

Chilean Copper Commission
Research and Policy Planning Department

THE CHILEAN SULFURIC ACID MARKET
Estimations Through 2020
(Revised to June 2011)
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Executive Summary

Sulfuric acid's key role in hydrometallurgy has turned Chile's thriving copper mining industry into the world's most intensive user outside of the phosphate fertilizer industry.

In an exceptionally virtuous circle, copper hydrometallurgy is a natural user of the acid resulting from sulfuric gas abatement at Chilean copper smelters.

The rise of copper hydrometallurgy since the eighties –it boasted a 66.3 percent market share in 2010- has turned Chile into the world's premier producer of SX-EW copper. Sulfuric acid use has closely tracked this development.

The Chilean Copper Commission closely tracks the domestic market for this strategic copper mining industry input. This report uses data supplied by leading producers and consumers to estimate market prospects through the year 2020.

Below is a summary of sulfuric acid market attributes and the conclusions drawn from estimates of market behavior through the year 2020.

1) The Chilean Sulfuric Acid Market

- Copper accounts for 96 percent of total sulfuric acid consumption, a total of 7.93 million tons in 2010. The balance is used by the industrial minerals, wood pulp, and chemical industries.
- Consumption is heaviest in northern Chile, notably Antofagasta with 72.6 percent, and Arica, Tarapacá, and Atacama with 21.7 percent. The balance is used south of Coquimbo.
- While most local consumers source their needs in the open market, some produce their own supplies. In 2010, 5.68 million tons were bought from third parties and 2.25 million were produced in-house.
- Sulfuric acid consumption rates in the copper mining industry are a key factor. These range from 1 to 12 tons per ton of SX-EW copper and have a direct impact on production costs. As leachable ore grades decline, average consumption has grown from 2.86 tons acid/ton of SX-EW copper in 2004 to 3.65 tons in 2010.
- Smelters accounted for 96 percent of the 5.13 million tons produced in 2010, with the balance coming from sulfur burners and molybdenum plants. Sulfur burners recently installed by Noracid and Cemin should increase these companies' share in short order.
- While plants in northern Chile account for 60.8 percent of total sulfuric acid production -including Antofagasta with 42.3 percent- they are unable to meet local demand. The balance is produced in central Chile, requiring over 1.8 million tons a year to be shipped north, often by ocean freight. These asymmetries pose significant logistical problems.

- In 2010, sulfuric acid producers destined 44 percent of their output to their own operations. The balance was sold in the open market, including a small quantity sold abroad.
- Inability to meet domestic demand has led to a structural deficit that must be offset by imports.
- Imports have risen from 500,000 to 600,000 tons in 2006 to 2.64 million tons in 2010. Peru (749,000 tons in 2010) has been a leading supplier since 2007. Other large suppliers include Japan, South Korea, and the Philippines.
- Mejillones, north of Antofagasta, is the main port of entry for sulfuric acid imports. Incoming supplies are shipped inland by train, truck, and intermodal transportation.
- As such, the Mejillones price is a domestic market yardstick for sulfuric acid pricing. Import prices reflect world prices, albeit with some lagtime.
- Sulfuric acid prices are determined by sulfur prices, in turn determined by the price of phosphate fertilizers, their main market. The phosphate market has rebounded as demand for foodstuffs and biofuels has increased following the crisis of late 2008. As phosphate prices have increased, so have the price of sulfur and sulfuric acid, most of which is produced involuntarily.

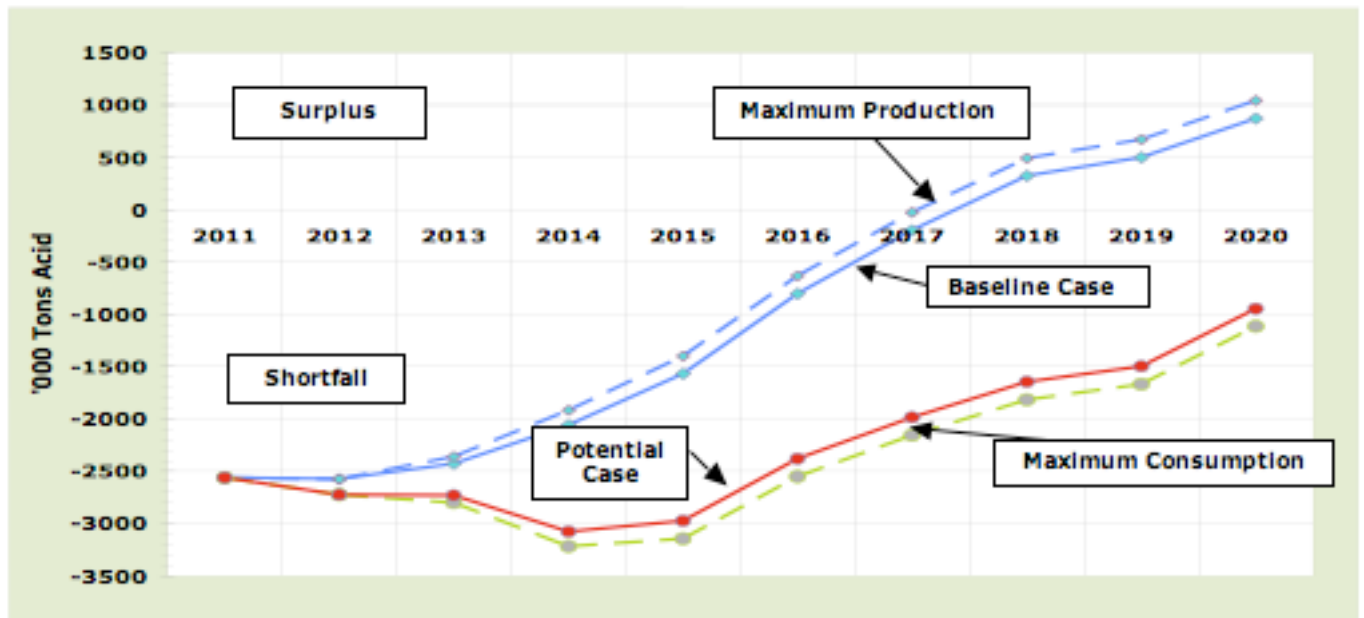
2) Chilean Market Prospects Through 2020

Based on acid producer and consumer data, the Chilean market should remain mostly unchanged. Market balance under various scenarios is shown below.¹

Domestic Sulfuric Acid Balance, 2011-2020 (kMT)

Description	Short Term			Medium Term			Long Term			
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline Production (1)	5,945	6,030	6,336	6,589	6,583	6,699	6,648	6,679	6,584	6,623
Potential Production (2)	0	0	70	140	170	170	170	170	170	170
Max. Production (3)	5,945	6,030	6,406	6,729	6,753	6,869	6,818	6,849	6,754	6,793
Baseline Consumption (4)	8,507	8,605	8,766	8,648	8,152	7,502	6,846	6,357	6,084	5,752
Potential Consumption (5)	0	150	372	1,158	1,576	1,748	1,958	2,138	2,168	1,988
Max. Consumption (6)	8,507	8,755	9,138	9,806	9,728	9,250	8,804	8,495	8,252	7,740
Balance Under Each Scenario										
Baseline (1-4)	(2,561)	(2,576)	(2,429)	(2,059)	(1,569)	(803)	(198)	322	500	871
Max. Production (3-4)	(2,561)	(2,576)	(2,359)	(1,919)	(1,399)	(633)	(28)	492	670	1,041
Max. Consumption (1-6)	(2,561)	(2,726)	(2,801)	(3,217)	(3,145)	(2,551)	(2,156)	(1,816)	(1,668)	(1,117)
Potential (3-6)	(2,561)	(2,726)	(2,731)	(3,077)	(2,975)	(2,381)	(1,986)	(1,646)	(1,498)	(947)

¹ **Baseline:** Operating + under construction. **Maximum Production:** Baseline + under review. **Maximum Consumption:** Baseline + under review. **Potential:** Baseline + production and consumption under review.



Source: Chilean Copper Commission, based on producer and consumer company reports to May 2011.

Conclusions

- The most likely scenario is the Potential case, with an expected annual shortfall of 2.5 to 3 million tons through the middle of the decade, then easing to about 1 million tons by the end of the decade. Market asymmetries will mean shortfalls in northern Chile and surpluses in central Chile.
- Short-term consumption (through 2013) remains strong as SX-EW copper production remains above 2 million tons. Increased acid production is expected as the Mejillones sulfur burner starts to operate at capacity.
- Medium-term consumption (2014-2016) could rise to as high as 9.8 million tons as new leaching projects come on stream. Increased consumption is caused by higher unit consumption rates at both existing and new projects, keeping the market tight without increasing cathode production.
- Shortfalls in this period should be partly offset as a new concentrate roaster at the Ministro Hales Mine comes on stream.
- While the long-term (2017-2020) baseline case predicts a surplus by 2018, this is somewhat unlikely, as it makes no provision for a project portfolio requiring over 2 million tons of acid a year by the end of the decade. After allowing for the natural decline in existing operations, the shortfall by the end of the decade is still expected to stand at about one million tons.
- Albeit to a lesser degree, Chile is still expected to continue depending on imports.

Cochilco gratefully acknowledges leading sulfuric acid producers and consumers for the data supplied for this report.

I. Introduction

1.1 Purpose and Contents

Sulfuric acid is a strategic input for the Chilean copper mining industry.

- ✓ Copper smelter sulfur emissions must be abated for environmental reasons. Producing one ton of refined copper yields nearly 3 tons of sulfuric acid.
- ✓ Copper hydrometallurgy produces SX-EW copper by leaching oxidized ores and secondary sulfide ores, using on average slightly over 3 tons of sulfuric acid per ton of copper cathodes obtained.
- ✓ This production-consumption correlation results in a financially and environmentally virtuous cycle.
- ✓ Strong demand for sulfuric acid creates significant value for a smelter byproduct and gives rise to a vigorous acid import and logistics market.
- ✓ New facilities producing sulfuric acid from sulfur are being set up to serve the copper mining industry.

