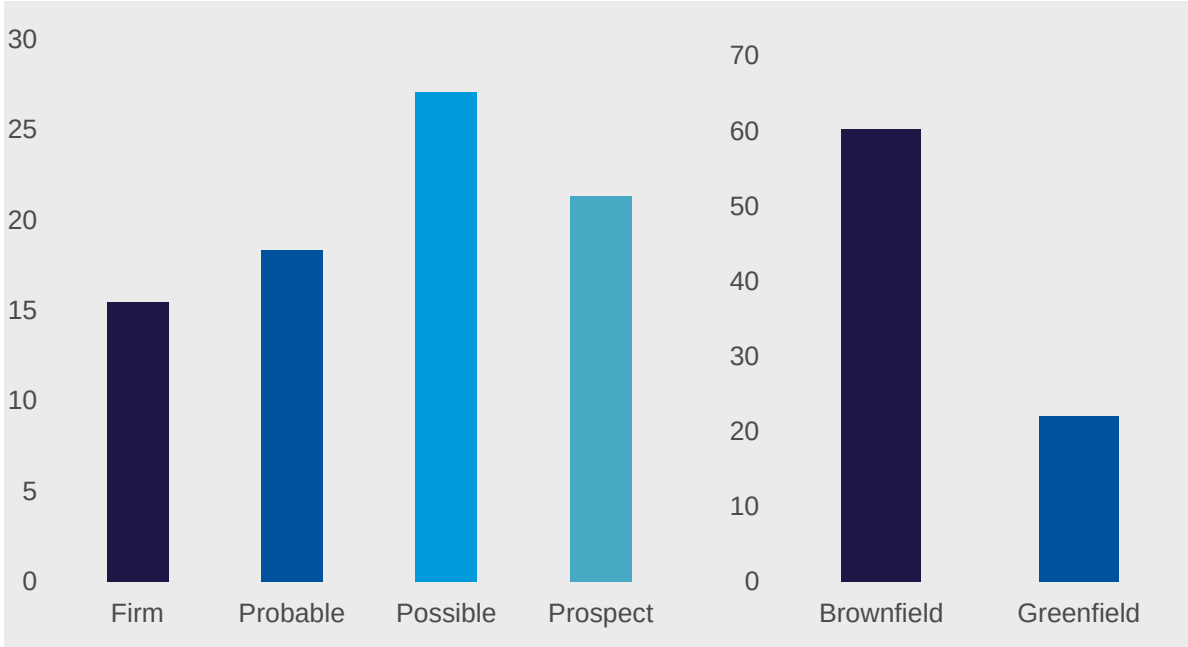
Investment attractiveness & CAPEX in the mineral sector

- According to the IAI, Chile is the **most attractive country in South America** for mining investment, ranking 15th in the world in 2019, up from 23rd in 2018.
- **If all the projects** in the current copper pipeline go ahead, a considerable investment of over 80 billion USD would be required. This is without considering the sustaining capital required to keep mining operations running smoothly over time.
- 75% of the projected investment corresponds to brownfield developments at existing operations. Brownfield projects generally face less hurdles to enter production compared with greenfield projects, predominantly due to the owners and operators' experience in project development, operation and experience in the market, as well as typically having existing infrastructure from associated operations.

Chile's potential mine copper production, '000 t Cu



Estimated capital investment by project ranking, Billion USD, 2017

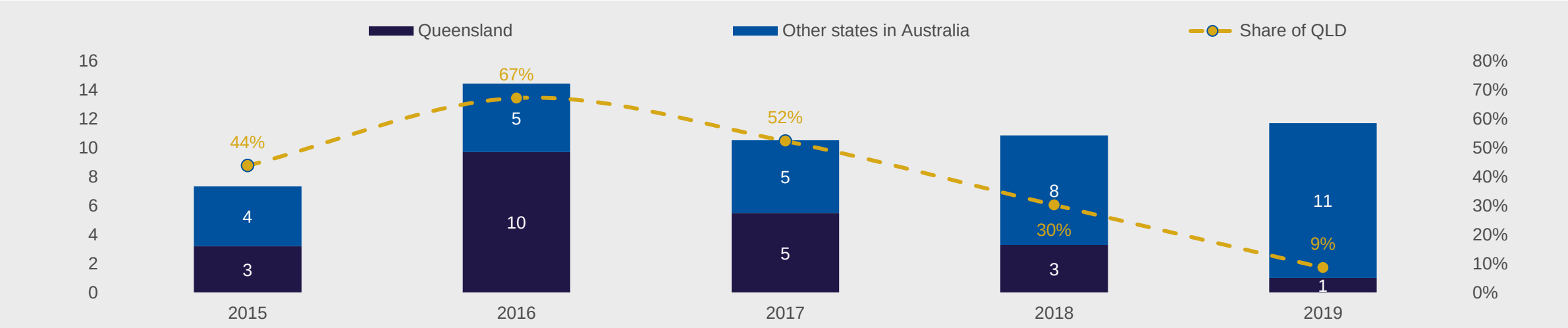


Data: CRU, Cochilco.

Trade relationship between Australia & Chile

- In July 2008, Chile and Australia signed a progressive Free Trade Agreement, the first FTA signed by Australia with a South American country, which was made effective in March 2009. This agreement brought customs fees to 0% in 2015, which includes the mining industry.
- From 2015 to 2019, Australian METS exports to Chile increased by US$4.4 million, a 60% increase in only 5 years.
- Exports from Queensland represent 40% of METS exports from Australia to Chile, however this proportion has decreased considerably from 2016 to 2019.
- On an annual average in the period from 2015 to 2019, Australia exported US$261 million of total goods to Chile, with US$11 million worth of METS exports during the same time period, representing 4.2% of the total. METS exports reached a maximum of 5.4% of total Australian exports to Chile in 2019. More than one third (34.6%) of these exports within the period from 2015 to 2019 correspond to parts of machinery for mineral processing.

Australian METS export to Chile in value, by states, US$ million

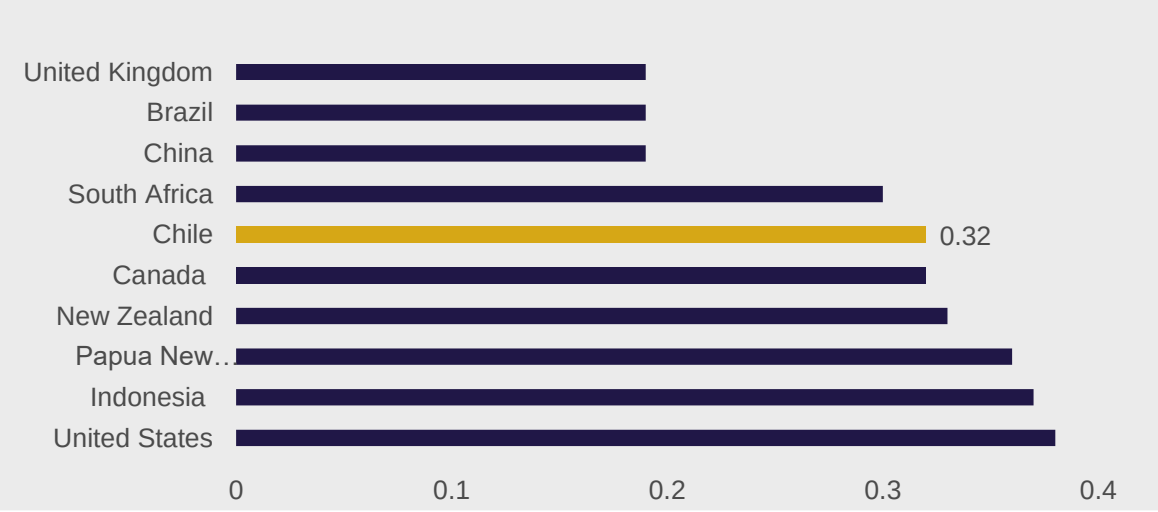


Data: IHS Markit

Business environment

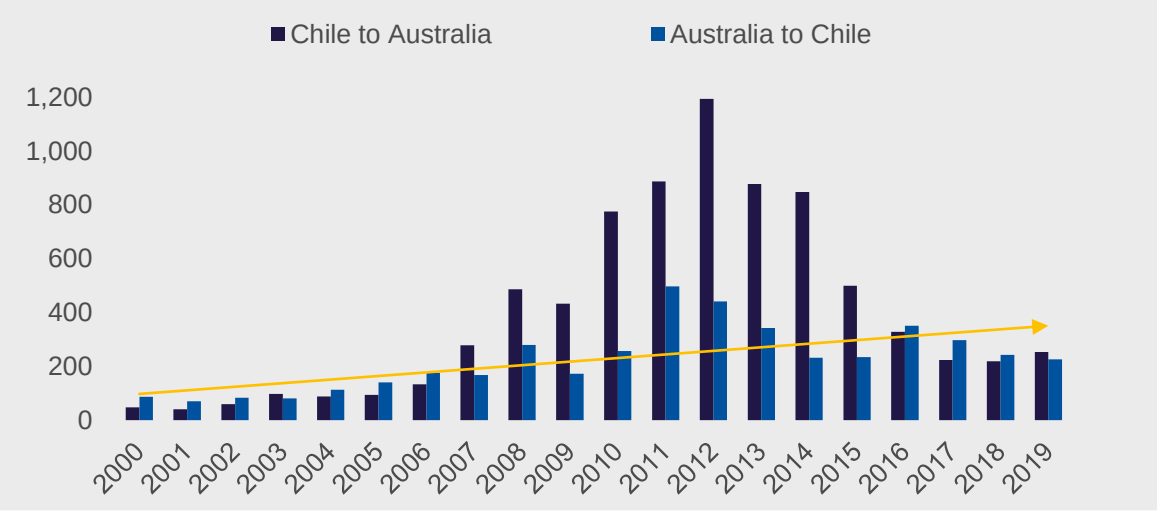
- Chile is the most important Australian commercial relationship in South America, with around 200 Australian companies established or represented in Chile, of which 65% correspond to mining related businesses or METS companies.
- Although most Australian businesses in Chile are focused on mining, there is an increasing interest in diversifying the Australian presence into areas such as digital technologies, clean energy, agriculture technologies and others. This is partly driven by the Asia-South America digital gateway, a submarine cable that will connect Australia and Chile, the implementation of the 5G network and the technological collaboration between both countries included in their 2009 FTA.
- Austmine's national METS survey positioned Chile as the 6th export destination of Australian companies. Tied with Canada, a 32% of surveyed companies declared to be exporting to Chile.
- The trade relationship between Australia and Chile has increased considerably during the last 20 years. Imports from Chile peaked in 2012, mainly from copper blister for refining and copper cathodes.

Top 10 export destinations of Australian companies



Note: Referred from the LTA research.

Trade between Australia and Chile, $US million



Data: IHS Markit.

COVID impacts & responses

COVID-19 impacts on the mining sector	
Prices	Copper prices dropped significantly between January and March 2020, reaching a low of US$5,048/tonne in April. Overall, Q1 and Q2 of 2020 saw prices 9% and a 12% lower than the same quarters for 2019 respectively.
Production	Although Chilean production of copper saw a slight increase during March 2020, it decreased by around 24,000 tons by April, mainly due to contingency measures implemented by mining companies.
Exports	During the first trimester of 2020, Chilean non-mining exports dropped 24.7% while mining exports have decreased by 12.5%, showing that the crisis has had a more limited impact on the mining industry.
Governmental economic measures	
Healthcare system	US$1,400 million were destined to strengthen the healthcare system.
Public and Private investment	• US$ 4,500 million for a 24 month public investment plan over the regular ministry budget as an economic boost and the creation of new jobs • US$24,521 million for the streamlining of 130 private investment projects to start construction or operation during the 2020-21 period, creating around 115,000 jobs.
New employment protection law	US$2,000 million for a new employment protection law to avoid losing jobs during the pandemic and tributary measures to reduce taxes.
Support for small businesses	28 measures to streamline permit processing of private investments and the creation of help funds for small businesses affected by the pandemic.

Data: Cochilco and the Chilean Government.

IP legislation, recognition & protection

- Chile has been a member state of the World Intellectual Property Organization (WIPO) since 1975 and therefore, it abides by international IP rights agreements. This is also reinforced by the FTA between Australia and Chile that reaffirms rights and obligations of both countries with the WIPO agreements.
- Chile differentiates between Intellectual property (Copyrights), regulated by the law N°17.336 of Intellectual Property of the Ministry of Education, and Industrial Property (Trademarks and Patents), regulated by the law N°19.039 of the Ministry of Economy.

Trademarks and Patents

- Trademark and patents registration is overseen by the National Institute of Industrial Property (INAPI).
- The Law of Industrial Property recognizes 5 types of patents: Invention patents, utility models, industrial design, industrial drawing and closed loop topography.

Copyrights

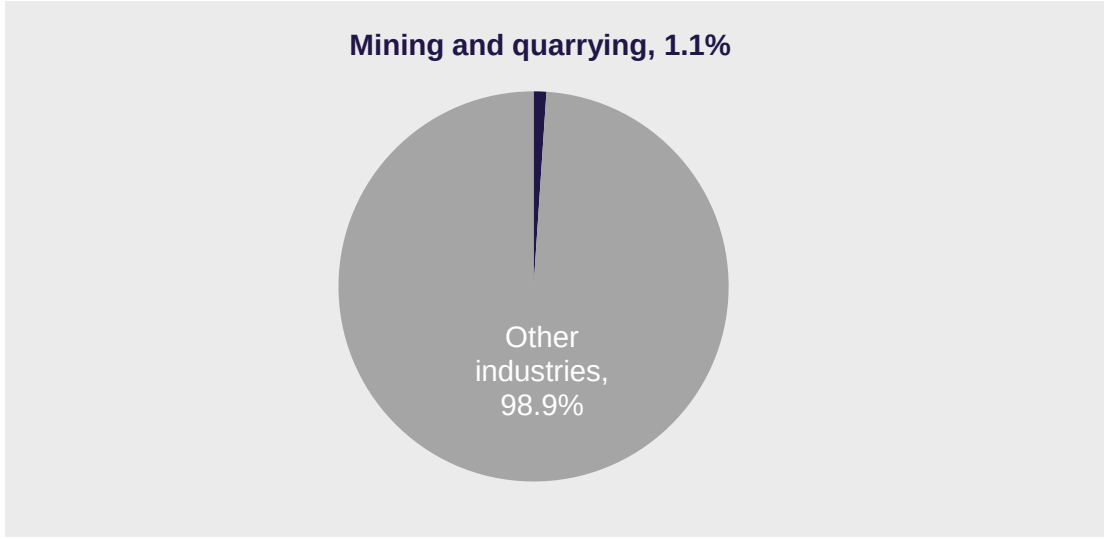
- Overseen by the Department of Intellectual Rights (DDI).
- Like Australia and Canada, copyright arises automatically at the time of creation of an eligible work in the domains of literature, arts and sciences.
- A copyright certificate is obtained after registration and the payment of a fee to the DDI.

3 Overview of target markets – Indonesia

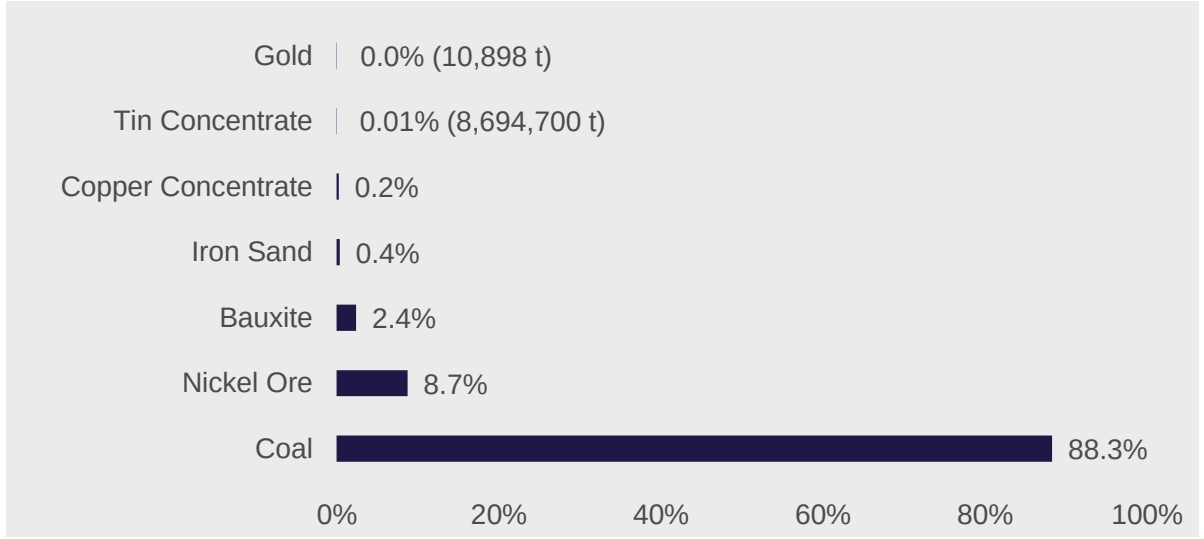
Overview of Indonesia's mining industry

- In 2018, Indonesia's mining industry directly contributed ~4.98% of the country's gross domestic product (GDP), and 16% of total Indonesian exports by value. The major contributor to the country's GDP is exported coal, reaching US$ 24 million in 2018. Export data from the Bank of Indonesia also indicates that exported nickel and bauxite ores in 2018 contributed US$ 628 million to Indonesia's GDP.
- In terms of mineral production, Indonesia produced around 616 Mt coal in 2019, accounting for ~88.3% of the country's mineral production by tonnage. Following coal, nickel ore and bauxite make up ~8.7% and 2.4% respectively.
- In 2019, the mining and quarrying sector directly employed 1,352,236 people, making up 1.1% of total jobs in Indonesia.
- CRU predicts that by 2033, Indonesia will join the "top ten club" of global economies. Indonesia's promising future is in part due to its demographic potential – it is the world's fourth most populous nation and it has a young and growing labour force. The future for economic growth is also being driven by its growth in its middle class, who are fuelling industry and private consumption.

Direct employment by sector in Indonesia, 2019



Production of minerals, 2019 (tonnes)



Data: Badan Pusat Statistik

Opportunities for Australian METS exports

Indonesia is one of the largest coal exporters globally and an important supplier of gold, copper, nickel, tin and bauxite. Globally, mining companies continue to rank Indonesia highly in terms of coal and mineral prospects, although challenges still remain in its mining regulations.

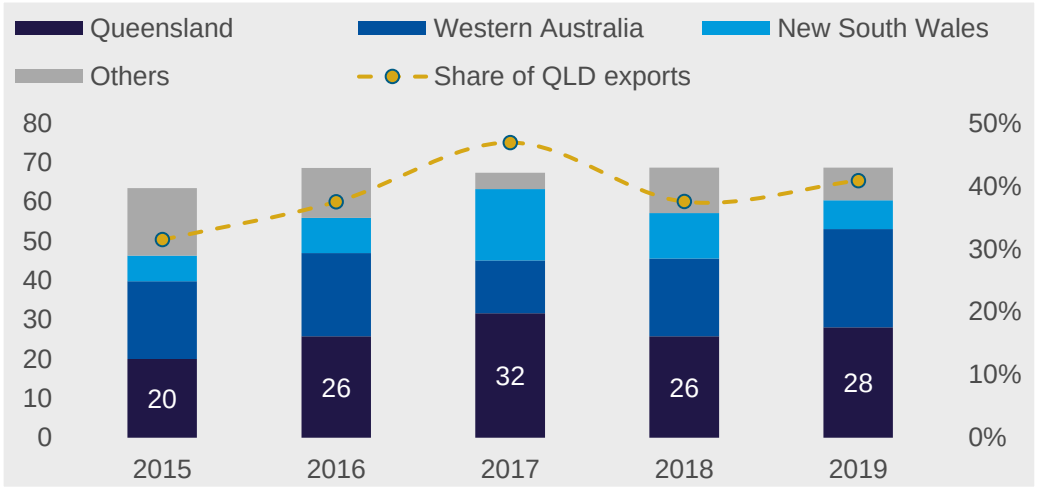
Similar to Australia, Indonesian miners are grappling with lower prices for commodities, and hence demand for savings, productivity enhancement and operation optimisation. The increasing sophistication and standards across Indonesian mining also creates demand for highly skilled workers, technical expertise, safety-related trainings, systems and technology, environmental management, etc.

From 2015-19, Australia exported approximately US$ 70 million METS products to Indonesia annually with 31%-47% exports coming from Queensland. Given the prospects of the Indonesian mining industry, we expect the METS exports to Indonesia to remain strong. Therefore, MIW METS companies, which are recognised as industry leaders in quality and innovation, still have significant opportunities to build market share in Indonesia.

Overview of the Indonesian mining sector

Data: CRU.

Australian METS export to Indonesia in value, by state, US$ million



Data: Australian Bureau of Statistics (ABS).

Deterrents to investment in the Indonesian mining sector

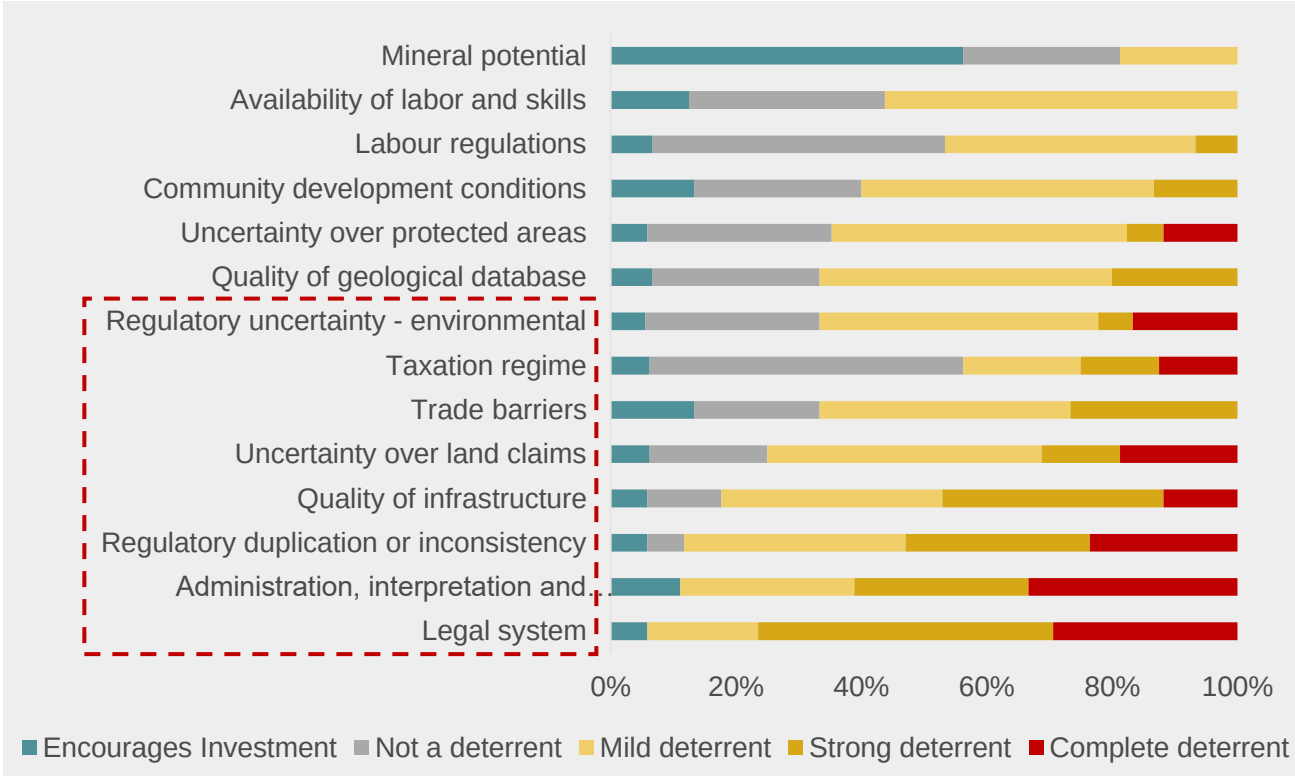
Although opportunities exist for Australian METS exports, according to a survey of mining companies in 2019 conducted by the Fraser Institute, concerns still remain regarding the stability of the Indonesian government and its polices for the mining sector. The Policy Perception Index ("PPI") established by the Fraser Institute provides a comprehensive assessment of the attractiveness of mining policies in attracting and winning investment. In 2019, Indonesia ranked 64th in the PPI with a score of 47.74. However, when considering policy factors and mineral potential, Indonesia ranks 27th in the Investment Attractiveness Index ("IAI") with a score of 73.09.

The 2018 survey indicated that the **key deterrents** to foreign investment in Indonesian mining are the legal system, administration and regulatory inconsistency/uncertainty. Although these risks remain for global investors, the overall investment environment in Indonesia has been **improving over recent years**, suggested by the rising PPI and IAI ranks.

PPI/IAI Score and Rank of Indonesia, Fraser Institute

Index	2019	2018	2017	2016	2015
PPI Score	47.74	54.64	39.92	29.93	40.41
PPI Rank	64 / 76 ↑	70 / 83	84 / 91	99 / 104	91 / 109
IAI Score	73.09	63.10	66.84	50.16	65.16
IAI Rank	27 / 76 ↑	47 / 83	35 / 91	78 / 104	49 / 109

Fraser Institute Annual Survey of Mining Companies 2018 – Indonesia



Data: Fraser Institute. Further information on methodology can be found in Appendix D.

Mining laws & regulations

The mining industry in Indonesia is regulated by mining laws. **The Ministry of Energy and Mineral Resources (MoEMR) is the principal regulatory body** that administers the implementation of mining laws and regulations. However, since the mining industry is closely tied to other sectors (e.g. forestry and the environment), other ministries govern matters that fall under their respective authorities. Mining companies in Indonesia must also comply with regulations issued by all those ministries other than the MoEMR, to the relevant extent.

The Constitution stipulates that Indonesia's natural resources are controlled by the state and must be used for the maximum benefit of the Indonesian people. The legislative framework for the mining sector in Indonesia is "Law No.4 of 2009 concerning Mineral and Coal Mining", which entered into force on January 12, 2009 by former President Susilo Bambang Yudhoyono. This is the principal legislation covering the Indonesian mining sector and covers all aspects of mining law including exploration, permitting, and mining rights, ownership, value addition and environmental management. This is further implemented by various regulations and decrees issued by the central government, MoEMR, and regional governments at the provincial and regency/municipal levels.

The objective of the Mining Law has been to support sustainable national development and has imposed requirements on investors in the mining sector, such as good mining practices, increasing the added-value of mining products, improving society, being cautious with regard to environmental impact, and maintaining governance and book keeping. However, many of the long standing legal policy and regulatory problems facing the Indonesian mining industry and foreign investors are the product of the last mineral commodities boom. Therefore, the Indonesian Government needs to do more to encourage foreign investment in the mining industry.

MINISTRY OF ENERGY AND MINERAL RESOURCES
REPUBLIC OF INDONESIA

Note: A summary of the Mining Law can be found in Appendix D.

Amendment to the Mining Law in 2020 (1 of 2)

Current economic and fiscal crises in Indonesia due to Covid-19 have been a contributing factor to a government rethink of the approach to attract investment. A **new Bill Amendment** to 2009's Mining Law was passed in the House of Representatives in May 2020 and the new Law Amendment No.3 of 2020 was signed by the President Joko Widodo and effective on June 10, 2020. On **November 2, 2020**, the President also ratified and enacted the **Indonesia Omnibus Law** with the Law Number 11 of 2020 on Job Creation (Omnibus Law), which amends various provisions in the Mining Laws. New Mining Law and Omnibus Law are intended to make Indonesia and local mining industry more attractive to both domestic investors and foreign investors. The below table summarises the most important changes in the Mining Law based on CRU's understanding:

Topic	Comments
License issuing	The central government will become the sole authority to issue mining license, while the power of regional governments will be removed. Central Government given specific authority to supervise all mining activities in Mining Areas ("WPs") and determine WPs/Business Permit Areas ("WIUPs").
Foreign divestment	The foreign ownership must be reduced to no more than 49%, while Indonesian shareholders must hold at the least 51% of the shares of a mining company. This will be achieved by way of a divestment requirement, that must commence after 5-10 years of production.
Transfer restrictions	The transfer restriction under GR 23/2010 has been removed. The holder of a mining license will be authorised to transfer the license to a third party. This would facilitate the flexibility in the disposal and acquisition of mining companies and assets.
Extension of Contracts of Work ("CoWs") and Coal Contracts of Work ("CCoWs")	Both may be extended for two additional terms of up to 10 years. CoWs/CCoWs holders are able to obtain Special Mining Permits ("IUPKs") as a Continuation of Contracts Operation. It provides greater certainty for holders of existing CoWs/CCoWs than MoEMR's current approach to administering, and avoids the SOE domination in the coal industry.
Export ban	The new Law effectively postpones a ban on the export of minerals for a period of another 3 years.

Amendment to the Mining Law in 2020 (2 of 2)

Item	Note
Mining services contractors	Mining services contractors are allowed to become directly involved in the core activities of extracting minerals, which was not permitted previously.
Exploration	Mining companies must now commit to exploration activity every year in order to increase proven reserves.
Environmental matters	Environmental Management Efforts ("UKL-UPL")/ Activity Plans Which are Obliged to Possess Environmental Impact Analyses ("AMDAL") now only required for "medium risk/high risk" business activities/operations with "significant impact" on environment, which will be carried out by Central Government only.
Forestry licensing simplification	Permission to use forestry areas will become part of Business Licenses issued through Online Single Submission ("OSS") System. Former requirement for minimum 30% of forest areas in river basins and on islands to be maintained has been dropped
Manpower reform	No time limit for Defined Period Employment Contracts. Mining companies are given greater freedom to outsource manpower needs. 2x Severance Payment "loading", in the case of termination due to "efficiency" and certain other reasons, has been dropped. 15% Severance Payment loading for housing and other benefits also dropped.

Although these amendments have been made by the Indonesian Government to attract investment in the mining industry, there are potentially still strategic problems for Indonesia's mining industry:

- Declining quality of foreign investment due to the loss of many world class investors/miners. These investors are not expected to return in the short to medium term.
- Entrenched resource nationalism and a favourable attitude to foreign investment that may be only temporary.
- Weak legal and court systems, which mean that foreign investors 1) have no assurance of adequate legal protection for their investment, 2) are always at a serious disadvantage in disputes with local parties and 3) underestimate the non-operating risks they face 4) are not confident of legal and policy stability.

Policies and regulations on mineral ore exports

Concerned by the massive surge of poorly regulated mining activities, which led to large volumes of unprocessed ores being exported to meet China's resource requirements in the 2000s, President Yudhoyono introduced legislation to trigger the development of value-adding processing activities and encouraging downstream investment and industrialization in Indonesia. The key mechanism to achieve this would be **a ban on the export of unprocessed ores, including nickel, bauxite, tin, gold, silver and antimony.**

Mining companies must refine or process mineral ores domestically. Mining companies can construct their own smelter or enter a cooperation with other mining or smelter companies through the sale and purchase of unprocessed ore or concentrate, or the joint construction of a smelter, subject to the approval of the MoEMR or governor (as applicable). This suggests that mineral ores may be exported only after the company:

- Satisfies the minimum level of processing and/or smelting/refining requirements prior to export, set out in MoEMR 25/2018, where gold and silver must be refined to gold and silver metals (no less than 99% gold and silver content) before being export;
- Obtains an export recommendation from the MoEMR set out in PerMen 6/2017 that holders of IUP-OP, IUPK-OP and Processing and/or Refining IUPs must submit an application for recommendation to the MoEMR with attention to the DGoMC.
- obtains export approval from the Ministry of Trade (MoT); and pays export duties

The following chart summarizes the main legislative items relevant to unprocessed ore exports since 2009 with further details in the Appendix:

2009
New mining law implemented with full ban on export of unprocessed minerals within 5 years

May 2012
Temporary suspension of mineral exports, introduce 20% export tariff

Jan 2014
Ban on unprocessed minerals to encourage downstream, value-adding investments

Jan 2017
Export ban on minerals lifted, export quotas granted to permitted miners

Sep 2019
Export ban on nickel ores was brought forward to Jan 2020

June 2020
Amendment to the 2009 Mining Law effectively postpones the export ban for a period of up to 3 years (to ~10 June 2023)

Free Trade Agreements between Australia & Indonesia

There is considerable opportunity for Australia to expand its trade, investment and economic cooperation relationship with Indonesia. There are currently two Free Trade Agreements in force for Indonesia:

ASEAN-Australia-New Zealand Free Trade Agreement (AANZFTA)

The ASEAN-Australia-New Zealand Free Trade Agreement (AANZFTA) entered into force on **1 January 2010** for Australia and most ASEAN Member States including **Indonesia**, and the First Protocol to Amend AANZFTA entered into force on 1 October 2015. AANZFTA delivers extensive tariff reduction and elimination, and promotes greater certainty for Australian service suppliers and investors.

Goods under AANZFTA: AANZFTA requires certificates of origin to claim FTA benefits. AANZFTA also binds current low tariffs, and delivers tariff elimination over time from the ASEAN member countries and Vietnam on 90-100 per cent of tariff lines covering approximately 95 per cent of Australian exports to the region. **METS are under Section XVI**: Machinery and mechanical appliances; electrical equipment; parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles.

Services under AANZFTA: it locks in commercially meaningful improvements to existing commitments by ASEAN members across services sectors including professional services, construction and **mining-related services**, education, financial services and telecommunications.

Indonesia-Australia Comprehensive Economic Partnership Agreement (IACEPA)

The Indonesia-Australia Comprehensive Economic Partnership Agreement (IA-CEPA) entered into force on **5 July 2020**. IA-CEPA builds on commitments under the existing free trade agreement, AANZFTA across goods, services and investment.

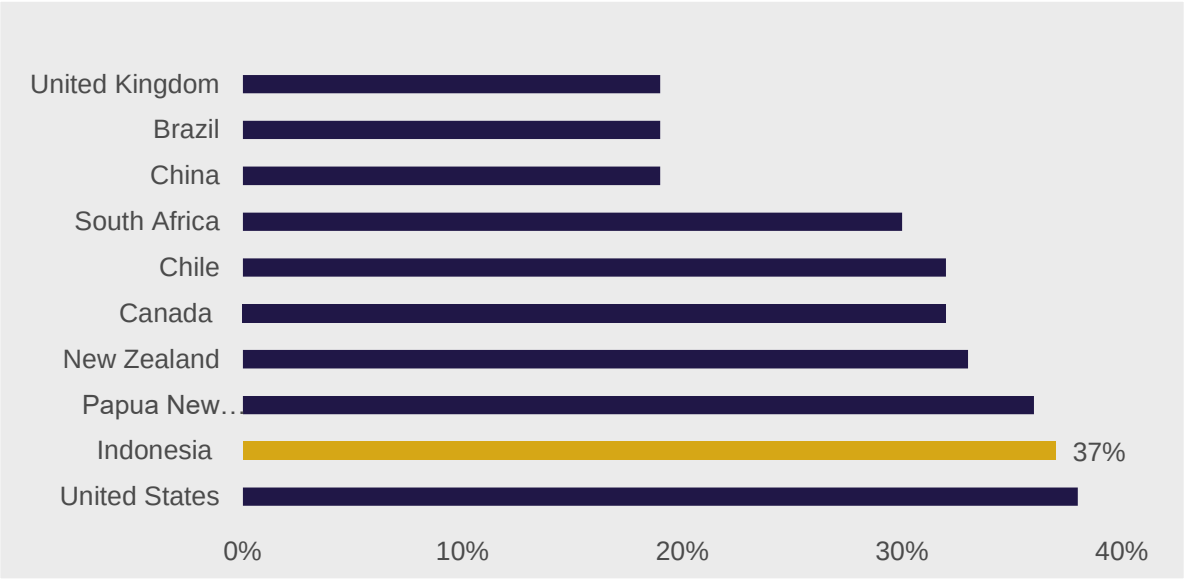
In addition to reducing non-tariff barriers to trade and simplifying paperwork, IA-CEPA will allow 99% of **Australia's goods exports** to enter Indonesia **duty free** or with significantly improved preferential arrangements, including **Australian METS products**.

IA-CEPA will improve conditions for services suppliers and the climate for two-way investment. Australian services suppliers and investors will have greater certainty for entry and operation in the Indonesian market, helping to facilitate more Australian investment in Indonesia. This will create more opportunities for Australians to help meet Indonesia's growing needs for investment and for the supply of world class services in its mining market.

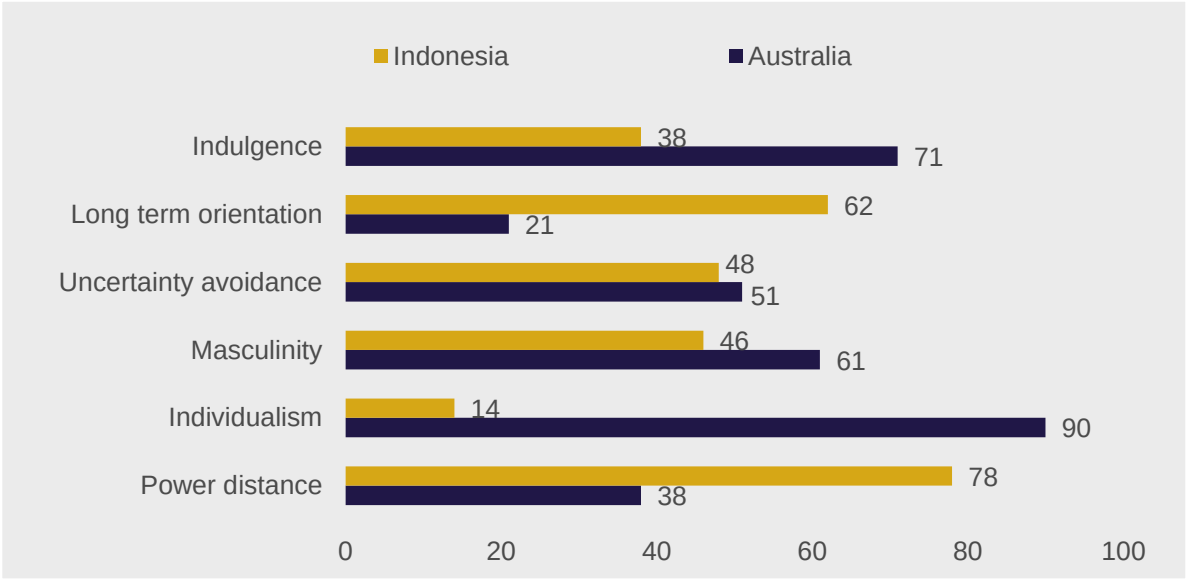
Business environment

- According to the Hofstede Cultural Dimension Model*, Australia and Indonesia are only similar in uncertainty avoidance and drastically different in the other 5 dimensions, which could disadvantage Australian companies entering the Indonesian market.
- However, the fast growing Indonesian economy has prompted significant imports from Australia. According to Austmine's national METS survey in 2020, Indonesia is the **2nd largest export destination** of Australian companies – 37% of companies that participated in the survey said that they are exporting to Indonesia.
- For the 71 companies in the Austmine's national METS survey that are not currently exporting to Indonesia, 25% of them are planning to target Indonesia as a new export market. Moreover, for the 402 companies who plan to expand their current exports, 17% of these have plans for expansion into Indonesia.

Top 10 METS export destinations of Australian companies



Lack of similarities may pose challenges in conducting business



Note: Referred from the Hofstede Insights: https://www.hofstede-insights.com/country-comparison/australia,indonesia/

IP legislation, recognition & protection

Indonesia is a member of international agreements for the protection of IP rights as administered through the World Intellectual Property Organization. IP rights can be registered in Indonesia for trade marks, patents, designs, copyright, plant varieties and geographical indications. The office of the Directorate General of Intellectual Property (DGIP) is the government agency overseeing Indonesia's IP System. IP rights are handled separately by different offices within the DGIP.

However, Indonesia is currently on the U.S. Trade Representative's (USTR) Special 301 priority watch list for intellectual property rights (IPR) protection due to Indonesia's failure to effectively protect intellectual property and enforce IPR laws. These failures have resulted in high levels of physical and online piracy, causing potentially billions of dollars in losses. Indonesian physical markets, such as Pasar Mangga Dua, were included in USTR's Notorious Markets list in 2018.

Further information on Indonesia's IP legislation can be found in Section 5.

COVID impacts and responses

In November 2020, Indonesia Government announced total state spending for the 2020 State Budget in handling the COVID-19 outbreak of Rp744.28 trillion, which is equivalent to US$52.68 billion (originally proposed Rp405.1 trillion in March 2020). The economic stimulus and other measures that are related to the mining sector include:

Category	Budget	Measures
Tax Incentives and Credit for Business	Rp120.61 trillion	The corporate income tax will be reduced from 25 percent to 22 percent; debt payments will be delayed by six months for micro loan credit for businesses affected by COVID-19
Stimulus for SMEs	Rp123.46 trillion	Interest subsidies for microcredit (KUR), MSME financing, guarantees, and placement of funds in banks.
Stimulus for SOEs and Corporations	Rp53.57 trillion	Disbursement to SOEs and corporations
Support for Ministries and regional administration	Rp106.05 trillion	Aim to help tourism sector, food security and fisheries, industrial estates, ICT development, Central Government loan to regional governments, and anticipating economic recovery.
Trade	-	Export-import processes to be sped up for reputable traders

Source: KPMG, The Government of the Republic of Indonesia.

④ Supply side dynamics & cost analysis

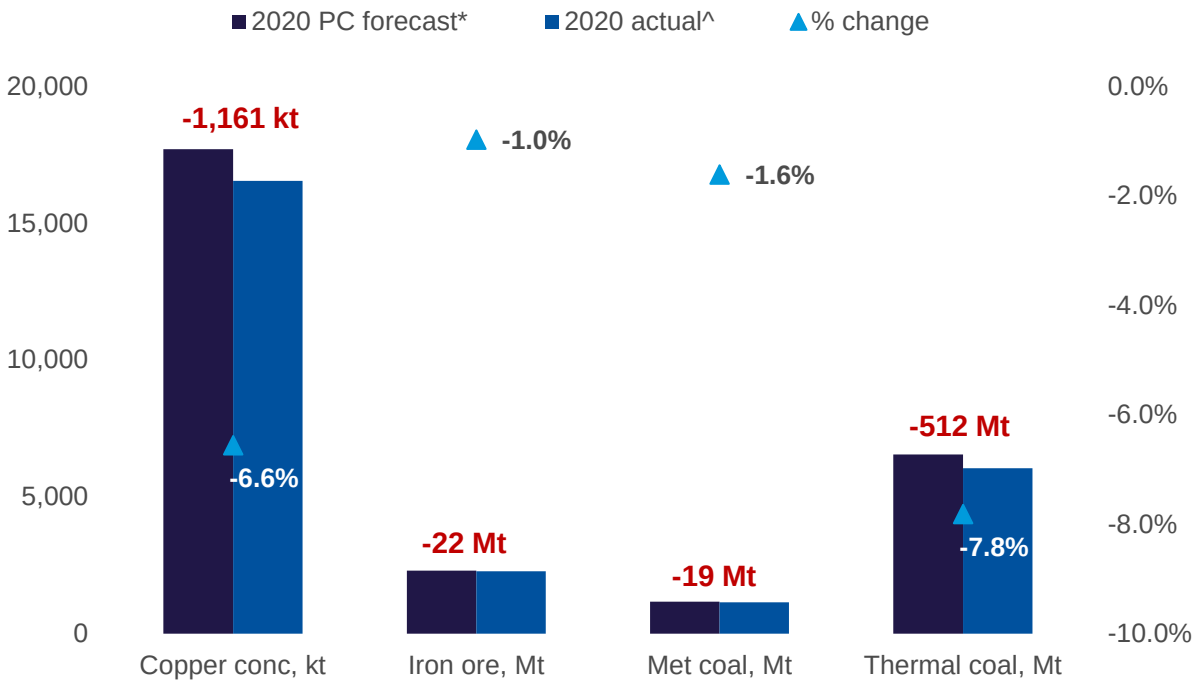
The impact of the Covid-19 pandemic on mining markets

Covid-19 has profoundly affected global market fundamentals for many mined commodities and primary metal products. Government-imposed lockdowns and sudden changes in demand for these products dramatically lowered consumption levels. Simultaneously, process disruptions and voluntary reductions in capacity reduced mined supply and primary metal production in many regions, with some being much more impacted than others.

