



TRANSFORMING MINES

CHANGE MANAGEMENT FOR ELECTRIFICATION





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ABOUT THIS REPORT

The Electric Mine Consortium (EMC) was created in 2020 when a group of leading mining and service companies joined forces with the ambition to accelerate progress towards the fully electrified zero CO2 and zero particulates mine. Over the last four years, the EMC has made significant progress towards achieving this vision and has been a catalyst for significant change within the broader industry, with active working groups across the areas of energy supply and storage, equipment and data, mine design and infrastructure, policy, skills, and carbon.

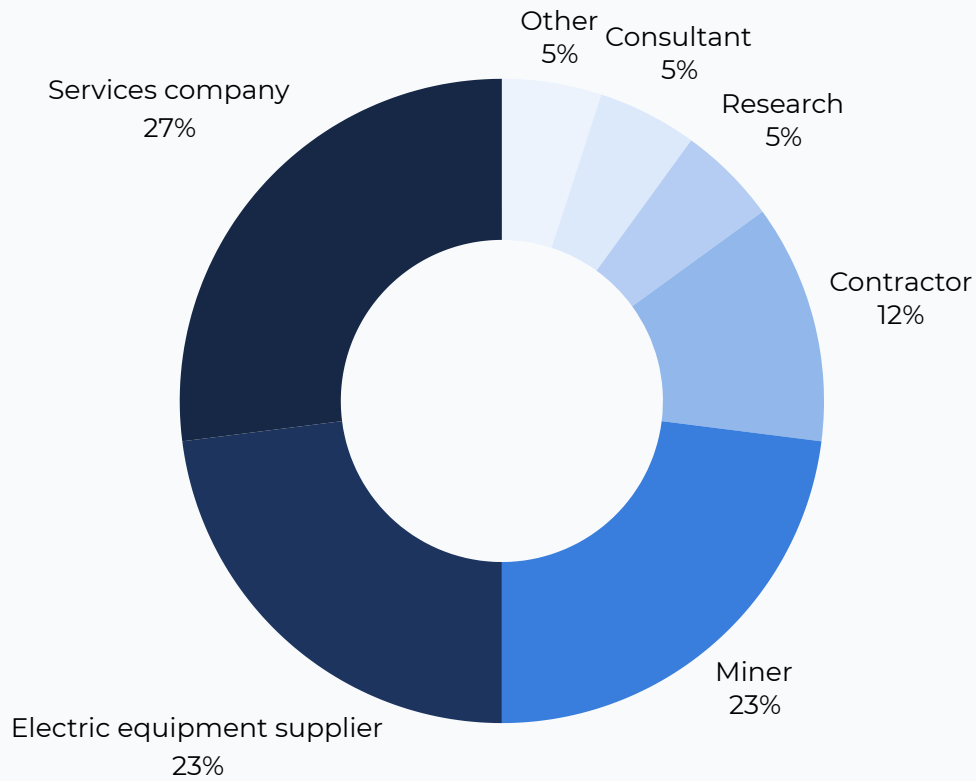
State of Play was initiated in 2012 to create a platform to support the resource industry's discussion of innovation and performance at a strategic level and provide macro-level insights into the industry ecosystem. Since then, we have undertaken several global surveys, conducted hundreds of interviews with experts and leaders, performed deep research and analysis, and published dozens of reports to deliver deep insights into the industry. Our partnership with the Electric Mine Consortium began in 2020 with our State of Play: Electrification report, available at www.stateofplay.org.

In August 2024, the EMC held a “**Transforming Mines**” workshop, focussed on change management for mine electrification. In preparation for that workshop we ran an industry mini-survey with 50+ respondents, spoke to participants at the Electric Mine Conference, interviewed experts from within and beyond the electric mine sphere, and undertook detailed background research. In the workshop, Consortium members and guest speakers heard three real industry case studies, discussed specific strategies and techniques for managing change in mining, and compiled reference checklists for electrification projects.

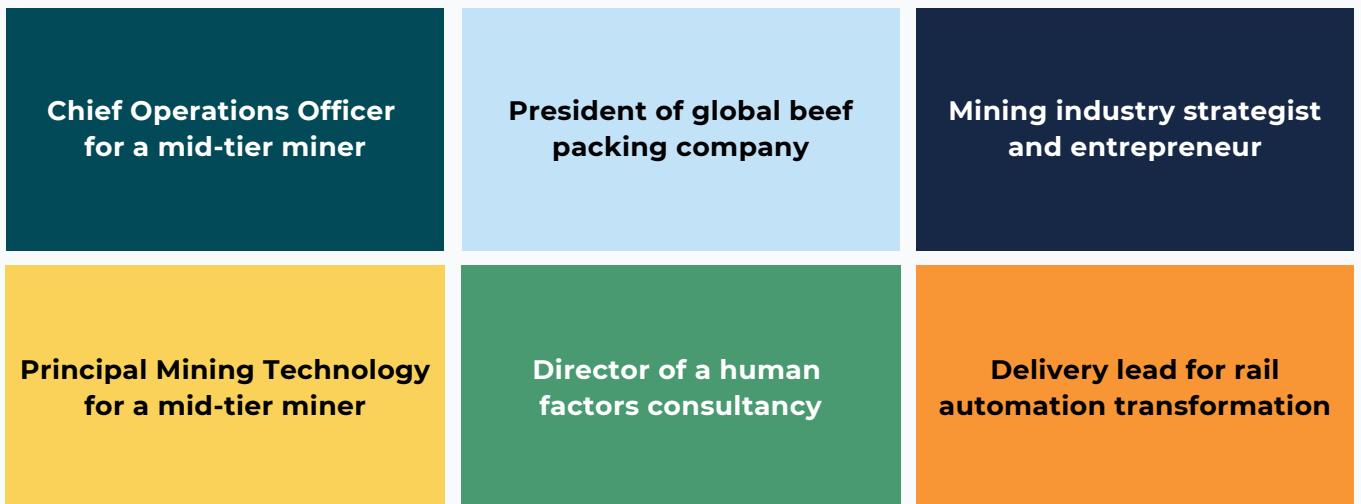


This report provides a public snapshot of those research efforts and conversations, and presents a summary of the insights we uncovered throughout the process. It is a great resource for anyone trying to understand how to effectively execute transformational change within a complex system, particularly for mine electrification projects.

