

Investments & Projects



We invest more than any other company in Chile. In 2016 we allocated US\$ 2.738 billion to our Capex portfolio. For the 2016-2020 period, we have developed a US\$18 billion investment plan.

Our structural projects are currently in different development and consolidation stages. They will be implemented as part of the transformation needed to ensure our company's future in order to offset the effect caused by declining ore grades at our current operations, improve productivity and add new production to maintain our leadership position in the global copper industry.

We also invested in our divisional study and project portfolio carried out every year to maintain assets in operation, ensure compliance

with environmental standards and implement appropriate standards to improve our long-term competitive advantage. For the five-year period from 2016 to 2020, we will have allocated US\$ 18 billion to our Capex portfolio.

In 2016, pre-investment studies and projects involved an investment of US\$ 2.738 billion, of which approximately US\$ 1.183 billion went to development projects.

Investment in 2016

US\$ million	
Development Projects	1,183
Equipment Replacement and Facility Refurbishment	123
Sustainability	489
Research and Studies	123
Business	150
Mine Development & Deferred Expenses	639
Exploration	31
Total	2,738

Note: Data obtained from actual costs as of December 2016 SAP/R3. Nominal currency, subject to accounting adjustments.

Chuquicamata Division

Chuquicamata Underground Mine Structural Project

Its goal is to continue mining the resources available under the open-pit mine another 40 years, this 100-year old mine will be converted into a world-class underground operation.

In 2016 we started the mass development of mine tunnels in order to commence operations in 2019.

During the year, we connected the access tunnel that will join the surface to the underground mine, through a 7.5 km long road (April 2016).

After more than three and a half years of work, we successfully completed the return airshaft excavation (918 metres deep and 11 metre effective diameter), one of the largest in global mining (July 2016).

Furthermore, we continued making progress on the mineral transport tunnel and other permanent infrastructure works. At the end of the year, this project had developed more than 59 km of tunnels, chimneys and shafts, out of a total 181 km.

Other Projects

At the concentrator plants, we continued implementing our investment plan to treat an average 175,000 tonnes per day and improve metal recovery. Key milestones in 2016 include: we started operations at the flotation plant to treat smelter slag, we prepared the initial start-up of the improvement projects for the secondary SAG mill and we replaced the flotation cells for the mineral processing plant.

Likewise, we continued to develop the project portfolio at the smelter to comply with Supreme Decree 28, issued by the Ministry of the Environment, for smelter emissions in Chile and it will become effective for Chuquicamata Smelter from December 2018.

We made significant progress in various projects, for example, the new Pierce-Smith converter started operations and we developed the Acid Plant Transformation project, which includes two new plants using double absorption and double contact technology.

During this project we started preparing the site where the new facilities will be located; at the same time, we made progress on detail engineering and purchased critical equipment for this plant. We are also completing the study to enhance the smelter business, by increasing the Flash Furnace smelting capacity to improve our competitive position.

At the electrolytic refining plant, we continued to implement the projects to refurbish the facilities and improve safety conditions.

At the Talabre dam we continued to develop the VIII stage, raising the dam walls from 2,490 m to 2,496 m above sea level. This project will ensure operational continuity of sulphide production at the North District.

In hydrometallurgical processing of minerals, we completed the studies of leaching of current gravel and artificial resources, in order to boost the division's oxide business.

Radomiro Tomic Division

Radomiro Tomic Sulphide Mine Structural Project

In January 2016, we obtained the project's Environmental Qualification Resolution, successfully concluding the consultation process with the majority of the local communities.

We also completed the detail engineering stage for the first concentrator module and we concluded the site preparations and land-clearing operations required for our future facilities.

In respect of the investment stage of the project, we adopted a development strategy consistent with market conditions; therefore, the start-up of the first module was rescheduled for 2024. This will enable us to optimise the business case, which will focus on extracting and processing sulphide minerals at the Radomiro Tomic Division.

Furthermore, we continued to develop engineering and analysis of the water desalination system, for which we are currently assessing implementation alternatives with third parties.

In 2017, we have already advertised to request for expression of interest. This system should initially supply 630 l/s of desalinated water to the North District.

Other Projects

At the mine operations we implemented projects to sustain production and improve mine safety. During the year we received new support drills and excavators, improving mine safety. We also installed next-generation sensors in the sulphide belt to predict overheating incidents and failures.

As for the development of the mine, we implemented the first stage to relocate the mining equipment's the electrical feed infrastructure to ensure operational continuity.

