Asia-Pacific Mining Sector Study - A Final Report
Prepared for ABAC: Executive Summary

Submitted by: ABAC
Asia-Pacific mining sector study

A final report prepared for APEC Business Advisory Council (ABAC)
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CRU has been commissioned to prepare this report by the APEC Business Advisory Council (ABAC). This report outlines the current status of the mining industry in the APEC region, discusses the importance of the mining sector and the various ways it can positively contribute to individual economies and their populace. It explains the positive steps governments can take to encourage investment in the mining sector, and goes on to describe the importance and benefits of mining companies maintaining best practices. This executive summary aims to draw out the key findings from the study in a digestible format – of these, the most important headlines are the following:

- **APEC economies are crucial suppliers of mined commodities**, collectively producing more than half of the world’s iron ore, more than 70% of the its copper, nickel, silver, lead, zinc, nickel, bauxite and tin, and more than 90% of its coal and molybdenum.

- **The mining industry can contribute as much as 24%** to individual APEC economies’ GDP, with **mineral rents for APEC as a whole accounting for more than $430bn in 2013**.

- **Government policies are important in attracting and sustaining investment in the mining industry**. Governments are encouraged to adopt best practices to create favourable conditions for sustainable mining to realize mineral potential. **It is crucial that host governments are educated as to the fundamental aspects of the mining industry**, including its inherent challenges for mining companies, as well as the positive impacts of mining, particularly those that are less immediately obvious.

- **Mining companies should be highly sensitive to the environment where they are planning to operate** – they should understand the development objectives of the host economy. A one-size-fits-all template in terms of project planning and operation is not feasible.
Mining is a significant contributor to many APEC economies’ GDP...

All of the 21 APEC economies covered by this report, with the exception of Brunei Darussalam, Hong Kong SAR and Singapore, earned a proportion of their GDP through mineral rents\(^1\) in 2012/2013. The proportion of GDP that can be attributed to mineral rents in APEC economies is highly variable, as can be seen in the chart below. The bubbles represent mineral rent as a percentage of GDP – a broad measure of the mining sector’s importance to a particular economy – for the year 2012, and their position is 2013 GDP plotted against the number of commodities each APEC economy has in the form of reserves.

There are four APEC economies for which mineral rents contributed more than 5% to GDP in 2012: Papua New Guinea (24.01%), Chile (15.27%), Peru (8.64%) and Australia (5.53%). Another group of economies shows less dependence on mineral rent as a contributor to GDP however the contribution is still important (1% to 3%): these are the Philippines, China, 

\(^1\) Mineral rent: the difference between the value of production for a stock of minerals at world prices and their total costs of production. Note that mineral rent is not the same as value added to GDP: rent is pure profit (price less marginal cost multiplied by quantity), whereas value-added is the sum of earnings from production that are due to residents, for example, the salaries of resident mine workers are included in GDP value-added while they are not included in rent.
Indonesia, Russia and Mexico. In the final group of economies mineral rent contributes less than 1% to GDP: Canada, New Zealand, Vietnam, Malaysia and the United States.

**Mining is an important factor in everyday life...**

The mined commodities which are the subject of this study are used to produce a wide variety of materials which impact on every aspect of everyday life, from buildings to cars to electronic equipment; from dentistry and cooking utensils to batteries and power generation.

Taking just one example, copper has a wide variety of end uses, most of which take advantage of the material’s high thermal and electrical conductivity, including: electric cables and wires, switches, plumbing, heating, roofing and building construction, chemical and pharmaceutical machinery, alloys (brass, bronze), electroplated protective coatings and cooking utensils. APEC economies account for more than 70% of global mined copper production, with Chile the world’s largest copper miner by some distance.

