Vietnam Mining Industry Webinar

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WEBINAR SPEAKERS

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Vietnam has a wide variety of mineral deposits.

- **Coal:**
  - coal dominates mining activities

- **Bauxite:**
  - substantial bauxite deposits - approximately 5.5 billion tons

- **Tungsten:**
  - Vietnam is the world largest tungsten producer outside China

- **Titanium mineral sand:**
  - Country titan resources estimated at 664 million tons mainly in Binh Thuan

- **Other minerals:**
  - iron ore, chromite, copper, plus significant reserves of tin, gold, lead, zinc, uranium, antimony, rare earths, gems, limestone, clay and other industrial minerals.

Source from MONRE, Vietnam, 2013
## VIETNAM COAL RESOURCES (MIL TONS)

<table>
<thead>
<tr>
<th>Coal type</th>
<th>Reserve</th>
<th>Confirmed Reserve</th>
<th>Reliable Reserve</th>
<th>Estimated Reserve</th>
<th>Resources</th>
<th>Total Reserve and Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>2.260</td>
<td>161</td>
<td>1.137</td>
<td>2.687</td>
<td>42.632</td>
<td>48.878</td>
</tr>
<tr>
<td>Dong Bac Basin</td>
<td>2.219</td>
<td>109</td>
<td>395</td>
<td>1.585</td>
<td>1.979</td>
<td>6.287</td>
</tr>
<tr>
<td>Red River Delta Basin</td>
<td></td>
<td>525</td>
<td>955</td>
<td>40.531</td>
<td>42.011</td>
<td></td>
</tr>
<tr>
<td>Other national coal mines</td>
<td>41</td>
<td>52</td>
<td>74</td>
<td>32</td>
<td>6</td>
<td>206</td>
</tr>
<tr>
<td>Local coal mines</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19</td>
<td>37</td>
</tr>
<tr>
<td>Lignite</td>
<td></td>
<td>133</td>
<td>107</td>
<td>96</td>
<td>336</td>
<td></td>
</tr>
</tbody>
</table>

(Source: National Coal Master Plan 403 3/2016)
VIETNAM MINING MARKET

Mining outlook

• Rich mineral resources
• A coal mining nation with deeper resource and swift to underground
• Mineral processing and deep processing is required
• Needs significant infrastructure and logistics capability
• Need stronger sustainable mining practice and regulation

Challenges

• High mining tax regime
• Except for coal, bauxite, mineral sand, most mines and deposits are small scale
• Deeper coal resources, therefore higher exploitation costs
• Environmental issues and local communities
• Illegal mining
Vietnam’s Mineral Processing Map

- Copper
- Tungsten
- Coal
- Iron
- Bauxite
- Titan
Major mineral producers

- **Masan Resources** - Nui Phao, Thai Nguyen: 
  (Tungsten, Fluospar, Bismuth, Copper) open cut mine

- **Asian Mineral Resources** - Ban Phuc, Son La 
  (Nickel, Copper)
  On hold and further exploration

- **Lam Dong Alumina Refinery**, Lam Dong 
  650,000 tons Alumina/year, open cut mine

- **Nhan Co Alumina Refinery**, Dak Nong 
  650,000 tons Alumina/year open cut mine

- **Vimico, Sin Quyen, and Ta Phoi mines** Lao Cai 
  open cut mine
  Expansion plan is in progress

- **Viet Trung Mining and Metallurgy** - Lao Cai iron ore, open cut mine

- **Vinaapaco Lao Cai**, Phosphate rock mining and fertilizer production, open cut mine

- **Phuoc Son Gold**, Quang Nam 
  Under restructuring - underground mine

Major coal producers

- **Vinacomin Group, Quang Ninh** 
  35 mil tons/year

- **Vietmindo, Quang Ninh** 
  3 mil tons/year

- **Dong Bac Corporation, Quang Ninh** 
  5 mil tons/year
VINACOMIN PROFILE

- 100% State owned enterprise

- 88 units under the corporation: Head Office, 22 branches, 23 companies 100% owned by Vinacomin, 32 affiliated companies, 7 institutes and training schools, 4 overseas subsidiaries, 10 joint venture partners

- Core business: Coal exploration, mining, mineral processing and trading

- Other business: Power generation; mineral exploration, mining and processing; chemical and mechanical industry and construction material production

