RENEWABLE ENERGY AND CHILEAN MINES: A MARKET OVERVIEW

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By Elizabeth Judd

For a relatively new and untested renewable-energy market, Chile has a remarkable number of strengths.

The country has incredibly attractive solar resources, according to Joel Link, vice president of development and global head of mining development for SolarReserve. "The Atacama Desert, in northern Chile, has arguably the world's strongest solar resource," he says, noting that this area also happens to be home to the lion's share of the country's mining activities.

In addition, parts of the country are extremely appealing to wind farm developers. Dominic Duffy, chief operating officer for Mandalay Resources Corp., which runs the Cerro Bayo silver and gold mine in Patagonia, says that in this part of Chile, "the choice is very easy. The wind never stops, and it's a very strong wind."

Duffy points out that Chilean mines face a clear challenge: the country is running short on energy. "One of the directions that the country has to go," he says, "is using renewable energy sources, such as wind and solar energy. You see more renewable companies coming to agreements with operating mines."

Large renewable energy projects for major mining companies, including Pattern's projects with Antofagasta and SunEdison's with CAP, are demonstrating that alternative energy can be a very viable option.

RENEWABLES & MINING SUMMIT AND EXHIBITION

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Chilean mines are actively seeking new energy solutions to reduce and secure energy costs for grid-connected and off-grid operations. With energy accounting for 20-40% of operating costs, reducing electricity expenditure is a now a major operational and strategic goal for Chile's mining leaders and renewables is set to play a significant role in meeting this aim for remote and grid-tied mines.

Following sell-out events in Toronto and Johannesburg, the 4th Renewables and Mining Summit & Exhibition will showcase the latest renewables-mining projects from Chile and address the key challenges for additional projects including innovative finance solutions.

Join Nelson Pizarro Contador, CEO of Codelco, and Fernando Reitich, President and CEO of CAP plus representatives from mines including:



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Joel Link SOLARRESERVE

And renewable energy advocates -- perhaps for the first time in history -- are now able to boast that solar and wind might be able to deliver cost savings. "Mines are interested in having lower operation and maintenance costs and decreasing the costs related to energy," says Daniel Rosende, managing director of SMA South America SpA (SMA Solar Technology AG subsidiary in Chile). "As an option, to generate energy with solar today is cheaper in Chile than conventional sources (i.e., diesel, gas, coal)."

Yet for all this promise, the renewables market is only now gaining a foothold in Chile -- and there are obstacles ahead. Mines struggle to sign contracts with solar and wind developers when the mine life is only a few years, and getting PPAs finalized continues to pose a challenge.

Understanding the Market

Typically, mines compare renewable energy costs to conventional, fossil-fuel-based generation, either natural gas from LNG regasification or coal-fired plants, explains SolarReserve's Link. With a wealth of energy choices, "price" usually tops a mine operator's wish list. "Price is very important. As commodity prices are depressed recently, it puts more margin pressure on mines to be profitable," he says.

"Energy can be anywhere from 15-40 percent of the operating budget for a mine," Link continues, "so ^{(Price is very important.} As commodity prices are depressed recently, it puts more margin pressure on mines to be profitable."

many mines are looking closely at the energy expense." He points out that Chile does not enjoy a superabundance of indigenous fossil resources and imports most of the coal and natural gas used. According to the law of supply and demand, the need to import conventional energy drives up prices. He draws a contrast to Peru and Argentina, which he describes as "gas-rich countries," and notes that solar can often compete on price with fossil fuels in Chile.

In 2012, Collahuasi, which operates on the electricity grid, put out a power tender and eventually signed a PPA contract with SolarPack, which now provides around 13 percent of electricity demand. In total, Collahuasi's solar energy consumption totals 60 gigawatts per year, says Verónica Cortez Silva, superintendent of strategic supplies at Collahuasi.

"With the power tender, we wanted to know more about the market for renewables," says Cortez Silva. "At that



"If developers have good and fair prices, they could increase their share in this market."



Verónica Cortez Silva **COLLAHUASI**

time, we only knew about the high prices that renewables had. The only way to test the market was through a tender." She continues: "It was the first power tender only for renewables in Chilean mining companies."

Cortez Silva points out that price is absolutely key to the success of renewable developers as they make their pitches to Chilean mining companies. "If [developers] have good and fair prices, they could increase their share in this market," she says. "We know that development costs have decreased over the past five years, so we want to see it."