Alternatively, nickel is widely used in over 300,000 products for consumer, industrial, military, transport/aerospace, marine and architectural applications. The public may recognise nickel in coins, as it is used for this purpose in pure or alloy forms by many countries, or as bright and durable electrolytically-applied coatings on steel (nickel plating). The biggest use, however, is as an alloying metal along with chromium and other metals in the production of stainless and heat-resistant steels. These are mostly used in industry and construction, but also for products in the home such as pots and pans, kitchen sinks, etc. Stainless steels are produced in a wide range of compositions to meet special industry requirements for corrosion and heat resistance, and also to facilitate a clean and hygienic surface for food and other processing. APEC economies accounted for more than three-quarters of global mined nickel production in 2013.
Mining also contributes to economies in other important ways...

The mining sector provides benefits to host economies in three ways:

- **Direct**: these are the impacts which result from the expenditures associated with constructing and operating the mine, such as the labour employed, materials purchased, capital invested etc – this is the type of contribution to GDP discussed above.

- **Indirect**: these are the impacts that result from suppliers to the mine purchasing goods and services and hiring workers to meet demand from the mine. *Importantly, these additional purchases and the hiring of extra workers would not have occurred were it not for the construction and operation of the mine.*

- **Induced**: these are the economic impacts resulting from employees at the mine using their wages to purchase goods at a household level.

These classifications apply to GDP contribution, and job creation, but mining projects also contribute in the following ways:

- **Infrastructure provision**: many mining projects involve the construction of transport infrastructure (roads, rail, ports), power generation, water provision, etc – all of which stand to benefit the economy by precipitating additional mining or other industrial projects, as well as the local community by providing community infrastructure such as schools, government building and sanitation and healthcare infrastructure.

- **Government revenues** through taxation of mining projects improves the national balance sheet and – particularly in developing economies where mining tax take is an important source of revenue for the government – provide funds for public services. This is an important benefit, though this may seem rather abstract compared to say the provision of funding for a local school or health centre.

In Chapter 2, CRU presents a case study on the Escondida mine in Chile which demonstrates these additional economic benefits – highlights of the case study are provided below.

**Labour**

In 2004 the Escondida mine accounted for 2,810 direct employees, over 99% of which were employed at the mine site or at port facilities. Of the 2,810, 11 were foreign and 2,799 were Chileans. There were 2,345 permanent contractors (indirect employees) employed by Escondida in 2004, with an additional 2,938 contractors being employed on the expansion projects that were underway at that time.
In 1999, Escondida’s secondary employment was estimated. This includes all employment in the Antofagasta region that is the result of both the mine and the mine employees’ spending. It was determined that the employment multiplier could vary between 3.1 and 5.7, with evidence from a purchasing survey indicating a likely value of 4.2. In 2004 estimated induced Escondida employment was 9,495 people.

It is estimated that in 2004 there were 8,813 dependents of Escondida employees, which gives a dependency multiplier of 2.9. If this is also applied to indirect and induced employment (11,840 in total), then the total number of dependents increases to around 35,700. However, the study mentions that this number maybe too high, as some individuals that have been classed as dependents may also work at the mine.

**GDP value-add**

In 2003 the ‘value-added’ by Escondida to Chile’s economy was USD$1.2 billion, and USD$2.7 billion in 2004, this is equivalent to 1.7% of Chile’s GDP in 2003 and more than 3.5% in 2004. The majority of the value generated remained within the Chilean economy. If it is assumed that all payments made to shareholders were repatriated, and that 40% of the amount reinvested went to foreign suppliers, the retained value-added figure is USD$1.7 billion or about 2.4% of Chile’s 2004 GDP.

**Infrastructure**

Escondida is dependent upon a range of infrastructure. Power and water supply have been sourced from distant locations. In theory, these power and water supplies could have been made available to others; but given the remote location of the mine, the benefits of these infrastructure services for local communities are limited. However, the large investment in power supply in the Antofagasta region in order to meet the needs of the mines is believed to have reduced the cost of power for the public in general. What is more, when the mine eventually closes the concentrate pipeline that runs from the mine down to the port in Antofagasta could be used to transport water and thus increase the availability of fresh water in the city. Due to the mine’s remote location, roads between Antofagasta and the mine were constructed. The roads were completed in 1990 at a cost of USD$8.5 million, these roads are maintained by the mine (at an annual cost of USD$850,000 in 2004) and are open for public use.
Several APEC economies have very high mineral potential...

