

Chilean Copper Commission
Research and Policy Planning Department

Copper and Gold Mining Investment in Chile
Estimations for 2010-2015,
Revised to May 2010
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Copper and Gold Mining Investment in Chile

Estimations for 2010-2015, Revised to May 2010

Foreword

This publication by the Chilean Copper Commission's Research and Policy Planning Department estimates investment in the local copper and gold mining industry based on project data available as at the close of May 2010. New investment has a direct effect on the mine copper and gold profile as new projects come on stream and existing operations are expanded and/or upgraded to offset declining grades.

Worth an estimated US\$50 billion, this is the most substantial investment period in the history of Chilean mining. Codelco-Chile is investing vast amounts in structural projects ensuring long-term sustainability. Similarly, major private miners are expanding their operations to prolong their lifespan and/or developing new projects.

This report highlights several new developments. First, new entrants accounting for significant investment amounts, including Japan's Pan Pacific Copper, Australia's PanAust, Brazil's Vale, and Canada's Quadra FNX Mining, Far West Mining and GoldCorp.

Second, development of vast new gold mining projects that will place Chile squarely among leading world producers.

Third, the emergence of important medium-scale projects in Atacama. This showcases the sector's vast potential and poses the challenge of culling and integrating the relevant new data into a later edition of this report, one that has earned a place among industry publications.

That said, it should be noted that 48 percent of portfolio value remains subject to the complexities inherent to mining projects. As it is in Chile's interest to ensure that valuable projects not suffer unnecessary delays, Cochilco brings its expertise and knowledge to bear, in line with Ministry of Mines policy to encourage mining investment.

ANA ISABEL ZÚÑIGA

Director, Research and Policy Planning Department

Santiago, Chile, May 2010

I. Introduction

This report provides an estimate of expected investments in the Chilean copper and gold/silver mining sector, notably projects coming on stream or starting construction in 2010-2015, in order to assess their impact on overall copper output through the year 2020.

This series of ongoing reports reviews and interprets publicly available investment reports by major sector players. It is regularly updated to reflect significant new developments.

This report has three parts:

- Estimated investments in 2010-2015 by both Codelco and private copper, gold and silver miners, including startup timelines for leading projects.
- Estimated mine copper output (concentrate and SX-EW cathodes) for 2010-2020.
- Brief description of leading investment projects under review.

Methodology notes are contained in Annex 1.

II. Investment Estimates (2010-2015)

2.1 Investment Profiles

Planned investment in Chilean copper and gold mining, including projects under construction and those likely to begin construction in 2010-2015, stand at an estimated US\$50 billion.

This includes US\$41.4 billion in copper mining (82.8%) and US\$8.62 billion in large-scale gold mining (17.2%).

In copper mining investment, Codelco accounts for 48.8 percent and major private miners for 48.3 percent. Medium-scale copper miners account for another 2.9 percent.

In addition to the US\$31.1 billion going into copper mining in 2010-2015, also noted is investment materialized prior to 2010 (US\$4.28 billion) and eventual balances to be materialized after 2015 (US\$5.98 billion).

Table 1: Expected Investment in the Copper and Gold/Silver Mining Sector
(US\$ Mn)

	Before	2010	2011	2012	2013	2014	2015	After	Total
Codelco	1,225	2,193	2,051	3,167	3,084	2,571	2,293	3,630	20,214
Large Private Miners	3,035	2,737	2,515	1,690	2,160	2,710	2,815	2,350	20,012
Medium-Scale Miners	22	85	105	295	555	150	0	0	1,212
1) Copper Mining	4,282	5,015	4,671	5,152	5,799	5,431	5,108	5,980	41,438
2) Gold/Silver Mining	470	245	975	1,675	3,210	1,650	400	0	8,625
Total (1 + 2)	4,752	5,260	5,646	6,827	9,009	7,081	5,508	5,980	50,063

Source: Cochilco, based on public reports.

2.2 Copper Mining Investment Allocations, by Certainty

Shown below is investment by degree of certainty, including projects under construction, projects whose feasibility and other studies are well underway and are therefore likely to begin construction soon, as well as those deemed possible based on company statements.

Table 2: Expected Copper Mining Investment Allocation
(US\$ Mn)

Sector	Projects	Before	2010	2011	2012	2013	2014	2015	After	Total
Total Copper & Gold	Construction	4,349	3,194	2,344	1,330	956	360	45	0	12,578
	Probable	87	572	1,055	1,290	850	700	600	300	5,454

	Possible	316	504	1,200	3,120	6,185	5,045	3,660	3,805	23,835
	Other	0	990	1,047	1,087	1,018	976	1,203	1,875	8,196
	Total US\$ Mn	4,752	5,260	5,646	6,827	9,009	7,081	5,508	5,980	50,063
Codelco	Construction	1,044	649	69	30	26	0	0	0	1,818
	Probable	20	240	370	770	300	0	0	0	1,700
	Possible	161	314	565	1,280	1,740	1,595	1,090	1,755	8,500
	Other	0	990	1,047	1,087	1,018	976	1,203	1,875	8,196
	Subtotal	1,225	2,193	2,051	3,167	3,084	2,571	2,293	3,630	20,214
Major Private Miners	Construction	2,923	2,345	1,700	950	845	360	45	0	9,168
	Probable	67	332	685	520	550	700	600	300	3,754
	Possible	45	60	130	220	765	1,650	2,170	2,050	7,090
	Subtotal	3,035	2,737	2,515	1,690	2,160	2,710	2,815	2,350	20,012
Private Medium-Scale Miners	Construction	17	50	25	0	0	0	0	0	92
	Probable	0	0	0	0	0	0	0	0	0
	Possible	5	35	80	295	555	150	0	0	1,120
	Subtotal	22	85	105	295	555	150	0	0	1,212
Gold Mining	Construction	365	150	550	350	85	0	0	0	1,500
	Probable	0	0	0	0	0	0	0	0	0
	Possible	105	95	425	1,325	3,125	1,650	400	0	7,125
	Subtotal	470	245	975	1,675	3,210	1,650	400	0	8,625

Source: Cochilco, based on public reports and own estimates.

