A new way to power mining projects

Jax Jacobsen looks at whether an upsurge in the use of renewable energy in mining projects is likely

Green technology for electricity generation has captured the attention of mining companies the world over, with more and more mining projects using renewable energy to power resource extraction. Renewable energy technologies have advanced at a quick clip, while the cost of implementing these systems has dropped significantly.

The number of mining projects that will utilise this energy is set to increase, according to a report from Navigant Research last year. By 2022, mining operations worldwide will deploy more than 1,438 megawatts in renewable energy.

Renewable energy “is now at a point where it can move forward into larger and more complex deployments, potentially including energy-storage technologies, which would enable a higher percentage of renewable use per mine site,” says Kerry-Ann Adamson, research director at Navigant Research.

Industry analyst Ernst & Young agreed in a 2014 report: “The role that renewables will play is not as remote or futuristic as you might think.”

There are a host of reasons why mining companies are interested in adopting these technologies.

REMOTE PROJECTS

Years of high-intensity exploration and development in developed regions will mean that new deposits will increasingly be found in more remote regions – or mining companies will have to dig deeper to find comparable mineral riches.

Deposits in remote areas will probably be far from existing electricity grids, forcing mining firms to be self-reliant in powering their operations. Transporting fossil fuels can substantially add to the cost of operations – regardless of how low the oil price may dip. Mining executives must also consider that global energy prices have increased by 260% since 2000.

Two remote mining projects in Canada have already begun to cut energy costs by implementing renewable-energy technologies.

Rio Tinto’s Diavik diamond mine, located 300km north of Yellowknife high in the Northwest Territories of Canada, has opted to install four wind turbines to generate 9.2MW, or around 10% of the mine’s needed power. Adding wind power to the mine’s energy profile saves Rio Tinto C$5-6 million (US$4.1-5 million), or anywhere between 60 million and 70 million litres of diesel fuel on an annual basis.

Another project in northern Quebec, Glencore’s Raglan nickel mine, has also opted to incorporate wind energy into its operations, acquiring a wind turbine that will generate 3MW of power on an annual basis.

Raglan is also building a wind-energy storage facility this year, and aims to build between three and five new turbines to power the mine by the end of 2015. Raglan is hoping to lower the amount of diesel required to power the mine by more than half.

EXPENSIVE/UNRELIABLE GRIDS

Mining firms don’t need to be located hundreds of kilometres from operating electricity grids to consider incorporating renewable energy into their projects. High electricity costs and the unreliability of power grids may also compel companies to use alternative fuels.

“A number of utilities globally have been increasing the cost of power to mining companies and industries,” Dennis Gibson, chief technical officer at Black & Veatch, tells Mining Magazine. “With that increased cost of power, electricity is now in excess of 50% of operating costs.”

In this scenario, adopting renewable technologies “makes sense”, he explains. These costs “help drive mining companies to look at more cost-efficient means”.

Mining companies are particularly interested in using alternative energy sources for projects in Chile, where power rates have climbed by 350% over the past 10 years. In response, Codelco, the world’s largest copper producer, has constructed a solar project at the Gabriela Mistral mine in northern Chile. The Pampa Elvira solar project consists of 2,620 solar panels and generates 51,800MWh/y, powering 85% of operations at the mine.

In other jurisdictions, national power grids are unable to withstand energy demands from mining projects, most of which are extremely energy-intensive.

In the case of Ghana, which is home to a host of large gold mines owned by Kinross Gold, Gold Fields, AngloGold Ashanti and Newmont Mining, among others, the government has informed mining firms that it is reducing power delivery to projects by 30% due to the
inability of the grid to meet demand. “That means that there are three days out of nine when companies are potentially out of power,” Gibson says, which has led to mining firms seriously considering the use of alternative fuels.

Other jurisdictions, notably South Africa, have unpredictable power grids with frequent periods of ‘load shedding’ when power is cut off to several sectors for a period of days or even weeks.

The South African electricity public utility, Eskom, has imposed a series of intermittent rolling blackouts for the last four months or so, and South Africa’s energy minister said in late March 2015 that the country will continue to have rolling blackouts for the next two years. The national energy crisis is estimated to have cost the national economy between US$1.7 billion and US$6.8 billion.

Such an unstable environment led South Africa-focused chrome miner Cronimet to pioneer a massive solar plant for its Limpopo site. With Solea Renewables, the mine built a 1MW off-grid photovoltaic facility, which consists of four 170 solar panels.

Renewable energy was the most feasible way of powering the mine, Cronimet managing director Rollie Armstrong tells MM. “For mines operating in increasingly remote locations, the cost of being in the national utility grid or being solely dependent on trucked-in diesel was simply not financially feasible or responsible for our shareholders,” he explains.

“We turned to renewable energy because we had no other option, and only later… did we find out we were also making a very smart operating business decision.”

