Smelting and refining: Chilean situation at May 2019

Chilean Copper Commission

May, 2019 –ICSG

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Smelting and refining in Chile

There are 7 smelters in Chile, and 3 of them also have refinery (Chuquicamata, Potrerillos, and Ventanas).

5 are state-owned, while 2 are private (Alto Norte and Chagres)
Smelting and refining in Chile

### Annual capacities in thousand tones

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Altonorte</td>
<td>1.160</td>
<td>-</td>
<td>1.000</td>
</tr>
<tr>
<td>Chuquicamata</td>
<td>1.400</td>
<td>540</td>
<td>970</td>
</tr>
<tr>
<td>Potrerillos</td>
<td>680</td>
<td>130</td>
<td>460</td>
</tr>
<tr>
<td>Hernán Videla Lira</td>
<td>450</td>
<td>-</td>
<td>253</td>
</tr>
<tr>
<td>Chagres</td>
<td>660</td>
<td>-</td>
<td>500</td>
</tr>
<tr>
<td>Ventanas</td>
<td>430</td>
<td>410</td>
<td>330</td>
</tr>
<tr>
<td>Caletones</td>
<td>1.370</td>
<td>-</td>
<td>1.200</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>6.150</strong></td>
<td><strong>1.080</strong></td>
<td><strong>4.713</strong></td>
</tr>
</tbody>
</table>

Chilean Copper Commission
Environmental context: Emission standard in smelters

Emission standard in copper smelters and other arsenic emission sources (DS 28/2013)

**Goals:**

Article 1º.- To protect human and environmental health in all national territory.

As a result of its implementation air emissions of particular matter (PM), sulfur dioxide (SO$_2$), arsenic (As) and mercury (Hg) will be reduced.
Emission standard in smelters

For old smelters:

- Smelters with **double contact acid plant**: Ventanas, Chagres and Altonorte must meet in **2016**
- Smelters **without** double contact acid plant: Chuquicamata, Potrerillos, HVL and Caletones must meet in **2018**

For new smelters:

- Compliance with **SO$_2$** capture greater or equal to **98%**
- Compliance with **As** capture greater or equal to **99.97%**.
- Chimney emission limits for unit operations: dryer (PM), slag cleaning furnace (MP, As), acid plant (SO2, Hg).
Current investments in smelters

Current smelters state

Required standard for 2016

- **Altonorte**: 97% SO2 and >95% As of capture by 2017
- **Chagres**: 98% SO2 and 95.54% As of capture by 2017
- **Ventanas**: 95% SO2 and 94.7% As of capture by 2017
Current investments in smelters

Current smelters state

- **Chuquicamata**
  - Improvements in dust and gas captures, replacement of equipment
  - No significant improvements in cost reductions

- **Potrerillos**
  - Improvements in capture and processing of gases, slag cleaning, and smoke treatment.
  - No significant improvements in cost reductions
Current investments in smelters

Current smelters state

Required standard for 2018

- **Hernán Videla Lira**:

**STAGE 1**: Compliance plan of DS 28 between 2018 and 2023.
- Improvement in gas capture
- No significant improvements in cost reductions

**STAGE 2**: New smelter: Higher capacity, compliance with DS 28 for new smelters.
- Capacity: 700 mil ton/year (twice as much as current)
- **First quarter of competitiveness and costs**
Current investments in smelters

Current smelters state

Required standard for 2018

- **Caletones**
  - Change of equipment for slag treatment, optimization of drying process for higher gas captures.
  - No significant improvements in cost reductions
Chilean smelters outlook
Environmental STANDARD COMPLIANCE (ds 28)

<table>
<thead>
<tr>
<th></th>
<th>Nominal Ktpa</th>
<th>SO2 capture %</th>
<th>Final Investment</th>
<th>Status DS28</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Cons</td>
<td>2010</td>
<td>2014</td>
<td>2019</td>
</tr>
<tr>
<td>Alto Norte</td>
<td>1.160</td>
<td>91,7</td>
<td>95</td>
<td>97</td>
</tr>
<tr>
<td>Caletones</td>
<td>1.370</td>
<td>86,2</td>
<td>91,6</td>
<td>95</td>
</tr>
<tr>
<td>Chagres</td>
<td>660</td>
<td>95,1</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>Chuquicamata</td>
<td>1.400</td>
<td>89,1</td>
<td>94</td>
<td>96</td>
</tr>
<tr>
<td>Hernan Videla Lira</td>
<td>450</td>
<td>90,7</td>
<td>86,8</td>
<td>97</td>
</tr>
<tr>
<td>Potrerillos</td>
<td>680</td>
<td>85,7</td>
<td>86,4</td>
<td>95</td>
</tr>
<tr>
<td>Ventanas</td>
<td>430</td>
<td>94,6</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td>Total/Avg</td>
<td>6.150</td>
<td>89,7</td>
<td>92,8</td>
<td>96,1</td>
</tr>
</tbody>
</table>

(1) The slag treatment plant is the most critical project for the operation of a smelter. In last January, Minera Las Cenizas was assigned the treatment of the slag.
(2) The critical aspect to start a smelter operation is the construction of two sulfuric acid plants. The CODELCO’s estimated date to start the smelter operation is April 2019.
(3) Implementation date was postponed from February to April 2019.
Impact in Productions

<table>
<thead>
<tr>
<th></th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>FuRe + Cucons (kT)</td>
<td>4,256</td>
<td>4,386</td>
<td>4,439</td>
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<tr>
<td>Var FuRe Q</td>
<td>-109</td>
<td></td>
<td>+105</td>
</tr>
<tr>
<td>Var Cucons Q</td>
<td>+239</td>
<td></td>
<td>-52</td>
</tr>
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</table>
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