SURVEY RESPONDENT PROFILE



PANEL RESPONDENT PROFILE



PRINCIPLES OF CHANGE

Transforming organisations requires changing hundreds or thousands of human behaviours, systems, and technical practices. Change will inevitably cause disruption; it must be well-engineered to ensure that the disruption is productive, not counterproductive. The most important principle of change is this: **change affects everyone..**

REQUIREMENTS OF TRANSFORMATIONAL CHANGE

VISION

- Generate discomfort with the business-as-usual status
- Understand the visceral, inherent value of changing
- Secure unwavering CEO intent, leadership and support for the change
- Know your peoples' appetite for change

PLANNING

- Understand the technical feasibility
- Define strategic goals and project scope– where to lead versus where to follow
- Spend time in uncertain early planning stages – open minds and explore all options
- Identify stakeholders, team and strategic partners
- Set KPIs and assign accountability structure
- Create tipping-point projects

CULTURAL IMPLEMENTATION

- Cultivate supportive social environment
- Communicate vision consistently
- Engage top-down to create champions
- Engage bottom up to smooth frictions
- Celebrate wins for resilience

TECHNICAL IMPLEMENTATION

- Anticipate & remove roadblocks
- Upskill employees
- Resource the work
- Use cross-discipline taskforces
- Integrate into business as usual

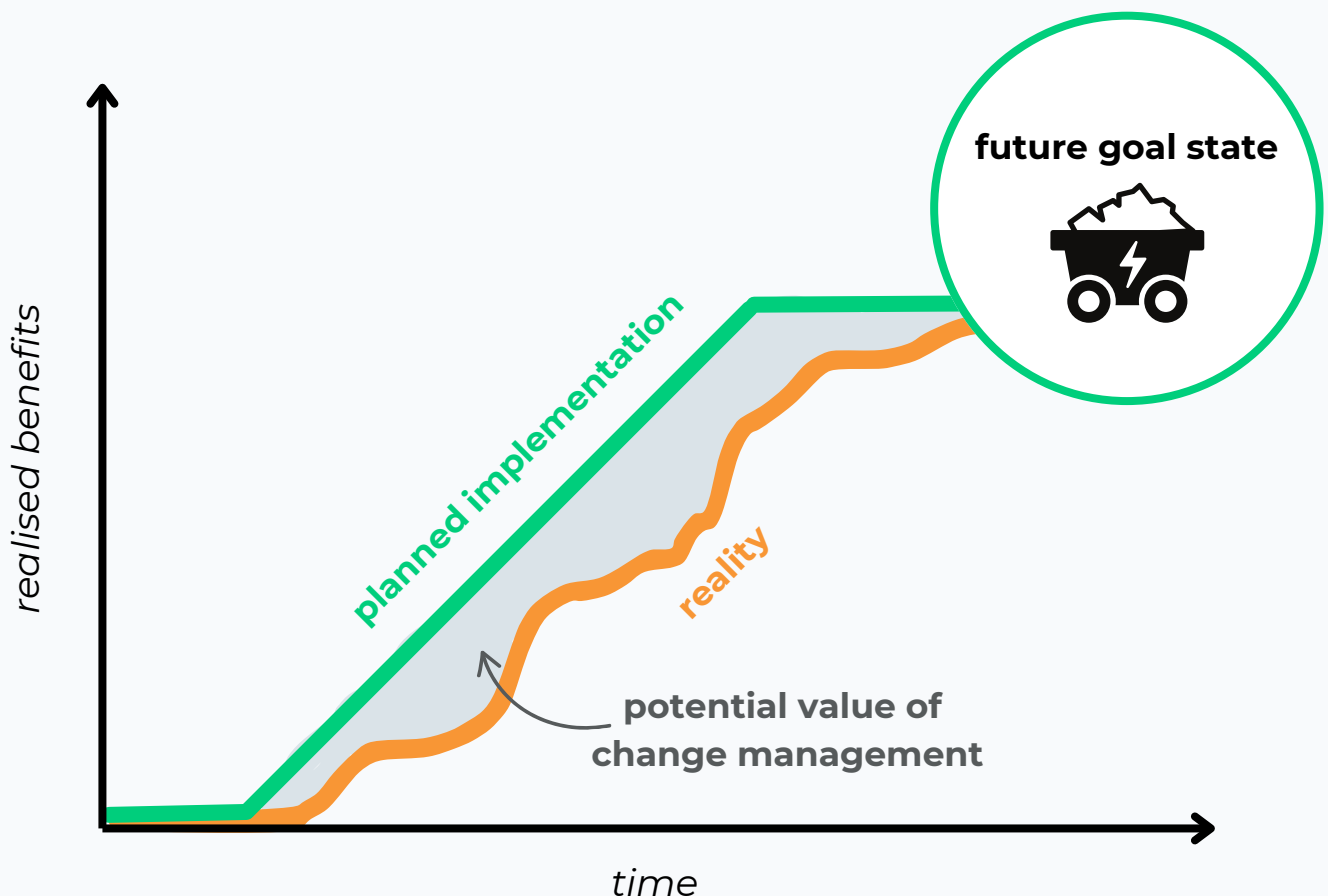
EMBEDDING CHANGE LONG-TERM

- Insulate against changes of key leaders
- Guard against reversion to the status quo
- Make the behavioural change inherent and satisfying rather than compliance-based
- Analyse results and record lessons learned

