CHILEAN COPPER MINING COSTS

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MINING COST: CHILE VS WORLD
• **2012**: Mining companies began to make efforts to contain the rise in costs.

• **2016**: Margins of the companies presented levels observed before 2002.

Source: Cochilco and Woodmackenzie Q32017
WORLD COPPER NET CASH COST C3 CURVES
2000 VS 2017(F)

- Costs moved from the second to the fourth quartile.

- In 2000, the production of Chile represented 34.7% of the world copper mine production. In 2017 it represented 26.3% (august).

Source: Cochilco and Woodmackenzie Q32017
WORLD COPPER CASH COST C1 CURVES
2000 VS 2017(F)

- Costs C1 moved from the second to the third quartile.

Source: Cochilco and Woodmackenzie Q32017
COST OF LARGE MINING COMPANIES IN CHILE- KEY FACTORS
VARIATION PER ELEMENT CASH COST - CHILE 2000-2016 (¢US/LB)

C1 Cash Cost 2016 134,3
Labour + 35,1
Other Consumables + 24,3
Services & Contractors + 20,2
TC RC y Marketing + 10,8
Power + 9,9
Acid + 5,0
Diesel + 4,0
Conc Freight + 2,7
Deferred Costs -7,0
BP Credit -15,2
C1 Cash Cost 2000 44,5

Source: Cochilco based on Woodmackenzie Q32016
VARIATION PER ELEMENT NET CASH COST - CHILE 2000-2016 (¢US/LB)

C3 Net Cash Cost 2016: 209.1
Cash Cost C1: +89.9
Depreciation: +36.9
Other: +5.3
Corporate Overheads: +5.3
Interest: +3.3
C3 Net Cash Cost 2000: 68.4

Source: Cochilco based on Woodmackenzie Q32016
AVERAGE COPPER MINING GRADES IN CHILE 1999-2016

- The decrease in ore grade in Chile has been higher than the world average.

- Mining development in Chile began earlier and ore deposits and blocks with a higher concentration of ore have been exploited.

Source: Cochilco
AVERAGE COPPER MINING GRADES
CHILE VS WORLD 2005-2016

- Average Ore grades of the sulfide line have decreased similarly (27%), Chile and the World.
- Ore grades of the oxides line in Chile are lower than the world average.
- There is a depletion of oxidized resources in Chile, which will mean 66% lower production of SX-EW cathodes by 2027.

Source: Cochilco and Woodmackenzie
ENERGY AND DIESEL

Chilean Energy
PMM SING y SIC (*)

Lower generation cost due to the fall in the price of diesel, improvements in efficiency in existing processes and the incorporation of cheaper technologies (NCRE).

(*) Average Market Price of Customers not subject to price regulation

Growth of supply (new alternatives for extraction and others.) and lower demand (China and Europe), have caused the decrease in oil prices.
**ENERGY AND DIESEL**

*Chilean Energy PMM SING y SIC (*)*

- Lower generation cost due to the fall in the price of diesel, improvements in efficiency in existing processes and the incorporation of cheaper technologies (NCRE).

*WTI Crude Oil*

- Growth of supply (new alternatives for extraction and others.) and lower demand (China and Europe), have caused the decrease in oil prices.

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(*) Average Market Price of Customers not subject to price regulation

Source: Cochilco
The prices of mining inputs have declined in recent years, given the lower mining activity. Relevant inputs are: fuels, sulfuric acid, grinding balls, OTR tires, chemical reagents, lubricants, etc.

Source: Cochilco
SCALE IS RELEVANT BUT NOT DETERMINANT

Quarterly Copper Production
(KTMF Avg IIIQ16-IIq2017)

Source: Cochilco
GEOGRAFICAL REGIONS ARE NOT DETERMINANT

Source: Cochilco
03 | CASH COST COCHILCO (¢US$/lb)
2014 vs 2017 (accumulated up to June)
QUARTERLY MONITORING OF CHILEAN COSTS

• In 2014, Cochilco began to seek quarterly cash cost (C1) of the 21 largest copper producing operations in Chile ("Observatorio de Costos").

