ICSG Meeting

Lisbon, September 2006

"Current and Future Situation of the Copper Industry in Chile"

Research and Policy Planning Division
Chilean Copper Commission

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Overview of the Chilean copper industry

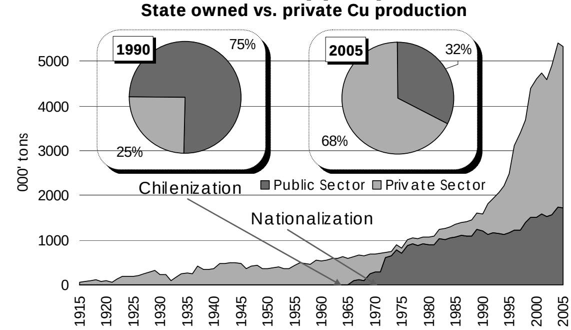
Chilean copper industry in 2005:

45%	→ of Chilean **exports.**
13,9%	→ of Chile's **nominal GDP**.
35,6%	→ of world **mine copper production** (**30,5%** of copper in concentrates, **58,7%** 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

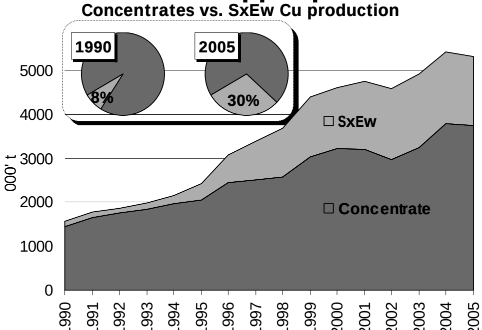
State owned vs. private Cu production



Source: Cochilco

Milestones in copper production

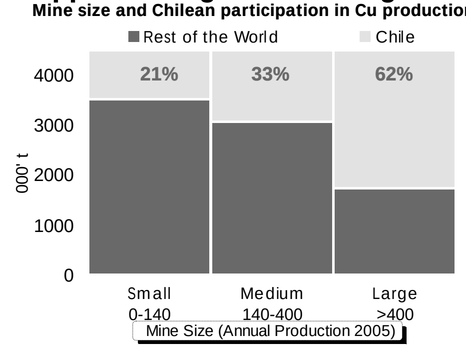
Concentrates vs. SxEw Cu production



Source: Cochilco

Copper mining in Chile: large scale

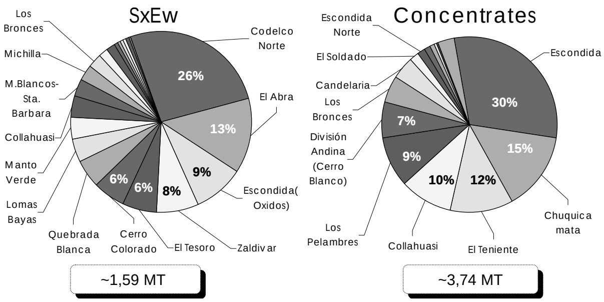
Mine size and Chilean participation in Cu production