Many APEC economies have substantial mineral resources – this is evidenced by the fact that they are destinations for two-thirds of global non-ferrous mineral exploration expenditure. The table below shows a summary of the positive and negative factors affecting the eventual mineral potential rating of each APEC economy denoted by CRU.

<table>
<thead>
<tr>
<th>APEC economy</th>
<th>Positive factors</th>
<th>Negative factors</th>
<th>CRU mining potential</th>
<th>Notes/comments/expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>Substantial resource base, mining friendly jurisdiction, very highly rated in terms of pure mineral potential in Fraser Institute survey</td>
<td>Major unexplored regions are in challenging mining environments</td>
<td>High</td>
<td>Mining expansion likely within established mining regions, though some potential for increased growth in other areas, through e.g. Plan Nord</td>
</tr>
<tr>
<td>Australia</td>
<td>Substantial resource base, mining friendly jurisdiction, very highly rated in terms of pure mineral potential in Fraser Institute survey</td>
<td>-</td>
<td>High</td>
<td>Growth expected in output of esp. bulk commodities; largest volumes from brownfield expansions but also increased output from new junior miners, e.g. Roy Hill</td>
</tr>
<tr>
<td>United States</td>
<td>Substantial resource base, untapped resources (notably in Alaska, Nevada), remains a significant destination for exploration investment</td>
<td>-</td>
<td>High</td>
<td>Majority of mining expansion most likely to come through organic growth within established mining regions</td>
</tr>
<tr>
<td>Mexico</td>
<td>Large copper, gold and silver reserves, with room for significant expansion; relatively mining friendly govt</td>
<td>Mining sector more exposed to gold/silver price movements than others, which aren't strongly connected to supply/demand fundamentals</td>
<td>High</td>
<td>Outcome of most minerals expected to grow steadily over next few years, thanks to brownfield and greenfield projects</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Large volumes of untapped resources, some of which are not readily available in the same volumes in other locations - e.g. Sn, Ni.</td>
<td>Very high Fraser Institute 'room for improvement' rating, showing disparity between investment attractiveness under current legislative conditions compared to theoretical 'best practice'</td>
<td>High</td>
<td>Significant uncertainty regarding mining/export laws making investors and project owners very hesitant to drive projects forward in the short term</td>
</tr>
<tr>
<td>Chile</td>
<td>Despite substantial existing mining sector, there are still significant untapped resources. Most attractive investment climate in South America; high level of exploration activity</td>
<td>Some concern about rising costs in future, mining sector tied to a relatively small number of commodities.</td>
<td>High</td>
<td>High potential for strong growth in the mining sector, with few obvious negatives/drawbacks</td>
</tr>
<tr>
<td>Philippines</td>
<td>Large volumes of untapped resources of various minerals - rated highest globally on Fraser Institute mineral potential index</td>
<td>Very high Fraser Institute 'room for improvement' rating, showing disparity between investment attractiveness under current legislative conditions compared to theoretical 'best practice'</td>
<td>High</td>
<td>Sector is not currently perceived to be highly attractive to investors, but good mineral endowment means that there is potential for investment to increase, but could require a shift in government policy towards supporting mining investment</td>
</tr>
<tr>
<td>Peru</td>
<td>Substantial mineral wealth and untapped reserves, mining established as an important part of the economy, significant exploration activity</td>
<td>Policy environment is not currently as attractive to investors as e.g. Chile</td>
<td>High</td>
<td>High potential for strong growth in the mining sector, both in terms of output at existing mines and major new projects</td>
</tr>
<tr>
<td>Papua New Guinea</td>
<td>Substantial mineral wealth and untapped reserves; mining established as an important part of the economy; significant exploration activity</td>
<td>High 'room for improvement' rating, suggesting current policy environment is not as encouraging of investment as it could be</td>
<td>High</td>
<td>Importance of mining to the PNG economy and significant untapped reserves should continue to drive the mining sector, but growth might be quicker under 'best practice' jurisdiction</td>
</tr>
</tbody>
</table>