Rosende underscores that economic factors, ranging from the price of commodities to that of energy, also affect the mining market. For mining companies, commodity prices, which may fluctuate wildly, can influence how much capital is available for investment. The price of various forms of energy is another key factor in decision-making.

Finally, Link points out that a sense of corporate social responsibility is increasingly a factor in decisions at Chilean mines. "Many mining companies view renewable energy as a way to do something good for the environment because they're extractive and altering the landscape."

An Eye on New Technologies

Mines are not always acquainted with all the applications for renewable energy. César Belaúnde, general manager at Enermine, points out that his company uses solar energy not for generating electricity but for generating heat that's necessary for some critical mining processes. "There's a lot of interest," says Belaúnde, noting that generating heat through solar energy can help mines reduce costs.

Intermittency from renewable-energy sources continues to be a sticking point for mining companies. Collahuasi's Cortez Silva points out that mining companies can only invest in a limited percentage of energy that's tied to the sun shining or the wind blowing. "Today, SolarPack supplies around 25 megawatts in the peak hours, the hours with sun, but we don't have more space to add other contracts" with the same characteristics because the mine operates around the clock.

Many experts believe that improvements within storage technology are helping alleviate the intermittency problem. At SolarReserve, for instance, the company has a baseload 24-by-seven offering. "A mine does not stop running at night, and so it needs a constant, firm source of power-- on demand," says Link.

He explains that SolarReserve is deploying breakthrough technology to efficiently and cost effectively store solar energy, so electricity can be dispatchable to meet demand whenever needed. This solar technology is a viable alternative to baseload coal, nuclear or natural gas burning electricity generation facilities, without the environmental impacts and volatile fuel costs. The offering is a fully integrated energy storage solution, where molten salt is the working fluid that both captures the sun's thermal energy and stores it until electricity is needed – 24 by seven.

Signing a PPA

Getting PPAs signed in Chile can be a tall order. "We have seen that our customers -- developers and other investment companies -- are having big challenges closing projects because of PPA timeframes, permitting, and the non-availability of financing," says SMA's Rosende.

When Link approaches a mine, he looks for investment-grade operations with stable balance sheets because those are the types of operations a bank will finance.



"We always wanted to put in renewable energy, but couldn't get a partnership with anyone willing to commit on such a mine life."



Dominic Duffy
MANDALAY RESOURCES

He notes that the greatest challenge in getting PPAs finalized is the frequent "mismatch" between the life of the mine and the number of years necessary for developers to recoup their capital investments. Link explains that a solar plant would typically target a 20-to-25 year PPA and yet that's usually a far lengthier time horizon than mining companies are willing or able to commit to.

Mandalay's Duffy has witnessed firsthand how conflicting business needs affect the development of renewable energy projects. At Cerro Bayo, energy constitutes 20 percent of total costs. The mine is remote, and the company has therefore relied on diesel, which is trucked and barged to the site for power generation.

Because of the outstanding wind resource at Cerro Bayo, Duffy has explored wind generation for the past three years. "The issue that Cerro Bayo always had was that it didn't have large enough reserves or a long enough mine life to justify the capital pay-down of construction," he says.

When further exploration at the site suggested that the mine has six-to-seven years of life, it then became feasible to work with a wind developer. Mandalay has contracted with Rame Energy, which started construction on a 1.8 MW wind farm in December.

"We always wanted to put in renewable energy, but we couldn't get a partnership with anyone willing to commit on such a mine life as we had previously," says Duffy. He believes that renewable energy developers in Chile should focus on smaller operations given that this market is under-served.

What the Future Holds

Rosende believes that developers and renewable energy stakeholders need to actively educate mining companies about all the various renewable technologies (for instance, solar photovoltaic integration with other energy sources -- hybrid and storage solutions. He emphasizes that the renewable energy sector in Chile is "quite new" and awareness will come gradually over time.

Meanwhile, Link is sanguine about the prospects for renewable energy in Chile. "There's a lot of pent-up investment appetite for Chile. As these new mines are developed and as commodity prices rebound, there will be commensurate requirements for more power supply," he says. "And as a result, you'll see more renewables integrated with mines in Chile."

That said, Link acknowledges that developers need to temper their enthusiasm with an understanding that mines are rightfully cautious about signing multi-year contracts. "Patience is a big part of renewable developers being successful with mining companies," he concludes. "It's going to be a long, steady journey to success as opposed to a very fast path."

Renewables and Mining Summit and Exhibition, May 6-7, Santiago. Details at **www.energyandmines.com/chile**