Source: Brook Hunt

Copper mining in Chile: large scale

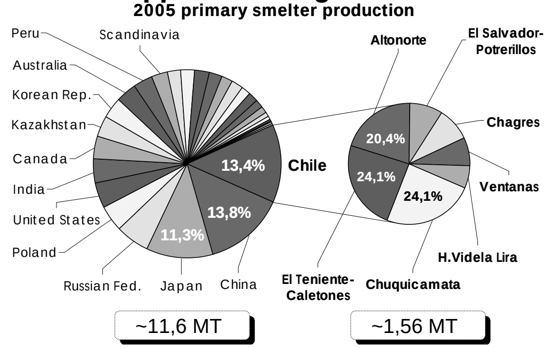
2005 copper mine production by site



Source: Cochilco

Copper smelting in Chile

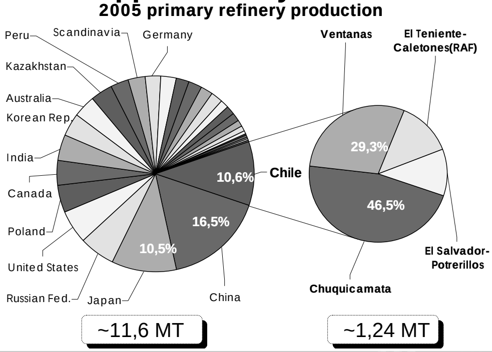
2005 primary smelter production



Source: Cochilco

Copper refinery in Chile

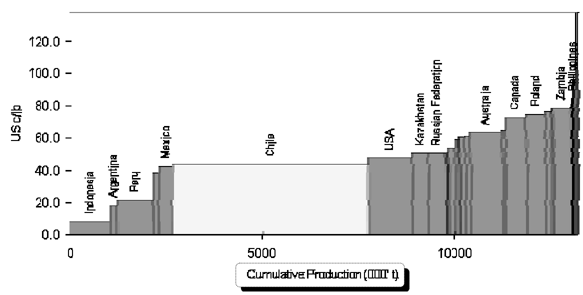
2005 primary refinery production



Source: Cochilco

Chilean copper mine costs

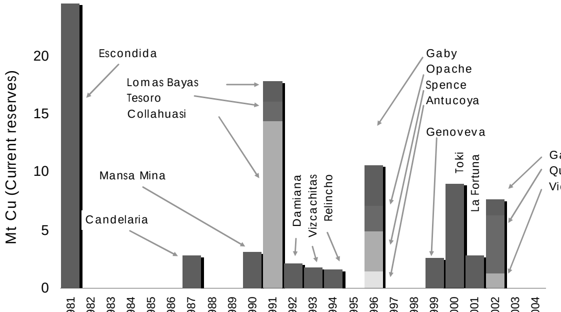
Average cash costs 2005 (composite)



Source: Brook Hunt

Milestones: exploration

Main discoveries since 1981 & current Cu reserves



Source: Cochilco, Brook Hunt.

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Future Chilean production on a glimpse

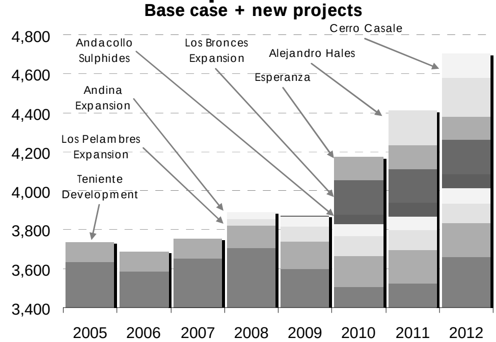
Chilean copper industry from 2006-2012:

- **8.800 MUS$** → Total **CODELCO investment**.
- **4.600 MUS$** → 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

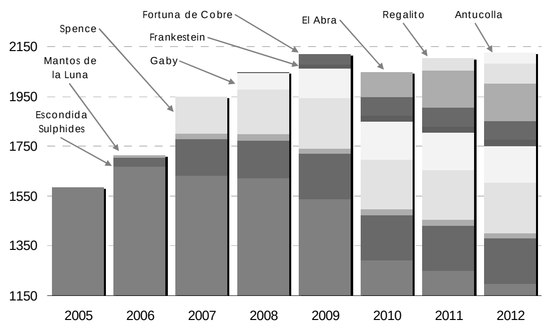
Base case + new projects



Source: Cochilco

SxEw production forecasts

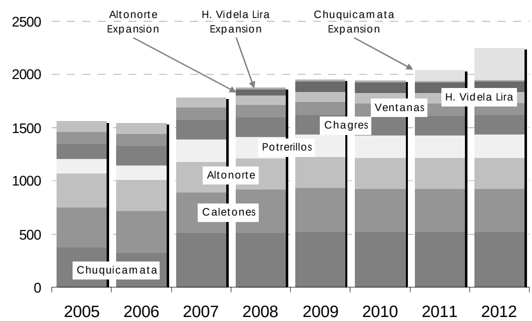
Base case + new projects



Source: Cochilco

Smelter production forecasts

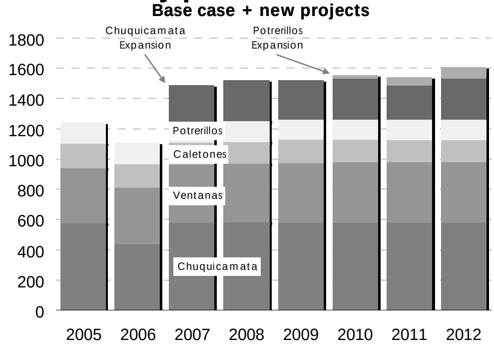
Base case + new projects



Source: Cochilco

Refinery production forecasts

Base case + new projects



Source: Cochilco

Overview of main new projects

Concentrates expansion & new mine projects

Project	Owner	Investment	Reserves	Grade	Start	Capacity
		MUS$	Mt	%	Year	000' t
Teniente (Expansion)	Codelco	634+	-	-	2005	175
Los Pelambres (Expansion)	Antofagasta Minerals	182	-	-	2008	100
Andina (Expansion Phase I)	Codelco	226	-	-	2008	80
Andacollo Sulphides	Aur Resources	350	421	0,42	2009	71
Los Broncos (Expansion)	Anglo American	800	-	-	2010	175
Esperanza	Antofagasta Minerals	600	295	0,66	2010	120
Alejandro Hales	Codelco	340	614	1,08	2011	200
Cerro Casale	Bema Gold	1.650	1.035	0,26	2012	125