In resources and reserves, we continued to invest to improve mineral resources data to transform them into reserves, and include them in the production plans. In 2016, the funds required to ensure the drilling, sampling and modelling programmes were approved for the next five years.

In order to make the crushing and leaching plant sustainable, investments were made to improve and expand the tailings extraction system, reconditioning the secondary crushers, and

we made progress in replacing the buck wheel excavator.

In solvent extraction and electrowinning (SX/EW) process, to sustain and improve throughout rate, we improved the EW Plant tankhouse, we installed a new stainless steel tank at the SX Plant. Finally, the long-term expansion of this business is being developed through a long-term, heap leaching prefeasibility study, to extend the division's hydrometallurgical business.

Ministro Hales Division

In 2016 we focused our investments on personnel safety projects, on complying with our commitments to the Calama community (road works), improving efficiency of production processes and on obtaining geological resources data.

A key improvement in safety was geotechnical and hydrogeological monitoring, ensuring a safe operation inside the mine, preventing accidents in the event of any structural collapse of mine walls.

With regard to community commitments, we completed a new north access road to the city of Calama, improving integration of the Tucnar Huasi and Huaytiquina villages.

Key projects that contribute to production efficiency and reliability, focused on increasing recovery at the concentrator plant and improving availability of the roasting plant, installation of a third column flotation cell, implementation of an expert control system at the concentrator, installation of a second fan and incorporation of a second cooler in the roasting plant.

By identifying geological and geometallurgical resources we delineated the southern side of the open pit to develop new mining phases. The delineation of the north ore body and deep central body helped to update the future mining models for Ministro Hales Underground Mine.

We carried out the company's largest investment program, in order to ensure the future of Codelco and to transform large mining reserves into resources for Chile.

Gabriela Mistral Division

Our 2016 Capex portfolio included investments to ensure operating continuity; we have practically completed the Tailings Dump Liner Installation – Phase VI project to store the tailings in heaps in line with the division's business plan. Furthermore, the Division started the feasibility study to install the Tailing Dump Liner Installation – Phase VII and VIII, to implement the phase VII of the project from 2018 and phase VIII, from 2020, in line with the 2017 Development & Business Plan.

Development and Business Plan

We developed the Hydrogeological Exploration project to ensure the division has water resources; it aims to improve the water supply to the division and develop two wells in Laguna Seca.

In respect of future developments, we completed the second drilling stage in the geological exploration for sulphide ores, the results will help to define the mineralisation potential of the Gabriela Mistral mine, go beyond the copper oxides currently being mined, and analyse long-term planning scenarios and incorporate potential mine projects in the division's future business plans.

Finally, the division continued its district geological exploration campaign that studies potential oxide and sulphide ores bodies and known porphyry feeder zones. We also conducted exploration using indirect methods (geophysics) in district zones identified as areas of geological interest for potential of economic mineralisation.

Salvador Division

Inca Mine Structural Project

In view of depleting reserves at Salvador Division's mine operations, we identified the potential to extend the mine life of the Rajo Inca project, by extracting through an open pit the remaining resources at Indio Muerto mine.

In 2016, we continued to collect geo-mineral-metallurgical data and we expect to complete the prefeasibility study at the

beginning of 2017, so as to develop an alternative project to give continuity to the Salvador business unit.

Other projects

The Salvador Division investment portfolio developed in 2016 primarily focused on driving sustainable development. In this context, we conducted the studies required to build the second stage of the tailings dump filtered from the slag flotation plant,

sulphuric acid tanks and the electrical installation in workshops and industrial facilities at Potrerillos. We started building a new filter plant adjacent to the concentrator plant, so as to stop using the concentrate duct to the old plant located in Llanta, eliminating environmental risks during transport.

In line with the new copper smelter emission standards, we continued the study required to find a solution to treat the black smoke from the smelter, generated during the reduction and oxidation steps in the anode furnaces, as well as implementing the Gas Capture and Processing Improvement project to find a comprehensive technical solution from the mouth of the converter furnace to the

acid plant. During 2016, we started the building contracts required to implement the first project stage and we issued the purchase order for the main equipment.

Furthermore, given the strategic decision to internalise the underground mine operation, we acquired a new fleet of mining equipment to give operational continuity to the business, significantly reducing the division's operating costs.

We also started building the refinery anode sludge plant to obtain and process copper-rich precipitates, thus improving recovery at the new Metal Recovery Plant, recently built in Mejillones.