Continued
**Table E.1: CRU mineral potential rating**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>China</td>
<td>Potential for consolidation of mining sector, as well as other improvements - both technical and legislative - that would increase FDI. Some important untapped resources.</td>
<td>Reserves of many minerals, declining; mines generally high cost; with currency, labour and power costs expected to increase.</td>
<td>Medium</td>
<td>Consolidation of fragmented mining sector and closure of higher cost operations should improve mining practices, though output not expected to grow substantially.</td>
</tr>
<tr>
<td>Russia</td>
<td>Large resource base, with significant untapped resources</td>
<td>Some resources are significant distances from consumers, leading to logistical constraints/need for on-site downstream processing.</td>
<td>Medium</td>
<td>Good potential for growth, FDI in Russia mostly focused outside mining sector (excl. coal) at present.</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Substantial reserves of coal, which forms an important part of the economy</td>
<td>Reserves other than Bauxite and coal not substantial, FDI in mining has been minimal and constrained by regulatory issues, investment and market access challenges.</td>
<td>Medium</td>
<td>Coal output not expected to increase substantially despite rapidly increasing demand, but bauxite production expected to make strong gains.</td>
</tr>
<tr>
<td>Thailand</td>
<td>Relatively mining-friendly environment</td>
<td>Limited mineral resource, mining not an important part of the economy, little exploration spend</td>
<td>Low</td>
<td>Existing mining sector mostly expected to maintain output.</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Some potential for coal expansion, government perceived as relatively mining-friendly</td>
<td>Limited / declining mineral resources for most minerals, greater focus on downstream power-intensive processing sector</td>
<td>Low</td>
<td>Reserves sufficient to support existing (relatively small) mining operations for some time, but little expansion expected.</td>
</tr>
<tr>
<td>New Zealand</td>
<td>Current reserves expected to sustain existing mining at least over the medium term</td>
<td>Reserves are not substantial, little exploration activity or expansion plans</td>
<td>Low</td>
<td>Little expansion of relatively small mining sector expected, but no decline expected either.</td>
</tr>
<tr>
<td>Japan</td>
<td></td>
<td>Limited mineral resources</td>
<td>Low</td>
<td>Little expectation for expansion of mining sector, though some interest/exploration for rare earths</td>
</tr>
<tr>
<td>Korea</td>
<td></td>
<td>Limited mineral resources</td>
<td>Low</td>
<td>Minimal exploration or expansion in mining sector expected.</td>
</tr>
<tr>
<td>Chinese Taipei</td>
<td></td>
<td>Limited mineral resources</td>
<td>Low</td>
<td>No significant exploration or expansion in mining sector expected.</td>
</tr>
<tr>
<td>Singapore</td>
<td></td>
<td>Negligible mineral resources</td>
<td>Low</td>
<td>No real potential for expansion of mining sector.</td>
</tr>
<tr>
<td>Hong Kong SAR</td>
<td></td>
<td>Negligible mineral resources</td>
<td>Low</td>
<td>Negligible potential for expansion of mining sector.</td>
</tr>
<tr>
<td>Brunei Darussalam</td>
<td></td>
<td>Negligible mineral resources</td>
<td>Low</td>
<td>Negligible potential for expansion of mining sector.</td>
</tr>
</tbody>
</table>

*Data: CRU, Fraser Institute Mining Survey 2013*
This mineral potential may be being constrained by policy factors...

The chart below shows data from the 2013 Fraser Institute Global Mining Survey indicating the difference between how readily respondents to the survey would invest in exploration in a variety of mining jurisdictions under two scenarios:

- **Best practices**: i.e. world class regulatory environment, highly competitive taxation, no political risk or uncertainty, and a fully stable mining regime – this is therefore an approximate surveyed assessment of each region’s pure mineral potential, without including policy-related issues.

