

A miner wearing a white hard hat with a headlamp, a tan work jacket, and heavy gloves is kneeling in a dark, rocky tunnel. He is holding a large, dark rock sample in his hands. The background is a rough, reddish-brown rock wall.

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Peru's Mining Industry: In Need of a Jump-Start

The country consolidates as the world's second largest producer of copper but requires more projects to avoid losing momentum

The mining industry is working under new paradigms. Worldwide, the rise and fall of iron ore has taken its toll on the largest mining houses, after years of multi-billion investments and project cost overruns. In gold, silver, copper and other base metals such as zinc and lead, prices are substantially lower than their 2011-2012 peak levels. As a result, mining companies have redefined their priorities, divested assets and rationalized investment pipelines, with the goal of reducing debt levels and creating more free cash flow.

Peru is no exception to this trend, and on top of that, the country is right in the middle of a presidential election process, so the industry is doubly cautious and has adopted a wait-and-see mode. Despite the fact that Anglo American has kept its Quellaveco copper asset in Peru out of its divestiture list, for instance, this does not mean that the project will be built anytime soon, even if it is technically ready to go. The same applies to other large projects.

Yet, Peru cannot keep its positive GDP growth levels without fresh investment in the mining sector. After a disappointing 2.35% expansion in 2014, growth levels picked up over the last quarter of 2015 to reach an annual average of 3.26%. This was mainly a result of the commissioning of two enormous copper projects: the expansion of Freeport McMoRan's Cerro Verde to 360,000 metric tons of throughput per day (mt/d), and the commencement of operations of Las Bambas, operated by Australian-Sino company MMG.

At the height of the mining supercycle, Roque Benavides, CEO of Buenaventura, the country's largest precious metals company, warned that Peru could not be complacent just because the value of exports had rocketed thanks to higher metal prices. "What matters is production", he said.

Looking at the latest production figures, Peru has reasons to believe it has done a good job in consolidating itself as a key mining country worldwide. Copper production jumped from 1.3



Peru increased its precious metals output during 2015. Photo courtesy of Hochschild

million mt/y in 2014 to 1.7 million mt/y last year, with expectations to reach 2.3 million mt/y in 2016, as the latest new ventures reach full capacity.

After three years of decline, gold production went up last year, reaching 4.66 million troy ounces per year (oz/y); silver production rose and reached 131.9 million oz/y. Zinc (+7.7%), lead (+13.4%) and molybdenum (+18.1%) also recorded positive growth figures. Only tin (-15.5%) and iron (-12.3%) performed worse in terms of volumes as compared to 2014.

The question now is 'what's next?' With the Conga and Tía María projects on hold for several years after social confrontation, 2016 may see the expansion of Southern Copper's Toquepala operation as the only sizeable capital endeavor. Other large copper projects in the pipeline, like the aforementioned Quellaveco, Rio Tinto's La Granja, China Minmetals' El Galeno or First Quantum's Haquira will still require some time to come online, provided positive investment decisions are triggered and the respective social licenses are obtained.

The fact that these projects have been in the Ministry's pipeline for years frustrates industry leaders because they are yet to translate into real production and real value for the country. In other words, the industry has done well, but could have done so much better.

Ernesto Balarezo, vice-president for the Americas at Gold Fields, laments that no new project has been added to the pipeline during the 2011-2016 Humala administration. "All the projects that started production recently, such as Las Bambas, Inmaculada or the expansion of Cerro Verde, come from the previous government. What we have seen is the exact opposite: projects being put on hold. If we have five more years of drought, this will result in an overall delay of 15-20 years before new mines come into production. It is an emergency for Peru's mining industry."

José Miguel Morales Dasso, partner at García Sayán law firm and president of the 2016 Gold Symposium in Lima, demands political action to boost mining



"International prices have been the same for Peru and Chile, but Chileans are aware that copper is their bread and butter. Chile is a mining country, while Peru is a country with mines. To be a mining country, we need to share a conviction that mining is our biggest strength."



**-Carlos Gálvez,
president,
SNMPE**

investment in these less favorable times: "People are concerned about whether the next president will be bold enough to put the country's locomotive, that is the mining industry, back in motion. The new president does not need a new locomotive, neither does he or she need to buy coal for the engine, or even switch it on because it is already on; it is a matter of stoking the fire."

As the economy was cooling down in 2014, one of the measures of the government to boost investment was to reduce income tax while it increased the



*New mining production is boosting economic growth.
Photo courtesy of Austin Engineering*

tax on dividends. Yet unattractive metal prices, social conflicts and lack of political leadership to push projects forward have left the industry waiting for a fresh start from the next administration.

Carlos Gálvez, president of the National Society of Mining, Petroleum and Energy (SNMPE), the main industry association, looks south and explains that Peru has a lot to learn from Chile in terms of its long-term plans and policies: "The international prices have been exactly the same for Peru and Chile. The difference is that in Chile, people are aware that copper is their bread and butter. Even Salvador Allende said it. Chile is a mining country, while Peru is a country with

mines. To be a mining country, we need to share a conviction that mining is our biggest strength."

As a new head of state is sworn-in this year, it remains to be seen what level of decisiveness he or she may have to tackle potential social unrest. Indeed, if the next president can unlock the large investments in Conga and Tía María or not, remains a big question mark. In the meantime, increased copper production during the year will have a positive impact in Peru's GDP growth figures, supporting the argument that if Peru is to diversify its economy, it needs to do so without giving its back to its main driver: the mining industry. •

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Production and Project Development

Peru's competitive cost position helps generate free cash flow, the mining producers' new mantra

Peru not only has one of the largest mining industries worldwide in terms of production, it is also one of the most profitable jurisdictions for those companies that were successful in project development, from both a technical and a socio-environmental perspective.

Looking at the international gold producers, their all-in-sustaining-cost (AISC) position in Peru outperforms their global averages. If in Yanacocha the difference is not noteworthy (\$880 per ounce (/oz) versus Newmont's \$898/oz average in 2015), in other cases it is outstanding. Barrick's Lagunas Norte operation produced at an AISC of \$509/oz last year, far below the company's \$831/oz average. Gold Fields' Cerro Corona gold and copper operation yielded costs of \$700/oz of gold equivalent, while the company's average is \$1,026/oz.

With the gold price at stable levels over \$1,200/oz, any mine with costs below \$1,000/oz not only has a healthy margin, but also is in an enviable position to capitalize on the next bullish rally. "Today, it is not about producing more for the sake of producing more. It is about producing in a profitable manner, maximizing free cash flow", said Manuel Fumagalli, executive director of Barrick in Peru.

As part of this effort, the company reduced its debt by \$3.1 billion last year worldwide.

In Peru, Lagunas Norte, one of the corporation's core assets, produced 560,000 oz of gold in 2015. This year it will have lower output, explained Fumagalli: "Our 2016 production guidance at Lagunas Norte is in the range of 410,000 to 450,000 oz of gold, at all-in sustaining costs of \$570 to \$640/oz. There is an increase in costs associated to lower production in line with the progressive depletion of the oxides, the transitioning to sulfides and the level of our capital expenditures, mainly for the expansion of the Phase 6 of the leach pad."

Considering Lagunas Norte's excellent results from a production and costs standpoint, the company is working hard to extend its mine-life. As part of the refractory ore project (PMR in Spanish), the pre-feasibility study of which was completed last year, gold reserves have increased to 3.7 million oz. The project is now entering feasibility to try to reduce the estimated \$640 million capital expenditure and it could see production by 2021.

"PMR production should be around 240,000 oz of gold per year for the first five years which, although smaller than the oxides

production, is still significant and opens the door to unlock other potential refractory ore sources in the surroundings. It would be the first autoclave plant in Peru", added Fumagalli.

A growing player in Peru's gold spectrum is Tahoe Resources, a medium-sized producer that has significantly raised its profile through the acquisitions of Rio Alto Mining and, more recently, Lake Shore Gold in Canada. The company's two assets in Peru are La Arena, which produced 230,000 oz of gold last year, and Shahuindo, a project in Cajamarca that will be reaching commercial production this year.

Tahoe's VP of operations Tim Williams gave some insights about the progress at Shahuindo: "Construction started last year and the start-up pad with a capacity of 4.5 million metric tons (mt) has been completed for the current 10,000 mt/d mine plan. One difference with the La Arena process is that Shahuindo recoveries will greatly benefit from crushing and agglomeration. Shahuindo is expected to operate at 36,000 mt/d as of 2018."

With regard to La Arena, the operation is currently exploiting the gold oxides where mineral reserves were still 919,000 oz as of the beginning of this year (taking the company through to 2021). Tahoe is working to expand gold resources there, while there is also the copper resource underneath: "At La Arena we have not closed the Calaorco pit, but expanding it would probably need higher gold prices. We also have the copper resource of 274 million mt at 0.33% Cu and 0.24 g/mt Au (M&I). Current copper prices are a bit low for us but we continue working on the engineering to define a possible copper mining operation. Combining our gold oxide and the copper-gold sulfide reserves,



Roque Benavides, CEO,
Buenaventura



there is potential for us to have a continuous presence in Peru for the next 20 years", emphasized Williams.

South African company Gold Fields is also looking at how to extend its Cerro Corona operation beyond 2028, when the reserves will be exhausted, but the mine is space-constrained and the Cajamarca region is very challenging from a social perspective.

In 2015, production was around 300,000 oz/y of gold equivalent (159,000 oz of gold and 28,700 mt of copper). The operation was cash flow-positive despite lower copper prices in 2015, and the company continues to push for more operational efficiency. While the main sources of capital expenditure are the tailings dam and the waste storage deposits, Ernesto Balarezo, executive VP for the Americas at Gold Fields, insists that creativity will be the main recipe for success: "In Cerro Corona we have not laid off a single person to reduce costs. I really believe that talent is everything. We are renegotiating contracts with suppliers, while we are picking everyone's brain in the organization on how we can make things better. Last year, we successfully implemented five operational initiatives, the most significant one being the 'sandwich project', which consists of uniformly blending the ore before going to the primary crusher."

