The road to decarbonisation in Australian mining
How do we get to net zero?
As a key pillar of the national economy, the Australian mining sector is in a position of industry leadership. And its authority as a leader has recently come to the fore in its response to climate change. Showing true accountability, mining players of all sizes have committed to net zero emissions goals to meet the pressing 2050 climate change target.

The road to decarbonisation, however, is going to be a challenge. But with every challenge, opportunity arises. This whitepaper acts as an advisory guide to those within the Australian mining and resources industries, tackling the questions: What does the journey to decarbonisation look like? What are the potential roadblocks? What infrastructure is required to power the future mine? And what practical steps can miners take now to prepare?

**Industry overview**

The mining and resources sector comprises 11.1% of Australia’s economy, brings in over $114 billion annually, and employs over 1.1 million people in direct and indirect jobs under the Mining Equipment, Technology and Services (METS) umbrella.¹-³

According to Christine Gibbs Stewart, CEO of Austmine, the value of the METS sector cannot be overstated.

“We have this world-leading, highly innovative industry that has a footprint in every corner of the world,” she points out. “It stands to reason that the industry wants to show leadership in addressing the challenges we’re facing on climate change, and I feel the whole Australian METS sector has stepped up in this regard.”

Likewise, Stuart Cowie, head of ABB Australia’s Process Industries business, agrees that the native METS sector has already shown impressive leadership on the sustainability front.

“Australia is in fact leading the charge on the sustainability front in mining, which is very exciting,” Stuart says. “We are seeing miners make strong commitments to the zero emissions target, including FMG who have brought forward their net zero target by ten years to achieve this by 2030. This greatly impacts decision-making around technology investment and modernisation.”

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“The METS sector contributes greatly to the Australian economy in terms of revenue, jobs, and export – that’s indisputable,” says Chris. “In addition to that, Australia is already recognised as a world-leading mining nation by other countries. The local perception of the sector is also positively changing from that of being a low-tech commodity output industry to one that is high-tech and that the Australian public can be proud of.”

Which is why Chris, who has been CEO of Austmine since 2014, believes the sector is perfectly positioned to take the lead on the decarbonisation charge.
**Why decarbonisation is the priority**

Both Stuart and Chris are of course referring to the 1.5 degrees climate change emissions target articulated in the Paris Agreement. As a significant contributor of greenhouse gas (GHG) emissions, the mining industry needs to reduce its CO2 emissions to net zero in order to meet that 2050 deadline.

It is estimated that the mining sector contributes between 4-7 per cent of Scope 1 and Scope 2 GHG emissions globally, and almost 30 per cent of indirect Scope 3 emissions.⁴

Collectively speaking, the industry has rallied to the cause.

In October 2021, the world’s top miners announced via the International Council on Mining and Metals (ICMM) that they would commit to a net zero direct and indirect carbon emissions target by 2050.⁷

Chris, however, ensures it’s much more than words and signed documents.

“The METS industry is coming together in a seriously proactive way – there are several projects happening that illustrate the sector’s commitment to tackling this issue, and from multiple angles,” she explains. “For example, survey data from Austmine reveals that about 40 per cent of our members have already invested in renewables, and there are initiatives such as the Charge On Innovation Challenge, which seeks to electrify mining haul truck fleets. The willingness of the industry to collaborate is inspired and shows earnest leadership.”

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**Emissions Explainer**

**Scope 1:** Emissions from a mining company’s direct operations such as emissions from diesel fuel used in haul trucks, or methane emissions from coal mines.

**Scope 2:** Emissions released from the power a mining company uses for its operations. This could include electricity produced by the burning of coal, or gas-powered electricity bought from the grid and used on site.

**Scope 3:** Emissions from customers using products sold by the mining company, such as processing iron into steel, or emissions from the supply chain and transport.⁵,⁶
Planning the journey
Individual initiatives aside, the question is, how does the industry get there?

Nik Gresshoff, who is head of mining at ABB Australia, advises that before mining companies embark on their decarbonisation journey, they need to first define what their carbon footprint is.

