




Energy management in mining

An emerging capability for
the energy transition



“The race is on. We need to act strategically and with urgency and ambition, to get ahead of the game and accelerate investment here. If we do, Australia will be a world-class electrostate, helping to lead the transition from the Industrial Age to the Electric Age.”

Alan Finkel, Former Chief Scientist

Electrifying your operations: Why mining companies need to act now to embed energy management as a capability

As the global climate crisis intensifies, the energy transition has emerged as a pivotal strategy for combating climate change. The increasing demand for mined products amidst a changing energy paradigm is driving a shift in the future of mining operations.

A changing landscape

1 Critical minerals increasing

According to the International Energy Agency, demand for critical minerals in the energy sector could increase by as much as **six times** by 2040.

2 Renewables on the rise

Renewable generation, as part of the energy fuel mix, is expected to almost double from 2021 rates to **50% globally** in 2030.

3 Electricity demand drivers

Climate pledges and electrification goals are increasing global electricity demand by as much as **25–30%** from 2021 to 2030 levels.

4 Policy decarbonisation imperative

Regulations are driving mandatory targets, scope 3 emissions reporting and declining baselines in the Safeguard Mechanism.

5 Energy system flexibility is key

As the energy mix changes, firming and other system support mechanisms need to be replaced by new technologies or more flexible demand.

6 Social licence

Mining companies need to authentically engage with local communities for the social licence to undertake these expansions.

A changing landscape cont.

Amidst this changing landscape, energy supply shifts from steady-state, fossil-fuelled power stations, to a portfolio of variable renewable generation and storage assets. Adapting to this change requires more than commitments to build batteries and renewable energy generation, like windfarms.

As companies transition to renewable energy sources, they will need to adopt new energy management capabilities, to ensure a smooth transition to operational readiness or risk high-capital spend on excess storage.

At a strategic level, mining firms will re-test their energy strategies – should they buy, own, or operate generation assets and storage? Will they connect or remain isolated from shared grids? Will they enter electricity markets for essential system services?

For mining operations, these decisions will matter more than ever. As the energy supply shifts – increasing in variability in source, time of day and by season – the energy management landscape grows in complexity.

Operations teams will need to prepare now for new capabilities, embracing energy efficiency e.g:

- Understanding the energy intensity of different processes, operational flexibility
- Across time of day or season, and an integrated approach to operational planning
- More agile maintenance planning aligned to energy variability.

Energy management in operations

In the new energy paradigm, mining operations need to ask:

- How will we organise and coordinate resources when the accountability for energy management decision-making sits at the nexus of services and operations?
- What talent do we need now and over time. What skills are required for a new energy landscape of efficiency, operational flexibility, and automation?
- What will be our 'system' of energy assets, hardware (sensors) and software platforms to orchestrate energy and operations?

We encourage mining operations to define a clear path forward, ensure sufficient lead time to build and buy these capabilities alongside your company's decarbonisation roadmap.



What to ask

Energy supply

- Should we buy, own, or operate generation assets and storage?
- Will we connect or remain isolated from shared grids?
- Will we enter electricity markets to sell excess energy as essential system services?

Energy demand

- Do we know our energy intensive processes? What data do we need to collect?
- Where are our energy efficiency opportunities?
- How might we optimise against *time of use* energy tariffs, or for peak demand?

Enabling resources and technology

- How should we organise, coordinate, and deploy resources in the new energy paradigm?
- Do we have the capability we need?
- How mature is our integrated planning?
- What orchestration and systems do we need?

Transition strategy: The changing face of supply

The rapidly declining costs of renewable energy, increasing availability of energy storage, and a drive to meet decarbonisation goals is seeing many mining companies transition their energy arrangements.

From an energy consumer, expecting an 'always-on' supply powered by fossil fuelled turbines and diesel generators, to an energy supplier, powered by a portfolio of variable renewable energy and an open mind to shifting operational demand to meet supply.

Electricity supply to mining is fundamentally changing.

Transition of assets

Coal or gas-fired turbines and diesel generators transition to batteries, wind farms, solar and biofuel generators.

A portfolio of assets

The number of energy assets shifts as power comes from a portfolio of supply and storage options, not just a few primary generation sources.

Connection options

Mines may consider operating with or without grid connection, making the most of renewable and distributed energy resources.

These are large scale changes requiring organisational consideration. Mining operations will need to evolve from expecting supply to match their demand, to optimising across supply and demand.

Renewable variability

The **value of energy** is more variable, over time of day and season, and may not always be available.

What to consider

Buy/own/operate: is generation a strategic imperative or a commercial commodity play?

Connect/isolate: who runs and maintains the integrated grid and how is transmission prioritised at peak times?

Electricity markets: what commercial benefits can be gained from providing other ancillary services (essential system services)?

Energy demand

Electrification will fundamentally reshape the way mines operate

To maintain maximum production output, understanding energy-in-process and electrification demand will enable integrated planning so operations can run safely, reliably and with lower emissions.

Digital orchestration will be used to create operational flexibility, optimising across energy availability and efficiency of operational processes in real and near real-time.

The electric mine's integrated network and operational control centres create an intelligent mine, able to predict and respond to intermittency and flexing capability.

In an electrified mine of the future, the role of electricity usage and availability changes.

As key pieces of mining equipment electrify, from haul trucks to conveyors or processing infrastructure, the demand profile shifts and expands significantly. The relative cost or availability of each additional MW of electricity may vary as steady state generation transitions to a portfolio of renewable generation plus storage – where time of day matters.