Codelco data was culled from Codelco's *2009 Business and Development Plan* (2009 PND) as at April 2009, as revised on the basis of investment clearances for 2010 and other available data.

This review is based only on investment amounts reported for major projects. Other significant investment supported by data as well as investment in restocking, exploration, research and development and smaller projects are noted under "Other".¹

This approach intends to provide an accurate overview of Codelco's investment potential.

Information on private mining projects is culled from official announcements, press reports and trade publications² providing an overview of stage of development and company plans. Gold as well as combined gold/copper mining projects are reported.

¹ Based on divisional investment amounts reported in the 2009 PND minus specific project amounts noted in this report.

² Notably *Proyectos Mineros* (Mining Projects Survey) 2010-2011, EDITEC, April 2010.

2.3 Startup Timelines

Least certain are projects in the “Possible” category. These are projects still under review and/or awaiting permits before a final decision is made. As these account for US\$23.8 billion or 47.6 percent of the US\$50 billion value of the project portfolio, they warrant close watching.

Codelco contributes US\$8.5 billion to this category. As most of this amount should materialize in 2012-2018, the final decision is expected to fall to the new Board of Directors. Most major private copper projects will materialize through 2013 and account for most short-term investment. Additional projects worth US\$7.09 billion may or may not materialize.

Gold mining has an additional US\$7.1 billion ranked as “Possible”. Also in this category are medium-scale projects worth another US\$1.1 billion. Based on these estimates and available data, Table 2 below notes major projects scheduled for startup starting in 2010, shown by year.

Table 3: Leading Project Startup Timeline

Startup	Company Name	Project Name	Amount (US\$ Mn)	REGION
2010 ³	Antofagasta Min.	Los Pelambres Expansion	1,000	IV
	Codelco Andina	94,000 TPD expansion (Phase I)	980	V
	Codelco Norte	R. Tomic Sulfides Phase I	397	II
	Codelco Teniente	Pilar Norte	125	VI
2011	Antofagasta Min.	Esperanza	2,170	II
	BHP Billiton	Escondida’s New Heap Bioleach	384	II
	Vale	Tres Valles	92	IV
2012	Anglo American	Los Bronces Expansion	2,200	Met
	Collahuasi	Expansion Phase I	750	I
	Freeport McMoRan	El Abra Sulfolix	600	II
	Xstrata	Lomas Bayas II Extension	293	II
2013	Pan Pacific Copper	Caserones	2,000	III
	Barrick	Pascua	1,500	III
	BHP Billiton	Escondida’s New Heap Ox. Lea.	413	II
	Cerro Dominador	Diego de Almagro	120	III
2014	GoldCorp	El Morro	2,500	III
	Codelco Norte	Ministro Hales Mine	1,700	II
	Far West	Santo Domingo	600	III
	Kinross	Lobo-Marte	575	III
	PanAust	Inca de Oro	400	III
	Codelco Salvador	San Antonio Oxides	230	III
2015	Codelco Andina	230,000 TPD Expansion (Phase II)	4,800	V
	Barrick	Cerro Casale	2,324	III
2015 and Beyond	Teck	Quebrada Blanca Hypogenic	3,000	I
	BHP Billiton	Escondida Phase V	2,514	II
	Collahuasi	Phase II Expansion	2,450	I
	Codelco Norte	Chuquicamata Underground	2,000	II
	Quadra FNX Mining	Sierra Gorda	1,600	II
	Codelco Teniente	New Mine Level	1,500	VI

Source: Cochilco, based on public reports.

³ Teck’s Andacollo Hypogenic project came on stream in early 2010 and is not included in this report.

This investment portfolio does not include projects that may materialize in the second half of the decade but for which insufficient data is available.

II. Estimated Chilean Copper Output

3.1 Mine Output⁴ (2009-2020)

Shown below is mine copper output through 2020, using 2009 as baseline year.

**Table 4: Potential Mine Copper Output in Chile Through 2020
(kMTF)**

Description	Type	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline Production	Concentrate	3,277	3,582	3,749	3,783	3,920	4,096	4,068	3,903	3,798	3,669	3,375	3,246
	SX-EW Cathodes	2,113	2,161	2,119	2,125	1,975	1,875	1,677	1,471	1,307	1,125	1,080	989
Total Baseline Production		5,390	5,743	5,868	5,908	5,895	5,971	5,745	5,374	5,105	4,794	4,455	4,235
Additional Probable	Concentrate	0	0	0	0	94	275	325	450	475	475	475	475
	SX-EW Cathodes	0	0	0	0	30	100	180	260	330	330	330	330
Plus Probable Production		0	0	0	0	124	375	505	710	805	805	805	805
Additional Possible	Concentrate	0	0	0	0	0	107	331	659	990	1,268	1,548	1,599
	SX-EW Cathodes	0	0	0	0	5	25	31	41	41	41	41	41
Plus Possible Production		0	0	0	0	5	132	362	700	1,031	1,309	1,589	1,640
Additional Hypothetical	Concentrate	0	0	0	0	0	0	0	220	387	359	468	412
	SX-EW Cathodes	0	0	0	5	5	5	145	204	252	248	223	194
Plus Hypothetical Production		0	0	0	5	5	5	145	424	639	607	691	606
Total Projection	Concentrate	3,277	3,582	3,749	3,783	4,014	4,478	4,724	5,233	5,649	5,772	5,865	5,732
	SX-EW Cathodes	2,113	2,161	2,119	2,130	2,015	2,005	2,033	1,976	1,930	1,744	1,674	1,554
Potential Production		5,390	5,743	5,868	5,913	6,029	6,483	6,757	7,209	7,579	7,516	7,539	7,286

Source: Cochilco estimates.

Table 4 provides a summary of expected mine copper output through the year 2020. It allows for the fact that the certainty of production potential profiles varies and projects may materialize under conditions and at times that differ from those originally contemplated.

Estimates are based on existing output profiles, new flows from projects under construction, and additional flows from probable or possible projects coming on stream through 2015.

The final component are hypothetical projects. These include projects that may materialize in the second half of the decade but for which insufficient data exists and were therefore not considered for investment projection purposes.