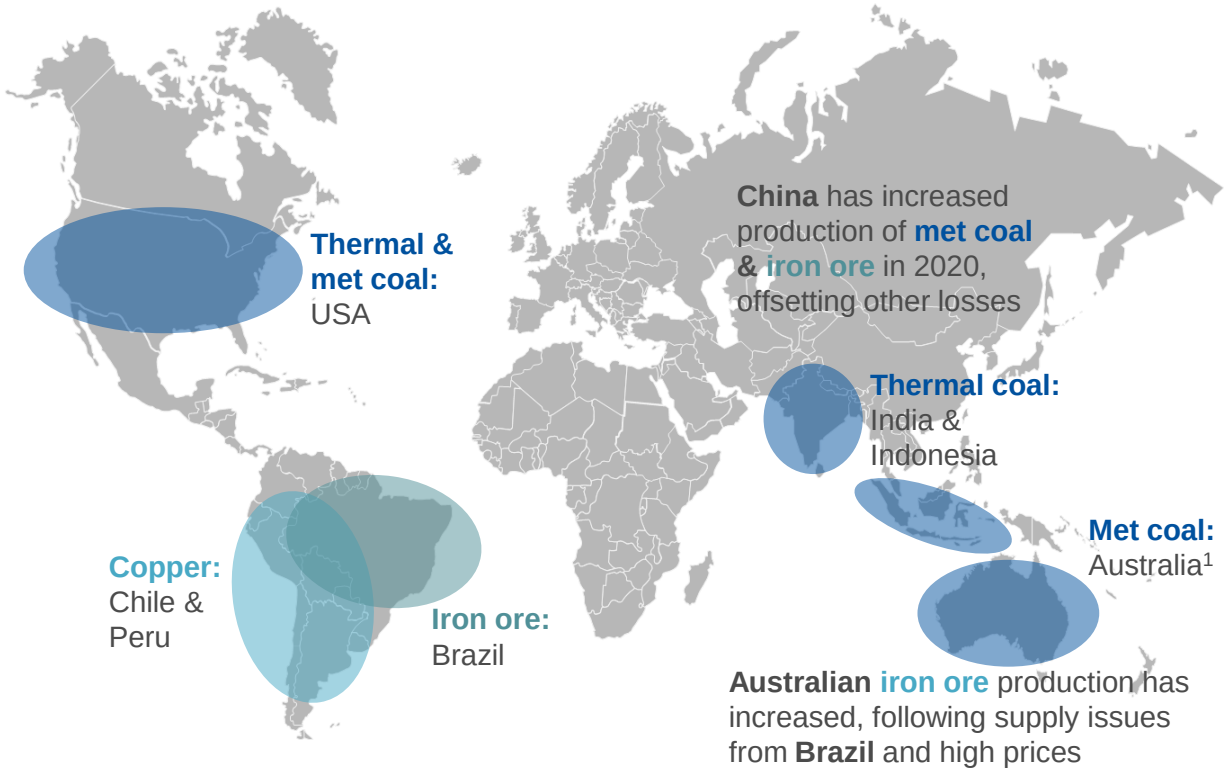
When comparing CRU's 2020 expectations versus how the year has eventuated, copper and thermal coal have been most severely impacted. South America were badly hit by the pandemic, resulting in many supply disruptions, to copper and iron ore. Thermal coal was badly hit in India and Indonesia, along with rising ESG pressures in 2020. Market conditions for metallurgical coal were already weak and have been exacerbated by the pandemic.

Covid-19 impact on mined supply

LHS: production, kt / Mt; RHS: % change



Major regional impacts of the pandemic to 2020 mined supply



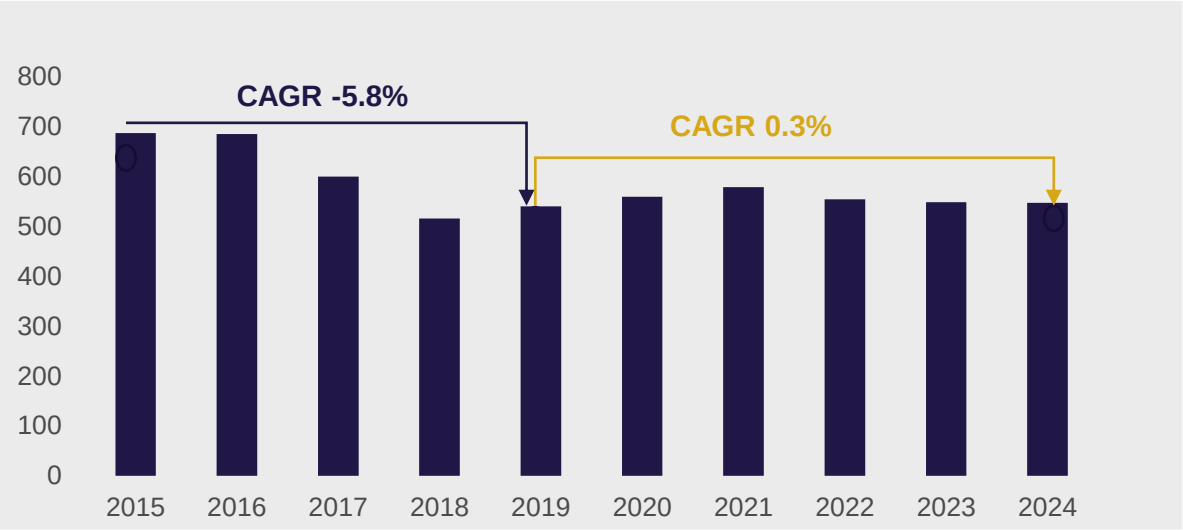
Note: * Pre-Covid forecast for 2020, published by CRU in late 2019. ^ 2020 estimate as of November 2020. 1) Also market-driven due to weak prices.

④ Supply side dynamics – Canada

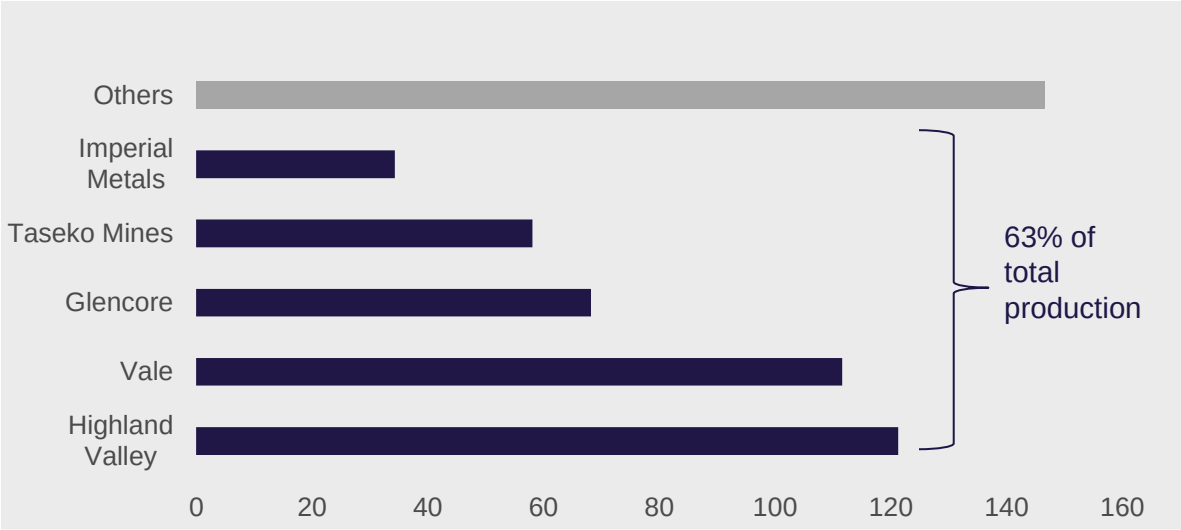
Copper production expected to remain relatively flat

- Canada is the 10th largest copper producer globally with 530 kt of copper concentrate production in 2020. CRU expect Canada's copper production to remain relatively flat over the medium term with a small CAGR increase of 0.3% from 2019 to 2024 (+6.9 kt).
- **British Columbia** and **Ontario** are the biggest copper producing provinces in Canada, with around 55% and 25% share respectively in 2018. Other copper producing provinces include Quebec (6.7%), Manitoba (6.5%), Newfoundland (5.1%) and Yukon (1.7%).
- Production of copper is moderately consolidated with the top 5 operators accounting for more than 60% of national production. Among the top operators, **Highland Valley** makes up 22% of the share, closely followed by **Vale** with 21%. Other than these two large producers, Glencore, Taseko and Imperial Metals together takes 30% of the market share, and the remain 27% is spread out among 13 other operators.

Canada copper production, '000 tonnes



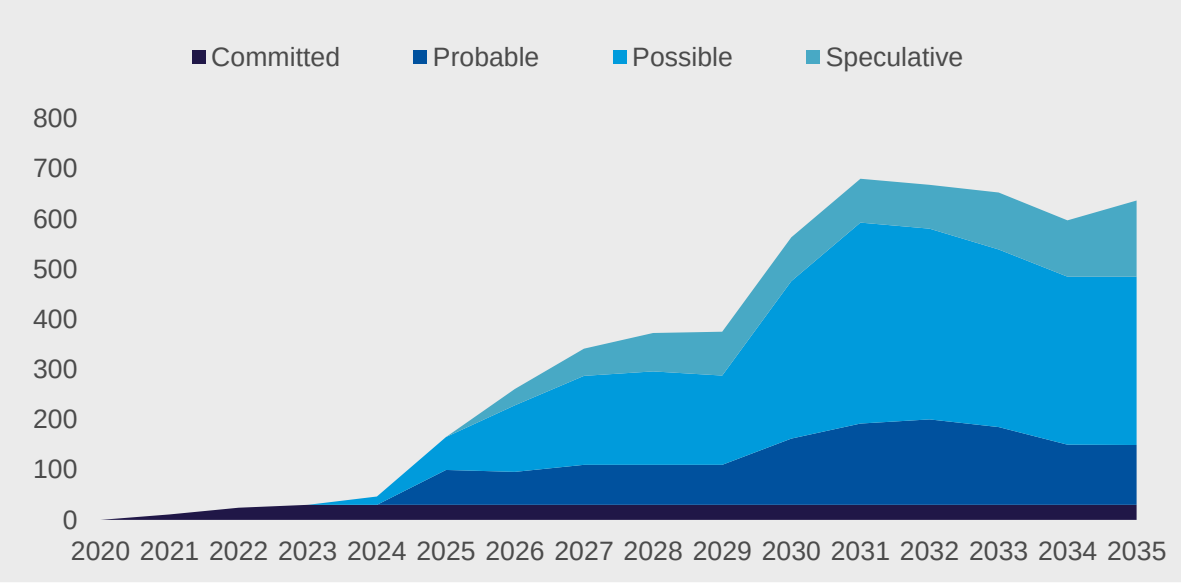
Top 5 copper operators and productions in Canada, 2019, '000 tonnes



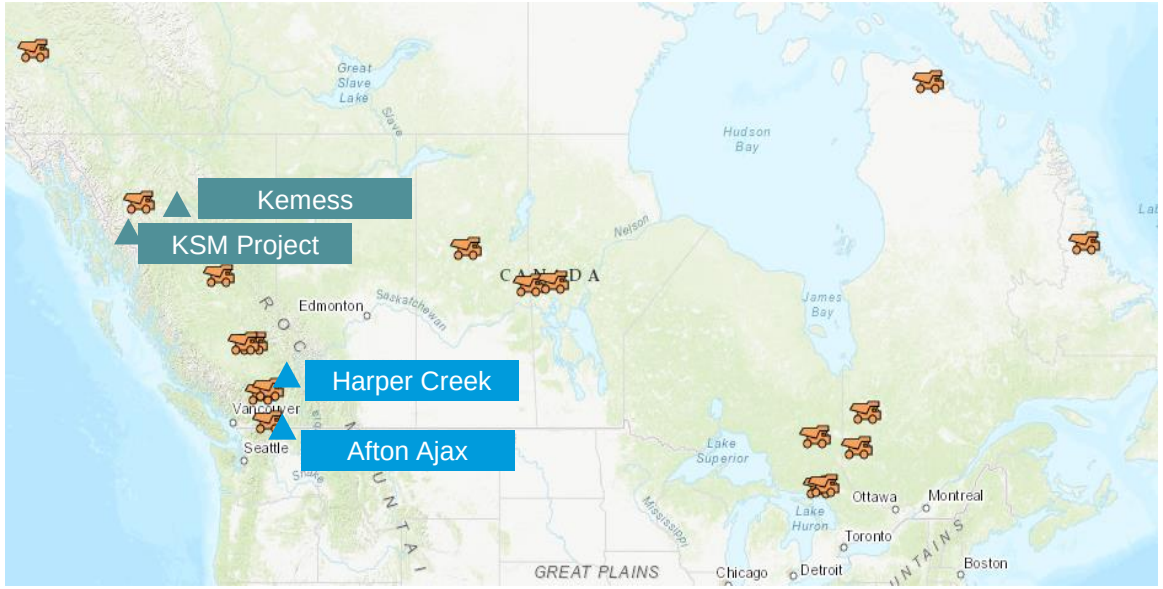
Copper operation & project overview

- CRU recognize 21 current copper operations in Canada owned by 12 operators. Among these, 7 are expected to deplete by 2025.
- The depletion will be quickly replaced by copper projects that are categorised as “Committed” and “Probable” by CRU. **Vale’s Voisey's Bay** underground expansion (Committed) is expected to come into production in 2021 and will reach full production of 30 kt per year from 2023. From 2025, Probable projects like Centerra Gold ’s **Kemess** project and New Gold’s **New Afton expansion** will add to supply.
- As shown in the map below, operations and projects are relatively concentrated in British Columbia, with some spreading across other provinces. In terms of scale, British Columbia also two of three large operations, namely **Highland Valley (121 kt)** and **Gibraltar (57 kt).**

Canada long term copper projects production, kt



Canada copper operation and projects map



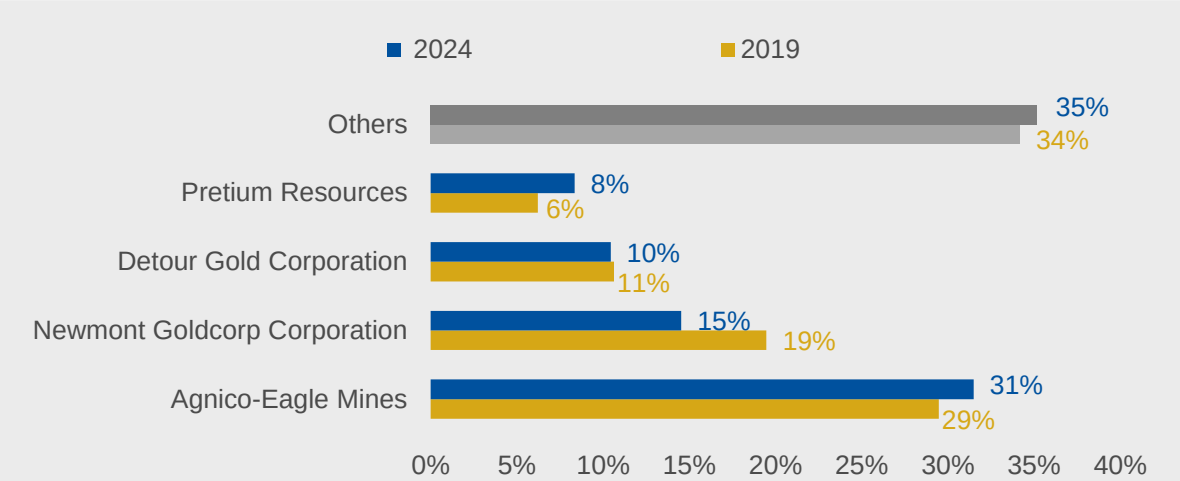
Probable project Possible project Current copper operation

Note: Please see the Appendix for a full list of projects and an explanation of CRU’s Project Gateway Methodology.

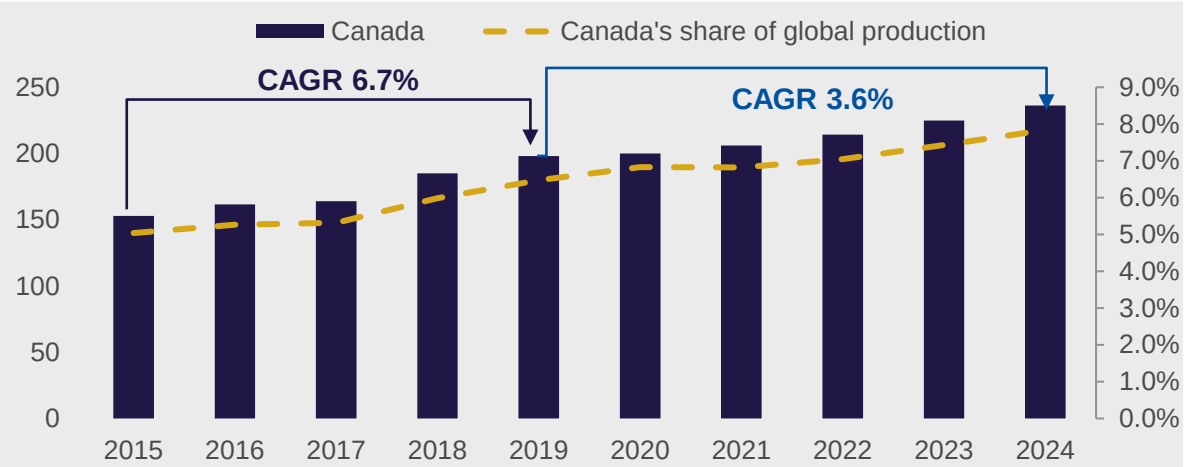
Gold production is geographically concentrated

- Gold is Canada's most valuable mined mineral, with a production value of $9.6 billion in 2018. There are 10 provinces that produce gold, with the top 3 provinces producing more than 85% of the national production (**Ontario** 42%, **Quebec** 34%, **British Columbia** 11%).
- Canadian gold production has been steadily increasing in the past and CRU expect it to continue increasing in the medium term. Canada's share of global production has also increased from 5% in 2019 to 6.5% in 2019, and is expected to further increase to 7.8% in 2024.

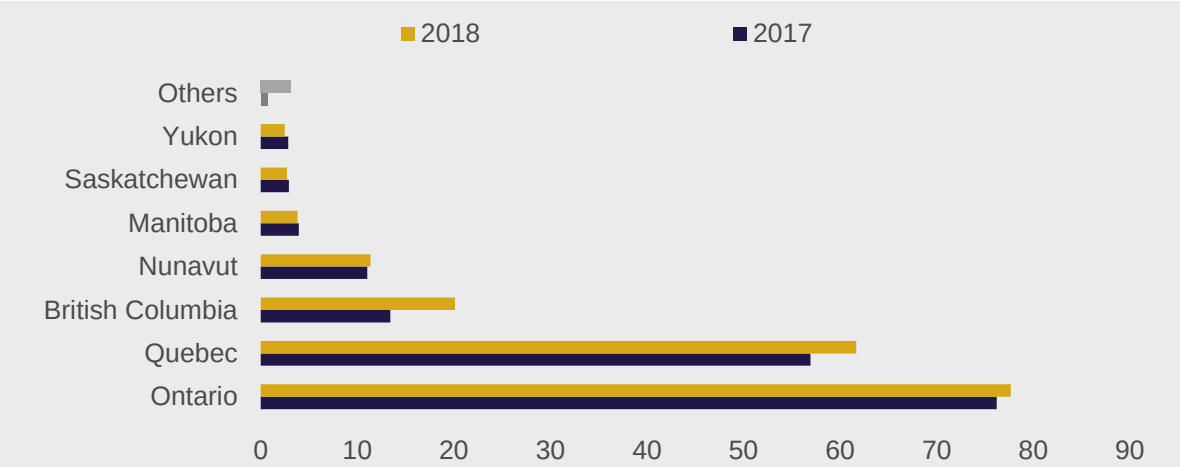
Gold mine production share by operator, %



Canada gold mine production (LHS) and global share (RHS), tonnes and %



Canada gold mine production by provinces, tonne



Major gold operations & projects

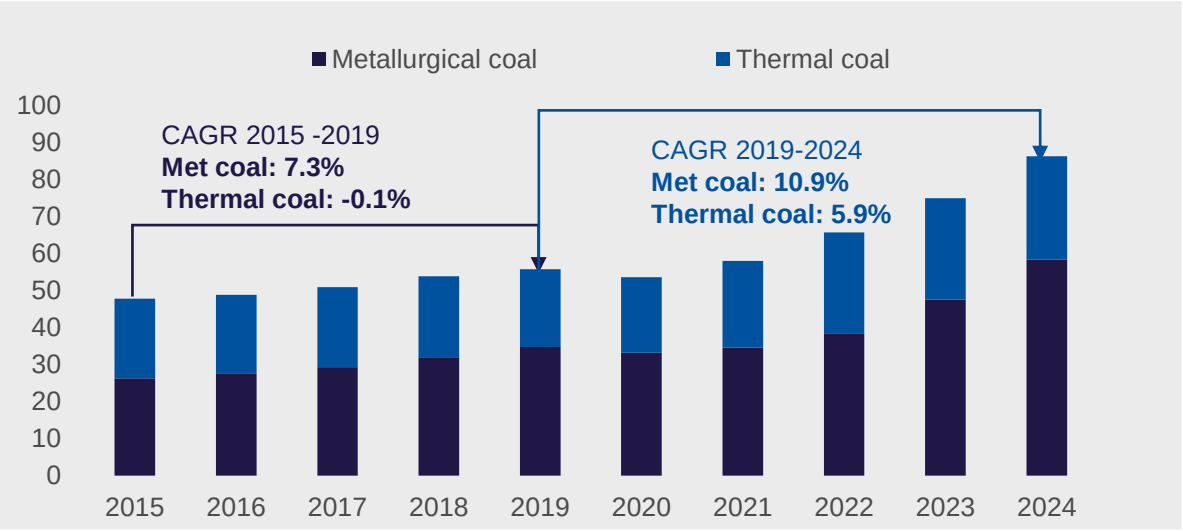
Operation	Location	Operator	2019 Production	Mine type	Mining method	Notes
Malartic	Quebec	Agnico/Yamana Gold	650,000 oz	Open pit	Truck & Shovel/ Loader	
Detour Lake	Ontario	Detour Gold	590,000 oz	Open pit	Truck & Shovel/ Loader	Approximate life to 2035
Eleonore	Quebec	Newmont Goldcorp	370,000 oz	Underground	Open stoping Longitudinal retreat	
Brucejack	British Columbia	Pretium Resources	345,000 oz	Underground	Longhole stoping Paste backfill	Approximate life to 2031, production to peak in 2022.
LaRonde	Quebec	Agnico-Eagle Mines	340,000 oz	Underground	Transverse open stoping	Production to peak from 2020.
Red Lake & Campbell	Ontario	Newmont Goldcorp Corporation	280,000 oz	Underground	Overhand cut & fill Longhole stoping	Life to 2028. Expected to decrease production to 100,000 oz from 2023.
Others			2970,000oz			

Project	Location	Operator	Status	Mine life	Mine type	Mining method	Notes
Coffee	Yukon	Newmont Corp.	Possible	10	Open pit	Truck & Shovel/ Loader	
Ajax	British Columbia	Abacus Mining & KGHM Ajax	Probable	19	Open pit	Truck & Shovel/ Loader	
Casino	British Columbia	Casino Mining Corp.	Probable	22	Open pit	Truck & Shovel/ Loader	
Cote	Ontario	IAMGOLD & Sumimoto Metal	Committed	16	Open pit	Truck & Shovel/ Loader	~$35 million of CAPEX are planned in 2020, construction has started in September 2020
KSM	British Columbia	KSM Mining	Possible	53	Open pit	Truck & Shovel/ Loader	
Blackwater	British Columbia	Artemis Gold	Probable	23	Open pit	Truck & Shovel/ Loader	
Back River	Nunavut	Sabina Gold & Silver Corp	Committed	12	Open pit /Underground	Truck & Shovel/ Loader Post pillar cut & fill	Pre-construction activities were commenced in 2020, including the extension of air strip and construction of a road network.

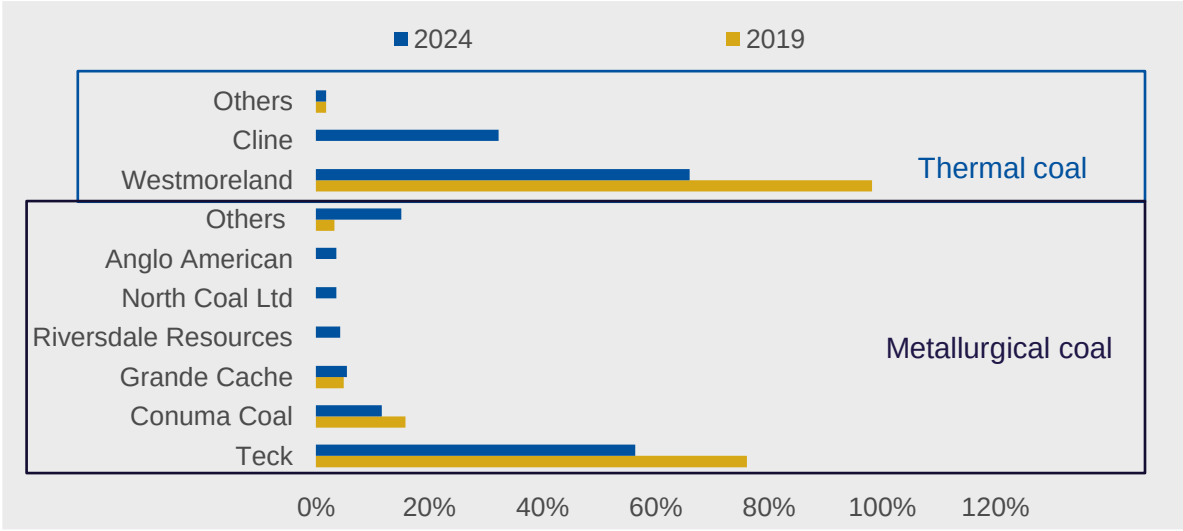
Coal production growth to be driven by metallurgical coal

- In 2019, Canada produced 56 Mt of coal, including 35 Mt of metallurgical coal and 21 Mt of thermal coal. Canada is a relatively small producer in thermal coal with production from Australia, the U.S and Indonesia are much larger. However, for metallurgical coal, Canada is the 4th largest producer globally, contributing ~8% of global production in 2019.
- In the medium term, metallurgical coal will become even more important to Canada's coal industry, with fast growth in met coal production at 10.9% from 2019 to 2024.
- The production of coal is highly consolidated: in 2019, Teck takes 76% of share in the metallurgical coal production and Westmoreland takes 98% in thermal coal production. Even though the share will be more spread out when new projects come online in 2024, the two largest operators will still account for more than half of each market.

Canada coal production by type, Mt



Canada coal production share by operator and type, %



Coal operations & projects

Operation	Location	Operator	2019 Production	Mine type	Logistic/ Infrastructure/ Technology	Notes
Fording River	British Columbia	Teck	8.3	Open pit	Truck & Shovel/ Loader	Estimated life of 29 years
Elkview	British Columbia	Teck	6.9	Open pit	Truck & Shovel/ Loader	Estimated life of 36 years.
Greenhills	British Columbia	Teck	5.4	Open pit	Truck & Shovel/ Loader	Estimated life of 50 years.
Estevan	Saskatchewan	Westmoreland	5.3	Open pit	Dragline	
Genesee	Alberta	Westmoreland	5.1	Open pit	Dragline	Estimated life to 2030.
Line Creek	British Columbia	Teck	4.3	Open pit	Truck & Shovel/ Loader	
Popular River	Saskatchewan	Westmoreland	3.5	Open pit	Dragline	
Sheerness	Alberta	Westmoreland	3.2	Open pit	Dragline	The current coal supply contract for the mine expires in 2026
Brule	British Columbia	Conuma Coal	3	Open pit	Truck & Shovel/ Loader	Produces both thermal and metallurgical coal, production was resumed in 2016.
Others			10.8			

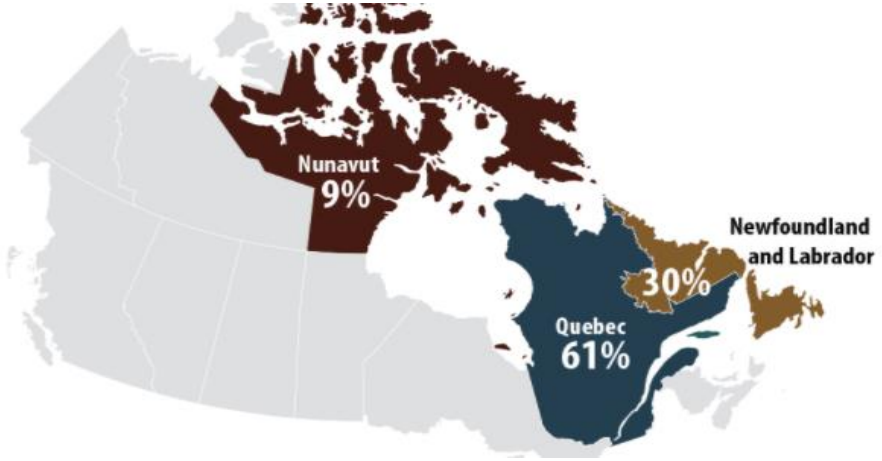
Project status	Number of projects	Open pit	Underground	Mixed	Expected production in 2024	Notes
Committed	0	0	0	0	0 Mt	
Probable	2	2	0	0	3.3 Mt	Project names: Grassy Mountain, Tena
Possible	10	7	2	1	28.7 Mt	The largest one is Vista by Cline, expected to produce 9 Mt in 2022.
Speculative	11	6	2	3	8.1 Mt	Bingay and Michel Creek will reach production of 2 Mt by 2024. Other projects will develop at a slower pace.
Total	**23**	**15**	**4**	**4**	**40.1 Mt**	

Please see Appendix C for a full list of projects.

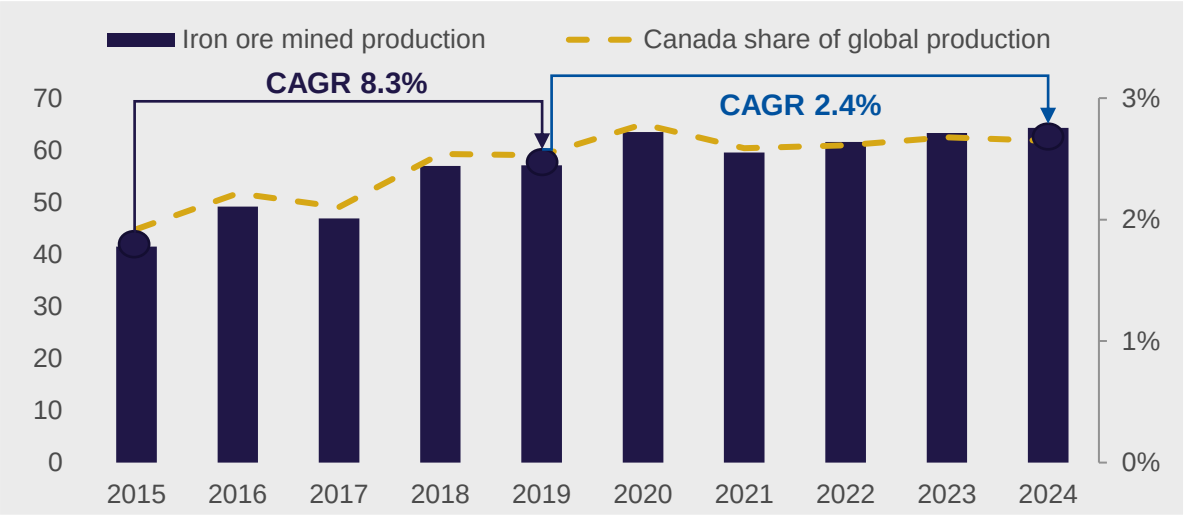
Iron ore production is concentrated in the Labrador Trough region

- Canada is the 6th largest in reserves and 8th largest iron ore producer by volume globally*. In 2019, Canada produced 57 Mt of mined iron ore, ~3% of global production. Currently production is split relatively evenly between pellets and fines, but we expect lump to take a small share of 8% by 2024.
- Iron ore production in Canada is highly concentrated, with more than 90% from the Labrador Trough region, along the border between **Quebec** and **Newfoundland** and **Labrador**. There is a small portion of ~9% from Nunavut as well.

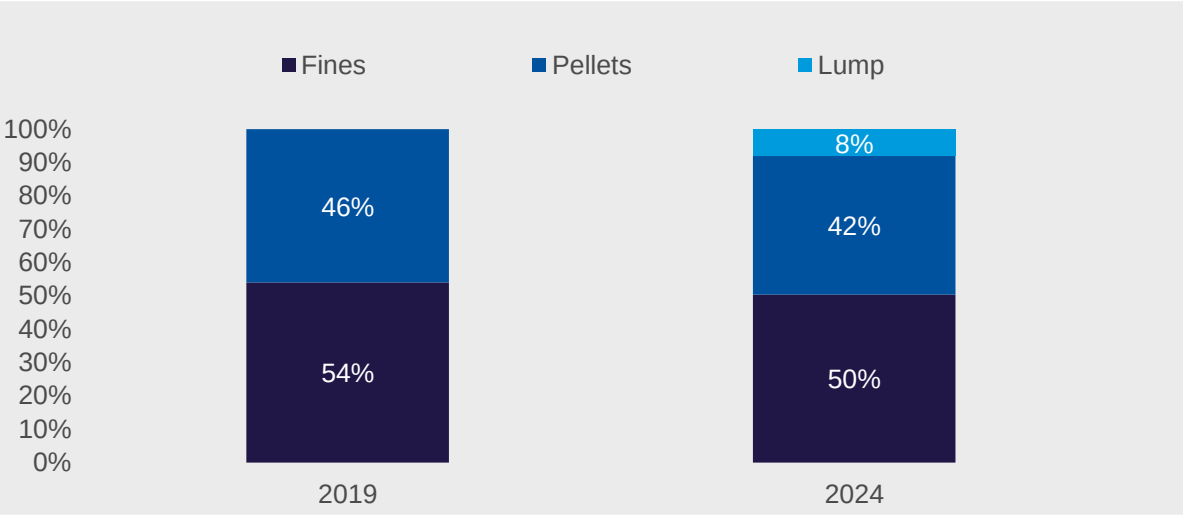
Canada iron ore production map, 2018



Canada iron ore production and global share, Mt and %



Canada iron ore production share by product type, %



Data*: Government of Canada 2018

Iron ore operations & projects

Operation	Location	Operator	2019 Production	Mine type	Mine life	Logistics	Mining method/ Technology notes
Bloom Lake	Quebec	Champion Iron	7.8 Mt	Open pit	21	Railroad	Truck & Shovel/ Loader
Carol Lake	Newfoundland	IOC	27.9 Mt	Open pit	>11	Railroad	Truck & Shovel/ Loader
Mary River	Nunavut	Baffinland	5.9 Mt	Open pit	35	Road train	Truck & Shovel/ Loader
Mt Wright	Quebec	ArcelorMittal	34.1 Mt	Open pit	25	Railroad	Truck & Shovel/ Loader
Schefferville	Quebec	Tata	1 Mt	Open pit	>6	Railroad	Wet processing plant in site
Wabush	Quebec	Cleveland Cliffs	0.9 Mt	Open pit	>10	Railroad	N/A

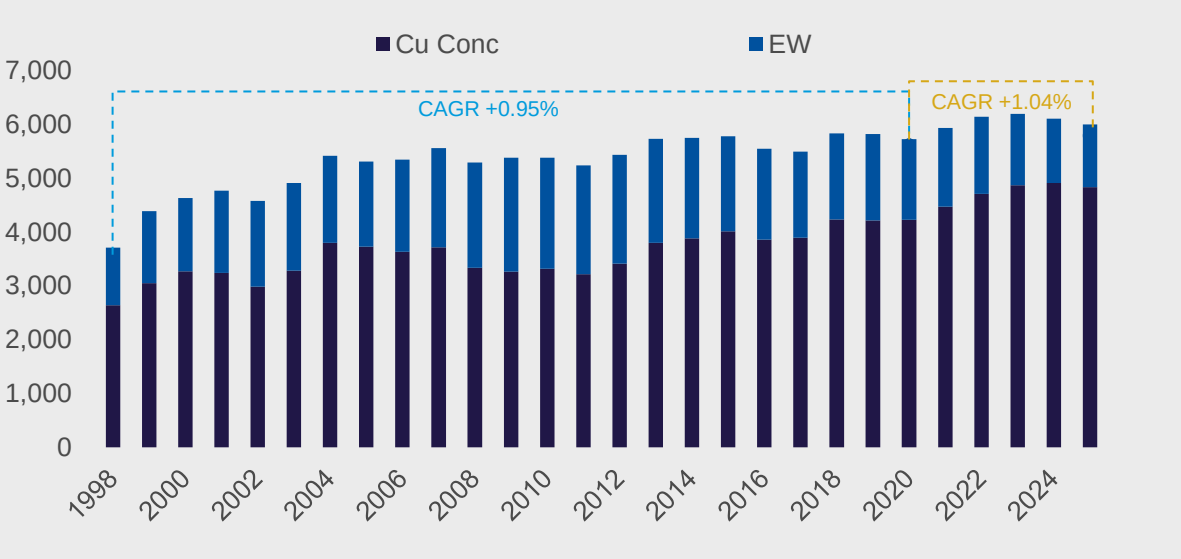
Project	Location	Operator	Status	Mine life	Mine type	Logistics	Mining method/ Technology notes
Bloom Lake Phase 2	Quebec	Champion Iron	Probable	21	Open pit	Railroad	Truck & Shovel/ Loader
Hopes Advance	British Columbia	Oceanic Iron Ore	Possible	28	Open pit	Slurry pipeline	Truck & Shovel/ Loader
Kami	Newfoundland	Alderon	Possible	23	Open pit	Railroad	Truck & Shovel/ Loader
Lac Otelnuk	Ontario	Lac Otelnuk Mining	Possible	30	Open pit	Slurry pipeline	Truck & Shovel/ Loader
Bending Lake	Ontario	Ambershaw Metallics	Speculative	30	Open pit	Railroad	N/A

④ Supply side dynamics – Chile

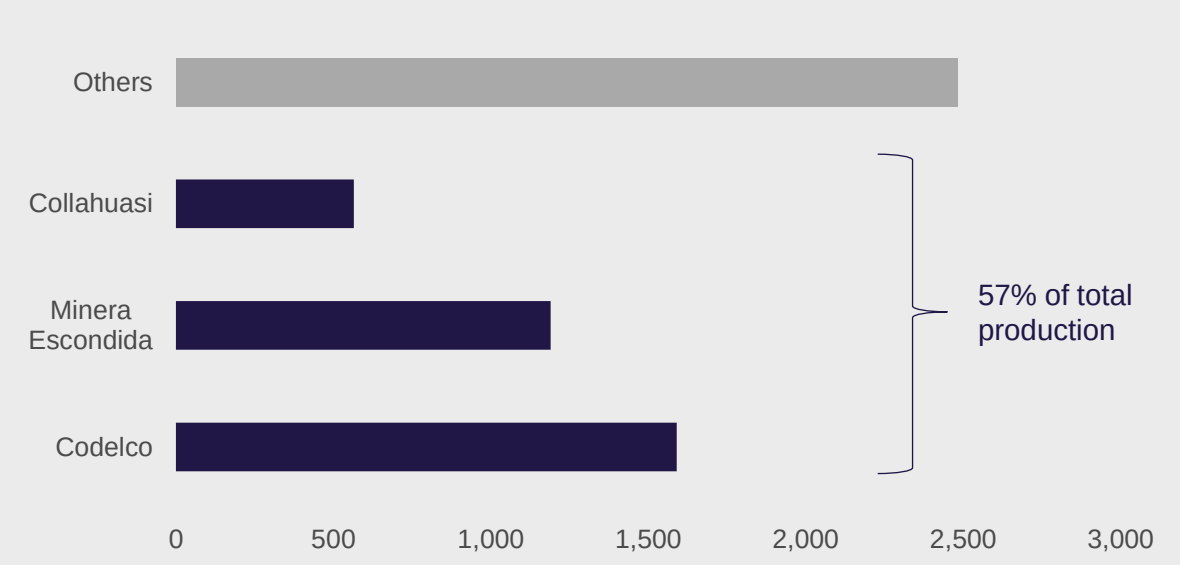
Steady increase in total copper production in the short term

- Chile is **the largest** copper producer in the world with 5,700 kt of copper mined in 2020. The country has seen a steady increase in total production with a CAGR of 0.95% in the last 20 years and a projected CAGR of 1.04% in the period from 2020 to 2025.
- Although the proportion between the production of EW copper cathodes and copper concentrate has remained relatively constant over time, we expect a decrease in the production of EW cathodes in the medium term (CAGR of -4.9% from 2020-25) while Cu concentrate production keeps rising.
- 57% of the total Chilean production in 2019 was from three operators; Codelco, Minera Escondida and Collahuasi, with production of 1,591 (27%), 1,190 (20%), 565 (10%) tonnes per year respectively. Codelco is the largest Chilean producer by a large margin followed by Minera Escondida, with BHP owning a 57.5% share.

Chilean copper production, '000 tonnes



Top copper operators and producers in Chile in 2019, '000 tonnes



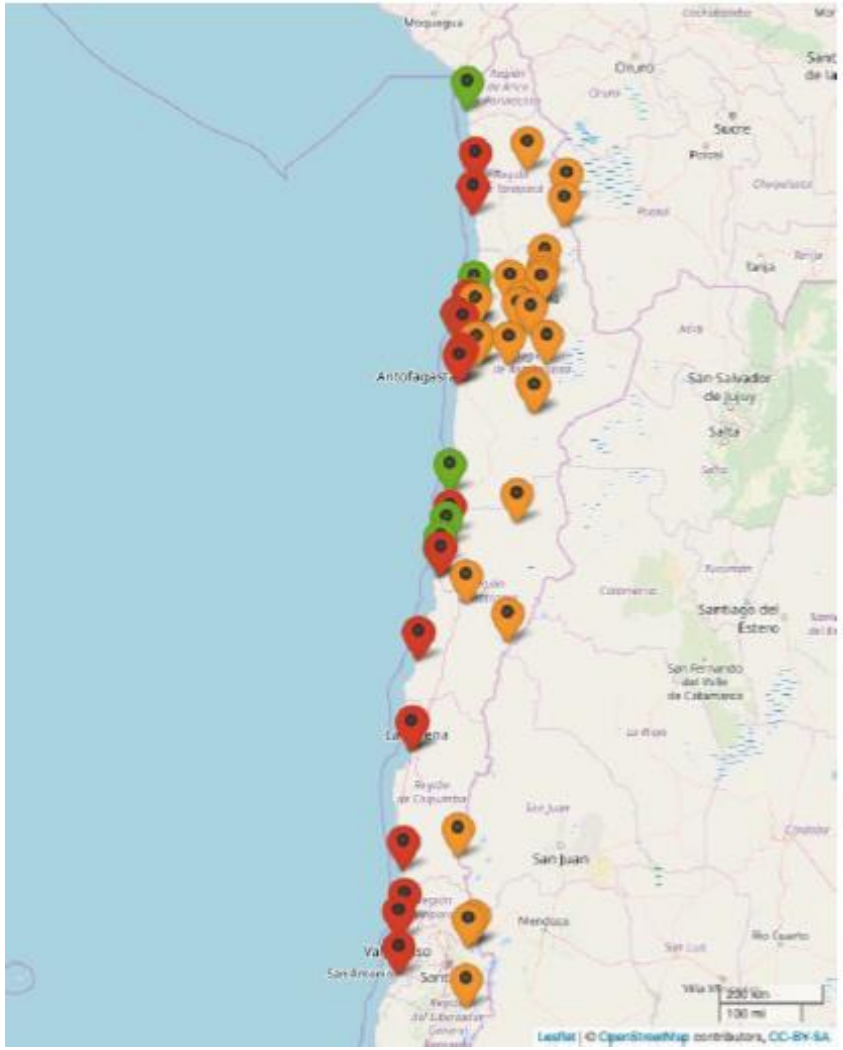
Copper operations are concentrated in Northern Chile

- Chile's mining activity is highly concentrated in the first three northern regions, with a total of 24 of the 32 currently operating mines located in these regions.
- Over 65% of mining GDP comes from these regions, which have also seen increased construction activity linked to the development of mining projects.
- The growth of the industry can also be seen in other related assets such as new ports and desalination plants.

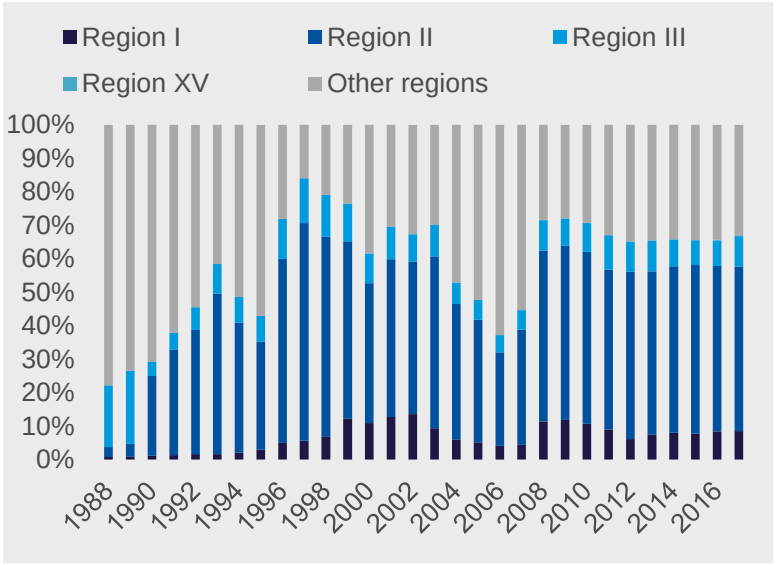
Mining operation

Port

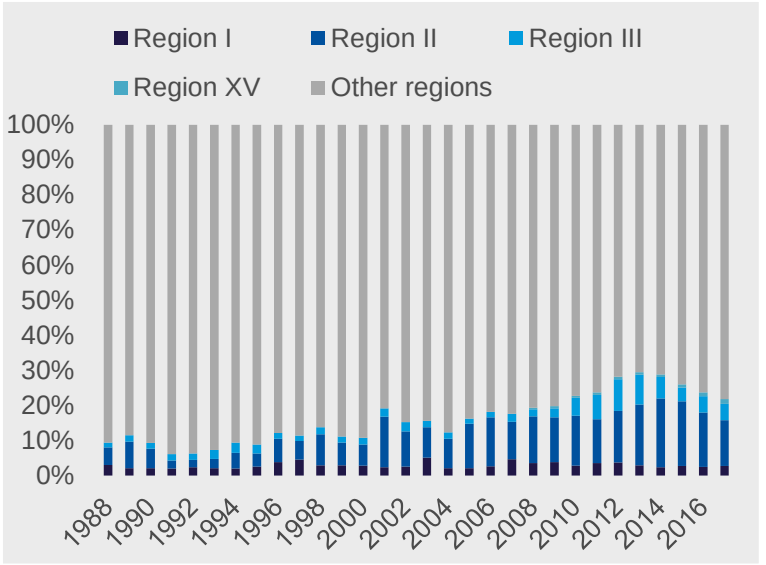
Desalination Plant



Chile's mining GDP by region (%)



Chile's construction GDP by region (%)



Data: Banco Central de Chile. Note: Region XV is the most northern Chilean region. Region I is the second from north to south.

