The guide to the mining industry in Southern Africa
Mining Prospectus

All about energy

Power on mines

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So serious has the issue of reliable, affordable and sustainable energy on mines become, that a leading South African mining company announced last year it would spend R3 billion on a solar power facility to help meet its energy requirements.


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Its plans are significant for a few reasons, and highlight some vital themes that mines increasingly have to consider as they navigate their way through the commodity price slump toward a more secure future.

The first interesting aspect about the plan is its sheer scale. The billions that will be spent is a reflection of energy's place on mine's ranking of its operating costs: around 20% in most cases, but up to 40% of a mine's total cost, according to global consulting group EY.[1]

Secondly, the initiative speaks to the erosion of reliability of the SA national power grid in recent years – although this has been a common problem for mines around the rest of Africa for decades. The World Bank reports that close to half of companies in sub-Saharan Africa identify unreliable electricity as one of the biggest constraints to doing business.[2]

Its report says that outages cost these firms about 5% in lost annual sales, and about 44% of firms cope by owning or sharing a generator, fueled typically by diesel or heavy fuel oil.

This introduces the third point of interest, which is the fact that the mine's choice of solution has been renewable, solar power. This is an encouraging step into a field of opportunity where the cost-benefit ratio is improving, especially in the context of South Africa's favourable climate for solar power generation. SA's sunlight could generate 220 kW/m^2, for instance – which is over double the potential 100 kW/m^2 in the United Kingdom.

However, this innovative example – and there are others such as hybrid schemes involving a combination of photo-voltaic and gas turbine power generation – should not belie the complexity of the energy efficiency issue as there are no easy solutions that are universally applicable to all mines. This article will describe some of those factors that must be weighed before strategies are decided and implemented, and will outline the kind of processes that can lead a mining company in the appropriate direction.

What's at risk?

Mines face a number of risks related to their energy consumption, including the following:

- Rising electricity prices, which threaten commercial sustainability;
- Lack of reliable supply, which disrupts operations and erodes efficiency; and
- Generating emissions, which is subject to air quality regulations and may soon also attract a carbon tax.

This combination of operational, financial and regulatory risk form a growing part of the company's risk profile – so there is a need to be properly understood and addressed through appropriate risk management strategies.

Most mines have generator sets for back-up supply in the case of grid-failure or load-shedding, but it is an expensive option and – for cost-sensitive operations – presents a risk in itself. While the record-low oil prices have given some breathing space, its potential volatility adds to the risk. The actual machinery is also a substantial cost, especially when maintenance and breakdowns are taken into account.

On the compliance front, a large operation with diesel-powered generators may need to consider the demands of the National Atmospheric Emission Reporting regulations (in Section 21 of the National Air Quality Act) – including the development of Pollution Prevention Plans and registering on the online National Atmospheric Emissions Inventory System (NAIES).

Another compliance risk is the much-discussed carbon tax, as contained in the Draft Carbon Tax Bill which Treasury published for comment last year. The tax is expected to be implemented in 2017, in two phases that would allow businesses to transition over to cleaner and more efficient technologies and corporate strategies.

Initially, the marginal carbon tax rate will be R120 per tonne of carbon dioxide equivalent (CO_2e), with thresholds, reflected as allowances in the Draft Bill, that are likely to bring the effective tax rate down to between R6 and R48 per tonne.[3] In the first phase of the tax's implementation, the mining sector will be allowed up to a 90% allowance on their tax liability. The system is to be administered by the South African Revenue Service (SARS) and verified through the NAEIS. There are, however, many uncertainties with the proposed carbon tax as it stands, so mining companies need a firm understanding of the risks faced with this additional tax burden to benefit from the tax relief incentives built into the bill.

As renewable energy has become more affordable and efficient, it can certainly address aspects of these risks. However, the key to improved energy security and efficiency lies not primarily in the technologies but in the management systems and organisational processes that integrate and apply these solutions.

Measuring in order to manage

An energy-efficient approach has been implemented on many mines, and begins with an understanding of both the sources (inputs) of energy – not just electricity but also energy sources like diesel in mining trucks – and the respective outputs. An energy audit, conducted in accordance with ISO5001 standards, is one of the ways of accomplishing this, by measuring inputs and outputs on which to base a conceptual energy mass balance.

The mine's energy balance – rather like the water balance that mines are more familiar with – creates the framework for measuring and monitoring the flow of energy, so that losses can be identified and targets set for future improvements in efficiency.

As Figure 1 shows, the energy flow can be mapped along with the mass associated with other mine inputs, allowing the representation of energy and mass flows, losses and outputs.

Specialised expertise is frequently required to conduct the necessary studies behind these measurements, but the systems must be integrated into the mine's daily routine of monitoring, evaluation and continuous improvement. For instance, an expert can establish whether the capacity of the electrical motors at work are optimally suited to their respective applications; ideally, they should be operating at close to 75% of capacity for increased longevity.

Social benefit in the sustainability journey

In addition to the operational and regulatory risks discussed above, mining companies' social licence to mine has emerged as a key risk needing attention at every level of an operation.[4] Even energy efficiency has a role to play in addressing this risk.