⁴ Including both copper concentrate and SX-EW cathodes.

Concentrate projects include Escondida's Phase VI and R. Tomic Sulfides Phase II. Hydrometallurgical projects include the Manto Verde life of mine extension, Codelco Norte's Quetena and RT SBL Bioleaching, Codelco Andina's SBL Bioleaching, and Apoquindo Minerals' Madrugador.

3.2 Mine Copper Output by Region (2009-2020)

As investment translates into operations in specific regions, Tables 5, 6 and 7 below show mine copper, concentrate and SX-EW cathode output profiles by region, respectively, using 2009 as baseline year.

"Baseline" data refers to existing production plus new flows expected once projects come on stream. The "Projects" category includes all, whether probable, possible or hypothetical.

**Table 5: Mine Copper Output Through 2020, Shown by Region
(kMTF)**

Region	Description	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Tarapacá	Baseline	730	728	700	650	735	827	794	784	739	699	689	639
	Projects	0	0	0	0	0	0	0	0	243	405	547	567
	Subtotal	730	728	700	650	735	827	794	784	982	1,104	1,236	1,206
Antofagasta	Baseline	2,933	3,116	3,161	3,186	2,980	2,900	2,777	2,467	2,326	2,200	1,987	1,833
	Projects	0	0	0	5	129	380	550	1,033	1,356	1,374	1,491	1,448
	Subtotal	2,933	3,116	3,161	3,191	3,109	3,280	3,327	3,500	3,682	3,574	3,478	3,281
Atacama	Baseline	336	354	326	265	345	415	349	341	341	330	317	324
	Projects	0	0	0	0	5	132	335	468	483	469	437	427
	Subtotal	336	354	326	265	350	547	684	809	824	799	775	752
Coquimbo	Baseline	342	449	542	567	549	536	522	521	521	517	506	506
	Projects	0	0	0	0	0	0	0	0	0	0	0	0
	Subtotal	342	449	542	567	549	536	522	521	521	517	506	506
Valparaíso	Baseline	261	310	341	343	328	308	331	336	285	235	160	160
	Projects	0	0	0	0	0	0	127	333	378	432	525	512
	Subtotal	261	310	341	343	328	308	458	669	663	667	685	672
Metropolitan	Baseline	236	229	229	294	375	402	429	417	412	392	392	392
	Projects	0	0	0	0	0	0	0	0	0	0	0	0
	Subtotal	236	229	229	294	375	402	429	417	412	392	392	392
O'Higgins	Baseline	404	415	427	468	451	451	411	375	347	289	271	248
	Projects	0	0	0	0	0	0	0	0	14	41	65	97
	Subtotal	404	415	427	468	451	451	411	375	362	330	336	345
Other	Baseline	148	142	142	135	132	132	132	132	132	132	132	132
	Projects	0	0	0	0	0	0	0	0	0	0	0	0
	Subtotal	148	142	142	135	132	132	132	132	132	132	132	132
Country Total	Baseline	5,390	5,743	5,868	5,908	5,895	5,971	5,745	5,374	5,105	4,794	4,455	4,235
	Projects	0	0	0	5	134	512	1,012	1,834	2,475	2,721	3,085	3,051
	TOTAL	5,390	5,743	5,868	5,913	6,029	6,483	6,757	7,209	7,579	7,516	7,540	7,286

Source: Cochilco estimates.

**Table 6: Concentrate Output Through 2020, Shown by Region
(kMTF)**

Region	Description	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Tarapacá	Baseline	493	496	481	438	520	612	600	600	600	600	600	550
	Projects	0	0	0	0	0	0	0	0	243	405	547	567
	Subtotal	493	496	481	438	520	612	600	600	843	1,005	1,147	1,117
Antofagasta	Baseline	1,252	1,394	1,471	1,458	1,420	1,444	1,449	1,324	1,293	1,303	1,123	1,063
	Projects	0	0	0	0	94	275	275	631	864	886	1,009	966
	Subtotal	1,252	1,394	1,471	1,458	1,514	1,719	1,724	1,955	2,157	2,189	2,132	2,029
Atacama	Baseline	232	236	212	177	242	302	286	278	282	277	266	270
	Projects	0	0	0	0	0	107	254	377	402	388	386	386
	Subtotal	232	236	212	177	242	409	540	655	684	665	653	657
Coquimbo	Baseline	323	434	520	544	526	513	499	498	498	494	483	483
	Projects	0	0	0	0	0	0	0	0	0	0	0	0
	Subtotal	323	434	520	544	526	513	499	498	498	494	483	483
Valparaíso	Baseline	247	294	325	327	312	298	321	326	275	225	150	150
	Projects	0	0	0	0	0	0	127	321	328	382	484	470
	Subtotal	247	294	325	327	312	298	448	647	603	607	634	620
Metropolitan	Baseline	190	183	183	248	329	356	383	382	382	362	362	362
	Projects	0	0	0	0	0	0	0	0	0	0	0	0
	Subtotal	190	183	183	248	329	356	383	382	382	362	362	362
O'Higgins	Baseline	401	413	425	466	449	449	408	372	344	286	268	245
	Projects	0	0	0	0	0	0	0	0	14	41	65	97
	Subtotal	401	413	425	466	449	449	408	372	344	286	268	245
Other	Baseline	139	132	132	125	122	122	122	122	122	122	122	122
	Projects	0	0	0	0	0	0	0	0	0	0	0	0
	Subtotal	139	132	132	125	122	122	122	122	122	122	122	122
Country Total	Baseline	3,277	3,582	3,749	3,783	3,920	4,096	4,068	3,903	3,798	3,669	3,375	3,246
	Projects	0	0	0	0	94	382	656	1,329	1,852	2,102	2,491	2,486
	TOTAL	3,277	3,582	3,749	3,783	4,014	4,478	4,724	5,232	5,650	5,771	5,866	5,732

Source: Cochilco estimates.