The very first reaction of miners to protect themselves against low cycles may be to downsize, to cut exploration and capital projects and to renegotiate contracts with suppliers to obtain lower costs. While all of these efforts are reasonable, the truth is that there is a point where it becomes impossible to cut any further. In order to obtain sustainable efficiency over the long run, mining organizations need to embrace innovation and, increasingly,

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- Ernesto Balarezo, executive VP Americas, Gold Fields



think outside the box to make the most of their different assets. As an example, Hochschild Mining has undertaken an impressive cost reduction effort over the last years. In 2012, AISC per oz of silver equivalent was \$21.7. Last year it was just \$12.9, a 41% decrease over three years, and a 26% decrease if compared to 2014. The main causes behind the 2014-2015 cost reduction are actually talent-driven. One is the commissioning of Inmaculada, a gold and silver mine that is expected to contribute 14 of the 32 million oz (Ag eq) the company plans to produce this year. The second factor consists of rising grades (a result of smarter exploration) and operational efficiencies.

This effort is not over; after abandoning the processing of ores that were not profitable, the company has 2,700 mt/d of spare capacity between its Pallancata, Arcata and Ares plants. "Our

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focus this year will be to find resources to use as much as possible from this capacity, which does not need any new permits, social licenses, environmental studies or financing", said Ignacio Bustamante, Hochschild's CEO.

Bustamante emphasized the extent to which Inmaculada is reshaping the company: "Inmaculada is a 70% gold-30% silver operation that required an investment of \$440 million. The mine has about 8 years of resources and a lot of geological potential. The target is to produce 14 million oz/y at an AISC of \$9-10/oz. We are currently operating at 3,850 mt/d; we believe that with efficient investments we can go up to 4,200 mt/d and 5,000 mt/d. With Inmaculada we now have a 50-50 split between gold and silver."

Realizing more competitive costs, coupled with larger production volumes, is also the strategy that medium-sized gold producer Poderosa implemented when gold prices started to fall. Output from this operation was 190,000 oz of gold last year (+22%), and estimates for this year are 205,000 oz, with a medium-term goal to reach 230,000 oz/y.

Poderosa's general manager Marcelo Santillana explained that, on top of the efforts of miners to reduce costs, market prices of supplies went back to more reasonable levels after the inflation of the boom years: "In 2015, we had more favorable prices of cyanide, steel, wood and fuel. Cyanide, for instance, went down from \$3 to just \$1 per kilogram."

The company increased its processing capacity to the current 600 mt/d, while it has been focusing on implementing more efficient schedules for tunneling activities (the company digs about 30,000 meters of tunnels every year). Poderosa's operation, located in the gold-rich Pataz batholith, also works as a gold-processing facility for artisanal miners; this represents 15% of Poderosa's production.

Copper: the Big Leap

In the years between 2005 and 2014, yearly copper production only increased by 370,000 mt/y, and Peru lost its second position in world copper production to China. 2015, however, was the start of a big transformation. Last year, production increased by 321,000 mt/y to reach 1.7 million mt/y. This year, the forecast is to reach 2.3 million mt/y, solidly placing Peru as the world's second largest copper producer in the world, after Chile.

While Las Bambas and the expansion of Cerro Verde have stolen most of the headlines due to the sheer size of these investments (\$7.4 billion and \$4.6 billion respectively) and the positive impact of construction activities in terms of economic development, production-wise it is actually this year that they will start making a big difference.

The main drivers of 2015's output increase were Chinalco's Toromocho, which finally overcame its technical difficulties to produce 182,000 mt/y (+159%) and Constancia, a brand new operation by Hudbay Minerals that yielded 106,000 mt/y. All the other majors also contributed with increased production: Antamina went from 362,000 to 412,000 mt/y. Glencore's Antapaccay produced 203,000 mt/y as compared to 167,000

one year before. Cerro Verde reached 256,000 mt/y (+9%) while Southern Copper's production remained fairly stable at 322,000 mt/y (+1%), divided in two operations, Toquepala and Cuajone. The expansion of Cerro Verde is a key milestone for Peru and for the region of Arequipa. The concentrator is trebling in size to reach a capacity of 360,000 mt/d. This places Cerro Verde as one of Freeport-McMoRan's top three operations. Harry 'Red' Conger, president & COO for the Americas and Africa at Freeport, said: "We have several mines that are capable of producing 1 billion pounds of copper annually today or in the future. Cerro Verde, Grasberg and Morenci are essentially at that rate today." [1 billion pounds is around 453,000 mt]

Conger explained that focusing on large, expandable assets rather than developing new deposits is paying off: "One of the strategic advantages of Freeport-McMoRan is that there is less risk associated with doing a brownfield expansion than with a new greenfield installation. These are natural advantages at a location like Cerro Verde; we had the infrastructure in place, we had a port (although we had to expand it), and we had a world-class, highly-trained Peruvian workforce."

Rick Coleman, president of Freeport-McMoRan Mining Company, gave more details on the expansion: "At the time that the original concentrator was commissioned, mine-life was 70 years at a 120,000 mt/d rate. We had good recovery rates and the concentrate was very clean and easy to sell, so the economics of the expansion were favorable. It was a \$4.6 billion investment to add 240,000 mt/d of nameplate capacity to the concentrator facilities. An additional \$1 billion was spent during the expansion project for a new leach pad, improvements in the existing concentrator and SX/EW facilities and the relocation of existing infrastructure, among others."

Project Development and Exploration

Total mining investments in Peru were \$7.5 billion in 2015, confirming the downward trend since 2013. This year, the estimate is \$5.3 billion, according to

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- Harry 'Red' Conger, president & COO Americas and Africa Mining, Freeport-McMoRan



Peru's Central Bank. The only large capital project expected this year is the \$1.2 billion expansion of Southern Copper's Toquepala operation, to go from 60,000 mt/d to 120,000 mt/d.

Buenaventura, that has postponed the construction of its San Gabriel project until 2018, is advancing towards production at Tambomayo, a \$340 million investment that will yield 150,000 to 170,000 oz of gold and 3.5 million oz of silver in 2017. First production should start in Q4 2016.

Other than that, the rest of the year will not see important developments

from the point of view of new capital projects. Certainly, the industry will see an enormous increase in copper production thanks to the recent investments, but mining suppliers are already suffering from lower levels of activity regarding projects.

The hiccup is also affecting the exploration segment although, as in 2009, the impact of the global reduction of exploration budgets is not hitting Peru as badly as in other countries. According to the *World Exploration Trends* report by SNL Metals & Mining, which covers non-ferrous metals, Peru received 6% of all the exploration

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Colquipuzco Silver Oxide Mineral Resource (Feb 26 2015)

14.3 Moz silver (Indicated) & 13.2 Moz silver
(Inferred)



dollars spent globally last year. Global investments in exploration dropped by 19% year-on-year to \$9.2 billion, but in Peru the reduction was only around 3%. This can be explained partly by the importance of underground mining in Peru, where brownfield exploration is constantly necessary to replenish reserves, as well as by Peru's perceived advantages in terms of geology, legal stability and competitive costs for mining development. Nevertheless, overall expenditures are half of what was spent in 2012. "In Peru there are many underground mines that cannot afford to stop exploring. In general, large and medium sized mines have continued their activities, but if you look at the overall volumes, we estimate that less than 30% of the drilling rigs in the country are working, as opposed to over 80% a few years ago", said Sergio Cepeda, sales director of Boart Longyear's product division in Peru.

Junior Companies

The lack of funds has seriously hit the junior segment, which has been forced to find new ways of financing as the appetite of investors for equity in risky ventures has vanished. Today, juniors are looking at alternative methods of raising funds such as looking for partners to fund their exploration efforts. They are also trying to put small deposits into production, rather than spending more money to define bigger resources. A third method is to enter the tolling business, which Dynacor has been doing for many years.

A pioneer in gold processing since 1998, Dynacor is now finishing the construction of its second plant at Chala, which should start operating in June or July this year at an initial capacity of 300 to 360 mt/d, expandable to 450 and 600 mt/d in the future. "The new mill will allow us to significantly reduce our costs. Firstly, Chala will be connected to the national power grid, which gives us an average cost of \$0.08 per kilowatt hour (kWh), a third of the current \$0.25 per kWh at our Huanca plant. Secondly, Chala is located only 5 kilometers away from a major highway. This is important for our clients who will be trucking their ore to our facility and



Marcelo Santillana, general manager, Poderosa



Jean Martineau, president & CEO, Dynacor

will allow us to attract more miners", explained Jean Martineau, president & CEO of Dynacor.

While other companies, such as Inca One Gold, have decided to abandon exploration to fully dedicate themselves to gold processing activities, Dynacor remains active as an explorer, with Tumipampa as its flagship project. Martineau summarized the main developments on that front: "Last year, we focused on underground exploration including excavation of cross-cuts, drifts, raises and drilling. The main achievement in 2015 was the discovery of a large gold and copper porphyry system of 1,700 by 750 meters. We are now planning the next exploration campaign. We expect to have a 43-101 report between May and June 2016 covering the gold and copper mineralized veins and mantos only."

With regard to other juniors active in Peru, Duran Ventures also decided to generate its own cash through an 80% participation in the Águila Norte polymetallic and precious metals processing plant. Indico Resources signed a joint venture partnership with Aruntani, Peru's largest



Andrew Swarthout,
president & CEO,
Bear Creek Mining



Graham Carman,
president & CEO,
Tinka Resources

private gold producer, to fast-track its Irmin copper project (previously Ocoña) towards production. Lupaka Gold is already mining ore from its Invicta gold-copper property. A few months ago it completed its first run-of-mine bulk test of 342 mt. Peruvian Precious Metals is also beginning its mining activities at the Igor gold project. Meanwhile, Panoro Minerals has recently signed a gold and silver streaming agreement with Silver Wheaton to finance exploration activities at the Cotabambas project, while it has also published a PEA for the Antilla project. In the region of Pasco, Tinka Resources is analyzing the geology of its Ayawilca-Colquipucro project, with a zinc resource (to be updated this year) of 13.3 million mt at a grade of 7.7% zinc equivalent. The project is large and diverse because there is a tin-copper body underneath and a silver oxide cap on top. The company completed 9,000 meters of step-out drilling last year and the plan is to carry out a new 10,000 meter campaign to move towards a preliminary economic assessment phase by 2017. The budget for this year is between \$5 and \$7 million.

Tinka's president & CEO Graham Carman acknowledges that analysts have been anticipating an increase of zinc prices for years, but he points out that the trend is already positive in 2016. "Ayawilca is one of the very few decent zinc projects with size potential. There are some projects in difficult locations in the Arctic and Greenland, but there are very few projects coming online within mining belts with good infrastructure. A lot of the existing zinc mines are very old assets with grades going down and costs going up."

Tinka is backed by Australia's Sentient Group, owners of 21% of the company. Last year, the World Bank's IFC also joined as a shareholder. In terms of project ownership, Tinka has 100% of Ayawilca-Colquipucro, although there is a 1% royalty in place that the company can buy back for \$1 million.