Copper operations

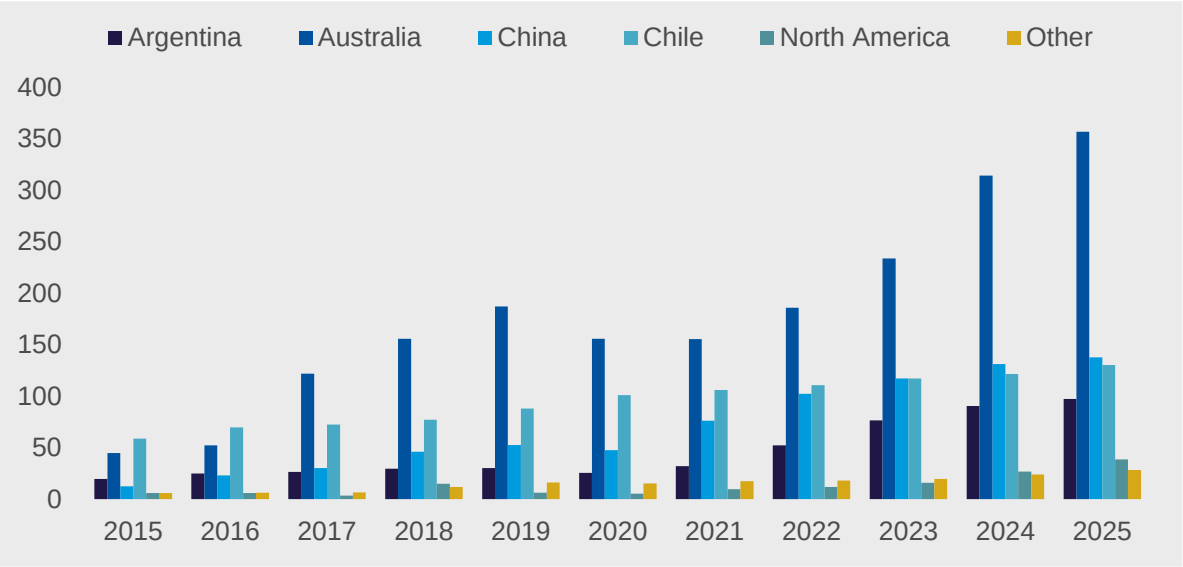
Operator	Mine Name	Mine Type	Production in 2019 ('000 tonnes)
Minera Escondida	Escondida	Cu Conc	940
Collahuasi	Collahuasi	Cu Conc	565
Codelco	El Teniente	Cu Conc	434
Minera Los Pelambres	Los Pelambres	Cu Conc	376
Codelco	Chuquicamata	Cu Conc	356
Min. Sur Andes	Los Bronces	Cu Conc	295
Minera Escondida	Escondida	EW	250
Codelco	Radomiro Tomic	EW	220
Minera Centinela	Esperanza	Cu Conc	203
BHP	Spence	EW	193
Codelco	Andina	Cu Conc	170
Codelco	Mina Ministro Hales	Cu Conc	158
Candelaria	Candelaria	Cu Conc	150

Note: Full list of operations and projects can be found in the Appendix.

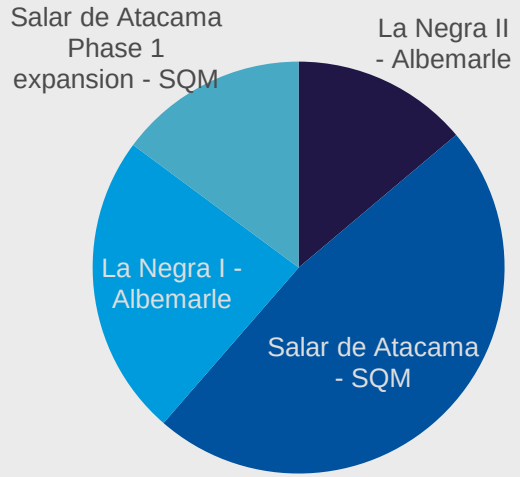
Chile is a world leader in lithium mining, alongside Argentina & Australia

- Chile was the second biggest LCE (lithium carbonate equivalent) producer in the world in 2020 with 101 kt of production, behind only Australia with 156 kt.
- Two companies produce all lithium in Chile, SQM and Albemarle, although the former accounts for 63% of total production. Both companies own two operations located in the Atacama Salt Flats and produce from brine deposits.
- CRU expects Chile to produce 130 kt/y by 2025, while Australian and Chinese production reaches 357 and 138 kt/y, leaving Chile in third place worldwide.

Main lithium producers, '000 tonnes



Chilean lithium production distribution



Data: CRU

Lithium operations & projects

Operator	Operation Name	Deposit Type	Production 2019 ('000 tons)
SQM	Salar de Atacama	Brine	45
SQM	Salar de Atacama Phase 1 Expansion	Brine	5
Albemarle	La Negra I	Brine	24
Albemarle	La Negra II	Brine	14

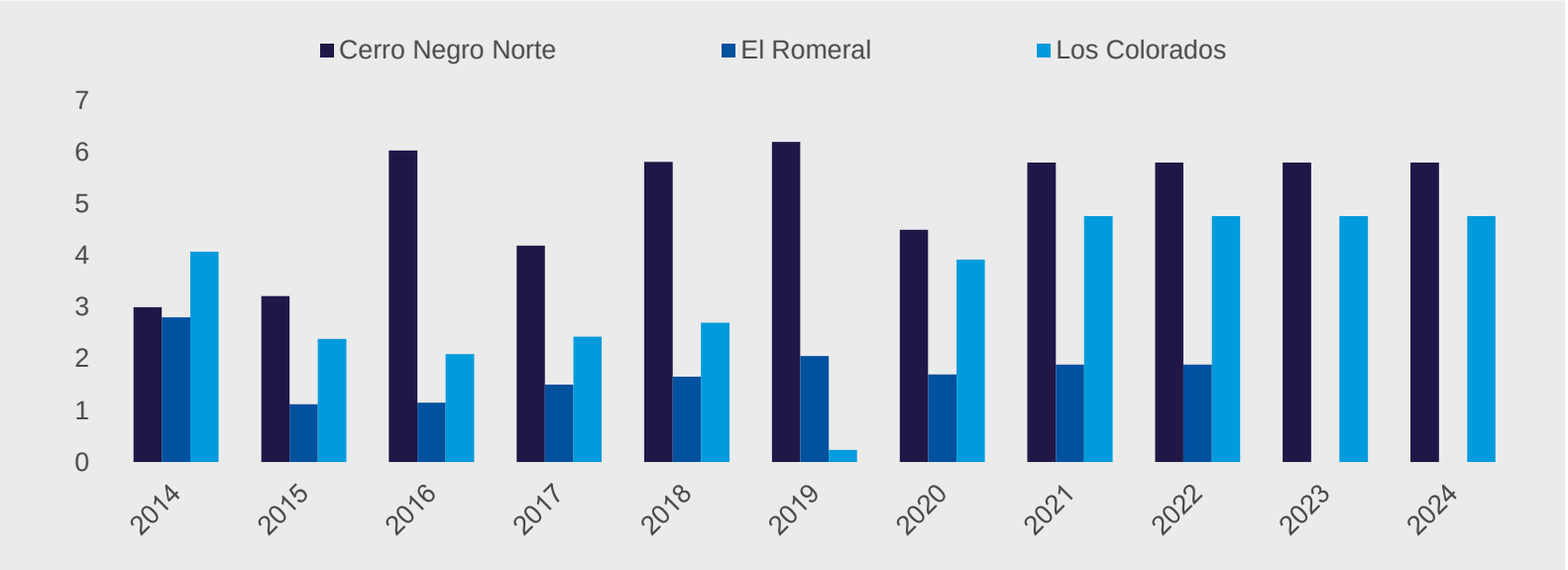
Operator	Operation Name	Deposit Type	Project Status
Lithium Power International & Minera Salar Blanco	Maricunga	Brine	Probable
Albemarle	La Negra III/IV	Brine	Probable
SQM	Salar de Atacama Phase 2 Expansion	Brine	Probable
SQM	Salar de Atacama Phase 3 Expansion	Brine	Possible

Data: CRU. * An explanation of CRU's Project Gateway Methodology can be found in Appendix D.

Chile's iron ore mining operated by one company

- Compañia Minera del Pacífico (CMP) produced 10.1 Mt of iron in 2019, 99% of Chile's total iron ore production.
- CMP operates 3 mines located in the north of Chile:
  - Cerro Negro Norte: 5.8 Mt wet capacity;
  - Los Colorados: 8 Mt wet capacity;
  - El Romeral: 1.7 Mt wet capacity (expected to stop production by 2023)
- There is only one potential project, a speculative open pit mine from CMP called Pleito and its planned location is in the fourth region, north of the city of La Serena.

CMP operations, Mt



Operating Iron Ore CMP mines

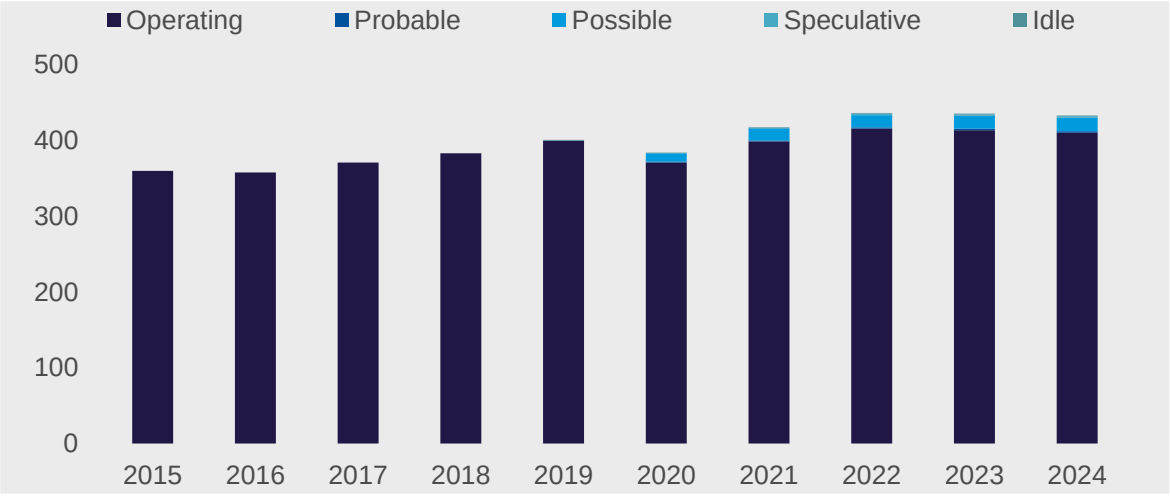
Data: CRU

④ Supply side dynamics – Indonesia

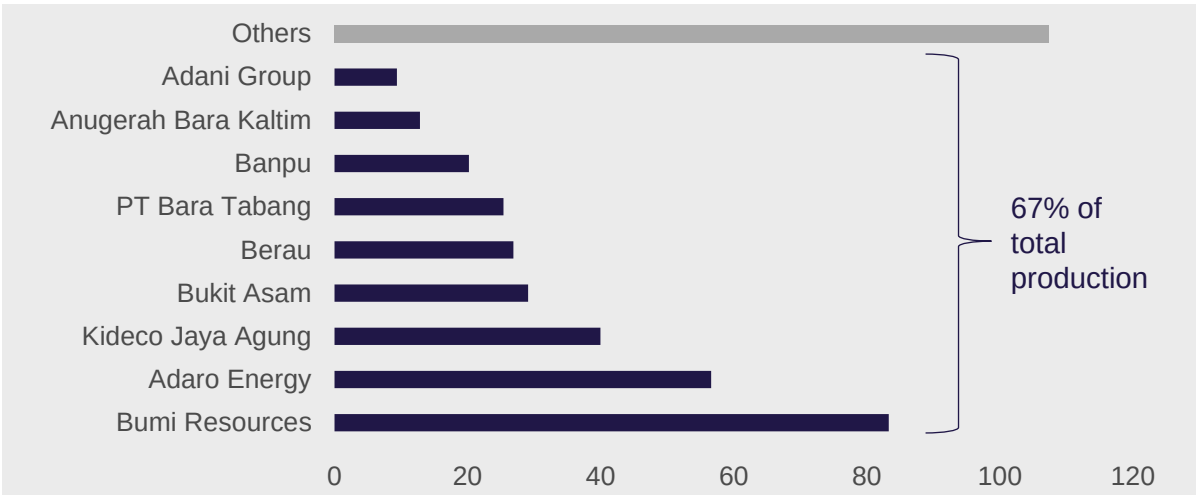
Indonesian coal mining will see limited growth in the medium term

- In 2019, Indonesia was the fourth largest thermal coal producer after China, India and the US, accounting for around 9% of thermal coal produced globally. In CRU's forecasts, operating and probable thermal coal supply from Indonesia is expected to remain flat at around 410 Mt to 2024, with an additional 20 Mt possible and speculative supply that can potentially come online in the medium term.*
- At a company level, the top 9 producers accounted for 67% of Indonesia's thermal coal supply in 2019. Notable existing operations include Adaro Energy's **Adaro mine** (~60 Mtpa), Bumi Resources' **KPC Sangatta** (~51 Mtpa), **Kideco Jaya Agung** mine (~40 Mtpa), **PT Bara Tabang** mine (~25 Mtpa), **Bukit Asam** mine (~25 Mtpa) and **Bhakti Energi Persada** mine (~15 Mtpa). Most of these operations are located in three regions, namely South Kalimantan, East Kalimantan and South Sumatra.
- In future there is some upside to Indonesia's thermal coal supply, with a few projects that could reach the market. CRU are aware of the following projects: Kangaroo Resources' **Pakar** (~16 Mtpa), **Arni Bersaudara** mine (~2 Mtpa), **Indo Bara Pratama** mine (~2 Mtpa), Harum Energy's **Karya Usaha Pertiwi** (~ 1Mtpa) and Resource Alam Indonesia's **Kaltim Mineral** (~1 Mtpa). These projects can potentially add 22 Mtpa to Indonesia's thermal coal supply in the medium term.

Indonesia thermal coal production, 2015-2024 (Mt)



The 9 largest thermal coal operators in Indonesia, 2019 (Mt)



Data: CRU. * An explanation of CRU's Project Gateway Methodology can be found in Appendix D.

Coal – major operation & project overview

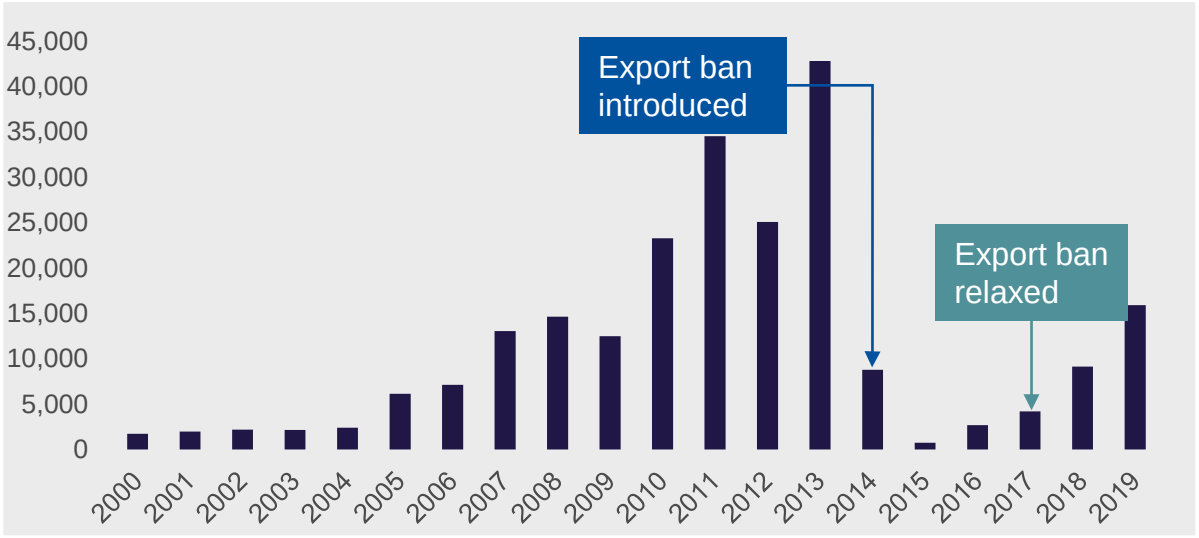
Asset name	Location	Status	Operator	Mine life	Production in 2019	Mine type	Logistic/Infrastructure /Technology	Note
Adaro	South Kalimantan	Operating	Adaro Energy	>15 years	56.6 Mt	Open pit	Barging	Adaro mining site produces sub-bituminous coal of calorific value between 4,000 and 5,000 kcal/kg GAR from its three mines: Paringin, Tutupan and Wara.
KPC Sangatta	East Kalimantan	Operating	Bumi Resources	>16 years	51.3 Mt	Open pit	Conveyor and road train	KPC Sangatta is an operating thermal coal mine operated by PT Kaltim Prima Coal (Bumi Resources)
Kideco Jaya Agung	East Kalimantan	Operating	Kideco Jaya Agung	>12 years	40.0 Mt	Open pit	Conventional truck and shovel techniques for coal mining	The site currently operates five open pits and has reserves of 651 Mt. The product is transported to Adang Bay Port.
Bara Tabang	East Kalimantan	Operating	PT Bara Tabang	>15 years	23.3 Mt	Open pit	Barging	The mine site produces low-ash and low-sulphur sub-bituminous coal.
Bukit Asam	South Sumatra	Operating	Bukit Asam	>60 years	29.1 Mt	Open pit	Rail	The mine has been increasing its coal production and railway transport capacity.
Karya Usaha Pertiwi	East Kalimantan	Probable	Harum Energy	>20 years	N/A	Open pit	Barging	KUP is located adjacent to MSJ and SB and will utilise existing infrastructure.
Kaltim Mineral	East Kalimantan	Probable	Resource Alam Indonesia	>160 years	N/A	Open pit	Barging	Kaltim Mineral is a probable thermal coal project that has a planed annual production of 1 Mt.
Pakar	East Kalimantan	Possible	Kangaroo Resources	>25 years	N/A	Open pit	Barging	The resource consists of 12 IUPs that contain a deposit of low-ash low sulphur sub-bituminous coal.
Arni Bersaudara	East Kalimantan	Possible	PT Arni Bersaudara	>24 years	N/A	Open pit	Barging	The IUP covers the Pamaluan and Balikpapan formations which typically host coal of GVC (Adb) 6,300 – 7,000 Kcal/Kg and 5,600 – 6,000 Kcal/Kg.
Indo Bara Pratama	East Kalimantan	Speculative	PT Indo Bara Pratama	>135 years	N/A	Open pit	Barging	No information found about a coal deposit. Some exploration done back in 2008.

Note: Please see Appendix C for a full list of operations and projects.

Bauxite production has been flexible and highly dependent on exports

- Historically, Indonesian bauxite production reached a peak of 42.8 Mt in 2013, before sharply declining due to the introduction of the export ban in 2014. Since 2017, as the export ban has been relaxed, export quotas are being permitted and the domestic PT Well Harvest Wining refinery came on stream. As a result, bauxite production in Indonesia rose to 15.9 Mt in 2019.
- The rapid change in volumes of bauxite production is enabled by the nature of bauxite mining in Indonesia. In Indonesia, although a large proportion of bauxite production is attributed to two largest state-owned producers in West Kalimantan, PT Antam and PT Cita Mineral Investindo, there are also many other small-scale privately-owned mines which accounted for 75% of Indonesian bauxite production in 2019. The production from these small mines is flexible and highly depends on Mining Licences (IUPs) and export quotas they obtain, given the small domestic market. With relatively low CAPEX for bauxite mining in Indonesia, the production resumption and ramp-up are easy and fast (typically within 3 months once the demand emerges), which is usually done by local contractors which are easy to source and employ. It is unlikely these small mines will pose many opportunities for METS exports from the MIW region.

Historical Indonesia bauxite production, 2000-2019 (,000 t)



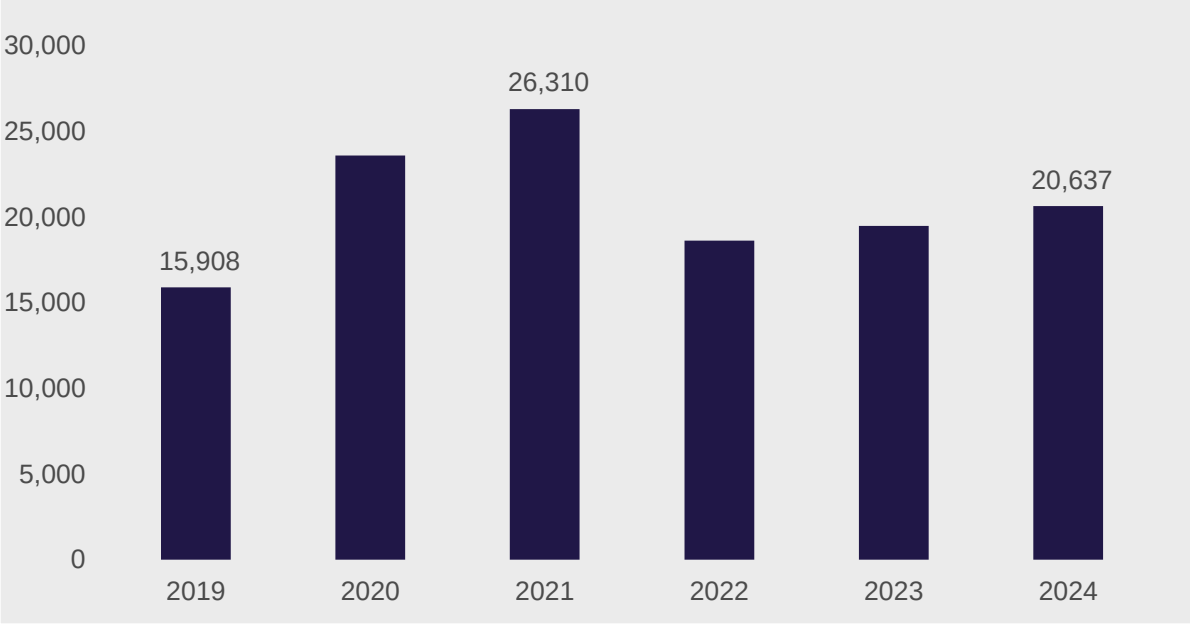
Bauxite mines that currently hold IUPs in Indonesia

Data: CRU, ESDM One Map.

Export ban remains a notable risk to bauxite production outlook

- Indonesia produced ~16 Mt bauxite in 2019, which is the third largest commodity by volume in Indonesia. In Indonesia, the total potential of national bauxite resources is around 3bn tonnes, which is mainly located in West Kalimantan (around 1bn tonnes) and Central Kalimantan (around 2bn tonnes). The Riau Islands also has small bauxite resources. The total reserve is around 1bn tonnes in Indonesia, according to USGS.
- CRU expects Indonesian bauxite supply to total 26.3 Mt in 2021, up 2.7 Mt compared to 2020 and 10.4 Mt compared to 2019 with the rapid ramping up of various small private-owned mine due to the relaxation of the export ban. Beyond 2022, CRU's base case view is that there will be limited Indonesian bauxite exports and production, with production falling to around 20 Mt/y. However, it remains an uncertain environment and there is a notable risk to any exports as the country pledges to enforce the ban by 2022.

Indonesia bauxite production, 2015-2024 ('000 t)



- With the rate of bauxite exports from Indonesia increasing over the past four years, the Indonesian authorities would recognise that a failure to push for more significant progress of alumina refinery projects now, could result in a substantial tonnage of bauxite leaving the country and a lack of committed development projects actually materialising.
- Nevertheless, there is still scepticism that enough value-added investment in alumina refining will occur ahead of January 2022 for the renewed ban on bauxite exports to serve its purpose. The other thing we cannot rule out is the possibility of the policy changes, based on the economic situation at that time. If the mining industry really need remain minerals exports to stay heathy, the government must consider to delay the ban again.

Bauxite – operations & projects

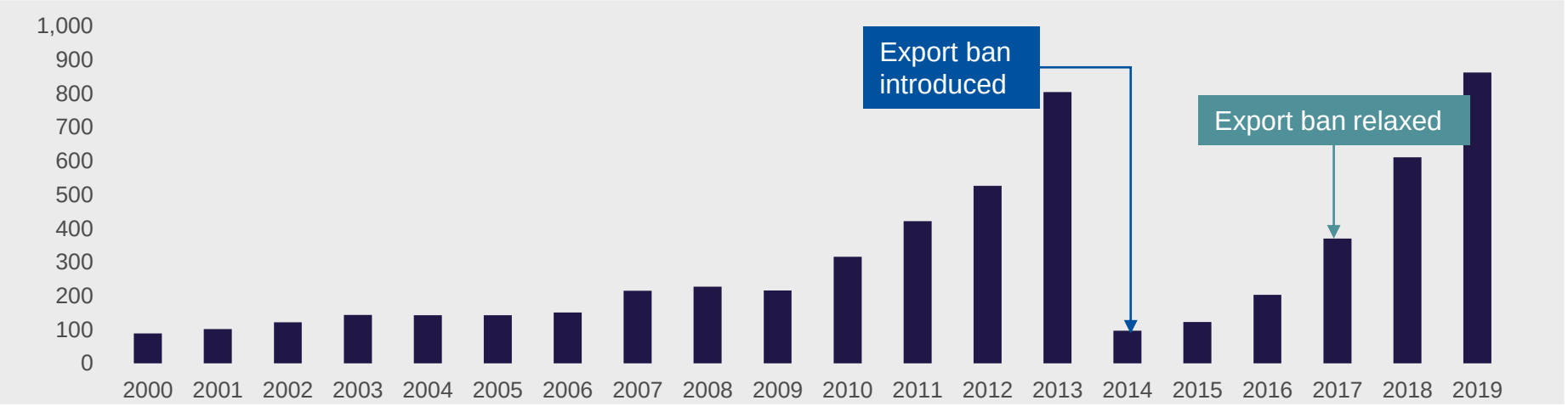
Name	Location	Ownership	Capacity (Mtpa)	Production in 2019 (kt)	Reserve (Mt)	Resource (Mt)	Client
Tayan mine	West Kalimantan	PT Aneka Tambang, Indonesia Chemical Alumina	3.2	1,670	33	127	Captive refinery in Tayan and export to China
Ketapang	West Kalimantan	Cita Mineral Investindo / PT WHWar	18.4	7,335	98	373	Captive refineries (WHWar) and export to China
Mempawah mine	West Kalimantan	Aneka Tambang (Antam), Indonesia Asahan Aluminium (Inalum)	7.0	N/A	13	19	Mempawah refinery and export to China
PT MKU and PT Sanmas	West Kalimantan	PT Mahkota Karya Utama and PT Sanmas Mekar Abadi	4.5	N/A	19	N/A	Captive Bintan Alumina refinery
PT KBP mine	West Kalimantan	PT Kalbar Bumi Perkasa	6.2	2,000	62	N/A	Export to China
PT DSM mine	West Kalimantan	PT Dinamika Sejahtera Mandiri	7.2	2,120	6	N/A	Export to China
PT Laman mine	West Kalimantan	PT Laman Mining	3.6	50	40	190	Export to China, but quota was revoked in 2019
PT TAB mine	Riau Island	PT Tanjung Air Berani	1.8	N/A	12	17	Domestic users
PT LNP mine	Riau Island	PT Lobindo Nusa Persada	1.9	370	7	15	Export to China, but quota was revoked in 2019
PT GBA mine	Riau Island	PT Gunung Bintan Abadi	1.6	260	14	22	Export to China but quota got revoked in 2019
PT TBJ mine	Riau Island	PT Telaga Bintan Jaya	2.7	N/A	71	45	Export to China
PT PMS mine	Central Kalimantan	PT. Parenggean Makmur Sejahtera	4.97	38	22	74	Export to China
PT BAM mine	Central Kalimantan	PT Bino Artomas Mineral	4.6	N/A	115	N/A	No export quota
PT BAP mine	Central Kalimantan	PT Borneo Alumindo Prima	12.5	N/A	N/A	N/A	No export quota

The table presents representative bauxite mines mainly in operation currently CRU identified. The capacity of each mine is either the maximum level historically reached or annual mine output to meet the demand for integrated refinery planned.

Nickel supply from small-scale mines are flexible and export-driven

- Nickel is the second largest mining product by scale in Indonesia after coal. Historically, nickel production in Indonesia reached a peak of 804 kt in 2013 before the export ban was placed on unprocessed nickel ore which led to a significant decline in nickel production in the following years. As the result of the export ban, a significant amount of investment from Chinese companies went into developing nickel pig iron (NPI) production bases in Indonesia.
- In 2017, Indonesia began to increase its nickel production and export large volumes of nickel ore due to a relaxation of government policies. According to data from IHS Markit, Indonesia exported 20 million wmt of nickel ore in 2018 and 32 million wmt of nickel ore in 2019, compared to none in 2016 and only 4 million wmt of nickel ore in 2017. In addition, following the relaxation of the export ban, many producers commenced setting up fully integrated nickel pig iron and stainless steel production operations which place production plants close to the supply of low-cost nickel ores and low-cost captive power.
- In 2019, Indonesia's total mined nickel production was estimated to be 0.86 million tonnes of nickel, with Antam and Vale being the two largest producers, accounting for 24.7% of the total mined nickel production in Indonesia.

Historical Indonesia nickel production, 2000-2019 (,000 t)

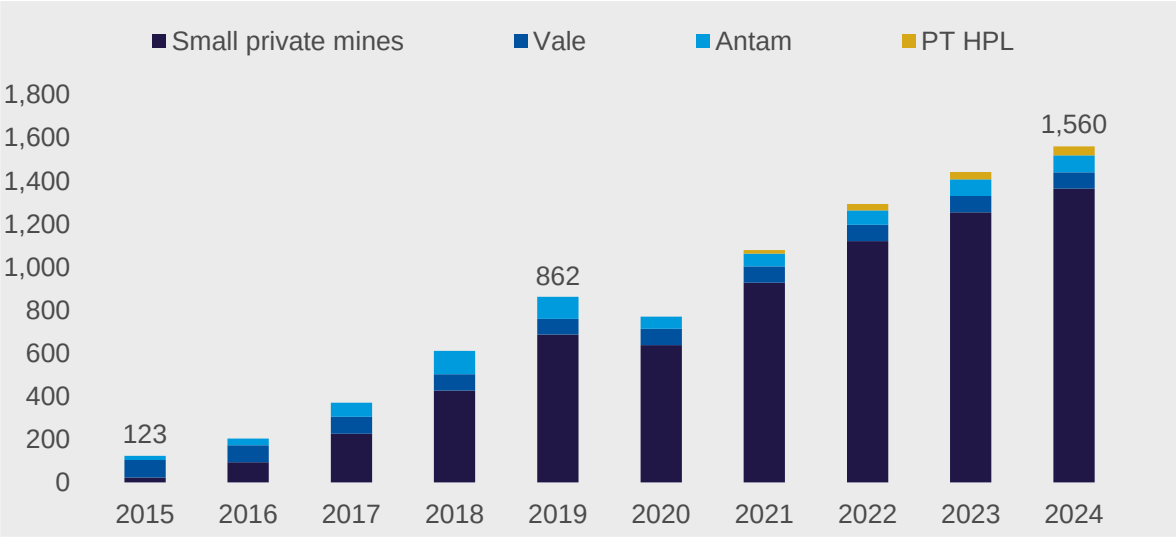


Data: CRU, ESDM One Map.

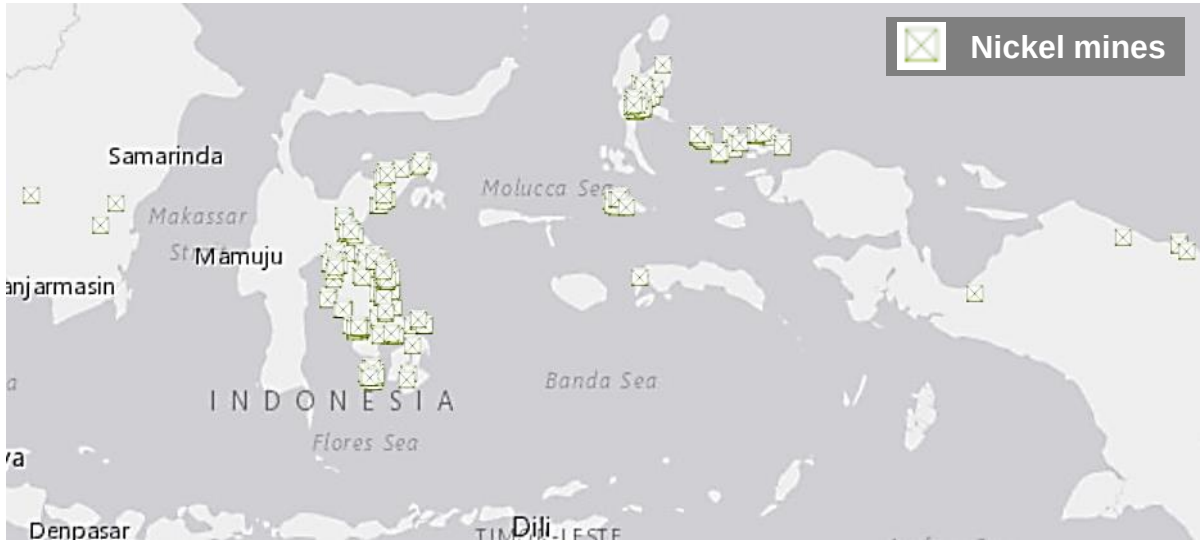
Strong supply growth from small-scale and private nickel mines

- In 2019, Indonesia was the largest nickel producer globally, accounting for 32.8% of global mined production. Similarly to bauxite mines, there are also a large number of small-scale “family-owned” nickel mines in Indonesia as shown in the map below, which are flexible with their production and hire contractors for laterite deposit mining.
- In the forecast period, CRU expects the nickel supply to increase from 862 kt in 2019 to 1,560 kt in 2024, as laterite resources are being exploited for the production of ferronickel and nickel pig iron (NPI) which are needed domestically (capacity invested in by Chinese companies) and in China for the steel sector and rising battery sector. Other major nickel producers such as Vale and Antam (which was estimated to hold 38.4% of the nickel reserve in Indonesia in 2019) will see limited growth in their nickel assets to 2024.
- Despite the strong growth in nickel supply from Indonesia, most of the growth will come from small privately-owned nickel mines, which typically vary their production based on market conditions and hire domestic contractors when needed. Therefore, the Indonesian sector is not expected to create significant opportunities for MIW METS exports.

Indonesia nickel ore production, 2015-2024 (,000 t)



Nickel mines that currently hold IUPs in Indonesia



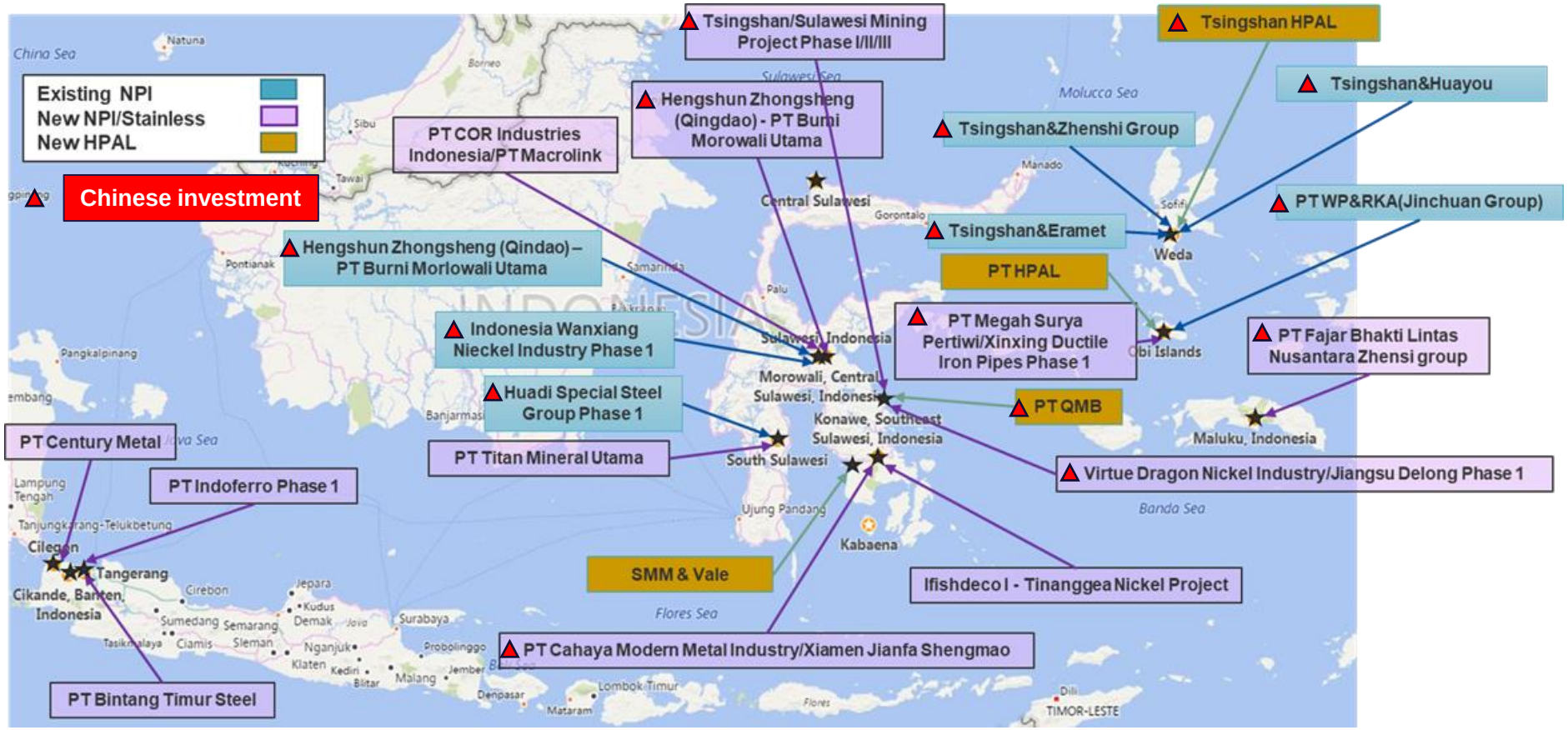
Data: CRU, ESDM One Map.

Indonesian nickel industry's exposure to Chinese investment

As discussed in previous slides, many producers have commenced setting up fully integrated nickel pig iron and stainless steel production operations in recent years, which are highly exposed to Chinese investment, as shown in the map below. Chinese companies, including Tsingshan, Virtue Dragon, Xinxing / Harita Group and Jinchuan are all within the top 5 ferronickel and NPI producers. These companies are all major consumers of nickel ores supplied by the aforementioned small private mines, which are unlikely to be viable for Australian METS.

Ferronickel and NPI production by company in 2019, '000 Tni in ferronickel

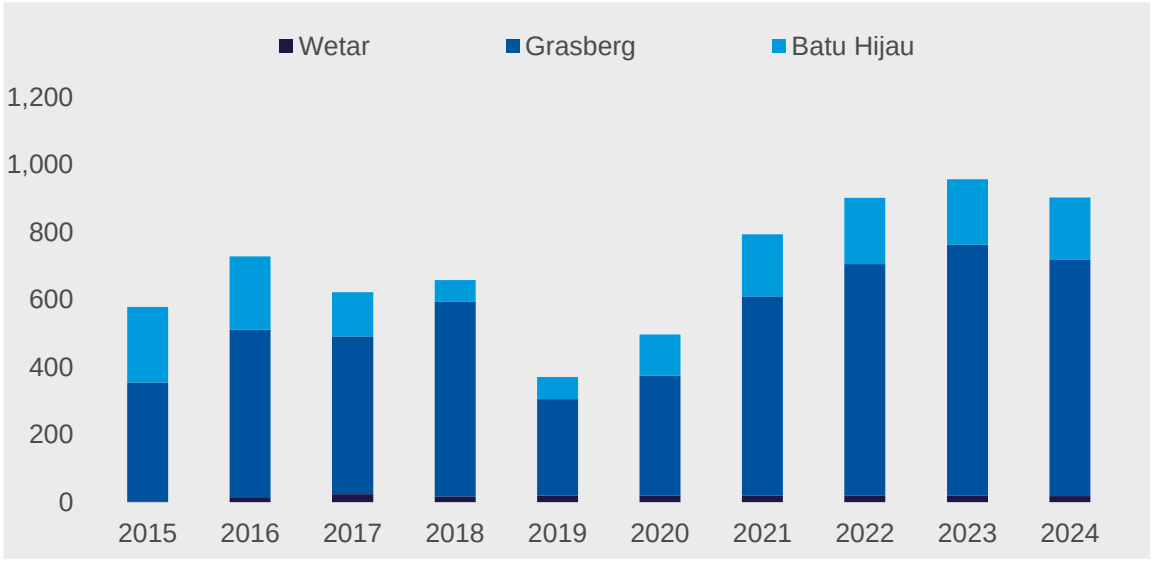
Operating Company	2019 Production (kt)
Tsingshan	229.8
Virtue Dragon Nickel Industry	63.0
Antam	26.9
Xinxing Ductile Iron Pipes / Harita Group	22.8
Jinchuan Group	7.2
PT Indoferro	6.0



Significant growth in copper supply led by block caves at Grasberg

- Indonesia is expected to grow its copper production from 2019 to 2024. There are currently three copper mines in CRU's project landscape, including Finders Resources' Wetar, PT Freeport Indonesia's Grasberg and PT Amman Mineral's Batu Hijau. Of these three, **Wetar** is expected to produce ~20,000 t copper annually after recovering from the COVID-19 pandemic. Elsewhere in Indonesia, we also expect to see strong growth from Amman Minerals' **Batu Hijau** mine as the phase seven cutback increases production towards 200,000 t/y in the medium term.
- At **Grasberg**, which is one of the largest copper mines globally, after the fall in production due to its transition from open pit to underground using block caving methods, the new block cave production is expected to ramp up swiftly. Production from the series of block caves is expected to climb back above 590,000 t/y by 2021; and on towards 745,000 t/y by 2023.
- Led by Grasberg, copper mine production in Indonesia is expected to grow significantly from 370 kt in 2019 to 903 kt in 2024.

Indonesia copper production, 2015-2024 (,000 t)



Indonesia copper operations

Data: CRU.

Copper operation & project overview

Asset name	Operator	Mine type	Processing route	Note
Wetar	Flinders Resources	Open-pit	Heap leaching, solvent extraction and eletrowinning (SX-EW)	Flinders has operated a sulphide heap leaching and SX-EW copper cathode demonstration plant on Wetar Island since 2009.
Batu Hijau	PT Amman Mineral	Open-pit	Copper concentrates	The mine is situated on a gold-rich porphyry deposit, which is mined via open pit methods and is accompanied by an on-site processing facility that produces copper concentrate. The mining unit facilities include extensive mining equipment, a processing plant with a 120,000 t per day capacity, an 112 megawatt coal-fired power plant, a port including a ferry terminal and an airstrip.
Grasberg	PT Freeport Indonesia	**Underground**	Copper concentrates	Freeport has operated block caves at Grasberg since 1980. In late 2019, Freeport ceased production from its open-pit mine and commenced production from its two new block caves – the **Deep Mill Level Zone (DMLZ)** and **Grasberg Block Cave (GBC)**. This adds to an existing block cave, the **DOZ mine** (currently at 20,700 t/d), which has operated since 2000, and a future block cave, **Kucing Liar**, which is scheduled to commence in 2025: • Production from the **GBC mine** commenced at the end of 2018. The ore flow system and underground rail line were installed during 2018. The GBC makes up approximately 50% of Grasberg's reserves and will run until the 2041 end of mine life. Targeted production rates at full capacity are expected to be within the range of 130,000 to 160,000 t/d which is expected to be reached in the next five years. • **DMLZ underground mine** commenced in December 2018 and produced at a rate of 30,000 t/d in Q3 2020. The mine is expected to reach full production rates of 80,000 t/d by 2022. The originally planned start-date for the DMLZ Mine, using the block caving method, was Q3- 2015, and the extraction rate was expected to be 60,000 t/d. However, technical challenges resulted in the delayed ramp-up of the mine. The operation suffered from mining induced seismic activity in 2017 and 2018. During the third-quarter of 2018, PT-FI commenced hydraulic fracturing activities to manage rock stresses and pre-condition the DMLZ for largescale production. While the results from the ongoing hydraulic fracturing used to manage seismicity and pre-condition the orebody have been effective, there remains a risk that these issues could re-emerge in the future.