This review of the Chilean sulfuric acid market is a standing component of the Cochilco Research Department's line of work. Its intent is to regularly report on markets of relevance to sustainable mining development in Chile.

This report reviews the Chilean sulfuric acid market through the year 2020, with special emphasis on events and trends that might emerge by the end of the decade.

Section I contains methodological notes.

Section II provides an overview of the Chilean sulfuric acid market, including key producers and consumers, historical industry data for 2001-2010, and relevant developments through 2010.

Section III estimates acid production and consumption and national and regional market balances through 2020, based on data provided by leading miners.

Section IV concludes with a review of projections, including the expected behavior of key sulfuric acid producers and consumers and the consequences thereof.

In addition to meeting the information needs of the public in general, the information in this report should prove relevant to sulfuric acid producers, consumers, traders, logistics service providers, and regulators.

1.2 Methodology

1.2.1 Scope

This report reviews sulfuric acid production, consumption, and trade in Chile.

Leading producers and consumers were asked to estimate their production and consumption profiles from 2011 through 2020. Their responses were received and tabulated in early 2011.

While the sulfuric acid balance presented here does not include supplies from foreign competitors such as Peru, some details about this market are provided as part of a review of domestic market prospects.

As the rather broad timeframe used makes it hard for respondents to accurately predict production and consumption profiles, distant projections remain tentative.

Data on acid imports and exports was culled from public sources and Customs data.

1.2.2 Scenarios by Degree of Certainty

Scenarios reviewed are based on the degree of certainty assigned to available data. Projects under construction are considered highly certain. Projects under consideration are also shown, even if construction has not yet been approved. Potential projects, which may materialize partially or never, are less certain.

These scenarios are as follows:

- a) **Baseline:** A balance for the period based on annual production and consumption profiles from operations either existing or under construction. This scenario underpins our projection, since the profiles involved depend only on the performance of activities now underway. Additional, yet less certain scenarios are built upon this foundation.
- b) **Maximum Production:** An intermediate scenario based on factoring in sulfur roasting plants under consideration but not yet approved. The balance for each year is calculated based on maximum production and basic consumption profiles. This yields an estimate of available market room under the most adverse conditions, with demand only from existing operations.
- c) **Maximum Consumption:** An additional intermediate scenario based on factoring in mining projects under consideration but not yet approved. The balance for each year is calculated based on maximum consumption and basic production profiles. As potential consumption profiles are highly likely to materialize, this scenario yields an estimate of the domestic acid situation under adverse conditions, with supply only from existing plants.

- d) **Potential:** An additional scenario based on factoring in potential production and consumption profiles from projects under consideration by mining industry acid producers and consumers. While potential profiles are less likely to materialize, this scenario provides insights into the overall sulfuric acid production and consumption potential in 2011-2020 and helps determine the likelihood of the Chilean acid market moving from shortage to surplus.

1.2.3 Timeframe

The period under review has been segmented into three parts, based on expected market behavior:

- a) **Short-Term (2011-2013):** As it reflects existing operations, this is the most certain segment.
- b) **Medium-Term (2014-2016):** By factoring in potential consumer and some production projects, this segment helps shed light on their impact but adds uncertainty to projections.
- c) **Long-Term (2017-2020):** While projections for this segment are less reliable, they provide insights into the impact of both leaching operation decline and startup of new projects that might relieve the domestic shortage.

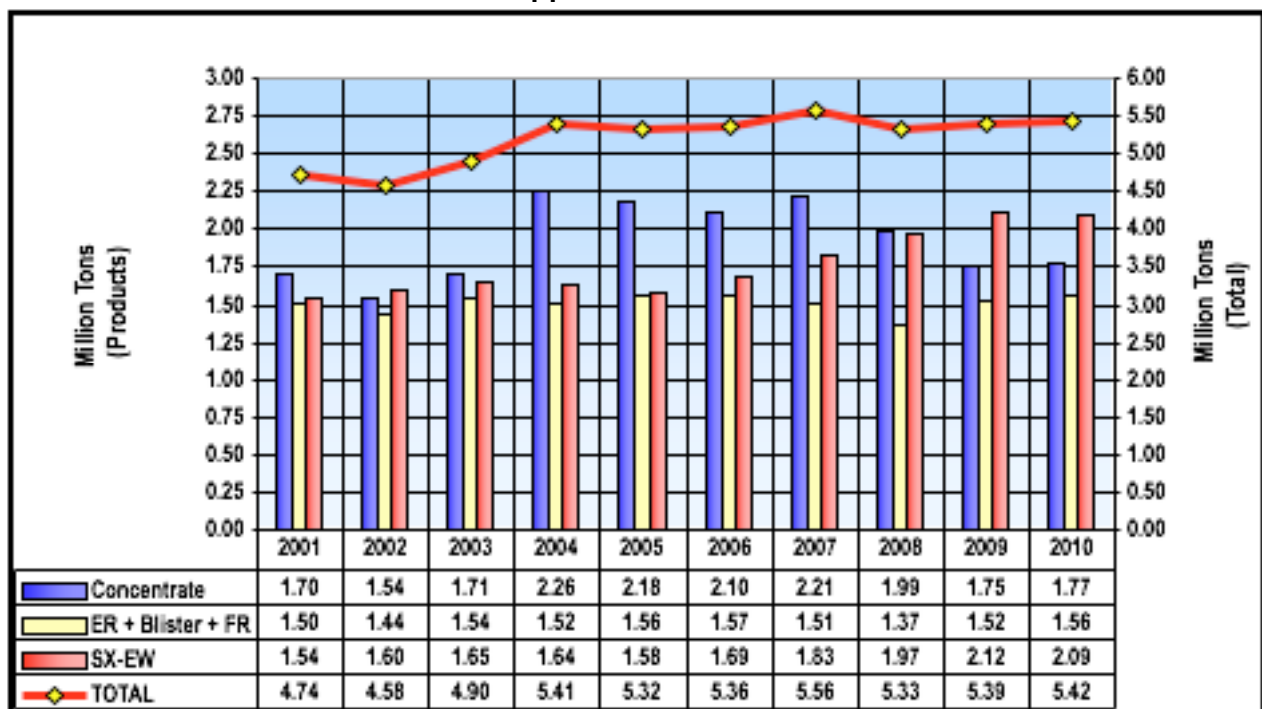
II. The Chilean Sulfuric Acid Market

This section summarizes sulfuric acid market behavior over the past 10 years.

2.1 Behavior in 2001-2010

Chart 1 below, which shows overall copper production by source, including hydrometallurgical (SX-EW), pyrometallurgical (ER+FR+Blister), and concentrate, illustrates the relevance of copper hydrometallurgy to Chile.

Chart 1: Copper Production in Chile



Source: Cochilco Copper and Other Mineral Statistics Yearbook, 1991-2010.

SX-EW copper production in the period rose by 550,000 tons, increasing its share of total mine production from 32.5 to 38.5 percent.

Chile is the world's largest producer of SX-EW copper with a 66.3 percent share in 2010, followed by the U.S. (13.6%), Congo DR (7.4%), and Peru (4.9%).

As a key leaching agent, sulfuric acid plays a crucial role in supporting the growth of copper hydrometallurgy. Table 1 below illustrates domestic production and the active import trade.

Table 1: The Chilean Sulfuric Acid Market (2001-2010)

(kMT)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Production	3,659	3,838	4,480	4,615	5,009	5,027	4,775	4,818	5,062	5,132
Plus Imports	559	523	488	340	552	607	1,285	2,399	1,872	2,644
Minus Exports	(2)	(74)	(162)	(150)	(481)	(131)	(124)	(84)	(13)	(13)
Apparent Consumption	4,216	4,287	4,805	4,805	5,081	5,503	5,936	7,132	6,921	7,763

Source: Cochilco Copper and Other Mineral Statistics Yearbook, 1991-2010.

2.2 Leading Sulfuric Acid Producers and Consumers

2.2.1 Plants and Projects

Table 2 below shows producer location, ownership type, destination of production (own supply within the region and/or sale to third parties), and potential projects.

Table 2: Leading Sulfuric Acid Producers

Region	Producers Operation	Ownership		Destination		Status	
		Public	Private	Self	Market	Operation	Project
	Smelters						
II	Xstrata - Altonorte		X	X	X	Baseline	
II	Codelco - Chuquicamata	X		X	X	Baseline	
II	Codelco - Ministro Hales	X			X	Baseline	
III	Codelco - Potrerillos	X		X	X	Baseline	
III	Enami - Paipote	X		X	X	Baseline	
V	Anglo Am. - Chagres		X	X	X	Baseline	
V	Codelco - Ventanas	X		X	X	Baseline	
VI	Codelco - Caletones	X		X	X	Baseline	
	Moly Plants						
II	Molynor - Mejillones Plant		X	X	X	Baseline	Potential
Metro	Molymet - Nos Plant		X	X	X	Baseline	
	Sulfur Burners						
I	Haldeman-Sagasca		X	X	X	Baseline	Potential
II	Noracid - Mejillones		X		X	Baseline	
III	Cemin - Dos Amigos		X	X		Baseline	

Source: Chilean Copper Commission

All existing operations are listed as baseline. These include a sulfuric acid plant to be built by Codelco within the Ministro Hales Division concentrate roasting plant.²

Haldeman Mining has a potential project consisting of an additional sulfur roasting plant producing sulfuric acid at rates comparable to its Sagasca facility. In addition, Molynor is contemplating an expansion to its Mejillones sulfuric acid plant.

² This plant is intended to remove arsenic and produce high-grade (37%) copper concentrate.