- **Current practices**: i.e. whether or not a jurisdiction’s mineral potential under the current policy environment (i.e., regulations, land use restrictions, taxation, political risk, and uncertainty) encourages or discourages exploration.

The index therefore shows the gap between how encouraging of mining exploration a jurisdiction would be under theoretical best practice compared to the current policy environment, or its ‘room for improvement’. The APEC economies (marked in red on the chart) of the Philippines, Indonesia, and China are the top scorers on this index, demonstrating how the current policy environment is not encouraging mining investment to nearly the same extent as it could be. Papua New Guinea and Russia also are ranked high on this index.

The relatively little difference between current practice and best practice for most Australian, USA and Canadian jurisdictions means that they have far smaller ‘room for improvement’.

Fraser Institute implied ‘room for improvement’ index

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The chart shows a bar graph with jurisdictions on the y-axis and a percentage scale on the x-axis. The bars in red represent current practices, while the bars in blue represent best practices. The chart visually demonstrates the gap between the two scenarios for various mining jurisdictions.
Investment attractiveness can be improved by host governments...

Four factors generally dictate the attractiveness of an economy to investment in exploration and mining, three of which are subject to government policy:

- Geological prospectivity
- Country risk
- Mining sector policy
- Infrastructure

Geological prospectivity is outside the control of governments. However, they may be able to improve their attractiveness to exploration companies by carrying out basic geological surveying and mapping. In addition, geological attractiveness may have an impact on government policy in general. For example a geologically attractive economy may feel it can have a more aggressive taxation policy than a less attractive economy. Many APEC economies have good geological prospectivity, as demonstrated in the CRU mineral potential ratings provided above. This means that there is great potential for investment attractiveness to be improved by host governments.

Country risk covers a multitude of factors, including political stability, internal security and risk of war or civil unrest, risk of expropriation or major policy changes, and so on. Below that general level of country risk there are issues of the rule of law, property rights and contract law, the strength of the courts, the efficiency of administration, and the level of corruption. At the next level we find overall government policy, particularly on macro-economic issues such as exchange rates, monetary stability and policy towards foreign direct investment.

Governments looking to improve their performance relating to the factors listed above are likely to also improve their attractiveness to mining investment.

Infrastructure provision is an important determinant of the attractiveness of an economy for exploration and mining investment. This includes the provision of roads and other transport infrastructure, power supplies, water supply. Softer issues of education, training and healthcare can also be important. It is obviously easier to carry out exploration and mining in an economy with a developed infrastructure.

Mining sector policy constitutes the elements of policy directed specifically at the mining sector. This will generally include the system for licensing areas for exploration and mining, as well as any mining specific taxation. Regulation of mining is often codified in a single Mining Act. Alternatively, some economies regulate mining by means of individual agreements with
major projects. In addition, there may be specific policies aimed at the small scale artisanal mining sector.

Governments can improve their attractiveness from a mining sector policy perspective through:

- **Taxation:**
  - Mining companies generally have a preference for direct taxes on profits over indirect taxes such as production royalties.
  - A preference for a progressive tax regime that automatically responds to changing conditions, since this is perceived as more stable and will reduce the likelihood of ad hoc demands to tax excess profits.
  - Tax stability is more valuable than getting an initial favourable tax deal whose legitimacy may later be challenged.