**Table 7: SX-EW Cathode Output Through 2020, Shown by Region
(kMTF)**

Region	Description	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Tarapacá	Baseline	237	232	219	212	215	215	194	184	139	99	89	89
	Projects	0	0	0	0	0	0	0	0	0	0	0	0
	Subtotal	237	232	219	212	215	215	194	184	139	99	89	89
Antofagasta	Baseline	1,681	1,722	1,690	1,728	1,560	1,456	1,328	1,143	1,033	897	864	770
	Projects	0	0	0	5	35	105	275	402	492	488	482	482
	Subtotal	1,681	1,722	1,690	1,733	1,595	1,561	1,603	1,545	1,525	1,385	1,346	1,252
Atacama	Baseline	104	118	114	88	103	113	63	63	59	53	51	54
	Projects	0	0	0	0	5	25	81	91	81	81	71	41
	Subtotal	104	118	114	88	108	138	144	154	140	134	122	95
Coquimbo	Baseline	19	15	22	23	23	23	23	23	23	23	23	23
	Projects	0	0	0	0	0	0	0	0	0	0	0	0
	Subtotal	19	15	22	23	23	23	23	23	23	23	23	23
Valparaíso	Baseline	14	16	16	16	16	10	10	10	10	10	10	10
	Projects	0	0	0	0	0	0	0	0	0	0	0	0
	Subtotal	14	16	16	16	16	10	10	10	10	10	10	10
Metropolitan	Baseline	46	46	46	46	46	46	46	35	30	30	30	30
	Projects	0	0	0	0	0	0	0	0	0	0	0	0
	Subtotal	46	46	46	46	46	46	46	35	30	30	30	30
O'Higgins	Baseline	3	2	2	2	2	2	3	3	3	3	3	3
	Projects	0	0	0	0	0	0	0	0	0	0	0	0
	Subtotal	3	2	2	2	2	2	3	3	3	3	3	3
Other	Baseline	9	10	10	10	10	10	10	10	10	10	10	10
	Projects	0	0	0	0	0	0	0	0	0	0	0	0
	Subtotal	9	10	10	10	10	10	10	10	10	10	10	10
Country Total	Baseline	2,113	2,161	2,119	2,125	1,975	1,875	1,677	1,471	1,307	1,125	1,080	989
	Projects	0	0	0	5	40	130	356	505	623	619	594	565
	TOTAL	2,113	2,161	2,119	2,130	2,015	2,005	2,033	1,976	1,930	1,744	1,674	1,554

Source: Cochilco estimates.

3.3 Estimate Review

By helping offset depletion, the investment process reviewed here will have a strong impact on overall copper and gold production in Chile.

Potential mine copper output will stand at 7.29 million tons refined copper by the year 2020, a 35.2 percent increase for the period under review and up 2.8 percent from the 5.39 million tons posted in 2009.

Hypothetical projects in section 3.1 above are considered only for the purposes of projecting overall copper output. These are expected to contribute some 606,000 tons refined copper in 2020 and more in subsequent years.

As such, most expected growth is taking place in concentrate output, which will go from 3.28 million tons in 2009 to 5.73 million tons in 2020, a 74.9 percent increase for the period under review or a 5.2 percent annual growth rate.

The trend reverses for SX-EW cathode output, expected to stay above 2 million tons through the year 2015, then decline to 1.55 million tons by the year 2020, a 26.5 percent slide over 2009. Natural depletion of surface leachable oxides and sulfides will make new leaching projects few and far between.

While overall production will expand about 35.2 percent in 2009-2020, growth will not be evenly shared across regions. Expected to stand above the country average are Valparaíso with 157.5 percent (Nueva Andina), Atacama with 123.8 percent (Caserones, El Morro, Cerro Casale and several medium-scale operations), Tarapacá with 66.2 percent (Quebrada Blanca Hypogenic and the Collahuasi Expansion) and Coquimbo with 65.2 percent (Pelambres Expansion and other minor operations). Antofagasta will grow 11.9 percent as hydrometallurgical operations decline.

As to gold production, projects in this report are expected to contribute some 2,250,000 oz. (70 TPY), with combined copper/gold projects contributing an additional 314,000 oz. a year (9.8 TPY). Combined with the 40 TPY averaged in the last decade, new production should help propel the figure to 110-120 TPY after 2015, plus a significant although as yet undetermined amount of silver.

An overview of copper mining in each segment is shown below.

3.3.1 Short Term (2010-2012)

Following a noticeable decline in copper concentrate output –from 3,78 million tons in 2004 to 3.28 million tons in 2009- major investments announced this year mark the start of a period of strong, sustained growth.

Codelco projects coming on stream in this period will successfully make up for declines caused by depletion and low grades.

Chief among private projects are production capacity and LOM expansions at existing operations such as Los Bronces, Pelambres, Collahuasi, El Abra and Lomas Bayas. Scheduled for start-up are Antofagasta Minerals' new Esperanza project in the promising Sierra Gorda district and Vale's Tres Valles, a medium-scale hydrometallurgical project in Coquimbo. Also in Coquimbo, Teck's Andacollo Hypogenic project came on stream earlier this year as a short-term replacement for leachable resources mined in this site by Teck.

Leaching operations are expected to stay above their all-time 2.1 million tons SX-EW cathode record.

The combined effect will be production of 5.91 million tons refined copper in 2012, a 9.7 percent global increase over 2009.

3.3.2 Medium Term (2013-2015)

This period is noted for projects under construction becoming fully operational and the startup of currently less certain projects. As a result, by 2015 the mine copper output will rise a significant 14.3 percent over 2012 to about 6.76 million tons refined copper.

Most of the momentum will come from concentrate, expected to rise by 970,000 tons over 2012. Hydrometallurgical production in this period is expected to drop by a net 97,000 tons over 2012 as the 1,000 TPY to be contributed by projects slated through the year 2015 (including some less certain hypothetical projects) fail to offset declines in existing operations.

Of projects coming on stream in this period, only Pascua and Caserones have begun construction. The remainder still await a final decision.

Crucially, if they are to meet startup deadlines, miners active in this period will have to move swiftly to obtain the permits and the technical and financial data required to make a decision.

Large-scale miners include Codelco (Ministro Hales, Andina Phase II), GoldCorp (El Morro), Barrick (Cerro Casale) and BHP (most of Escondida Phase V will materialize in this period).