“It needs to start with a definition of what your organisation’s carbon footprint is, and what falls within the scope of decarbonisation. Are you focusing on scope 1 and 2 emissions initially or are you including your whole supply chain from the outset?” questions Nik. “The next step is to examine the technology and what is currently possible to decarbonise. If you graph this versus the benefit, the low hanging fruit should stand out such as light commercial vehicles moving to electric.”

In relation to the second step, Nik points out that miners need to do a full asset analysis in addition to accurate monitoring of their power usage and fuel consumption.

“Certain assets in a mine might be decades old, and to convert these could involve a huge capital expense,” he notes. “Having a clear understanding of where your assets are in their life cycle is critical, as well as an understanding of what technology is available and what technology could fit with your current operation.”

Infrastructure to be considered for electrification
Importantly, Nik says that miners wanting to decarbonise via electrification will need to review their entire electrical infrastructure. On this, his ABB colleague Ralf Eckert – who worked in the Australian mining segment with ABB for over 5 years – concurs.

“From the electrical point of view, I would ask: what is the required power, what are the largest consumers, what does the owner want to achieve in the long run, what kind of energy and power supply do they have, and what is the quality and strength of the electrical grid system at site?” asks the Senior Solutions Architect. “Do they have green energy from renewables available or is the owner interested to produce or get green energy? Do they want to decarbonise the whole mine from mine to port or just some areas? For example, just a few truck roads or the whole fleet?”

Other questions miners should ask is whether their energy network is strong and stable enough, contends Ralf, pointing out that all the energy generated from fossil fuels will need to be offset from energy from the electrical grid system.

“Energy efficiency and power quality is becoming increasingly important,” he notes. “One critical point is how the power is managed. As an example, a change to electric trucks from diesel underground will change the electrical demand for ventilation into one for charging infrastructure.”

In terms of battery capacity, whilst Ralf acknowledges there is rapid progress in this area, he advises mining companies to be mindful of practical limitations.

“I would recommend that the overall battery voltage should stay below 1000V so that we can use low voltage technology,” he says. “The maximum current limitation for batteries and the charging system are a bit more complex as higher currents defines larger cables, larger busbars, larger dimensions and forced cooling is going to be required.”

Until the power density and battery technology allows for larger vehicles to be economically run on batteries, Ralf says other technologies can be considered such as green hydrogen-power, conveyor systems, hoists where applicable which are also an electrified solution.

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A future of combined power

Both Nik and Ralf agree that the road to decarbonisation involves a combination of green hydrogen power and electrification in mines.

“I would say the future mine is powered by using a combination of these. How quickly battery technology develops might dictate how far hydrogen goes, but to be honest, hydrogen will still play a major role in how a mine is powered overall,” Nik predicts. “It’s not like Beta versus VHS, it’s going to be a combination. However, mining companies should already be working on changing out what diesel-powered vehicles and equipment they can with electric.”

Nik mentions ABB’s expertise on the electrification front.

“Since our beginnings 130 years ago, ABB has supported mining companies with electrification. Because we are an electrical technology company first and foremost, we understand what is required for electrification and automation,” he says. “The move to decarbonisation is not going to happen overnight, however, ABB has cemented a place in electrification with solutions such as our automated fast battery charger, our trolley systems, and traction motors for trucks. We are well-positioned with our expertise to advise mining companies on the electrical infrastructure required to make electric transitions.”

In fact, ABB unveiled its ABB Ability™ eMine suite of technologies in 2021 to specifically facilitate electrification of mines from pit to port. In 2022, the technology leader will launch the complementing Ability eMine™ FastCharge – an innovation currently in its pilot phase – that will accelerate charging electric haul trucks.

Moreover, Nik highlights that the road to decarbonisation is intrinsically connected to automation and digitisation.

“To automate equipment, you have to digitise it, and you have to create connectivity between your equipment and systems,” he explains. “In a simplistic example, you need to have digital connectivity to identify where your electric vehicles are and what their charging status is. Because if your electric vehicle runs out of battery – unlike with diesel where a jerry can be used to bring petrol to your vehicle – you can’t bring an electrical charger to the vehicle.”

ABB Ability™ eMine: The Key to Digital Mining

ABB Ability eMine™ is a zero-carbon mine solution that enables the electrification of mining equipment across hauling, hoisting, grinding and material handling. The suite of electrification technologies has been furnished with digital applications to monitor and optimise energy usage. It also comes with the eMine™ Trolley System, aimed at reducing diesel consumption by up to 90 per cent.

