

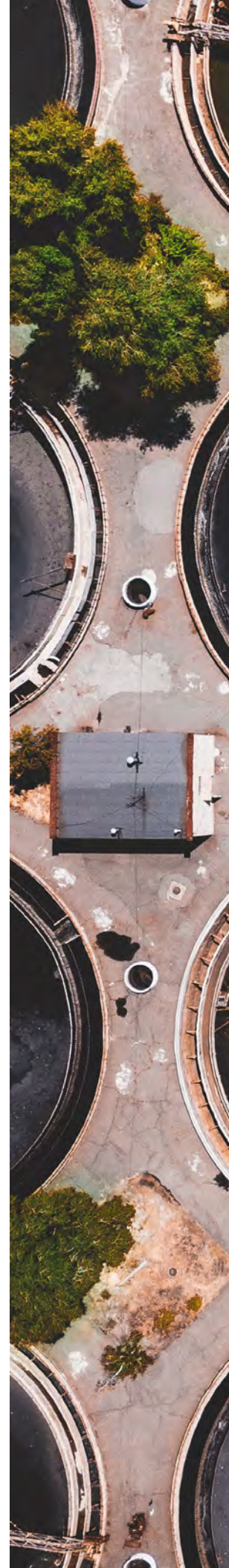
‘No aspect of a mine will remain untouched’

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Energy and Mines

There may not be one perfect solution to decarbonise the mining sector, but the transformation is happening nonetheless. Trevor Gilchrist, Practice Leader, Mining and Debra Johnson, Senior Advisor, Sustainability at Stantec, have seen mining companies’ strategies and the overall decarbonisation trend evolve dramatically in recent years. Here, they share their observations and predictions about the different paths the industry will take to net-zero.

Energy and Mines: Which disruptive technologies will likely be the most effective in terms of completely replacing diesel for mine energy, transport and processing?

Trevor Gilchrist: On the mine infrastructure side, that remains an open question, and the industry has yet to see widespread implementation of truly disruptive technologies. The most obvious exception is the growing use of battery electric vehicle (BEV) technology, although it must be said that at this stage, those vehicles essentially replace the diesel drivetrain





with BEV, and the vehicle remains similar. Is it truly disruptive? Other contenders include several variations of rail or monorail-based concepts that are readily electrifiable, and being strongly considered, or implemented in several cases.

On the energy supply side, the answer may be less of a single solution, and more of a range of technologies that are implemented over time as they develop. In the near term, known solutions like wind, solar, energy storage, carbon capture and biomass are already being implemented. Those technologies on their own are not likely to completely replace diesel. Couple those, however, with solutions which are further out in the pipeline, and the path to true net-zero is clearer. Those solutions include things like hydrogen and small modular nuclear reactors (SMRs) which are being developed aggressively, further development of biogas, and geothermal.

E&M: What are the main challenges for mines in trying to lower emissions while maintaining production targets?

Debra Johnson: Most of the technologies that will materially lower carbon emissions over the next decade are either relatively new to mining or in development. Mining's relationship with cutting edge innovation has not been strong for a variety of reasons, not least of which is the fact that innovation can be disruptive to productivity. The perception is that the technology isn't mature enough to do the job. Often the technology's maturity is not the issue, but rather, execution falters causing issues that are inappropriately extrapolated to a scaled implementation. When pilots are structured as a validation and foundation for scaling rather than as a proof of concept, the success rates are much higher. Stantec is positioned to help both mining companies and innovative technology suppliers by bridging this gap in execution.

E&M: Are mines attracting new types of “green capital” to support their decarbonization projects?

DJ: Mining companies with positive ESG (environment, social and governance) metrics attract interest from many different types of investors. ESG drives financial performance and reduces risk, which in turn attracts investment; this capital is then invested into decarbonisation projects that further enhance ESG metrics. It's a virtuous circle regardless of the colour of the capital! So yes, the market and green capital are supportive of decarbonisation projects in their own — sometimes round-about way.

E&M: How are decarbonisation goals driving the integration of power generation, mobility and processing systems?

TG: For existing operations, it's really about finding efficiencies in existing systems, and in some cases replacing them with different, less carbon-intensive, or electrifiable transport systems. On the power supply side, it's about how the power is generated, and implementing some of the initiatives already discussed.

For new projects starting with a blank slate, there are several possible strategies. The goal is to move less material over shorter distances, while using clean energy to move what must be moved. Many projects are carefully considering location of infrastructure, i.e. locate processing close to the source, and consider several alternate solutions where that is not feasible. For example, one project which involved several mines distant from an existing mill considered use of ore sorting to significantly reduce the quantity of material to be moved. Other examples include careful consideration of elevations that tailings need to be pumped to, and siphoning, rather than pumping reclaim water, and then recovering energy from it.



As pressure to decarbonise mining continues to mount, the other factor that will drive this integration is that companies will begin assigning a value to carbon reduction. This means that return on investments (ROIs) for energy and decarbonisation projects that would normally fail to beat out competing operational improvement projects will eventually percolate to the top in the capital budget analyses.

E&M: How are operational energy strategies for mines aligning with mid and long-term carbon reduction targets?

DJ: Most of the Tier 1 and some of the Tier 2 miners have made commitments to achieving carbon neutrality by 2050 with at least Scope 1 and 2 emissions, as well as 30% emissions reductions by 2030, with a few having even more aggressive targets. The conversations we are having with our clients reflect the seriousness of those commitments. At the same time, challenges persist in bridging corporate carbon reduction goals with budgets and operational realities.

Therefore, we are seeing clients working to build momentum in existing operations with more established technologies like wind and solar paired with mature energy storage solutions like Pumped Hydro Storage (PHS) and Battery Electric Storage Systems (BESS), since these are relatively easy to include in operational strategies. These initiatives are being implemented because miners have enough confidence that they can be successful with these technologies. Being in an upcycle also helps with being able to invest in these initiatives to keep up with the current rapid pace of change.

Step change energy strategies like green hydrogen, ammonia as fuel, and other newer energy storage solutions will generally not be coming on board for a few years. Nonetheless, we are seeing



opportunities to use an agile approach to deliver incremental innovations, thereby providing necessary foundations for step change strategies.

E&M: As decarbonisation targets ramp up, what level of renewable energy integration will become attractive and/or necessary for mining companies?

TG: There is no question that a very high level of renewable energy integration will be needed. Accordingly, when you talk about the level of integration, you are also talking about how renewables will be paired with technologies like mine electrification, green hydrogen, green ammonia, and various energy storage solutions. These integrations are essential to achieving decarbonisation targets since renewable energy cannot by itself replace fossil fuels, especially diesel.

Also worth noting is the circular relationship between renewables and mining. The end users for renewables will likely not accept that their batteries were manufactured using large amounts



of non-renewables like diesel. In turn, mining companies will have to demonstrate that they are pursuing higher levels of renewables.

E&M: Beyond powering operations, how are renewables expected to play a role in broader energy and sustainability goals - i.e. minerals processing, fleet decarbonisation and electrification initiatives?

DJ: The mining industry is in the midst of the biggest and most rapid change in any time in history. In 10 years, the industry will be dramatically different from what we see today. No aspect of a mine will remain untouched by this intersection of decarbonisation, energy transition, digitalisation, globalisation, and innovation. Renewables will drive efforts to replace existing energy sources, but will also influence what new technologies are developed for fleets, processing and electrification. Equipment manufacturers will ultimately focus their efforts on developing solutions that will both adapt to and leverage the limitations of renewable energy.