Also on the silver and polymetallic spectrum, Bear Creek Mining continues with the arbitration process with the Peruvian government to recuperate its Santa Ana project, while it holds on to its very large Corani silver asset, for which a final feasibility study was completed last year. Bear Creek's president & CEO, Andrew Swarthout, thinks that a price of silver in the range of \$15-16/oz would not justify putting the project into production considering that it requires a capital investment north of \$600 million: "With a return on investment of around 10 or 12%, we would have a hard time getting a board to approve a construction decision. However, Corani's net present value (NPV) increases by about \$120 million and its rate of return increases around 2% for every \$1 increase in the silver price, so if we saw silver prices increase to \$18/oz, we would be able to comfortably take a construction decision. I think that is our threshold", said Swarthout.

Back to copper, Regulus Resources maintains its position in the AntaKori project, adjacent to Buenaventura and Southern Copper's Tantauatay mine and 7 km away from Gold Fields' Cerro Corona mine, in the district of Hualgayoc, Cajamarca. The project already has a 43-101-compliant resource of 295 million mt with grades of 0.48% copper, 0.36 g/



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mt gold and 10g/mt silver. John Black, CEO of Regulus, expects to replicate at AntaKori the success of the sale of the Haqira project to First Quantum Minerals in 2010. He explained that mineralization at Antakori is open in all directions except up: "This inferred resource is based on only 17,000 meters of historic drilling, so the size of this project will most likely increase substantially with further work. We are probably looking at a three to five year drilling campaign with 80,000 to 100,000 meters of drill core to identify how big the deposit is."

The short-term challenge is AntaKori's land position, as it intertwines with Tantahuatay's land. Regulus is working on potential agreements with its neighbors to do some collaborative exploration, but Black actually sees this as an opportunity rather than a challenge: "The location adjacent to an operating mine means that the project is essentially a brownfield opportunity and may be able to be advanced more rapidly than a stand-alone project located far from infrastructure. Once we finalize the agreements, we will be able to tell the size of the area that we are going to explore and how the permitting process will work between the different parties", he said.

Finally, not everything is metallic mining in Peru. By the coast in Piura, close to Vale's large phosphate operation, several companies are advancing other sizeable phosphate ventures. One of them is Fosfatos del Pacifico, a subsidiary of local company Cementos Pacasmayo that plans on producing 2.5 million mt/y of phosphoric rock for 20 years as part of an off-take agreement with Mitsubishi of Japan, which also owns 30% of the project. A construction decision is expected this year.

Meanwhile, junior company Focus Ventures has completed initial engineering studies to develop its Bayóvar 12 phosphate project, where it plans to produce direct application phosphate rock fertilizer (DAPR). The company completed a pre-feasibility study late last year and is currently working on an update to optimize aspects of the study that should further improve project economics. Focus is moving extremely quickly in advancing Bayóvar 12, especially considering that they completed a prefeasibility study in less than 2 years from drilling the first hole on the project.

David Cass, president of Focus Ventures, highlighted the project's key advantages: "Two key points for Bayóvar 12 are logistics and simple geology. Being a bulk commodity, a location close to tidewater and access to international markets is big advantage compared to many phosphate deposits. Bayóvar 12 is a flat-lying, sedimentary deposit simple to mine and upgrade to fertilizer by simple washing and desliming of the phosphate ore using seawater, without the use of chemicals. The current resource is considerable, over 430 million mt of 13% P205 with only 30% of the property drilled to date, meaning there is excellent potential to expand the mine life well beyond the 20 years outlined in the prefeasibility study. Finally, the project's location in desert away from major communities should allow for a straight forward environmental permitting process and project development."

New Leader in Precious Metals



Tahoe operates La Arena and Shahuindo Gold Mines in Peru

Personnel

- ✓ +72% employees are from local communities
- ✓ Paid ~\$23 million in employee salaries
- ✓ Paid ~\$15 million in employee benefits



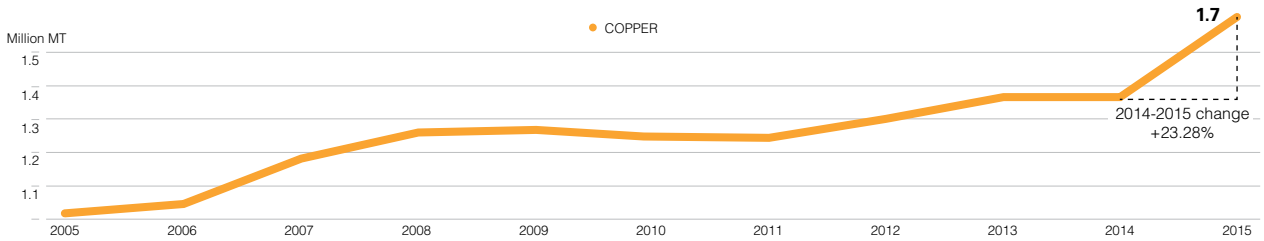
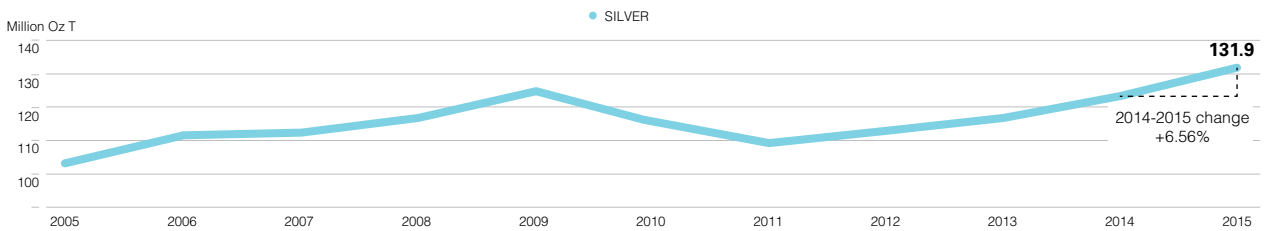
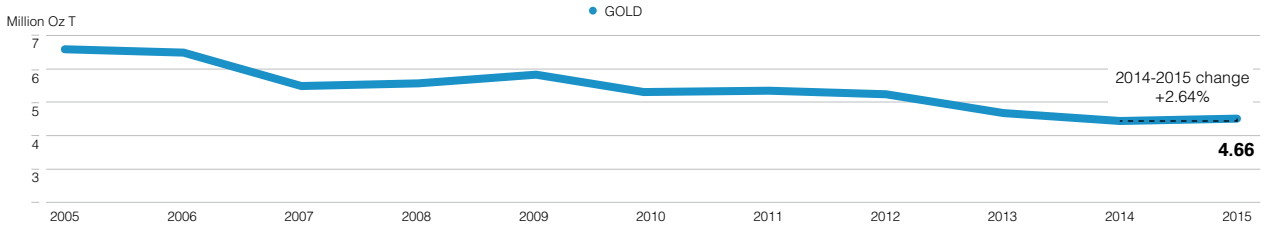
Social Investments

- ✓ Vocational Training Center
- ✓ Nutritional Anemia Prevention
- ✓ Guinea Pig Farming
- ✓ Livestock Vaccination Clinics
- ✓ Trout Hatchery
- ✓ Reforestation
- ✓ Water Programs
- ✓ Participatory environmental monitoring of air, soil and water quality with local communities



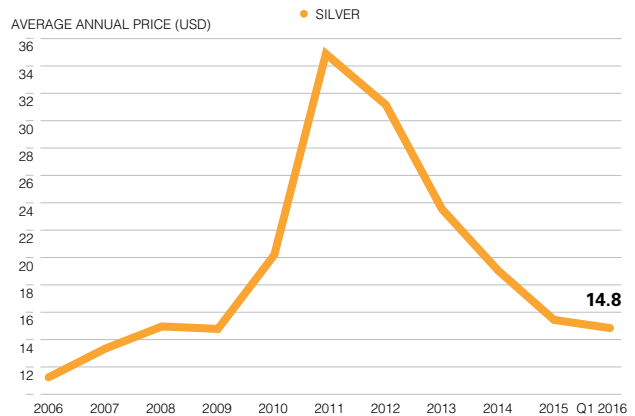
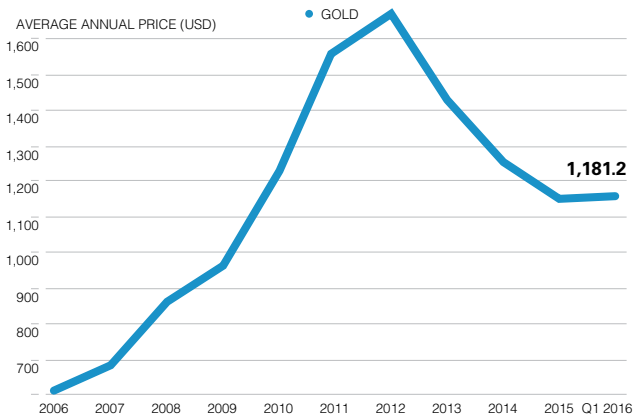
PERU, A DIVERSIFIED METALS PRODUCER

Source: Ministry Of Energy And Mines / GBR



GOLD AND SILVER PRICE CHARTS

SOURCES: KITCO / GBR



"All gold mines in Peru produce at costs below \$1,000/oz"

José Miguel Morales Dasso

President,
12th International
Gold and Silver
Symposium



The Gold Symposium started in the 1990s. What was the rationale behind this event?

As an industry, we decided that we had to attract new investments in gold projects, and holding the symposium was a good vehicle for that. Looking back, we have been quite successful. In 1992, Peru only produced 300,000 ounces (oz) of gold, and output reached a peak of 6 million oz annually. After a few years, we also decided to expand this effort to attract new investment in the silver segment because Peru is one of the world's key silver producers.

This 12th edition of the symposium comes at a moment of uncertainty, both in the metals market and in Peru's political landscape. What are the main topics of discussion?

The symposium comes at the right time because it is in these moments that the country needs a stronger effort of promotion. The conferences will start with an analysis of the international macroeconomic situation. Then, we will have expert speakers on the precious-metals market and, since the event will take place between the first and the second leg of the presidential election, we will have a battery of recommendations for the two runners-up. We would like to insist on the formulas that were very successful a few years ago and that have faced many obstacles in recent times.

Where does Peru's mining industry stand today?