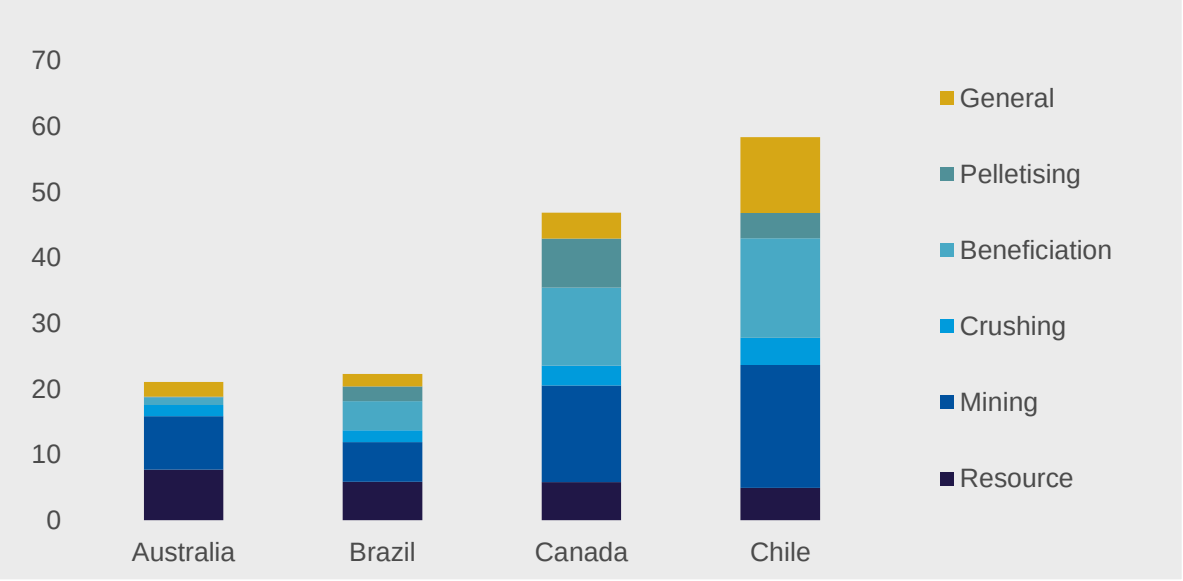
Note: CRU has also identified a potential copper project called KSK/Beruang Kanan owned by Asiamet. However, this project has been classified as Possible by CRU and is not expected to come online until 2025 based on CRU's understanding.

④ Cost analysis

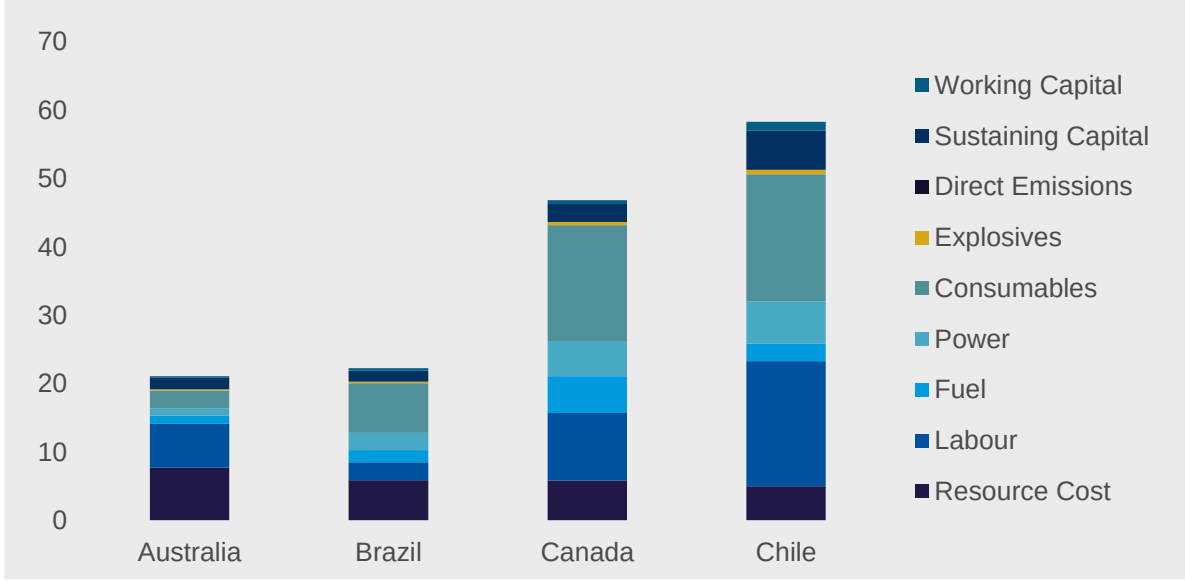
High site costs for Canada & Chile present opportunities for METS

- As Brazil and Australia are the two major iron ore producers with competitive cost positions, we have compared the cost position of relevant target markets with these two benchmark countries. The LHS table below lists the key drivers of total iron ore costs while the RHS chart presents only **site costs, which can generally be reduced/streamlined through investments** e.g. equipment or technology. Non-site costs are typically less impacted by METS goods/services.
- For both Canada and Chile, the two largest site cost components are **labour and consumables**. Consumables include a broad range of mining and non-mining related items, such as spares and parts for machinery, safety equipment for workers and food.
- Due to high costs in these categories, Canada and Chile's total cost is significantly higher than Brazil and Australia, despite high value-in-use. **This highlights a potential area of opportunity in these target markets for METS companies.**

Iron ore site costs by category in 2019, US$/t, real 2019



Iron ore site costs by drivers in 2019, US$/t, real 2019

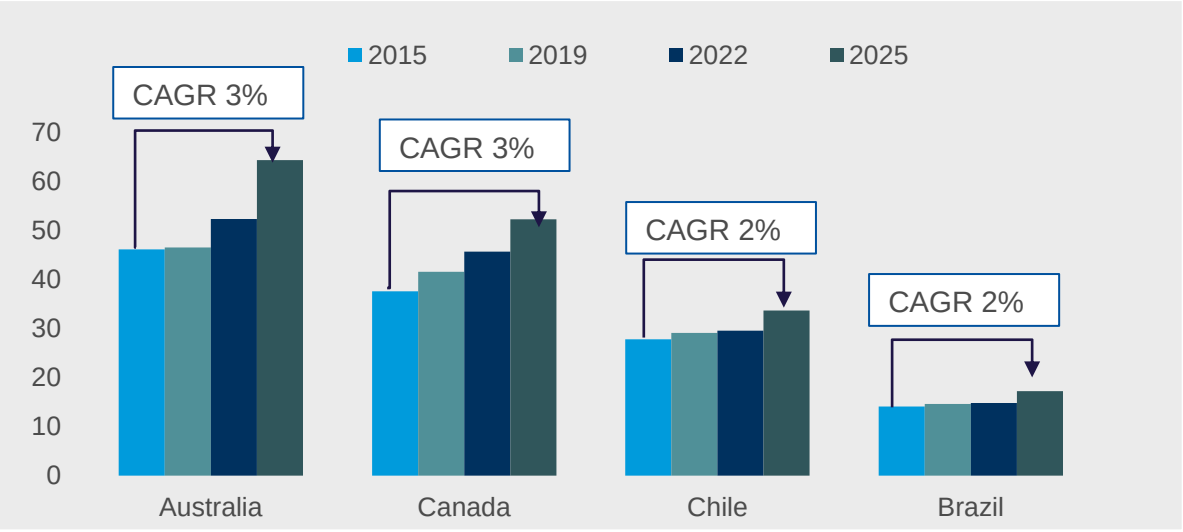


Technology is a key part in lowering overall labour costs

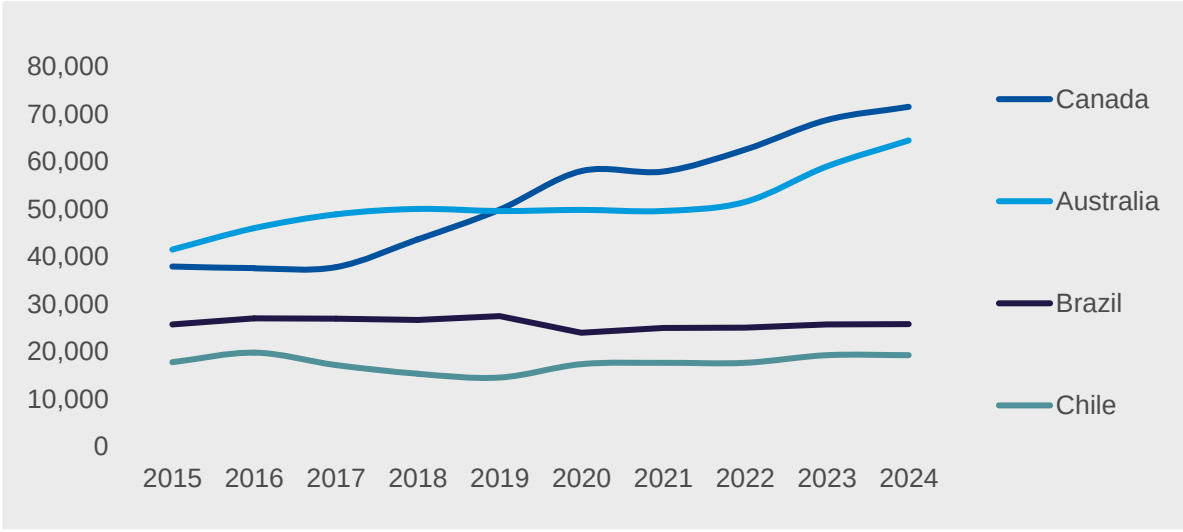
CRU's estimate of labour costs is a combined metric of **labour productivity / efficiency** (represented by labour productivity on the RHS chart) and **wage costs** (LHS chart).

- The unit cost of labour is fundamental, with more developed economies having higher hourly wage rates. As unit cost depends on macroeconomics and can not be easily improved from operation site, **technology** plays an important part in lowering overall labour cost by increasing productivity.
- The **geological characteristics** of deposits also influences the labour cost through the labour intensity required. Despite having high wage rates and slightly lower productivity than Canada from 2019, Australia is characterised by high quality direct shipping ore (DSO) ore bodies that require **minimal processing**, which explains the lower total labour costs compared with Canada, which have comparable wage rates, but lower grade ore bodies requiring more processing.

Wage rates comparison, 2015-30, US$/hour



Iron ore labour productivity in mining, 2015-30, t/FTE*

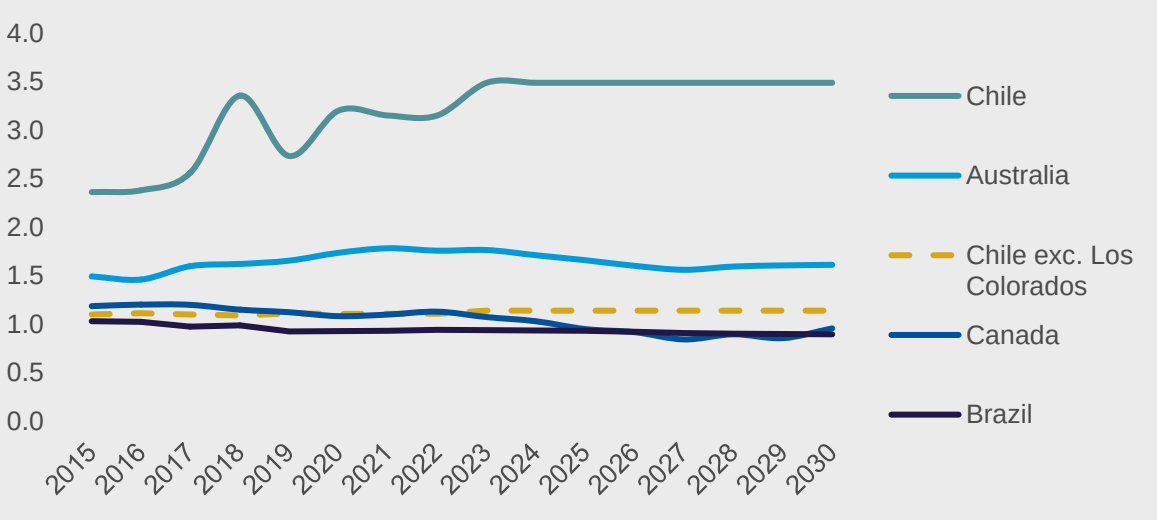


Note*: t/FTE = tonne of iron ore produced per unit number of full-time employee equivalents (FTE) that are employed

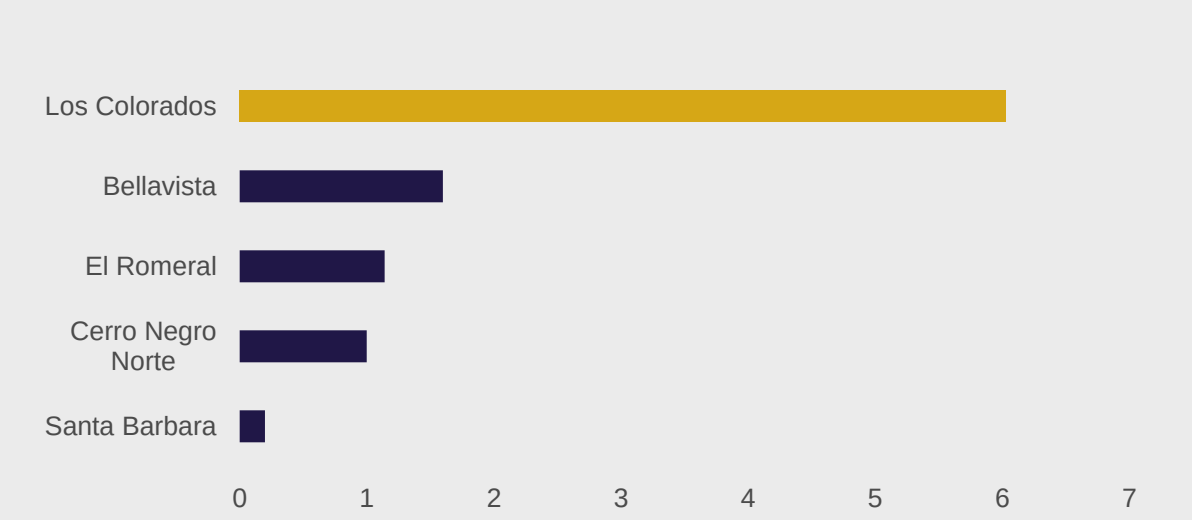
Stripping ratio is a key driver of mining costs, particularly for iron ore

- The majority of iron ore production is open-cut, therefore, the stripping ratio of a mine is one of the most important determinants of mining costs. The stripping ratio is defined as the ratio of waste rock that must be removed to mine one tonne of ore. This ratio determines the total amount of material that must be excavated and moved around the mine, affecting the workforce size, fuel usage and the size and number of the excavation and haulage fleet that must be deployed.
- **Canada's** country average stripping ratio has been low and steady since 2015 and is expected to decrease from 1.1 in 2019 to 0.9 in 2025.
- Chile's stripping ratio is significantly higher but it is heavily skewed by one mine, Los Colorados (see RHS chart below). Excluding Los Colorados, Chile's stripping ratio falls to a level close to that of Canada (yellow line on LHS chart).
- Both Canada and Chile have a stripping ratio similar to that of Brazil (one of the benchmark countries) indicating that this metric is at a competitive level. Stripping ratios are heavily determined by the geology of each deposit, **however the loading and hauling fleet is more controllable and may present METS opportunities.** This is explored further on the following slides.

Iron ore stripping ratio by country, 2015-30



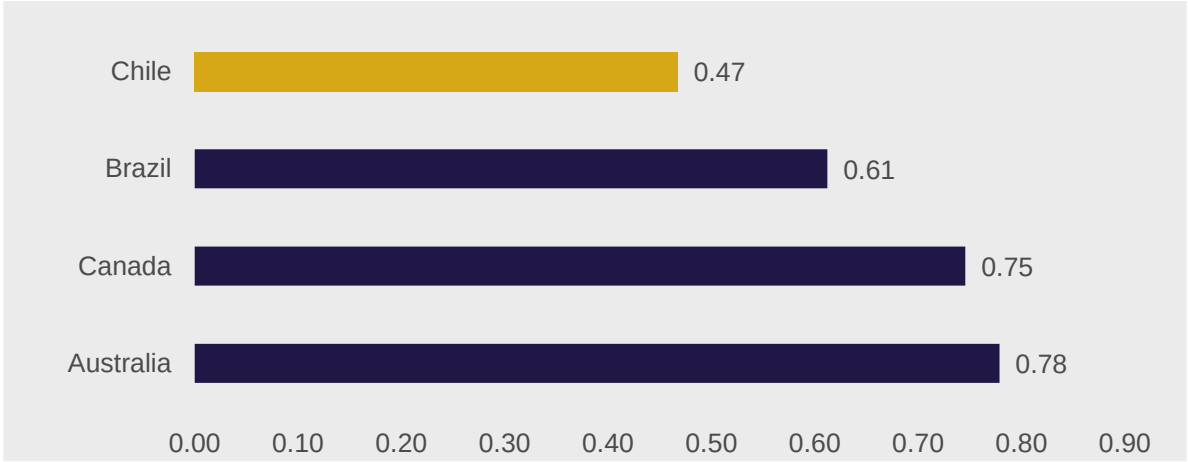
Iron ore stripping ratio in Chile by operation, 2019



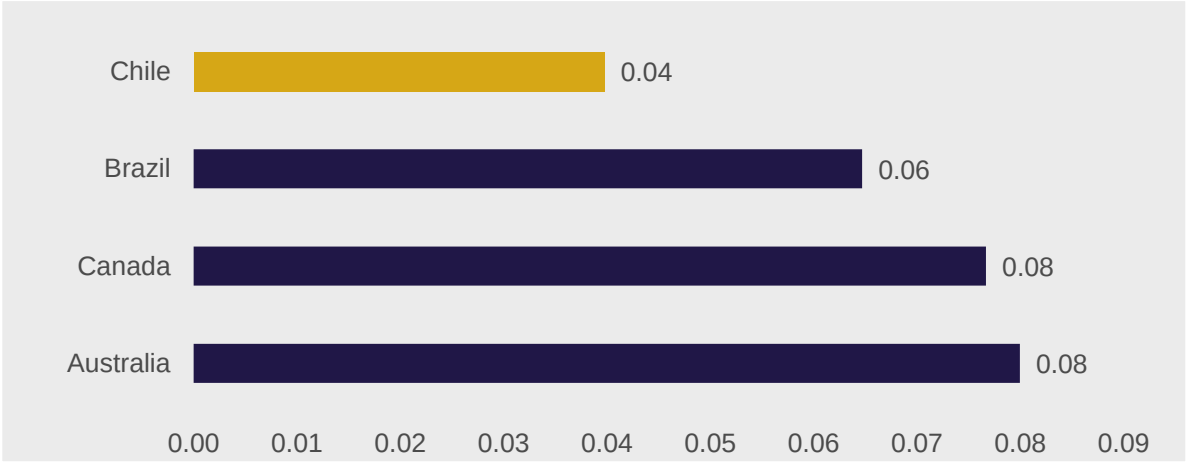
Chile's movement efficiency can be improved compared to Australia

- **Efficiency of equipment** when lifting and transporting ore and waste are measured by **haulage fleet efficiency** and loading fleet efficiency. For loading fleet efficiency (RHS chart) the formula is $\frac{Material\ movement}{Loading\ fleet\ capacity}$.
- The haulage fleet efficiency (LHS) is calculated in two steps:
  - 1. Measure the **absolute utilization rate** of haulage fleet: Mt of material movement per tonne of haulage capacity $= \frac{Material\ movement}{Haulage\ fleet\ capacity}$
  - 2. As the above step does not include the distance required for material to be moved (more important for haulage than loading), we also include distance for this metric: $\text{Efficiency} = \frac{Material\ movement}{Haulage\ fleet\ capacity} * distance$
- For both loading and haulage fleets, **Chile has the lowest efficiency and thus METS exporters may have a good opportunity** to help improve the efficiencies with Australian equipment or analytical services on current equipment.

Loading fleet efficiency for *representative* iron ore mines, Mt of material movement per m^3 of loading capacity, 2019



Haulage fleet efficiency for *representative* iron ore mines, kmMt of material movement per haulage capacity, 2019

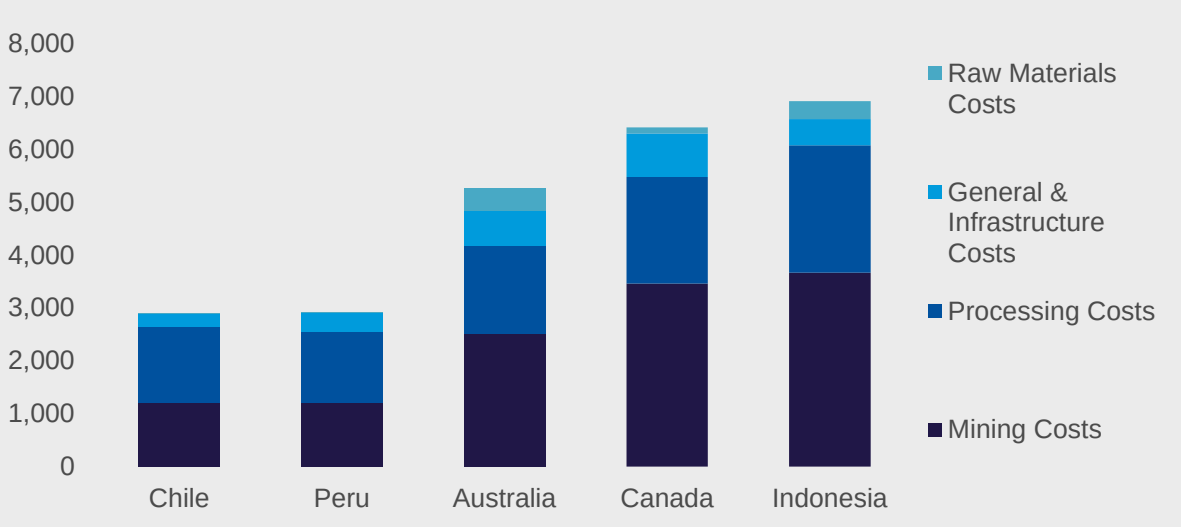


Note: For each of the key markets, a mine operation that is representative (with business cost close to the country level average) is chosen.
Chile: Cerro Negro, Brazil: SES - IC - Cauê + Tubarao I & II, Canada: Mt Wright, Australia: Mt Newman.

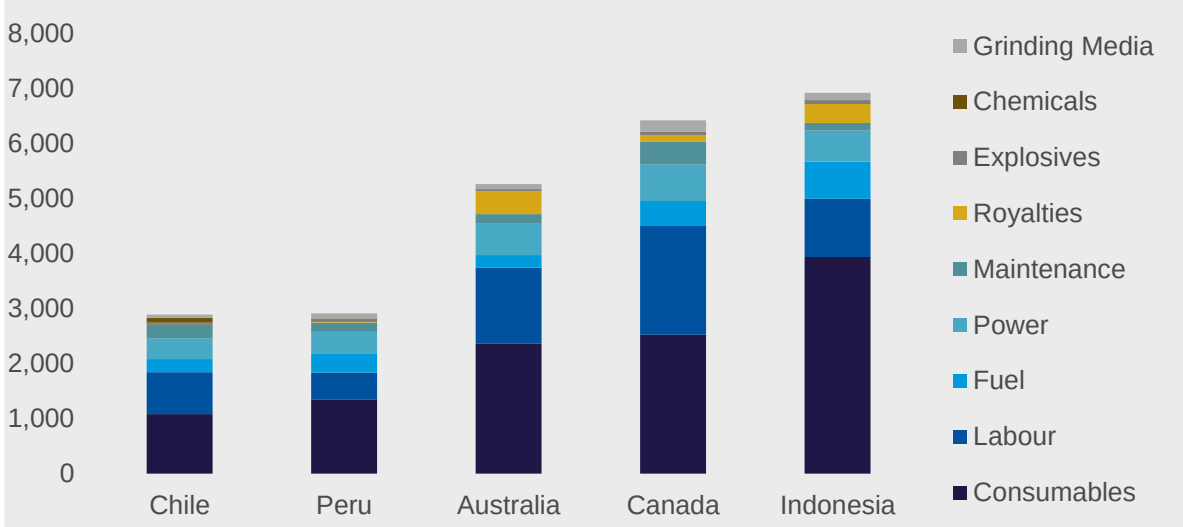
Canada & Indonesia are disadvantaged due to mining & processing costs

- Chile is the largest copper producer globally, accounting for 28% of global production capability. The cost position of Chile is also the most competitive among the major producers. However, if we take into account by-product credits, Chile's cost position is much less competitive.
- The site cost of copper mines shows that both Indonesia and Canada have high mining costs and processing costs of $3,664/t and $3,460/t respectively, which provides room for METS exporters to potentially assist.
- It is worth noting that some copper mines produce high value by-products such as gold and silver, which add **by-product value** which can significantly reduce overall costs. Canada's total cost (cash cost after by-product credit) is negative for example. As such, Canadian producers will be less inclined to invest in products or services to reduce site costs, unlike Indonesia.

Site cost by process in 2019, US$/t



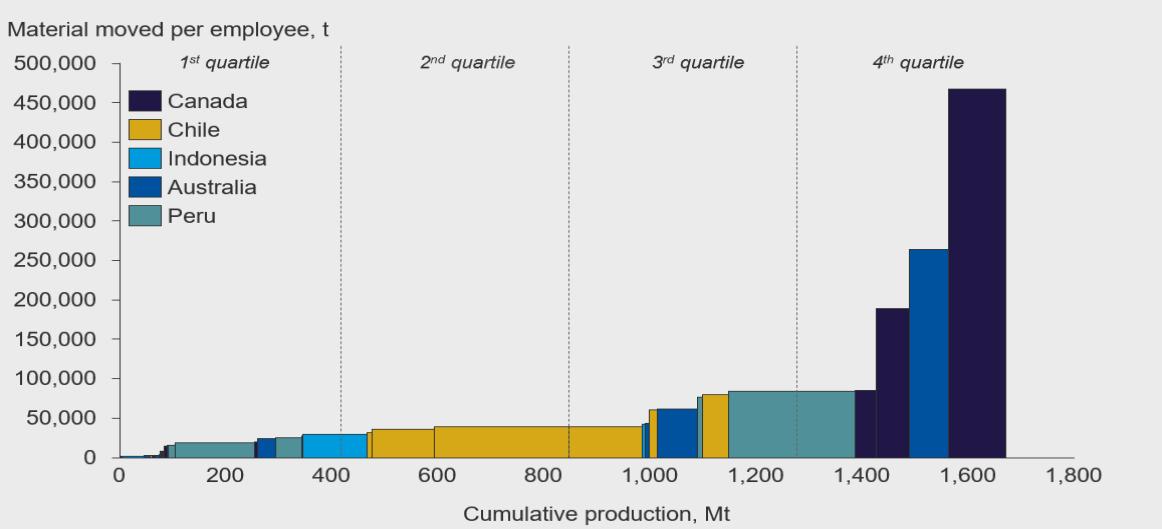
Site cost by drivers in 2019, US$/t



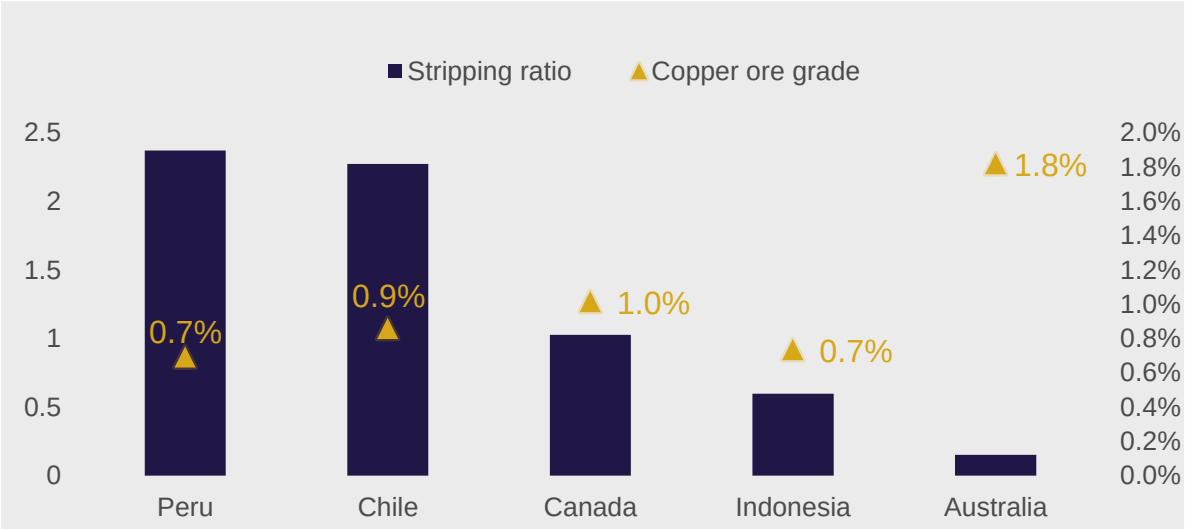
Wage inflation & labour issues in Chile adds instability to costs

- **Chile** and Peru are the largest copper producer and sit at a very competitive cost positions. A large part of this cost competitiveness comes from low labour costs, which offsets the relatively low labour productivities. The LHS chart below shows that Chilean labour productivities are concentrated in the 2nd quartile and lower 3rd quartile, suggesting some room to improve. Also, the unstable labour situation and thus potential reform in Chile adds instability to the costs.
- **Indonesia** also has low wage rates currently but its labour cost is still significant due to low labour productivity. In the next five years, CRU forecast the wage inflation in Indonesia to be high (CAGR 8.2%), which will further decrease the country's labour cost competitiveness.
- **Canada** has similar wage rate levels to Australia and has even higher productivity, but still has much higher costs than Australia. This is likely because Canada's operations generally have higher stripping ratios and much lower ore grades, which adds to a higher mining and conversion cost.

Labour productivities in 2019, t material/ employee



Stripping ratio and copper ore grade in 2019, weighted average



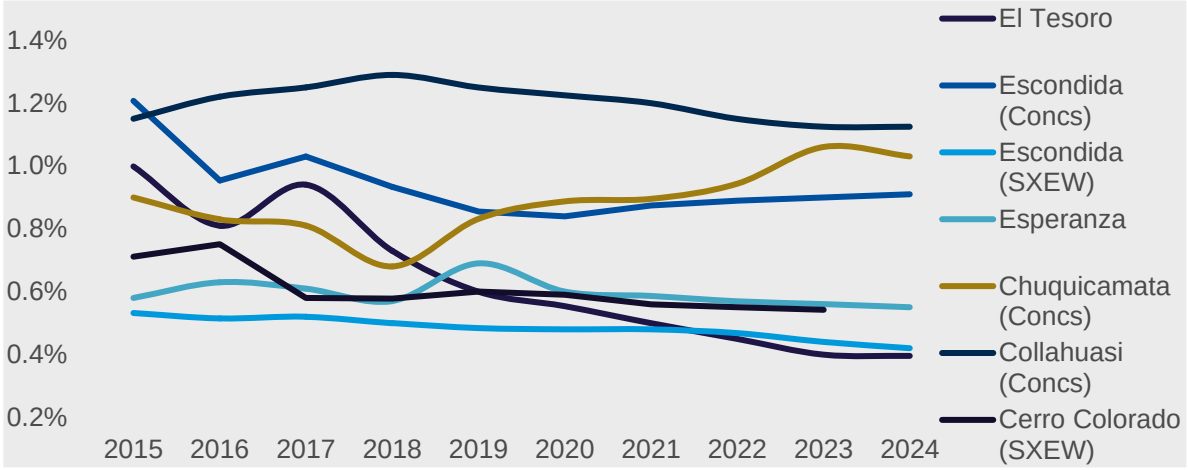
Technology developments in copper mining

- Technology is playing an increasingly important role in complex operational environments, for example through predictive models for caving propagation, subsidence geometry, and material flow with real-time data. Two of the key technologies in copper mining are:
  - **Block cave mining**

    Over the last couple of decades, an increasing number of open pit mines have transitioned underground to block caves due to a sustained **decline in copper grades** (namely in Chile [see chart], Peru and Australia) and the depletion of near surface ore bodies. A detailed overview of block cave mining will be presented in the following slides.
  - **Automation and machine learning techniques:**

    Automation is becoming more common, especially in regions with higher wage costs or expected to experience wage inflation. In Chile, the potential labour reform might have a long-term effect on promoting autonomous trucks and loaders, as current caving and open pit mines are very suitable for highly automated equipment. Advanced ore sorting technology is also becoming more common.

Copper ore grades of selected Chilean mines, %



Automation examples of major miners

Operator	Mine	Use
BHP	Oak Dam copper asset	Ore discoveries
Vale	Coleman nickel-copper mine	Explore for new areas to drill
Codelco	Several aging mines	Digital transformation

Automation initiatives in Chilean mining

Chile's mining industry is moving quickly towards automation, especially in areas such as communication, safety and process controls. Large companies such as Codelco and Anglo American have already started to implement these technologies. Some examples are provided below.

Codelco	Description
Concentration plant automation	This initiative has permitted Codelco to reach high levels of concentration plant automation in Chuquicamata, Ministro Hales, Salvador, Andina and El Teniente Divisions.
Geological information - best practice transfer	Standardization and automation of the capture, storage, access and management of geological information.
Remote operation of high risk activities	Implementation of a robotic system operated remotely to identify rock instability after blasting operations in the Andina division.

Anglo American	Description
Mining operations	Implementation of a truck tracking system, high precision GPS, geomechanical monitoring and anti-collision systems.
Processing plants (including refining plants)	Implementation of instrumentation for online mineralogical monitoring and artificial vision for granulometry measurements in conveyor belts and froth flotation. Real time databases and automated rick crushers and cathode harvesting robots.

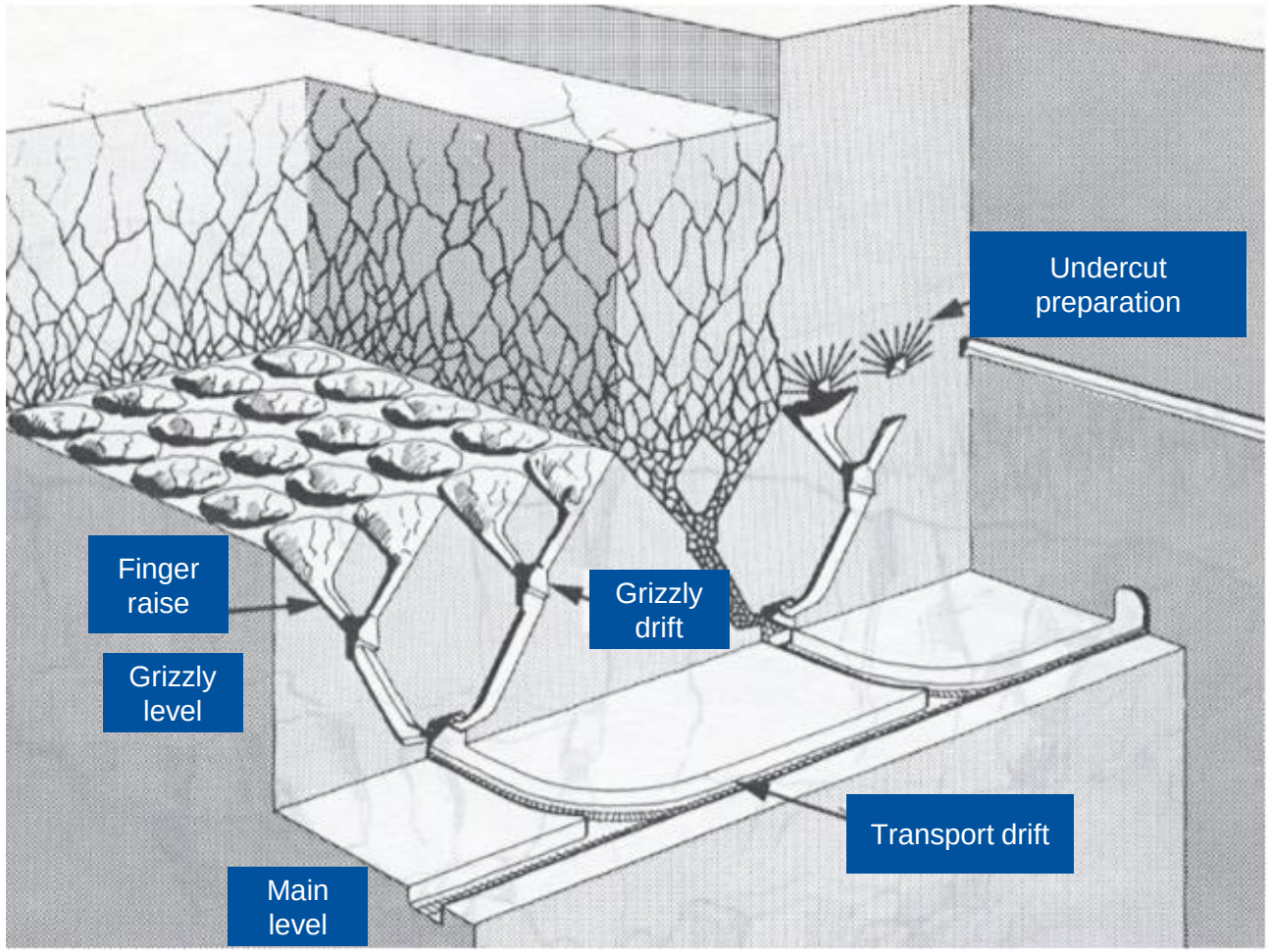
Overview of block caving

- Block caving is an underground mining technique that allows for the bulk extraction of **large**, relatively **lower grade ore** deposits with substantial vertical dimension.
- Interest in block cave mining has been increasing for the following reasons:
  - The depletion of near surface orebodies.
  - The **operation cost** of block caving is significantly lower than traditional underground mining techniques.
  - Open pits often have a continuation of the orebody below their economic depth. Extracting these ores using traditional mining methods is not economic.

Block caving process

- The technique involves undercutting a large section of ore by drilling and blasting, which then starts to collapse under gravity.
- The broken ore falls into a series of pre-constructed funnels, known as drawbells. The ore is then removed from access tunnels underneath the caving rock mass.

Graphic illustration of block cave mining



Block cave mining in **Indonesia & Chile**

- Block cave mining is the proposed mining method for a growing number of significant copper projects that have recently commenced or are currently under development.
- The operations and projects under developments in the target markets are listed in the table below.
  - **Chile:** Codelco, the owner of the Chuquicamata mine and El Teniente NML project, has operated block caves at El Teniente in Chile for decades.
  - **Indonesia:** In late 2019, Freeport ceased production from its open pit mine and commenced production from its two new block caves – the Deep Mill Level Zone (**DMLZ**) and Grasberg Block Cave (**GBC**). This adds to an existing block cave, the **DOZ** mine, which has operated since 2000, and a future block cave, **Kucing Liar**, which is scheduled to commence in 2025.

Copper block cave operations - current and under development

Country	Mine	Owner	Production (‘000t/d)	Status
Indonesia	Grasberg – DOZ	PT – Freeport Indonesia	38	Operating
Indonesia	Grasberg – DMLZ	PT - Freeport Indonesia	80 by 2022	Operating
Indonesia	Grasberg – BC	PT - Freeport Indonesia	130 in 4 years	Operating
Indonesia	Grasberg – Kucing Liar	PT - Freeport Indonesia	100	Project
Chile	El Teniente	Codelco	95	Operating
Chile	Chuquicamata	Codelco	140	Operating
Chile	Andina Expansion	Codelco	N/A	Approved
Chile	Los Bronces	Anglo American	N/A	Planed

Block cave mining in **Canada**

- Currently in Canada, New Afton is the only operating copper mine with block caving technology. The mine was developed between 2007 and 2012, and mill production commenced in 2012 with ore from the West Cave.
- **Projects**
  - **New Afton:** in February 2020, New Gold completed a Feasibility Study (FS) for the exploitation of the C Zone using block cave mining. The C Zone is a continuation of the New Afton copper-gold deposit, extending along strike and down plunge from the zones being mined. Production from the C Zone is expected to start in 2023, with LOM production of 338,244 t of copper and 917,800 oz of gold, from Q3 2024 to 2030.
  - **Red Chris:** Newcrest is planning a block cave mine as part of its two stage transformation of its Red Chris mine in Canada. Stage 1 of Newcrest's plans involves optimisation of the existing mine and process plant, supply chain improvements and resource extension. Stage 2 involves applying Newcrest's technological expertise in a number of areas, including block caving. A Block Cave concept study was recently completed, based on Imperial Metals' historical drillhole database. A Pre-Feasibility Study (PFS) is now being undertaken on the East Zone, as well as an early works program.

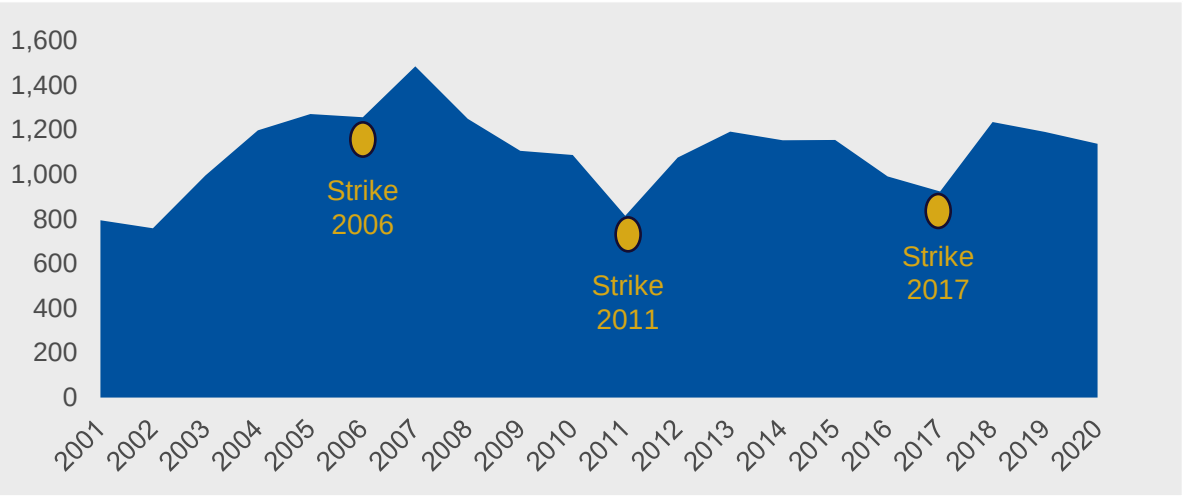
Copper block cave operations - current and under development

Country	Mine	Owner	Production ('000t/d)	Status
Canada	New Afton	New Gold	15	Operating
Canada	New Afton - C-Zone	New Gold	13.3	FS (2020)
Canada	Red Chris	Newcrest Mining	N/A	Planned
Canada	Kemess Underground	AuRico Gold	N/A	Updated FS (2016)

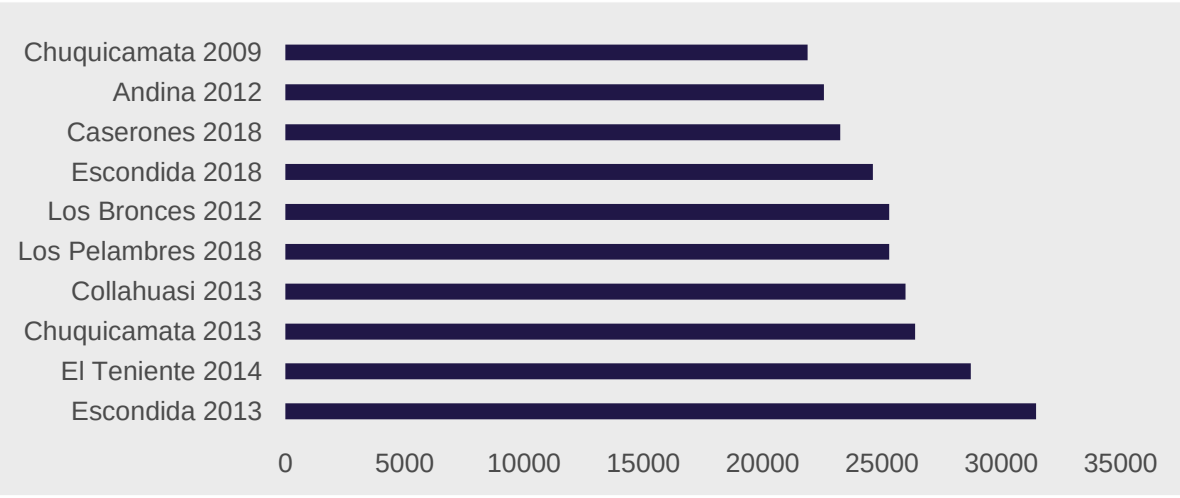
Recurrent contract negotiations drive Chilean labour costs

- Chilean copper producers are highly exposed to labour, which accounts for around 25% of conversion costs. This high share is mostly due to wages that have put upward pressure on the cost structure of Chilean mines. Power and fuel, account for 20% of overall conversion costs, in line with the global average of 23%.
- Although the gap is decreasing, mining salaries in Chile are 68% higher than the country's average. This is mainly due to the **high level of unionization*** in the Chilean mining industry, at 34.8%, more than 20% above the country average of 13.2%. Union strikes are common in Chilean mining, where workers renegotiate salaries, benefits and monetary "end of conflict" bonuses that sometimes ascend to millions of Chilean pesos (see RHS chart).
- Historically, labour contract negotiations and associated strikes do not tend to meaningfully impact production, although there are noticeable exceptions, such as Minera Escondida's 2006, 2011 (coupled with a mineral grade reduction) and 2017 strikes, as shown in the chart.
- There is a thick pipeline of Chilean labour contract negotiations in 2021 (see Appendix for further details) and the mere threat of a strike can, as is arguably the case currently, can give support to copper prices.

