Overview of the Chilean copper industry

Chilean copper industry in 2005:

- 45% of Chilean exports.
- 13.9% of Chile’s nominal GDP.
- 35.6% of world mine copper production (30.5% of copper in concentrates, 56.7% of SxEw).
- 30.0% of world reserves of copper.
- 8.6% of global exploration expenditure in base metals (3.2% of global expenditure).
- 24.7% of world refined production (EW+primary ER).
- 10.6% of world primary ER production.

Source: Cochilco

Milestones in copper production

State owned vs. private Cu production

Rest of the World

Chile

Copper mining in Chile: large scale

Mine size and Chilean participation in Cu production

Source: Brook Hunt
CONTENTS

1. Chilean copper industry: current situation
2. The future of Chilean copper production
3. Challenges for Chilean copper industry
Future Chilean production on a glimpse
Chilean copper industry from 2006-2012:

- 8.800 MU$ → Total CODELCO investment.
- 4.600 MU$ → Total private investment.
- 1.55 M tpy → Additional copper mine production.
- 3.7% → Annual growth in copper production.
- 0.69 M tpy → Additional smelter production.
- 0.37 M tpy → Additional refinery production.

Source: Cochilco

Concentrates production forecasts
Base case + new projects

SxEw production forecasts
Base case + new projects

Smelter production forecasts
Base case + new projects

Refinery production forecasts
Base case + new projects

Overview of main new projects
Concentrates expansion & new mine projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Owner</th>
<th>Investment</th>
<th>Reserves</th>
<th>Grade</th>
<th>Start</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chuquicamata (Expansion)</td>
<td>CODELCO</td>
<td>684</td>
<td>-</td>
<td>-</td>
<td>2005</td>
<td>175</td>
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<tr>
<td>Los Pelambres (Expansion)</td>
<td>Antofagasta Minerals</td>
<td>182</td>
<td>-</td>
<td>-</td>
<td>2008</td>
<td>100</td>
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<tr>
<td>Andina (Expansion Phase I)</td>
<td>CODELCO</td>
<td>228</td>
<td>-</td>
<td>-</td>
<td>2008</td>
<td>80</td>
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<tr>
<td>Andacollo Sulphides</td>
<td>Aur Resources</td>
<td>350</td>
<td>421</td>
<td>6.42</td>
<td>2009</td>
<td>71</td>
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<tr>
<td>Los Bronces (Expansion)</td>
<td>Anglo American</td>
<td>800</td>
<td>-</td>
<td>-</td>
<td>2010</td>
<td>175</td>
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<tr>
<td>Esperanza</td>
<td>Antofagasta Minerals</td>
<td>890</td>
<td>295</td>
<td>6.46</td>
<td>2010</td>
<td>120</td>
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<tr>
<td>Las Joyas Hales</td>
<td>CODELCO</td>
<td>740</td>
<td>414</td>
<td>1.98</td>
<td>2011</td>
<td>200</td>
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<tr>
<td>Cerro Casale</td>
<td>Roma Gold</td>
<td>1,650</td>
<td>1,035</td>
<td>0.26</td>
<td>2012</td>
<td>125</td>
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</table>
Overview of main new projects
SxEw expansion & new mine projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Owner</th>
<th>Investment</th>
<th>Reserves</th>
<th>Grade</th>
<th>Start</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escondida S. - bowie</td>
<td>BHPB</td>
<td>~370</td>
<td>~1100</td>
<td>~8,52</td>
<td>2009</td>
<td>~180</td>
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<tr>
<td>Mantos de la Luna</td>
<td>Lipedol</td>
<td>~55</td>
<td>~41</td>
<td>~1,39</td>
<td>2004</td>
<td>~24</td>
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<tr>
<td>Spenne</td>
<td>Rio Tinto</td>
<td>~580</td>
<td>~40</td>
<td>~1,0</td>
<td>2008</td>
<td>~290</td>
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<tr>
<td>Cuiba</td>
<td>Codelco</td>
<td>~874</td>
<td>~541</td>
<td>~6,44</td>
<td>2008</td>
<td>~150</td>
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<tr>
<td>Frunekstein</td>
<td>Continental</td>
<td>~78</td>
<td>~34</td>
<td>~5,6</td>
<td>2008</td>
<td>~42</td>
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<tr>
<td>Fortuna de Cobres</td>
<td>Xstrata</td>
<td>~335</td>
<td>~670</td>
<td>~6,25</td>
<td>2009</td>
<td>~75</td>
</tr>
<tr>
<td>El Abra S. - bowie</td>
<td>Phelps Dodge</td>
<td>~350</td>
<td>~800</td>
<td>~6,55</td>
<td>2010</td>
<td>~150</td>
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<tr>
<td>Regalillo</td>
<td>Pan Pacific</td>
<td>~480</td>
<td>~628</td>
<td>~5,65</td>
<td>2011</td>
<td>~80</td>
</tr>
<tr>
<td>Anadina Sxew</td>
<td>Codelco</td>
<td>~155</td>
<td>~20</td>
<td>~0,2</td>
<td>2012</td>
<td>~42</td>
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<tr>
<td>Antucoilla</td>
<td>Antofagasta minerals</td>
<td>~100</td>
<td>~300</td>
<td>~6,45</td>
<td>2012</td>
<td>~40</td>
</tr>
</tbody>
</table>