2.2.2 Leading Consumer Projects and Operations

Table 3: Leading Sulfuric Acid Consumers

Region	Consumer	Ownership		Source		Status	
		Public	Private	Self	External	Baseline	Potential
	Self						
I	Haldeman - Sagasca		X	X		X	
II	Codelco - Chuquicamata	X		X		X	X
II	Codelco - Radomiro Tomic	X		X		X	
II	Xstrata - Lomas Bayas		X	X		X	
III	Codelco - Salvador	X		X		X	X
Several	Enami - Plants	X		X		X	
III	Cemin – Dos Amigos		X	X		X	
V	Cemin – Amalia Catemu		X	X		X	
V	Anglo Am. - El Soldado		X	X		X	
Met	Anglo Am. - Los Bronces		X	X		X	
VI	Codelco - El Teniente	X		X		X	
	External						
XV	Quiborax ³		X		X	X	
I	BHP - Cerro Colorado		X		X	X	
I	Collahuasi		X		X	X	X
I	Teck- Quebrada Blanca		X		X	X	
II	Codelco - Gaby	X			X	X	X
II	Freeport- El Abra		X		X	X	
II	Antofagasta Mins.- El Tesoro		X		X	X	
II	Antofagasta Mins.- Michilla		X		X	X	
II	Antofagasta Mins.- Antucoya		X		X		X
II	BHP - Escondida		X		X	X	
II	Milpo - Iván		X		X	X	
II	Cerro Dominador		X		X	X	
II	Anglo Am. - Mantos Blancos		X		X	X	X
II	Sierra Miranda		X		X	X	
II	Mantos de la Luna		X		X	X	
II	BHP- Spence		X		X	X	
II	Barrick - Zaldívar		X		X	X	
II	Las Cenizas - Taltal		X		X	X	
III	Can-Can - Diego de Almagro		X		X		X
III	Centenario- Franke		X		X	X	
III	Punta del Cobre		X		X	X	X
III	Anglo Am. - Manto Verde		X		X	X	
III	P.P. Copper - Caserones		X		X		X
IV	Teck - Carmen de Andacollo		X		X	X	
IV	Vale – Tres Valles		X		X	X	
Met	Chemical industry		X		X	X	
South	Wood pulp plants		X		X	X	

Source: Chilean Copper Commission

³ Boric acid producer in Arica-Parinacota.

Table 3 above shows consumer location, ownership type and acid origin (own or third-party). Existing operations and planned leaching projects and/or expansions with a consumption potential of 30,000 tons a year and up are given baseline status. Smaller mining and industrial consumers are also shown. Potential cases include projects in the preliminary stage and therefore less certain to materialize before the end of the decade under review.

2.3 Production and Consumption in 2010

2.3.1 Regional Distribution

Regional distribution of acid production and consumption in 2010 is shown below.

Table 4: Distribution of Sulfuric Acid Production and Consumption in 2010 (kMT)

	Production		Consumption ⁴		(Shortfall) Surplus
Country Total	5,132	%	7,933	%	(2.801)
Region					
Arica + Tarapacá	107	2.1	796	10.0	(689)
Antofagasta	2,172	42.3	5,763	72.6	(3.591)
Atacama	843	16.4	924	11.7	(81)
Coquimbo	0	0.0	68	0.9	(68)
Valparaiso	821	16.0	113	1.4	708
Metropolitan	49	1.0	119	1.5	(70)
O'Higgins	1,140	22.2	40	0.5	1.100
Other	0	0.0	110	1.4	(110)
Supply Type					
Self	2,256	44.0	2,256	28.4	0
Commercial	2,876	56.0	5,677	71.6	(2.801)
Ownership					
Public	3,574	69.6	2,068	27.6	1.506
Private	1,558	30.4	5,865	72.4	(4.307)

Source: Chilean Copper Commission, with company data.

2.3.2 Production/Consumption Ratios

Sulfuric acid production in 2010 stood at 5.13 million tons. Only 210,000 tons came from sources other than copper smelters.⁵

Consumption in 2010 stood at 7.93 million tons. Some 7.64 million were used by copper mining operations to produce 2.09 million tons of SX-EW copper, an average consumption rate of 3.65 tons of acid per ton of copper.⁶

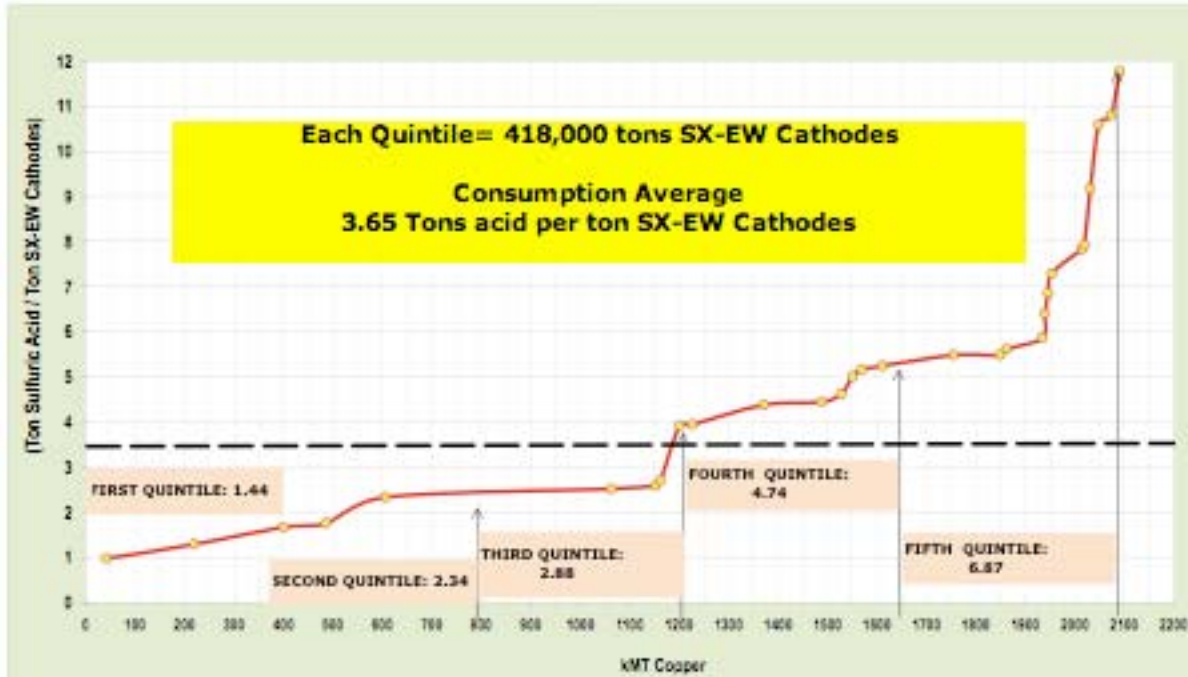
⁴ Estimates based on consumer company reports. May not match apparent consumption in Table 1 due to inventory changes and bias in data reported.

⁵ Copper smelters produce nearly 1 ton of acid per ton of concentrate treated. This equals 2.9-3 tons of acid per ton of refined copper, depending on concentrate type and rate of sulfur gas abatement.

⁶ As leachable ore quality varies greatly, mining operation consumption rates range from 1 to 12.

Chart 2 below shows consumption rates by leading operators in ascending order. Segmenting total production by quintiles⁷ (418,000 tons copper in 2010 ea.) shows significant differences, notably a fifth quintile consisting of low-production, high-consumption operations.

Chart 2: SX-EW Copper Production by Rate of Sulfuric Acid Consumption (2010)



Source: Chilean Copper Commission

Rising acid consumption rates (3.65 tons in 2010 but 2.86 tons in 2004, 3.24 in 2006, and 3.45 in 2008) confirms a growing decline in leachable ore quality.

2.4 The Sulfuric Acid Trade (2001-2010)

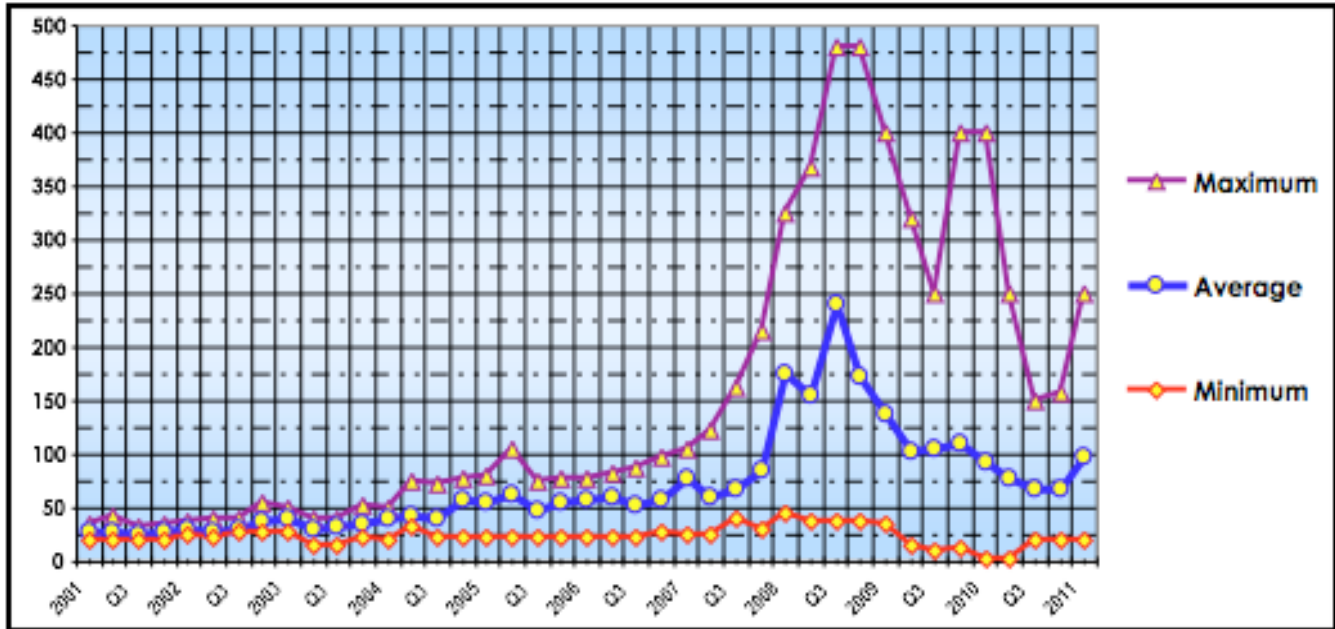
2.4.1 Imports

Strong demand from the copper industry has made Chile a leading sulfuric acid buyer. As Mejillones in Antofagasta is the port of entry for most sulfuric acid imports, the CIF Mejillones price acts as a yardstick for domestic pricing.

