



## Applications & Installations



Photo: Neoen

The 10.6 MW solar and 6 MW storage system at the DeGrussa gold-copper mine in Western Australia is the largest off-grid solar and storage system powering a mining site. The system was developed by Neoen for the mine owner, Sandfire Resources.

# Renewables and mining

**Remote off-grid systems:** The mining industry creates the raw materials that make up the technologies powering the energy transition. For example, every megawatt of solar PV requires four metric tons of copper to build. Increasingly, these renewables are powering the mining operations that create their source material. However, transitioning the mining industry away from fossil fuels will require renewable developers to speak the language of miners, and to sell renewables on the value they provide beyond a lower cost of electricity.

Estimates for the mining industry's energy use range from 1.25% to 11% of global energy consumption. The mining industry's significance as an energy consumer makes it a critical part of any decarbonization strategy to mitigate climate change.

Global mining firms have begun to understand the value of renewable energy, as 1 GW of renewables has already been built at mining sites across the world, with another 1 GW in the pipeline. A recent report from the Rocky Mountain Institute estimates that 180 GW of renewables would be required to meet only the electricity needs of mining sites, or 32% of total energy consumption. Fully decarbonizing the entire mining industry would require further electrification of mining operations, and the deployment of more renewables.

To accelerate renewable adoption to this level, mining industry stakeholders must see renewables as a strategic solu-

tion to key problems within their industry. Educating the mining industry about the value of renewable energy will require renewables developers to start speaking the language of miners. They must make a concerted effort to tailor their marketing and service offerings to the needs of mining companies.

### The value of renewables

Energy has always been fundamental to mining, even before prospectors were blowing up rocks with dynamite. Today, energy makes up 15% of total production costs, with that share rising to as much as 40% in some metal mines. This means that energy prices and price stability are among the issues that will contribute to the long-term profitability of mines.

Energy's share of costs has increased in recent years and will continue to increase, as demand for metal and minerals has pushed mining companies to more remote sites with lower-grade ore.

The higher energy usage from processing lower-grade ore and electrifying remote locations is partly responsible for the stagnation in the energy productivity of the mining industry.

In its comprehensive 2017 summary of mining industry trends, Deloitte - a global professional services company - reported that "while many companies benefited from the 50% decline in global oil prices in the last two years, their actual energy efficiency on a [gigajoule per ton] basis has remained flat or even risen in some cases."

Given the increasing energy usage, renewable energy, primarily wind and solar PV, has gained traction in the mining industry by offering lower-cost energy and long-term price stability. Deloitte reported in its 2015 summary that renewables can offer fuel savings of between 10% and 40%.

In key mining markets, renewables are often competitive with grid prices, and

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Lazard's LCOE Study 10.0 demonstrates that solar PV is cheaper than diesel electricity across the globe. That makes solar a viable option for all off-grid mines that are currently running on diesel generators.

The prospect of carbon-pricing legislation has also compelled many mining companies to consider additional costs from carbon-intensive energy sources. Carbon pricing legislation has been proposed or passed in key mining markets such as Australia, South Africa, Ghana, Brazil, Argentina, Chile, Europe, Canada, and parts of the U.S.

## Reliability of renewables

Beyond price considerations, renewables can offer a more reliable source of electricity. In many developing countries, the electrical utilities often lack reliable supplies of electricity, leading to supply cuts to mining operations.

In 2013, Eskom, South Africa's main utility, met only 77% of electricity demand. That shortage put pressure on the mining industry, which makes up 5% of the country's GDP.

Wärtsilä Energy Solutions, a global energy systems integrator with a strong focus on the mining sector, told **pv magazine** about the reliability needs of mining operations. "Like other customers, mining sites are looking for reliable and affordable energy for their operations. What makes them special is that the loss of revenue generated by the shutdown of an energy source is tremendous. That is why they require the reliability percentage to be close to 99%. As they cannot fully rely on the grid of the country where they are operating to reach this level, they will require their own energy production facility."

During supply cuts, mines have to either halt operations or rely on expensive backup generation. Electricity shortages are common in many developing countries, though natural and human events can put an electricity system in crisis, as has happened in Zambia. Drought in the African country has curtailed hydropower generation, leading to a severe shortage of electricity. In response, the government has started rationing electricity to mining companies, which consume more than half of the country's electricity supply. Electricity prices have also doubled as the government has resorted to expensive, imported electricity from neighboring countries.