Medium-scale miners include Cerro Dominador (Diego de Almagro), Far West (Santo Domingo), Codelco (San Antonio Oxides) and PanAust (Inca de Oro, with Codelco).

Hypothetical hydrometallurgical projects contributing some 145,000 tons SX-EW cathodes may also get a start in this period.

3.3.3 Long Term (2016-2020)

This is when maximum production potential is reached as currently probable or possible plus new hypothetical projects enter full operation. As such, production in 2017 should stand at about 7.58 million tons, then begin to gradually decline.

While concentrate output should rise to a record 5.86 million tons, SX-EW cathode output will decline by 479,000 tons over 2015, mainly due to the closure of leaching operations at Quebrada Blanca and Codelco Norte's RT oxides.

As the timeline progresses, uncertainty increases. This is the period when key projects such as Codelco's Chuquicamata Underground and the New Teniente Mine Level, both crucial to keeping long-term production within current levels, are slated to come on stream.

Also contemplated in this period is Quebrada Blanca Hypogenic, a project designed to process primary sulfides lying under the leachable layers currently under development. The promising Sierra Gorda project, currently in an advanced exploration stage, could also come on stream.

New Escondida and Codelco expansions as well as increases in the lifespan of hydrometallurgical operations not considered here should have an additional positive impact.

IV. Leading Investment Projects

4.1 Codelco (www.codelco.cl)

RADOMIRO TOMIC SULFIDES, Phase I (Northern Division):

Involves initial development of sulfides surfacing at the Radomiro Tomic Mine as overlying oxides become depleted. Project calls for extraction and primary crushing of 100,000 TPD of ores and subsequent transportation by conveyor belt to the Chuquicamata concentrating plant to make up for lower open-pit production. Some RT sulfides are already being trucked to Chuquicamata. Phase II, involving construction of a new concentrating plant and marginal bioleaching of low-grade sulfides, is under review. This hypothetical project is considered in this report only for the purposes of projecting mine copper output.

Est. Investment Amount: US\$397 Mn

Status: Work underway, expected operational in H2 2010.

MINISTRO HALES MINE DEVELOPMENT (Northern Division)

Located halfway between Chuquicamata and Calama, Ministro Hales is a copper sulfide deposit holding estimated reserves of 219 million tons and 1.13 percent average grades. Once fully operational, Ministro Hales should be able to process up to 50,000 TPD in a concentrating plant adjacent to the open pit. High arsenic levels will require fluidized bed roasting (up to 350,000 TPY concentrate). This would yield high-grade (37 percent refined copper content) concentrates for sale and/or smelter feeds.

Est. Investment Amount: US\$1.7 Bn

Status: A probable project currently undergoing a feasibility review. Mining and high-grade concentrate production expected to commence in 2010 and 2014, respectively.

CHUQUICAMATA UNDERGROUND (Northern Division)

Codelco is exploring deep geological resources at Chuquicamata to determine the viability of high-productivity underground mining using panel caving methods. The four 30,000 to 40,000 TPD faces involved should yield some 300,000 TPY refined copper. Startup would coincide with the end of the open pit's economic life and the ore would feed existing concentrators.

Est. Investment Amount: US\$1.9 Bn

Status: A possible project currently undergoing a feasibility review. Gradual development is expected, with commencement of production slated for 2018.

GABRIELA MISTRAL Phase II (Minera Gaby)

Gabriela Mistral came on stream in 2008. Phase II, intended to attain 170,000 TPY production throughout the life of the project, is now underway.

Est. Investment Amount: US\$190 Mn (Phase II)

Status: Phase II construction expected to conclude in April 2011.

SAN ANTONIO OXIDES (Salvador Division)

A project involving processing of oxidized ores left over from underground development of the old Potrerillos Mine. Located 8 km SE of the Potrerillos Smelter at 3,200 m altitude, with estimated reserves of 111 million tons. Plans include a crushing plant on the old mine site and construction of a conveyor-fed hydrometallurgical (SX-EW) plant in the Potrerillos area. Capacity is an estimated 30,000 TPY SX-EW cathodes over 17 years.

Est. Investment Amount: US\$230 Mn

Status: Possible project. Prefeasibility review underway, submitted for EIA review. Mining and cathode production expected to commence in 2011 and 2014, respectively.

PHASE I 94,00 TPD EXPANSION / ANDINA DEVELOPMENT PLAN (Andina Division)

Initial stage of Division plans to upgrade mining and processing capacity to 94,000 TPD to compensate for declining grades. Includes a net 60,000 TPY copper concentrate output increase and linkup work for Phase II.

Est. Investment Amount: US\$980 Mn

Status: Under construction, expected operational in June 2010.

PHASE II: 244,000 TPD EXPANSION / NUEVA ANDINA (Andina Division)

Phase II calls for upgrading mining and processing capacity from 94,000 TPD to 230,000 TPD. Includes developing a new open pit, continuing underground mining and relocating processing plants to a lower altitude. Phase II should contribute an additional 320,000 tons, for an overall output of 600,000 TPY refined copper in concentrate form.

Phase III, calling for expanding capacity to 290,000 TPD, is under profile review. Also being considered is underground development of the Sur Sur Mine once the third panel is shut down. Given the vast amount of low-grade sulfides generated by massive mining operations, forced leaching is being considered. This would help mitigate the environmental impact of acid water. These hypothetical projects are considered in this report only for the purposes of projecting mine copper output.

Est. Investment Amount: US\$4.8 Bn (Phase II)

Status: A possible project currently undergoing a feasibility review. Expected operational in 2015.

PILAR NORTE, OTHER (Teniente Division)

Pilar Norte involves mining a section of reserves on the northern mine side in order to feed an extra 17,000 TPD to the concentrating plant. Includes the new Diablo Regimiento (Phase III) development as well as plans to mine other areas of the current Teniente site (i.e., southern pit) not considered in this report.

Est. Investment Amount: US\$251 Mn (Pilar Norte: US\$125 Mn; Other: US\$131 Mn)

Status: Pilar Norte is expected on stream in 2010. Other projects remain in the prefeasibility stage and could come on stream in 2013.