Even though the facets of change management theory are well known, most transformational change processes fail through either lack of persistent leadership resolve and/or lack of effective attention to the full set of requirements. This typically manifests as a shortfall between the goals and the real outcomes, or projects running well over budget and time. Good operational readiness and change management can close that lost value gap.

“ Imagine yourself doing the job. What are the practical things that get in the way? Because in theory, it all works, but in practice, you know, there are little things that really stuff you up. ”

THE CASE FOR CHANGE MANAGEMENT



THE MINE ELECTRIFICATION PROBLEM

“

“A couple of years ago, nobody was really too excited about electrification, but now it's all that anybody can speak about, isn't it?”

”

DRIVERS

- A significant or complete removal of diesel particulate exposure for workers
- A significant or complete removal of greenhouse gas emissions
- A cleaner, cooler, quieter, less vibration-intensive mine environment
- Reduced cost and risk (by powering equipment with renewables over diesel)
- Potential productivity gain (from increased EV torque or automation capabilities)

CHALLENGES

- High capital investment
- Operational disruption and risk to production
- Safety concerns (e.g., for battery fires)
- Lack of familiarity with and confidence in new technology
- Conservative industry attitudes with respect to physical asset innovation



LEARNING FROM OTHER INDUSTRIES

The manufacturing industry's adoption of robotic process automation

- **Driven by** the need to increase productivity, lower costs, overcome skills shortages, improve product quality, and improve safety outcomes by distancing them from hazardous areas.
- **Challenged by** high capital costs, production disruption, perceived health and safety risks from equipment malfunctions, the need for new skills, and fears of job losses
- **Revealed** the importance of proactive stakeholder change management, seeing the implementation as a journey rather than a discrete project, considering workforce task impacts on an enterprise-wide basis, and continuously monitoring and evaluating the impact of changes



To me, it (mine electrification) almost sounds like an occupational safety and welfare type of situation.



I can remember the meat industry when it was pretty wild, and somebody got hurt, you just called Human Resources and said "I need a replacement", versus today, where we take incredibly good care of our people and our injury rates are very low relative to what they were in the past...

It's just a mindset change. It's just a belief that you can do it safely... We always said no job is so important that it can't be done safely. And if we can't do it safely? We won't do it."

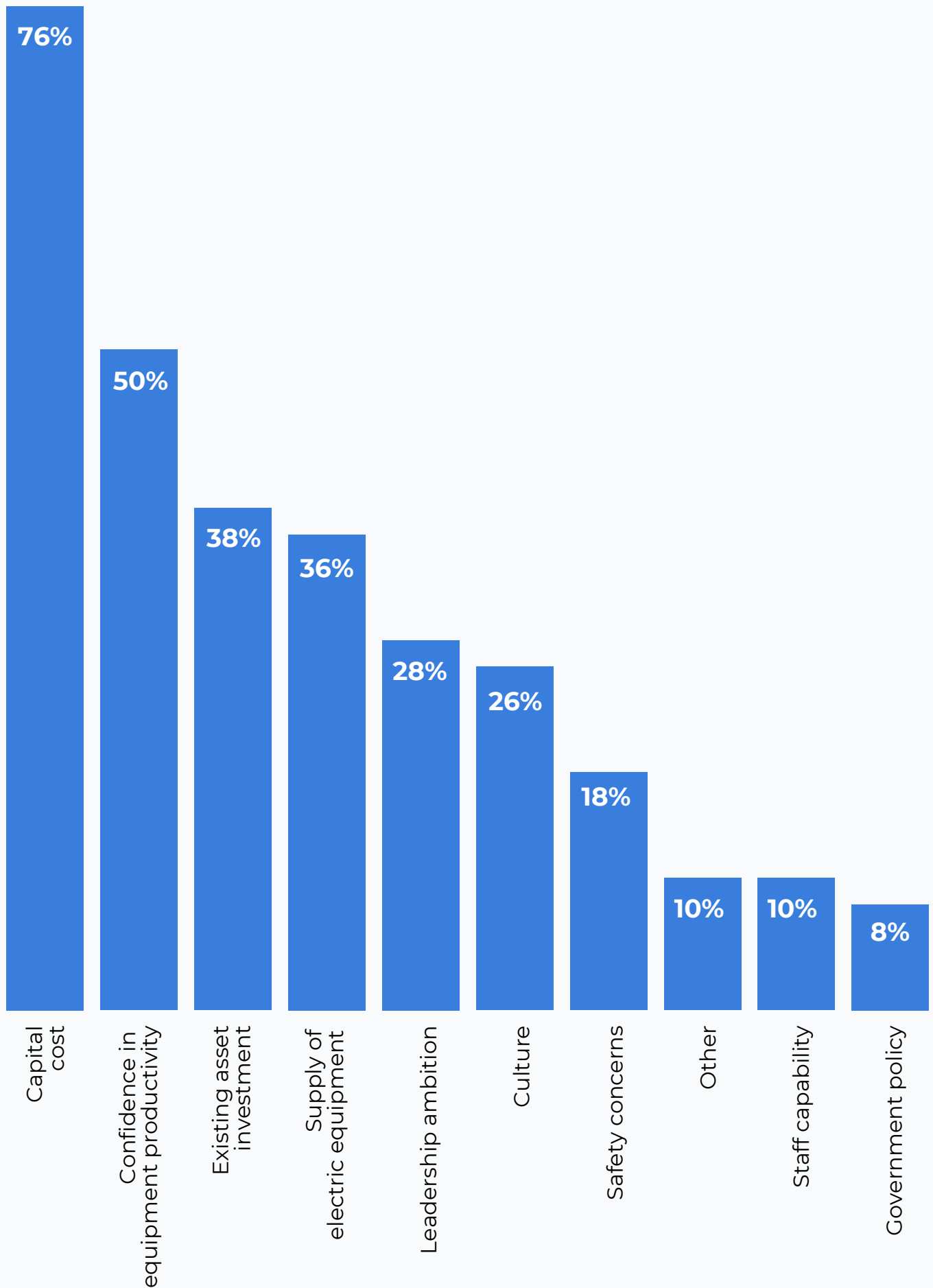
The healthcare industry's transition to electronic health records*