Chart 3 below shows average sulfuric acid import prices and quarterly highs and lows since 2001.

⁷ Portion of a frequency distribution containing one fifth of total sample.

Chart 3: Sulfuric Acid Import Prices, CIF Mejillones (US\$/Ton) (Q1 2001-Q1 2011)



Source: Chilean Copper Commission, with Customs data.

Imports in Q1 2011 stood at 746,700 tons and were worth US\$73.5 million. CIF prices averaged US\$98.5/ton and ranged from US\$20 to US\$250/ton. Table 5 below provides additional details.

Table 5: Sulfuric Acid Imports (Jan. 2001 – Dec. 2010)

Period	Tons	US\$'000 CIF ⁸	US\$/Ton Avg.	US\$/Ton
Q1	170,962	4,518,1	26.4	20.0 - 35.0
Q2	178,109	4,883,0	27.4	21.0 - 42.2
Q3	149,320	3,815,2	25.6	20.5 - 33.2
Q4	<u>60,070</u>	<u>1,651,5</u>	27.5	20.5 - 35.0
Total 2001	558,461	14,867,8	26.6	20.0 - 42.2
Q1	178,506	5,459,5	30.6	25.0 - 36.8
Q2	155,300	4,354,5	28.0	23.5 - 38.9
Q3	102,348	2,962,3	28.9	26.5 - 39.8
Q4	<u>86,361</u>	<u>3,130,9</u>	36.3	26.4 - 55.3
Total 2002	522,515	15,907,3	30.4	23.5 - 55.3
Q1	158,962	6,219,2	39.1	28.0 - 50.1
Q2	114,743	3,533,8	30.8	15.0 - 40.1
Q3	107,403	3,446,4	32.1	15.0 - 40.5
Q4	<u>106,713</u>	<u>3,647,1</u>	34.2	22.4 - 52.6
Total 2003	487,821	16,846,5	34.5	15.0 - 52.6
Q1	80,941	3,154,0	39.0	20.0 - 52.6
Q2	76,185	3,202,1	42.0	32.2 - 74.7
Q3	83,154	3,362,5	40.4	22.1 - 72.0
Q4	<u>99,946</u>	<u>5,648,8</u>	56.5	22.1 - 78.0
Total 2004	340,226	15,367,4	45.2	20.0 - 78.0
Q1	179,828	10,109,9	56.2	22.1 - 81.0
Q2	150,573	9,529,5	63.3	22.5 - 104.7
Q3	75,313	3,483,9	46.3	22.5 - 74.5
Q4	<u>146,693</u>	<u>8,146,9</u>	55.5	22.5 - 78.2
Total 2005	552,407	31,270,2	56.6	22.1 - 104.7
Q1	174,993	10,045,9	57.4	23.0 - 78.2
Q2	120,398	7,278,4	60.5	23.0 - 83.2
Q3	135,986	7,143,7	52.5	23.0 - 88.2
Q4	<u>175,491</u>	<u>10,165,9</u>	57.9	26.7 - 98.5
Total 2006	606,868	34,633,9	57.1	23.0 - 98.5
Q1	265,259	20,349,8	76.7	24.0 - 105.0
Q2	300,983	17,848,2	59.3	25.3 - 122.0
Q3	358,409	24,194,6	67.5	39.0 - 162.6
Q4	<u>360,437</u>	<u>31,081,7</u>	86.2	31.0 - 215.0
Total 2007	1,285,088	93,474,2	72.7	24.0 - 215.0
Q1	626,324	109,827,7	175.4	44.0 - 324.4
Q2	556,877	86,176,6	154.7	38.0 - 367.7
Q3	664,851	160,095,0	240.8	38.0 - 480.0
Q4	<u>550,406</u>	<u>94,896,8</u>	172.4	38.0 - 480.0
Total 2008	2,398,457	450,996,1	188.0	38.0 - 480.0
Q1	477,106	65,973,6	138.3	35.0 - 400.0
Q2	434,495	44,872,1	103.3	15.9 - 320.0
Q3	464,509	48,271,4	103.9	10.0 - 250.0
Q4	<u>496,215</u>	<u>54,646,5</u>	110.1	12.0 - 400.0
Total 2009	1,872,325	213,763,6	114.2	10.0 - 400.0
Q1	667,780	62,104,2	93.0	3.0 - 400.0
Q2	707,280	54,549,6	77.1	3.0 - 250.0
Q3	604,249	40,909,5	67.7	20.0 - 150.0
Q4	<u>664,366</u>	<u>45,112,0</u>	67.9	20.0 - 157.0
Total 2010	2,643,674	202,675,3	76.7	3.0 - 400.0

Source: Chilean Copper Commission, with Customs data.

⁸ Unit price is CIF for most imports except for Codelco, which uses a C+F variant that excludes insurance. Does not include sulfuric acid imports for use by laboratories and the explosives industry.

Shown below is annual import data by country of origin, including amounts, global price, average unit price for each year, and the freight and insurance portions of the price. Tables 6.1 and 6.2 show figures for 2001-2006 and 2007-2010, respectively.

Table 6.1: Sulfuric Acid Imports by Country of Origin (2001-2006)

Country of Origin / Year	Amount (Tons)	CIF Price (US\$'000)	Average Price (US\$/Ton CIF)	F + I (US\$/Ton)
Japan	181,722	4,209,3	23.2	13.8
Peru	168,191	4,664,6	27.7	13.8
Germany	60,912	1,654,1	27.2	19.1
Australia	52,470	1,479,1	28.2	20.0
U.S.	36,644	1,152,2	31.4	20.6
Mexico	32,911	1,056,0	32.0	24.4
Korea	14,054	371,7	26.4	13.2
Philippines	11,444	277,9	24.3	12.2
Canada	113	2,9	25.5	22.0
Total 2001	558,461	14,867,8	26.6	
Japan	220,034	5,950,6	27.0	10.5
Peru	108,981	3,621,2	33.1	13.8
Mexico	82,238	3,074,5	37.4	26.6
Sweden	74,488	2,112,7	28.4	27.9
Philippines	18,207	582,6	32.0	25.8
Canada	10,183	271,9	26.7	20.0
Switzerland	8,383	293,8	35.0	27.5
Total 2002	522,514	15,907,3	30.2	
Japan	191,846	6,846,4	35.7	3.4
Peru	105,717	3,248,6	30.7	14.2
Sweden	96,899	2,763,5	28.5	24.9
Korea	49,487	2,461,7	49.7	30.1
Australia	25,190	933,7	37.1	30.1
Spain	12,637	353,8	28.0	26.0
Algeria	6,045	238,8	39.5	12.5
Total 2003	487,821	16,846,5	34.5	
Japan	122,618	4,413,5	36.0	4.4
Peru	97,631	3,605,6	36.9	14.2
Sweden	78,819	4,328,7	54.9	37.5
South Korea	21,988	1,583,1	72.0	43.5
Philippines	16,000	1,201,5	75.1	50.1
Mexico	3,170	235,0	74.1	37.1
Total 2004	340,226	15,367,4	45.2	
Japan	161,270	5,617,2	34.8	1.7
Mexico	150,880	11,071,9	73.4	42.2
Peru	107,412	4,362,2	40.6	15.8
South Korea	68,504	5,181,7	75.6	45.4
Sweden	41,935	3,018,4	72.0	53.3
Bulgaria	19,024	1,764,8	92.8	66.2
Philippines	3,382	254,0	75.1	50.1
Total 2005	552,407	31,270,2	56.6	
Mexico	184,012	12,485,3	67.9	40.3
Japan	102,105	4,592,9	45.0	2.2
South Korea	96,389	6,290,9	65.3	44.6
Peru	89,615	3,831,0	42.7	16.8
Germany	49,741	2,801,4	56.3	48.2
Finland	31,648	1,507,9	47.6	38.3
Sweden	30,697	1,627,0	53.0	52.7
Canada	16,155	856,6	53.0	52.0
Bulgaria	6,506	640,9	98.5	64.2
Total 2006	606,868	34,633,9	57.1	

Source: Chilean Copper Commission, with Customs data.