Minera Escondida Production '000 t



Ranking of end of conflict bonuses, USD

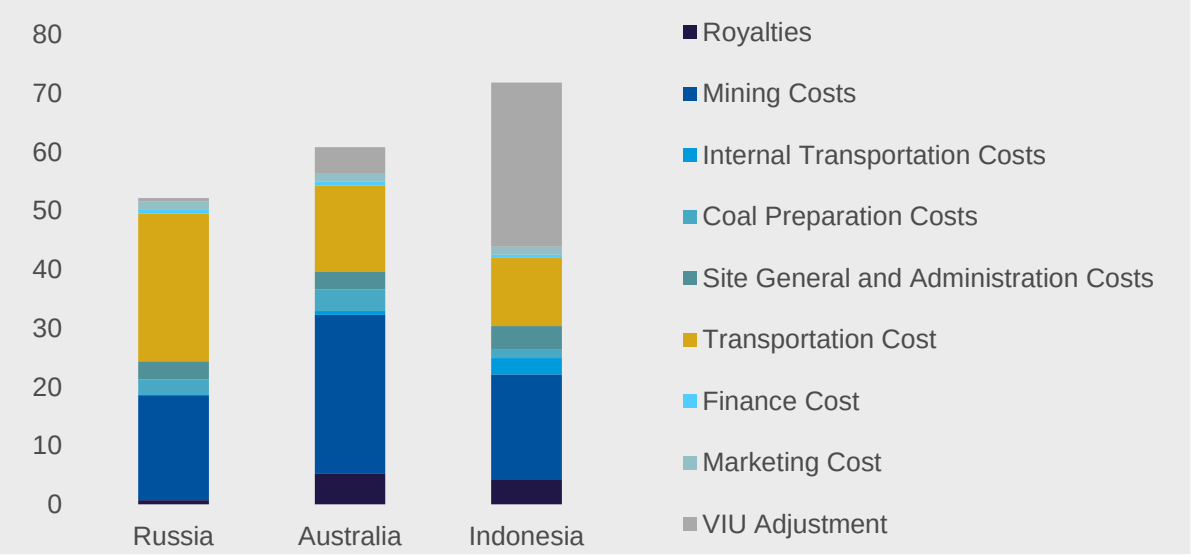


Data: CRU, CASEN. *Percentage of workers who are members of a union.

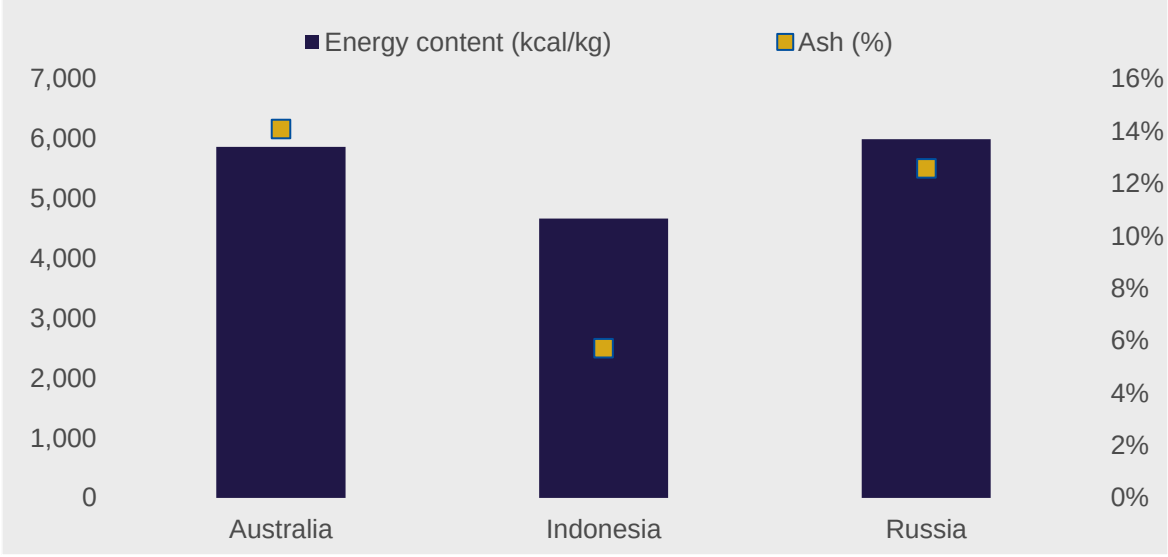
Indonesian supply is disadvantaged due to the low coal quality

- Australia and Russia are included in the following cost analysis as 'benchmarks' as they are two of the major thermal coal exporters.
- Value-In-Use ("VIU") adjustments accounted for most of Indonesia's thermal coal business costs (~39%) in 2019. The high VIU adjustment significantly increased Indonesia's thermal coal business costs to a level that is higher than Australia and Russia's thermal coal production, according to CRU's cost analysis at a country average level.
- This high VIU penalty is attributed to the low energy content of Indonesian coal compared to the 6,000 kcal/kg benchmark, as shown in the chart below. The Indonesian industry is characterised by high volumes and low margins. While the energy content is low, in-situ ash is extremely low and this saves on washing costs and makes the coal desirable to Indian and Chinese consumers for blending purposes.
- As margins are typically low, even during spells of strong demand, profitability is often squeezed as benchmark prices decline. As a result, Indonesian miners are relatively flexible and ramp production up and down through different price cycles.

Business cost by category in 2019, US$/t, real 2019



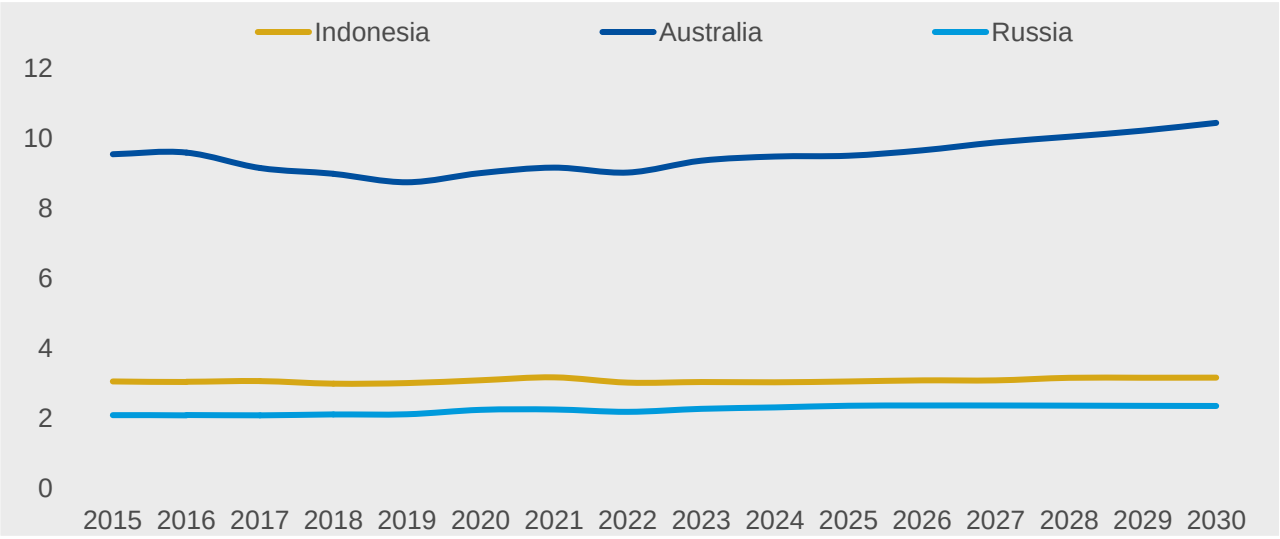
Thermal coal quality in Indonesia, Australia & Russia



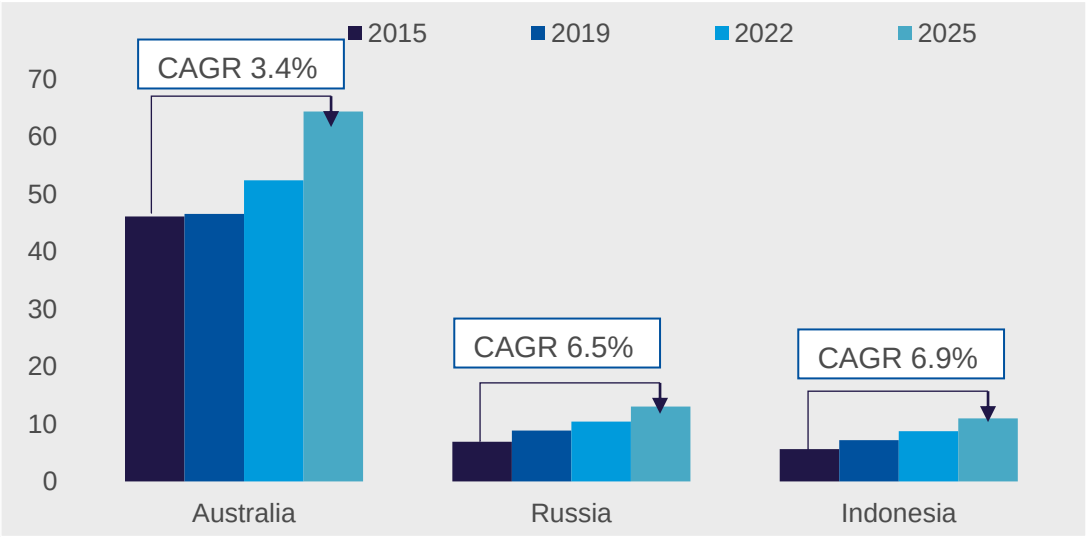
Indonesia's low labour productivity and expected wage inflation

- Labour costs vary substantially from one country to another. The primary driver of average wages is the economic development of a country and overall supply of labour. We estimate that average salaries in Australia are 6-7 times higher than Indonesia in US$ terms. This, in turn, encourages massive discrepancies in the amount of people employed at coal mines.
- In Australia, labour is very expensive and, over the years, this has resulted in high levels of mechanisation and labour efficiency, whereas in countries where labour is relatively cheap, such as Indonesia, mechanisation and labour productivity are low, as demonstrated in the LHS chart below. While wages are higher in more economically advanced countries, wage inflation is strongest in lesser developed countries. In Indonesia, we estimate that salaries in the coal industry will rise by nearly 6.9% CAGR from 2015-24, while in Australia wage inflation will increase by around 3.4% CAGR over the same period.
- Therefore, with low labour productivity and higher wage inflation, the mining costs for Indonesian thermal coal will potentially rise, and **more advanced mining technology/higher mechanisation could play a more significant role in Indonesian coal mining.**

Labour productivity in Indonesia, Australia and Russia, 2015-2030 ('000 t/person)



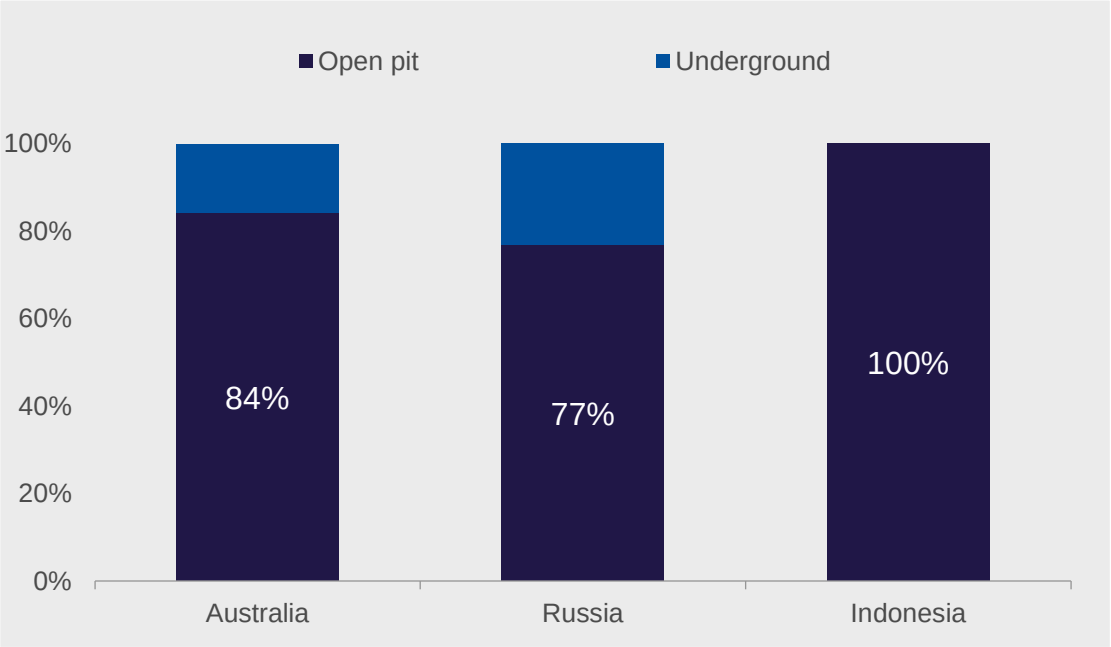
Wage rates comparison, US$/hour



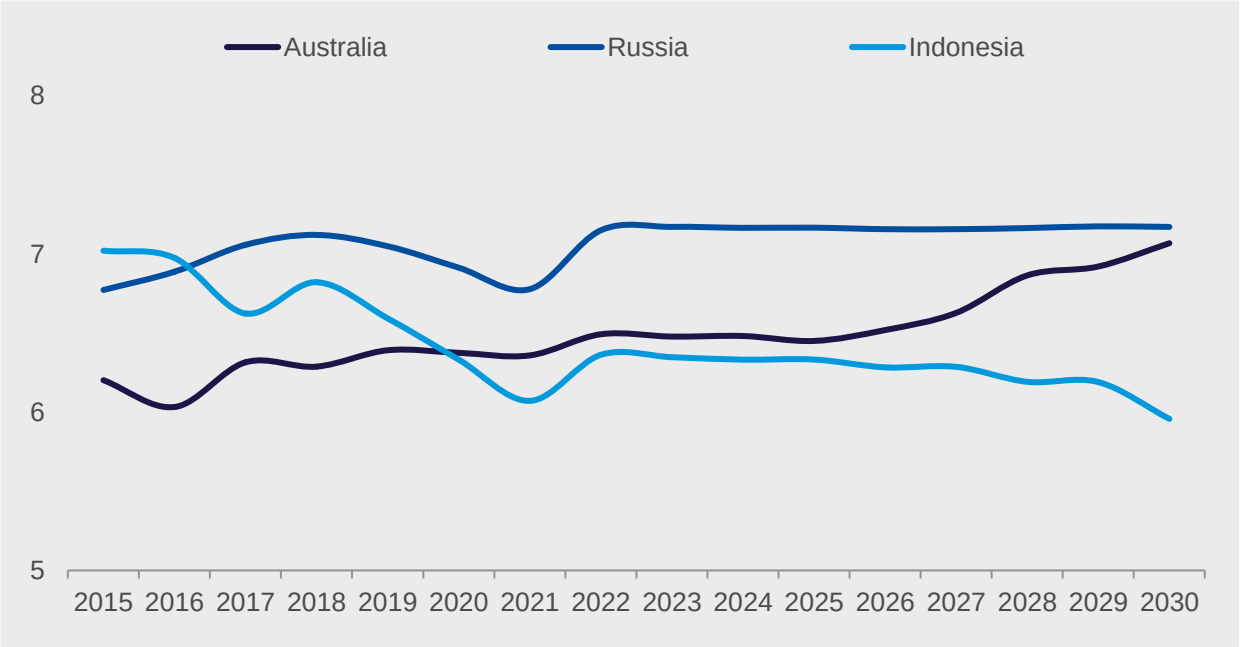
Average stripping ratios expected to decline in Indonesia

- Similarly to iron ore mining, most thermal coal operations are open-pit as shown in the chart below. Therefore, the stripping ratio of a mine is one of the most important determinants of the cost of mining.
- Of the three countries analysed (Indonesia and the two benchmarks), geological conditions are worsening most quickly in Australia, with the country average stripping ratio forecast to increase to ~7.1 by 2030, from around 6.3 currently. Russia's ratio is also expected to increase moderately to ~7.2 in the long term.
- On the other hand, in Indonesia, the stripping ratio is forecast to decline to below 6 by 2030 from ~6.6 in 2019, due to a larger pool of new projects that have relatively low stripping ratios.

Open-pit/underground shares of thermal coal mining by country, 2019



Strip ratio by country (run-of-mine basis, BCM/t), 2015 - 2030

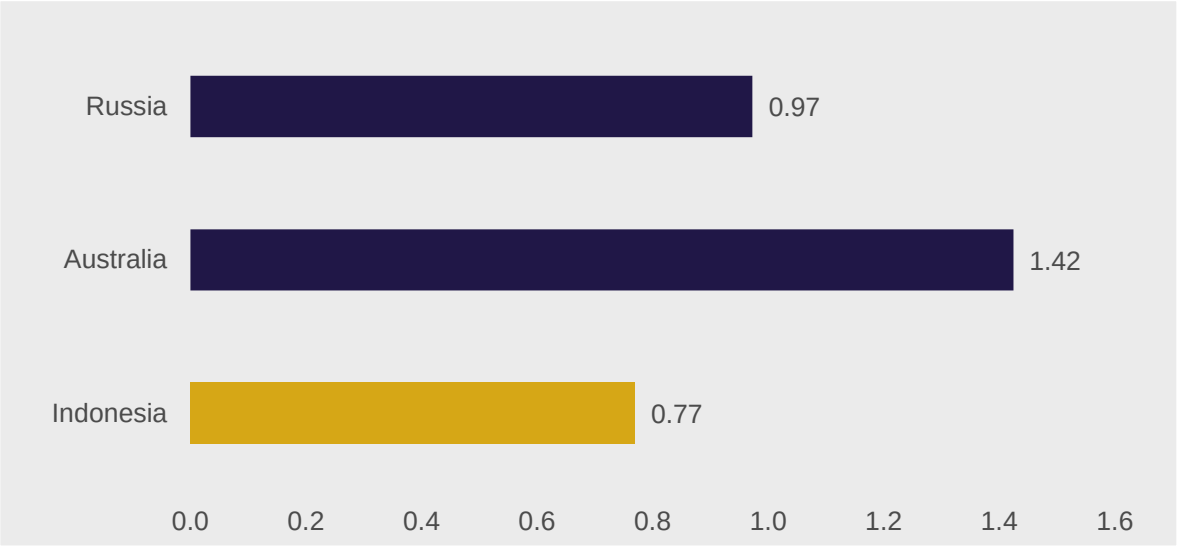


Note: Bank Cubic Metre (BCM) is a measure of overburden removed in mining operations. Equivalent to one cubic meter of material in its undisturbed condition.

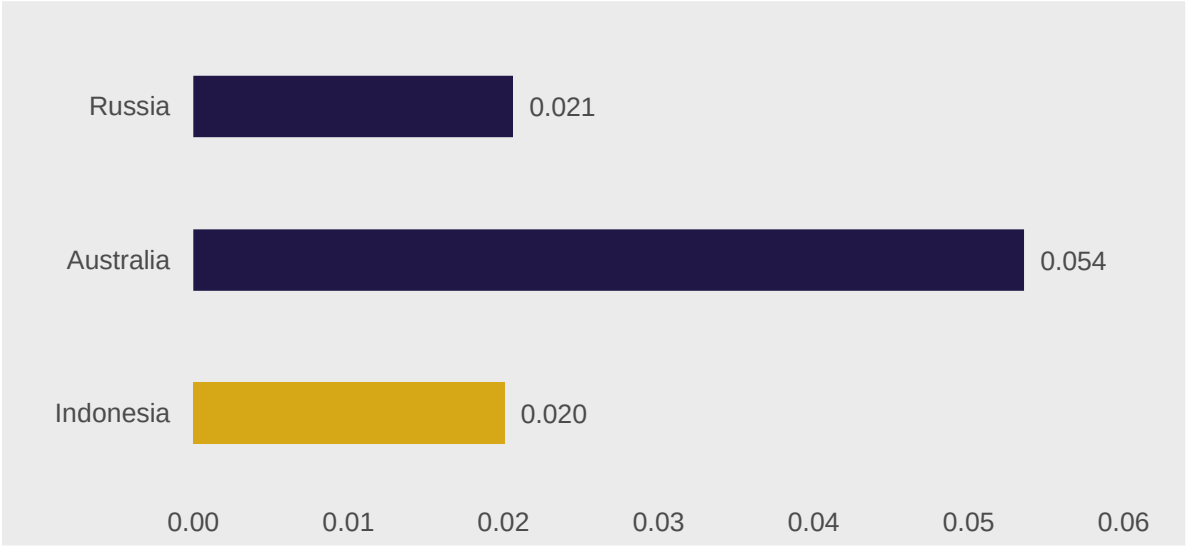
Thermal coal loading and haulage fleet efficiency is low for Indonesia

- The representative Indonesian **loading** fleet efficiency is well below the Australian benchmark, disadvantaging its mining costs. Therefore, the use of MIW's METS capabilities in bulk material handling could potentially help to improve the utilisation rate and efficiency of loading fleets of Indonesian mines. Particularly given the MIW region's coal expertise.
- The **haulage** fleet is also, on average, less efficient than Australia and Russia, as indicated by the lowest haulage fleet efficiency within these three countries. Similarly to the loading fleet, this suggests that the haulage fleet could be another potential area for improvement and cost reductions for Indonesian thermal coal operations which could be supported by MIW METS providers.
- In addition, Russia also has low efficiencies for both loading fleet and haulage fleet, potentially due to low labour productivities and less efficient technologies implemented on site.

Loading fleet efficiency for _representative_ mines, Mt of material movement per m^3 of loading capacity, 2019



Haulage fleet efficiency in _representative_ mines, kmMt of material movement per haulage capacity, 2019

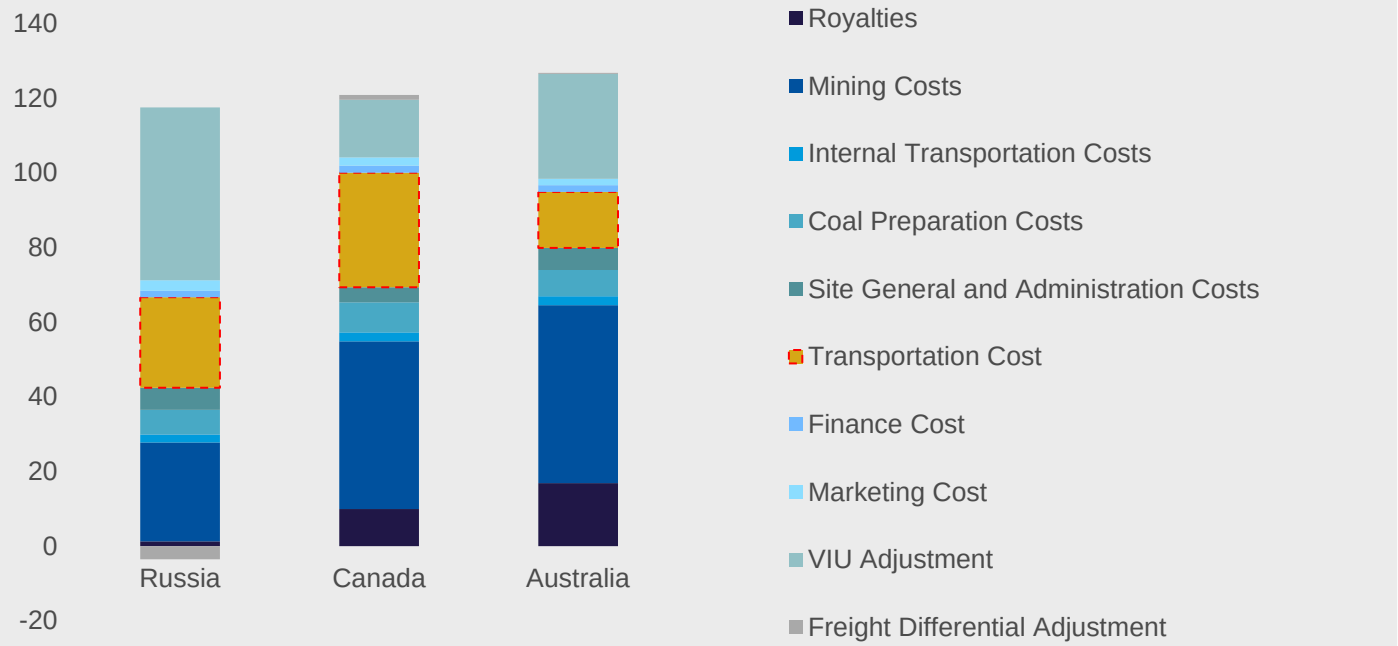


Note: For each of the key markets, a mine operation that is representative (with business cost close to the country level average) is chosen.
Russia: Elga; Australia: Ravensworth Operations; Indonesia: Kimco Armindo.

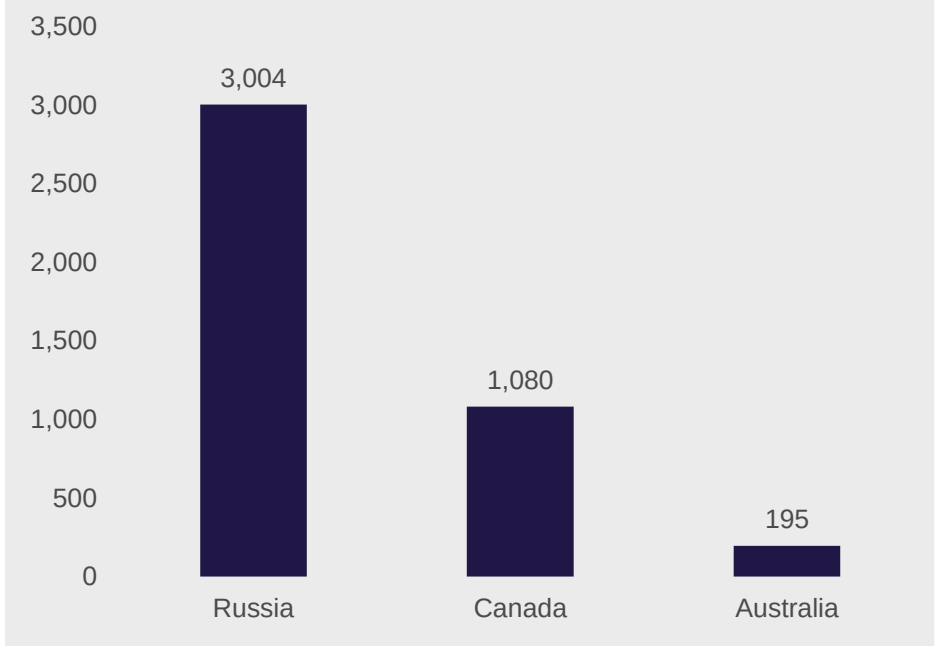
Canada's met coal supply disadvantaged by high transportation costs

- Australia and Russia are included in the cost analysis as 'benchmarks' as they are two of the major metallurgical coal exporters.
- Overall, Russia, Canada and Australia, as three major seaborne met coal suppliers, have similar overall business costs despite differing shares for the major cost categories. By cost category, Canada has the highest transportation costs out of the three major metallurgical coal exporting countries below, despite Canada's lower rail distance than Russia (as coal transportation is subsidised in Russia).
- Canada has relatively high mining costs, due to high labour costs and fuel costs, which will be further explained in the following slides.

Metallurgical coal business cost by category in 2019, US$/t, real 2019



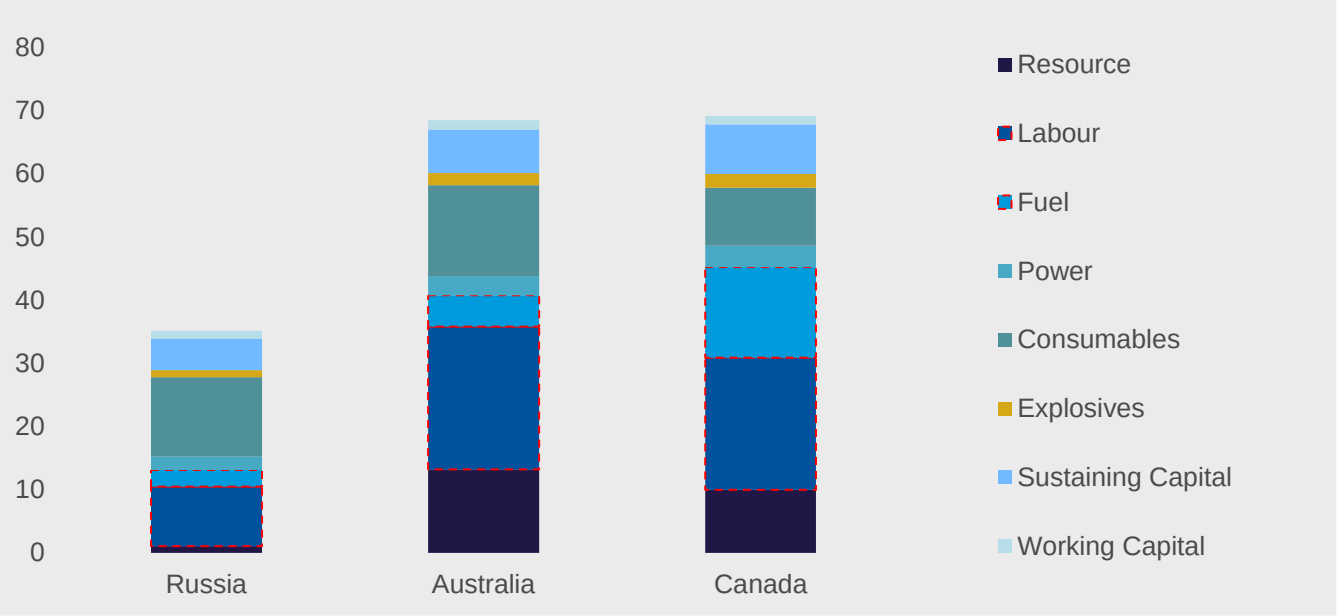
Rail distance from mine site to port for ship loading, km



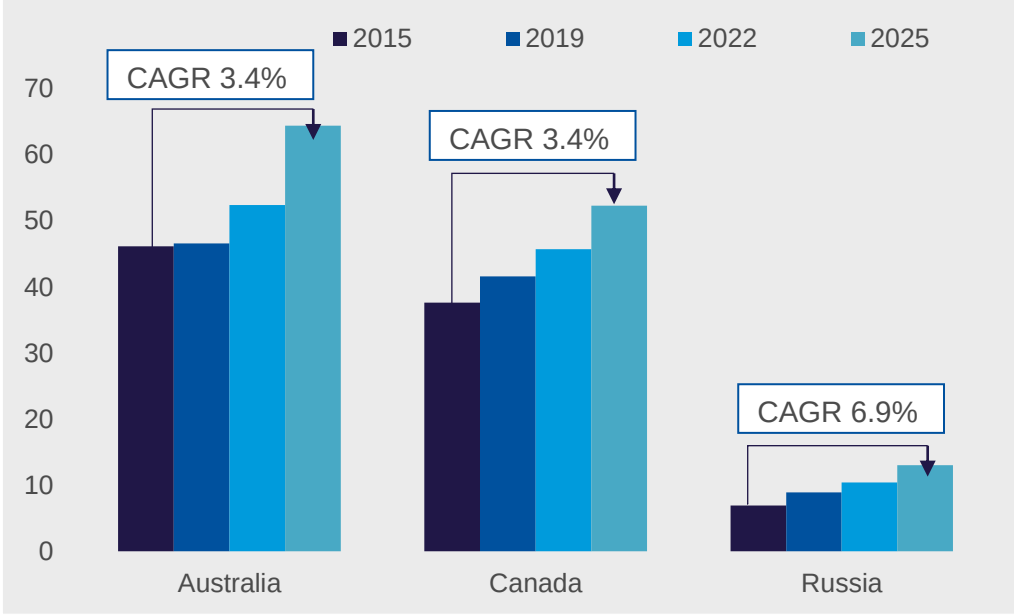
Canada's mining costs are high due to labour rates and fuel costs

- Canada's met coal site costs have a relatively high fuel cost share compared to Russia and Australia. This has been attributed to the high share of renewables (~80%) in the power mix, in particular hydropower. In addition, due to high wage rates and expected wage inflation in future, high level of mechanisation have been implemented in Canada and will continue to play a significant role in the future, in order to offset high wage rates and maintain labour costs at a reasonable level.
- Overall, CRU understands that METS opportunities amongst Canadian metallurgical coal producers are likely to be limited in terms of cost optimisation, as the high mining costs are largely due to the country's high wage rates, high share of renewables in its power mix and the geographical location of mineral reserves (high transport costs), all of which are beyond the remit of METS providers. However, looking forward, the development of new projects will likely require METS company support.

All product site costs by category in 2019, US$/t, real 2019



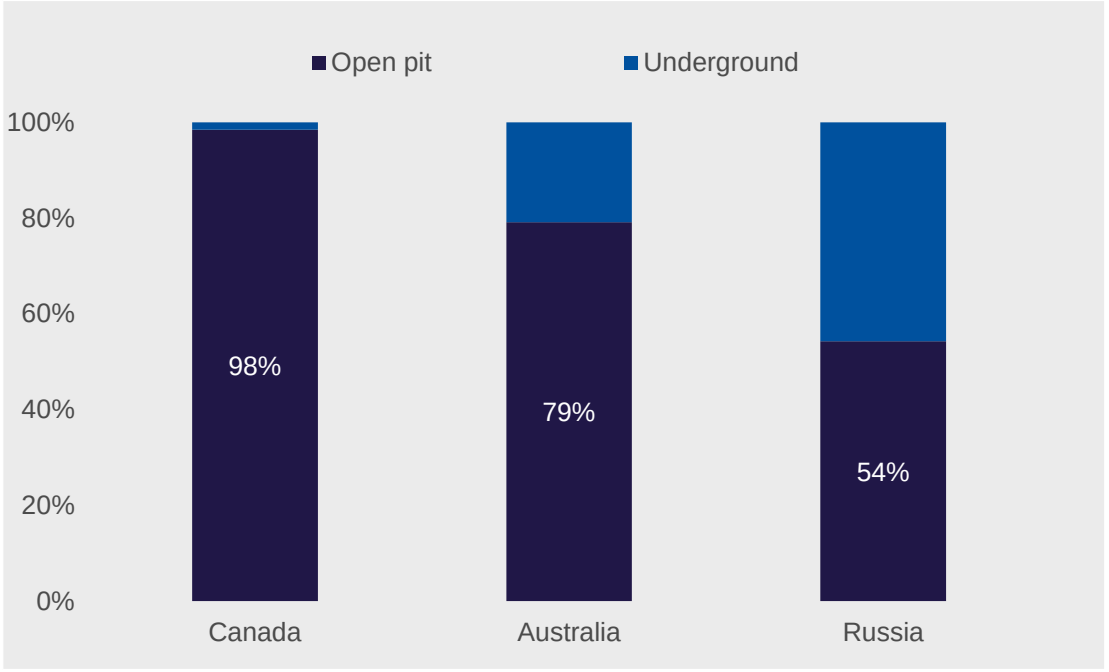
Wage rates comparison, US$/hour



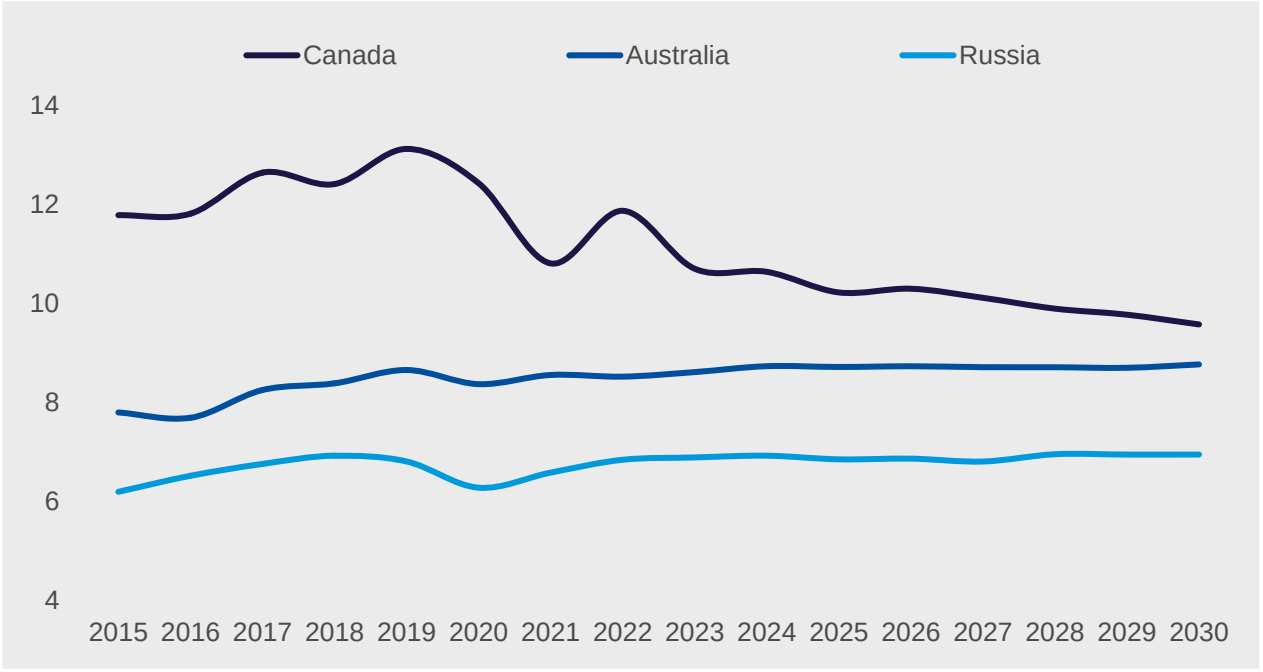
Stripping ratios expected to improve in Canada over the long term

- A significant proportion of metallurgical coal mines in Canada, Australia and Russia are open pit, as shown in the LHS chart below. Therefore, similarly to previous analysis, country average stripping ratios have been presented here for metallurgical coal.
- Australian and Russian metallurgical coal producers are both expected to have stable stripping ratios over the forecast period from 2020-30. On the other hand, the country average stripping ratios for Canadian operations are estimated to move lower to ~9.6 by 2030, compared to ~13.1 in 2019, due to high-quality coal projects coming online and the opening of new mining areas with better geological conditions by Teck.

Open pit/underground shares of met coal mining by country, 2019



Strip ratio by country (run-of-mine basis, BCM*/t), 2015-30

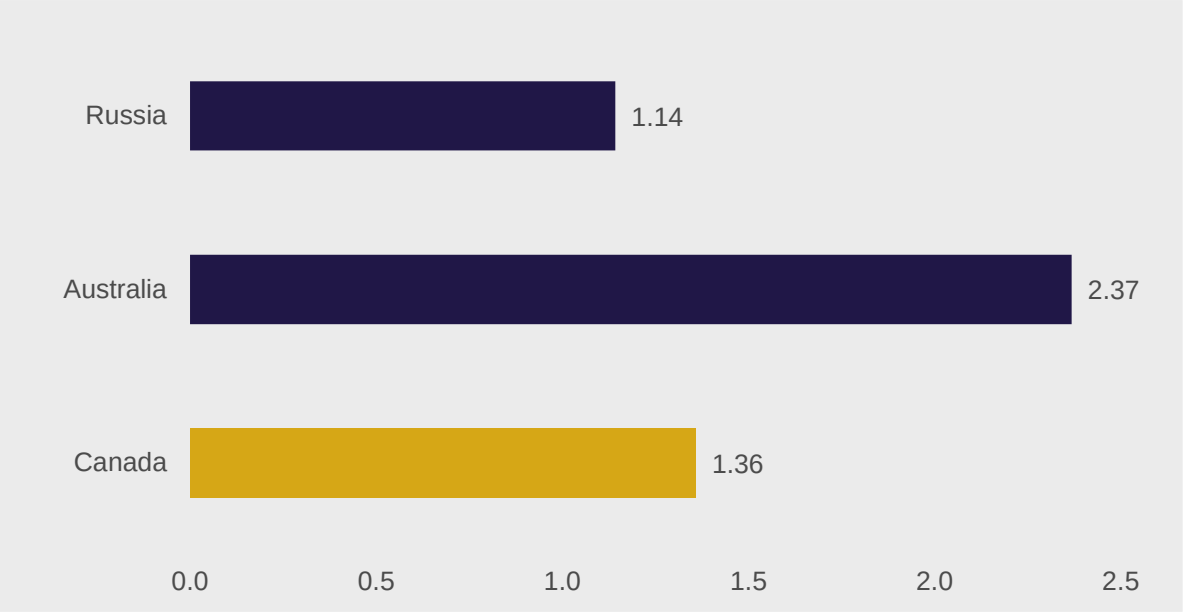


Note: Bank Cubic Metre (BCM) is a measure of overburden removed in mining operations. Equivalent to one cubic metre of material in its undisturbed condition.

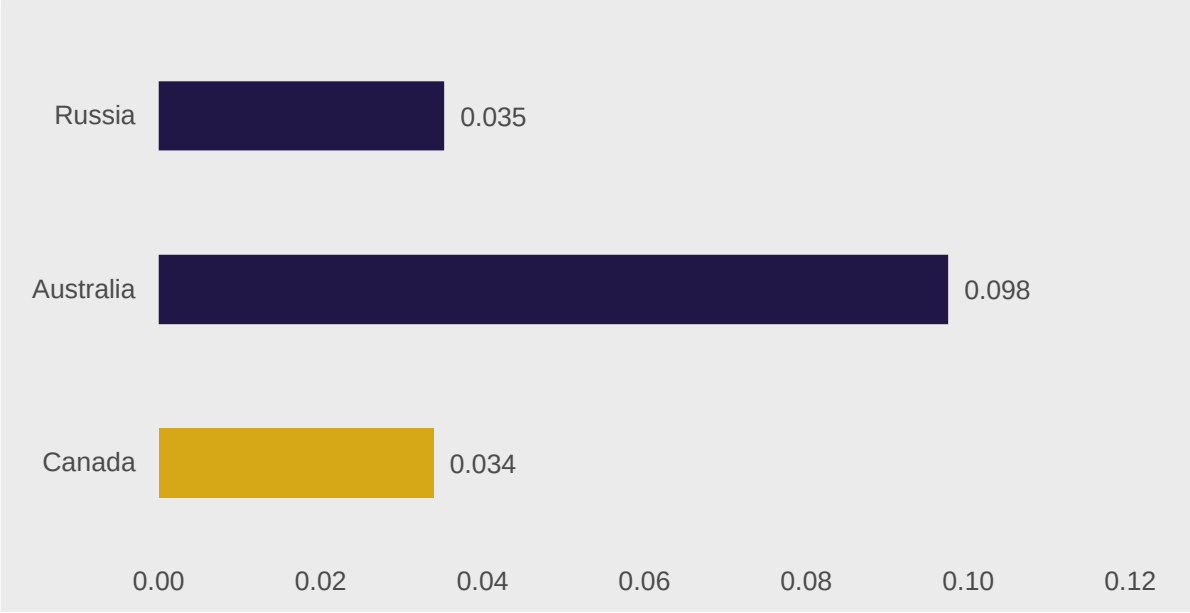
Potential for improvements in loading and haulage fleet intensity

- **Loading fleet efficiency** and **haulage fleet efficiency** (on average) for Canada's metallurgical mines is significantly lower than Australia and of a similar magnitude to Russia. The low fleet efficiencies indicate that a typical Canadian metallurgical coal mines tends to have a low absolute utilisation rate, which can be potentially improved by MIW METS.
- Therefore, opportunities for Australian METS in Canadian mining industry lie in efficiency improvements and hence cost reduction for loading fleet and haulage fleet facilities of metallurgical coal mines and projects.

Loading fleet efficiency for *representative* mines, Mt of material movement per m^3 of loading capacity, 2019



Haulage fleet efficiency in *representative* mines, kmMt of material movement per haulage capacity, 2019



Note: For each of the key markets, a mine operation that is representative (with business cost close to the country level average) is chosen.
Russia: Mezhdurechensky; Australia: Dawson Complex; Canada: Line Creek.

Key conclusions from supply and cost analysis: **Canada**

Key commodities

Iron ore
- Annual production of 57 Mt in 2019.
- 10% of Canada's mineral production.

Metallurgical Coal
- Annual apparent production of 34 Mt in 2019.
- 14% of Canada's mineral production.

Copper
- 10th largest producer, production of 530 kt in 2020.
- Most copper mines also produce gold and silver.

Weaknesses

High labour and consumables cost
Canada's total labour costs are significantly higher than in Australia.

Low machinery efficiencies
Low loading and haulage fleet efficiency in coal mining.

High maintenance cost
Compared to Australia, Canada's maintenance costs are significantly higher.

Opportunities for MIW METS

Bulk material handling and automation
Potential opportunities for METS to improve material movement efficiency and reduce labour costs.

Services
Higher level of automation or better management of current machinery may help optimize efficiency.

Technology
Technology to monitor the condition of mines and diagnose potential issues may reduce maintenance costs.

Key conclusions from supply and cost analysis: **Chile**

Key commodities

Copper

- Largest copper producer globally.
- Produced 4,228 kt of mined copper concentrate in 2020.

Iron ore

- Annual production of 18 Mt in 2019.
- Compañia Minera del Pacífico (CAP) is the sole producer in Chile.

Weaknesses

Low machinery efficiencies

Low loading and haulage fleet efficiency in iron ore mining.

Copper operations becoming deeper and more complex

Near surface deposits depleting and ore grades continue to decrease.

Labour issues

Strong labour unions and frequent strikes leads to operational instability.

Opportunities for MIW METS

Technology services

Sensor and data analytics could be applied more widely in to monitor and optimize equipment efficiencies.

Shift to underground

METS companies in the MIW region are experts in UG mining and can potentially help with the change in mining methods.

Rise in automation?

With recurring labour and union issues, operations could turn to more automation to reduce operational risks and slowdowns.

Key conclusions from supply and cost analysis: **Indonesia**

Key commodities

Thermal coal

- Annual production of 411 Mt in 2019.
- Indonesia's largest commodity by production volume.

Copper

- Annual production of 370 kt in 2019.
- Grasberg is one of the largest copper mines globally.

Weaknesses

Low machinery efficiencies

Low loading and haulage fleet efficiency in coal mining.

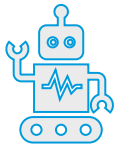
Low labour productivities

Less skilled labour and lack of advanced mining technology.