- **Driven by** the need for improved health outcomes, more efficient patient recalls, and communication with the community, particularly over the long term but also in urgent critical care situations.
- **Challenged by** high capital costs (inc. funding access), workflow disruption, perceived health and safety risks for patients, technical barriers, technical learning curve, resistance from workers, privacy concerns, the diversity of stakeholders, and the scale of the transformation.
- **Revealed** that case studies in isolated regions provided valuable learnings, that a simple, workable system was better than aiming for a perfect system, that a resolute need for project success helped to overcome major hurdles, and that decision-making was best devolved to the regional level.

**Cripps et al. 2011, 2012*

WHAT ARE THE MOST IMPORTANT BARRIERS TO ELECTRIC EQUIPMENT ADOPTION IN THE MINING INDUSTRY?

% of respondents, given three answers





“ It all starts with strategy - if the transformation is not supportive and aligned with the strategy, it will ultimately be hard to convince people to fully support the change...” ”

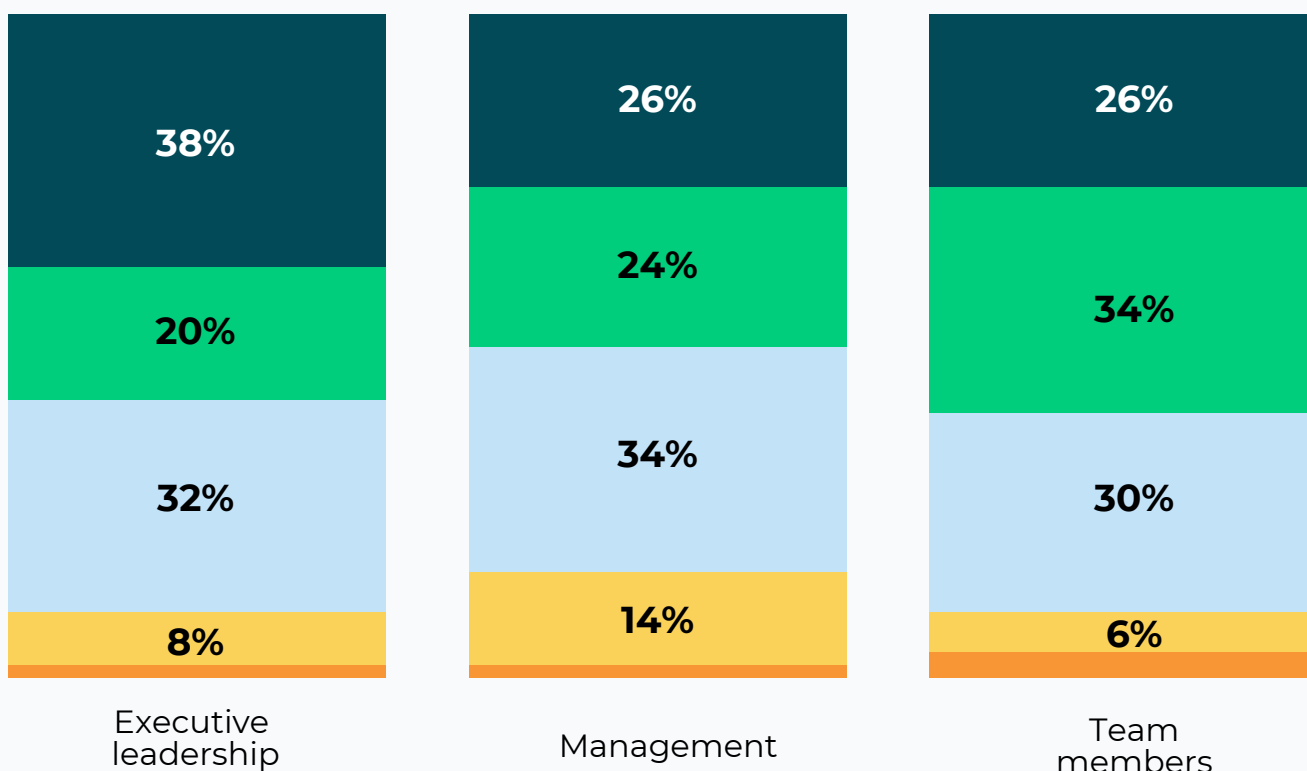


INCENTIVES TO CHANGE

Without the correct incentives for each stakeholder, transformation is likely to fail. Mine electrification involves changing the physical equipment and processes of a workforce on the apparent basis of protecting the environment - even though environmental disturbance is part and parcel of the daily routine. Providing a range of incentives, from transactional to transformational, at all levels (including leadership) will align and energise the organisation towards successful change.