Table 6.2: Sulfuric Acid Imports by Country of Origin (2007-2010)

Country of Origin / Year	Amount (Tons)	CIF Price (US\$'000)	Average Price (US\$/Ton CIF)	F + I (US\$/Ton)
Peru	499,280	25,812,8	51.7	13.0
Japan	286,694	19,243,0	67.1	41.2
South Korea	223,178	23,025,6	103.2	70.0
Philippines	71,464	8,764,0	122.6	61.8
Mexico	51,405	2,683,8	52.2	19.8
Germany	45,305	3,240,3	71.5	11.0
Bulgaria	37,881	4,076,9	107.6	73.3
Poland	20,028	1,622,3	81.0	56.9
Spain	18,352	1,892,9	103.1	64.3
Sweden	17,075	1,699,0	99.5	70.2
U.S.	14,425	1,413,6	98.0	48.1
Total 2007	1,285,087	93,474,2	72.7	
Peru	683,504	54,629,0	79.9	13.4
South Korea	391,376	73,994,2	189.1	84.7
Japan	370,320	62,646,7	169.2	77.2
India	335,895	91,712,7	273.0	103.1
China	210,482	58,146,1	276.3	90.4
Philippines	203,570	55,807,9	274.1	97.0
Spain	51,336	10,396,7	202.5	80.5
Mexico	48,877	16,626,9	340.2	50.4
Indonesia	22,517	8,353,1	371.0	111.7
Canada	21,079	4,979,5	236.2	109.7
Sweden	18,673	2,357,9	126.3	77.2
Bulgaria	18,460	4,270,2	231.3	85.4
Poland	13,637	3,276,7	240.3	95.3
Egypt	8,732	3,798,4	435.0	140.6
Total 2008	2,398,458	450,996,0	188.0	
Peru	635,796	53,502,5	84.2	14.6
Japan	335,189	48,687,6	145.3	69.9
Philippines	203,202	30,030,8	147.8	67.8
South Korea	189,645	32,568,8	171.7	62.7
Spain	143,286	16,692,1	116.5	52.4
Germany	121,150	11,815,9	97.5	59.0
Mexico	51,334	3,991,7	77.8	41.2
Brazil	47,333	906,3	19.1	15.0
Australia	38,910	684,6	17.6	14.2
Bulgaria	36,530	6,717,9	183.9	63.2
Poland	34,006	4,635,6	136.3	71.5
Finland	15,407	585,5	38.0	36.1
Italy	10,600	1,583,0	149.3	82.5
India	9,937	1,361,3	137.0	91.0
Total 2009	1,872,325	213,763,6	114.2	---
Peru	749,158	48,690,3	65.0	13.8
Japan	675,451	56,476,0	83.6	42.6
South Korea	669,413	44,184,1	66.0	45.2
Philippines	153,599	11,760,0	76.6	51.5
China	111,733	11,325,4	101.4	46.8
Spain	98,782	12,522,3	126.8	45.2
India	59,505	6,422,5	107.9	67.3
Germany	37,014	1,892,0	51.1	50.1
Bulgaria	31,575	5,234,1	165.8	61.1
Finland	19,723	100,3	5.1	2.3
Australia	18,855	566,2	30.0	25.0
Canada	15,855	2,298,9	145.0	77.9
Italy	3,008	1,203,1	400.0	74.6
Total 2010	2,643,675	202,675,3	76.7	---

Source: Chilean Copper Commission, with Customs data.

Shown below is annual import data by importer, including transaction volumes, prices, and domestic market share. Tables 7.1 and 7.2 show figures for 2001-2006 and 2007-2010, respectively.

Table 7.1: Sulfuric Acid by Importer

Importer / Year	Tons	US\$'000 CIF	US\$/Ton Avg.	Share (%)
Interacid	216,507	5,142.2	23.8	38.8
Codelco	147,415	4,106.1	27.9	26.4
Miners	146,638	4,363.1	29.8	26.3
Chemtrade ⁹	<u>47,901</u>	<u>1,256.3</u>	26.2	8.6
Total 2001	558,461	14,867.8	26.6	100.0
Codelco	254,640	6,977.9	27.4	48.7
Miners	138,607	4,507.7	32.5	26.5
Interacid	82,238	3,074.5	37.4	15.7
Chemtrade	<u>47,029</u>	<u>1,347.3</u>	28.6	9.0
Total 2002	522,514	15,907.3	30.4	100.0
Codelco	181,846	6,320.5	34.8	37.3
Miners	110,446	3,125.0	28.3	22.6
Trans Sud	95,245	2,986.8	31.4	19.5
Interacid	84,677	3,921.2	46.3	17.4
Chemtrade	10,472	261.8	25.0	2.1
BCT Chemtrade	<u>5,136</u>	<u>231.1</u>	45.0	1.1
Total 2003	487,822	16,846.5	34.5	100.0
Codelco	112,652	3,889.5	34.5	33.1
Trans Sud	90,189	3,687.1	40.9	26.5
Miners	63,402	3,013.4	47.5	18.6
BCT Chemtrade	44,847	2,816.9	62.8	13.2
Interacid	<u>29,136</u>	<u>1,960.5</u>	67.3	8.6
Total 2004	340,226	15,367.4	45.2	100.0
Miners	218,967	15,886.9	72.6	39.6
Codelco	161,270	5,617.2	34.8	29.2
Trans Sud	88,390	3,331.4	37.7	16.0
Interacid	53,669	4,183.8	78.0	9.7
BCT Chemtrade	<u>30,111</u>	<u>2,250.9</u>	74.8	5.5
Total 2005	552,407	31,270.2	56.6	100.0
Miners	207,297	13,073.5	63.1	34.2
Codelco	144,598	7,573.8	52.4	23.8
Interacid	115,934	7,532.5	65.0	19.1
Trans Sud	89,321	3,299.4	36.9	14.7
BCT Chemtrade	<u>49,718</u>	<u>3,154.7</u>	63.5	8.2
Total 2006	606,868	34,633.9	57.1	100.0

Source: Chilean Copper Commission, with Customs data.

⁹ In 2003 Chemtrade Chile Ltda. was split into BCT Chemtrade Ltda. and Comercial Trans Sud Ltda.

Table 7.2: Sulfuric Acid by Importer

Importer / Year	Tons	US\$'000 CIF	US\$/Ton Avg.	Share (%)
Miners	573,990	37,457.7	65.3	44.7
Interacid	212,878	18,473.1	86.8	16.6
Trans Sud	180,557	12,085.0	66.9	14.0
BCT Chemtrade	161,657	15,678.0	97.0	12.6
Codelco	<u>156,005</u>	<u>9,780.3</u>	62.7	12.1
Total 2007	1,285,087	93,474.2	72.7	100.0
Miners	1,266,840	229,451.4	181.1	52.8
Interacid	437,979	103,809.6	237.0	18.3
Trans Sud	287,189	37,719.2	131.3	12.0
Codelco	204,998	38,066.3	185.7	8.5
BCT Chemtrade	201,452	41,949.6	208.2	8.4
Total 2008	2,398,458	450,996.1	188.0	100.0
Miners	1,239,025	159,085.1	128.4	66.2
Interacid	363,674	38,650.5	106.3	19.4
Trans Sud	210,460	10,577.0	50.3	11.2
Codelco	43,770	2,217.8	50.7	2.3
BCT Chemtrade	<u>15,396</u>	<u>3,233.2</u>	210.0	0.8
Total 2009	1,872,325	213,763.6	114.2	100.0
Miners	1,536,480	136,982.1	89.2	58.1
Interacid	636,005	35,222.3	55.4	24.1
Trans Sud	413,345	26,722.1	64.6	15.6
Codelco	37,755	1,438.4	38.1	1.4
BCT Chemtrade	<u>20,090</u>	<u>2,310.3</u>	115.0	0.8
Total 2010	2,643,675	202,675.3	76.7	100.0

Source: Chilean Copper Commission, with Customs data.

2.4.2 Exports

While Chile has an acknowledged structural deficit, some sulfuric acid is exported, notably to South American countries.

In addition to some local producers being required to fulfill standing supply contracts with neighboring countries, temporary excess production can lead to surpluses which cannot be stored or sold domestically. Such surpluses must be sold on the spot market at less advantageous prices.

Shown below is annual distribution by destination plus volume amount, global FOB amounts, and resulting unit price for 2001-2010.

Exports in Q1 2011 were an additional 3,488 tons worth US\$335,086, for a unit price of US\$96.1/ton.

Table 8: Sulfuric Acid Exports by Destination (2001-2010)

Destination & Year	Tons	US\$'000 FOB	US\$/Ton
Argentina	1,316	44.4	33.7
Bolivia	<u>550</u>	<u>36.4</u>	66.2
Total 2001	1,866	80.8	43.3
Peru	57,417	1,477.9	25.7
Brazil	10,314	350.7	34.0
Bolivia	<u>5,949</u>	<u>303.4</u>	51.0
Total 2002	73,680	2,132.0	28.9
Brazil	77,351	2,362.1	30.5
Peru	72,487	1,933.8	26.7
Bolivia	10,723	449.4	41.9
Argentina	1,740	47.8	27.5
Costa Rica	<u>23</u>	<u>2.5</u>	110.0
Total 2003	162,324	4,795.6	29.5
Peru	107,926	4,618.8	42.8
Brazil	26,098	950.1	36.4
Bolivia	13,615	772.7	56.8
Argentina	2,394	99.6	41.6
Costa Rica	<u>259</u>	<u>31.5</u>	121.6
Total 2004	150,292	6,472.7	43.1
USA	199,401	1,978.6	9.9
Peru	180,311	10,618.1	58.9
Brazil	43,692	378.4	8.7
Cuba	29,300	795.0	27.1
Bolivia	12,420	974.5	78.5
Argentina	10,633	612.1	57.6
Mexico	5,084	68.6	13.5
Costa Rica	<u>52</u>	<u>6.7</u>	128.8
Total 2005	480,893	15,432.0	32.1
Brazil	55,921	1,048.6	18.8
Peru	48,192	2,163.9	44.9
Argentina	14,501	521.6	36.0
Bolivia	<u>12,699</u>	<u>954.5</u>	75.2
Total 2006	131,313	4,688.6	35.7
Peru	42,028	2,083.5	49.6
Brazil	37,514	2,276.3	60.7
Cuba	20,036	1,247.2	62.2
Bolivia	12,627	940.7	74.5
Argentina	<u>11,948</u>	<u>535.1</u>	44.8
Total 2007	124,153	7,082.8	57.0
USA	33,261	6,269.3	188.5
Cuba	17,812	2,986.7	167.7
Bolivia	10,596	2,588.8	244.3
Argentina	9,095	2,304.2	253.4
Brazil	8,149	559.1	68.6
Peru	<u>5,000</u>	<u>245.1</u>	49.0
Total 2008	83,913	14,953.2	178.2
Bolivia	10,594	1,581.9	149.4
Argentina	<u>2,865</u>	<u>480.0</u>	167.4
Total 2009	13,459	2,061.9	153.4
Bolivia	11,687	801.1	68.5
Argentina	<u>1,696</u>	<u>121.0</u>	71.3
Total 2010	13,383	922.1	68.9

Source: Chilean Copper Commission, with Customs data.