Wage inflation

Currently labour costs are still competitive due to low wage rates, however expected to rise in medium to long term.

Opportunities for MIW METS



Bulk material handling and automation

Potential opportunities for METS to improve material movement efficiency and reduce labour costs.

Services

Higher level of automation or better management of current machinery may help to optimize efficiency.

5 Insights from existing exporters in the MIW region

Insights from MIW exporters (1 of 3)

Company: 2Censor 2censor.com
Offering: sensor devices and pipe products
Export markets: Chile, USA, South Africa
Prospective markets: Canada, India

- **BHP METS Challenge** in Chile and partnered with local company. This helped to develop network and has lead to new customers. 18 months until 1st sale – be persistent.
- Won a **regional innovation competition** in Canada in 2019 & spoken to Ministry of Trade & Export Development recently about opportunities with potential customers.
- Use Axora (digital solutions marketplace – 'Amazon of mining technology') to **advertise their capabilities** and find new contacts. Has been important during Covid.
- **LinkedIn is the main tool now** – sponsored ads, approaching contacts with marketing material and increasing awareness of products. Best use of their marketing budget – nothing else as effective.
- **3rd party testing** of products to use in marketing material.
- Using same Chilean distributor as Vayeron (see right) – working well together and learning from each other.

Company: Vayeron vayeron.com
Offering: conveyor monitoring ('Smart-Idler')
Export markets: Chile, Peru, Brazil & Canada*
Prospective markets: TBC

- * strongest markets. Also sales to US, Malaysia & Japan.
- Used **website analytics** to identify most prospective target markets at start of business. New opportunities also come from website enquiries.
- Use **case studies in marketing material** to showcase benefits and capabilities.
- **Partnership programme has been key to their success** – work with conveyor manufacturers to integrate Smart-Idler at design stage. Specific criteria to be selected as **exclusive** partner. Benefits of co-branding & co-marketing.
- Hope to **open up regional offices** in medium term in North & South America to support existing clients and continue to build reputation and network.
- Have used **TIQ & Austrade** in the past, but only really useful for initial introductions. Also provide legal support & other services if required.

Insights from MIW exporters (2 of 3)

Company: Techserve techserve.com.au
Offering: engineering resources & contractors
Export markets: India & China (in the past)
Prospective markets: no plans to increase exports

- It can be hard to export services internationally – some safety issues with sending contractors to some markets.
- Don't plan to expand internationally at present.
- **South America, India & China expected to be important markets for MIW companies in future.**
- Can **use local dealers & contractors** (e.g. CAT dealer) to find new opportunities.
- **Business partnerships** work well to innovate & develop new products.
- Use RIN / MIW Export Hub to **collaborate with other companies** in the region – reduce international marketing costs.
- **Advertise the capability** of the MIW region & encourage potential customers to visit – speak to companies & visit the RIN Centre of Excellence.

Company: Nome Services nomeservices.com.au
Offering: monitoring equipment, support services
Export markets: US & Canada
Prospective markets: India, Russia & South Africa

- Used some **TIQ grants**, but only small value. Generally help to fast track internal projects & development.
- **R&D grants** are more useful as costs can be claimed for previous 2 years.
- Grant paperwork can be very time consuming.
- **TIQ have been very supportive**, particularly the local representatives during the Covid pandemic. Help with translation, setting up meetings and organising missions.
- **JV** with engineering company in the UK with wide, global network (60 years in industry). Used to export to North America.
- **Conferences & trade shows** to improve product awareness – Russian opportunity generated through Austmine event.
- Important to **teach local distributors** about the exact products to improve market access & reach.

Insights from MIW exporters (3 of 3)

Company: Mainetec mainetec.com.au
Offering: engineering services & equipment
Export markets: Mongolia & USA
Prospective markets: Kazakhstan & Canada

- Aiming for 75% of revenue to be domestic in 2025.
- Currently sell to Oyu Tolgoi in Mongolia & Bingham Canyon in USA.
- Many companies don't show capability – need **strong marketing material** with **data to support.**
- Data must be commodity specific & relevant to each customer.
- **Critical to have someone on the ground** to break into new markets – trained in products, technical aspects, strategy, customs regulations, etc.

Company: Link n Light www.linknlight.com.au
Offering: LED lighting & electrical contracting
Export markets: USA
Prospective markets: Chile & South America

- Important that product is simple to use and flexible to different applications.
- **Use distributor in the US** with large network – **exclusive agreement** encourages distributor to market strongly.
- In negotiation with Chilean distributor, similar exclusivity arrangement to US distributor.
- Train sales agents to understand product & applications.
- **Trade missions** from South America to Mackay to facilitate relationships and build reputation. Also other trade shows & missions through RIN / MIW Export Hub.
- **SMEs struggle to commit resources** to marketing, social media, etc. This makes it hard to consistently market products.
- **Advertise** on digital media platforms & get approached by many potential partners.
- Small **TIQ grant** in 2020, but only short term help.

Key takeaways – insights from MIW exporters

- **Routes to market:**
  - Marketing material needs to be focussed and supported by data and case studies.
  - Advertising through digital media platforms helps to improve product awareness – potential partners then approach directly.
  - Trade missions and shows / conferences are useful to build network and reputation.
  - TIQ provide some small grants to assist with export and trade activities. R&D grants also available.
  - Use local dealers & contractors (e.g. CAT) to find new opportunities.

- **Market presence and distribution:**
  - Critical to have a local representative with sufficient technical background and understanding. Need to train sales personnel on the product and its applications.
  - Use of a distributor with exclusive local/regional rights can help with product promotion and sales.
  - Partnership strategies:
    - With other MIW companies to reduce international marketing and business costs.
    - With established companies to benefit from their network and contacts.
    - With equipment manufacturers to integrate and collaborate at design stage. Exclusivity again a good strategy.

6 Target market stakeholder interviews

Stakeholder interviews in the selected target markets

CRU completed 19 interviews for this study across the 3 target markets. Stakeholders were identified **across a variety of the major mined commodities**, along with **supporting industries** including consulting/engineering services, banking, events, R&D institutions and intermediaries. More interviews were conducted in Indonesia due to limited experience for the MIW region in this market.

The following section summarises the key takeaways from interviews with stakeholders in the companies detailed below. The structure of the results broadly follows the semi-structured questionnaire that was agreed upon with the MIW team.

Canada		Indonesia		Chile	
Company	**Focus**	**Company**	**Focus**	**Company**	**Focus**
Allegiance Coal	Met coal	**Adaro**	Coal	**CAP**	Iron ore
Capstone	Cu	**Amman (AMNT)**	Cu & Au	**CEMIN Holding Group**	Cu
Minerai de Fer Quebec	Iron ore	**Antam**	Ni, Bx & coal	**Minera Tres Valles**	Cu
New Gold	Cu, Au & Ag	**Archi Indonesia**	Au	**SCM Minera Lumina Copper Chile**	Cu
Ausenco	Consulting & engineering	**Merdeka**	Cu & Au	**Emere**	Intermediary
		Nickel Mines	Ni		
		Bank Mandiri	Bank		
		Jakarta Mining Club	Networking & event organiser		
		MIND ID	Holding company, R&D		

Current & future needs

	Canada	Chile	Indonesia
How have METS requirements changed in recent years?	• Increasing bulk material handling requirement during mine expansion. • Expanding UG operations to access deeper orebody – engineering firm designing and new conveyor system being installed. • Teck are investing in conveyors to reduce truck usage.	• Automatization has been the main change pursued, from the use of new software for admin purposes to operational uses. 'Big data' becoming more important. • Communication infrastructure and sensors have also been installed to further automate processes.	• Not a substantial amount of cutting edge technology used in Indonesia – many operations are only small to medium size. Exceptions for the larger operations e.g. Grasberg & Batu Hijau. • Limited use of conveyors as operations are small scale & labour is cheap.
How have operations changed during the Covid-19 pandemic?	• Mining was one of the first industries in Canada to have Covid guidelines – it has been well protected. • Strict testing procedures when coming onto site for FIFO & construction workers.	• Mining is one of the largest industries in Chile, hence the government allowed it to continue operating, although with strong recommendations on procedures. • Most companies had to adopt strict prevention, testing and traceability protocols with the reduction of FIFO workers on site.	• Difficult to get FIFO workers and foreign personnel onto site. Some companies have banned 3rd parties onto site (except contractors). • Minimal impacts on mine productivity.
What technology changes are expected in the short to medium term?	• Battery powered / electric equipment was mentioned by a number of respondents. ESG is a particular theme in Quebec, with hydropower a key energy source. • Digitisation & automation. • *See following slides for opportunity areas.*	• Autonomous mining operations should become easier to implement at any level (medium and small mining). • Electric mining equipment and green technologies, supporting the migration from fossil fuels to green energy sources (e.g. hydrogen, solar, etc.).	• Incentive for equipment automation / labour efficiency is limited as costs are low*. • e.g. can get 100 tonne trucks from India (duties exempt) for significantly lower cost than larger trucks from Europe (plus duties). Higher number of smaller trucks is not an issue due to labour rates.
What are the key challenges going forwards?	• Maintaining reputation of mining industry. • Integrate new technology & make actual decisions in operations/in the field. • *See following slides for opportunities.*	• Operational challenges in UG mines. • Energy efficiency. • Ensuring small-medium sized companies have latest technologies. • *See following slides for opportunities.*	• ESG is on the radar for Indonesia – PT Vale are an industry leader; Indo govn are developing renewables. • *See following slides for opportunities.*

Note: * Indonesian truck driver would cost ~US$1000 / month – significantly cheaper than in Australia for example.

Identified opportunity areas

General	Canada	Chile	Indonesia

• If METS providers can partner with the OEMs, then their products can be procured at the same time as the OEM equipment.
• Ore sorting technology is being developed at present, with pilot plants underway at a number of Canadian operations.
• Investing in technology generally requires scale – very small producers will not have budget for high end equipment/services.
• New technology must be a significant step change to be considered – can improvements be guaranteed?
	• Battery powered equipment to reduce GHG emissions and carbon footprint.
	  ○ OEMs are not servicing this well as yet.
	  ○ LNG trucks also being trialled by Teck to replace diesel
	• Bulk material handling
	  ○ "untapped potential in handling & systems"
	  ○ Conveyors can be utilised more effectively
	• Automation
	  ○ Particularly for the less popular equipment brands & models. Companies tend to only be good at the most popular e.g. F150 trucks.
	• Rising ESG awareness
	  ○ GHG emissions, water usage, reducing waste
		• Efficiency
		  ○ Productivity optimization is one of the main issues faced by small-medium size mining companies. Therefore, equipment or technology that address a more efficient use of resources will be a clear opportunity.
		• Automation
		  ○ Although some larger companies have already implemented automation and monitoring technologies (inc. remote systems), there is a gap in the small-medium mining sector that can be filled.
		• Water efficiency / usage
		  ○ ESG awareness as a whole has been increasing in the industry; nonetheless, water usage has become a critical problem as most mining companies are located in areas with high level of water scarcity.
		• Switch in UG mining techniques
		  ○ Old methods have been replaced by block caving which requires different mining equipment & expertise.
			• Battery powered trucks for UG use, to reduce diesel fumes & ventilation issues. Looking for suitable providers as technology is still relatively new.
			• Small companies have limited internal expertise, so they do require assistance with engineering, metallurgy, etc.
			• Sensor devices for safety e.g. fatigue.
			• MIND ID & mining entities are committed to research & innovation – collaboration opportunities?
			• Collaboration with the 2 major equipment suppliers: PT United Tractors (~20 branches; Komatsu) and PT Trakindo (CAT).
			• Potential opportunity for regular consumable products (e.g. bucket teeth) – domestic dealers tend to only offer most expensive options.
			• UG mine expansion support services.
			• Bucket sensors, operational databasing systems.
			• Material handling & logistics expertise.
			• Pumping support to mitigate against high rainfall at primarily OP operations.

Specific opportunities identified during the interview programme

"aiming to be the early adopters"

newgold

"keep the mine at the forefront of the industry"

Material handling, logistics & rail freight expertise

adaro MINING

"we are a small company that like to be efficient…we are forward looking"

MINERAI DE FER QUÉBEC
QUEBEC IRON ORE

"seen as an energetic company in Quebec by research organisations & universities"

Archi Indonesia

Potential for regular consumable products such as bucket teeth & haul truck tyres

LUMINA COPPER CHILE

Caserones typically in the 3rd or 4th cost quartile. "Efficiency is a key aspect in our business..."

CEMIN HOLDING MINERO

"We must implement a strong digitization program with a focus on operational technologies"

MINERA TRES VALLES

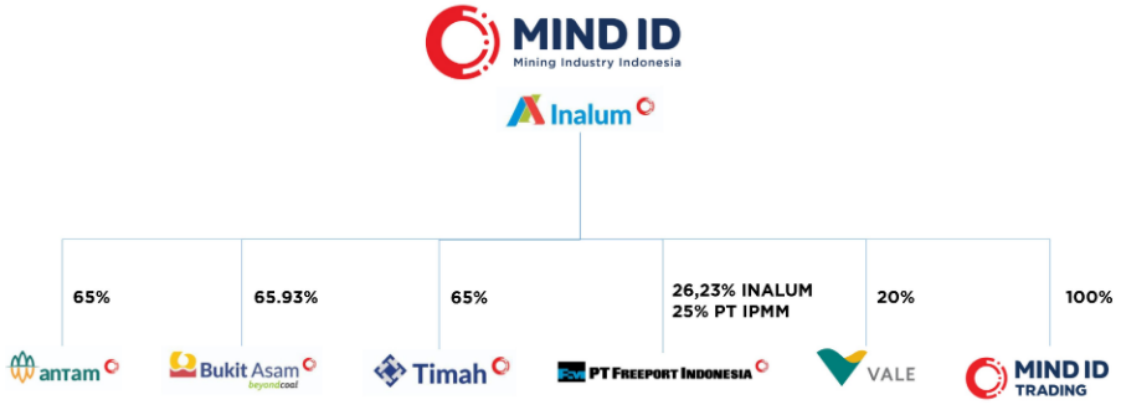
"There is not good knowledge in maintenance and operation, and there is an important lack of spare parts in Chile."

Other companies happy to discuss further:

MIND ID · MERDEKA COPPER GOLD · antam · AMMAN MINERAL · Ausenco · Capstone MINING CORP · EMERE

Spotlight: Potential collaboration opportunities with MIND ID

- **Mining Industry Indonesia (MIND ID)** is a holding company comprising stakes in PT Antam (Ni & Au), PT Bukit Asam (Coal), PT Freeport (Cu), PT Inalum (Al) and PT Timah (Sn).
- MIND ID (also known as Inalum) became a state-owned mining industry holding company in 2017 and combined the government's stakes in the 4 other mining companies, as shown below.
- The organisation has **3 mandates from the government**:
  1. Acquire 20% of mining resources in Indonesia and conduct exploration to expand resource base.
  2. Invest downstream – smelter or downstream processing facility must be part of each Indonesian mining asset.
  3. Become a world class company, ideally Fortune 500.



  - The **Mining & Minerals Institute (MMII)** is the R&D division of MIND ID, focussing on research & innovation to benefit the Indonesian minerals industries. They are currently involved in projects on coal emissions, downstream nickel technologies and REE processing.
  - They aim to be a key point of contact between MIND ID and international R&D organisations. They generally sign an MOU with organisations (e.g. in discussions with CSIRO at present) and then collaborate on specific research projects.
  - They organise an annual innovation competition (or Hackathon) to find new mining / processing technologies to commercialise.
- Through discussions with MMII, **CRU have identified potential collaboration opportunities for MIW companies:**
  - Engage with MIND ID's 5 entities – leverage MMII's innovation focus to provide new technologies to these operations.
  - Work directly with MMII on R&D projects that will be mutually beneficial to both MIND ID & the MIW region.

Source: https://mind.id/ & interview with Mining & Minerals Industry Institute, MMII.

Challenges facing mining operations & opportunities for METS

• Using **'big data'** effectively to make key operational decisions & assist maintenance • **Integrate** different sensor & data systems ○ *e.g. Teck have a Digital Group and efficiency program* called RACE21™* • **Strong digitization** program with a focus on operational technologies.	→ • **Data analytics & software solutions** to efficiently use **large volumes of data** across different platforms • Potential for **bespoke work** to assist individual companies with solutions
• **Limited case study data or examples** for new, cutting edge technologies, making it hard to make procurement decisions	→ • Provide **data from operations** where technology has been successfully applied
• Increasing focus on **ESG & carbon emissions** in all markets	→ • Adjust business models to ensure alignment with ESG initiatives & requirements. **Development new products** as needed.
• Managing **handling & logistics costs** for remote operations (in both Canada & Indonesia)	→ • Provide unique solutions for efficient **bulk material handling & automation**

Note: * https://www.teck.com/news/connect/issue/volume-26,-2019/table-of-contents/race21

Existing providers & competitive environment (1 of 2)

	Canada	Chile	Indonesia
Where are METS products & services currently sourced from?	• OEMs are generally the source of all earth moving & heavy equipment • Some processing technology and engineering services from Australia • Major producers can afford to purchase equipment, however smaller companies typically use contractors with their own fleet.	• METS products or services are imported from OEMs mostly but also purchased locally, depending on specific requirements. • International providers tend to have some local presence.	• Domestic contractors typically used for mining services; OEMS are key source of bulk material handling equipment. • Chinese investors are heavily involved in many mining supply chains in Indonesia (particularly Ni), meaning that METS are procured from China directly (*see slide for further info*).
Strengths of existing providers?	• Technology should be continually developed, even after purchase.	• Services and products include employee training along with assistance when needed. • Warehouse and spare parts in country. • Price-quality ratio and long term relationships. • Good after-sales support & expertise.	• Some local providers have acquired international companies to gain knowledge. • Chinese providers are incredibly fast – have large team working 24/7; delivered to own port in Indo; no issues with build quality / reliability. • Domestic providers are cheaper than international.
How could a new provider improve upon existing?	• Some concerns about the quality & reliability of Chinese equipment. Also hard to source spare parts. • Some companies try to visit all clients at the same time (e.g. every 3 months), but service is poor in between.	• Spare parts availability is critical for some medium and small mines. Therefore, having this rapidly available is a clear advantage. • Lead time of products. • High quality products & services with competitive prices and the establishment of good relationships with clients.	• Some concern around quality of Chinese providers, but reputable consulting firms used for equipment due diligence. • 100% domestic providers often provide slow service.

Existing providers & competitive environment (2 of 2)

	Canada	Chile	Indonesia
Are there any gaps in the METS market?	• Conveyors seen as under-utilised across Canadian industry as there is a tendency to rely on trucks (some minor issues with snow & ice). • OEMs still need to develop more battery and automated equipment. • Working with OEMs to provide 3rd party services (e.g. automation systems).	• Lack of knowledge of maintenance requirements, operations, and new technologies from some METS providers. • Lack of innovation & development programs for new technologies.	• Common to use mining contractors who source all equipment & goods. • Limited laboratory facilities in Indo for sampling. It can be hard to export samples due to trade restrictions. • Dewatering & pumping. Also in volcanic environments (very hot water in pit). • Rail logistics expertise.
Examples of new technology / equipment that has been adopted? **What was the process?**	• Critical to trial products at the operation, particularly for a new supplier replacing an existing provider. • Trials can be complimentary or paid and typically last for at least 3 months.	• Mostly replacement of obsolete equipment.	• Team of strategic business analysts look at spending & procurement trends to identify needs & opportunities. • Experienced employees recommend suitable providers.
What worked well? How could the process be improved?	• Important to have lots of discussions with the provider to fully understand their product & overall service	• Follow-up between the providers and mining companies. • Establish minimum requirements that providers must meet with reliable deadlines for deliveries.	

Chinese supply chains will have limited opportunities for MIW METS

- As discussed previously on slide 78, Chinese stakeholders are heavily involved in the nickel industry in Indonesia, as either mining or processing companies, or investors. This is due to a number of reasons, but the Indonesian government's ore export ban has been a significant contributing factor – Chinese stainless steel producers have installed NPI and steel capacity to integrate with nickel ore production that cannot be exported. As a result, 4 of the 5 largest global FeNi and NPI producers are Chinese-owned and have capacity installed in Indonesia.
- Chinese operators typically use their own engineering, METS and service providers when they are in control of a supply chain. This is the same for Indonesian nickel, where equipment, plant materials and consumables are sourced from China as much as possible, with very efficient supply chains in place.
  - For example, Tsingshan have a 24/7 team in China producing materials and parts for the NPI supply chain in Indonesia, with a fast and efficient logistics route to their own port at the Indonesia Morowali Industrial Park ('IMIP'). They are also very cost effective in building new capacity, with 4 new RKEF lines and a power plant expected to cost only US$700 million.
- Due to the reliance on domestic providers, supply chains with major Chinese shareholders are very difficult to break into – this is supported by the interview with Nickel Mines, who have a major offtake agreement with Tsingshan. As a result, **we expect there to limited opportunities for MIW METS providers in the Indonesian nickel mining sector**, as approximately 80% of the supply is coming from small privately owned mines which utilise contractors for nickel mining and these operations are heavily involved in Chinese supply chains for NPI, FeNi and HPAL productions.
- The potential exceptions to this include:
  - Antam (part of MIND ID) – interviewed as part of this study. Antam's nickel assets include Aneka Tambang, PT Feni Haltim and Pomalaa.
  - Allway Mineral and Science Technology Corp
  - PT Vale Indonesia
  - PT Halmahera Persada Lygen

Procurement processes & routes to market (1 of 3)

	Canada	Chile	Indonesia
How do you find new METS products & services?	• *See following slides for more details.*	• *See following slides for more details.*	• *See following slides for more details.*
Are there any domestic industry / trade organisations that can support?	• Partnerships with some universities (e.g. British Columbia) and small companies to develop bespoke products for them • Institute of Mining has not been very useful. • Trade missions differ in quality – they sometimes don't bring the right people or products. Can also be slow & expensive.	• There are few specific organizations that provide support, although the Chamber of Commerce was mentioned as an institution with links to many international markets. • ProChile & Sonami mentioned by one respondent.	• Some in the early stages, but not developed enough yet. Most research through universities. • Very limited support in Indonesia (especially compared to Australia). • Jakarta Mining Club – *see separate slide*.
Is it important for an international provider to have local representation? **If so, in what form?**	• Local & knowledgeable technical support is a key factor in decisions, including sufficient inventory of spares & parts. • *See following slides for more details.*	• Depending on the complexity of the product or service, local presences can be critical, especially due to language barrier (not all people in small & medium mines speak English) and inventory availability. • *See following slides for more details.*	• Critical in Indonesia due to government regulations. • *See following slides for more details.*

Procurement processes & routes to market (2 of 3)

	Canada	Chile	Indonesia
What are your key procurement criteria?	• Overall value for money is most important. • Suitable technical support from knowledgeable representative, with access to parts & spares when needed. • Reputation of provider. They need to be proven & demonstrate capability. • If a new product, is there data / evidence to support its capabilities?	• Cost & quality are the key criteria. • Lead times and existing partnerships are also relevant aspect to be considered.	• Local technical support • After market support must be sufficient to service remote operations across Indonesia. • Access to critical parts & reliability of equipment to service 24/7 operations.
How is procurement managed?	• Generally at asset level as targeting small-medium size mining companies. • Majors conduct bulk purchasing across whole Group to reduce costs for common equipment/parts e.g. tyres	• All interviewers indicated that procurement is managed by asset, especially in the case of small-medium size mining companies which only own an individual asset.	• At asset level for small companies & at Group level for multiple operations. • Typically formal procurement & tender review process. Some direct approaches don't go to tender. • Important to get proposals from both domestic & international providers in case govn. approval is required for imports.
Are there any restrictions / limitations on procurement?	• "Construction decree" in Quebec prevents importing construction labour – must use from within particular regions. This doesn't apply to engineering services however.	• No specific restrictions or limitations were identified by the mining companies.	• Some mining services on multi-year contracts. • Generally avoid LT contracts (need to be careful in Indonesia). • Limitations on imports of overseas and second hand goods – *see following slides*.

Procurement processes & routes to market (3 of 3)

	Canada	Chile	Indonesia
If you currently procure from Australian companies, what are their strengths & weaknesses?	• Companies must ensure that they understand the specific operating conditions. Operating in snow, ice or mountainous conditions requires previous experience.	• None of the interviewed mining companies purchase currently from Australian companies, although some of them have bought in the past. Within the strenghs mentioned are expertise and knowledge of the mining industry.	• Some components from Hoffman Engineering. • Mill expansion support from Como Engineers. • Australian providers are generally more expensive than domestic – Indonesian companies are price sensitive, particularly to foreign providers.
Would you consider procuring from Australia in future?	• Yes, all processing technology currently from Australia. • Definitely open to serious & professional approaches from Australian companies. • Providers must have experience in Canadian operating environments.	• Yes, but in some cases subject to extent of local presence and having a competitive price to quality ratio.	• Yes, but likely from Perth-based company due to existing presence in WA. • Some respondents already do use Australian providers for select purposes (e.g. engineering & geological services).
What should be the key considerations for an Australian company to sell into your market?	• *See following slides for more details.*	• *See following slides for more details.*	• *See following slides for more details.*

Typical methods for finding new METS products & services

- Most respondents generally **use their existing network** first – companies that are known and trusted. Recommendations and word of mouth is the most common route.
  - Many operations have personnel that have worked at international companies, so have had exposure to different operating methods.
  - Small companies (e.g. in Indonesia) do not have a large team for due diligence, so best to use known quantities.
  - So if a provider is not known to them then they will not receive RFPs or bidding information – networking is important.
- **LinkedIn:** needs to be a personal and genuine approach. Impersonal approaches are generally ignored.
  - Excellent platform to get your name out there – post about new technology and innovation.
  - This can generate interest and get people talking about your products – this has been successfully applied by MIW companies e.g. 2Censor.
- Attending / sponsoring **technical trade shows / conferences** can be useful to find new products and also for finding potential partners.
  - Employees typically encouraged to attend events, particularly in innovative Canadian companies.
  - Good to use Austmine or Austrade booth when first entering market.
  - But can be expensive and time consuming.
- **Mining magazines** (e.g. Mining Journal, AusIMM), white papers, internet searches
- Internal business improvement programmes encourage staff to bring new ideas and improve operations
  - e.g. *Adaro, Indonesia*: company awards and incentives for business improvement – new initiatives can be deployed across organisation.

The importance of local representation: **Canada**

- Almost all respondents highlighted the **importance of local representation**, including timely and knowledgeable technical support. This could be in the form of a sales representative, another company selling similar products (as a partner), or setting up a local / regional entity.
  - Must be in timezone at minimum and have **technical knowledge and understanding** of the products.
  - Ideally they should also be able to help with technical quotes and proposals.
  - There should also be **timely access to parts and spares** (perhaps a local / regional warehouse is required). All equipment and technology needs to be supported through its life. Equipment should also be available in the event of an emergency or major maintenance issue.
  - Engineering services or software can be easier to support remotely, but tangible products / equipment is hard to service properly.
- If local representation is expensive or complicated, it **may be helpful to partner** with another MIW / Australian organisation to share business costs.
  - Its very important to commit to establishing a local presence.
- Most companies don't want to commit to establishing a local presence without numerous customers. However, they generally need to accept a loss in the first 2-3 years by **investing sufficiently in technical support and expertise** and this will be a huge benefit later down the line. Its difficult for companies as this is a risk, but if successful it will be beneficial.
- If technical support is poor, then other potential customers will find out (e.g. highlighted in regional Canada) and this will impact upon future business. Conversely, a provider will also generate strong reputation quickly with appropriate technical support. **Providers must work hard to make sure new products / technology works effectively at the start and that any issues are quickly resolved.**
- A number of respondents commented on the requirement for minimum productivity levels / improvements with equipment or technology. If there are any issues then the provider is expected to resolve them. There are also typically performance guarantees included in contracts.

The importance of local representation: **Indonesia**

- **Local, permanent presence is essential**, but doesn't need to be significant.
  - Legal requirement to have Indonesian representation – government aiming to localise employment as much as possible.
  - Many of the major consulting companies have local presence, but use a lot of expertise from other international offices.
  - A local presence generally makes business operations more efficient.
- Local technical support must be **knowledgeable and provide timely service** (inc. to remote operations).
  - Access to critical parts and reliability of equipment to service 24/7 operations.
  - Ideally warranty on product performance.
  - Some companies (e.g. from India) now offering performance-based contract – if they improve metrics by given quantity, then a bonus is paid. This shows confidence in their technology and capability and incentivises success.
- **Procurement is heavily regulated** by the government (Section 555 of the Mining Act):
  - All purchases must be signed off by the government, even if privately owned.
  - Second hand goods or components are not allowed into Indonesia.
  - Purchases from overseas must be approved at least 1 year in advance. Must have good justification for the choice of provider – the government are aiming to reduce overseas requirements.
    - However if a foreign provider has a **PT* entity**, then goods (not second hand) can be imported and sold as if from domestic provider.
    - Companies must report on the proportion of domestic procurement. Foreign providers with PT entity are treated as domestic.
  - If approved to buy from overseas (without PT entity) then there are numerous, and sometimes heavy, trade tariffs and duties.
- **Tax systems are complicated** for wholly foreign companies.

Note: * Perseroan Terbatas (PT) is a legal business entity that allows foreign investors to run a revenue-generating business in Indonesia.

The importance of local representation: **Chile**

- **A local presence** is a positive aspect for almost all respondents, although the criticality will depend on the type of product or service.
  - The most important aspect is a **timely response** for both technical and commercial requirements.
  - Small to medium sized mining companies can be highly affected if they cannot have access to **parts and spares** on time. Therefore, companies with **local warehouses** can play an important role when deciding between providers. Lead times are important.

- **Local technical support** for mining equipment and technology must be maintained throughout its life.
  - A good knowledge in maintenance and operation is essential for a good customer-seller long term relationship.

- **None of the respondents showed a preference for the type of presence** in Chile either, be it a joint venture, a local sale representative, or sales directly from the supplier. Nonetheless, all suggested that it is necessary but they are still willing to buy from companies without local representation if the overall offering is attractive.

- **Having a local presence appears to be less critical** than other target markets (but still required for some products and services). Despite this, it is important to note that small to medium sized producers in Chile rely heavily on **timely access to spare parts and technical support.**

Spotlight: The Jakarta Mining Club has an established network

- Industry organisations can be a useful place to start when entering a new market – they have an established network, deep understanding of the industry and a desire to assist their members where they can. Approaching Resource Industry Network would be a sensible strategy if wanting to enter the MIW market, the same applies for international market entry. **This is particularly important where companies are less familiar with a market (e.g. Indonesia) or if there are language barriers (e.g. Chile).**

- The **Jakarta Mining Club (JMC)** aims to promote, educate and encourage dialogue across the Indonesia mining industry.
  - It currently has around 3,600 members and 28 sponsors (inc. Newcrest Mining, Weir Minerals, Trakindo CAT, Metso Outotec, etc).
  - Before the Covid pandemic, they organised regular networking events, seminars and lunches; more recently, the focus has been on monthly virtual webinars, where they gather at least 300 attendees per session.
  - They also have association with Indonesian mining conferences and events where they further promote their sponsors and members.

- Similarly to other respondents in Indonesia, JMC recommended the importance of establishing a local presence in Indonesia as it is very difficult to develop a reputation at arms length. The Mining Club is a good place to start – to develop a network, build a reputation and find new opportunities. **JMC would welcome a conversation with MIW and the potential exporters about future opportunities.**

- **Opportunities for the MIW Export Hub:**
  - Discuss membership and sponsorship options.
  - Organise a webinar to showcase technology & innovation within the MIW region.
  - Provide contacts and arrange networking events.

Source: https://djakarta-miningclub.com/ & interview with Vice Chairman of JMC.

Key considerations for Australian suppliers: **Canada**

- Marketing material:
  - Lots of companies in the RIN Capability document for standard labour hire services – try to focus the document in distinct sections based on expertise / capability.
  - If the export strategy is focussing on only certain areas of expertise, then **CRU recommends that a new version of the Capability Document is prepared for this purpose.**
  - Given the high level of mining competency in Canada, **CRU recommends that the export strategy for Canada should be focussed on higher valued added / innovative products, as opposed to labour provision or general engineering services.**
- **Canadian resource: SEDAR** – https://www.sedar.com/homepage_en.htm
  - Publishes securities documents and information from publicly listed companies in Canada.
  - Useful resource for development projects, plans and announcements – search for potential METS customers and opportunities.
- Process for **pitching new products and demonstrating capability** – example from Canada:
  - Received portfolio of companies (for a given product type) for review and chose a select number to progress.
  - 15 minute pitches for each – 'speed dating' style event.
  - New technology changes rapidly and they want to find it fast, so the whole process needs to be efficient.
- Very important to be **first to the market** with new technology in Canada, particularly as there are plenty of innovative companies. If you are second or third then you may miss your chance.
- "Think of it as a **North American market** (including Mexico) – it needs to be treated as one region, not just looking at Canada".
  - Consider country specific factors e.g. equipment to the US should be marketed and advertised in imperial units.
- The majority of operators in Canada are small to medium size – requires a **different mentality to working with the majors.**

Key considerations for Australian suppliers: **Chile**

- **Language barriers** must be taken seriously as English is limited below manager level so depending on the product it may be better to approach in Spanish – even in large mining companies.

- There is a **trade agreement** between Chile and Australia where most imports are exempt from taxes, especially in the mining industry. Therefore, it is a clear opportunity that should be taken advantage of by Australian METS providers.

- **Cultural aspects** were highlighted in several interviews. Small and medium mining companies can be very conservative in implementing new technologies or buying from new providers, unless they are proven to work well.
  - Local partners could be a necessary step to understand the local culture, especially due to the time zone difference when quick responses are required.
  - Giving **guarantees on products and services** and a permanent follow-up to the company´s collaborators, together with minimum conditions, can be key to success and gain the trust of buyers.

- Chilean industry has a variety of mines size ranging from the largest in the world to small assets. Large mines have already implemented automation and new technologies; however, small to medium mines are just starting this process and this may be a **good opportunity to enter into the market.** The Chilean government want to ensure that small-medium operations are not left behind.
  - “The search for new technologies is a permanent practice in the company. In the coming years, we must implement a strong digitization program with a focus on operational technologies.” – CEMIN.

Key considerations for Australian suppliers: **Indonesia (1 of 2)**

- **Processes (approvals, permitting, etc.) are very slow** – be patient! It will take longer than in Australia or other markets.
  - Procurement is typically a complicated process so needs to be a serious and well planned. Take time to understand the market and the processes required.
  - Generally need original documents (not digital copies) from banks, ATO, etc.
  - Additional controls and verification processes in place due to issues with corruption, cyber attacks, etc.
- Lots of government regulations and bureaucracy – **easier with local presence**
  - Legal framework is complex – not clear on exact impact of New Omnibus Laws yet.
  - Changes on the horizon, but may be too little too late. Don't expect significant changes in the near future.
  - Downstream / smelting requirements (and export bans) are hard to manage for producers – project economics struggle with CAPEX.
- **IP protection:**
  - Collaboration between miners and METS providers means that both parties have 'a moral right' to the IP.
  - Rights are comprehensively covered in contracting, typically using standard international clauses.
- Indonesian companies can be seen as 'nationalistic' – sometimes reluctant to consider overseas providers due to both government restrictions and perception that non-domestic companies are expensive.
  - **Value for money is very important** to purchasers – need to display the overall value of the investment.
  - If it is seen to add value then it will be considered.
- Common for companies to use **domestic contractors for mining operations**, who are also in charge of equipment procurement.
  - International contractors have been used in the past (e.g. John Holland, Thiess), but this is less common now. Likely due to price sensitivity and exit of multi-national mining companies from Indonesian industry.

Key considerations for Australian suppliers: **Indonesia (2 of 2)**

- Marketing material:
  - Split the capability document into sections by focus or expertise – potential customers can then look in the section of interest.
  - Ensure that experience and capabilities are supported by real world data and case studies.
  - If the export strategy is focussing on only certain areas of expertise, then **CRU recommends that a new version of the Capability Document is prepared for this purpose.**
  - Conversely to Canada, **CRU recommends that the export strategy for Indonesia can be focussed on general engineering services as well as higher valued added / innovative products.**
- Pitching new products / services:
  - Companies receive lots of approaches, so it needs to be **individually tailored and suitable**.
  - Be succinct and ensure its easy to understand where the value is and how it aligns with the business / operation (e.g. specific to UG or open pit).
  - **Need to embed into organisations** and slowly build profile and reputation.
- It can be very hard to recruit in Jakarta, where companies typically have their management / head office.
  - Westerners don't typically enjoy the lifestyle – poor infrastructure, congestion, pollution, limited entertainment and services.
- Indonesian board of directors and shareholders generally prefer local providers (weary of Western providers). They can also be very price sensitive, which is an issue for overseas providers.
  - Shareholders tend to be closely involved with the business – must manage their views as well as management.
- **Important to undertake full due diligence** around any business decision or investment – some issues with corruption and collusion.
- Communication via WhatsApp is common. Email does not dominate as in the West.

7 Appendices

Appendix A – Profiles of interviewed companies

Stakeholder interviews – company profiles

Canada		Indonesia		Chile	
Company	**Focus**	**Company**	**Focus**	**Company**	**Focus**
Allegiance Coal	Met coal	**Adaro**	Coal	**CAP**	Iron ore
Capstone	Cu	**Amman (AMNT)**	Cu & Au	**CEMIN Holding Group**	Cu
Minerai de Fer Quebec	Iron ore	**Antam**	Ni, Bx & coal	**Minera Tres Valles**	Cu
New Gold	Cu, Au & Ag	**Archi Indonesia**	Au	**SCM Minera Lumina Copper Chile**	Cu
Ausenco	Consulting & engineering	**Merdeka**	Cu & Au	**Emere**	Intermediary
		Nickel Mines	Ni		
		Bank Mandiri	Bank		
		Jakarta Mining Club	Networking & event organiser		
		MIND ID	Holding company, R&D		

Allegiance Coal

General information	
Position in supply chain	Iron ore producer
Headquarter location	Sydney, Australia
Assets	• Tenas (Telkwa) Project, British Columbia, Canada • New Elk project, The US
Announced technology changes	
Contact details	Mark Gray - Chairman & CEO mgray@allegiancecoal.com.au
Other useful information	Allegiance Coal formed a subcompany Telkwa Coal Limited to develop the Telkwa coalfield, which is within a complex of three separate coal deposits: Tenas, Goathorn and Telkwa North. Allegiance became the owner of the three deposits in late 2016 and from then to today, has completed 3 years of environmental baseline studies, 2 pre-feasibility studies the first covering all 3 deposits and the second focused solely on Tenas, and a definitive feasibility study focused solely on Tenas. Allegiance is now in the pre-application environmental assessment and permitting phase for the Tenas Project.
Company website	https://www.allegiancecoal.com.au/site/content/

Asset locations

Asset name	Description
Tenas metallurgical coal project	• An underground metallurgical coal project in British Columbia of Canada • Status: Probable
New Elk metallurgical coal project	• An underground metallurgical coal project in the US • Status: Probable
Kilmain	• A coking and Low ash thermal coal project in Bowen Basin, Australia • Kilmain has potential for both an underground and open cut coal deposit

https://www.allegiancecoal.com.au/site/contact-us/contact-us1

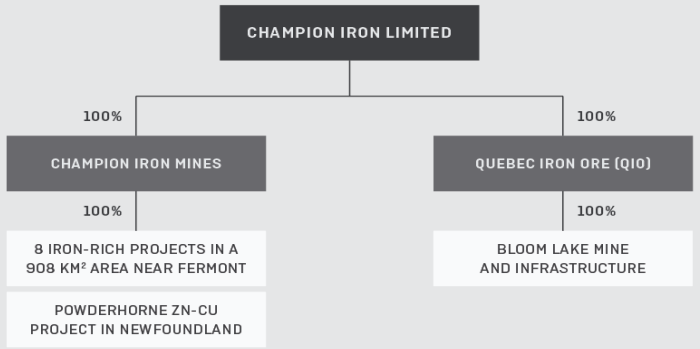
Capstone Mining

General information	
Position in supply chain	Copper producer & developer
Headquarter location	Vancouver, Canada
Assets	• Pinto Valley in the US, copper mine • Cozamin (Cu-Ag) in Mexico, copper mine • Santo Domingo project in Chile (Capston has 70% and Korea Resources Corp has 30%)
Announced technology changes	• Eriez HydroFloat Coarse Particle Flotation at Pinto Valley mine • Novel patented catalytic technology to existing dump leach for SX-EW • One way ramp in UG operation at Cozamin to improve output
Contact details	David Osachoff - Marketing Director for Capstone DOsachoff@capstonemining.com
Other useful information	• MOU for port & rail agreement for Santo Domingo project
Company website	http://capstonemining.com/home/default.aspx

Asset locations

Asset name	Description
Pinto Valley Copper Mine	• An operating open-pit copper mine • Produced 53 kt of copper, 0.07 t of gold and 8.5 t of silver in 2019.
Cozamin Copper Mine	• An operating underground polymetallic mine • Produced 16 kt of copper, 8 kt of zinc. 1 kt of lead and 41 t of silver in 2019
Santo Domingo project	• An Iron oxide copper gold open-pit project in Chile • Status: Probable • Expected production: 9.8 kt of copper in 2024

Minerai de Fer Quebec (Quebec Iron Ore)

General information	
Position in supply chain	Iron ore producer
Headquarter location	Quebec, Canada
Assets	• Bloom Lake Mine, Quebec, Canada
Announced technology changes	• Looking at autonomous vehicles, drilling and battery powered vehicles
Contact details	Francois Lavoie - Technical Director Flavoie@MineraiFerQuebec.com Dominic Lajeunesse - Operational Excellence Manager DLajeunesse@MineraiFerQuebec.com
Other useful information	Minerai De Fer Quebec 100% owned by Champion Iron 
Company website	https://mineraiferquebec.com/?lang=en

Asset locations

Description of the company

The Bloom Lake Mine is an operating iron ore mine with an expansion (Bloom Lake Phase II) currently going on.

The original facility has a capacity of 7.4 Mt/y, however, there are plans to double this capacity to 15 Mt/y by 2021 as part of the Phase 2 expansion plan submitted in August 2019. The expansion aims to increase iron recovery to 82.4% by improving and replacing some of the existing mineral processing infrastructure. This includes new gravity spiral and magnetic separator technology as well as a new crusher and revised mining plan. Champion Iron has committed total capex of $512.6 million, after making its final investment decision in November 2020. The company is aiming to complete the expansion by 2022 Q2.

The company is “One of the leaders in Canadian sustainable production”.

New Gold

General information	
Position in supply chain	Copper, gold and silver producer
Headquarter location	Toronto, Ontario, Canada
Assets	• New Afton gold-copper mine • Rainy River, gold-silver mine • Blackwater Project gold stream • Cerro San Pedro gold-silver mine
Announced technology changes	New Afton: • Autonomous scoops and mill process controls • Electrification of C-Zone
Contact details	Bruce Melleny bruce.mulleny@newgold.com Peter Prochotsky - New Afton Mine Manager Peter.Prochotsky@newgold.com Martin Froehling - New Afton Mill Manager Martin.Froehling@newgold.com
Company website	https://newgold.com/

Asset locations

Asset name	Description
Rainy River mine	• Resources: 1.9 million oz of gold and 5.1 million oz of silver • Production started from November 2017, 2019 production is ~254 koz
New Afton mine	• Resources: 933 Million pounds of copper, 1.1 million oz of gold and 3.8 million oz of silver • 2019 production is ~69 koz of gold and 79 million pounds of copper.
Blackwater project	• Resources: 8.2 million oz of gold and 61 million oz of silver
Cerro San Pedro mine	• Currently under reclamation, last production was 2017.

Ausenco

General information	
Position in supply chain	Consulting & engineering services
Headquarter location	Vancouver, Canada
Offices	• 26 offices in 14 countries
Announced technology changes	N/A
Contact details	Paul Antonioni - Procurement & Contracts paul.antonioni@ausenco.com
Other useful information	Main activities includes: • Consulting • Engineering & Project delivery • Asset operations • Management and optimisation solutions to the minerals & metals, oil & gas and industrial sectors
Company website	https://www.ausenco.com/

Key office locations

Description of the company

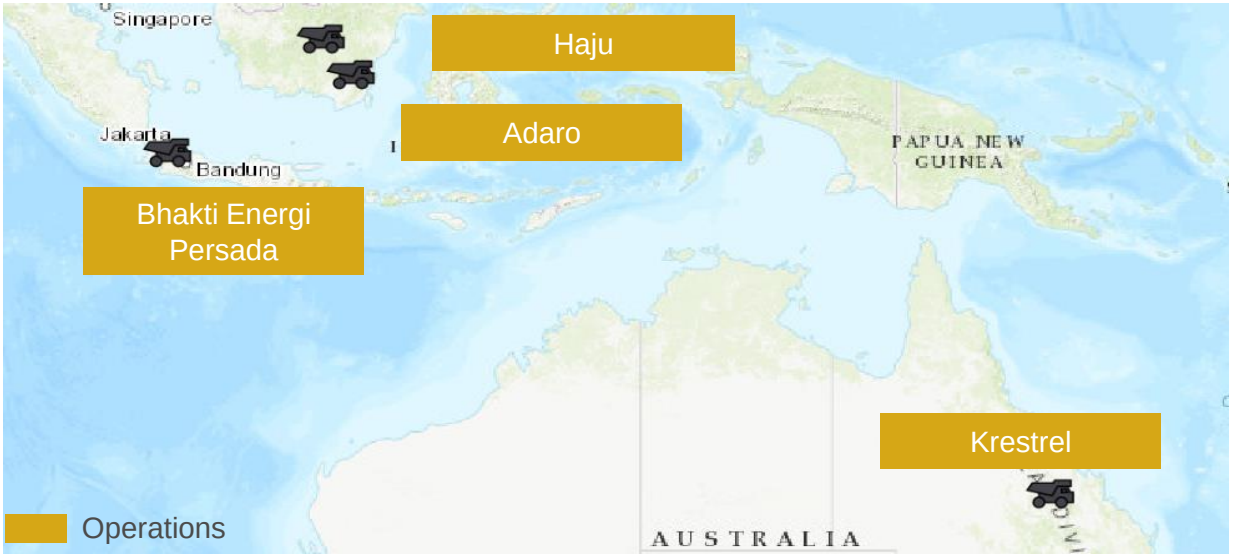
Ausenco formed three JVs: Duro Felguera S.A, Kramer Ausenco and Regional Economic Solutions (RES).