The main medium-term hope for boosting the supply of electricity in Zambia is a 100 MW solar tender issued by Zambia's Industrial Development Corporation. The lowest energy price

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offering from the solar tender is \$0.06/kWh, which is significantly lower than the current emergency measures. Mining companies in the country have taken note of the government turning to solar to ease the crisis.

### License to operate

Limited supply of electricity not only strains day-to-day operations at mines, but also jeopardizes mining companies' social license to operate. In many developing countries with significant mining industries, the mines compete with citizens for limited electricity supplies. This competition puts mines at odds with the well-being of citizens, souring their view of mining companies.

On-site renewables can reduce a mine's demand for electricity from the public

no such microgrids are in operation, this business model is being deployed with off-grid telecommunication towers in many countries with low electrification rates, such as India.

### Challenges to adoption

Despite the numerous economic and social reasons for transitioning to renewable power, adoption has been slowed by the conservative nature of the mining industry. Additionally, mining companies' market valuations are based primarily on their reserves and future production targets. Optimizing existing operations is less of a priority, making it difficult to justify productivity-enhancing investments such as renewables.

Third-party financing of renewables systems allows mining companies to

### Miners know best

As more renewable projects on mining sites have been developed, financiers have become more comfortable with mine lifetime risks providing opportunities for developers to tailor contracts to the mining industry's needs.

In an interview with *pv magazine*, the Rocky Mountain Institute's Harvey suggested that "renewable developers can innovate beyond conventional PPAs, and consider a shortened PPA term of 10 years, or even link PPA durations to the lifetime of the mine."

Another hang-up for mining companies in signing a renewable PPA is the need to pay several energy suppliers. To ease such concerns, renewable-energy developers can work with a mine's existing energy supplier to ensure that the owners of the facility end up only making payments to a single energy supplier.

Flexible PPA durations and partnerships with existing energy suppliers are just two examples of how renewable developers can tailor their services to meet miners' needs. Ultimately, developers need to innovate beyond their conventional offerings to create solutions that solve problems unique to the mining industry. As Harvey succinctly puts it, "The miners know best."

Hillig of THEnergy was more direct. "Developers need to optimize their sales and marketing processes," he says. "Many are not doing more than just waiting to be addressed by the end-customers. The golden era of renewables in most countries is over. Today, they have to do more than just be there."

### Transitions

By tailoring their offering to meet the needs of mining companies, developers can accelerate the transition to a renewable-powered mining industry. Miners, for their part, need to recognize the shift toward renewables in their industry and across the economy as a whole. In 2016, Deloitte cited the "inevitable move to alternative power sources" as one of the top 10 issues facing the mining industry.

When discussing innovation with stakeholders, Harvey likes to ask the question: "If Elon Musk vertically integrated into lithium mining, what would his mine operations look like?"

You can be sure that Musk's lithium mines would be renewable powered. ♦

Dustin Zubke



The Barrick gold mine in McCarren, Nevada, has a 1.5 MW solar system, in addition to a 116 MW gas power plant supplied by Wartsilä.

grid and provide a pathway to reframe its image in local communities.

Ned Harvey, Managing Director at the Rocky Mountain Institute, which has been working with mining companies to adopt renewables through their Sunshine for Mines program, told *pv magazine* that "maintaining mining companies' social license to operate is a key strategic challenge. Renewables can help mining companies enhance their social position in local communities by competing less for limited electricity resources, reducing overall carbon emissions, and reducing strain on local infrastructure through the consistent transport of diesel fuel to off-grid mines."

As large, creditworthy customers, mining companies can also partner with local utilities or private developers to build local microgrids in off-grid locations that electrify nearby communities. Though

devote capital to their operations, but the uncertainty of a mine's lifetime can prevent them from signing long-term deals.

Renewable power purchase agreements (PPAs) usually last 15 to 20 years, whereas mine operations can be curtailed abruptly if commodity prices decline. If a mine is the sole off-taker of a PPA, it risks paying for electricity that it doesn't need, while the renewable plant risks becoming a stranded asset. To manage this problem, renewable developers should target mines with more certain lifetimes.

Thomas Hillig, founder of THEnergy, a consultancy focused on renewable integration into mining operations, told *pv magazine* that "in the commodity slump, management's attention was on everything but renewables. It is no surprise that renewables were more successful in mining disciplines that were not affected by the crisis, such as gold mines."