Table 9 below shows sulfuric acid exports by exporter and share.

Table 9: Sulfuric Acid by Exporter (2001-2010)

Exporter / Year	Tons	US\$'000 FOB	US\$/Ton Avg.	Share (%)
Enami	1,316	44.4	33.7	70.5
Codelco	<u>550</u>	<u>36.4</u>	66.2	29.5
Total 2001	1,866	80.8	43.3	100.0
Interacid	47,593	1,134.0	23.8	64.6
Codelco	<u>26,087</u>	<u>998.0</u>	38.3	35.4
Total 2002	73,680	2,132.0	28.9	100.0
Codelco	84,255	2,420.6	28.7	51.9
Trans Sud	60,550	1,904.3	31.4	37.3
Interacid	15,756	420.2	26.7	9.7
Enami	1,740	47.9	27.5	1.1
Other	<u>23</u>	<u>2.6</u>	113.0	0.0
Total 2003	162,324	4,795.6	29.5	100.0
Interacid	61,569	2,524.4	41.0	41.0
Trans Sud	47,130	1,809.5	38.4	31.4
Codelco	38,938	2,007.8	51.6	25.9
Enami	2,150	81.4	37.9	1.4
Other	<u>503</u>	<u>49.6</u>	98.7	0.3
Total 2004	150,292	6,472.7	43.1	100.0
Codelco	279,500	7,337.1	26.3	58.1
Interacid	101,798	3,824.6	37.6	21.2
Trans Sud	82,954	3,845.9	46.4	17.2
BCT Chemtrade	12,610	124.3	9.9	2.6
Enami	276	10.5	38.0	0.1
Other	<u>3,755</u>	<u>289.7</u>	77.2	0.8
Total 2005	480,893	15,432.1	32.1	100.0
Trans Sud	66,210	2,517.1	38.0	50.4
Codelco	<u>65,103</u>	<u>2,171.5</u>	33.4	49.6
Total 2006	131,313	4,688.6	35.7	100.0
Codelco	72,112	4,373.5	60.6	61.7
Trans Sud	42,028	2,083.5	49.6	29.4
BCT Chemtrade	<u>10,013</u>	<u>625.8</u>	62.5	8.8
Total 2007	124,153	7,082.8	57.0	100.0
Codelco	61,008	11,692.8	191.7	72.7
BCT Chemtrade	17,812	2,986.7	167.7	21.2
Trans Sud	5,001	245.1	49.0	6.0
Other	<u>92</u>	<u>28.6</u>	310.4	0.1
Total 2008	83,913	14,953.2	178.2	100.0
Codelco	12,927	1,986.6	153.7	96.0
Other	532	75.3	141.5	4.0
Total 2009	13,459	2,061.9	153.2	100.0
Codelco	13,134	897.2	68.3	98.1
Other	249	24.9	100.0	1.9
Total 2010	13,383	922.1	68.9	100.0

Source: Chilean Copper Commission, with Customs data.

2.5 Relevant World Prices

Shown below are sulfuric acid prices at a key referential market (FOB Tampa, Gulf of Mexico) and the price of commodities directly or indirectly impacting the sulfuric acid market. These include Canadian and Middle Eastern sulfur, diammonium phosphate (DAP) at Tampa, and copper at the London Metal Exchange (LME).

**Table 10: Sulfuric Acid, Sulfur, Phosphate and Copper
 Quarterly Price Comparison, June 2006-June 2011**

Monthly Price (US\$/Ton)						Price Index (Dec. 2006=100)					
	Sulfuric Acid	Sulfur		DAP	Copper		Sulfuric Acid	Sulfur		DAP	Copper
Month	FOB Tampa	FOB Vancouver	FOB Middle East	FOB Tampa	LME	Month	FOB Tampa	FOB Vancouver	FOB Middle East	FOB Tampa	LME
Jun-06	50	56	62	265	7,198	Jun-10	79.4	100.0	119.2	103.1	107.8
Sep-06	55	56	57	260	7,602	Sep-10	87.3	100.0	109.6	101.2	113.9
Dec-06	63	56	52	257	6,676	Dec-10	100.0	100.0	100.0	100.0	100.0
Mar-07	68	65	84	435	6,452	Mar-11	107.9	116.1	161.5	169.3	96.6
Jun-07	72	65	135	440	7,476	Jun-11	114.3	116.1	259.6	171.2	112.0
Sep-07	72	180	220	436	7,649	Sep-11	114.3	321.4	423.1	169.6	114.6
Dec-07	125	300	497	610	6,588	Dec-11	198.4	535.7	955.8	237.4	98.7
Mar-08	220	480	666	1,190	8,439	Mar-12	349.2	857.1	1,280.8	463.0	126.4
Jun-08	253	660	806	1,160	8,261	Jun-12	401.6	1,178.6	1,550.0	451.4	123.7
Sep-08	452	665	360	890	6,991	Sep-12	717.5	1,187.5	692.3	346.3	104.7
Dec-08	110	65	53	395	3,072	Dec-12	174.6	116.1	101.9	153.7	46.0
Mar-09	0	40	51	347	3,749	Mar-13	0.0	71.4	98.1	135.0	56.2
Jun-09	5	30	40	285	5,013	Jun-13	7.9	53.6	76.9	110.9	75.1
Sep-09	10	25	43	300	6,195	Sep-13	15.9	44.6	82.7	116.7	92.8
Dec-09	45	55	73	300	6,980	Dec-13	71.4	98.2	140.4	116.7	104.6
Mar-10	90	174	206	510	7,743	Mar-14	142.9	310.7	396.2	198.4	116.0
Jun-10	90	155	155	445	6,499	Jun-14	142.9	276.8	298.1	173.2	97.4
Sep-10	115	60	140	520	7,709	Sep-14	182.5	107.1	269.2	202.3	115.5
Dec-10	130	160	165	580	9,147	Dec-14	206.3	285.7	317.3	225.7	137.0
Apr-11	140	225	225	627	9,531	Apr-15	222.2	401.8	432.7	244.0	142.8
Jun-11	155	225	240	613	9,045	Jun-15	246.0	401.8	461.5	238.5	135.5

Source: Chilean Copper Commission, with data from Sulphur (sulfuric acid and sulfur through 2009), Pentasul (DAP, sulfuric acid and sulfur since 2010), and Cochilco (copper).

A referential price index (December 2006=100) helps place subsequent price fluctuations in perspective.

Table 10 above also provides a useful comparison of Chile import and world prices.

III. Sulfuric Acid Balance Estimations (2011-2020)

3.1 Domestic Balance

As explained in the methodology notes,¹⁰ the domestic sulfuric acid balance evaluates four scenarios (Baseline, Maximum Production, Maximum Consumption and Potential), each in turn projected over the short, medium, and long-term. Results are shown below.

Table 11: Domestic Sulfuric Acid Balance, 2011-2020 (kMT)

Description	Short Term			Medium Term			Long Term			
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline Production (1)	5,945	6,030	6,336	6,589	6,583	6,699	6,648	6,679	6,584	6,623
Potential Production (2)	0	0	70	140	170	170	170	170	170	170
Max. Production (3)	5,945	6,030	6,406	6,729	6,753	6,869	6,818	6,849	6,754	6,793
Baseline Consumption (4)	8,507	8,605	8,766	8,648	8,152	7,502	6,846	6,357	6,084	5,752
Potential Consumption (5)	0	150	372	1,158	1,576	1,748	1,958	2,138	2,168	1,988
Max. Consumption (6)	8,507	8,755	9,138	9,806	9,728	9,250	8,804	8,495	8,252	7,740
Balance Under Each Scenario										
Baseline (1-4)	(2,561)	(2,576)	(2,429)	(2,059)	(1,569)	(803)	(198)	322	500	871
Max. Production (3-4)	(2,561)	(2,576)	(2,359)	(1,919)	(1,399)	(633)	(28)	492	670	1,041
Max. Consumption (1-6)	(2,561)	(2,726)	(2,801)	(3,217)	(3,145)	(2,551)	(2,156)	(1,816)	(1,668)	(1,117)
Potential (3-6)	(2,561)	(2,726)	(2,731)	(3,077)	(2,975)	(2,381)	(1,986)	(1,646)	(1,498)	(947)

Source: Chilean Copper Commission, based on producer and consumer company reports to May 2011.

3.2 Regional Balance

Sulfuric acid production and consumption behavior is provided in regional balances under the maximum scenario.

Table 12 below shows individual balances for leading consumer regions plus central and southern Chile (i.e., Coquimbo to Los Ríos). Shown for each region are baseline and potential production and consumption profiles and the resulting balance (shortfall or surplus).

¹⁰ See section 1.2 above.

