

Reliable power supply with hybrid power solutions for remote mines and other industrial installations

Instrumentation, Controls & Electrical



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ATTRACTIVE ECONOMICS AND COST SAVINGS

Why mines are turning to renewables

This thought leadership piece provides insights from Rob Lydan and Michel Carreau of Hatch's renewable energy team. The two offer perspectives for mining companies on the economics of wind and solar energy, the challenges of integrating hybrid power solutions, and the 10-20% potential cost savings from moving towards alternative energy solutions.

Up until quite recently, if you asked miners to describe renewable power, you'd often hear words like 'unreliable,' 'expensive,' and 'risky,'" says Rob Lydan, Director, Solar and Wind, at Hatch. Lydan acknowledges that for many years, solar, wind, hydro, and other forms of renewable energy were intriguing but seemed too expensive and too cutting-edge for the comfort of the mining industry – but that's all begun to change.

Over the past few months, the capital costs for renewables have continued to drop considerably. Consequently, many renewable solutions are now less expensive than diesel. "Wind power in a remote mining installation can reduce your cost of energy by 10-20%," says Michel Carreau, Hatch's Director of Renewable Power.

At the same time, the ability to engineer a hybrid renewable solution that is highly reliable has increased. With proper implementation and education, Carreau and Lydan are convinced that a hybrid renewable energy system can work just as reliably as running diesel gensets on their own.

A CHANGING LANDSCAPE

For most mining companies, a conversation about renewable energy quickly morphs into a discussion of economics. Mines everywhere are investigating new sources of energy because the cost of the existing fuel source – diesel – is hefty.

Carreau points out that today 30% of the cost of operating a mine goes to energy, relative to 23-25% a few years ago. At some point, he observes, miners can't be profitable unless they decrease the cost of energy.

Meanwhile, miners are being confronted with another practical problem: the quality of ore is declining and so it now takes more effort and energy to get the same yields as in the past.

Lydan also notes that on a kilowatt hour basis, today's liquid fuel costs are "very high" relative to renewables. He points out that the balance between diesel and renewable power has tipped because the price of both solar and wind energy has come down dramatically. In fact, estimates Lydan, the cost of solar energy components has fallen by nearly two-thirds in the past three years.

Although miners like the concept of "green" energy, they need the promise of cost reductions before making a move, says Lydan. "At this point, hybrid energy projects have to compete against all the capital demands of the mine. And they have to have a payback similar to any capital activity at the mine."

Carreau points out that renewables make the most economic sense for mines in remote locales, especially those operating off grid. However, many of these

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- Rob Lydan -
Hatch

farflung places face other challenges, whether it's extreme temperatures or the threat of corrosion on Caribbean islands. As the technology has matured, these engineering hurdles have been cleared.

Only recently, Carreau notes, have manufacturers learned to build wind turbines with the proper de-icing technology and the ability to keep the nacelle, which is the core of a wind turbine, warm enough so that the blades and transmission gears can operate properly. Today, though, wind turbines are even running successfully in the Arctic.

WHAT MINES NEED TO CONSIDER

Component costs are not what determines what type of renewable energy a mine should pursue; rather, it's the natural resources available at a given site. "If you have a windy location with poor sun, wind's the way to go," says Lydan. "And if you're near the equator where it's sunny and there are no trade winds, then solar is the way to go."

Site matters, too. Lydan explains that solar projects are easier to install for small energy requirements because cranes and other heavy equipment aren't necessary. "Generally speaking, if there's a project that's a couple of megawatts and there's a good solar resource, most mines would use solar," says Lydan.

Although many factors go into decisions around renewables, the most pressing issues concern integration. "Miners won't accept a situation where you're going to shut down their mine. They're not interested in that," says Lydan. Therefore, he notes, everything from the question of back-up energy sources to protecting the power system at a mine needs to be carefully considered.

Carreau notes that mines can always meet the required load using diesel generators, but the cost savings come from properly matching the wind or solar resource with the spinning reserves (or back-up power). By carefully monitoring the availability of wind or sunlight, companies can become adept at understanding how to maximize renewable energy. "We want the market to realize this challenge is well understood and can be tamed," he says.



The most compelling testament in favor of renewables is the projects themselves. Carreau points out that in the Nunavik region of northern Quebec, Glencore Xstrata is looking to produce 10 MW of wind power for its 20 MW energy needs at Raglan Mine, which is off grid. Here, the ground is in a state of permafrost and yet Enercon's wind turbines can now operate in these harsh conditions.

He also points to Bonaire, a Caribbean island that is using 11 MW of wind power along with 14 MW of diesel gensets and a 3 MW storage battery, as an example of what renewables can now achieve.