The industry employs nearly 200,000 workers and, according to the Peruvian Economy Institute (IPE), for every job created in the industry there are nine more jobs created in the ancillary segments. So, directly or indirectly, 2 million people earn their livelihoods from the mining industry in Peru. Mining is a locomotive for the country and must continue to be strong. The government has created too many bureaucratic processes, the famous *permisología*. We do not want to avoid processes but, as Aristotle said, the answer is the desirable middle: neither too much, nor too little. The way to attract investment is not with tax

benefits, but ensuring that an investor can get permits and put a mine into production in 12-to-18 months.

How do you expect gold prices to behave in the medium term?

It is truly difficult to predict where gold prices will go, but the current trend is an upward trend. All gold mines in Peru produce at costs below \$1,000/oz, so any increase in prices will translate directly into profits, which is probably not the case in other parts of the world. We are not likely to see prices of \$1,800/oz in the medium term, but prices will likely stabilize around \$1,200/oz, which is good enough. I do not see the gold price going below \$1,000/oz.

In past symposia there have been talks about the role of recycled gold. Until when will the world need new gold from mines?

We will continue to have new gold deposits and new gold production. Although the amount of recycled gold present in the market increases every year, so does the demand for gold, so there is a need for new output. With emerging middle classes, there are more people willing to buy gold. Plus, there is a demand not just from the investing community, but from industrial uses of gold as well.

How do you see Peru's mining production evolving in the coming years?

Gold production increased in 2015, which is good news because gold was suffering from a declining trend in previous years. We are currently the sixth-largest gold producer. Silver production also increased and we are tied with China in second position; Mexico is number one. The decline at Yanacocha, which is expected to lower its production this year, should be mitigated with new gold production as a by-product in copper mines. Gold output is not likely to boom in the future, but it should remain fairly stable. •

Insights on the Gold Business

"Investors are seeing that the economies are not growing at the expected level; that currencies are not as strong as they thought; that interest rates are not high and could even become negative interest rates. On the other side of the equation, we have less and less discoveries, exploration is more difficult worldwide, heap leaching technology cannot go any further to exploit low-grade deposits, and the environmental and social restrictions are increasing. In one more year, I expect gold to be worth \$1,400 per ounce."

- Carlos Gálvez,
president, SNMPE / CFO, Buenaventura



"We are very enthusiastic for the long term. The demand is going to continue growing and the supply is decreasing. If you look at the last year, the movement of gold and silver prices directly correlated to what happened in the U.S. economy. If the economy gives a weak signal, prices go up. If the Fed says it is going to increase interest rates, prices go down. From a gold supply standpoint, we believe that if prices continue at the current levels, a few mines could potentially shut down, generating some potential upside getting into 2017."

- Ignacio Bustamante,
CEO, Hochschild Mining

"Right now, Barrick has the largest gold reserves in the industry. The idea is to maintain financial discipline and assess individual projects against our return on invested capital hurdle rate of 15%. If you want to reduce costs, you need to focus on the best assets and implement best in class practices. [...] We have patented the TCM-thiosulfate leaching technology; it is already operating commercially in Nevada, and it offers enormous potential, allowing for the exploitation of complex gold ore bodies."

- Manuel Fumagalli,
executive director, Barrick



"Gold has a luster that combines the sense of wealth and an emotional attachment. At times it is considered a safe haven for investors and also for buyers that actually want metal. At other times and for other people it is simply a commodity where traders bet on rising or falling trends. With the world ever more connected, the economic or political changes anywhere stimulate a faster response in the market. This gives a feeling of volatility."

Tim Williams,
VP Operations, Tahoe Resources

Engineering and Construction

The new focus on opex-related projects

Companies dedicated to the development of infrastructure projects are facing a very particular situation this year. On one side, low metal prices have discouraged new investment decisions in the mining industry. On the other, the general election is leaving in a limbo those projects that were paralyzed by social issues, such as Conga and Tía María, at the same time that public spending in infrastructure projects (roads, ports, etc) will only be reactivated once the new government is in place.

More specifically in mining, the reduction of backlogs has already hit the main engineering houses. In the words of Mario Marchese, general manager of Hatch: "Commodity prices are still low, so mining companies are cash-constrained. The question today is, 'how do we produce more without investing in new equipment?' Most of these efficiencies are achieved through debottlenecking and changes in the circuits that do not represent new capital expenditures."

Marchese pointed out that Hatch's project team had to downsize to adapt to the new market, while their services in operational performance have continued to grow in recent months, to the point that they currently represent 50% of the revenue in the Lima office. This has only been achieved by offering more competitive rates, though: "Mining companies have significantly adjusted their staff. Many of the people that left mining producers or companies like us have become independent consultants, who can offer services at very low costs, because these type of optimization projects do not require to be bankable."

Because these projects are smaller in nature, consultancy companies need to rely on a larger number of shorter projects to maintain healthy levels of cash flow: "During the boom years in mining, work flowed our way. Now it is us who need to go out and sell our services, and it is not a simple process for consultants. We need new business development skills



Operators are focusing on project optimization. Photo courtesy of Poderosa

"Mining companies have significantly adjusted their staff. Many of the people that left mining producers or companies like us have become independent consultants, who can offer services at very low costs, because optimization projects do not require to be bankable."

**- Mario Marchese,
general manager, Hatch**



that were not needed two years ago", said Alberto Coya, general manager of MWH, an international consultant specialized in wet infrastructure that has recently been acquired by Stantec.

Coya underlined the difficulty of planning in advance when clients are focused on the short term: "There is not one single mining company that can tell you openly how much they are going to invest this year in their different projects. They are not necessarily secretive about this. In most cases, they just do not know these numbers. They are handling cash flow

quarter by quarter, deciding what they can do and what they cannot."

Construction Services

Big construction firms are following the same pattern of chasing smaller projects as a way of maintaining their strategic relationship with the mining sector. If for engineering consultancies this has meant competing with independent consultants, large contractors with top safety standards and integrated management systems have also started to compete with smaller family-owned construction firms.



Global expertise serving the Peruvian mining industry



Ricardo Vega,
president, OHL



Diego Aguirre,
general manager, Esmetal

Antonio Ferreccio del Río, general manager of HV Contratistas, believes that the mining industry will win with the increased availability of large construction firms: "By hiring a formal, solid contractor, you get better productivity, you have no problems with the regulations and you do not need to provide finance to your contractor, so all these aspects need to be taken into consideration when calculating the overall project costs."

Yet large firms have had to adapt their cost structure as well, as high standards alone will not do the magic of winning new contracts. OHL, for instance, decided to invest \$20 million in new equipment last year, counter-cyclically, as a way to offer better rates to the market.

With this renewed fleet, the idea of the company, which previously undertook very large projects at Antamina and Las Bambas, is to win smaller opex-related projects. "Tailings dams need to add new capacity constantly, and gold mines need new leaching pads on top of their operation capacity expansions. We are already present in these types of jobs", said Pedro Romero, territory director at OHL. Diversification not only applies to the size



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“We have been working on the construction and startup of Constancia and Shahuindo, but right now there are not many new projects like these. The breakdown between mining operations activities and construction work is 50/50 at the moment, but moving forward into 2017 we anticipate mining to account for 65% of the total, reflecting the lack of investment in new projects.”

**- Steve Dixon, CEO,
STRACON GyM**



of the projects. At OHL's industrial division, for instance, one of the goals is to start working in operation and maintenance contracts for mineral processing plants, as they already do in Chile for Codelco and BHP Billiton. "The advantage for mining companies is that they get a fixed price per metric ton. As a contractor, we would make all possible efforts to achieve the best production rate", explained Ricardo Vega, president of OHL in Peru.

STRACON GyM, one of Peru's largest mining contractors, is also looking at new business models in order to win more work, while it increasingly looks at markets outside of Peru to offset the decrease of new large capital investments in the country. A project that exemplifies both strategies is the San Ramón gold mine in

Colombia, where the company has actually taken a stake in the project in order to help the client with the financing and obtain contract work in return. "We are not interested in becoming a mining company, but we will look to support projects where we can supply services and add value", affirmed Steve Dixon, CEO of STRACON GyM.

The company has mining contracts with Tahoe Resources for both La Arena and Shahuindo, while it has been doing extensive work for First Quantum's Cobre Panama project and Hudbay Minerals' Constancia. Traditionally an earthmoving and open-pit mining contractor, STRACON GyM wants to increasingly look at underground opportunities, like the aforementioned San Ramón mine by Red Eagle.

"We are looking for underground mining opportunities throughout the region. In Peru, this is a very competitive market. It is an old industry and the culture has not yet internationalized in terms of its development and the contractors base. The projects out there right now are very small, but some companies are starting to think differently and we want to position ourselves in this segment for the future", said Dixon.

Meanwhile, HV Contratistas, specialized in civil works and mechanical and electro-mechanical installations, is also evaluating entering the underground mining market, capitalizing on the expertise of their mother company in Chile, SalfaCorp. "In Chile, the group has a company specifically dedicated to tunneling and underground mining activities, called Geovita. This provides us with an excellent platform to expand to the underground segment", said Ferreccio del Río.

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PANAMA
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MEXICO



Enrique Sattler,
general manager,
Robocon

the gold segment in alliance with local contractor AESA for exploration tunnels at Yanacocha.

As underground mines extract ore from deeper locations, there is a need for new solutions to take the shotcrete down from the surface to the mine face: "In the main underground operations worldwide, operators have implemented solutions to transport the shotcrete via vertical pipes or 'slick lines' that reduce mining cycle times and the amount of people and vehicles required, as well as traffic and pollution within the mine", said Sattler.

One of the key areas in underground mining is rock support, and the mechanized application of shotcrete is increasingly widespread in Peru's mining sector. Enrique Sattler, general manager of Robocon, a specialized shotcrete contractor, explained that innovation has played an important role in increasing productivity in areas like compressed air supply and computerized systems to incorporate the different shotcrete additives.

Robocon works in Peru in different mining operations run by Volcan and Pan American Silver, and has recently entered

These pipes, with lengths between 200 and 1,000 meters, can save between two and six hours to transport the shotcrete, improving productivity in remote faces. "We are currently presenting slick line solutions to three mines in Peru, working in partnership with chimney drilling contractors, concrete technology and additives suppliers and engineering players, in order to provide the required support locally", added Sattler.

The electromechanical industry, very reliant on capital projects over the last years, is also reshaping. Esmetal, a manufacturer of metallic structures with



María Eugenia Parot,
VP Latin America,
Golder Associates

operations in Peru and Chile, only sees 30% of its metallic structures business going to the mining sector this year. As part of a strategic diversification plan, the company invested \$2 million in a new plant to provide painting services for new metallic structures or industrial maintenance for third parties.