At a corporate level, the decision to go partly or completely 'off-grid' in response to national supply disruptions – and perhaps even to realise energy cost savings – may seem the responsible route to take. It offers smoother operations, less risk to investors and a higher level of overall efficiencies.

However, the social licence that mines seek from stakeholders like governments, citizens and local communities is generally based on the principle of shared value, where inputs and benefits derived from mining are shared more fairly among all affected parties. The danger to be avoided lies in creating an 'energy island' that serves the mine and does not integrate with the wider world.

A common and positive response that many mines already make in this regard is to share their water or energy resources with neighbouring communities – which is generally well received. There is a growing argument, though, that calls for a higher-level and more strategic engagement between mines and their host countries on the transformative opportunities within "power-mining integration".

Integrating power and mining in Africa

In a recent report, the World Bank argues against self-supply of power by mines, saying that this arrangement "imposes a loss for everyone—people, utilities, mines, and national economies"[5]. It says that, since 2000, mines in Africa have spent over $15 billion to cover their own electricity investment and operating costs – installing nearly 1,600 MW.

"None of this power made it onto a national grid," the report says. The argument is that, as well as being costly for companies, self-supply has not benefited the local community. By contrast, better power-mining integration creates a win-win situation.

"Mining companies could be anchor customers for utilities, facilitating generation and transmission investments by producing the economies of scale needed for large infrastructure projects, in turn benefiting all consumers," continues the report. "Utilities can also secure large revenues from creditworthy customers. Grid supply in turn costs mines less than self-supply from diesel and HFO and allows the mines to focus on their core business."

The benefits of such high-level arrangements are not hard to see, but of course take time, patience, resources and willing networks of well-placed executives and government officials. SRK has seen first-hand the positive outcomes of such processes; in our recent role as technical advisors to the government of Cameroon, we were able to contribute to the negotiation of complex project arrangements involving not just a mine but rail and port facilities. The value of these processes cannot be over-stated, and should in fact form an important focus for the private sector – especially in

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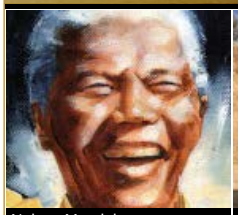
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downturns like the present when there is time to take stock and plan ahead in preparation for the next economic upswing.

Many mining companies already have policies in place – regarding environmental and social impact, for instance – that could pave the way into such engagements with the relevant stakeholders. By integrating their energy efficiency efforts with government's national or local programmes in their host country, the drive to improve energy efficiency could be enhanced while reinforcing the social licence to mine. (For examples of SA government initiatives, see the sidebars alongside: 'Better rebates for energy efficiency' and 'Government agencies on hand'.)

Potential for renewables

This is not to undermine the role and potential of renewable energy sources in the mining sector; on the contrary, it would seem that Africa is already taking the lead in pursuing renewable options for both large-scale and localized power generation – potentially leap-frogging over the coal age on which most developed countries based their industrialisation.

A strong indication of future trends is emerging from the unexpectedly positive impact of South Africa's Renewable Energy Independent Power Project Procurement Programme (REIPPPP). In a few short years, private investors – working in partnership with public authorities – are adding some 5,000 MW to South Africa's generation capacity.[6]

In doing so, this process has brought both inspiration and practical lessons to Africa's electricity-starved countries – of which over 30 now experience power shortages and regular interruptions in service, according to the African Development Bank.

Energy efficiency on mines is about more than the insertion of the latest technologies. It is about strategically understanding an operation's energy balance, and contextualising the available options within a broader risk profile.

This requires not just expertise in energy-related fields, but a full appreciation of all the factors that make a mine successful – from environmental impact assessments, geotechnical engineering, hydrology and rock mechanics to mine planning, waste management and stakeholder engagement. Only then can an effective energy management system be aligned to the company's strategic objectives and make a real impact on efficiency and capitalise on opportunities.

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References:

[1] EY, 2015 - Business risks facing mining and metals 2015–2016, page 28.

[2] World Bank Group, 2015 - The Power of the Mine: A Transformative Opportunity for Sub-Saharan Africa, page 1.

[3] http://www.thecarbonreport.co.za/the-proposed-south-african-carbon-tax/

[4]EY – page 20

[5] The Power of the Mine: A Transformative Opportunity for Sub-Saharan Africa 2015, page xi.

[6] By 2014, a total of 64 renewable energy projects – representing a commitment of US$14 billion and generating almost 4,000 MW between them – had been awarded to the private sector. Source: South Africa's Renewable Energy IPP Procurement Program: Success Factors and Lessons (May 2014) by Anton Eberhard, University of Cape Town, Joel Kolker, World Bank Institute, and James Leigland, Private Infrastructure Development Group (http://www.gsb.uct.ac.za/files/PPIAFReport.pdf). South Africa's integrated resource plan 2010 (IRP 2010) identified the energy sources mix required over a 20 year planning horizon to 2030, of which 17 800 MW should be met from RE by 2030, with 5000 MW to be operational by 2019 and a further 2000 MW by 2020 (http://www.ee.co.za/wp-content/uploads/2015/06/Energize-RE-Vol-3-june15-p9-12.pdf).

[7] https://saneditax.org.za/Symfony/web/app.php/homeDisplay/21