- **Duro Felguera S.A**: The company was formed in 2015 with Spanish multinational construction company Duro Felguera S.A. (DF). The subject is to jointly pursue and deliver EPC projects globally and increase market share in their sectors.
- **Kramer Ausenco** is a 50/50 merger between the Kramer Group, a multi-disciplinary engineering and architectural firm based in Papua New Guinea, and Ausenco.
- **Regional Economic Solutions (RES)** was formed in 2013 through the common desire of its business Directors, Leann Wilson and Mal Meninga, to bring about real economic change for Indigenous Australians.

Adaro

General information	
Position in supply chain	Coal producer – number of operations
Headquarter location	Indonesia
Assets	• South Kalimantan • Central Kalimantan • Lignite / sub bit mine • JV with Kestrel mine
Contact details	Banggas Sitorus Head of Technical Marketing Division, Jakarta banggas.sitorus@adaro.com Kelaswara Citra - Technical Team, Jakarta patricia.gaol@adaro.com
Other useful information	• There are a number of different coal companies under the Adaro Group, including Adaro Mining, Adaro Logistics, Adaro Water, etc. • PT Adaro Indonesia (AI) runs coal mining operations in South Kalimantan and Central Kalimantan under a Coal Cooperation Agreement (CCA) with the Government of Indonesia until 2022, with option to extend
Company website	http://www.adaro.com/

Asset locations



Asset name	Description
Adaro in Central Kalimantan	• Thermal coal mine, production of54 Mt in 2020
Haju in South Kalimantan	• Acquired from BHP 3 years ago • 2.4 Mt, aiming to ramp up to 6 Mt in next 5 years
Bhakti Energi Persada	• Open pit thermal coal mine • Annual production 15 Mt in 2020
Lignite / sub bit mine	• 2 Mt expected in 2021 • Opened 2 years ago
JV with Kestrel mine	• Coking coal mine Australia

Amman Mineral

General information	
Position in supply chain	Copper & gold producer
Headquarter location	Jakarta, Indonesia
Assets	• Batu Hijau copper and gold mine
Announced technology changes	N/A
Contact details	Anton Herayawan Sr. Manager Capital Procurement & Contract Anton.Heryawan@amnt.co.id James Adams Sr. Manager Capital Procurement & Services James.Adams@amman.co.id
Other useful information	• The parent company of Amman Mineral is MedcoEnergi, who holds 82.2% interest of Amman. • In December 2020, the company announced that it is preparing to launch an initial public offerings, although the company has not decide on the timing yet.
Company website	https://www.amnt.co.id/tentang-kami

Asset locations

Description of the company

Batu Hijau is located in the West Nusa Tenggara province and is the second largest copper-gold mine in Indonesia after Grasberg mine in Papua Province. In 2020, it produced 122 kt of copper, 13 t of gold and 29 t of silver.

The mine construction was completed in 1999 and previously owned by Newmont. In 2016 Amman Mineral purchase the asset at US$1.3 billion.

The mining unit facilities include extensive mining equipment, a processing plant with a 120,000 tonne per day capacity, an 112megawatt coal-fired power plant, a port including a ferry terminal and an airstrip. All operational facilities are owned by Pt Amman Mineral Nusa Tenggara (Amman Mineral).

Antam

General information	
Position in supply chain	Ni, coal & Bx producer
Headquarter location	Jakarta, Indonesia
Assets	• Pomalaa nickel mine , Southeast Sulawesi • West Papua nickel mine, Gag Island • Sarolangun coal mine, Jambi • Kijang bauxite mine, Bintan Island
Announced technology changes	• Potential use of Smart Predictive Line Control
Contact details	Agung Adiyanto – VP of Mining +62 813-9955-5659
Other useful information	• The company became a limited liability state-controlled company in 1968 • Major activities include exploration, excavation, processing to marketing • Commodities: nickel, coal, gold and PM refinery, bauxite and alumina • Customers are based in Europe and Asia
Company website	https://www.antam.com/en/contact

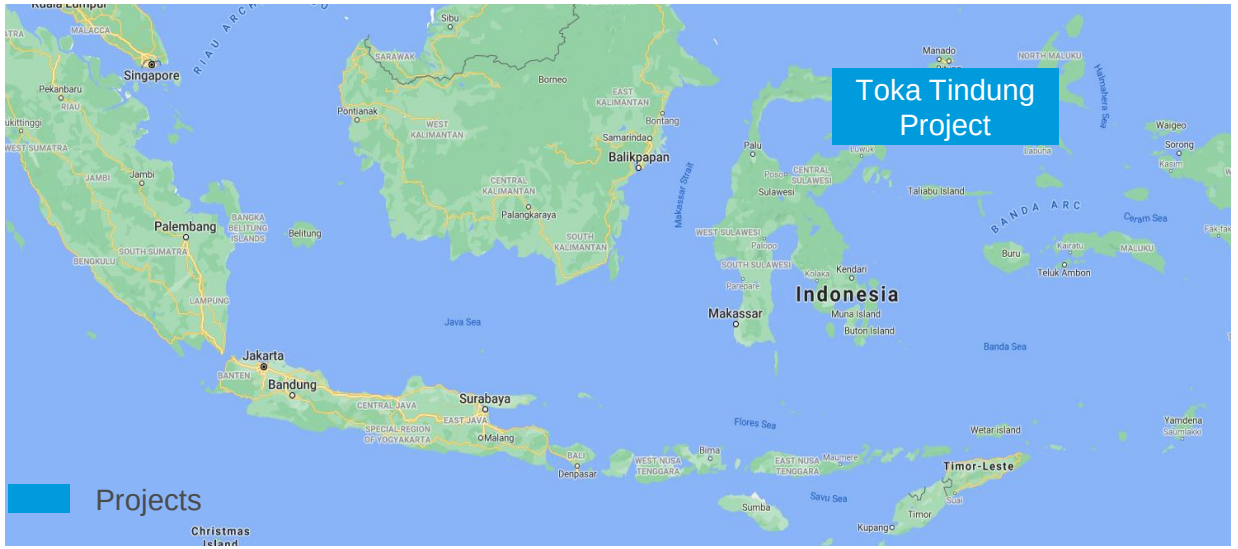
JV locations and share

Asset name	Description
Haltim Ferronickel Plant Development Project	• Nickel processing to ferronickel • Capacity: 13,500 TNi pa (Line 1) • Status: Committed
Mempawah Smelter Grade Alumina Refinery (SGAR) Project	• Bauxite processing to smelter grade alumina (SGA) • Capacity: 1 million tons of SGA pa (Stage 1) • Status: Probable

Archi Indonesia

General information	
Position in supply chain	Gold producer
Headquarter location	Jakarta, Indonesia
Assets	Toka Tindung Gold Mine and Project
Announced technology changes	Open pit operation (5 pits)
Contact details	Kell Monro – Operations Director Kell.Monro@archimining.com
Other useful information	The Toka Tindung Mine is owned by Archi Group, which is fully owned by PT Rajawali Corpora. The mining rights of the Toka Tindung Project is via two Contract of Work companies, namely PT Meares Soputan Mining **(MSM)** and PT Tambang Tondano Nusajaya **(TNN).**
Company website	https://archiindonesia.com/

Asset locations



Description of the company

Toka Tindung is an open gold mine located approximately 35 km northeast of Manado in North Sulawesi, Indonesia. The project began commercial production in April 2011 and reached its first production year in 2011.

Gold produced increased from 134 koz in 2012 (the first commercial production year) to 251 koz in 2017 and will continue to increase in accordance with the 5-year Life of Mine (LOM) plan made in 2018.

Other facilities:

- The Toka Processing Plant has an installed 2.1 million tons capacity per year.
- A permanent road connecting to an international airport near Manado
- A deep sea port in Bitung, 30 km south of the project location.

Merdeka Copper Gold Tbk

General information	
Position in supply chain	Copper and gold operator & developer
Headquarter location	Jakarta, Indonesia
Assets	• Tjuh Bukit Gold Operating Mine & UG extension project • Wetar Copper op & numerous projects • Pani Joint Venture
Announced technology changes	N/A
Contact details	Tim Adams - Project Economist tim.adams@merdekacoppergold.com
Other useful information	The company's missions: • To be the development partner of choice in the Indonesian mining & metals industry • To be a leader in safety, environmental protection & corporate social responsibility • To generate superior value & investor returns through prudent investment and effective project development • To be a leader in innovation and efficiency
Company website	https://www.merdekacoppergold.com/

Asset locations

Asset name	Description
Tjuh Bukit Gold operating mine and project	• Produces gold and silver • Has been expanded from 4 Mtpa to 8 Mtpa in 2019 • Plan for UG expansion started since 2018 and the Pre-FS will be completed in 2021
Wetar Copper mine and project	• Located on Wetar Island, Maluku Barat Daya Regency, Maluku Province. Reserve • 8.3 Mt of ore at 1.4% Cu • 22 Mt of ores at 1.33% Cu
Pani Gold	• Gold mine located in Pohuwato Regency, Gorontalo Province.

Nickel Mines

General information	
Position in supply chain	Nickel producer
Headquarter location	Sydney, Australia
Assets	• Holds 80% interest of the Hengjaya Nickel and Ranger Nickel projects, Indonesia
Announced technology changes	• 4 new RKEF lines at Morawali stainless plant
Contact details	Justin Werner - Managing Director werner@nickelmines.com.au
Other useful information	• 80% economic interests in the Hengjaya Nickel and Ranger Nickel projects, both of which operate 2 line Rotary Kiln Electric Furnace ('RKEF') plants producing NPI within the Indonesia Morowali Industrial Park ('IMIP') • Offtake agreement with Tsingshan for nickel ore (following export ban), developed into strategic partnership in 2017 • Morawali Industrial Park: US$10 billion invested to date on vertically integrated stainless steel plant
Company website	https://www.nickelmines.com.au/

Asset locations

Description of the company

Nickel Mines Limited is an Australian public company. Prior to the implementation of the Indonesian Government's ban on the exportation of unprocessed minerals in January 2014, Nickel Mines operated a small scale DSO operation having advanced the Hengjaya Mine through all necessary stages to achieve "clean and clear" status for the direct exporting. Shortly after the export ban was enacted, mining operations were suspended and Nickel Mines was forced to pursue ore sales to domestic producers and explore in-country beneficiation options.

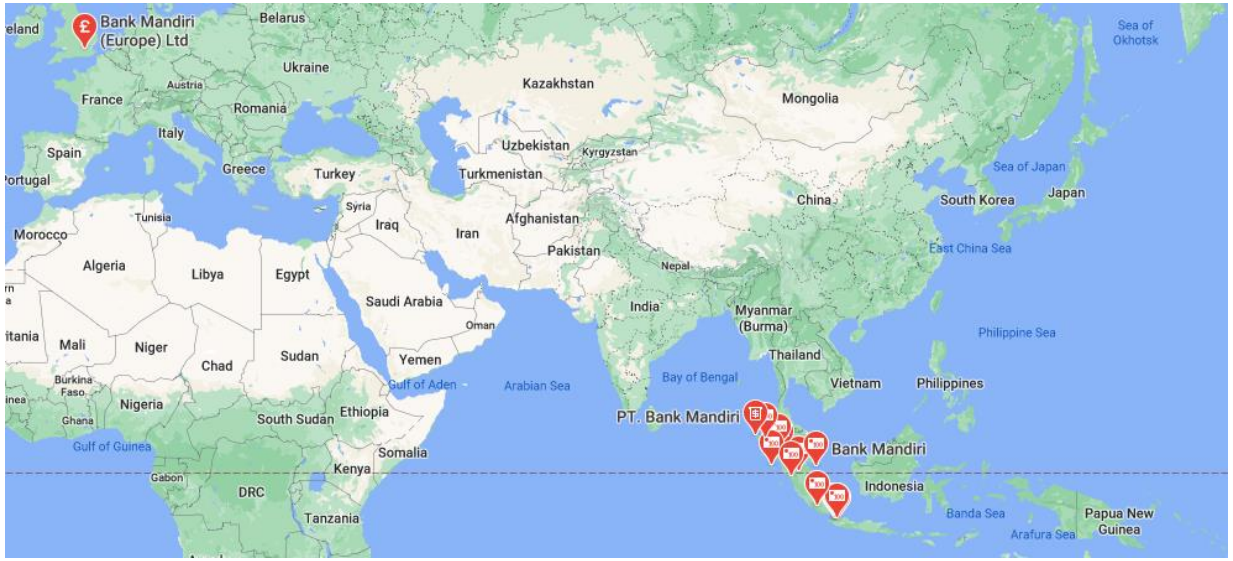
In 2015 Nickel Mines signed an offtake agreement with Tsingshan for the supply of high grade saprolite ore.

Since 2018 Nickel Mines has been listed in the Official List of the Australian Stock Exchange ('ASX').

Bank Mandiri

General information	
Position in supply chain	Bank
Headquarter location	Jakarta, Indonesia
Announced technology changes	N/A
Contact details	Whitney Simorangkir – Banking whitney.simorangkir@bankmandiri.co.id T: 622130023000
Other useful information	Mandiri Group owns a list of subsidiary companies including: • Bank Syariah Mandiri • Mandiri Sekuritas • AXA Mandiri Financial Services • Mandiri Taspen Pos • Mandiri Tunas Finance • Mandiri AXA General Insurance • Asuransi Jiwa InHealth Indonesia • Bank Mandiri (Europe) Ltd
Company website	https://bankmandiri.co.id/en/web/guest

Office locations



Description of the company

Bank Mandiri was established on 2 October 1998, as part of the bank restructuring program of the Government of Indonesia. In July 1999, four state-owned banks - Bank Bumi Daya, Bank Dagang Negara, Bank Exim and Bapindo - were amalgamated into Bank Mandiri.

Currently Bank Mandiri is the largest bank in Indonesia in terms of assets, loans and deposits.

The Jakarta Mining Club (JMC)

General information	
Position in supply chain	Networking and event organiser
Headquarter location	Jakarta, Indonesia
Company scale	• 3,600 members • 28 sponsors
Contact details	David Duffy dduffy@djakarta-miningclub.com +62 811 188 1860
Major activities	• Promote, educate and encourage dialogue across the Indonesia mining industry. • Their sponsors include Newcrest Mining, Weir Minerals, Trakindo CAT, Metso Outotec, etc • They organised regular networking events, seminars and lunches; more recently, the focus has been on monthly virtual webinars, where they gather at least 300 attendees per session.
Company website	http://djakarta-miningclub.com/

Major sponsors

Vermeer Indonesia

MMD Mining Machinery Indonesia

RPM Global

Tekenomiks Indonesia

Metso: Outotec

PT United Tractors Pandu Engineering

Siemens AG

PT ExxonMobil Lubricants Indonesia

ABEL GRUP INDONESIA

Recent events

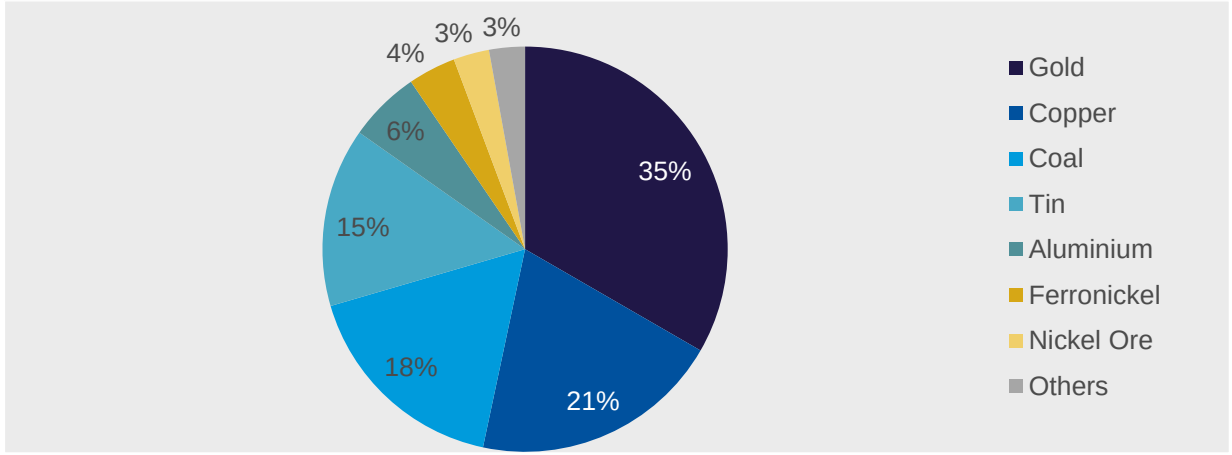
- 34th Djakarta Mining Club Networking Event - 6 February 2020
- 33rd Djakarta Mining Club x IHS Markit Indonesian Coal Market Briefing - 26 November 2019
- Djakarta Mining Club Lounge at Mining Indonesia 2019 - 18 – 21 September 2019
- 32nd Djakarta Mining Club x Embassy of Canada - 17 September 2019
- 31st Djakarta Mining Club - 25 July 2019

Mining Industry Indonesia (MIND ID)

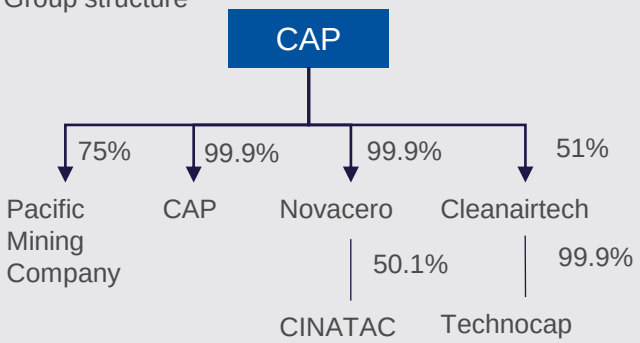
General information	
Position in supply chain	Mining industry holding company
Headquarter location	North Sumatra, Indonesia
Assets	• PT Antam (Ni & Au) • PT Bukit Asam (Coal) • PT Freeport (Cu) • PT Inalum (Al) • PT Timah (Sn)
Contact details	Adhita Widiadhari - Corporate finance / Hybrid adhita.widiadhari@inalum.id
Other useful information	• MIND ID (also known as Inalum) became a state-owned mining industry holding company in 2017 and combined the government's stakes in the 4 other mining companies, as shown in the RHS chart • The Mining & Minerals Institute (**MMII**) is the R&D division of MIND ID, focusing on research & innovation to benefit the Indonesian minerals industries. They are currently involved in projects on coal emissions, downstream nickel technologies and REE processing.
Company website	https://mind.id/

Holdings

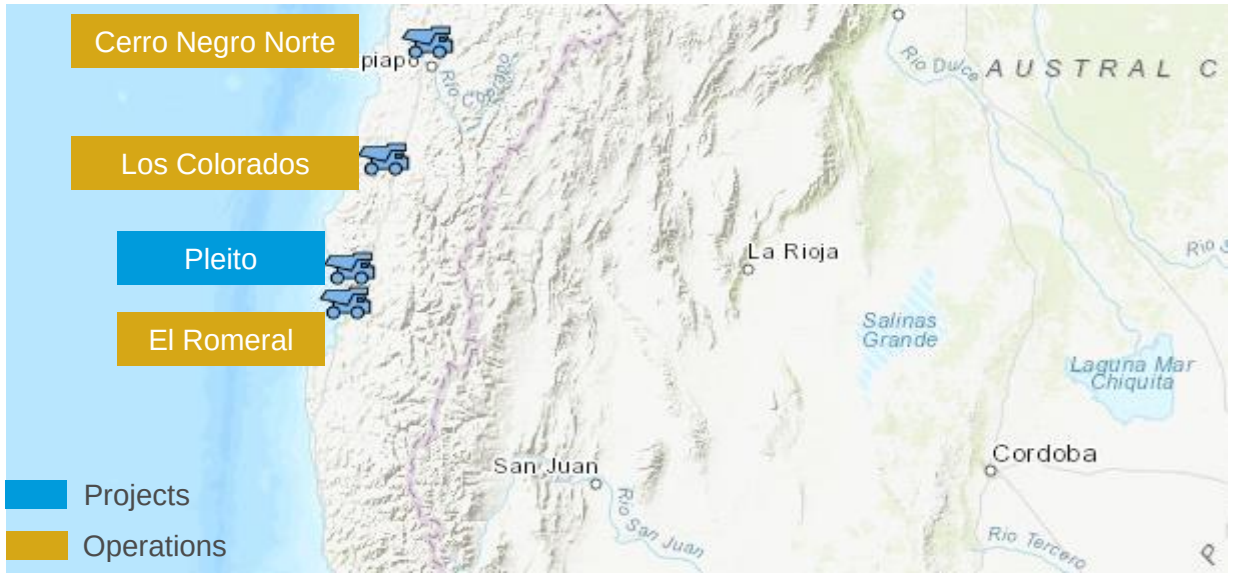
Revenue by commodity



CAP

General information	
Position in supply chain	Iron ore producer
Headquarter location	Santiago, Chile
Assets	• Cerro Negro Norte • Los Colorados • Pleito • El Romeral
Announced technology changes	N/A
Contact details	Diego Carrasco Head of Research, Corporate Strategy dcarrasco@cap.cl
Other useful information	Group structure 
Company website	https://www.cap.cl/

Asset locations



Asset name	Description
Cerro Negro Norte	• Open pit iron ore mine • 5.6 Mt of iron oreproduction in 2020
Los Colorados	• Open pit iron ore mine • 8 Mt of iron oreproduction in 2020
Pleito	• Speculative project
El Romeral	• Open pit iron ore mine • 1.6 Mt of production in 2020,

CEMIN Holding Group

General information	
Position in supply chain	Copper producer
Headquarter location	Santiago, Chile
Assets	• Amalia Catemu Industrial Complex, San Felipe, • Minera Pullalli, La Ligua • Dos Amigos, Domeyko
Announced technology changes	• Tailings disposal technology
Contact details	Marcelo Valenzuela Procurement and Contracts Division contacto@cemin.com T: +56 2 2471 3600
Other useful information	Environment and Innovation news • Pullalli joins the HuellaChile program of the Ministry of the Environmentis • Pullalli is first mining company to receive HuellaChile stamps for GHG reduction and quantification • Amalia plant has replaces use of oil with LNG • Obtained the fifth place in the Excellence Award Kaizen Chile 2019
Company website	https://www.cemin.com/

Asset locations

Asset name	Description
Amalia Catemu Industrial Complex	• Copper mines • Has a copper cathode leaching and electrowinning plant.
Minera Pullalli	• An underground gold mine and processing plant.
Dos Amigos	• Includes eaching piles, a plant for the electrowinning of copper cathodes by processing minerals provided by its own mines and third parties in the area.

Minera Tres Valles

General information	
Position in supply chain	Copper producer
Headquarter location	Santiago, Chile
Assets	Minera Tres Valles project includes: • Papomono (Underground deposit) • Don Gabriel (Open pit mine)
Announced technology changes	Salt leaching and small footprint inclined block caving
Contact details	Alejandro Exss Strategic Projects Engineer, Finance alejandro.exss@mineratresvalles.cl T: +56442081010
Other useful information	**2009 - 2010** Construction began by Papomono& Don Gabriel **2011** Start of operations by Vale **2013** Vecchiola Group became propietor **2017** SRHI Inc. Acquaried 70% of the company
Company website	https://mineratresvalles.com

Asset locations

Description of the company

Minera Tres Valles is a mining project located near the towns of Salamanca and Illapel that is dedicated to the production of high grade copper cathodes. Its efforts focus on exploiting its own ore bodies, Papomono (an underground deposit) and Don Gabriel (an open-pit mine), which were re-opened in October 2015.

Its processing plant has a normal capacity of 5,400 tonnes per day (tpd) of ore, and consists of a copper leaching operation that has a crushing and agglomeration plant, heap leach pads and pools, and an SX-EW plant.

The facility is designed to produce up to 18,500 tonnes per annum (tpa) of thin copper cathodes.

SCM Minera Lumina Copper

General information	
Position in supply chain	Mining company
Headquarter location	Santiago, Chile
Assets	Caserones (Caserones del cerro)
Contact details	Axel Mihanovich Supply Chain Manager amihanovich@caserones.cl T: +56940061498
Other useful information	**Ownership structure** JX Nippon Mining & Metals — 52% Mitsui Mining & Smelting — 26% Mitsui & Co — 23% Pan Pacific Copper 22.63% 77.37% SCM Minera Lumina Copper
Company website	https://www.caserones.cl/mlcc/

Asset location

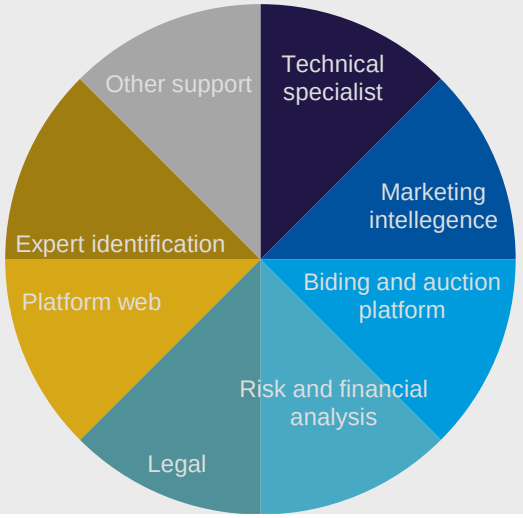
Asset description

Caserones is an open pit copper mine wholly owned by Japanese companies. Production of refined copper began on March 2013 and of copper concentrates in May 2014. The volume of copper concentrates to be produced here is equivalent to around 10% of the Japanese import volume. It is expected to contribute to the supply of copper resources to Japan through the year 2040.

Emere

General information	
Position in supply chain	Intermediary company
Headquarter location	Santiago, Chile
Assets	N/A
Contact details	Pablo Hamame CEO EMERE phamame@emere.cl
Other useful information	The value of the company: • **Trust** the beginning of everything • **Ethics** the fundamental pillar**.** • **Excellence** the result of a well-executed job. • **Contribution** to collaborate on everyone's result
Company website	https://emere.cl/

Company system



Description of company

- EMERE is a purchasing management platform for the supply of industrial inputs available to its buyer, supplier and EMERE stakeholders.
- The focus of EMERE is on medium-sized companies.

Appendix B – Key commodity market overviews

Iron ore

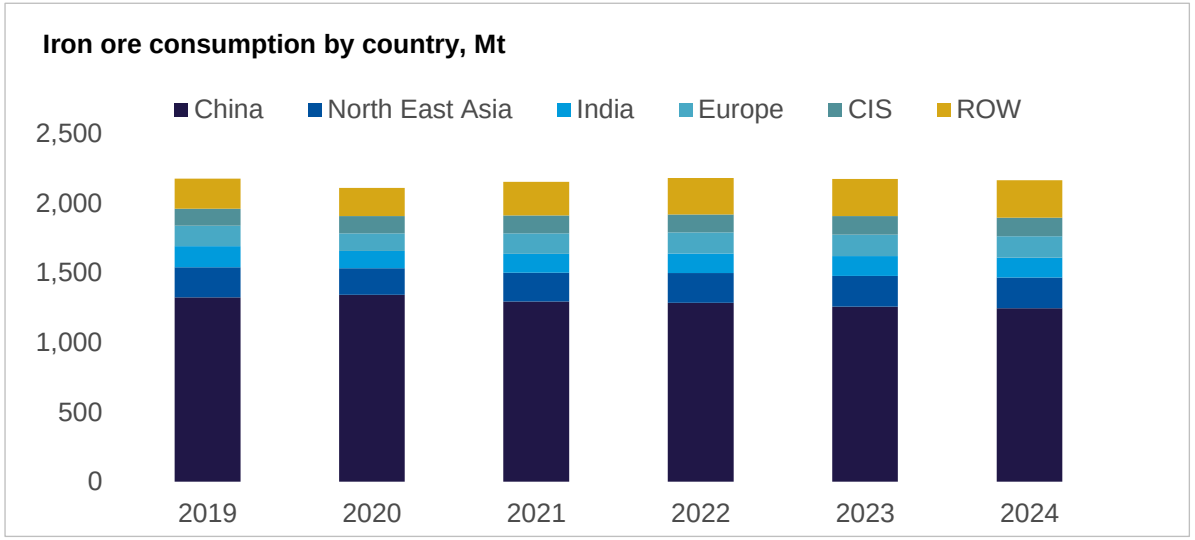
Global demand will recover & be met by growing Brazilian supply

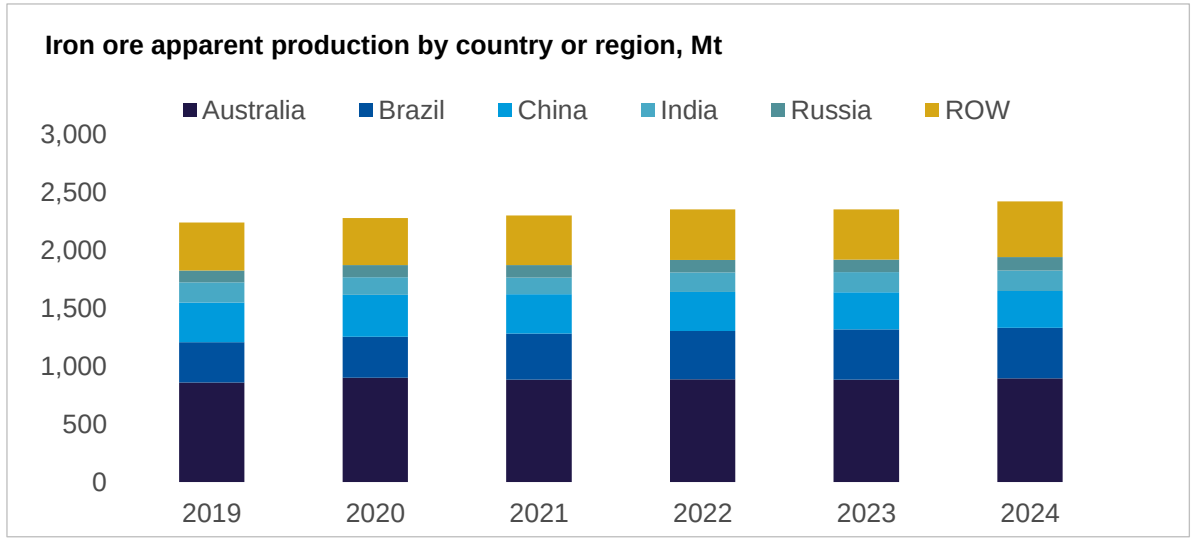
Demand

- Global iron ore demand is expected to grow from 2,111 Mt in 2020 to 2,167 Mt in 2024 (CAGR of 0.7%), which is slightly lower than pre-Covid-19 level.
- In 2020, Chinese iron ore demand has been exceptionally strong due to government stimulus. However, Chinese demand is expected to fall from 2021.
- Europe is recovering quickly, expected to return pre-Covid-19 level from 2021 and reach 154 Mt by 2024 (CAGR +5.3% from 2020 to 2024).

Supply

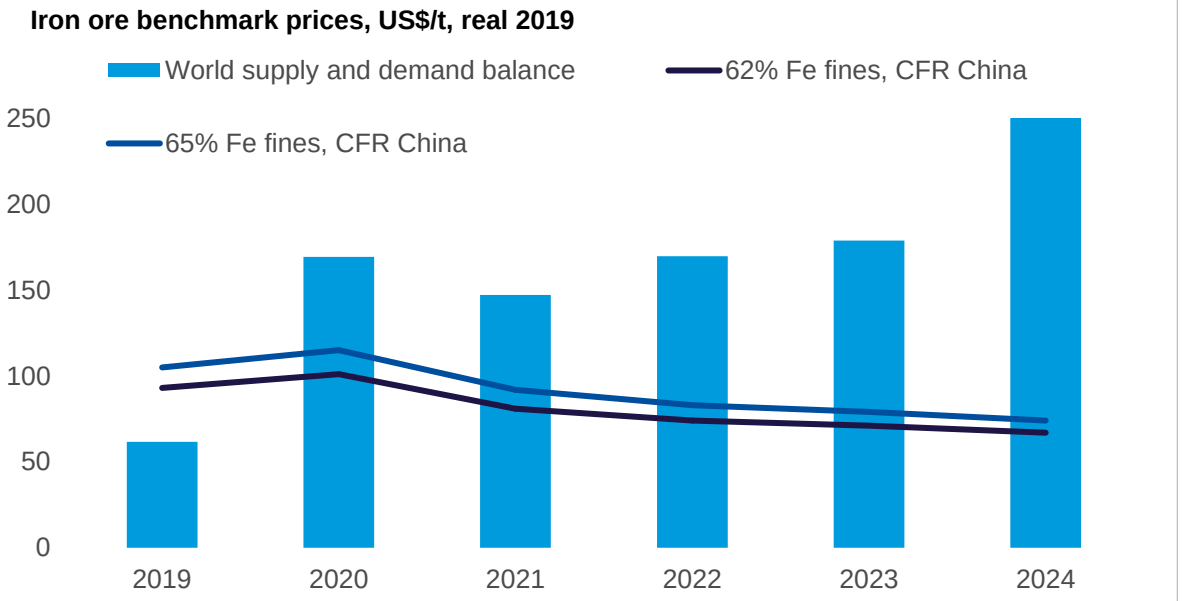
- Australia will remain dominant in the iron ore production but loosing share to Brazil – Australia's share of 40% in 2020 will fall to 37% in 2024.
- Brazil will have the highest and fastest growth (CAGR 5.4%, +83 Mt) from 2020 to 2024 as disrupted productions will resume.
- China's production will fall from 361 Mt in 2020 to 317 Mt in 2024 as environment restrictions tightens (CAGR -3.2%, -44 Mt).

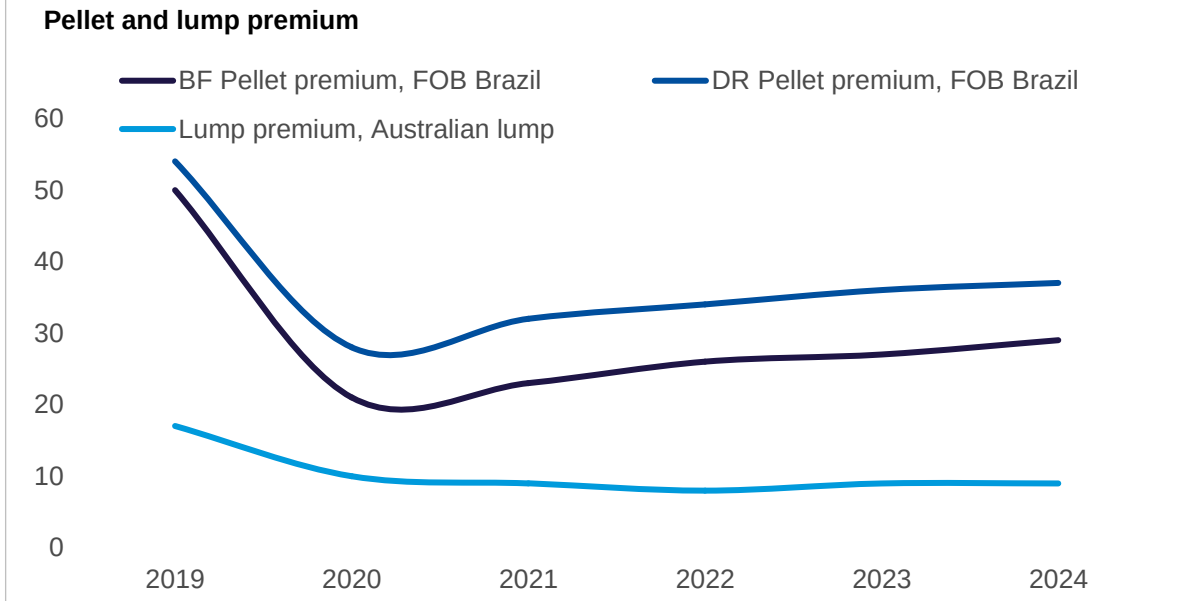




Market balance: Increasing supply surplus will bring down price

- Chinese demand surged in 2020, but availability of iron ore to Chinese market was limited due to weak Brazilian supply and tight offloading measures in China. As a result, price increased in 2020 to $101/t (62$ Fe) and $115/t (65% Fe).
- Looking into 2021, demand from other parts of the world recovers, supply from Brazil and Australia are also expected to increase. Global supply and demand balance will ease, and price is expected to fall back and reach $67/t (62% Fe) and $74/t (65% Fe).
- Pellet premiums dropped significantly in 2020 to $21/t (BF pellet) and $28/t (DR pellet) due to weak demand in traditional markets like Europe and JKT. Europe demand continued to be impacted by the pandemic infections and JKT was struggling with low economic growth already before the pandemic. From 2021, Europe is expected to recover and bring up pellet premium in the medium term.





Thermal coal

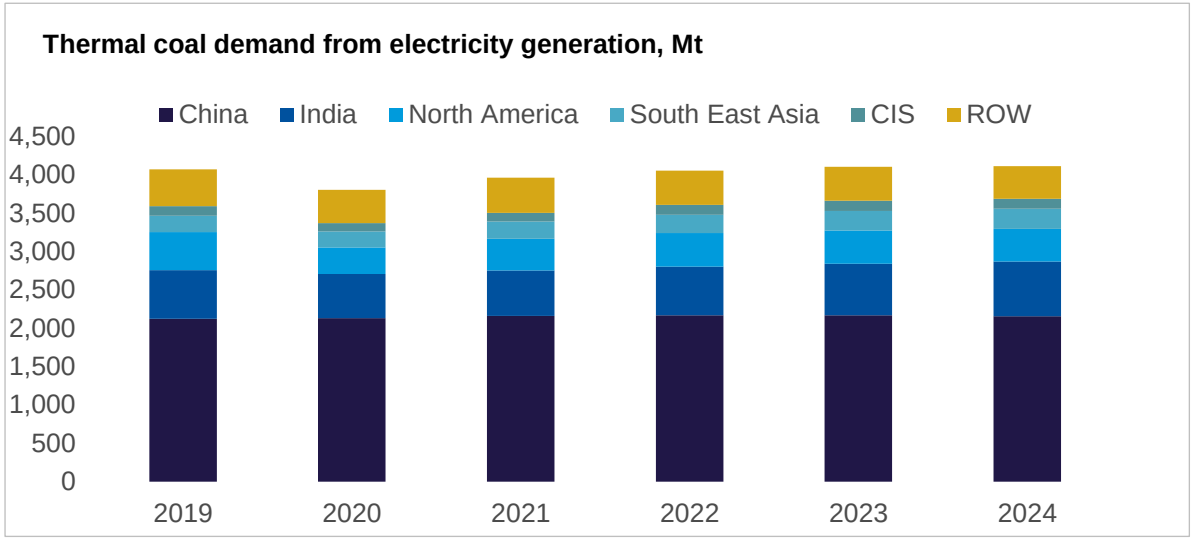
Thermal coal to be relatively flat despite growing electricity demand

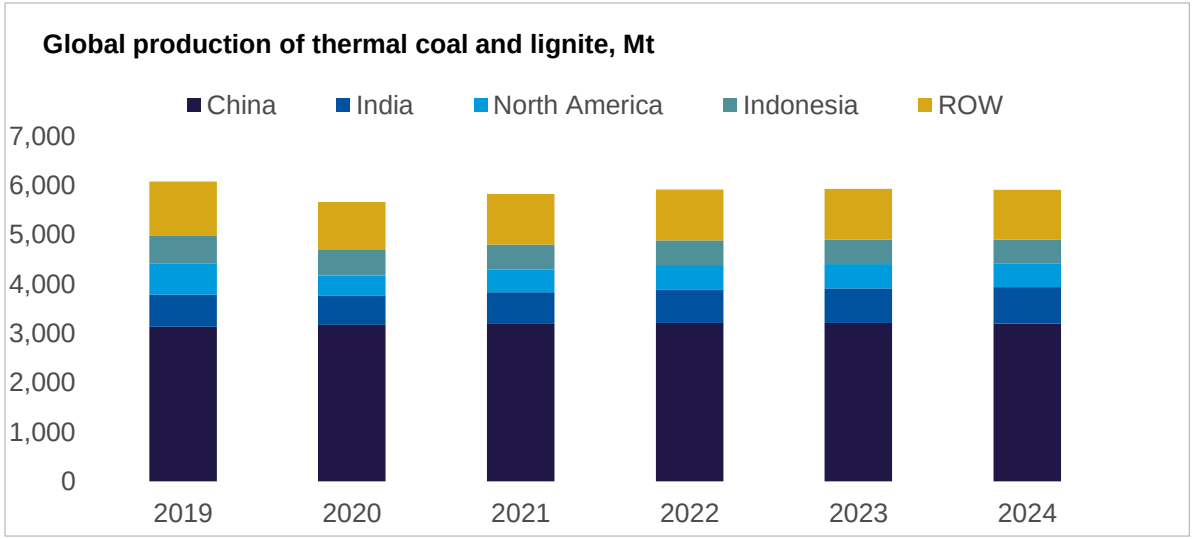
Demand

- Despite expected growth in primary power and electricity generation, coal-fired electricity generation is forecast to remain relatively steady as environmental concerns grow.
- As a result, global thermal coal demand from electricity generation is expected to remain flat in the forecast period with a slight increase from 3,806 Mt to 4,117 Mt from 2020 to 2024 (CAGR of 2.0%).
- The major growth will be from South East Asia (+5.9%), India (+5.5%) and North America (+5.4%).

Supply

- The global thermal coal production is expected to remain broadly flat with a slight increase from 4,657 Mt in 2019 to 4,802 Mt in 2024 (0.6% CAGR).
- China and the India are the two biggest producing countries, with 53% 10% share in 2020. The share of China is expected to fall slightly to 50% and India grow to 12% by 2024.
- Other high growth countries include Kazakhstan (CAGR 2.0%) and Russia (CAGR 0.6%).

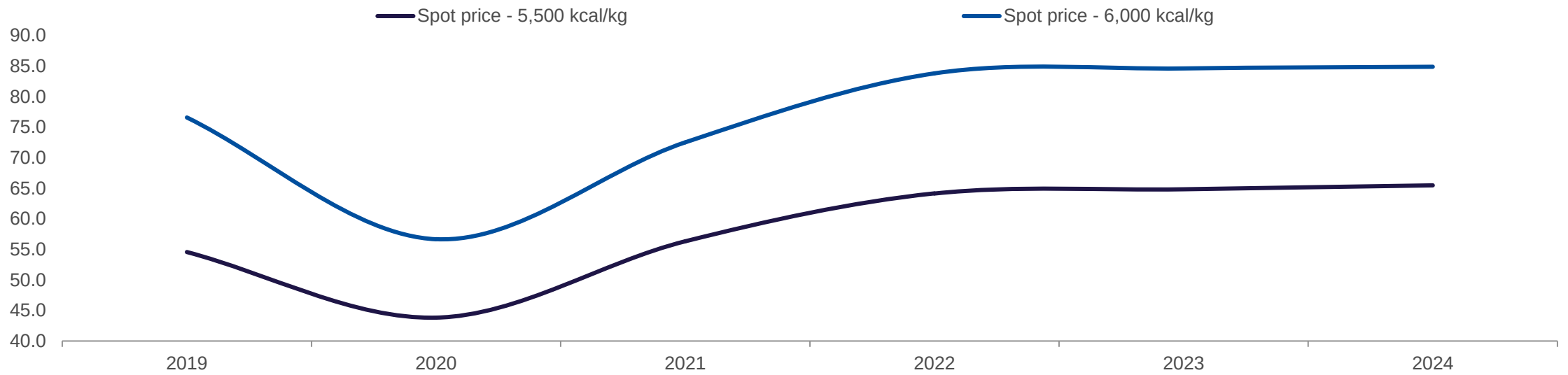




Assumed demand recovery across the worlds will bring price up

- In 2020, thermal coal prices remained at low levels as markets generally remained oversupplied. Annual average price reached $43.0/t and $56.7/t for 5,500 kcal and 6,000 kcal thermal coal.
- In Q4 2020, we see recovery of thermal coal prices driven by the return of buying activity from China and this recovery is expected to continue into 2021.
- In medium term to 2024, recovery of total thermal coal demand across the world and recovery of the seaborne market from the 2020 lows suggest that supply will be needed again. We expect prices to return to the 90th percentile of global business cost and stabilize at ~$65/t and $85/t respectively, despite the consistent oversupply throughout forecast period.