While the metallic structures business has not decreased, the new coatings business already represents 25% of the total revenue. The company has also integrated vertically to do basic engineering, and also to provide installation services. "Up until last year, 95% of our business was just the fabrication of structures. With the new business units (engineering, installation, painting services) we are a completely different company", explained Diego Aguirre, general manager of Esmetal.



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The Environment: Samarco Lessons

In November 2015, the burst of a tailings dam in Mariana, in the Brazilian state of Minas Gerais, left 19 people dead and caused enormous environmental and social damage. The tragedy, considered to be the worst environmental disaster in Brazil's history, reminded the industry of the dramatic consequences potentially caused by engineering, construction or maintenance failures.

Leaving aside the hefty compensations that Vale and BHP Billiton are expected to pay over the next years (prosecutors in Brazil are suing for \$58 billion worth of damages), this accident triggered alarms about the sustainability of future projects, in a context where mines are becoming elephants that process huge volumes of ore every day.



Large mines require careful environmental management.
Photo: Toromocho pit, courtesy of Chinalco.

"Big mining companies are using technical review boards to supervise tailings facilities, to make sure that the existing infrastructure is safely built, enlarged and operated. With regard to new facilities, we need to generate very safe and cost-effective designs."

- Alberto Coya, general manager, MWH



A few days after the disaster, Golder Associates was hired by Samarco to provide assistance in environmental damage assessment and remediation strategies. The company has about 150 people working on this project, half of them in Brazil. "We developed a preliminary assessment of the impacts, which we used as a basis to prepare a detailed plan that is now under review by the Brazilian authorities. It is a very challenging project. From a resources point of view, putting together such a big team so quickly was not an easy task", explained María Eugenia Parot, vice-president Latin America at Golder Associates.

Parot affirmed that innovative technologies for tailings management are more present than ever in today's mining sector: "In response to the challenges of the mining industry, our solutions consider different technologies for tailings dewatering, transport, co-disposal, and backfilling into underground workings", she said. For Alberto Coya of MWH, "big mining companies are using technical review boards to supervise their tailings facilities, to make sure that the existing infrastructure is safely built, enlarged and operated. With regard to new facilities, we need to generate very safe and cost-effective designs for our clients."

Cost efficiency is indeed key in this context. An example of how new ideas can mitigate the ever-increasing capital and operational costs related to environmental management is given by French multinational Veolia, that is working with Chilean state-company Codelco at El Teniente in a project where Veolia takes the soluble copper out of the tailings and provides the concentrate back to Codelco. Christopher Howell, Veolia's vice-president Mining & Metals, calls this a "waste-to-value proposition".

"Some mines have a positive water balance and need to discharge

waste, typically converting it into solid waste that is easier to manage. If you cannot increase your footprint, you may want to remove the tailings from the storage facility to make space for new tailings. We are doing a pilot project in Brazil looking at a rapid, relatively mobile or modular dewatering technology. We are also looking at how Veolia can provide a process flowsheet as a service instead of a high capital cost item, providing a dollars-per-cubic-meter solution", explained Howell.

For the large size of the mines and the long lifespan of some of them, there will constantly be new projects to deal with the issues associated to the operations. Latin America has already become a key mining region and as such, it already has world-class providers to help solve these problems. The focus should be clear on how to ensure the industry is sustainable on all fronts: environmental care, human safety and economic feasibility. Disasters like Samarco's cannot happen again. •

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Equipment Providers

The search for higher productivity and better after-market solutions

From some of the largest open-pit operations in the world, to narrow-vein underground operations, Peru is an excellent market for the whole range of mining equipment. On the larger end of the spectrum, the main players are Caterpillar, Komatsu and Joy Global, but other brands are starting to focus on the Peruvian market, such as Hitachi and, more recently, Liebherr. The German manufacturer, that has already gained market share in Peru's construction business with its cranes, expects its 400 short ton (363 metric ton) mining truck, the T 284, to make a difference over the next years. "The T 284's electrical traction allows the truck to quickly get out of the pit through steep slopes, making sure that the equipment does not suffer and that fuel is used efficiently. As mines process more volume, using a smaller payload truck would increase congestion and push




Carlos Fonseca,
general manager,
Joy Global

haulage costs up", said Carlos Ballesteros, Liebherr's sales manager for mining. On the shovel side, models are also getting bigger to match the capacity of larger trucks. Liebherr has its R 9800 model, while Joy Global has the 4800XPC, with a payload capacity of 135 short tons. According to Carlos Fonseca, general manager of Joy

Global in Peru: "The 4800XPC is almost a proven product because it is similar to a 4100XPC but with a bigger capacity."


Fonseca also discussed the impact of the 2650CX hybrid excavator, one of Joy Global's latest developments: "It is a rope shovel without a cable; a hydraulic excavator with less hydraulics than a standard hydraulic excavator. It is diesel-electric with technology to capture the energy generated and re-use it to reduce diesel consumption. It will be very interesting to see this product enter the surface mining segment and compete with hydraulic shovels."

Joy Global is also applying this hybrid technology, acquired from Letourneau, to their underground equipment offering. The company has aggressive growth plans in underground hard rock mining after the acquisitions of MTI in Canada and drill manufacturer Montabert.



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Brian Doffing,
general manager,
Atlas Copco

With regard to Atlas Copco, the Swedish manufacturer anticipates a paradigm shift in underground mining development, according to its Peru general manager, Brian Doffing: "At a corporate, macro level, we see that mechanical rock excavation will increasingly replace drill and blast. We are doing a test in Chile in a mining project where instead of using a scoop and a drive-and-load method, we are using a Häggloader that has arms to feed the conveyor. We need to confirm if this method could be a good solution in underground mining."

Atlas Copco is also focusing on improving its technology platforms to enhance efficiency. In Milpo's Cerro Lindo, for instance, the operator is using Atlas Copco's Simba M4C with total ABC (Advanced Boom Control), where the pattern is loaded in, and the operator can sit back while the machine drills the long holes.

The Operations-Based Model

The larger installed capacity in the country as a result of last years' investments, and the more recent reduction of capital projects, have resulted in a stronger focus on the after-market segment.

According to Doffing: "Customers are increasingly looking at how to lower their cost per meter or cost per ton, rather than acquiring new equipment. We are offering a business model whereby our clients do not buy the equipment but pay for its use. We also have consignment contracts for consumables, so clients have the parts or tools available and it aids their cash flow. What I am curious about is if, three years from now, we will go back to the previous

model or if we will keep this operations-based model."

In the current scenario, after-market support is actually the strategy adopted by both new players in the market (such as Joy Global with their underground offering) and non-OEMs in order to keep a relationship with mining companies.

Austin Engineering, an Australian manufacturer of truck bodies that owns the Westech brand, entered Peru with contracts for Las Bambas and Antapaccay, and is now taking advantage of this market presence to capture service contract opportunities.

Tim Mitchell, general manager of Austin Engineering in Peru, explained that mining operators do not necessarily tie themselves to traditional OEMs. "We are proud to be the only manufacturer in the world that has been able to deliver a non-OEM tray for new Caterpillar 797F trucks."

The company is also working to improve the efficiency of existing running fleets: "A client in Peru had problems with 'carry back' in the OEM trays. This occurs when the material sticks at the back of the tray, so you carry 5 or 10 tons back and forth,



Marcus Hörberg, managing
director, Volvo Peru

wasting payload. Westech has a lot of experience reducing the carry back in the cold, sticky environments of North America. Hence we were able to provide a solution to reduce this problem in Peru", Mitchell related.

Beyond the Huge Trucks

In smaller payload needs, brands like Volvo and Mercedes-Benz also play a key role in Peru's mining industry. In 2013, Peru was the largest market worldwide for Volvo's FMX model, and, even if today the market has contracted, this truck continues to be

An advertisement for Normet. The top half shows a large white mining truck with a blue robotic arm in a tunnel. The bottom half shows a worker in a white protective suit and red helmet. The Normet logo is prominently displayed in the center, with the tagline "FOR TOUGH JOBS". Below the logo, there is a paragraph of text describing their services for shotcrete in mining and tunneling. At the bottom, contact information for Lima, Peru is provided.

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a key driver for the company. The latest evolution of the FMX was launched in late 2014.

"A very important new feature for the mining sector is the I-Shift automatic gearbox with an ultra-light crawler gear which we are launching this year. This provides exceptional startability for heavy-duty trucks in steep inclinations, reducing fuel consumption. There is a strong trend towards the I-Shift in the market, as opposed to the mechanic gearbox", explained Marcus Hörberg, managing director of Volvo Peru.

While several Asian brands have entered Peru's market for heavy duty trucks, premium brands still keep an edge. Also, as of this year, Volvo can offer the synergies of handling Volvo Construction Equipment's business, previously in the hands of a distributor.

"The cost consists of several elements. The price of the truck is just one aspect, and there we are never the cheapest option. However, Volvo trucks sell at much higher prices at the second-hand market. This is the result of the quality of the product, but also of the low levels of downtime, thanks



Franklin Pease,
general manager,
Normet

to the high availability of parts and service centers. This is key for mining companies", said Hörberg.

With regard to Mercedes-Benz trucks, the business is handled in Peru by a local distributor, Divemotor. Operating mines that are using Mercedes-Benz's Actros model include Vale's Bayóvar phosphate operation and Aruntani's gold operations. Like Volvo, which is investing to expand its service network in the country with new shops in Pucallpa and Chiclayo, Divemotor is also opening up new centers in Cusco, Piura and Arequipa. José Antonio Heredia,

manager of Divemotor's truck division, underlined the importance of a large service network: "Sometimes a vehicle of a certain brand offers some technical advantages, but if you do not have the right support and the truck needs to stop for a day, those advantages just vanish."

Better Performance

The mining industry truly works on a global basis. In this respect, technology and knowledge transfers are fundamental to continuously improve efficiency and safety. Normet, a Finnish manufacturer of underground equipment with a strong presence in shotcrete application processes, has recently invested in a simulator in Lima to train operators without having to use real machines and real shotcrete.