- **Mining policy:** the following factors are desirable qualities of a jurisdiction’s mineral concessions policy from a mining company perspective:
  - Administrative simplicity and efficiency
  - Low transactions costs – for example avoiding overlapping or multiple layers of jurisdiction
  - Security of tenure, within the law
  - The ability to freely mortgage or transfer the rights
  - Transparency
  - Minimal administrative discretion

**Mining companies are responsible for ensuring best practice operation...**

Mining is a high-visibility industry (particularly in smaller economies), with a relatively poor public reputation in many regions. Mining involves the removal of a non-renewable resource, and because of the finite life of any mine the issue of sustainability in mining has focused on the sustainable and responsible use of the non-renewable resource. It is therefore important for mining companies to minimise their impact both socially and environmentally, in order to reduce resistance to mining projects at both the public and governmental level.
Throughout the lifecycle shown above it is important for mines to address the following issues:

**Environmental impacts:**
- Biodiversity
- Air emissions
- Noise and vibrations
- Water management

**Social impacts:**
- Community engagement
- Community development
- Indigenous communities
- Labour practices

For example, during exploration it is crucial for mining companies to engage with local communities at this early stage in order to influence future relationships – the greater the effort during this stage, the more the reward during other phases of the mining cycle. At the same time, they should be looking to minimise noise, vibrations and adverse impacts on biodiversity whilst performing exploratory drilling.

Generally, fulfilling the environmental and sustainability standards set out by host governments is considered a minimum requirement by most mining companies, who instead look to go much further with their CSR and sustainability efforts. For example, Groote Eylandt Mining Company (GEMCO), operated by BHP Billiton, employs and trains members of the local aboriginal community to rehabilitate the areas that are no longer being mined. This way, the rehabilitation process is carried out as mining continues, and the aboriginal community’s knowledge of the area makes rehabilitation easier, making this a win-win situation for the company and the local indigenous community.
The following are CRU's main recommendations for APEC's member economies

**Host government education:** It is crucial that host governments are educated as to the fundamental aspects of the mining industry, including its inherent challenges for mining companies, as well as the positive impacts of mining, particularly those that are less immediately obvious.

**A project-specific approach should be taken by mining companies:** Mining companies should be highly sensitive to the environment where they are planning to operate – they should understand the development objectives of the host economy. More broadly it could be said that a one-size-fits-all template in terms of project planning and operation is not feasible, as site-specific factors should be considered at all stages of the mining lifecycle. **This recommendation also strongly applies to host governments** – a policy which is suitable for one operation, project, geographical region, or commodity may be completely unsuitable for another – it is crucial to consider the reasonableness of a policy across all projects under the jurisdiction, and the wider, less immediately obvious, impact that a policy change might bring about. In addition, a **gradual, transparent, change from one policy environment to another is more likely to be advantageous** to all parties than a radical shift which could bring about unexpected consequences.

**A stable mineral policy that incentivises exploration will attract investment:** From a government perspective, a good minerals concession policy should act as an incentive (rather than a deterrent) to attracting bona fide mineral explorers and miners to a jurisdiction. It should facilitate exploration and mining activity, but not at undue expense to the environment or other stakeholders; confer secure, undisputed title to the concession holder in return for periodic rental payments; and create economic incentive for concession holders to conduct meaningful exploration (and mining) activity rather than simply to ‘hibernate’ the concession. **Policy stability is extremely important** to mining companies given the immovable nature of their assets. If the policy environment in a host government is perceived to not be very stable, then this can have a damaging impact on the attractiveness to mining investment in that economy.

**Involve industry associations to help facilitate mining best practice:** CRU also recognises the importance of industry associations as excellent sources of data, knowledge and expertise regarding mining best practice. They can assist mine operators - particularly smaller players or new entrants to the market - with ensuring that their project is optimally managed from a social and environmental perspective. This stands to improve the mining sector’s reputation in general, garnering buy-in from local communities at the same time. Associations also have a role to play in negotiating with potential host governments as to the benefits of prospective mining projects – presenting a case on behalf of the sector as a whole rather than an individual company stands to improve the amenability of a host government to the proposition as well as reducing the
possibility of corruption. CRU therefore recommends mining companies to involve industry associations in these kinds of discussions, as well as governments to collaborate with associations when drawing up regulations regarding mining operations. Similarly, a regular and transparent public-private consultation process can form the basis for a sustainable partnership with industry associations as well as business groups and the investor community (e.g. Chamber of Commerce, Business Associations).

The full text of this report can be found at http://ncapec.org/issues/mining.html.