HOW WOULD YOU RATE YOUR COMPANY'S APPETITE FOR ELECTRIFICATION?

Non-existent Low Moderate High Very high



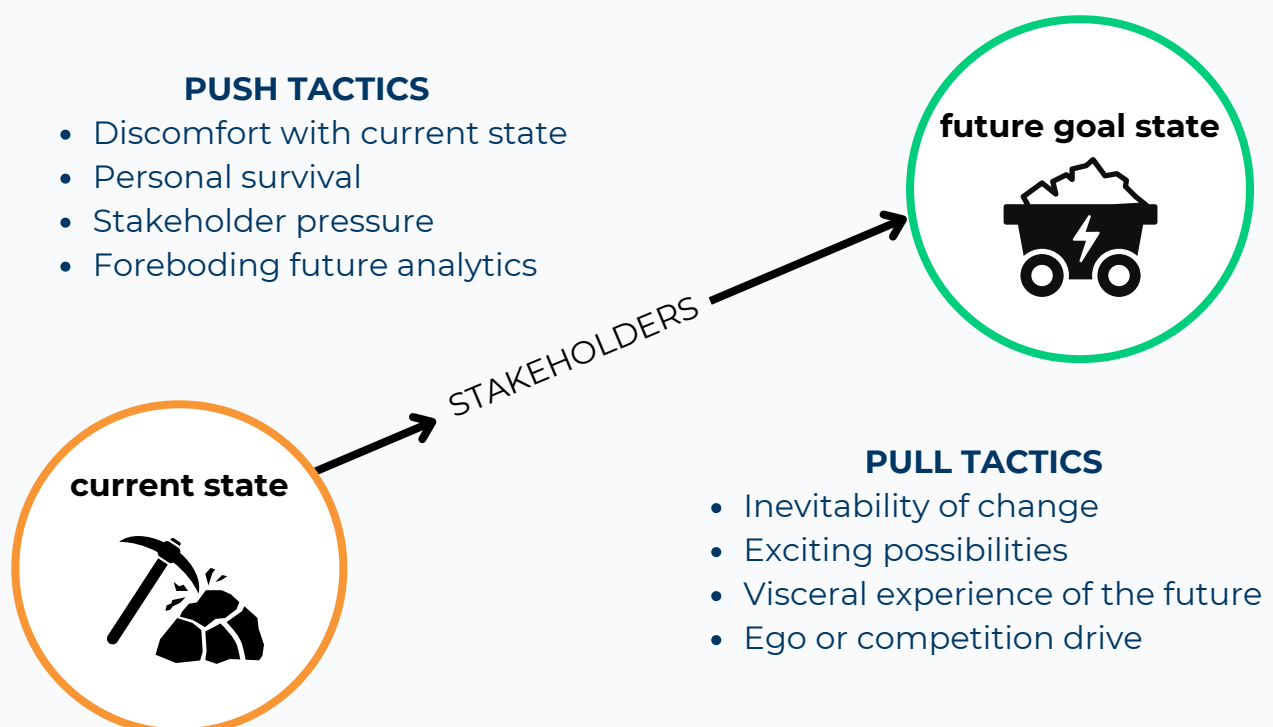
MOTIVATE THE CHANGE

- Show people the future - e.g., take them to see electric mines and equipment
- Design short- and long-term performance incentives that are linked to the change, and span the organisational levels
- Include non-financial rewards to help offset temporary disruption
- Leverage internal motivation: link staff reputations and job satisfaction to their efforts and attitudes on the change project
- Build the change into business planning processes so it becomes an expected part of business as usual

WHAT'S IN IT FOR ME?

- A healthier, quieter, cooler, cleaner work environment for in-mine staff. The reported reductions in diesel particulate matter, noise, vibration, heat, and dust from electrification are remarkable.* This flows on to improved talent attraction and retention, and a reduction in health costs experienced by the organisation.
- Skills development and proven experience with emerging technologies and processes - good for future job security, and as a novel/personal challenge.
- Being part of transforming the mining industry by removing up to 100% of Scope 1 equipment-related emissions, reducing exposure to both climate and regulatory risks.
- Bragging rights - the opportunity to deliver one of the first fully electric mines. Public, shareholder, and regulatory sentiments around worker and environmental health are only getting stronger, emphasising the personal and organisation-wide reputational value of mine electrification as time goes on.