Cronimet’s renewable energy system saved the firm money on fuel and upfront expenses. “That was the most important factor [in turning to renewables]: no capital expenditures on behalf of the mining operations, and lower operating expenditures by way of cheaper..."
photovoltaic electricity that offset the high cost of diesel,” Armstrong says. Mining companies are also increasingly aware of corporate social responsibility and reducing greenhouse gas emissions, and are turning to renewables to help secure community support of the project. Firms are coming under more pressure than ever to meet improve the environmental sustainability of their extraction projects. Changing jurisdictional requirements on carbon emissions and environmental impact are also propelling mining companies to incorporate more alternative fuels. When it comes to choosing which mining projects will move forward, companies are increasingly looking at the amount of greenhouse emissions when making that decision, according to Gibson. However, Vancouver-based PR Associates president Robert Simpson warns not to read too much into those other factors in explaining the growing interest in renewable energies. “In the end, though, it really does come to cost,” he tells MM.

**“Up in the Atacama desert, there’s high altitude, as well as plenty of land available and sunshine”**

**CHOICE OF RENEWABLES**
The majority of renewable-energy projects are expected to centre on wind, with an estimated 516MW of capacity at mining operations to be brought online by 2022, the Navigant study found. Solar energy will follow, with 493MW of capacity installed by that same year.

But choice of energy type is largely due to geographic location and topography. Determining which energy alternatives were naturally present and financially feasible is the first step, Armstrong says.

When explaining why the company chose solar, he comments: “Wind speeds were not consistent enough to provide a reliable diesel-replacement solution that could substantially reduce the mini-grid’s levelised cost of electricity. The remote countryside was too flat and arid for mini- or pump-hydro power, [while] biomass posed a potential feedstock supply threat” as well as potential strikes and transportation issues.

Different forms of renewable energy will fit different regions of the world, Gibson says. “In Chile, solar energy will be a significant factor in certain areas,” he suggests. “Up in the Atacama desert, there’s high altitude, as well as plenty of land available and sunshine.”

Renewable projects are not limited to mining companies’ energy self-sufficiency projects. In the Canadian province of British Columbia, renewable energies are being incorporated into the general electricity grid, which is also used by mining projects. “Up in northwestern British Columbia, Altigas has a run-of-river project that has been connected to the Northwest Transition line, which was built to fuel a number of [mining] projects up there,” Simpson says. “The renewable energy mix is going right into the traditional energy grid.”

Meanwhile, in Australia, Rio Tinto Alcan recently unveiled a groundbreaking renewable project for its Weipa bauxite mine located in the far north of Queensland. The solar project is expected to generate 1.7MW/y; 18,000 solar panels will be installed in the first phase of the project. The second phase will generate an additional 5MW in power, which would together satisfy 100% of the mine’s energy needs.

**THE STORAGE PROBLEM**
Achieving 100% renewable power for any project – mining or otherwise – is complicated by the very nature of renewable sources and issues of storage. Renewable energy is intermittent, meaning that once the wind stops blowing or the sun stops shining, energy production comes to a standstill. Because of this factor, projects will need to rely on a base-load power source – traditional fuel sources of oil, gas or diesel.

Cronimet is employing a solar-diesel hybrid system to power its Limpopo mine, the largest of its kind in the world. In this model, photovoltaic solar
Power generation provides for 60% of the mine's power needs, while diesel accounts for the remaining energy requirements, usually during the night.

Being able to fully rely on renewable sources for energy would require storage technologies to advance at a faster clip, explains David Watson, wind-integration researcher from Canada's Wind Energy Institute.

Storage technology has already produced small storage systems in the form of flywheels, such as that which will be used by Glencore's Raglan mine, and batteries. For longer-term storage, pumped-storage hydroelectricity and compressed-air systems could also be used, says Watson.

But technological innovation of storage systems that would allow for a complete reliance on renewables has stalled, he notes.

"The financial incentive for [developing technologies for] storage hasn't been there," Watson explains. "Since storage doesn't produce power, it doesn't produce revenue in the same way as an energy source."

Projects are under way to expand the capacity of storage systems, Jimmy Royer, senior technical advisor for renewables at Natural Resources Canada, tells MM.

"In the case of [Glencore's] Raglan mine, they're putting in hydrogen to store electricity," he says. "But they're also intending to use the hydrogen in other applications. For instance, you can mix hydrogen with natural gas to power a vehicle."

For mining projects, storage is only necessary for energy grids with a high penetration of renewable energy, according to Royer.

If mining companies are targeting 5-10% penetration, they wouldn't need an energy storage system, he adds.

"It all depends on how much you want to reduce your diesel consumption by," he says. "If you want to have higher penetration, then you're going..."
to put a large wind or photovoltaic system in to generate as much as energy as you can, and at times you will be overproducing. The best option is to store it, so in the time that you don’t need a lot of electricity, you can use the electricity [to store] in the battery.”

Natural Resources Canada has committed C$7.8 million (US$6.4 million) to the project, in the hopes that this technology will increase energy security for remote northern Canadian communities and improve their long-term sustainability.

For now, because of the limits of current-day storage technology, mining companies must still rely on traditional energy sources to account for a significant percentage of their overall energy grid.

However, Gibson sees much to cheer in the mining industry’s embrace of cleaner technologies.

“There is a very strong movement within mining companies to really embrace the whole concept of sustainability and management of greenhouse gases,” he says, marking a substantial change from the industry’s traditional reliance on coal-fired power.