"We are constantly analyzing case studies from Finland, Canada and other locations in order to have the best results in the mine. Our job is to connect our local clients with other operators worldwide and generate benchmarking with other companies", said Franklin Pease, Normet's general manager. Pease developed on the huge impact that bad practices in shotcrete application can have on overall operating costs: "If a company uses 1,000 cubic meters of shotcrete monthly, at a cost of \$300 per cubic meter, this makes \$300,000 monthly. If 20% of that drops to the ground, you are throwing \$60,000 to the bin every month. This is the salary of quite a few people. Acceptable waste rates are 8 to 10%; if you are at 20%, there is room for optimization. On top of the wasted shotcrete, you are also spending more money on fuel, machines and people to transport that extra shotcrete around the mine."

While everyone agrees that training is key to obtain the best results of the different machines, the low cycle has actually intensified the debate between those who want high-tech equipment and those who prefer sacrificing some of the productivity that technology brings to the table, in favor of short-term lower costs. "Mining contractors prefer low-tech machines, while larger contractors and mining companies are more open to introduce new technologies. In times of lower metal

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prices, clients are focused on keeping a healthy cash flow by reducing operating costs and increasing productivity, but some clients also favor low-tech machines to do maintenance in house and save money there", explained Mario Lara, commercial manager for underground mining at Joy Global.

On top of the global players like Sandvik, Atlas Copco and now Joy Global, underground operators also have the option of buying from Resemin, a Peruvian manufacturer that sold 42 machines last year to mines in Peru as well as other countries like South Africa, Canada, India, DRC, Argentina, Chile and Mexico. Resemin's motto is to build 'uncomplicated' machines.

James Valenzuela, CEO of Resemin, summarized the company's most recent news: "We have developed the Barycenter system for long-hole equipment that allows for a better synchronization of the drilling and rotation axes. We have also consolidated our market position by launching the Muki, which is the smallest jumbo in the world, designed to replace the manual pneumatic jacklegs and significantly reduce rockfall-related risks. We have sold 10 Mukis over the last 14 months."

Moving forwards, the company has updated the designs of its long-hole machines and bolters, while it is launching a new product this year, Resemin's first scaler. "For the longer term, we also have plans to enter the hauling business with new models, but it will take some time. We want to grow sustainably so we need to go step by step", Valenzuela concluded.

Plant solutions

Mobile equipment is not the only area where efficiencies can be obtained. With increasing volumes, processing plants are becoming true monsters where tiny scalable improvements can translate into large savings in the long run.

Grinding is a key area of focus, as explained by Javier Castro, general manager of Moly-Cop, an Australian-owned grinding media manufacturer: "20 years ago, the largest ball mills had maximum diameters of 16 feet and engines of 3,000 horsepower. Today, Semi-Autogenous mills can reach diameters of 42 feet and use 30,000-horsepower engines. The impact conditions inside the mills are much higher today so the product that was used 20 years ago would not have a good performance today."

To respond to the increased demand in the country (the market for grinding balls has jumped from 180,000 mt/y in 2010 to 300,000 mt/y today), Moly-Cop is investing in a new 175,000 mt/y plant in La Joya, near Arequipa, to reach a total capacity in Peru of 350,000 mt/y. This will cover any demand increases over the next years, and also opens up export opportunities.

Moly-Cop has recently launched a new product, the NG SAG ball, made of special alloys as defined by the company's R&D department. According to Castro, Moly-Cop has served five of its customers uninterruptedly for 35 years, and there has been a lot of work behind to improve productivity along the process: "In 1990, we set up our first grinding laboratory in Peru. Also, we have developed software for mineral processing, called Moly-Cop Tools. We give that free of charge to all our customers, and we are constantly updating

"20 years ago, the largest ball mills had maximum diameters of 16 feet and engines of 3,000 horsepower. Today, Semi-Autogenous mills can reach diameters of 42 feet and use 30,000-horsepower engines. The impact conditions inside the mills are much higher today."

- Javier Castro, general manager, Moly-Cop



it; we also go to the mines to train operators on its usage."

Processing plants also offer big space to include new automation technologies. According to some estimates, only 1% of a project capex goes to automation, yet the impact it has on productivity is enormous.

Multi-national company Siemens is working to introduce new automation solutions to the market, trying to utilize the potential of the digital world to its full. According to Edwin Chávez, CEO of Siemens Peru, Ecuador and Bolivia, "automation needs to meet two goals: to improve the quality of the processes, and to acquire data that will allow the client to further improve those processes and reduce costs."

Chávez affirms that, in the mining industry, automation can play a key role in providing energy savings, while other parameters, such as temperature and pressure, can also be optimized to increase productivity in the processing plant. "This allows the operator to take the best decisions before it is too late. Without automation, you would need to reach the end of the process to introduce changes, at much higher costs."

Chávez further explains that labor costs are rising in Latin America, making the case for more automation, but that Siemens' vision is not to have plants solely operated by robots. "Our idea is to have automation systems, but also human talent intervening where it is more valuable: not in the manual part, but in the analysis of data," he concludes. •



Mining Services

Providers increase their value proposition

The last couple of years have not been easy for the companies serving the mining industry. Overall, they have had to give more for less, and this process is not over yet.

Things often happen for a reason, though; during the boom years, the industry paid salaries that were unheard of not long before, which inflated costs along the value chain. As the industry is reaching a new point of equilibrium, those companies that have adapted their cost structures and that are not hostage to large debts can look at the future with bright eyes.

The exploration segment is where it all starts and it has been the first victim of the low cycle. While operating mines have had to continue a good portion of their brownfield exploration efforts, generative exploration has been pretty much wiped out of the market, with a few exceptions.

Geotec, one of Peru's largest drilling contractors, only has 15 rigs

operating today, out of a fleet of over 60. The company is working at La Granja, Yanacocha, Marcobre and Antapaccay. Its general manager, Miguel Ángel Arenas, looks at the positive side of the crisis: "We were able to offer a better rate to the market thanks to achieving more efficient processes. Today, Geotec is able to compete in price with a small family drilling company. Our advantage in low periods like this is that, along with selecting the best equipment, we have also kept the best supervisors, drillers and technicians."

Peru's drilling market is estimated to be 1.2 million meters this year, which is less than half the amount in 2012. Market rates per meter are also far lower than four years ago. Out of the total 1.2 million meters, 60% comes from underground exploration, an area where Geotec has never been present. "We are losing out by not being present in underground mining. It is a significant



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Miguel Ángel Arenas,
general manager,
Geotec

market and we are evaluating entering the business this year, with a new technology that is not being offered in Peru yet and that allows you to drill more rapidly and efficiently. If we decide to work in the underground mining market, we want to offer a competitive advantage", said Arenas.

With the feasibility of exploration activities under pressure, adding value is also a recurrent theme for laboratories, which cannot obtain good margins just by providing the classic geochemical tests. Now, the idea is to think of metallurgy and production from the very first stages of a project, explained Luz Blancas, commercial manager of Certimin, one of the largest laboratories in Peru: "Providing test results in a commoditized way is not the way to go, you need to anticipate the clients' needs right from the moment they are exploring. Years ago, geologists were not involved in the metallurgical process, but today they want to know from day 1 if the mineral they have discovered is economically recoverable. You can easily save \$1 million if, instead of thinking of exploration and metallurgy separately, you plan them together."

By diversifying into metallurgical tests with a mini-pilot plant and investing to expand its environmental capabilities, Certimin is now positioned to offer an integrated value proposition. In the words of Miguel Caillaux, director of Certimin: "You can use part of the sample from the exploration campaigns for metallurgical tests, rather than having to obtain new samples. Obtaining a 20-30 metric-ton

sample for a classic pilot plant test is very expensive. Our mini-plant handles 10-15 kg per hour, as opposed to 150-300 kg per hour in traditional pilot plants."

SGS, a multinational company that also offers geochemical, metallurgical and environmental tests, as well as certification services for minerals trading, is also increasingly relying on metallurgical work to offset the decline of exploration activities. José Luis Alván, vice-president of SGS' Minerals business in Latin America, gave more details on this front: "We started our metallurgy offering three years ago in Peru and it has been a good process. We can do flotation tests, grinding tests and cyanide tests, among others. The only things that we do not have here are the pilot plant and the mineralogy services, which we have in Chile."

The Impact of R&D

The reduction of copper prices during 2015 brought pressures to the open pit mining segment. Rock fragmentation providers have had to offer new alternatives to achieve lower blasting costs as mining operations use large volumes of explosives on a regular basis. Peruvian blasting solutions company Exsa introduced Quantex in 2014 and clients like Southern, Yanacocha, Gold Fields, Hudbay and Tahoe have rapidly made the shift towards this technology. According to Gustavo Gómez Sánchez, Exsa's general manager, besides the operational and environmental improvements, the impact on the final bill is remarkable: "With Quantex we can save up to 50% in diesel consumption when preparing the explosive mix. Also, at the moment of applying the product, you can regulate the density you need depending on the type of rock; with the traditional heavy anfo, you cannot. Then there is the environmental performance: Quantex reduces significantly the risk of releasing red fumes while carbon emissions are also reduced. We have proven that we can reach savings of 30%. As an example, Southern Copper saved \$16 million over



José Miguel Ríos,
commercial lead,
Orica

the course of a few months by shifting to Quantex."

Surface mining represents 65% of Exsa's revenue. Gómez Sánchez explained that they are working on new developments to increase efficiencies for underground mining as well. Besides which, the company is completing the construction of a new initiations system in the country, which represents a \$40 million investment.

Another big player in rock fragmentation is Orica, a company that is serving large open pit operations including Cerro Verde, Las Bambas and Antapaccay. According to its commercial lead in Peru and Bolivia, José Miguel Ríos, the pressure to reduce costs in a context of lower copper prices is translating into better logistics and personnel management, and into a search for new technologies that can yield better productivity.

In operations like Toromocho and Las Bambas, for instance, the company is working on higher-energy explosives that can increase the amount of fine material (below one inch) obtained from blasting from around 20% to over 40%. "When you increase the amount of fine material, you are actually increasing the throughput by several percentage points, boosting productivity. This is where the money is", says Ríos.

According to Ríos, Orica has a market share of around 35% in bulk explosives and a 60% participation in initiation systems. The company is increasing its manufacturing footprint in Peru, as it is doubling capacity at its Congata emulsion

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*Miguel Caillaux, director,
Certimin*

explosive plant, near Arequipa, while it is also evaluating a \$12 million investment in a new plant in Southern Peru.

Outsourcing Services to Specialists

Peruvian miners are not as inclined as their counterparts in Australia or North America to outsource all sorts of non-core services, but they are increasingly realizing that they can actually save themselves a lot of headaches by doing so. Following a high-profile robbery of gold in Juliaca's airport last year, mining companies in the precious metals spectrum are looking at how to reduce those sort of risks from the moment they produce a gold bar until it is actually exported.