- Coal production (2017): 35 Mil tons

- Turnover (2017): ~USD4.4Bil
# MAIN PRODUCTION OF VINACOMIN

<table>
<thead>
<tr>
<th>Production</th>
<th>Unit</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal mined</td>
<td>Mln. Ton</td>
<td>48.232</td>
<td>44.512</td>
<td>42.687</td>
<td>37.430</td>
<td>37.684</td>
<td>34.791</td>
<td>35.037</td>
</tr>
<tr>
<td>Tin bars</td>
<td>Ton</td>
<td>934</td>
<td>833</td>
<td>731</td>
<td>868</td>
<td>648</td>
<td>549</td>
<td>407</td>
</tr>
<tr>
<td>Zinc bars</td>
<td>Ton</td>
<td>9464</td>
<td>7,744</td>
<td>8,208</td>
<td>10,800</td>
<td>10,532</td>
<td>10,800</td>
<td>10,947</td>
</tr>
<tr>
<td>Refined Copper ore of 25% Cu</td>
<td>Ton</td>
<td>42076</td>
<td>45,569</td>
<td>46,960</td>
<td>47,430</td>
<td>50,190</td>
<td>51,104</td>
<td>50,129</td>
</tr>
<tr>
<td>Copper plate</td>
<td>Ton</td>
<td>8130</td>
<td>8,200</td>
<td>9,716</td>
<td>11,151</td>
<td>11,316</td>
<td>11,600</td>
<td>11,496</td>
</tr>
<tr>
<td>Iron ore of 61% Fe</td>
<td>Ton</td>
<td>209911</td>
<td>240,900</td>
<td>243,114</td>
<td>130,516</td>
<td>108,927</td>
<td>77,690</td>
<td>132,011</td>
</tr>
<tr>
<td>Gold</td>
<td>Kg</td>
<td>305</td>
<td>392</td>
<td>385</td>
<td>564</td>
<td>539</td>
<td>584</td>
<td>557</td>
</tr>
<tr>
<td>Alumina</td>
<td>Ton</td>
<td>65900</td>
<td>57,500</td>
<td>60,876</td>
<td>67,400</td>
<td>70,000</td>
<td>64,300</td>
<td>61,000</td>
</tr>
<tr>
<td>Explosive</td>
<td>Ton</td>
<td>6690</td>
<td>6,305</td>
<td>8,408</td>
<td>8,450</td>
<td>8,991</td>
<td>8,493</td>
<td>9,385</td>
</tr>
<tr>
<td>Electricity</td>
<td>Mln. KWh</td>
<td>93,969</td>
<td>95,424</td>
<td>100,105</td>
<td>103,568</td>
<td>106,860</td>
<td>101,180</td>
<td>109,200</td>
</tr>
</tbody>
</table>

Source: Vinacomin
Table 1 – The coal reserves which can be applied mechanization in Quang Ninh mines

<table>
<thead>
<tr>
<th>Company Names</th>
<th>Evaluation Level</th>
<th>Reserves (10^3 Tonnes)</th>
<th>Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mao Khe</td>
<td>-80 ÷ -150</td>
<td>68.613,1</td>
<td>9.3</td>
</tr>
<tr>
<td>Vang Danh</td>
<td>+200 ÷ -150</td>
<td>125.517,8</td>
<td>16.9</td>
</tr>
<tr>
<td>Than Thung – Yen Tu</td>
<td>+290 ÷ -350</td>
<td>106.693,2</td>
<td>14.4</td>
</tr>
<tr>
<td>Ha Lam</td>
<td>+25 ÷ -500</td>
<td>167.309,9</td>
<td>22.6</td>
</tr>
<tr>
<td>Nui Beo</td>
<td>+25 ÷ -325</td>
<td>47.684,7</td>
<td>6.4</td>
</tr>
<tr>
<td>Suoi Lai</td>
<td>+140 ÷ -250</td>
<td>8.270,5</td>
<td>1.1</td>
</tr>
<tr>
<td>Thong Nhat</td>
<td>+120 ÷ -300</td>
<td>39.836,3</td>
<td>5.4</td>
</tr>
<tr>
<td>Duong Huy</td>
<td>+38 ÷ -350</td>
<td>94.879,6</td>
<td>12.8</td>
</tr>
<tr>
<td>Mong Duong</td>
<td>-50 ÷ -300</td>
<td>14.606,6</td>
<td>2.0</td>
</tr>
<tr>
<td>Khe Cham II-IV</td>
<td>-50 ÷ -760</td>
<td>67.427,2</td>
<td>9.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>740.838,9</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
NEW DEVELOPMENTS

■ Thach Khe Iron Ore (Vinacomin – major shareholder)
  Location: Ha Tinh province
  Latest update: On hold
  www.satthachkhe.vn
  Latest updates: Under construction

■ Pu Sam Cap Gold project (TPJ)
  Location: Lai Chau province
  Latest updates: Under exploration stage, looking for investor

■ Viet Phuong Bauxite and Alumina project in Laos
  Location: Dak Cheung, Sekong Province, southeastern Laos
  Latest updates: Signed contract with Lao government on 11 Sep 2018

■ Underground Coal mine projects (Vinacomin)
  Location: Quang Ninh province
  Latest update refer to the previous slide
OPPORTUNITY FOR AUSTRALIAN METS