Going forward, Lydan believes that existing projects will convince miners that renewable energy is reliable and can result in real cost-savings. However, he doesn't believe a day will come when mines will be powered 100% by renewable energy. In fact, he believes that a 30-40% contribution from renewables is about as high as mines will ever go.

"This is an industry that is taking inordinate risks building projects in remote locations, and they have to stomach that risk," Lydan concludes. "They can't send a thousand people home because the sun wasn't shining. That's simply not going to happen." ●



WHY RENEWABLES ARE A GOOD FIT FOR MINES Q&A with Barrick Gold



Scott Fraser, Barrick Gold

Scott Fraser, Director of Power Projects at Barrick Gold Corporation, is currently assessing the potential for using different forms of renewable energy to power particular mine sites. Barrick Gold is a leader in innovative energy strategies having invested in wind projects in Argentina and Chile including the 20 MW Punta Colorado wind farm. The company also has solar demonstration sites in Nevada and Chile.

CANADIAN CLEAN ENERGY CONFERENCES: Why are mining companies becoming more interested in renewables?

SCOTT FRASER: There are two reasons: One is the drive to reduce greenhouse gas emissions and demonstrate sustainability and the other is the cost. Renewable energy cost structures have reduced to the point that, particularly for isolated mines, in some cases they have become more economic than diesel fired generators.

CCEC: What are the main drivers behind Barrick Gold's investment and interest in renewables?

SF: Our focus has been energy conservation alongside renewables. We have several facilities that are not connected to national electrical grids and some which are connected but the grid is not always sufficiently reliable to support our operations. Our most reliable source of power right now in these locations is frequently diesel-fire generation and so we are looking at renewable options to save on costs and offer additional greenhouse gas emissions reductions.

Chile has seen our greatest investment in renewables which is partly driven by the government's renewable energy requirement. When you use electricity in Chile, you either have to have a certain portion coming from renewable energy sources or you are required to purchase renewable energy credits from within the country at prices

that are expected to increase in the future. So, investing in wind or other renewable energy projects meet our obligations for renewable energy and demonstrates our commitment to sustainability.

CCEC: What types of renewable energy options are you looking at now?

SF: Solar is of great interest and we have two demonstrate sites – one in Nevada and one in Chile. These regions both have very good solar resources. In Nevada, we have an existing 1 MW solar plant in Reno and have been in discussions with solar developers who are interested in using our Legacy mine site to develop a solar farm. In Chile, we have small test facility.

The other thing we are doing right now is field test work near one of our mine sites because there is surface evidence of a geothermal resource there. We are very encouraged by geothermal as we believe it will match our need for continuous power 24 hours per day every day of the year. We have studied geothermal options for two other mine sites as well.

CCEC: What are the main challenges for integrating renewable energy into a mine's energy supply mix?

SF: One of the largest barriers is the intermittent nature of most renewable energy sources. This requires an alternate power supply such as diesel or a national grid backup because mining normally has a very continuous demand. We can't just operate when the sun is shining or the wind is blowing. While power storage technologies are continuing to develop, the life cycle cost of energy storage remains prohibitive for most industrial applications.

CCEC: What are you looking forward to at the Renewable Energy and Mining Summit in September 25-26 in Toronto?

SF: Hearing the technical case studies that show how various developers have applied solutions and networking with individuals who are able to help develop and finance renewable energy developments associated with mining companies. I expect this forum will assist these developers in understanding the differences between conventional feed-in tariff (FIT) projects associated with a regulated utility and the more specific needs of the mining industry. ●

“One of the largest barriers is the intermittent nature of most renewable energy sources.”

- Scott Fraser -
Barrick Gold

MAKING THE TRANSITION TO RENEWABLES

In this thought leadership piece, Marcus Koenig, Vice President for Smart Generation Solutions at Siemens AG, explains the typical considerations for mines contemplating a shift to renewables. He analyzes everything from the volatility of solar and wind resources to the protection of wind turbines in case of hurricanes and the emerging possibilities within storage technologies for renewables.

A customer in Kenya recently contacted Siemens AG about possibly installing a hybrid plant including a diesel genset and a photovoltaic plant. At first, both the customer and Siemens were enthusiastic because Africa is known for having abundant sunlight. On closer analysis, however, Siemens realized that Kenya is actually quite cloudy and so it makes far better sense to install a wind farm there, explains Marcus Koenig, vice president of Smart Generation Solutions.