NEW MINE LEVEL (Teniente Division)

Involves mining a new sector at altitude 1,880 m, 100 m below the current mine level. The plan is intended to increase reserves and ensure the long-term continuity of Division operations.

Est. Investment Amount: US\$1.5 Bn

Status: A possible project currently undergoing a feasibility review. Expected to begin gradual production in H2 2017.

4.2. Major Private Copper Miners

4.2.1 Anglo American (www.anglochile.cl)

Los Bronces Development (Anglo American Sur)

A project designed to increase processing capacity from 60,000 to 160,000 TPD, thereby adding some 175,000 TPY to the Los Bronces concentrate output. Includes a new crushing and milling line plus a slurry pipeline for transportation of thickened ores to high-capacity copper and molybdenum concentrating plants in the valley.

Est. Investment Amount: US\$2.2 Bn

Status: Under construction; expected on stream in late 2011.

4.2.2 Antofagasta Minerals⁵ (www.antofagasta.co.uk)

ESPERANZA (Minera Esperanza)

An orebody located 6 km southeast of the El Tesoro deposit in the Sierra Gorda district. Reserves are an estimated 786 million tons sulfides (0.53% copper and 0.2 GPT gold). Expected output is 195,000 TPY copper concentrate with a gold content estimated at 215,000 ounces per year. Oxides might be integrated into the El Tesoro mining plan. Processing will use 640 l/sec. seawater and thickened tailings techniques.

Est. Investment Amount: US\$2.1 Bn

Status: Under construction; expected on stream in late 2010.

LOS PELAMBRES EXPANSION (Minera Los Pelambres)

Subsequent to a recent overhaul, plans are underway to increase processing capacity from 144,000 to 175,000 TPD. Designed to compensate for declining grades, the upgrade will increase molybdenum recovery and expand the copper concentrate output by 80,000 TPY to an overall 440,000 TPY. While the expansion is supported by the upgraded El Mauro Tailings Dam, current reserve levels do not suggest an extension in the life of mine.

Est. Investment Amount: US\$1 Bn

Status: Under construction; expected on stream in mid-2010.

4.2.3 BHP Billiton (www.bhpbilliton.com)

HEAP LEACHING CONSTRUCTION (Minera Escondida)

To support its SX-EW cathode production plan, Escondida is planning to implement additional heap leaching areas, complete with the required equipment and facilities. Plans call for consecutive construction of sulfide bioleaching and oxide leaching areas.

Est. Investment Amount: US\$384 Mn (bioleaching); US\$413 Mn (oxides)

Status: Construction of bioleaching area about to begin; expected on stream in July 2011. The oxides project is in the prefeasibility stage and should be operational in late 2013.

EXPANSION PHASE V (Minera Escondida)

The original Laguna Seca Plant project was complemented by a new mill and concentrating plant replacing the Los Colorados facility, to be dismantled in order to clear the area for mining. These plans are designed to retain current concentrate output in spite of declining grades. A new phase to be defined may consider construction of a third concentrating plant plus a desalination plant supplying water to the new operations. This hypothetical Phase VI is considered in this report only for the purposes of projecting mine copper output.

Est. Investment Amount: US\$2.5 Bn

Status: A probable project; feasibility study to be reviewed per the new objectives. The new facilities are expected on stream in H2 2012 (mill) and H1 2016 (plant).

⁵ The hypothetical Antucoya Project is considered in this report only for the purposes of projecting mine copper output through 2020.

4.2.4 Doña Inés de Collahuasi (www.collahuasi.com)

COLLAHUASI EXPANSION (SCM Doña Inés de Collahuasi)

A project designed to augment Collahuasi's overall copper concentrate and SX-EW cathode output to 650,000 TPY based on increasing sulfide ore processing while retaining leachable ore capacities. Phase II will seek to bring the overall refined copper output up to 1 million tons.

Est. Investment Amount: Phase I: US\$750 Mn / Phase II: US\$2.4 Bn

Status: Phase I under construction; expected on stream in 2012. A possible Phase II still requires a feasibility review; expected to enter gradual operations after 2015.

4.2.5 Freeport McMoRan (www.fcx.com)

SULFOLIX (Cía. Contractual Minera El Abra)

El Abra's Sulfolix project ensures operational continuity through copper sulfide leaching. The project, which should yield some 115,000 TPD for overall production of some 160,000 TPY SX-EW cathodes, leverages existing mining and SX-EW capacities. The Sulfolix project addresses declining oxides production and should extend the life of mine by at least 10 years.

Est. Investment Amount: US\$600 Mn

Status: Under construction. Gradual startup in 2012, fully operational in 2015.

4.2.6 Pan Pacific Copper (www.ppcu.co.jp)

CASERONES (Minera Lumina Copper Chile)

Caserones stands at 4,200 m altitude, some 115 km southeast of Copiapó, Atacama. Recent estimates determined that the best option is to mine sulfides for their copper, gold and molybdenum content and leach lower-grade resources. Plans call for expanding concentration capacity to 150,000 TPY refined copper and 3,000 TPY molybdenum and leaching capacity to 30,000 TPY SX-EW cathodes.

Est. Investment Amount: US\$2 Bn

Status: Under construction. Startup expected in 2013 (leaching) and 2014 (concentration).

4.2.7 Quadra FNX Mining (www.quadramining.com)

Sierra Gorda (Minera Quadra Chile)

A deposit located in the vicinity of Spence and Tesoro, 140 km east of Antofagasta. Exploration now underway suggests the presence of major copper, gold and molybdenum reserves that could be processed at a rate of 110,000 TPD to produce some 130,000 TPY copper concentrate, 36,000 ounces of gold and 7,000 tons of molybdenum over 25 years. Oxides may also be mined.

Est. Investment Amount: US\$1.6 Bn

Status: A possible project currently undergoing a prefeasibility review. Considering Quadra's financing agreement with China's State Grid International Development and its standing interest in a prompt feasibility study, the project is expected on stream in 2015.