Hermes, a company dedicated to the custody and transportation of valuables, is going beyond the traditional 'point A to point B' transportation service to offer the complete vault management service within the mines. Marcos Olórtegui, director of Hermes' mining business, explained the advantages of this system: "Vault management works in a way whereby the client gives us the gold bar the moment it is produced and we take responsibility for it from that precise moment. This means that we actually operate the client's vault. At the same time that the risk of theft decreases, the mining company's insurance costs go down. Also, with the vault you can optimize the number of trips you need to take the mineral out of the mine."

The company is already providing this service to three mines in Peru and expects



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Marcos Olórtegui, mining business director, Hermes

potential savings are not worth the man-hours behind it. This is where the renting business has a big window for growth.

Avis, for instance, only started in Peru in 2013 and is expecting to close 2016 with a fleet of 1,200 vehicles. Its general manager, Fernando Martínez, affirmed that renting only represents 0.2 to 0.3% of the country's vehicle fleet, when 3 or 4% would be a more reasonable figure. While the target client for renting services are those companies that need replacement cars every two to three years, like mining companies, Martínez believes that many other businesses have a lot to win by switching to renting: "Today, companies do not buy computers; they go to one big brand such as Dell or HP and pay for a package that includes the renewal of the units every few years. The same applies to vehicles, because managing fleets is not the core business of companies."

In order to ensure the right fleet management as numbers grow up, Avis has obtained the ISO 9001 certification.



Fernando Martínez, general manager, Avis

to consolidate this offering with two more clients this year.

Although not as sensitive, the management of the mines' vehicle fleets can also become a nuisance. If, in the past, mining companies dealt with all the admin work attached to buying vehicles, managing the insurance policies and selling the used units in the second hand market, many mining companies and contractors have decided that the

As outlined in this report, achieving efficiencies is not just the result of cutting costs here and there. The mining operation has many phases and rethinking policies and strategies can pay off, especially nowadays, when there is a wide variety of specialized service providers that can deliver great performance at competitive costs. •

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Mining Safety

A mix of new technologies, better processes and a safety culture

The Peruvian Ministry of Energy and Mines' official spreadsheets on fatal accidents have two tabs. One looks at the total number of deaths and breaks that figure down into accident types, aseptically. The other one is tougher to digest: it lists all accidents one by one, including all the 'Ws': who, when, where, why? The 'what?' is always the same: someone, with name and surname, lost his life.

Macro statistics are very useful to identify the areas of focus for further improvements in safety standards. For instance, rockfall is historically the biggest source of fatalities by far, so companies know that more efforts are needed to mitigate the risks associated to underground operations.

However, not forgetting what the numbers hide (real people who left devastated families behind) is essential to continue improving safety statistics. Perhaps the key word is 'awareness'. Technology and processes have made great progress over the years, but any new worker that joins the mining sector needs comprehensive induction on safety, often from scratch. Without the proper leadership and safety culture, strict safety procedures can be less effective than initially thought.

"An external consultant will not necessarily improve safety trends. What matters is the working culture, the leadership, and the ownership of safety issues", affirms Marcus de Monzarz, vice-president Sales Andean region and Peru country manager at Sandvik. "At the end of the day, it is the worker who takes the decision about an action being safe or not," continued de Monzarz. "Factors such as the pressure from the client, the pressure from the boss, the fact that I want to get home as fast as possible, all play a role. [Changing the culture] is a bigger

effort than a marathon, it is an ultra iron-man: we need constant behavioral change."

Ignacio Bustamante, CEO of Hochschild Mining, added: "The problem to solving safety issues is that in Peru it is very difficult to create a safety culture. People tend to think that someone else will take care of them, so they typically do not question the commands they receive from their superiors. If workers feel a situation is not safe, they have the right to stop, but it is not easy to make sure they all understand that".

28 people died last year in Peru's mining sector, as opposed to 32 in 2014 and 47 in 2013. This figure includes traffic accidents by people going to work or getting out of work (for benchmarking, in other countries like Chile traffic accidents are not included as mining fatalities). Fernando Borja, manager of Peru's Institute of Mining Safety, commented on this result: "Since we have records of this figure dating back to the 1970s, we can say that this is the first time that we have less than 30 fatalities. As long as a single life is lost, there is a lot of work to be done, but it is good to see that fatalities are decreasing on an annual basis. The improvement is not only seen in the absolute numbers, but also in the ratio of deaths per 10,000 workers."

Asked if the tougher negotiating position of mining operators in front of their contractors could be having a negative effect on safety, Borja refers to Frank Bird's Loss Control Management philosophy: "Over the last few years, we have had periods of high metal prices and low metal prices. Yet we have seen a continuous trend towards a reduction of accidents. Accidents, besides the painful loss of human life, cause material losses as well, so preventing them is the best way to reduce costs."



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Antonio Ferreccio del Río, general manager of HV Contratistas, a construction company, agreed: "Safety is the most important thing. It is not just about the value of human life: accidents have a negative psychological effect over the rest of the workers and, as a result, productivity decreases. Also, there are medical expenses and the project can be stopped by the authorities. It is always more efficient to do things right from the beginning."

The Role of New Technologies

Going back to the 'where', it is a fact that underground mining is the riskiest environment for workers. Rock fall alone caused nine deaths in 2015, or 28% of the total. Generally speaking, the trend towards more mechanization in underground mines continues, and the efforts in terms of safety training and awareness are bigger than ever. Perhaps the area where the low cycle is putting a brake is in the development of more sophisticated technologies.

In the words of Brian Doffing, general manager of Atlas Copco in Peru, the bottom line should be "getting the operator only as close to the face as they need to be".

In this respect, tele-remote systems could mean transformational change; however, the pressure on cost reduction has caused many operators to shy away from ambitious technology changes. "Safety standards have not gone down, but probably the investment in these new technologies is being delayed by the market situation", said Doffing, who points out that most of the interest in tele-remote systems has come from the surface mining side, where clients have bigger financial shoulders.

Doing a better mapping of what is beneath the surface can also result in better safety tools and strategies. Alberto Pazos,



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general manager of DSI, a multinational player specialized in rock support, gave more details: "It is in the prevention area where a lot can be done; for instance, developing the right geological studies that will define the best support solution for each particular mine. The problem is that this is costly and sometimes it is not feasible because some areas are not even accessible."

The industry is full of examples where innovation is making a difference. Fatigue-detection systems based on eye-blinking are increasingly being installed across a variety of mining vehicles. The availability of smaller jumbos, such as the Muki by Resemin, a Peruvian equipment manufacturer, is driving the change towards mechanization and the elimination of dangerous manual mining methods; and tele-remote systems may be taking slower than expected to penetrate the market, but they are progressively being adopted. Water solutions company Xylem, for example, is developing a remote dewatering system

"Over the last few years, we have had periods of high metal prices and low metal prices. Yet we have seen a continuous trend towards a reduction of accidents. Accidents, besides the painful loss of human life, cause material losses as well, so preventing them is the best way to reduce costs."

- Fernando Borja, manager, ISEM



for an underground mining operator after a successful project on the surface side with Cerro Verde.

Carlos Coll, sales manager at Xylem, gave more insights about these systems: "Today, our client needs 50 to 100 people going around the tunnels and checking the pumps, taking measurements and turning them on or off. With a remote monitoring room, you would need a maximum of 10 people. This would improve productivity and safety because less people would be exposed to the risks

of underground mining".

Over the first quarter of 2016, 8 people have already lost their lives in Peru's mining industry. Projecting that number over four quarters, we would be at the same levels of 2015; yet, the first three months of the year are traditionally the ones that concentrate the highest number of fatal accidents, so, with the increased effort by the industry and all the workers, we should hope for the best over the rest of the year. Stakeholders should not rest until the figure is zero. •



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MAIN TOPICS

- Consulting Mechanisms
- Social Development
- Multi-actor Dialogue Arenas
- Demolishing Myths

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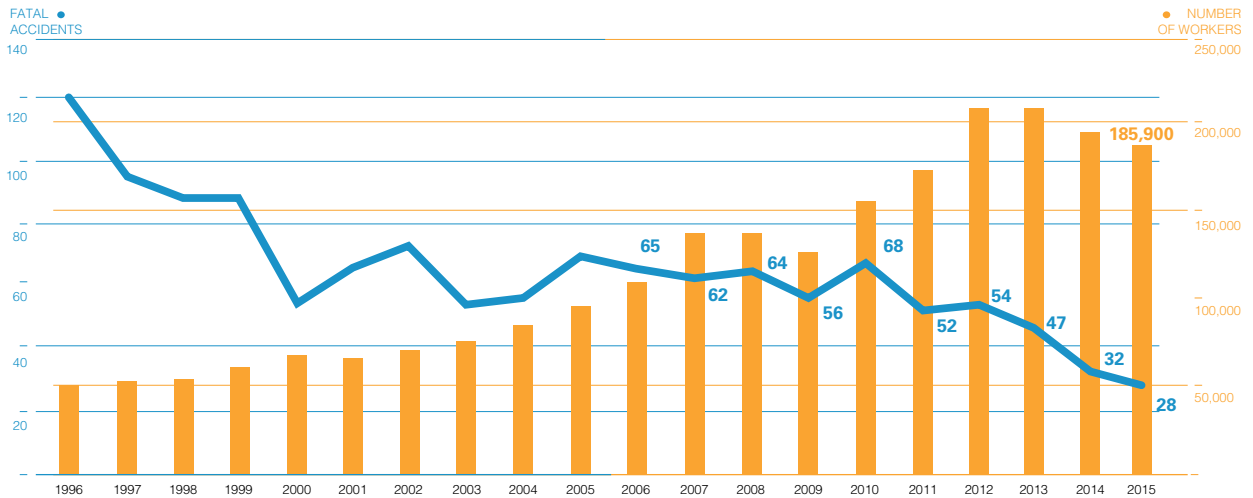






FATAL ACCIDENTS vs NUMBER OF WORKERS

Source: ISEM



Safety: Leaders Have their Say

"Working on safety every single day is an essential factor to our success. We draw a lot upon the bigger company for the worldwide procedures that we have learnt over many years, and work on our own safety programs on site as well. We encourage people to stop working if they see an unsafe operation, but people in Peru often do not get that message in other industries, so it takes time. As of today, we have developed a very strong safety culture, and Cerro Verde has one of the best safety records around Freeport-McMoRan."