• They account 92% of copper mine production in Chile and 25% of world copper production.
OPERATIONAL COST OF LARGE CHILEAN COPPER MINING (%)
Q1 2017

- Services and purchase of consumables represent 46% of the operational costs.

Source: Cochilco
### 21 PRODUCERS - LARGE COPPER MINING

<table>
<thead>
<tr>
<th>Operation</th>
<th>Main Controller</th>
<th>Accumulated production to June (ktmf Cu)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escondida</td>
<td>BHP Billiton</td>
<td>328</td>
<td>13,0%</td>
</tr>
<tr>
<td>El Teniente</td>
<td>Codelco</td>
<td>219</td>
<td>8,7%</td>
</tr>
<tr>
<td>Collahuasi</td>
<td>Anglo American plc y Glencore</td>
<td>247</td>
<td>9,8%</td>
</tr>
<tr>
<td>Anglo American Sur</td>
<td>Anglo American plc</td>
<td>175</td>
<td>6,9%</td>
</tr>
<tr>
<td>Los Pelambres</td>
<td>Antofagasta Minerals</td>
<td>170</td>
<td>6,8%</td>
</tr>
<tr>
<td>Radomiro Tomic</td>
<td>Codelco</td>
<td>152</td>
<td>6,0%</td>
</tr>
<tr>
<td>Chuquicamata</td>
<td>Codelco</td>
<td>116</td>
<td>4,6%</td>
</tr>
<tr>
<td>Centinela</td>
<td>Antofagasta Minerals</td>
<td>117</td>
<td>4,6%</td>
</tr>
<tr>
<td>Andina</td>
<td>Codelco</td>
<td>112</td>
<td>4,4%</td>
</tr>
<tr>
<td>Spence</td>
<td>BHP Billiton</td>
<td>103</td>
<td>4,1%</td>
</tr>
<tr>
<td>Ministro Hales</td>
<td>Codelco</td>
<td>113</td>
<td>4,5%</td>
</tr>
<tr>
<td>Candelaria</td>
<td>LundinMining</td>
<td>76</td>
<td>3,0%</td>
</tr>
<tr>
<td>Gaby</td>
<td>Codelco</td>
<td>60</td>
<td>2,4%</td>
</tr>
<tr>
<td>Zaldivar</td>
<td>Barrick Gold/ Antofatasta Minerals</td>
<td>52</td>
<td>2,1%</td>
</tr>
<tr>
<td>Sierra Gorda</td>
<td>KGHM International Ltd</td>
<td>52</td>
<td>2,0%</td>
</tr>
<tr>
<td>Mantos Copper</td>
<td>Audley Capital Advisors LLP</td>
<td>42</td>
<td>1,7%</td>
</tr>
<tr>
<td>Caserones</td>
<td>SCM Minera Lumina Copper Chile</td>
<td>56</td>
<td>2,2%</td>
</tr>
<tr>
<td>Cerro Colorado</td>
<td>BHP Billiton</td>
<td>35</td>
<td>1,4%</td>
</tr>
<tr>
<td>El Abra</td>
<td>Freeport McM</td>
<td>37</td>
<td>1,5%</td>
</tr>
<tr>
<td>Salvador</td>
<td>Codelco</td>
<td>27</td>
<td>1,1%</td>
</tr>
<tr>
<td>Quebrada Blanca</td>
<td>Teck</td>
<td>12</td>
<td>0,5%</td>
</tr>
<tr>
<td>Otros</td>
<td></td>
<td>223</td>
<td>8,8%</td>
</tr>
<tr>
<td><strong>Total país</strong></td>
<td></td>
<td><strong>2 522</strong></td>
<td><strong>91,2%</strong></td>
</tr>
</tbody>
</table>

Source: “Observatorio de Costos” Cochilco
## QUARTERLY CHILEAN CASH COST (C1) Q4 2012- Q2 2017