Andina Division

Andina Future Development Structural Project

We have made progress on the prefeasibility study for the future development of Andina to expand the division's treatment capacity. As a general concept, the project involves transferring the flotation facilities to the valley and recycling water from the Ovejería dam. The project will balance the division's need for mineral resources with a business case that will require less investment, less construction time and which is to the current environmental scenario.

Andina Transfer System Structural Project

During 2016, this project, to maintain the current mineral throughput rate at Andina Division, was on schedule, and we started the

excavation work where the new primary crusher will be located, in an area known as Nodo 3,500; it will replace the current system that will be affected by pit growth.

We also had good results in underground developments; we started the project's main tunnel, for the new mineral transport system, towards the plant located in the mountains.

Other Projects

We continued to implement the Ovejería dam - Stage I project, more than 640 m above sea level.

We also made progress on the second stage of the Andina drainage water treatment project (TADA Barroso). At the same time, we started the feasibility study on the extended north waste rock dump project; it incorporates new clear water capture and piping and contact water treatment.

We started building and developing the new areas for the underground mine included in the divisional business plan; we defined to water resource optimisation and assurance-related investments, both in the underground mine and the concentrator, as well as projects to

implement the infrastructure required to improve workplace health and safety conditions.

Furthermore, we commenced work on replacing the concentrate transport line and improving the tailings pipelines, significantly mitigating environmental risks.

Ventanas Division

Key investments focused on the executing and starting projects to comply with the new copper smelter emission standards to control fugitive emissions, specifically for secondary gas capture and leakage from the Teniente Converter, Pierce Smith Converters and the electric furnace.

We also launched a project to eliminate the visible fumes around the fire-refining area and the tail gas treatment plant at the acid plant. In terms of safety, we opened the new footbridge over the F30-E motorway to reduce risks for pedestrians crossing the access road to the division.

We also made progress on implementing the project to build a refinery copper-rich precipitate treatment plant, where they are prepared, packed and sent to the Metal Recovery Plant in Mejillones.

In terms of energy efficiency and given the success of the project to replace the diesel oil burners with oxy-fuel burners in the Pierce Smith converter and furnace, we started a project to replace the burners in the tilting furnace and retention furnace in the fire-refining area.

El Teniente Division

Teniente New Mine Level Structural Project

This project expands El Teniente mine operation even deeper, incorporating reserves that extend the division's useful life by more than 50 years. During 2016, we made progress on finding a solution for the project's technical and construction challenges.

While developing the main tunnels we generated new knowledge and innovations to address geomechanical issues, incorporating technical solutions and cutting-edge technology, applying innovation in the construction process, to ensure our employees's safety. It

should be noted that renowned global and national experts and professionals have helped to adapt project engineering and obtain a better response to the unfavourable geomechanical conditions detected.

We also made progress on the underground works in the area where future mine production will start, and the project is on schedule.

Other Projects

We continued to implement mining projects to renew the mine's production capacity, to replace depleting areas and the delayed start-up of the structural project, in particular, we started on the prefeasibility studies for two areas, Andesita and Diamante, which will allow us to extend Teniente level 8 mine operations.

We began implementing the Diablo Regimiento project Phase V, a throughput rate of 8,000 tonnes per day at the processing plant and an expected 126,000 tonnes of refined copper in 8 years. In this last phase, one of five phases planned to operate the Diablo Regimiento mine, our production should be 403,000 tonnes of refined copper over the next 10 years.

The Dacita project is in full operation, its production capacity is 17,000 tonnes of mineral per day, expected to generate 490,000 tonnes of refined copper over a 12-year period, and most of the work was completed in 2016. We also commissioned the Pacífico Superior project that should produce 216,000 tonnes of refined copper over the next 8 years.

We also completed the prefeasibility study for the North Resources project, to mine the north section of the deposit; we started work on the main access roads and initial infrastructure. The project is expected to start operations in 2020, producing 1 million tonnes of refined copper over a period of 20 years.

In terms of sustainability, at the Caletones smelter, we completed the feasibility study and we started work on the emission reduction projects for the gas cleaning plants, the slag treatment plant for the Teniente convertors. We have also made progress on the feasibility study to reduce the opacity of the smoke from the anode furnaces.

After implementing these projects, in December 2018 the Caletones smelter will be able to comply with Chilean gas emission, opacity and particulate matter standards.