Overview of main new projects
Smelter & refinery expansions

<table>
<thead>
<tr>
<th>Project</th>
<th>Owner</th>
<th>Investment</th>
<th>Current Production</th>
<th>Change in Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMM S MAM</td>
<td>Jinchuan</td>
<td>~1200</td>
<td>~2100</td>
<td>~900</td>
</tr>
<tr>
<td>EL VALENCIA</td>
<td>Enami</td>
<td>~150</td>
<td>~250</td>
<td>~100</td>
</tr>
<tr>
<td>CHUQUICAMATA Expansion II Phase</td>
<td>Codelco</td>
<td>~375</td>
<td>~500</td>
<td>~75</td>
</tr>
<tr>
<td>EL MIRRU</td>
<td>Xstrata</td>
<td>~180</td>
<td>~250</td>
<td>~70</td>
</tr>
</tbody>
</table>

Main projects in the long term
Expansion projects & new mines

<table>
<thead>
<tr>
<th>Project</th>
<th>Owner</th>
<th>Investment</th>
<th>Reserves</th>
<th>Grade</th>
<th>Start</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chuquicamata</td>
<td>Codelco</td>
<td>~900</td>
<td>~1254</td>
<td>~6,79</td>
<td>2014</td>
<td>~375</td>
</tr>
<tr>
<td>Andina Expansion II Phase</td>
<td>Codelco</td>
<td>~2100</td>
<td>~679</td>
<td>~5,84</td>
<td>2013</td>
<td>~140</td>
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</table>

Main projects in the long term
Exploration projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Owner</th>
<th>Metal</th>
<th>Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHIMBORAZO</td>
<td>BHP Billiton</td>
<td>Copper</td>
<td>Evaluation</td>
</tr>
<tr>
<td>RELINCHI</td>
<td>Luma Copper Corp.</td>
<td>Copper &amp; Moly</td>
<td>Exploration</td>
</tr>
<tr>
<td>VIZCACHITA</td>
<td>Luma Copper Corp.</td>
<td>Copper &amp; Moly</td>
<td>Exploration</td>
</tr>
<tr>
<td>CONCORDIA</td>
<td>Breakwater Resources</td>
<td>Copper, Lead &amp; Zinc</td>
<td>Exploration</td>
</tr>
<tr>
<td>WEST WALL</td>
<td>Falconbridge</td>
<td>Copper</td>
<td>Exploration</td>
</tr>
<tr>
<td>SIERRA GORDA</td>
<td>Quadra Mining</td>
<td>Copper</td>
<td>Exploration</td>
</tr>
</tbody>
</table>

Challenges for Chilean copper mining
Water & mining in Chile

- 4.5% Water use by the mining industry in Chile.
- 70% Water use in mining regions by the mining industry.
- 2.7 Index of water price in mining regions (Santiago = 1).
- 1.0 m³/t Concentration water use / ton of mineral.
- 0.3 m³/t Hydrometallurgy water use / ton of mineral.