Integration of 'on-site' generation and battery systems to capture and store excess renewable energy directly at operations, whilst maintaining connection to the power grid, act as a backup source and provide an opportunity to sell excess renewable energy.

Under this paradigm, mining operators can mature energy management by monitoring and analysing energy-intensive processes and taking action. Seamlessly integrating weather forecasts into maintenance planning is just one example of optimising against energy availability for real-time and near real-time decision-making.

Data driven insights

Energy operations become **more complex** with AI necessary for data assisted human-decision-making.

What to consider

Baseline: do we know our energy intensive processes? What business rules need to be set and how do we manage conflicting priorities by exception?

Energy efficiency: what critical opportunities exist and how do we visualise them as part of our future mining operations?

Optimise: how do we best deploy storage locally behind-the-meter versus centralised storage at generation points?

A growing shortage of talent and materials affecting multiple industries

The energy transition is simultaneously occurring across industries and geographies.

Beyond electricity utilities, industrial companies and energy and resources firms are expanding their energy capability as renewable generation, critical minerals and increasing populations create booming demand.

Amidst this activity, demand for electrical skilled resources – both blue and white collar, is increasing.

Fighting a war on talent won't enable the ecosystem: partnering, developing, and transitioning from adjacent industries will be some of the creative approaches needed in the adaptive workforce strategy for the energy transition.

When building the capability needed, start with assessing the maturity of your operations. Look to test your strategic use cases for operational flexibility, shifting loads to match energy surpluses or deploying maintenance activities at short intervals.

People, process, then technology. Technology roadmaps will need to continuously adapt to the rapidly changing landscape for energy management systems, with a proliferation in vendors in recent times and an expectation for this market to grow to US\$75.6 billion by 2028.

Mining companies, energy companies and other major industrials will be competing in similar markets for talent, materials and equipment. Forward-looking and adaptive strategies, embracing creative solutions and working with – rather than against – the ecosystem will be necessary to meet major capital and production goals.

Operational agility

Intelligent operations will **ensure agility** to changes driven by new dynamics in energy management.

What to consider


Process: how should we organise, coordinate, and deploy resources in the new energy paradigm?

Deploy: how flexible are our maintenance strategies and how do we shape asset management in an increasingly dynamic future?

Capability: is our workforce hiring roadmap robust against a diverse needs of electrification skillsets?

Integration: have we built in visualisation of energy and started to incorporate insights into how we operate?

Orchestration: have we explored the role that artificial intelligence will play in our future data-driven decision-making?

A man wearing a white hard hat and an orange safety jacket is operating a vehicle, likely a mining truck. He is holding a tablet that displays a map or technical drawing. The background shows a mining site with hills and other vehicles.

“There is no company whose business model won’t be profoundly affected by the transition to a net zero economy... companies that are not quickly preparing themselves will see their businesses and valuations suffer.”

Larry Fink, Chairman & CEO of BlackRock

A glimpse into the future of mining operations

The integrated control centre

Electricity network control centres play a crucial role in managing and operating power systems through the energy transition.

Increased integration of renewable energy sources and distributed energy resources, advancement of fleet automation, assisted decision-making via artificial intelligence and adoption of new technologies are just a few of the reasons control centres of the future will need rethinking around systems and capability.

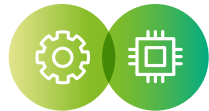
Mining companies will require sophisticated energy management solutions (EMS/DERMS), to enable coordination of their electrified mines. These will need to be part of the operational control centre for a truly integrated view of operations.

Mature integrated operations that consider energy management as a capability can yield benefits from:

- Integrated planning for efficient use of resources and process infrastructure
- Digital twins that can identify potential risks and improve the ability to respond to volatility
- Safely and securely managing through transient energy events
- Leveraging artificial intelligence for self-healing networks to be back online, quicker
- Load shifting – embracing operational flexibility – for energy efficiency savings.

Deloitte's Integrated Operations and Intelligent Mine approaches ensure the most effective use of people, process and technology, and solves the variability of production to maximise installed production capacity.

Key terms



Digital twin

A digital twin is an evolving digital profile of the historical and current behaviour of a physical object or process that helps optimise business future business performance.

A digital twin is enabled by sensors and actuators from the physical world, integrated with data and analytics form the digital world.



Self-healing network

The self-healing of an electricity network is its ability to automatically identify faults (system disruptions), isolate that condition or minimise the branches of the network affected and restore to normal operating conditions – all without human intervention.

Self-healing networks use combinations of physical and digital technologies to bring the system back to a steady state such as: network optimisation algorithms, predefined switching schemes, digital twins, sensors, network switches and other enabling technologies.



The integration of renewable energy into mining operations has the potential to revolutionise the industry. Embracing electrification will fundamentally reshape mining operations. Transitioning from fossil fuel-dependent energy supply and machinery to renewable generation and storage and electric-powered equipment not only reduces emissions but is driving a wave of innovation, digitalisation and an urgency for new capabilities.

Swift action is needed to prepare the organisation for this new way of looking at energy management, as an integral part of planning, delivering and optimising operations, as the world looks to accelerate towards the energy transition.

Talk to our team today about how we can support your forward planning to embrace energy management as an organisational capability.

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Acknowledgements

Nicky Ivory, Alan Marshall, Ian Sanders, Matt Judkins, John O'Brien, Jill Riseley, Celia Hayes, Nuno Soares Carneiro, Kasia Allan, Marnus Van Heerden, Andrew Leatt-Hayter, Alex Manual and Byron Hall at Deloitte, for providing their time, support and valuable contributions in creating this report.



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