**Acuña-Duhart et al. (2024).*





SELECT THE RIGHT METRICS

“ The supervisor that had a good safety rating and low turnover, the other things were always very good. And conversely, the guy who had poor safety performance and high turnover, all the other things were lousy. It just all came back to: **if you take care of your people, your people will take care of you** ”

WE ASKED MINERS, SUPPLIERS AND SERVICES COMPANIES TO DESCRIBE TWO THINGS THAT WOULD HELP THEIR PEOPLE SUCCESSFULLY NAVIGATE THE TRANSITION TO AN ELECTRIC MINE



MINERS

- Success stories, case studies, real-life examples, maintenance results
- Common standards from OEMs to minimise learning curve
- Appetite to accept short-term increase in cost/productivity/ease



SUPPLIERS

- More engagement and commitment from end customers
- Transparent discussions with suppliers
- Clear pathways to identify and talk to the right people



SERVICES

- Rewrite the biased pit optimisation software
- Develop a clear operations strategy that shows the productive pathway to electrification
- Learn from electric mines of the 60's-80's; talk to operations people



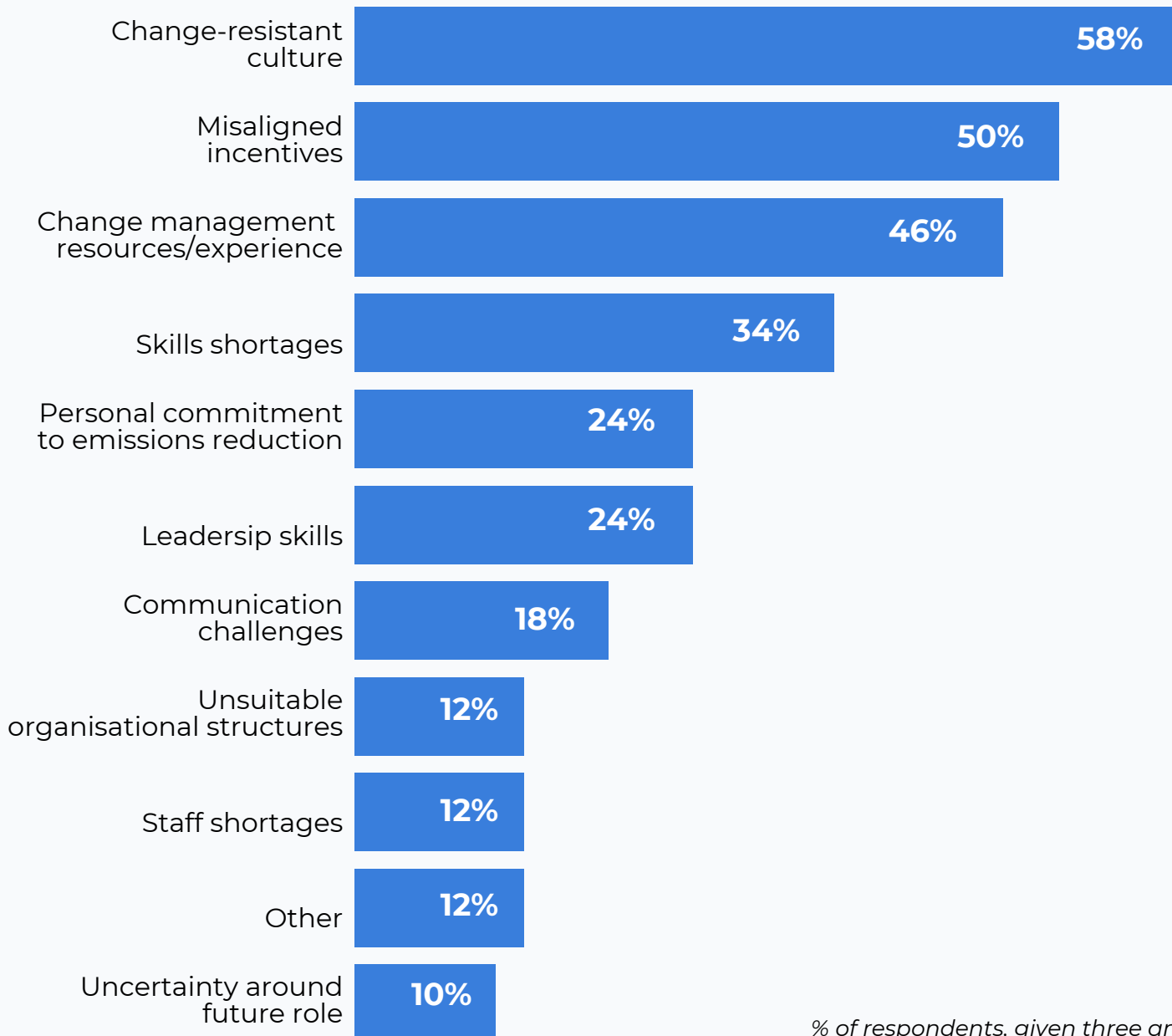
INDUSTRY- WIDE

- Training and education
- Committed leadership with a clear vision
- Government policy support
- Executive-sponsored technology demonstration programs



“ The thing that will stop electrification is not the capability, it's the lack of commitment to doing things differently. ”

WHAT ARE THE BIGGEST CHALLENGES IN SUPPORTING PEOPLE TO ADOPT ELECTRIC TECHNOLOGY IN THE MINING INDUSTRY?



% of respondents, given three answers

THE LEADERSHIP ROLE

Top-down endorsement is not just helpful — it is vital. Without active and visible leadership, the transformation risks losing engagement and momentum. To succeed, leaders need to fully own the transition, giving it their explicit support and supporting their teams to come on board with a clear mandate to electrify.

Committing fully to electrification has been challenging for mining industry executives. There is a sense that leadership is “stuck”, with little prior experience or industry reference points to rely on, and a temptation to pursue immediate financial gains rather than invest in electrification. However, by tempering their short-term expectations and strategically developing and nurturing an electrification plan, leaders could find themselves and their businesses in a much better position in the long run.

BEFORE WE EVEN GET TO THE CHANGE STEP, HOW DO WE SHOW OUR LEADERSHIP TEAMS THE VALUE OF THIS CHANGE?