Thermal coal prices, FOB Newcastle, $/t real 2019



Metallurgical coal

Supply and demand will be roughly balanced from 2021

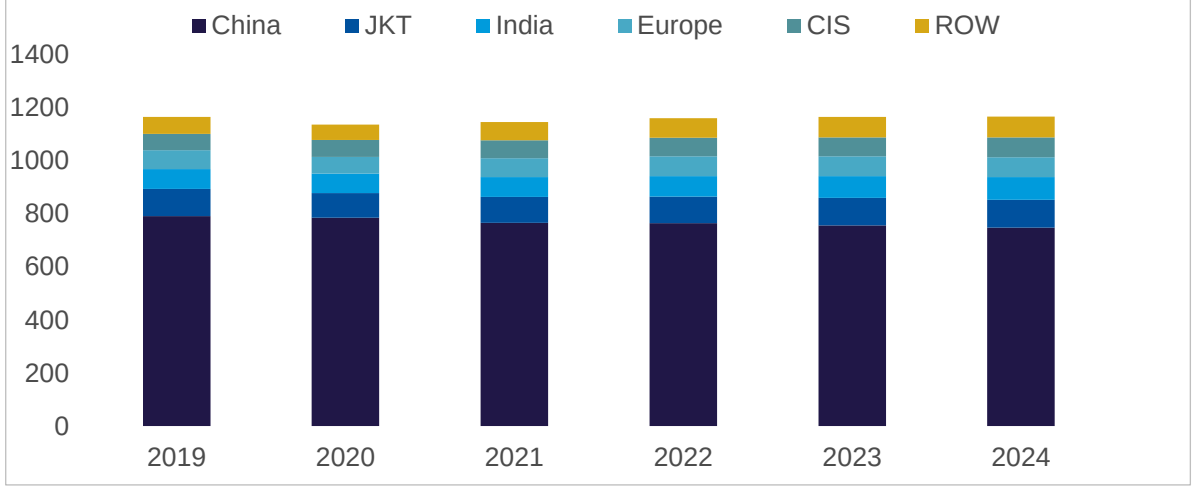
Demand

- Global met coal demand is expected to increase from 1,136 Mt in 2020 to 1,166 Mt in 2024 (CAGR +0.7%, + 30 Mt). Most of the growth will come from India and Southeast Asia, while Chinese metallurgical coal imports will see a further small decline over the period.
- China's demand will fall by 37 Mt (-1.2%), mainly driven by a fall the decline in ironmaking capacity as BOF steel production falls.

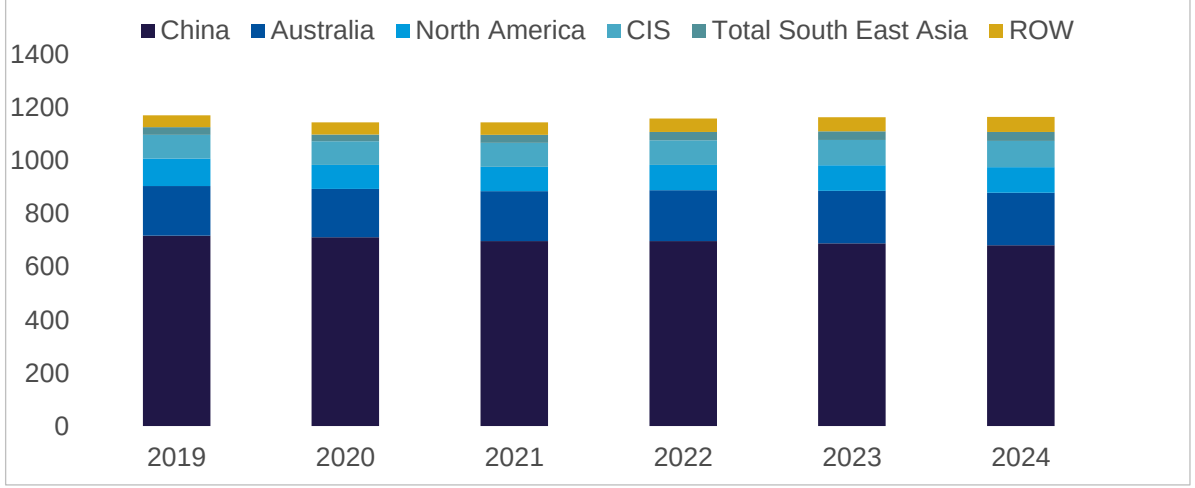
Supply

- In line with demand, supply will increase slightly from 1,144 Mt in 2020 to 1,165 Mt in 2024 (CAGR 0.5%, +21 Mt).
- South East Asia will see a fast growth in supply of CAGR 7.2% but from a very low base (from 25 Mt in 2020 to 34 Mt in 2024). Other fast-growing region include CIS (+10 Mt, CAGR 2.7%) and Australia (+16 Mt, CAGR 2.1%).

Metallurgical coal consumption by country and region, Mt



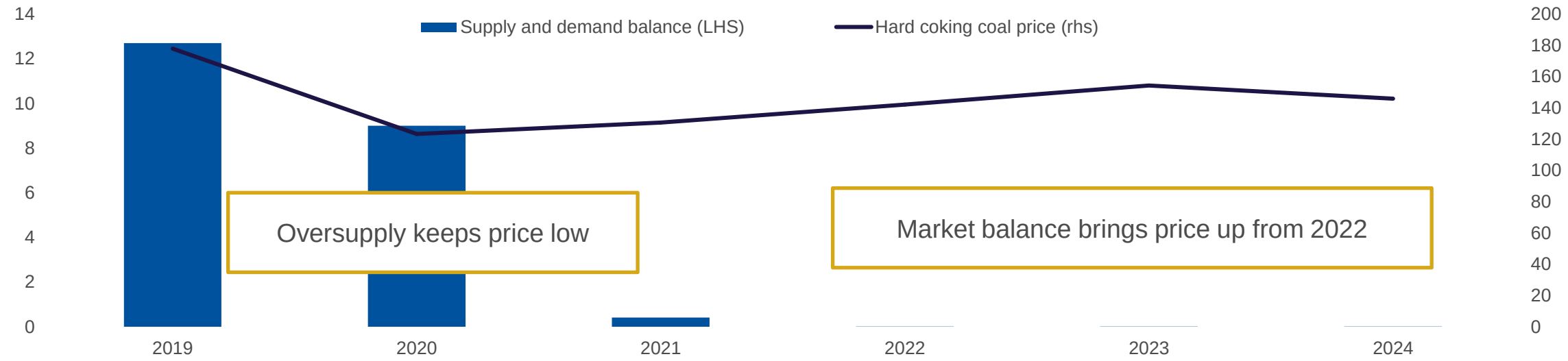
Metallurgical coal production by country and region, Mt



Higher demand expected to drive prices back

- In the second half of 2020, Chinese import restrictions has kept coal prices depressed, resulting in an annual average hard coking coal price of $123/t.
- We expect hot metal production to grow by 3% y/y in 2021, which will underpin coking coal demand and bring back HCC prices to $131/t.
- Over the medium term, the demand side is expected to recover as global industrial activity begins to recover by the end of this year. On the supply side, while there is significant capacity in the project pipeline, only those that can demonstrate considerably higher returns are likely to progress. As such, the market should be kept broadly balanced and our price forecast shows that the 2024 price will be at $146/t.

Hard cooking coal market balance and spot price, Mt(LHS), FOB Australia, $/t real 2019 (RHS)



Copper

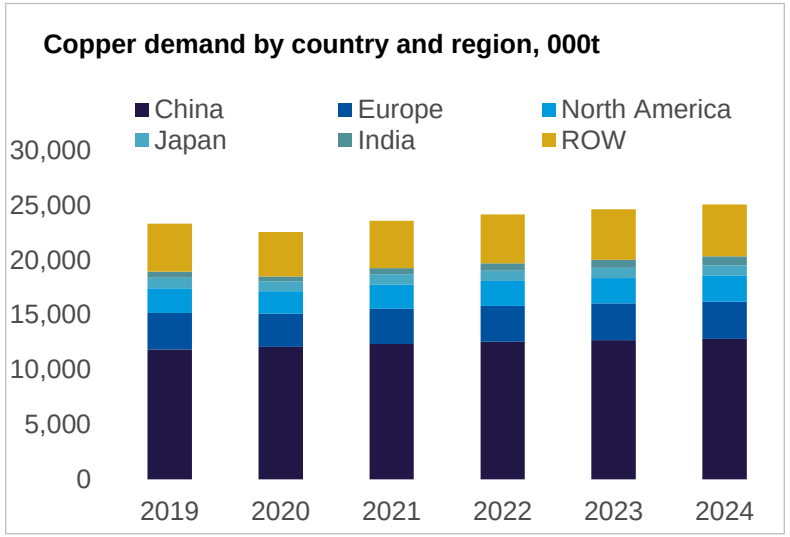
Africa & North America will see fastest growth in refined copper supply

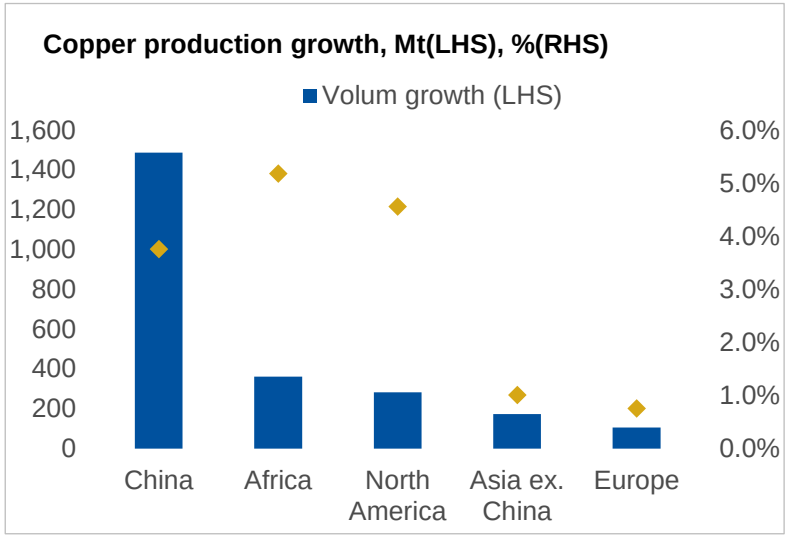
Demand

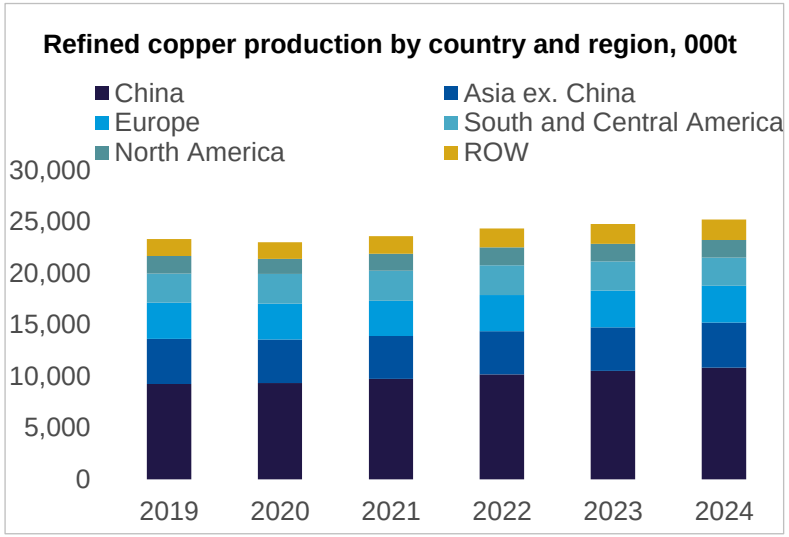
- Copper demand is expected to come out of recession from 2021 as construction sector recovers and the push toward EVs also driving up demand.
- Global refined copper demand is expected to be strong from 2020 to 2024(+2.5 Mt, CAGR 2.7%), with most growth outside of China, primarily from India and SE Asia. India will have the fastest growth both in terms of volume and speed (+0.4 Mt, CAGR 16.6%).

Supply

- There has been high disruption rate in 2020 especially in Peru due to the pandemic influence but supply is expected to recover from 2021.
- Over medium term refined copper production is expected to slowly increase in line with demand (+2.2 Mt, CAGR 2.3%). China will remain dominant in the production and the fastest growth will from Africa (CAGR 5.2%, +361Mt) and North America (CAGR 4.6%, +283 Mt)

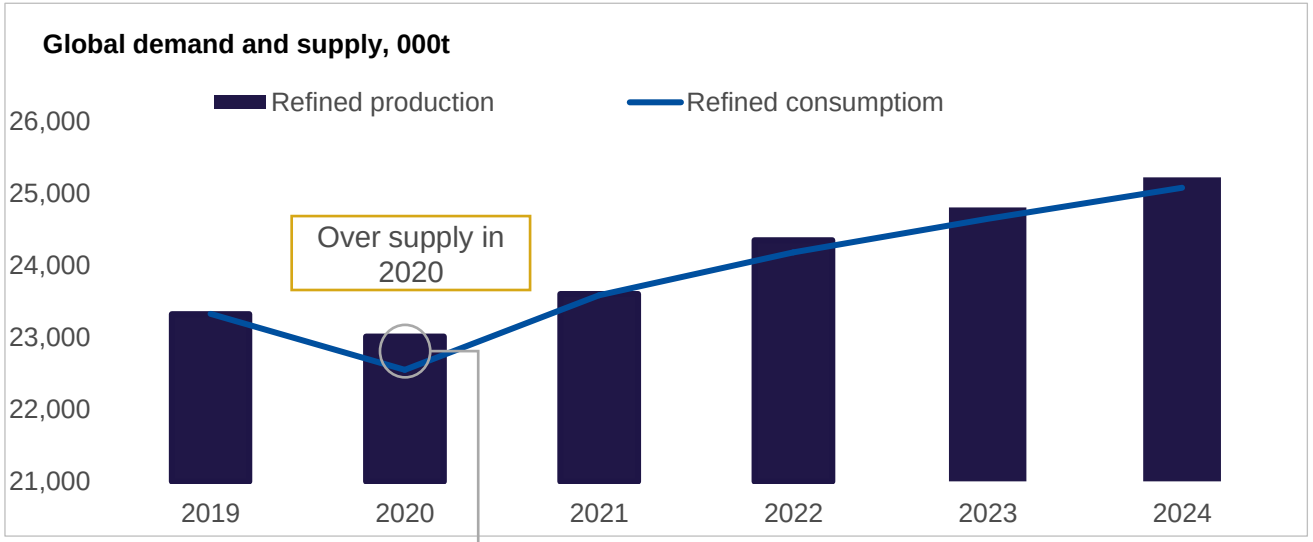


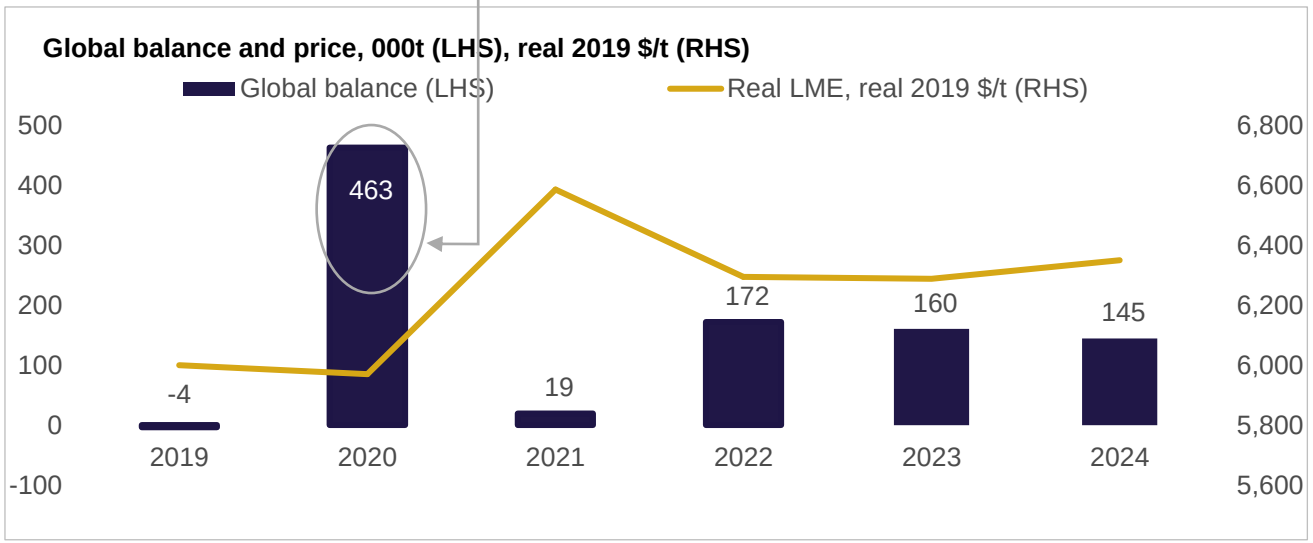




Modest supply surplus will keep price stable in the medium term

- In 2020, the refined copper market is significantly oversupplied with 463 kt of excess supply, driving price down to $5,971/t (LME price, real 2019).
- Looking into 2021, the copper market will come back to be roughly balanced compare to 2020 as the supply will be digested by the assumed recovery in world ex-China demand. As such, price is expected to increase to $6,587/t, which is even higher than pre-Covid-19 level.
- Over the medium term, we expect modest surpluses between 2022 and 2024 and the price will stabilize at around $6350/t in 2024.





Appendix C – List of operations & projects

Indonesia coal operations and projects

Operation	Operator	Mine type	2019 Production
Adaro	Adaro Energy	Open-pit	56.6
KPC Sangatta	Bumi Resources	Open-pit	51.3
Kideco Jaya Agung	Kideco Jaya Agung	Open-pit	40.0
Bara Tabang	PT Bara Tabang	Open-pit	23.2
Bukit Asam	Bukit Asam	Open-pit	29.1
Bhakti Energi Persada	PT Bhakti Energi Persada	Open-pit	5.0
Banpu Indominco Mandiri	Banpu	Open-pit	12.5
Berau Binungan	Berau	Open-pit	12.1
Mahakam Sumber Jaya	Harum Energy	Open-pit	3.7
Bunyu	Adani Group	Open-pit	9.4
Arutmin Asam Asam	Bumi Resources	Open-pit	8.3
Multi Sarana Avindo	Anugerah Bara Kaltim	Open-pit	8.4
Antang Gunung Meratus	PT Baramulti Suksessarana	Open-pit	8.0
KPC Bengalon	Bumi Resources	Open-pit	9.5
Jembayan	Sakari Resources	Open-pit	7.7
Tuah Turangga Agung	United Tractors	Open-pit	7.0
Arutmin Sarongga	Bumi Resources	Open-pit	4.0
Artumin Kintap	Bumi Resources	Open-pit	5.7
Berau Lati	Berau	Open-pit	10.0
Banpu Trubaindo	Banpu	Open-pit	4.7
Bhumi Rantau	Tapin Suthra Berjaya	Open-pit	5.0
East Kalimantan - Large - OC	Various	Open-pit	4.0
South Kalimantan - Large - OC	Various	Open-pit	4.0
Kutai Energi	Kutai Energi	Open-pit	3.5
Mega Prima Persada	PT Mega Prima Persada	Open-pit	3.0
Insani Bara Perkasa	Resource Alam Indonesia	Open-pit	3.0
Suprabari Mapanindo Mineral	Itochu Corp	Open-pit	2.0
Berau Sambarata	Berau	Open-pit	4.8

Operation	Operator	Mine type	2019 Production
Adimitra Baratama Nusantara	Adimitra Baratama Nusantara	Open-pit	2.5
East Kalimantan - Medium High - OC	Various	Open-pit	2.4
South Kalimantan - Medium High - OC	Various	Open-pit	2.4
Fajar Sakti Prima	PT Bara Tabang	Open-pit	2.2
Bara Kumala Sakti	PT Bara Kumala Sakti	Open-pit	1.9
Firman Ketaun Perkasa	Bayan Resources	Open-pit	1.9
Kimco Armindo	PT Kimco Armindo	Open-pit	1.8
Banpu Jorong Barutama Greston	Banpu	Open-pit	1.7
Wahana Baratama Mining	Bayan Resources	Open-pit	1.6
Teguh Sinarabadi	Bayan Resources	Open-pit	1.5
Central Kalimantan - Medium - OC	Various	Open-pit	1.5
East Kalimantan - Medium - OC	Various	Open-pit	1.5
South Kalimantan - Medium - OC	Various	Open-pit	1.5
Prima Multi Mineral	United Tractors	Open-pit	1.6
Marunda Graha Mineral	Itochu Corp	Open-pit	1.4
Damanka Prima	PT Hardeo Mines	Open-pit	1.3
Banpu Kitadin Embalut	Banpu	Open-pit	1.3
Perkasa Inakakerta	Bayan Resources	Open-pit	1.3
Baramulti Suksessarana	PT Baramulti Suksessarana	Open-pit	1.3
Rinjani Kartanegara	PT Rinjani Kartanegara	Open-pit	1.3
Multi Tambangjaya Utama	PT Multi Tambangjaya Utama	Open-pit	0.7
Central Kalimantan - Medium Low - OC	Various	Open-pit	1.1
East Kalimantan - Medium Low - OC	Various	Open-pit	1.1
South Kalimantan - Medium Low - OC	Various	Open-pit	1.1
South Sumatra - Medium Low - OC	Various	Open-pit	1.1
Sanga-Sanga Perkasa	PT Multi Energy Sumber Artha	Open-pit	1.0
Sebuku	Sakari Resources	Open-pit	1.0
Binamitra Sumberarta	PT Delta Ultima Coal	Open-pit	0.9

Indonesia coal operations and projects

Operation	Operator	Mine type	2019 Production
Sinar Kumala Naga	PT Sinar Kumala Naga	Open-pit	0.9
Central Kalimantan - Small High - OC	Various	Open-pit	0.8
East Kalimantan - Small High - OC	Various	Open-pit	0.8
South Kalimantan - Small High - OC	Various	Open-pit	0.8
South Sumatra - Small High - OC	Various	Open-pit	0.8
Indomining	Indomining	Open-pit	0.7
Fajar Bumi Sakti	PT Fajar Bumi Sakti	Open-pit	0.5
Raja Kutai Baru Makmur	PT Raja Kutai Baru Makmur	Open-pit	0.5
Central Kalimantan - Small - OC	Various	Open-pit	0.4
East Kalimantan - Small - OC	Various	Open-pit	0.4
South Kalimantan - Small - OC	Various	Open-pit	0.4
South Sumatra - Small - OC	Various	Open-pit	0.4
Harsco Mineral	PT Harsco Mineral	Open-pit	0.2
Anugerah Bara Kaltim	Anugerah Bara Kaltim	Open-pit	4.5
Gunungbayan Pratama	Bayan Resources	Open-pit	0.5
Arutmin Batulicin	Bumi Resources	Open-pit	0.0
Santan Batubara	Harum Energy	Open-pit	0.0
Kalimantan Energi Lestari	PT Kalimantan Energi Lestari	Open-pit	0.0
Parisma Jaya Abadi	PT Parisma Jaya Abadi	Open-pit	0.0
Trisensa Mineral Utama	Trisensa Mineral Utama	Open-pit	0.0

Project	Operator	Mine type	Status
Karya Usaha Pertiwi	Harum Energy	Open-pit	Probable
Kaltim Mineral	Resource Alam Indonesia	Open-pit	Probable
Pakar	Kangaroo Resources	Open-pit	Possible
Arni Bersaudara	PT Arni Bersaudara	Open-pit	Possible
Tekno Orbit Persada	MEC Holdings	Open-pit	Possible
Indo Bara Pratama	PT Indo Bara Pratama	Open-pit	Speculative
East Kutai Coal Project	Churchill Mining	Open-pit	Speculative
Ratu Ayu	PT Ratu Ayu	Open-pit	Speculative

Canada copper operations and projects

Operation	Operator	Mine type	2019 Production
La Ronde	Agnico-Eagle		6
Minto	Capstone Mining		2
Copper Mountain	Copper Mountain Mining Corp		33
Highland Valley	Highland Valley		121
Flin Flon	HudBay Minerals		15
Snow Lake/Photo Lake	HudBay Minerals		5
New Afton	New Gold Inc		36
Red Chris	Imperial Metals		33
Mount Milligan	Centerra Gold		34
Gibraltar	Taseko Mines		57
Gibraltar	Taseko Mines		1
Sudbury	Vale		69
Sudbury	Vale		15
Voisey's Bay	Vale		23
Voisey's Bay	Vale		4
Kidd Creek	Glencore		32
Matagami/Perseverance	Glencore		6
Raglan	Glencore		7
Sudbury Division	Glencore		20
Sudbury Division	Glencore		3
Nunavik	Jilin Jien Nickel		12

Projects	Operator	Mine type	Status
Voisey's Bay Underground (VBME)	Vale	Underground	Committed
Kemess Underground	Centerra Gold	Underground	Probable
KSM	Seabridge Gold	Open Pit & Underground	Probable
New Afton Extension (C-Zone)	New Gold	Underground	Probable
Huckleberry Restart	Imperial Metals	Open Pit	Possible
Izok Corridor	MMG	Open Pit	Possible
Victoria	KGHM International	Underground	Possible
Afton-Ajax	KGHM Ajax Mining	Open Pit	Possible
Casino (concs)	Western Copper and Gold	Open Pit	Possible
Harper Creek	Taseko Mines	Open Pit	Possible
New Ingerbelle	Copper Mountain Mining Corporation	Open Pit	Possible
New Prosperity	Taseko Mines	Open Pit	Possible
North Island (Hushamu & Red Dog)	Northisle Copper and Gold	Open Pit	Possible
Berg	Centerra Gold	Open Pit	Speculative
Galore Creek	Galore Creek Mining	Open Pit	Speculative
Granduc	Castle Resources	Underground	Speculative
Morrison	Pacific Booker Minerals	Open Pit	Speculative
Poplar	Universal Copper	Open Pit	Speculative
Redstone	Private Company (Canada)	Underground	Speculative
Schaft Creek	Teck	Open Pit	Speculative

Canada coal operations and projects

Operation	Operator	Mine type	2019 Production
Fording River	Teck	Open pit	8.3
Elkview	Teck	Open pit	6.9
Greenhills	Teck	Open pit	5.4
Estevan	Westmoreland	Open pit	5.3
Genesee	Westmoreland	Open pit	5.1
Line Creek	Teck	Open pit	4.3
Popular River	Westmoreland	Open pit	3.53
Sheerness	Westmoreland	Open pit	3.19
Brule	Conuma Coal	Open pit	3
Coal Valley	Westmoreland	Open pit	2.2
Wolverine	Conuma Coal	Open pit	1.7
Grande Cache - Various	Grande Cache	Open pit/ Underground	1.7
Cardinal River	Teck	Open pit	1.6
Donkin	Kameron Collieries	Open pit	1.5
Paintearth	Westmoreland	Open pit	1.31
Willow Creek	Conuma Coal	Open pit	0.8

Projects	Operator	Mine type	Status
Grassy Mountain	Riversdale Resources	Open pit	Probable
Tena	Allegiance Coal Ltd	Open pit	Probable
Aries	Ramaco	Open pit	Possible
Carbon Creek	Cardero	Open pit	Possible
Central South	Glencore	Open pit	Possible
Coal Mountain Phase 2	Teck	Open pit	Possible
Crown Mountain	Jameson Resources Ltd	Open pit	Possible
EB PIT	Walter Energy	Open pit	Possible
Murray River	HD Mining International Ltd	Open pit	Possible
Roman Mountain	Anglo American	Open pit	Possible
Sukunka	Glencore	Open pit	Possible
Vista	Cline	Open pit/ Underground	Possible
Bingay	Centerpoint Resources Inc	Open pit	Speculative
Gething	Canadian Dehua	Open pit	Speculative
Elko Coking Coal	Pacific Coal	Open pit	Speculative
Michel Creek	North Coal Ltd	Open pit	Speculative
Mount Klappan	Fortune Minerals	Open pit	Speculative
No16	Grande Cache	Open pit	Speculative
Lodgepole	Cline	Mixed	Speculative
Flatbed	Colonial Coal	Mixed	Speculative
Huguenot	Colonial Coal	Underground	Speculative
Raven	Compliance Energy Corp		Speculative

Chile copper operations (1 of 2)

Mine	Operator	Processing type	Mining type
Andina	Codelco	Concentrates	Mixed
Antucoya	Minera Antucoya	Hydrometallurgical	Open Pit
AuAgCu Chile Various	Various	Concentrates	Underground
Candelaria	Candelaria	Concentrates	Mixed
Carmen de Andacollo	Andacollo	Concentrates	Open Pit
Carmen de Andacollo (SXEW)	Andacollo	Hydrometallurgical	Open Pit
Caserones-Regalito (Concs)	Lumina Copper	Concentrates	Open Pit
Caserones-Regalito (SXEW)	Lumina Copper	Hydrometallurgical	Open Pit
Cerro Colorado (SXEW)	Cerro Colorado	Hydrometallurgical	Open Pit
Chuquicamata (Concs)	Codelco	Concentrates	Mixed
Chuquicamata (SXEW)	Codelco	Hydrometallurgical	Mixed
Collahuasi (Concs)	Collahuasi	Concentrates	Open Pit
El Abra	Minera El Abra	Hydrometallurgical	Open Pit

Mine	Operator	Processing type	Mining type
El Bronce de Atacama	Atacama Kozan	Concentrates	Underground
El Soldado (Concs)	Min. Sur Andes	Concentrates	Mixed
El Teniente	Codelco	Concentrates	Mixed
El Tesoro	Antofagasta	Hydrometallurgical	Open Pit
Escondida (Concs)	Minera Escondida	Concentrates	Open Pit
Escondida (SXEW)	Minera Escondida	Hydrometallurgical	Open Pit
Esperanza	Antofagasta	Concentrates	Open Pit
Franke	KGHM	Hydrometallurgical	Open Pit
Gaby	Codelco	Hydrometallurgical	Open Pit
Lomas Bayas	Min Lomas Bayas	Hydrometallurgical	Open Pit
Los Bronces (Concs)	Min. Sur Andes	Concentrates	Open Pit
Los Bronces (SXEW)	Min. Sur Andes	Hydrometallurgical	Open Pit
Los Pelambres	Minera Los Pelambres	Concentrates	Open Pit

Chile copper operations (2 of 2)

Mine	Operator	Processing type	Mining type
Mantos Blancos (Concs)	Mantos Copper	Concentrates	Open Pit
Mantos Blancos (SXEW)	Mantos Copper	Hydrometallurgical	Open Pit
Mantos de Luna	Min Mantos de Luna	Hydrometallurgical	Open Pit
Mantoverde	Mantos Copper	Hydrometallurgical	Open Pit
Michilla	Michilla	Hydrometallurgical	Open Pit
Mina Ministro Hales	Codelco	Concentrates	Open Pit
Mina Ministro Hales (SXEW)	Codelco	Hydrometallurgical	Open Pit
Ojos del Salado	Ojos del Salado	Concentrates	Underground
Punta del Cobre	Punta del Cobre	Concentrates	Mixed
Punta del Cobre (SXEW)	Punta del Cobre	Hydrometallurgical	Mixed
Quebrada Blanca	Teck	Hydrometallurgical	Open Pit
Radomiro Tomic (Concs)	Codelco	Concentrates	Open Pit
Radomiro Tomic (SXEW)	Codelco	Hydrometallurgical	Open Pit

Mine	Operator	Processing type	Mining type
Salvador (Concs)	Codelco	Concentrates	Mixed
Salvador (SXEW)	Codelco	Hydrometallurgical	Mixed
Sierra Gorda	KGHM	Concentrates	Open Pit
Spence	BHP Billiton	Hydrometallurgical	Open Pit
SXEW Chile Various	Various	Hydrometallurgical	Open Pit
Valle Central (El Teniente Tailings)	Amerigo Resources	Concentrates	Open Pit
Zaldivar	Zaldivar	Hydrometallurgical	Open Pit

Chile copper projects

Mine	Operator	Processing type	Mining type	Status
Andina Expansion - Phase II	Codelco	Concentrates	Mixed	Probable
Centinela Development Phase 2	Antofagasta Minerals	Concentrates	Open Pit	Probable
Centinela District Development	Antofagasta Minerals	Concentrates	Open Pit	Probable
Mantoverde Sulphide	Mantos Copper	Concentrates	Open Pit	Probable
Quebrada Blanca Sulphides	Teck	Concentrates	Open Pit	Committed
Radomiro Tomic Sulphides II	Codelco	Concentrates	Open Pit	Probable
Salvador Extension - Rajo Inca (Concs)	Codelco	Concentrates	Open Pit	Probable
Salvador Extension - Rajo Inca (SXEW)	Codelco	Hydrometallurgical	Open Pit	Probable
Santo Domingo	Capstone Mining	Concentrates	Open Pit	Probable
Spence - Sulphides	BHP Billiton	Concentrates	Open Pit	Committed

Mine	Operator	Processing type	Mining type	Status
Collahuasi Expansion	Compania MDI de Collahuasi	Concentrates	Open Pit	Possible
Los Bronces Underground	Anglo American Sur S.A.	Concentrates	Underground	Possible
Los Pelambres Expansion II	Minera Los Pelambres	Concentrates	Open Pit	Possible
Norte Abierto	Compania Minera Casale	Concentrates	Open Pit	Possible
NuevaUnion	NuevaUnion JV	Concentrates	Open Pit	Possible
Productora (Concs)	Hot Chili	Concentrates	Open Pit	Possible
Productora (SXEW)	Hot Chili	Hydrometallurgical	Open Pit	Possible
Radomiro Tomic Sulphides III	Codelco	Concentrates	Purchased	Speculative
Rajo Inca Concentrator	Codelco	Concentrates	Purchased	Speculative
Vizcachitas	Los Andes Copper	Concentrates	Purchased	Speculative

Appendix D – Methodologies & further information

IAI and PPI by Fraser Institute

An overall Investment Attractiveness Index (**IAI**) is constructed by combining the Best Practices Mineral Potential index (**BPI**), which rates regions based on their geologic attractiveness, and the Policy Perception Index (**PPI**), a composite index that measures the effects of government policy on attitudes toward exploration investment.

The **PPI** is an index that captures the opinions of managers and executives on the effects of policies in jurisdictions with which they are familiar. To calculate the PPI, a score for each jurisdiction is estimated for all 15 policy factors by calculating each jurisdiction's average response. A jurisdiction's scores on each of the 15 policy variables are then added up to generate a final, standardized PPI score. That score is then normalized using the formula

$$\frac{Vmax - Vi}{Vmax - Vmin} \; x \; 100$$

The jurisdiction with the most attractive policies receives a score of 100 and the jurisdiction with the policies that pose the greatest barriers to investment receives a score of 0.

The policy factors are as follow: uncertainty concerning the administration, interpretation, and enforcement of existing regulations; environmental regulations; regulatory duplication and inconsistencies; taxation; uncertainty concerning disputed land claims and protected areas; infrastructure; socioeconomic agreements; political stability; labour issues; geological database; and security

The mining industry regulatory framework in **Indonesia**

Mining Law No. 4/2009

Government Regulations

- **Mining Areas** GR 22/2010
- **Mining Business Activities** GR 23/2010 as amended by GR 24/2012, GR 1/2014, GR 77/2014, GR 1/2017, and GR 8/2018
- **Reclamation and Mine Closure** GR 78/2010
- **Mineral and Coal Mining Direction and Supervision** GR 55/2010
- **Royalty Rates** GR 9/2012
- **Tax and Non-Tax State Revenue Treatment in the Mineral Mining Sector** GR 37/2018

DGoMC Circulars, Regulations, and Decrees

- **Royalty Calculations** No. 32.E/35/DJB/2009
- **Adjustment Costs for Coal Benchmark Prices** No. 515.K/32/DJB/2011 No. 999.K/30/DJB/2011 No. 644.K/30/DJB/2013
- **Coal Benchmark Price for Certain Types and Uses** No. 480.K/30/DJB/2014
- **DMO Credits** No. 5055/30/DJB/2010 No. 300.K/30/DJB/2018
- **Use of Affiliates for Mining Services** No. 376.K/30/DJB/2010
- **Coal Benchmark Price for Mine-Mouth Power Plants** No. 953.K/32/DJB/2015

MoEMR Regulations

- **Mining Area, Licensing and Reporting in Mineral and Coal Mining** PerMen 11/2018 as amended by PerMen 22/2018 and PerMen 51/2018
- **Determination of Mining Areas** PerMen 37/2013
- **Authority Delegation for Mining Licence Issuance** PerMen 25/2015
- **Supervision of Business Activities in the Sector of Energy and Mineral Resources** PerMen 48/2017
- **Benchmark Pricing** PerMen 7/2017 as amended by PerMen 44/2017 and PerMen 19/2018
- **Coal Price Determination for Mine Mouth Power Plants** PerMen 9/2016 as amended by PerMen 24/2016
- **Domestic Market Obligation ("DMO")** PerMen 25/2018 as amended by PerMen 50/2018
- **Increasing Mineral Value Added Through Processing and Refining Activities** PerMen 25/2018 as amended by PerMen 50/2018
- **Restrictions on the Exports of Processed and Refined Minerals** PerMen 25/2018 as amended by PerMen 50/2018
- **Divestment Procedures and Mechanism of Price Determination** PerMen 9/2017 as amended by PerMen 43/2018
- **Mine Reclamation and Closure** PerMen 26/2018

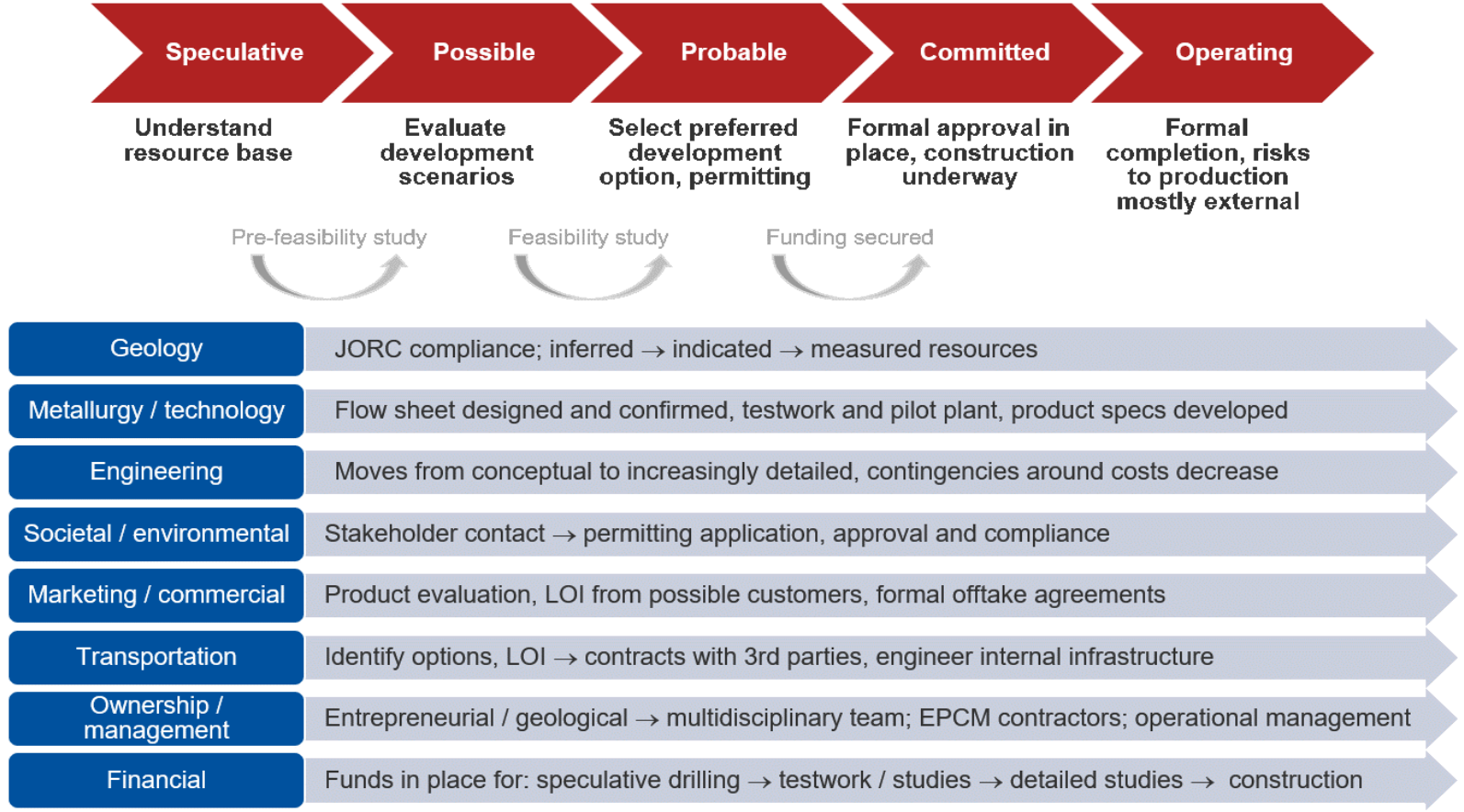
Relevant legislations on mineral ore exports in **Indonesia**

Legislation	Key outcomes in relation to mineral ore exports
Law No. 4 of 2009 concerning Mineral and Coal Mining	Introduced the export ban after 5 years and the requirement for domestic processing to accompany mining activities
Regulation No. 23 of 2010 concerning Implementation of Mineral and Coal Mining Business Activities", subsequently amended by Regulation No. 24 of 2012	Implementing regulations for Law No. 4 2009
MoEMR Regulation No. 7 of 2012	Brought forward the export ban to May 2012, but subsequently annulled
Presidential decree January 11, 2014 and implementing regulations	Implemented the export ban on unprocessed minerals to encourage downstream investment and industrialization in Indonesia
Regulation No. 1 of 2017	Permitted semi-processed product and certain types of ores exports for a 5-year period until 10 January 2022 provided that miners have constructed or are in the process of constructing a processing/smelting/refining facility, either individually or jointly with other parties, and pay export duties under the relevant laws and regulations
MoEMR Regulation No. 11 of 2019	Export ban on low-grade nickel ores (below 1.7%) was brought forward to January 2020 from the previous date of January 11, 2022
Law Amendment to the 2009 Mining Law, effective June 11, 2020	The Law Amendment effectively postpones the export ban for a 3-year period until June 10, 2023, to promote the build-up of a domestic processing/smelting/refining capacity, but allow more time for relevant facilities to come online.

CRU's Project Gateway Methodology

CRU assesses long term potential supply and prices using our Project Gateway Methodology. This involves an objective assessment of each potential project using a series of criteria to determine the likelihood of each project reaching the market. As well as **Operating** (and **idled**) assets, projects are classified into the following categories: **Committed**, **Probable**, **Possible** and **Speculative**.

The figure below provides an overview of this methodology:



Chilean labour contract expiry dates during 2020

Operation	Type	Production in expiry year ('000t)	Operator	Country	Expiry date
Chagres*	Smelter/Refinery	140	Anglo American	Chile	30-03-2020
El Abra*	Mine - SXEW	70	Freeport Americas	Chile	30-04-2020
Franke*	Mine - SXEW	19	KGHM	Chile	30-04-2020
Mantos Blancos***	Mine - Concs	26	Audley Capital	Chile	30-06-2020
Mantos Blancos***	Mine - SXEW	19	Audley Capital	Chile	30-06-2020
Mantoverde***	Mine - SXEW	40	Audley Capital	Chile	30-06-2020
Zaldivar**	Mine - SXEW	106	Barrick / Antofagasta	Chile	30-07-2020
Esperanza**	Mine - Concs	170	Antofagasta Minerals	Chile	30-07-2020
Los Bronces*	Mine - Concs	275	Anglo American	Chile	30-08-2020
Los Bronces*	Mine - SXEW	38	Anglo American	Chile	30-08-2020
Candelaria	Mine - Concs	166	Lundin Mining	Chile	30-09-2020
Ojos del Salado	Mine - Concs	12	Lundin Mining	Chile	30-09-2020
Escondida	Mine - Concs	890	BHP Billiton / Rio Tinto	Chile	06-10-2020
Escondida	Mine - SXEW	248	BHP Billiton / Rio Tinto	Chile	06-10-2020
Radomiro Tomic*	Mine - SXEW	198	Codelco	Chile	30-10-2020
Radomiro Tomic*	Mine - Concs	55	Codelco	Chile	30-10-2020
Collahuasi*	Mine - Concs	637	Anglo American/Glencore	Chile	30-10-2020
El Teniente*	Mine - Concs	413	Codelco	Chile	30-10-2020
Esperanza	Mine - Concs	170	Antofagasta Minerals	Chile	30-10-2020
Esperanza	Mine - Concs	170	Antofagasta Minerals	Chile	30-11-2020
Lomas Bayas	Mine - SXEW	75	Anglo American/Glencore	Chile	14-12-2020
El Teniente	Mine - Concs	413	Codelco	Chile	30-12-2020

Note:* Contracts successfully renegotiated, ** Contract renegotiations in progress, ***Contract renegotiations status unknown

Chilean labour contracts expiry dates during the 2021 – 2022 period

Operation	Type	Production in expiry year ('000t)	Operator	Country	Expiry date
Collahuasi	Mine - Concs	611	Anglo American/Glencore	Chile	30-10-2021
Gaby	Mine - SXEW	115	Codelco	Chile	30-12-2021
Gaby	Mine - SXEW	115	Codelco	Chile	30-01-2022
Chuquicamata	Mine - Concs	319	Codelco	Chile	30-01-2022
Chuquicamata	Mine - SXEW	31	Codelco	Chile	30-01-2022
El Soldado	Mine - Concs	48	Codelco	Chile	30-03-2022
Quebrada Blanca	Mine - SXEW	0	Teck	Chile	30-03-2022
Salvador	Mine - Concs	9	Codelco	Chile	30-05-2022
Salvador	Mine - SXEW	8	Codelco	Chile	30-05-2022
Chuquicamata	Mine - Concs	319	Codelco	Chile	27-06-2022
Chuquicamata	Mine - SXEW	31	Codelco	Chile	27-06-2022
Carmen de Andacollo	Mine - Concs	61	Teck	Chile	30-09-2022
Carmen de Andacollo	Mine - SXEW	0	Teck	Chile	30-09-2022
Antucoya	Mine - SXEW	83	Antofagasta Minerals	Chile	30-09-2022
Quebrada Blanca	Mine - Concs	83	Teck	Chile	30-11-2022
Carmen de Andacollo	Mine - Concs	61	Teck	Chile	30-12-2022
Carmen de Andacollo	Mine - SXEW	0	Teck	Chile	30-12-2022
Chagres	Smelter/Refinery	145	Anglo American	Chile	30-12-2022

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