- Bruce Clements, president, Cerro Verde



"We focus on mechanizing and modernizing our operations with a goal to make them safer to mine. Today's modern mechanized mining methods allow for bigger openings, bigger equipment and installation of modern ground-control systems to prevent rock falls with more reliability than older methods. Our safety record has improved dramatically and we believe this is also the general direction that mining companies in Peru are taking while cooperating with the increasing standards the Government requires."

- Steve Busby, COO, Pan American Silver

"Safety is in our DNA because we handle explosives in our operations and mining presents serious risks. We have a strategic alliance with DuPont in our training center, the Blasting Technology Center. What we are trying to do is go beyond the quality and the safety of the products, as well as beyond the safety processes, to touch upon the conduct of all the workers."

- Gustavo Gómez Sánchez, general manager, Exsa



"In Las Bambas we completed 15 million man-hours without any lost-time incident (LTI). In Antamina we had a smaller project but we had 1,000 people at some point and we had 1 million hours without any LTI. For us, adapting to the safety requirements of the mining industry was a great process and we have taken these high standards to other infrastructure segments."

- Pedro Romero, territory director, OHL

Community Relations

Building trust does not happen overnight

The issue of social conflicts related to the mining sector is nothing new. While the press typically focuses on high-profile cases, like the recent awarding of the Goldman Environmental Prize to Máxima Acuña, a farmer in litigation with Yanacocha over a plot of land, there are many disputes that people in Lima never hear of, unless violence and clashes erupt.

According to Peru's Ombudsman Office, which publishes every month a snapshot of social conflicts, in March 2016 there were 208 conflicts in the country. Of these, 146 had to do with socio-environmental issues, and within this group, mining-related disputes accounted for 93 of them.

Among the factors explaining these conflicts we may find past environmental mistakes by the industry, low profile communication policies, hidden political agendas by anti-mining activists, the absence of State representatives in rural areas, and the incompetence (or even corruption) of authorities to invest the tax money in sustainable projects.

Each conflict should be analyzed on a case-by-case basis, avoiding simplistic generalizations. Yet both the central government and the industry should reflect on what needs to change at a macro level as well. It is shocking that modern, formal mining operations in Peru have been developing for more than two decades in the country, yet in the past presidential poll Gregorio Santos, an outspoken anti-mining activist who happens to be in jail, managed to get 40% of the

vote in the Cajamarca region. Social unrest does exist, and it needs to be addressed.

What Mining Companies Can Do

Social conflicts in the mining and energy industries are not exclusive of Peru. Cases of disputes can also be seen in Chile, Australia or Canada. Peru, however, presents its own particularities due to the striking inequality levels between the coastal regions and the Andean areas, where most of the mines are.

The mining industry is right to argue that it is already the largest contributor of income tax money to the State's coffers, and that it should not be its responsibility to build roads, hospitals and schools. The unsettled reality, however, is stubborn, and change is not happening as fast as it should. In this context, mining companies have learnt that they actually have a lot to lose if they do not go the extra mile when it comes to corporate social responsibility initiatives.

Beyond compliance with the already strict environmental and social regulations, the opportunities to improve local living standards are multifold, and go from healthcare and education, all the way to improving pastures and helping local businesses. All this, however, should be done in coordination with authorities at all levels, ensuring that the mining company is not seen as a piggy bank but as another neighbor in the community, who contributes with taxes,



*Cerro Verde's water treatment plant benefits the wider community in the Arequipa region.
Photo courtesy of Cerro Verde.*

local employment and with expertise in project development.

Canadian company Bear Creek Mining was stripped off its license for the Santa Ana project back in 2010 after a general strike ended in violence. Since then, the company has been trying to get damages from the Peruvian government through an arbitration process, but it has also been actively working on its social license for the larger Corani silver project in Puno, a \$600-million capital project.

Elsiarío Antúnez, COO of Bear Creek, gave more details on the company's social projects: "For the last years, we have been working on three main pillars: education, health, and sustainable productivity. Back when we started in 2007, education levels were extremely poor; probably only 5% of the people could read and write. Now, the local Chacaconisa and Quelccaya schools have received educational quality awards for three consecutive years from the Puno region."

"In terms of health, we helped reduce newborn mortality rates from 30% in 2010 to less than 5% today. Finally, we have worked on alpaca wool projects, improving the quality of the wool and helping producers export directly to Europe instead of selling locally to traders. Before, they were paid \$4 per pound of wool, and now they can sell for \$70 to \$100 per pound", Antúnez explained. In May 2015, the Peruvian government announced a \$20 million investment program in infrastructure in the Corani district. Antúnez said that Bear Creek was instrumental to act as a bridge between the local community and the State authorities, in order to unlock sanitation and housing projects in the area.

The Water Issue

Corani's latest feasibility study incorporates a very interesting concept that is fairly new for large volume operations: the use of dry stack tailings, which means the mine will not have a tailings dam. Andrew Swarthout, president and CEO of Bear Creek, assures that water was never an issue at Corani, yet this technological innovation "can reduce the environmental impact of Corani even further".



*Alpaca wool producers in the Corani district.
Photo courtesy of Bear Creek Mining.*

Leaving aside the potential risks of tailings dams management, the use of water itself is a recurrent source of disputes between mining companies and rural people in the surrounding area. The conflicts over Conga, where the construction of alternative reservoirs failed to convince the local communities, or over Tía María in the fertile Tambo valley in Arequipa, are cases in point. The industry, however, has proven that it can successfully implement initiatives that create synergies in water usage. Milpo was a visionary company in this respect, when it implemented the country's first desalination plant at Cerro Lindo in 2008. Today, Cerro Lindo is the company's flagship operation, and is expanding yet again to reach 20,000 mt/d of processing capacity.

In the south, Cerro Verde realized that, at the same time that it assured the supply of water required for its expanded operation, it could help the city of Arequipa, as most of the raw sewage was going directly into the river. So, it built a brand new treatment plant to clean up the water and take one cubic meter per second for its own process. "One of the big upsides of the project is that, because of the quality of the water that farmers downstream were getting before, they could not meet the export standards

for produce. Now, with the improved quality, they have a wider choice in terms of what they can produce", said Harry Conger, president and COO Americas and Africa Mining at Freeport-McMoRan.

Bruce Clements, president of Cerro Verde, further developed on this: "Farmers in Arequipa use approximately 71% of the available river water. We use another 10%, and the city, the remaining 19%. There is more water than people believe there is. Many farmers are using flood irrigation systems that are not efficient. By increasing efficiency, they could expand their cultivable land. We can certainly help them in this process."

Mining is a central activity for Peru and it plays a key role in its economic and social development. Arequipa, for instance, is seeing remarkable growth, thanks to Cerro Verde and the pool of providers that are investing in plants and service shops in the region. The challenge will be to replicate that across the whole Andean region. In this context the industry, the authorities and the communities should all work together to ensure that mining continues to develop in a sustainable manner, respecting the environment and helping reduce income inequality. •

"Peru is a pioneering country in social aspects"

What is the objective of this year's Community Relations Congress?

The Community Relations Congress is an initiative that will count with the participation of local and international experts and academics, and that aims at providing training to the professionals involved in community relations. This is an area that has been identified as strategic by the industry. If you do not have a good community relations strategy, it does not matter if you have the best deposit, geologically speaking, or open access to finance: the project will simply not go ahead. We want to show that Peru is a pioneering country in social aspects. The country had its mining boom in parallel to its reconstruction phase after a long period of violence. When mining investments started, poverty rates were very high. This is why we were able to build capacities faster than in other countries.

One of the themes of the Congress revolves around consultation processes. Where does Peru stand in this respect?

One of the greatest challenges for the coming years is the previous consultation process for mining projects. It is already affecting some oil and gas projects, but for mining it is something new, even though Peru was one of the first signatories of ILO's Convention 169. This process is handled by the State and helps overcome the challenge we had before of not having any State presence whatsoever. The State has the obligation to listen to the local communities and help solve their concerns with concrete initiatives. The problem is that the process is seen by many as an opportunity to veto projects, and this is not the case.

How do multi-actor mechanisms work?

Multi-actor spaces should be a widespread practice around the country. This has probably been the best heritage of the current government and comes from the need to bring the State authorities right to the areas where they receive a big chunk of tax revenues; so right by the mines. The State needs to come with all its actors, not just the Ministry of Energy and Mines, but also Health, Education, Housing, Justice, etc. This needs to be implemented at the beginning of projects, before any conflicts may come up. Other positive results of this collaboration are a better management of tax revenues and the increased awareness among civil servants of the importance of these mining projects. At the other end, the mining company can bring its expertise to the table in development projects while it can defend its rights as a resident in that particular district.

Gonzalo Quijandría

President,
3rd International
Community Relations
Congress



Talking about social development, do you think the voluntary contribution program should be reinstated?

The voluntary contribution program worked well 10 years ago, at a time when the authorities were unable to efficiently spend the money from the mining canon. Today, processes are still slow on the government side, but there are alternatives to voluntary contribution, such as the Works for Taxes program or other types of public-private partnerships.

Another issue in social development is how to increase job creation within the communities. This is one of the main demands to mining companies and the challenge is to give as many jobs as possible locally, when the people do not have the required skills. There is a great opportunity to provide training in advance.

What are the main 'mining myths' to be deconstructed?

One of them is that mining is not very important for the Peruvian economy. We have seen a clear example recently, when we ended 2015 surprisingly well in terms of GDP growth thanks to Cerro Verde and Las Bambas. No other sector can contribute as much as mining. Some people argue that the core of the Peruvian economy is services and trade, but why do we have all those services? The mining industry creates nine indirect jobs for every direct job.

Water is another myth. Peru is one of the countries with the highest water availability and the mining industry has successfully implemented initiatives to transfer water resources to desert areas. Finally, another myth is that mining affects people's health. If you do things right, there will not be any health issues. After many years discussing about the animals that died around Tintaya, the government has stated that it was the bad quality of pastures and the presence of parasites that killed the animals, not anything to do with the mine. The mining sector has actually been very good, historically, at promoting livestock activities. •



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www.gbreports.com

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Project Directors: Alfonso Tejerina, Laura Brangwin

Reporters: Alfonso Tejerina, Miguel Pérez-Solero, Katya Koryakovtseva

Project Coordinator: Katherina Prügel

Editor: Mungo Smith

Graphic Designers: İnanç Duman, Özgür & Deniz, Gonzalo Da Cunha

General Manager: Agostina Da Cunha

Cover Photo: Courtesy of Poderosa