### LARGE COPPER MINING

**Cash Cost USD/lb**

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2012 Q4</td>
<td>176.5</td>
<td>148.1</td>
<td>168.8</td>
<td>154.1</td>
<td>149.3</td>
<td>146.3</td>
<td>156.1</td>
<td>144.8</td>
<td>162.7</td>
<td>148.2</td>
<td>157.4</td>
<td>161.3</td>
<td>130.4</td>
<td>130.3</td>
<td>128.1</td>
<td>129.9</td>
<td>130.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** “Observatorio de Costos” Cochilco

**Note:**

- **2016:** Strong decrease in costs
- **Escondida Labor strike** impacted production
CASH COST (C1) LARGE COPPER MINING
2015 VS 2016

Source: “Observatorio de Costos” Cochilco
## CASH COST COCHILCO ($US$/LB)
### 2015 VS 2016 (Accumulated Costs)

<table>
<thead>
<tr>
<th>Category</th>
<th>2015 (¢US$/lb)</th>
<th>2016 (¢US$/lb)</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash Cost 2015</td>
<td>153.5</td>
<td>127.4</td>
<td>-26.1</td>
</tr>
<tr>
<td>Management efforts</td>
<td>-26.5</td>
<td>-7.0</td>
<td></td>
</tr>
<tr>
<td>Market factors</td>
<td>-7.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Ore Grades</td>
<td>+7.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Strong incidence of lower costs of Services.
- During 2016, a large part of the mining companies finalized their adjustment processes.
- Throughout 2016, costs were favored by a higher value of the average exchange rate and lower energy / fuel prices.
- High impact of lower ore grades, which in some cases was compensated with increased tonnage processed.

Source: Cochilco
CASH COST COCHILCO (¢US$/LB) 
2016 vs 2017 (accumulated up to June)

- The lower copper production impacts on lower purchases of materials and consumption of Energy and Fuels.
- Higher prices of byproducts (subtracted from cost) and lower prices of materials and services (among others), help to counteract the strong impact of the lower price of the dollar.
- In the first semester, the impact of the fall of 10% in the production of the sample of 21 operations (-252 ktmf) is maintained.

<table>
<thead>
<tr>
<th>Cash Cost 2016 (¢US$/lb)</th>
<th>129,7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Efforts</td>
<td>-1,6</td>
</tr>
<tr>
<td>Market Factors</td>
<td>-4,0</td>
</tr>
<tr>
<td>Lower Production</td>
<td>+13,7</td>
</tr>
<tr>
<td>Cash Cost 2017 (¢US$/lb)</td>
<td>137,8</td>
</tr>
</tbody>
</table>

+ 8,0 ¢US$/lb

Source: Cochilco
**CASH COST COCHILCO (C1)**

*2016 vs 2017 (accumulated up to June)*

8 operations decreased their costs C1

13 operations increased their costs C1

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations that increased costs</td>
<td>13</td>
<td>130.3</td>
<td>155.8</td>
<td>+ 25.5</td>
<td></td>
</tr>
<tr>
<td>Operations that decreased costs</td>
<td>8</td>
<td>128.2</td>
<td>119.3</td>
<td>-8.9</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>129.7</td>
<td>137.8</td>
<td>8.0</td>
<td></td>
</tr>
</tbody>
</table>

Source: Cochilco
Generalized displacement of the cost curve and especially of those operations with higher costs

Source: Cochilco
### VARIATION CASH COST COCHILCO (¢US$/lb)
#### 2016 vs 2017 (accumulated up to June)