"We only find out the true renewable resource during the consulting phase," he says. "The real key is to find out which combination of generation types is the best fit for a specific mine. You can't copy a solution all over the world because you have to take into consideration your area, the wind speed, the solar radiation, and how many days you have different types of energy available. In the end, the most economic hybrid solution can even be a combination of diesel gensets with both solar and wind."

Finding the smartest solution matters because mines rely on having a consistent energy supply – and they want the energy provided at the best possible price. Koenig anticipates that when the proper analysis is done, mines can use hybrid solutions to have power available 100 percent of the time for a 30-60 percent cost reduction. For most mines, that means a return on investment for a PV plant or other infrastructure investment of five to seven years.

Increasingly, real-life examples are showcasing what can be accomplished. In February 2013, Siemens designed a 1.3 MW hybrid plant for the Galapagos Islands that could provide 3,000 megawatt hours of energy to be sold to the Minister of Energy in Ecuador. Siemens would be supplying a full turnkey solution, including all parts of the system. In this case, to further decrease the carbon footprint of the hybrid power plant, Siemens is using a very new biodiesel from the jatropha plant to stabilize the system and grid frequency.

When mines consider renewable energy, "the biggest hurdle is the volatility of the renewable energy sources."

- Marcus Koenig -
Siemens AG

ANTICIPATING PROBLEMS

When mines consider renewable energy, the biggest hurdle "is the volatility of the renewable energy sources," says Koenig. He notes that almost everyone contemplating photovoltaic energy has heard of "the famous cloud." Once a large cloud passes overhead, in a matter of milliseconds, the power supply can completely vanish.

Naturally, mines can't stop operating simply because a cloud is not cooperating. Koenig explains that with a proper automation system, a mine can monitor the weather and then react swiftly. Stored energy can tide the mine over until the diesel genset is up and running.

Koenig emphasizes that for mines, managing natural resources can seem far afield of their usual competences. "The core business of miners is to operate the mine. They shouldn't notice anything about a change in generation times or devices. If you make sure they don't notice anything, then you've done a good job on the power generation side," he says.



Marcus Koenig, Siemens

Another hurdle is protecting the physical infrastructure for a renewable solution. Koenig points out that special precautions must be taken for wind turbines operating in areas where hurricanes often hit. He points out that some wind turbines can be quickly lowered in the event of a hurricane. And in other cases, the gondola where the propeller is located can be fixed to the earth so that the turbine is not destroyed in a powerful storm.

WHAT'S NEEDED NEXT

The key to 100-percent reliability for renewables is storage. To remain cost-effective today, companies need to keep their storage demands as small as possible. Koenig explains that hybrid solutions use storage only for the very brief time period during which a diesel generator is starting up.

Koenig notes that the hybrid power plants are completely automated to enable a seamless transition from PV plants or wind farms to diesel and then back again to renewables. However, he emphasizes that the automation needs to be "very intelligent" to manage the whole system in the most cost efficient way.

The key to 100-percent reliability for renewables is storage. To remain cost-effective today, companies need to keep their storage demands as small as possible.

Storage is changing, too. Koenig points out that there's now a prototype for a new lithium-air battery that could reach energy densities of 2,000-2,500 watt hours per kilogram, compared to the current lithium ion technology that has an energy density of 200 watt hours per kilogram. "This represents a huge step forward," he says. "The same set of batteries could store much more energy if you reach that energy density." What's more, battery suppliers are working hard to lower the costs for storage in other ways, as well.

For operations and maintenance, Siemens has for years been running a remote access center that's open 24/7 to "produce fast support for trouble-shooting." Siemens recognizes that mine operators want to concentrate on mining and so the company is offering lifecycle management, meaning that the mines do not have to handle maintenance on their own.

IS 100-PERCENT RENEWABLE ENERGY POSSIBLE IN MINING?

Koenig points out that there are no technical limitations to running a mine completely on renewables. The limitations come from the size of the PV plant or wind farm that would be required and also from the expense of having a sufficiently large storage system to generate power at night or when the wind is not blowing. Koenig points out that a 100-percent renewable system would be so gargantuan and costly that it would make no economic sense.

That said, when Koenig considers the storage advances of the past five years, he believes that taking another enormous leap forward within the next five years is a distinct possibility. Should storage technology improve dramatically, then PV plants or wind farms could collect energy when it's abundant and store the excess for times when the sun isn't shining or the wind has stopped.

Whether or not advances in storage make it possible for mines to run completely on renewable energy in the coming years, today's technologies still offer plenty of attractive options. "Diesel gensets always supply mines with the energy they need for the load required," he concludes. "Mines want to achieve the same 'feel good' with the integration of renewables, and that's finally happening." ●

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