“ That is incredibly difficult. Change from the middle is brutal, right? ...If the organisation doesn't see leadership as committed to change, it'll never happen. I mean, maybe you can get a little groundswell of energy, but it'll fizzle out fast if senior management is sitting in judgement...”

“ Good middle and senior leaders should be building a sophisticated case to take to the board.”

“ Most changes start bottom up, but you've got to chip away at the senior leaders with your story and convince them.”

“ You do need to be able to show that there's not just the moral gain or the environmental improvements, but there's definitely a business improvement there too. Some of the projects we've seen, in early stages there has been so much effort in presenting a good business case to senior management, and as technical people or as engineers or psychologists, it's hard to wrap your head around the importance of that business case sometimes, but it does underpin the success of any of these major projects.”

WHEN TIMES GET TOUGH



When the technology has glitches (and it will), and the clock is ticking, production losses are mounting up, top-down commitment is critical to keeping the change on track... Quick wins on recording and fixing defects have a positive impact.



Organisations must be realistic about their expectations for electrification,, particularly during the ramp-up stage. Setbacks are to be expected with any transformation, but particularly those involving pilot technologies. A pragmatic change management plan anticipates and prepares responses for such setbacks ahead of time, and also takes into account the volatility of industry cycles on access to capital. Advanced planning allows organisations to rapidly identify and efficiently fix any inevitable issues, demonstrating prowess to their stakeholders and maintaining (if not boosting!) momentum for the change.



...in six months time when you're to your ankles in alligators, you're going to remember why you drained the swamp in the first place, right?



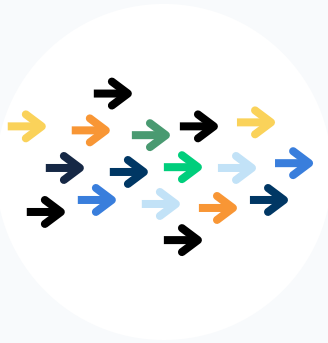
In challenging times, talk may matter just as much as action. In the age of rapid information exchange, both staff and shareholders are able to see through corporate spin or cover-up, which is why a level of transparency and authenticity need to be baked into the change communications plan. Acknowledging challenges head-on can put out fires before they start, and develop a sense of trust that the organisation has the integrity to deliver on their electrification goals despite challenges. It also builds alignment and a sense of buy-in across the stakeholders; nothing brings a team together like successfully overcoming an obstacle.



In my mind as the leader, what we needed to guard against was not losing talent during those tough times... as hard as it is, I think you've got to take a longer term view when you're in a cyclical commodity business.



CHANGE TOUCHES EVERYONE



**ALIGNED
STAKEHOLDERS**



**CHANGE-DISRUPTED
STAKEHOLDERS**



**CHANGE-ALIGNED
STAKEHOLDERS**

Nobody in an organisation is immune from the effects of change - and it often ends up involving external stakeholders (e.g., customers or shareholders) too. In some large or small way, everybody will have to interact with the transformation to an electric mine - which means everybody can contribute to or curtail its success. To stay aligned for success, leaders must make sure everyone understands where they fit and why they matter.

Early in the change process, the impact on stakeholders should be thoroughly mapped out. As part of the ensuing impact assessments, it can be helpful for change managers to engage staff in conversations about what they think electrification might mean for them, and for the broader organisation. These discussions provide the building blocks for the critical stakeholder-specific change execution plans, which should describe the future roles and the specific steps needed to get there from the current order.

The stakeholder discussion process also helps to inform the specific design of the broad transformation, as the direct workers often see things that higher-ups cannot. These small, precise details can have a big impact for the overall project.





If you have a senior manager that's standing there going " Hey, all this stuff is good, but don't involve me or my team", that pretty much undercuts the whole deal



By demonstrating a willingness to listen and work collaboratively with their employees on the ways that electrification will impact them, organisations can build general enthusiasm and goodwill that will help to retain talent and smooth over any stumbling blocks down the line. A supportive team culture is particularly important in times of change, when every point of friction that can be eliminated matters. Team culture begins with team leaders, so throughout the organisation it is imperative that managers and supervisors are brought onboard and supported in their adoption of the change process.



We all filter our behaviour when the boss is around (human nature, or as part of my best behaviour), but partly filter when our peers are around and we're unfiltered when our direct reports are around.



What that means is you can see through your boss because they're unfiltered. You know what they're good at, bad at, how they work. You can sort of see through your peers. You cannot see through the people reporting to you, because you're only getting the filter.

You go down a couple of layers, you get filtering on filtering on, filtering. You know one of those two is not doing the right thing,, but the story's conflicting. You can't tell which one it is, whereas, from their level, they're going, "this is so obvious. Why can't you see this?"

Organisational engagement also serves the purpose of identifying two important groups of stakeholders: the change champions, and the change opponents. Change champions can be distributed and leveraged to inject support at crucial areas of the organisation and process; no matter their rank or role, the most valuable change champion is one who has the respect or influence of their peers. Change opponents tend to represent a vocal minority who can cause a significant disruption to the process, and require special attention to be converted to supporters (or isolated from the project).

STAGE YOUR APPROACH

Staging the approach to mine electrification can help to manage risk and embed long-term success. A strategically-phased roll-out allows for an organisational adjustment period and gives operations a chance to learn from early stages and refine processes to maximise efficiency.