• Underground coal mine solutions, equipment
• Open pit improvement and deepening
• Locally manufacturing JV for mining equipment
• Mineral processing technologies, equipment (bauxite, copper, titanium)
• Parts, consumables
• Operation improvement solutions
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MASAN RESOURCES

Evan Darcy
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Nui Phao Mining Company
Mission

Become a world class producer of our targeted minerals
Vietnam’s Leading Business Group

- Vietnam’s largest private-sector industry group, listed on the Ho Chi Minh Stock Exchange (HCM: MSN), with a market cap of ~US$5 bn.
- Businesses include Masan Consumer, Masan Brewery, Masan Resources and Techcombank with leading operating platforms in the consumer products, resources and financial services sectors.
- Marquee investor/partners include TPG, KKR, IFC, Goldman Sachs, JP Morgan.
- 2014, Tungsten APT production (JV with H.C Starck).
- 2015, initial IPO - Masan Resources.
- Dec 2015, US$1.1b strategic partnership with Singha Asia Holding
- Sep 2018, Tungsten APT plant 100% operated & owned by Masan Tungsten
Key ingredient to our success story ....

People

- Diversity of Backgrounds
- Technically qualified
- Years of experience
- Ability to learn and to teach

Attitude

- No mountain is an obstacle
- Committed to seeing the job through
- Thinking outside the box
- Making decisions to continually move forward

Management

- Operations given the space to solve the problems
- Making the funds available to deliver the required improvements
- Commitment to continual R&D projects
- Ability to adapt to change
Complex Processing Plant designed to process the poly metallic ore

Processing Plant produces 5 discrete mineral products

- Copper Concentrate
- Bismuth Concentrate
- Bismuth By-Product
- Tungsten Concentrate
- Fluorite Concentrate
Nui Phao Mining Project

**Unique Asset**
- The largest Tungsten mine & one of largest fluorspar mines in the world with significant deposit of bismuth and copper
- Polymetallic; diverse revenue base with reserves >17 years
- Lowest quartile of industry cost curve.

**Location**
- Located 80km from Hanoi in Thai Nguyen province
- Road links to Hai Phong [containers] and Quang Ninh [bulk] ports ensure transport to markets.

**People**
- International, experienced management team
- Skilled local workforce, supplemented by expatriate supervision with regional Asian experience.

**Social Responsibility**
- Awarded “Corporate Social Responsibility Excellence Award” from Vietnam’s Ministry of Planning and Investment for supporting local communities and exceeding world-class standards for environment, safety and social practices.

**Established Operation**
- Over US$ 750 million invested in the project
- First production Q2/2013, first sales Q3/2013
- Established global customer base, >80% exported since startup.
Supplier Engagement

Australian suppliers have successfully engaged with Nui Phao Mining to provide many products and services across a broad area some of which includes; crushing equipment, grinding mills, pumps, valves and other mechanical items, safety & PPE products, ore test works, mine consulting, mine planning and software

Procurement Process

Procurement is conducted primarily through tender process however some equipment and services may be sourced to maintain consistency of equipment and standardization of spare parts and are established through contract agreements

Local Partnerships

Establishing a local presence by partnering with Vietnamese companies is highly regarded in the procurement decision process. Back-up service support and training are also critical aspects of the business partnership integration

Key Procurement Drivers

Procurement decisions focus on total cost of ownership, lead-time & availability, sustainability & support and environmental compliance
Suppliers expenditure

Off Contract Spend
(Direct Charge Project, Operation and Inventory)

Total $31,957,805

Vietnam, 66%
Australia, 16%
China, 8%
Asia, 6%
North America, 2%
European Union, 1%

"Suppliers expenditure"
Supplier Expenditure

On Contract Spend
(Service, Contract and Inventory)

- Vietnam, 70%
- Asia, 14%
- Australia, 12%
- China, 2%
- Europe, 1%
- South Africa, 1%
- North America, 1%

Total $129,319,872
Supplier Opportunities

Australian suppliers have an open invitation to engage with Nui Phao Mining in up-coming major projects in the following areas;

- Engineering and Consultancy
- Copper / Gold Recovery & Smelter Plant
- Increased Tungsten APT Throughput
- New Tungsten Project [Future]
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MASAN RESOURCES
NUI PHAO MINING COMPANY LIMITED
(A subsidiary of MASAN RESOURCES)
Bill Howell
Managing Director & Owner, Triple Plate Junction Ltd
and
Head of Mining Working Group, Vietnam Business Forum
VIETNAM MINING: CURRENT STATUS AND POTENTIAL

- Vietnam is exceptionally mineral-rich, but only a fraction of its resources have been discovered to date - due to the country never having been systematically explored using modern technologies and methods, particularly airborne geophysical surveys to locate more deeply buried, large or richer deposits and favourable structural controls.