4.2.8 Teck (www.teck.com)

Quebrada Blanca Hypogenic (Minera Quebrada Blanca)

A hypogenic primary sulfide deposit underlying secondary supergenic sulfide ores currently yielding 85,000 TPY SX-EW cathodes through leaching. Development is slated to commence

once economic leachable reserves are depleted. Once operating at capacity, the project should yield about 200,000 TPY copper concentrate and 4,000 TPY refined molybdenum. Teck is implementing a similar but smaller (80,000 TPY) copper concentrate project in Andacollo.

Est. Investment Amount: US\$3 Bn

Status: Prefeasibility stage. Construction not expected before 2014; expected on stream in 2017, concurrent with final leachable ore stages.

4.2.9 Xstrata (www.xstrata.com)

LOMAS BAYAS II (Minera Lomas Bayas)

Following a 75,000 TPY cathode expansion and given initial deposit depletion, plans now call for mining a new pit 3 km from the current site, construction of a new heap leaching facility, and retaining the existing plant infrastructure in order to extend the life of mine through 2020.

Est. Investment Amount: US\$293 Mn

Status: Under construction. Startup expected in 2012.

4.3. Medium-Scale Copper Miners

4.3.1 Cerro Dominador (www.elbronce.cl)

DIEGO DE ALMAGRO (Minera Diego de Almagro S.A. Pending)

An IOCG (iron oxide-copper-gold) deposit in Atacama, 10 km from Diego de Almagro, with reserves estimated at 300,000 tons copper and 27,000 oz. gold. Plans include leaching oxides and concentrating sulfides to produce 11,000 TPY SX-EW cathodes (years 1-8) and 22,000 TPY copper concentrate (years 2-8). Iron content recovery not contemplated.

Est. Investment Amount: US\$120 Mn

Status: A possible project currently undergoing a feasibility review. Not expected on stream before 2013.

4.3.2 Far West Mining (www.farwestmining.com)

SANTO DOMINGO

Santo Domingo is the largest of four IOCG deposits being explored by FWM in the Diego de Almagro district. Available information suggests possible development of sulfide resources to produce some 65,000 TPY copper concentrate and some gold plus 2.7 million TPY iron ores (i.e., magnetite and hematite).

Est. Investment Amount: US\$600 Mn

Status: A possible project currently undergoing a feasibility review. Might come on stream in 2015.

4.3.3 PanAust (www.panaust.com.au)

INCA DE ORO

A smaller Codelco property in the Diego de Almagro district. The prefeasibility review suggests production of some 50,000 TPY copper concentrate and 40,000 ounces per year of gold. Since this is a minor project for Codelco's scales of operation, a 60 percent share was sold to Australia's PanAust with Codelco retaining 40 percent ownership per Law 19137.

Est. Investment Amount: US\$400 Mn

Status: A possible project, soon to undergo a feasibility review. Expected on stream in 2014.

4.3.4 Vale (www.vale.com)

TRES VALLES (Minera Tres Valles)

A project calling for underground mining of the Papamono mine and nearby deposits in southern Coquimbo. Hydrometallurgical processing is expected to yield some 18,000 TPY SX-EW cathodes. To leverage the installed capacity, the plant may process third-party ores.

Est. Investment Amount: US\$92 Mn

Status: Construction underway; expected on stream in 2011.

4.4 Gold and Silver Mining

4.4.1 Barrick Gold (www.barrick.com)

PASCUA (Cía. Minera Nevada S.A.)

Pascua, a gold deposit standing at 4,600 m altitude 53 km north of the old El Indio Mine, forms a single unit with the Lama deposit on the Argentine side of the border. Global reserves are estimated at 17.1 million oz. gold and 560 million oz. silver, mostly oxides. Three-fourths of reserves lie in Chile (Pascua) and the remainder in Argentina (Lama). Ores will be crushed on-site in Chile, then trucked to plants across the border. These include a cyanide leaching plant processing free-milling ores (83%) to produce metal doré⁶ and a concentrating plant processing refractory ores (17%) to obtain a gold- and silver-rich copper concentrate. Expected annual output stands at 800,000 oz. gold and 35 million oz. silver, about 75 percent from the Chilean side. Information on marginal copper content not available.

Est. Investment Amount: US\$1.5 Bn (portion to be invested in Chile out of the US\$3 Bn total)

Status: Construction underway; expected operational in 2013.

CERRO CASALE (Minera Estrella of Gold Ltda.)

This orebody, located in Aldebaran, on the southern end of the Maricunga gold district 100 km due east of the city of Copiapó, is among Chile's largest undeveloped gold deposits. The project contemplates co-production of gold, silver and copper. A 75,000 TPD cyanide leaching plant will process free-milling ores to obtain metal doré while a 150,000 TPD concentrating plant will process sulfide ores to obtain a gold- and silver-rich copper concentrate. Global production stands at an estimated 1 million ounces of gold and 100,000 TPY copper concentrate.

Est. Investment Amount: US\$4.2 Bn

Status: Barrick took over the project (75%) following acquisition of Arizona Star and of a portion of Kinross' stake, which retains a 25 percent interest. A feasibility study now in its final stages will shed light about a likely timeline. Based on information available as of this writing, startup is not expected before 2015.

⁶ A gold and silver alloy in bar form obtained from recovery of noble metals present in ores. It is a common commercial gold ore form. Metal doré is refined to separate gold and silver.

4.4.2 Kinross (www.kinross.com)

Lobo-Marte (SCM Santa Rosa)

A deposit in the Maricunga gold district, mined unsuccessfully in the nineties and bought by Kinross after several relaunch attempts. The prefeasibility review calls for open-pit mining at a rate of 47,000 TPD and leaching ores to obtain an estimated 350,000 ounces per year of gold in metal doré form.

Est. Investment Amount: US\$575 Mn

Status: A possible project undergoing a new prefeasibility review by Kinross, new owner as of January 2009. Construction could start in 2012, once feasibility is completed. Not expected on stream before 2014.

4.4.3 GoldCorp (www.goldcorp.com)

EL MORRO (Minera El Morro)

Spans two deposits (El Morro and Fortuna, the latter holding the largest potential) located 80 km east of Vallenar, in Alto del Carmen, Atacama. Reserves are an estimated 6.7 million ounces of gold and 2.56 million tons of copper. The estimated 90,000 TPD processing capacity should result in 165,000 TPY copper concentrate with a high (353,000 oz.) gold content over 15 years. The project contemplates a 740 l/s desalination plant supplying most water requirements.