- ¿How to develop sustainable mining in one of the driest places on earth?
**Challenges for Chilean copper mining**

**Water & mining in Chile**

**Source:** Cochilco

**Mining sector response:**

- **Water legislation**
  - Water Code considers more supervision by the authority (DGA), regarding the constitution and tender processes of the water rights.
  - Regulates increasing competition between mining and other economic sectors for water resources.
  - Other institutions concerned with water management.

- **Investment**

- **Efficiency**

**Mineral sector response:**

- In new technology, like desalination plants. An example is Escondida’s recent investments, with a rate of 525 t/s for the Escondida Low Grade Sulphides project. (170km from plant to mine, 3000m difference).
  - Exploration to find new water resources. For example Pampa Puno by Codelco.

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3. Challenges for Chilean copper industry
   1. Water
   2. Energy
   3. Mining cluster

**Challenges for Chilean copper mining**

**Energy & mining in Chile**

- SING* marginal cost of energy 2005
  - Increase in marginal cost 2003-2005
  - Electricity use / ton of SxEw cathode
  - Natural Gas in SING system.
  - Mining energy use of SING

- How to secure energy supply for mining & other sectors?

- Even though prices have gone up in recent years, they are still below historical levels (the effect of natural gas).

- Energy policy is an issue that goes beyond the mining sector and affects the country as a whole.
- The most important aspect is reliability of supply, which is being analyzed at the highest level to achieve appropriate diversification of energy sources.
- The northern regions have adapted to problems with natural gas supply by converting to other energy sources.

* SING grid provides electricity to the northern regions.
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Challenges for Chilean copper mining
Development of a mining cluster

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (MUS$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual expenditure in engineering 2002-2005</td>
<td>140 MUS$</td>
</tr>
<tr>
<td>Annual expenditure in construction 2002-2005</td>
<td>550 MUS$</td>
</tr>
<tr>
<td>Expenditure in goods and supplies for mining</td>
<td>1,255 MUS$</td>
</tr>
<tr>
<td>Expenditure in services for mining</td>
<td>1,590 MUS$</td>
</tr>
<tr>
<td>Number of supplier companies to mining</td>
<td>370</td>
</tr>
</tbody>
</table>

• ¿How to develop an economic cluster around mining & achieve sustainable development in the mining regions?

Mining sector response
Public-private initiatives to increase transparency, competitiveness and foster innovation:

- Programs with local suppliers to mining (Minexport: association to facilitate exports of goods, services & supplies to the mining industry; Suppliers development plan, a program to develop local suppliers in the Antofagasta Region; a registry of approved suppliers by AIA, for transparency & less transaction costs).
- Information about business opportunities for the mining suppliers sector published periodically by Cochilco.
- Research institutions: (Cicitem, a mining sector research institution related to Antofagasta & Northern Catholic Universities, with public & private financing.)

Final remarks

• Water, energy & the development of a mining cluster are just some of the challenges faced by this complex and competitive industry. Other issues are arising:
  1. Challenges for the further development of mature mines, mines at high altitude & complex environments.
  2. Promotion of exploration investment.
  3. Closure of mines & site rehabilitation.
  4. Other environmental issues.

• The mining industry remains competitive by anticipating these challenges & coordinating its actions.

ICSG Meeting
Lisbon, September 2006

-Current and Future Situation of the Copper Industry in Chile”

Research and Policy Planning Division
Chilean Copper Commission