- State-owned and private Vietnamese mining companies have been primarily focused on developing outcropping or near-surface bulk minerals, such as coal, iron ore, bauxite, titanium mineral sands and limestones etc.

- Local small scale activities, often artisanal or illegal, account for mining much of the gold, silver, tin and some rare earth occurrences - using mostly outdated, inefficient mining methods resulting in considerable environmental issues.

- However, the Nui Phao tungsten polymetallic open-pit mine, now the world’s largest, is an example of the diversity of Vietnam’s rich resources and what can be achieved by a Vietnamese-owned group using modern technologies and world best practices and expertise.

- The only other deposits operated to international standards have been the Ban Phuc nickel sulphide deposits in Son La Province, and Phuoc Son gold-vein deposits in central Vietnam.
VIETNAM MINING: CHALLENGES AND OPTIMISM

• Vietnam’s largest state-owned mining conglomerate, Vinacomin, is the first to acknowledge that the challenges it faces are “outdated technology and low levels of mechanization, poor infrastructure, low productivity, excessive energy use, high safety risks and unacceptable environmental pollution”

• The Government, through the Ministry of Planning & Investment and Ministry of Natural Resources & Environment, recognise that Foreign Direct Investment (FDI) is the best way to bring modern technology and practices to Vietnam

• Inconsistent mining legislation and high royalty rates, export tariffs and other taxes have until now been a disincentive for such FDI. However, recent proposals to address some of these issues are welcomed and encouraging

• Vietnam’s first ever formal Mineral Law was only introduced in 1996. Mineral Law 2010 has improved the mining legislation, even permitting foreign companies to hold 100% of Mineral Exploration Licences.

• There is also a growing belief that the mining legislation must better differentiate how it handles major world-class discoveries and small-scale local mining activities at both central and provincial levels. It is an ongoing process
Pu Sam Cap located near junction of three tectonic plates –
South China Plate
Indochina Plate
Burma-Malay Plate
Intercontinental extensional rift zone tapping very deep mantle sources of metals

GEOLOGICAL SETTING OF NORTHERN VIETNAM

TPJ Licence Plate boundary, suture or rift zone
Known mineralised zones on 3D Landsat drape

TPJ VIETNAM
Pu Sam Cap Project, Lai Chau Province

Targets identified:
7-8 km diameter Oligocene diatreme with classical alteration assemblages of:

- Alkaline bulk-tonnage porphyry type copper-gold, mineralized rock over over +10 sq.km in area
- IOCG-type epithermal high-grade but narrow gold-bearing veins over 3-4 km strike length
- Massive chalcocite-bornite with high silver and credit gold in structurally controlled zones
- Marginal lead-zinc skarn mineralization
TPJ Vietnam - Pu Sam Cap - Airborne Magnetics 2006

Pusamcap Magnetics RTP - 200m line spacing

Pusamcap Magnetics Interpretation
2013 SURFACE INDICATORS OF CUPOLA ABOVE POSTULATED DEEP PORPHYRY CU-AU AT PU SAM CAP

After Kirwin, 2012

All photos are examples from Pu Sam Cap
THE CHALLENGE

- Average time from start of modern exploration to discovery of the four above deeply buried porphyry copper-gold deposits is **19 years**

- Average time to drill out and establish internationally accepted indicated and inferred resources is **another 8 years**

- BUT deep underground mining is environmentally less damaging than surface mining, particularly in high rainfall, mountainous terrain such as in Vietnam

- Potentially very large deposits and therefore high revenue to government and communities, plus major infrastructure development and service industries, particularly in the remote mountainous regions and poorer socio-economic areas

- Many opportunities for Australian METS, provided long-term stable, consistent, secure mining legislation and a competitive fiscal regime to attract major investment with modern, high technology capability and world best practices

EXEMPLARY OF NEW GENERATION OF DEEP (BULK) MASS MINING OF LARGE TONNAGE, LOWER GRADE DEPOSITS

- Golpu, Morobe, Papua New Guinea
- Cadia East, NSW, Australia
- Hugo Dummett, Oyu Tolgai, Mongolia
- Pampa Escondida, Chile
1977
Modern exploration commenced leading to discovery of the Wafi epithermal Au-Ag vein deposits

2009
Deep drilling discovered significant Cu-Au grades from 890m depth. Deposit still open at 2,000m depth

2012
Pre-feasibility study completed

2020
Start of production planned by underground block-caving

(After Moorhead, 2012)
GOLPU DEPOSIT – PLANNED MINING CONFIGURATION

Golpu: Major Technical Findings

Two block cave lifts: sequential mining of lifts
Reserves = 12.4 Moz Au and 5.4 Mt Cu
Access via twin declines
Production rate of 22Mtpa
Conveyor incline to Watut is most appropriate ore haulage method v Shaft extraction

(After Moorhead, 2013)
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