Est. Investment Amount: US\$2.3 Bn

Status: Possible project. Feasibility review underway, submitted for EIA review. Canada's GoldCorp recently acquired a 70 percent stake from Xstrata, with New Gold retaining a 30 percent interest. Construction could start in 2012, once feasibility is reviewed by the new owners. Not expected on stream before 2015.

ANNEX

METHODOLOGY

The methodology used to draft this report is explained below.

1. Scope

This report covers current and planned investments in 2010-2015 by both Codelco and medium- and large-scale private miners.

Investment estimates are allocated on a per-annum basis. Also shown are actual investments made through 2009 in connection with ongoing projects with a commencement date prior to 2010.

Investments in connection with projects with an estimated commencement date beyond 2015 are identified as such.

Project particulars are complemented by estimations on additional copper output contributed, if any, plus notes on current status.

Information is provided on a best-guess basis, based on data current at the time of writing. Where no such data is available, annual investment allocations are estimates not necessarily supported in sources.

As such, companies are not in any way responsible for the forecasts made in this report.

2. Investment Likelihood

Investment information is qualified by the author by degree of certainty. Projects are ranked from most to least likely as either under construction, probable –i.e., feasibility and environmental impact assessment reviews in an advanced stage- or deemed possible based on prefeasibility results and company statements of intent, even if no formal commitment has yet been made.

Hypothetical projects include projects that may materialize in the second half of the decade but for which insufficient data exists. These are considered only for mine copper output projection purposes.

3. Codelco Investment Plans: Sources of Information

3.1 Methodology

While most Codelco investments involve projects yielding a return, the company also invests in equipment replacement, facility upgrades, mining exploration, R&D, feasibility studies, environmental cleanup, workplace safety, and employee benefits.

Investment estimates are based only on Codelco submissions to the Investment Project Authorization (API) process.⁷

⁷ A process jointly reviewed by Cochilco and the Ministry of Planning (MIDEPLAN). Does not include disbursements considered as investments by Codelco (i.e., deferred expenses and the like) which require no such authorization.

These estimates are based primarily on reports submitted on a regular basis to the Cochilco Strategic Management Assessment Division. Investment projections and startup schedules are based on information publicly available through April 2010.

Information is derived primarily from Codelco's *2009 Business and Development Plan (2009 PND)*, the most recent submitted to Cochilco, updated to include the 2010 Investment Plan approved by the Codelco Board of Directors in January 2010.

As such, the information herein should be construed only as a strategic planning tool. It is not in any way binding on the government agencies charged with reviewing investment projects.

Its value resides in reflecting the long-term vision of Codelco prior to corporate governance changes introduced recently. As such, it is not binding on current Codelco officials and staff.

The key points considered in presenting Codelco data are as follows:

- a) Investment for 2010 is US\$2,193 million, the maximum authorized for the current year under the API process.
- b) Annual investment for subsequent years is as shown in the 2009 PND, minus deferred expenses.
- c) Only estimated investment amounts for major projects were considered.
- d) The "Other" category comprises estimated major investments with profile support, operation replacements, exploration, R&D and smaller projects. These were determined based on annual divisional investment amounts in Codelco's 2009 PND minus annual investment amounts explicitly noted therein.
- e) Smelter and refinery investments were excluded as Codelco is reviewing its strategy with a view to integrating Caletones and Ventanas.

4. Private Copper and Gold Mining Investment: Sources of Information

Sources include public reports and announcements culled from company web sites, the news media, trade publications, and the like. Routine or exploration investments were not included.

Often only a global investment amount and intended commencement year are known. In such cases, annual allocations are estimated assuming a 30-month completion timeframe for complex projects and generally assigning about half of the investment amount to year two.

4.1 Large Copper Mining

Includes all projects under construction, adjusting investment amounts and startup timelines for delays suffered in late 2008 and early 2009.

Projects still under consideration were brought up to date based on a review of their current status, investment forecasts, estimated startup and output profiles. The most significant change noted involves Escondida's Phase V downsize and shift of additional goals to a subsequent Phase VI to be implemented in the following five-year period.

Some minor changes in private projects were also noted.

4.2 Medium-Scale Copper Mining

The report notes construction start at Vale's Tres Valles project. In addition, estimated startup at Cerro Dominador's Diego de Almagro project was pushed back a year due to the absence of data supporting progress.

This report also notes two important medium-scale projects commencing in Atacama's Diego de Almagro district. The first of these is Inca de Oro, spearheaded by Codelco in association with Australia's PanAust under Law 19317. PanAust holds a 60 percent interest and is in charge of implementation. The second such project is Far West Mining's Santo Domingo, a novel copper and iron ore concentrate co-production project.

4.3 Gold Mining

Construction start at Barrick's binational Pascua Lama project is noted, including recognition that investment will be evenly divided among Chile and Argentina. Based on availability of ores, Chile will account for 75 percent of the output and Argentina for the remaining 25 percent.

Data for the Cerro Casale project (75% Barrick, 25% Kinross) was updated to reflect a budget increase to US\$4.2 billion and postponement of startup to not before 2015.

The Lobo-Marte project was added to reflect the strong interest stated by new owner Kinross.

The El Morro project was reclassified from copper to gold mining as new owner GoldCorp is specifically targeting the gold content. This will entail a revision of the feasibility review.

5. Copper Output

Information shown is based on concentrate and SX-EW cathode output from mine sources through the year 2020. This includes estimated output profiles for both existing operations and projects in paragraph 2 above.

Smelter and refinery output is not included, as no formal investment projects currently exist in these particular sectors.

All figures are shown as refined copper content relative to 2009, based on the most recent data available to the Cochilco Research and Policy Planning Department.

Ranking projects as under construction, probable, possible or hypothetical helps determine the likelihood of output profiles for each category. The sum total equals the mine copper output potential existing in Chile based on the project portfolio reviewed in this report.

A Cochilco Research and Policy Planning Department Publication Prepared By

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