Table 12: Sulfuric Acid Balance by Region - Potential Scenario for 2011-2020 (kMT)

Regional Scenarios	Short Term			Medium Term			Long Term			
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1) Arica-Parinacota + Tarapacá: Baseline Case										
Baseline Production	116	135	135	135	135	135	135	135	135	135
- Baseline Consumption	(882)	(763)	(713)	(713)	(625)	(533)	(518)	(523)	(503)	(503)
Arica-Parinacota + Tarapacá: Baseline Shortfall	(766)	(628)	(578)	(578)	(490)	(398)	(383)	(388)	(368)	(368)
Arica-Parinacota + Tarapacá: Potential Case										
Baseline Production	116	135	135	135	135	135	135	135	135	135
+ Potential Production	0	0	70	140	140	140	140	140	140	140
Maximum Regional Production	116	135	205	275	275	275	275	275	275	275
- Baseline Consumption	(882)	(763)	(713)	(713)	(625)	(533)	(518)	(523)	(503)	(503)
- Potential Consumption	0	(30)	(40)	(50)	(90)	(150)	(150)	(150)	(150)	(150)
Maximum Regional Consumption	(882)	(793)	(753)	(763)	(715)	(683)	(668)	(673)	(653)	(653)
Arica-Parinacota + Tarapacá: Potential Shortfall	(766)	(658)	(548)	(488)	(440)	(408)	(393)	(398)	(378)	(378)
2) Antofagasta: Baseline Case										
Baseline Production	2,748	2,909	3,172	3,351	3,305	3,341	3,290	3,321	3,226	3,265
- Baseline Consumption	(6,172)	(6,463)	(6,669)	(6,591)	(6,165)	(5,879)	(5,714)	(5,224)	(4,954)	(4,630)
Antofagasta: Baseline Shortfall	(3,424)	(3,554)	(3,497)	(3,240)	(2,860)	(2,538)	(2,424)	(1,903)	(1,728)	(1,365)
Antofagasta: Potential Case										
Baseline Production	2,748	2,909	3,172	3,351	3,305	3,341	3,290	3,321	3,226	3,265
+ Potential Production	0	0	0	0	30	30	30	30	30	30
Maximum Regional Production	2,748	2,909	3,172	3,351	3,335	3,371	3,320	3,351	3,256	3,295
- Baseline Consumption	(6,172)	(6,463)	(6,669)	(6,591)	(6,165)	(5,879)	(5,714)	(5,224)	(4,954)	(4,630)
- Potential Consumption	0	-	(24)	(770)	(1,058)	(1,180)	(1,390)	(1,570)	(1,600)	(1,420)
Maximum Regional Consumption	(6,172)	(6,463)	(6,693)	(7,361)	(7,223)	(7,059)	(7,104)	(6,794)	(6,554)	(6,050)
Antofagasta: Potential Shortfall	(3,424)	(3,554)	(3,521)	(4,010)	(3,888)	(3,688)	(3,784)	(3,443)	(3,298)	(2,755)
3) Atacama: Baseline Case										
Baseline Production	923	928	953	953	953	953	953	953	953	953
- Baseline Consumption	(981)	(883)	(895)	(895)	(932)	(663)	(187)	(183)	(202)	(206)
Atacama: Baseline Surplus	(58)	45	58	58	21	290	766	770	751	747
Atacama: Potential Case										
Baseline Production	923	928	953	953	953	953	953	953	953	953
+ Potential Production	0	0	0	0	0	0	0	0	0	0
Maximum Regional Production	923	928	953	953	953	953	953	953	953	953
- Baseline Consumption	(981)	(883)	(895)	(895)	(932)	(663)	(187)	(183)	(202)	(206)
- Potential Consumption	0	(120)	(268)	(298)	(388)	(418)	(418)	(418)	(418)	(418)
Maximum Regional Consumption	(981)	(1,003)	(1,163)	(1,193)	(1,320)	(1,081)	(605)	(601)	(620)	(624)
Atacama: Potential Surplus	(58)	(75)	(210)	(240)	(367)	(128)	348	352	333	329
4) South-Central Chile: Baseline Case										
Baseline Production	2,158	2,058	2,076	2,150	2,190	2,270	2,270	2,270	2,270	2,270
- Baseline Consumption	(472)	(496)	(489)	(449)	(430)	(426)	(426)	(427)	(425)	(413)
South-Central Chile: Baseline Surplus	1,687	1,562	1,587	1,701	1,760	1,844	1,844	1,843	1,845	1,857
South-Central Chile: Potential Case										
Baseline Production	2,158	2,058	2,076	2,150	2,190	2,270	2,270	2,270	2,270	2,270
+ Potential Production	0	0	0	0	0	0	0	0	0	0
Maximum Regional Production	2,158	2,058	2,076	2,150	2,190	2,270	2,270	2,270	2,270	2,270
- Baseline Consumption	(472)	(496)	(489)	(449)	(430)	(426)	(426)	(427)	(425)	(413)
- Potential Consumption	0	-	(40)	(40)	(40)	-	-	-	-	-
Maximum Regional Consumption	(472)	(496)	(529)	(489)	(470)	(426)	(426)	(427)	(425)	(413)
South-Central Chile: Potential Surplus	1,687	1,562	1,547	1,661	1,720	1,844	1,844	1,843	1,845	1,857

Source: Chilean Copper Commission, based on producer and consumer company reports to May 2011.

IV. The Chilean Sulfuric Acid Market: Estimations Through 2020

Projected sulfuric acid consumption and production and the resulting balances are discussed below.

4.1 Sulfuric Acid Consumption

Baseline and potential profiles show consumption peaking at 9.8 million tons in 2014, then declining back to current levels by 2018.

With copper ore leaching accounting for 96 percent of Chilean sulfuric acid demand, SX-EW copper production and unit consumption rates are key to properly estimating future consumption.

4.1.1 SX-EW Production

Cochilco estimates to May 2011¹¹ for SX-EW production in 2011-2020 are presented below. Estimates are based on existing operation and new project profiles.¹²

Table 13: Expected SX-EW Copper Production, 2011-2020 (kMT)

Status	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Operating	2,089	2,114	2,113	2,064	2,005	1,875	1,740	1,670	1,544	1,478	1,399
Under Construction	0	0	8	13	22	21	24	17	20	18	27
Baseline Total	2,089	2,114	2,120	2,077	2,027	1,897	1,764	1,687	1,564	1,496	1,426
Probable Projects	0	0	0	0	0	0	0	0	0	0	0
Possible Projects	0	0	0	0	72	164	205	205	209	222	245
Total Projects	0	0	0	5	72	164	205	205	209	222	245
Total SX-EW	2,089	2,114	2,120	2,083	2,100	2,061	1,969	1,893	1,773	1,718	1,671

N.B.: Baseline = Operating + Under Construction
 Probable = Advanced studies + EIA approval
 Possible = Advanced (from prefeasibility underway on)

Source: Chilean Copper Commission

Baseline production should stay above 2 million tons through 2014. Subsequent declines will only be partly offset by projects currently under consideration.

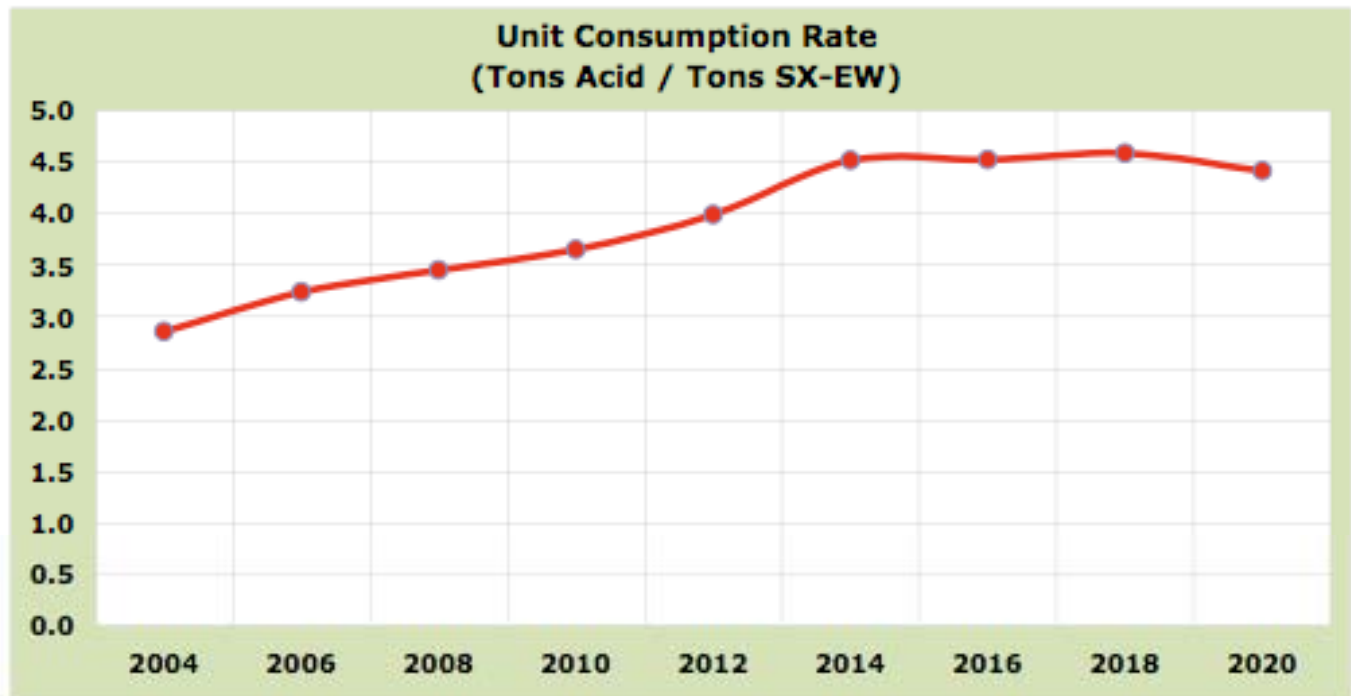
4.1.2 Sulfuric Acid: Unit Consumption Rates

Sulfuric acid consumption per ton of SX-EW copper has been growing steadily. Chart 4 below illustrates expected annual unit consumption rates based on SX-EW production and reported mining company demand (about 96 percent of the total).

¹¹ See report *Copper and Gold Mining Investment in Chile*, available from www.cochilco.cl.

