

# MICROGRIDS FOR MINES: GLOBAL PERSPECTIVES

By Melodie Michel, Energy and Mines

Source: Glencore

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The energy and greenhouse gas (GHG) emissions savings that can be achieved through renewables microgrids in mines are evident. A diesel power plant consumes about 250 liters of fuel per MWh. A 1 MW block of solar, for example, typically produces about 2,000 MWh in a year, meaning it can displace about 500,000 liters of diesel annually.

The carbon footprint of a liter of diesel is 2.7 kg of CO2 equivalent, so the same 1 MW solar plant can result in about 1,350 tons of CO2 abatement per year. In a typical 25-year asset life, that equates to avoiding the release of more than 30,000 tons of CO2 into the atmosphere. "The asset has an embodied carbon footprint, but within about 9 months of operation, we've paid back that whole carbon footprint through diesel savings. It's all a huge solar carbon abatement," says Will Rayward-Smith, General Manager at Australian solar IPP SunSHIFT.

For wind, the savings are also tremendous. Mining giant Glencore commissioned the installation of a 1MW-3MW wind turbine at its Raglan site in Northern Canada back in 2014. In three years, the facility has displaced over 6.5 million liters of diesel and reduced Glencore's GHG footprint by 18,000 tons, according to Director of Capital Projects, Geology

and Exploration Jean-François Verret.

The experiment has been so successful that the company is now planning to install further turbines to integrate even more renewables into Raglan's 20 MW energy grid.

### Ever-more affordable technology

The initial capital cost of installing solar panels or wind turbines on a mining site has traditionally been a deterrent for companies. But renewables independent power providers (IPPs) are increasingly offering other options. SunSHIFT, for example, has found a way to make its solar panels recoverable, which means they can remain under the IPP's ownership, and be reused on different sites. Because of this, the company is able to offer a low early-termination fee in case commodity price cycles force the mine to close down before the end of its life cycle.

Because SunSHIFT retains ownership of the solar blocks, it also arranges its own asset financing facility, sparing miners the hassle of sourcing project financing. Though it is currently the typical model of funding renewables integration, project finance is set to decrease in popularity, since banks usually require fairly long power purchase agree-

ments (PPAs) as security. New regulation issued in 2016 by the the International Accounting Standards Board (IASB) will require any company in the world to put their PPA and lease obligations on their balance sheet from January 2019, which will likely encourage companies to look for shorter PPAs -- turning project finance into a much less obvious option.

"Having an asset finance facility that we can draw on and deploy on multiple projects lowers the project-specific financing costs, but also extends the amortization period beyond the PPA duration," Rayward-Smith adds.

### Reliability and accountability

Miners' biggest concern when integrating renewables is the reliability of the energy produced, since any power cut can cause losses of millions of dollars. Aside from technological advances that are making microgrid technology more and more reliable, experts have also observed a trend for increased collaboration between renewables providers and diesel IPPs -- sometimes even to the point of commercial integration.

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and that led to issues at that particular microgrid where you've got the different parties pointing at each other when there's issues with energy reliability. Now there's sophistication commercially where the miners want to maintain a single contract and therefore ask solar providers to speak to their IPP and integrate the renewables with the IPP," Raymond-Smith says.

Still, commercial integration and single contracts are not for everyone. Verret explains that at Raglan, diesel is managed by Glencore and wind energy by a third-party provider. "Of course, for new projects, some of the miners will want to get into a full PPA, but for a brownfield operation to implement renewables, it has to be a hybrid model. We've already got the knowledge and the know-how to operate diesel generators."

### Enabling technologies

The technologies surrounding renewables integration also appear to have reached the technological maturity needed in the market. "The basis for making any good decision comes down to accurate and sufficient data, and we're seeing miners gaining significantly better understanding of their own load profiles and energy requirements to help make good decisions on renewable energy integration," says Craig Palmer, Program Manager at GHD.

At Raglan for example, Glencore worked with consultants to create an algorithm to predict, and therefore manage, wind fluctuations.

Operators were also given a cheat sheet explaining how much energy they could use and how much they needed as back-up.

Energy control software can be another useful tool. Spirae was launched in 2002, and the latest version of its platform, which controls renewable and traditional energy generation to maximize renewables integration, has shown tremendous results. At a mining shop in Arizona (which includes offices and workshops next to the mine), the system has made it possible to function solely on solar power for 6 to 8 hours a day -- about 52% of the site's energy consumption.

"Peak loads on this facility are around 400 kW," says Spirae's Director of Microgrid Business Development, Mike Murray. "A mine site can be 7 MW to 14 MW of power need, so I don't see a full renewables system going to that size just yet, but, even if you had to keep a couple of generators online to maintain voltage, with a high-control system, you could start turning additional generators off and having a lower fuel cost and less run time on your engine."

### Delivering power stability with storage

If power reliability is miners' biggest problem, storage has to be its most obvious solution. Craig Evans, CEO of ESS Energy, explains that the combination of renewables and storage can also lead to significant cost savings.

"If you've got a microgrid and you are operating off of diesel fuel, your typical electricity



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cost is going to be 30 to 40 cents per kWh. You'll have the opportunity to integrate solar with storage to reduce that diesel fuel cost to the point where you're down to 10 to 15 cents per kWh," he reports. "On top of that, if you're connected with the grid and you have tariffs to deal with, those tariffs can bring on demand charges, peak rates etc. When you add renewables and storage, you can move the cost of energy to the point where you won't need that, you can make that storage your base load."

Hybrid thermal and compressed air energy storage (HTCAES) provider Sigma Energy sees tremendous potential for integrating storage into mining power systems. "It's a technology based on well-known mechanical elements. We use the most standard equipment possible, with longstanding components, which allows us to ensure that our system can last decades," says Martin Larocque, Sigma's President and Managing Director.

"An interesting use for storage is that it allows power plants to operate without spinning reserve," observes Nicholas Allen, Mechanical Engineer at BBA. "Typically, power plants have an additional diesel genset running constantly just to cover any potential power failure. Instead, they could use storage to cover the power loss while they start another generator, which takes about 5 minutes, which fits the small capacity of storage technology. With a battery, you can instantly get to full capacity, in comparison to a standby genset. By running one less diesel generator, main-



tenance will be reduced, and the efficiency of the power plant will be improved."

Miners should first understand the complexity of the different systems and how they can fit their particular needs, as there is no standard solution. Mining operators will want

to analyse all the costs including installation, transportation, disposal over the life of the project. As ESS' Evans notes: "The solar and wind industry have used LCOE technology for decades but when people look at batteries, they tend to only look at capex, and that's not the right way to look at things." ■

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– CRAIG PALMER, PROGRAM  
MANAGER, GHD



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