Source: Cochilco

Overview of main new projects

SxEw expansion & new mine projects

Project	Owner	Investment	Reserves	Grade	Start	Capacity
		MUS$	Mt	%	Year	000' t
Escondida S. leach.	BHPB	870	1100	0,52	2006	180
Mantos de la Luna	Lipesed	55	41	1,39	2006	24
Spence	BHPB	990	400	1,0	2007	200
Gaby	Codelco	874	541	0,44	2008	150
Frankestein	Continental	70	34	-	2008	42
Fortuna de Cobre	Xstrata	335	470	0,31	2009	75
El Abra S. leach.	Phelps Dodge	350	800	0,53	2010	150
Regalito	Pan Pacific	660	628	0,43	2011	80
Andina SxEw	Codelco	193	20	0,2	2012	42
Antucolla	Antofagasta Minerals	100	300	0,45	2012	40

Source: Cochilco

Overview of main new projects

Smelter & refinery expansions

Project	Owner	Investment	Current Production.	Change in Production.
		MUS$	000' t Cu	000' t Cu
SMELTERS				
Altonorte	Xstrata	58	290	110
H. Videla Lira	Enami	28,3	94	15
Chuquicamata	Codelco	-	375	445
REFINERIES				
Chuquicamata	Codelco	-	580	270
Potrerillos		-	138	75

Source: Cochilco

Main projects in the long term

Expansion projects & new mines

Project	Owner	Investment	Reserves	Grade	Start	Capacity
		MUS$	Mt	%	Year	000' t
Chuquicamata Underground	Codelco	~900	1254	0,79	2014	~375
Andina Expansion II Phase	Codelco	~2100	-	-	-	~170
El Morro	Xstrata	~1200	479	0,64	2013	~100

Source: Cochilco

Main projects in the long term

Exploration projects

PROJECT	OWNER	METAL	STAGE
CLUSTER TOKI	Codelco	Copper	Evaluation
CHIMBORAZO	BHP Billiton	Copper	Evaluation
RELINCHO	Lumina Copper Corp.	Copper & Moly	Exploration
VIZCACHITA	Lumina Copper Corp.	Copper & Moly	Exploration
CONCORDIA	Breakwater Resources	Copper, Lead & Zinc	Exploration
WEST WALL	Falconbridge	Copper	Exploration
SIERRA GORDA	Quadra Mining	Copper	Exploration

Source: Cochilco

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1. Chilean copper industry: current situation
2. The future of Chilean copper production
3. Challenges for Chilean copper industry
    1. Water
    2. Energy
    3. Mining cluster

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 m^3/t	→ **Concentration** water use / ton of mineral.
0,3 m^3/t	→ **Hydrometallurgy** water use / ton of mineral.

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

Source: Cochilco

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Challenges for Chilean copper mining

Water & mining in Chile

Mining sector response:

Water legislation

Investment

Efficiency

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

Source: Cochilco

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Challenges for Chilean copper mining

Water & mining in Chile

Mining sector response:

Water legislation

Investment

Efficiency

- In new technology, like **desalinization plants**. An example is Escondida´s recent investments, with a rate of 525 lt/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.

Source: Cochilco

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Challenges for Chilean copper mining

Water & mining in Chile

Mining sector response:

Water legislation

Investment

Efficiency

- **Best practices** for the efficient use of water resources (Public-Private Initiatives) leads to:
- Better **management systems** of water resource.
- **Measurement** & efficiency **indicators**.
- Increased rates of re-circulation & other concrete **measures**.

Source: Cochilco

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Challenges for Chilean copper mining

Energy & mining in Chile

28 US$/MWh	→ SING* **marginal cost** of energy 2005
81%	→ increase in **marginal cost** 2003-2005
2,90 MWh/t	→ Electricity use / ton of SxEw cathode
3,05 MWh/t	→ Electricity use / ton of ER cathode
58%	→ Natural Gas in SING system.
85%	→ Mining energy use of SING

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

- * SING grid provides electricity to the northern regions.

Source: Cochilco

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Challenges for Chilean copper mining

Energy & mining in Chile

Mining sector response:

→ **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.

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

Source: Cochilco

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Challenges for Chilean copper mining

Development of a mining cluster

140 MUS$ → Annual expenditure in engineering 2002-2005
550 MUS$ → Annual expenditure in construction 2002-2005
1.255 MUS$ → Expenditure in goods and supplies for mining.
1.590 MUS$ → Expenditure in services for mining.
370 → Number of supplier companies to mining

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

Source: Cochilco

Challenges for Chilean copper mining

Development of a mining cluster

Mining sector response

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

→ **Programs with local suppliers to mining** (**<u>Minexport</u>**: 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.)

Source: Cochilco

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.**

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