¹² See leading sulfuric acid consumers in Table 3.

Chart 4: Copper Mining Industry - Sulfuric Acid Consumption Rates



Source: Chilean Copper Commission

Chart 4 above shows unit consumption growing 4.4 to 4.6 in the second half of the decade, helping delay the decline expected by the end of the decade.

Accounting for increased average unit consumption rates are lower grades in existing projects and higher consumption by new projects.

4.2 Sulfuric Acid Production

Baseline sulfuric acid production should rise sharply in 2011 as Noracid's Mejillones plant comes on stream, followed by more moderate growth as smelters introduce operating improvements. The Ministro Hales' planned acid plant in Antofagasta and Haldeman's potential second plant in Sagasca, Tarapacá, should provide additional production.

Combined, these facilities are expected to produce some 6.8 million tons a year, about 1.7 million tons more than the amount produced in 2010.

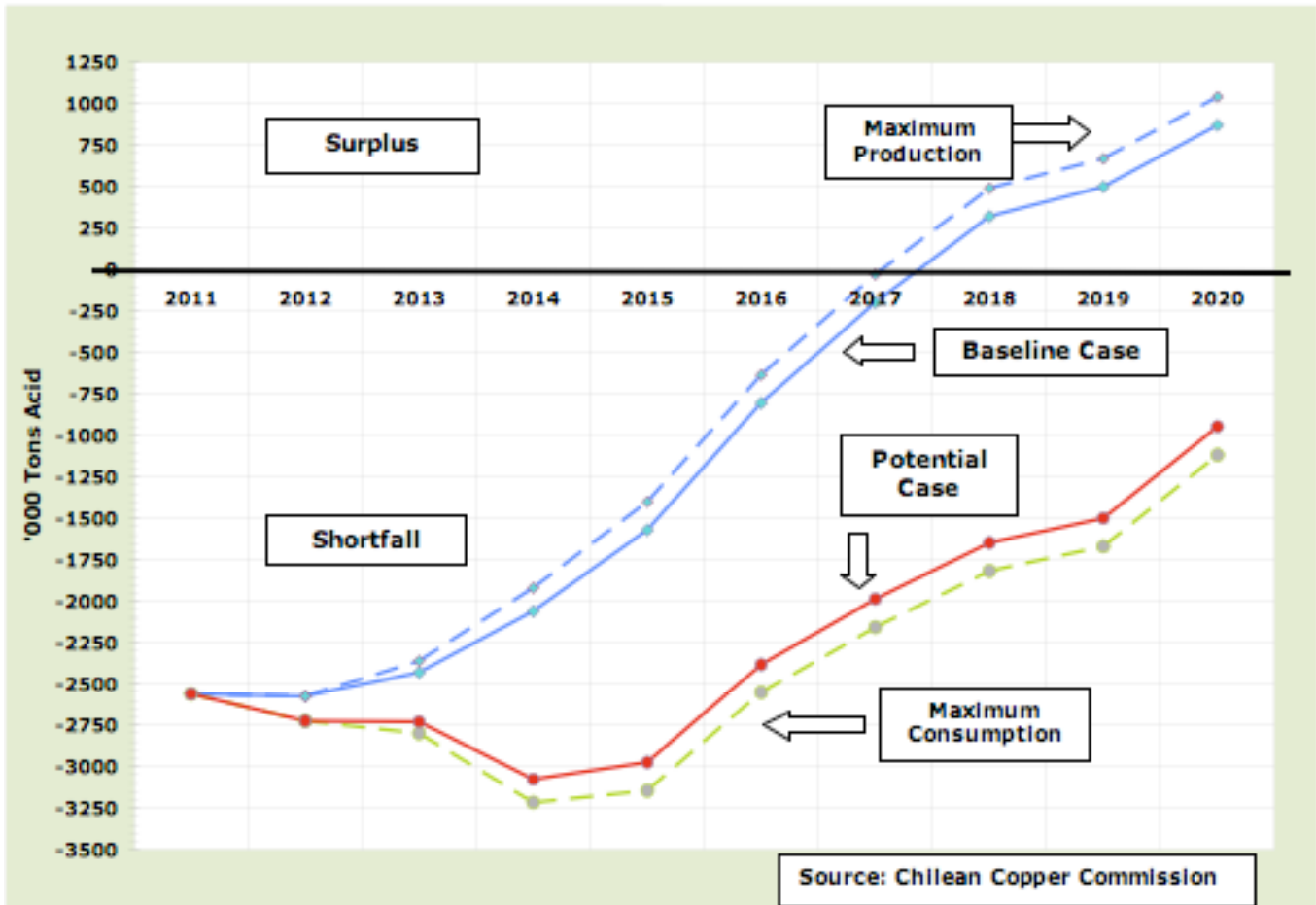
Smelter production profiles are regarded as stable, as it is in the nature of the smelting business to maximize installed capacity use.

Eventual changes introduced by the smelter and refinery policy review underway at Codelco are not considered.

4.3 Chile’s Structural Sulfuric Acid Deficit

Sulfuric acid consumption and production forecasts show the Chilean market remaining in a structural deficit condition. The extent of the shortfall depends on the actual behavior of profile estimates for each scenario. The resulting market balance by scenario is shown below.

Chart 5: Sulfuric Acid Market Balance By Scenario (2011-2020)

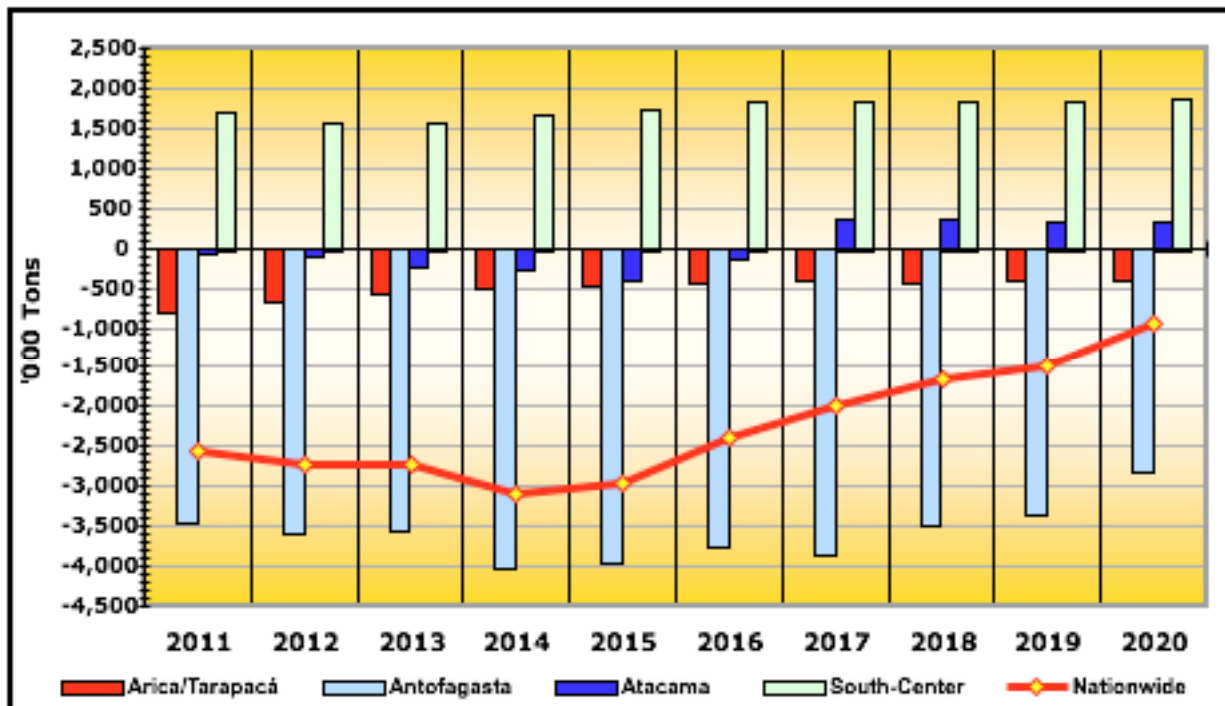


4.4 Domestic Market Asymmetry

Chile’s structural sulfuric acid deficit is a function of strong demand and insufficient local production in northern Chile, especially Antofagasta. In contrast, large surpluses are available in the south-central regions of Valparaíso and O’Higgins.

Distance between acid producer and consumer centers results in significant market asymmetry. This is evident in the national and regional market balances shown in Chart 6 below.

**Chart 6: National and Regional Sulfuric Acid Market Balances
 (Potential Scenario, 2011-2020)**



Source: Chilean Copper Commission

The shortfall hits hardest in Antofagasta, where some 3.5 to 4 million tons of sulfuric acid from both domestic and foreign sources are required each year. This trade considerably taxes port facilities at Mejillones and may force an upgrade.

4.5 Dependence on Imports

The most likely scenario is the Potential case, with annual shortfalls of 2.5 to 3 million tons through 2015 followed by imports declining to about one million tons by the end of the decade. At present, Peru is Chile's largest sulfuric acid supplier. Peruvian imports have grown from 500,000 tons in 2007 to 750,000 tons in 2010.

While proximity to northern Chile makes Peru a competitive supplier, the extent of its available surplus remains uncertain. While Peru's sulfuric acid production potential is an estimated 2.5 million tons through 2015, this is contingent on settlement of the conflict affecting Doe Run Peru's La Oroya Smelter, currently shut down by the government. Present production stands at about 1.6 million tons.

Sulfuric acid demand in Peru is expected to track the growth of new hydrometallurgical operations seeking to increase SX-EW copper production to 675,000 tons by the end of the decade. These projects could boost demand from 0.7 million tons at present to over 3.3 million tons.

An insecure supply and strong demand driven by high copper prices could cause Peru's acid surpluses to shrink or even vanish in the second half of the decade.

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