In addition, the technology leader is piloting its Ability eMine™ FastCharge solution aimed at accelerating the charging of electric haul trucks. The Ability eMine™ FastCharge has been especially designed to withstand harsh environments typical to remote Australian mines. In its trial phase, it has shown to achieve suitable charging of an electric haul truck within 15 minutes.8
With all challenges, come opportunities
Digitisation and automation also come with cost savings and efficiency gains.

“From fleet management to operations management, such as ventilation on demand – there are lots of opportunities to save on energy use and costs,” enthuses Nik. “An excellent illustration of this is the Boliden Kankberg gold mine in Sweden. By implementing ABB technology to optimise the ventilation in the mine, they were able to achieve ventilation energy savings of 54 per cent.”

He also cites the Gold Fields Granny Smith mine in Western Australia as a paragon of digitisation – ABB is working with the mine to connect and coordinate their entire operations in real-time, from face preparation to crusher.

“There are plenty of opportunities to be gained in the digitisation process which are of course going to be essential to how mining companies decarbonise,” says Nik. “As leaders in this field, ABB can assist mining companies in providing ideas on how they can reduce their electrical consumption on current assets, or how we could substitute equipment or componentry with a more sustainable option such as a permanent magnet on a conveying system. There are a plethora of ways in which we can collaborate and assist mining companies in this journey.”

Chris looks at opportunities from the perspective of the METS sector in Australia.

“There are tremendous opportunities regarding the technologies used to reduce carbon emissions,” she says. “From a digital point of view with better connectivity at mine sites and automation, there will be both efficiency improvements and cost savings.

We’re also seeing a spike in start-ups in Australia who are developing technologies specifically to address the decarbonisation issue. It is quite exciting.”

The Austmine CEO also reiterates the significance of the Charge on Innovation Challenge in which Austmine is a facilitator and the opportunities that this is bringing to the fore.

“The Charge on Innovation Challenge shows the willingness of the industry to come together to solve a problem – to coalesce around what is undoubtedly the greatest challenge of our time,” enthuses Chris. “It’s not only encouraging established vendors to get involved in this common goal but has opened up opportunities for companies on the supply side, who wouldn’t normally have access to this type of project.”
The Charge On Innovation Challenge

The Charge On Innovation Challenge is an initiative where vendors across the METS sector have been tasked with coming up with a solution to feasibly electrify haul trucks.

The initiative came about as an extension of BHP’s partnership with Austmine, whereby an Innovation Hub had been developed by the two organisations with the purpose of encouraging suppliers in the Australian METS sector to develop technological solutions to tough mining challenges. BHP, Rio Tinto and Vale then came together as Founding Patrons to use this innovation hub to define and promote the Charge On Innovation Challenge.

What does the actual Challenge involve?

“The Charge On Innovation Challenge asks vendors to present interoperable solutions that can safely deliver electricity to large battery-electric off-road haul trucks in a way that maintains or improves current productivity levels,” the Founding Patrons explain via their website. “Specifically, we want mechanisms capable of delivering in the order of 400kWh of electricity to each truck within a haul cycle (ie load, travel, dump, return, queue). The delivered electricity is to charge a battery, and if applicable directly propel the truck.”
In summary
While the road to decarbonisation is going to be challenging – and there will be roadblocks – the experts interviewed for this whitepaper agree that there is a willingness among the Australian mining sector to achieve this goal.

“Currently, a lot of the infrastructure required to reach a zero-carbon goal is not on site, so it’s going to take a lot of investment and a lot of operational change to achieve the target,” says Chris. “However, we are seeing this willingness to invest already, and we’re seeing positive collaborations such as the Charge On Innovation Challenge rally the METS sector into action. From my point of view, these are brave steps – and that’s what’s needed to make a difference.”

Nik imagines a future mine with embedded technologies for both batteries and hydrogen.

“I’m inspired by the innovation we’re seeing on both the electrification and hydrogen front,” he concludes. “The challenge for mining companies now is to map out their own journey, and to weigh up the gains that can be achieved now through automation, along with the investment required to get to net zero. It’s an energising challenge.”

References