<table>
<thead>
<tr>
<th>Cash Cost Cochilco (¢US$/lb)</th>
<th>2016 (accumulated to June)</th>
<th>2017 (accumulated to June)</th>
</tr>
</thead>
<tbody>
<tr>
<td>By product credit</td>
<td>-7,7</td>
<td></td>
</tr>
<tr>
<td>Acid</td>
<td>-0,4</td>
<td></td>
</tr>
<tr>
<td>TC/RC y Marketing</td>
<td>-0,1</td>
<td></td>
</tr>
<tr>
<td>Consumables</td>
<td>0,2</td>
<td></td>
</tr>
<tr>
<td>Freight</td>
<td>0,3</td>
<td></td>
</tr>
<tr>
<td>Diesel</td>
<td>1,1</td>
<td></td>
</tr>
<tr>
<td>Power</td>
<td>2,1</td>
<td></td>
</tr>
<tr>
<td>Labour</td>
<td>3,8</td>
<td></td>
</tr>
<tr>
<td>Services and Others</td>
<td>8,7</td>
<td></td>
</tr>
</tbody>
</table>

**Variación (¢US$/lb)**

+ 8

*Source: Cochilco*

- Higher Au, Ag and Mo prices => higher credits for by-products
- Increase quarterly of power average prices of free client contracts, especially in the SING (+21%).
- Increase of the diesel (+27%)
- Slight increase in average own endowments (+2%)
- Increase item “Services and others”, with strong impact of the fall of the dollar.
Average price of the dollar falls $ 30 (-4%) and negatively impacts on costs in Chilean peso.

Increase the production of by-products and lower consumption of materials, energy and fuels.

Higher price by-products and lower prices of services, materials, H2SO4 and TC-RC.

Copper production decreased 252 ktmf (-10%).

### VARIATION CASH COST COCHILCO (¢US$/lb)

<table>
<thead>
<tr>
<th></th>
<th>2016 (accumulated to June)</th>
<th>2017 (accumulated to June)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash Cost Cochilco (¢US$/lb)</td>
<td>129,7</td>
<td>137,8</td>
</tr>
<tr>
<td>Quantity Effect (Inputs, workers, q consumptions, etc.)</td>
<td>-1,5</td>
<td>13,7</td>
</tr>
<tr>
<td>Prices effect (Supplies, Personnel, Consumptions, etc.)</td>
<td>-12,0</td>
<td>7,9</td>
</tr>
<tr>
<td>CPI effect, exchange rate and IPM USA</td>
<td>7,9</td>
<td>7,9</td>
</tr>
<tr>
<td>Lower Production</td>
<td>13,7</td>
<td>7,9</td>
</tr>
</tbody>
</table>

Variación (¢US$/lb) + 8

Source: Cochilco
CAPEX INTENSITY TREND FOLLOW THE PRICE

Source: Cochilco
COST CONTROL IS KEY FACTOR FOR LONG TERM SUSTAINABILITY

Creating value

Mining
Ecosystem

Productions

Productivity

Market Share
Community Participations

Funding
Infrastructure

Human Capital

Investment Climate

Tech Transf

Environmental Governance

Innovations policies

Environmental

Water

Land

Electricity

Geological potential

Communities

Environment

Government
Workers
Junior C.
Mayor C.
NGO

Providers
Codelco
Universities and TC
S&M Mining

Players

Strategies

Pillars

Main Goal
STRATEGY FOR ENHANCING CASH COSTS COMPETITIVENESS

Main goal: Creating value

Strategies:
- Productivity
- Innovations

Players:
- Mining Co
- Government
- Providers
- Universities
- Tech C

Policies & Programs:
- ALTA LEY
- CORFO
- FIE
- CLUSTER ANTOFAGASTA
- CONICYT
- FCH Expande
05 FINAL REMARKS
FINAL REMARKS

• The Chilean mining lost competitiveness in terms of cash cost, mainly for decreasing in ore grades, and increase in CAPEX because the inflation in the key inputs.

• In recent years the cost control has becoming a priority for companies and the government and has been one of the focus in the policies.

• The strategies to recovery cash cost competitiveness is focusing policies in improving productivity and increasing investment in innovation.
CHILEAN COPPER MINING COSTS

Jorge Cantallops
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Chilean Copper Commission

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