Stages may be divided into:

- Personnel
 - Early on in the design process, engage a small, controlled group of staff who understand both high-level strategy and day-to-day operations. These individuals should have up-to-date hands-on experience to bridge the gap between leadership and frontline workers and provide crucial expertise on the project details. They should also be carefully selected for their adaptability - early teams can be thought of as “change champions” for the broader rollout, and should be fittingly enthusiastic about electrification.
- Technology
 - Some equipment classes may be easier to transition than others, providing an opportunity to build familiarity and momentum through an “easy win”. The best fleet candidate for this will depend on the specific operation, but generally, light and auxiliary vehicles have been more straightforward than heavy load-and-haul.
- Geography
 - It’s prudent to identify the most “low-risk” operational areas or sites to transition first. Companies can then use the valuable learnings from that pilot site to inform the transition of the rest of their portfolio. Before even getting to site, the best case is to begin implementation away from operations completely (e.g., off-site trials at a dedicated testing facility).

“ Develop and test as much as practical away from operational pressures. ”

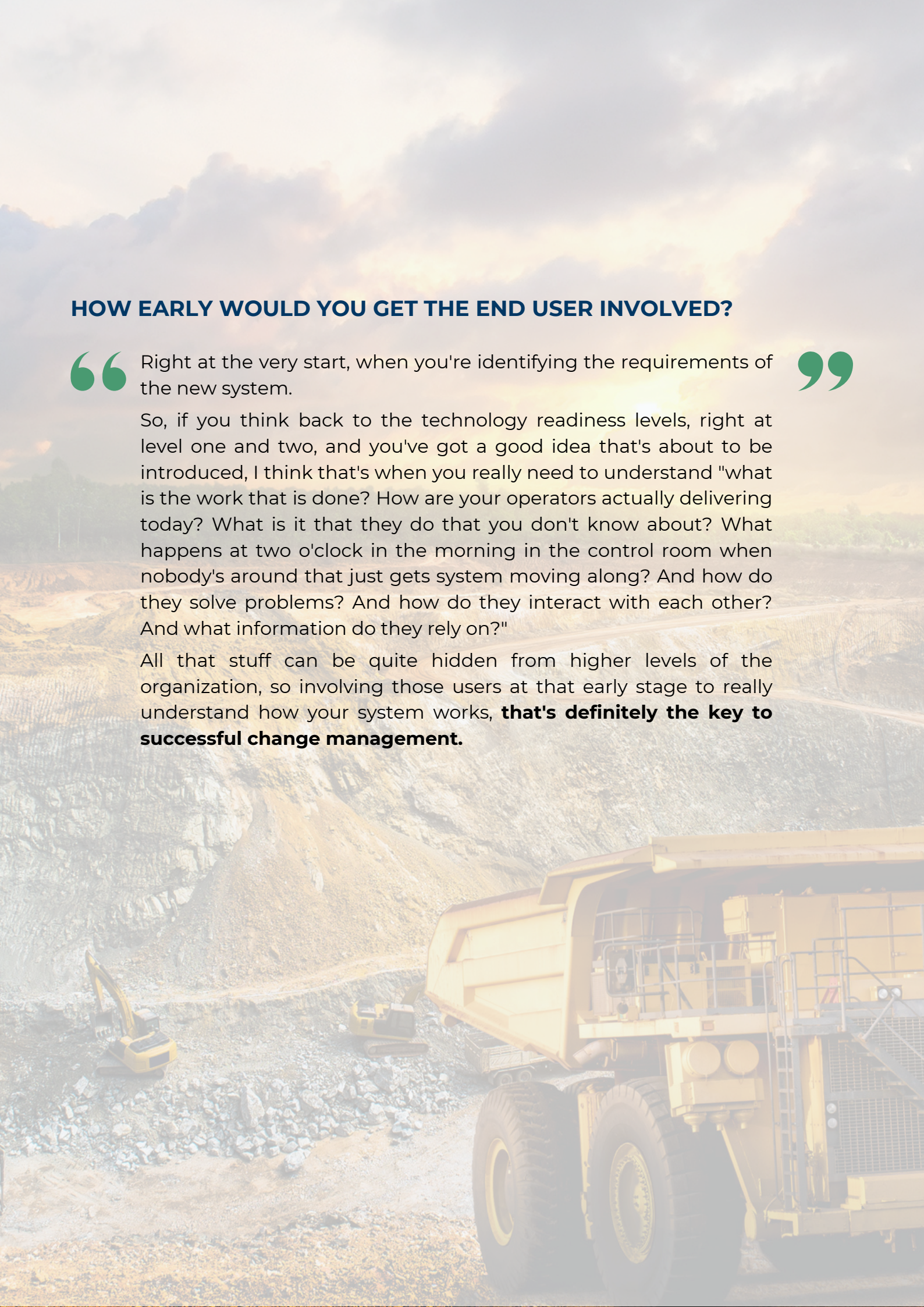


HOW EARLY WOULD YOU GET THE END USER INVOLVED?

“ Right at the very start, when you're identifying the requirements of the new system. ”

So, if you think back to the technology readiness levels, right at level one and two, and you've got a good idea that's about to be introduced, I think that's when you really need to understand "what is the work that is done? How are your operators actually delivering today? What is it that they do that you don't know about? What happens at two o'clock in the morning in the control room when nobody's around that just gets system moving along? And how do they solve problems? And how do they interact with each other? And what information do they rely on?"

All that stuff can be quite hidden from higher levels of the organization, so involving those users at that early stage to really understand how your system works, **that's definitely the key to successful change management.**





DESIGN FOR DAILY OPERATIONS

As important as it is to play the right pieces early, eventually the entire electrification effort must be integrated into one cohesive, productive system. At this stage, any oversights or friction points are likely to manifest first within the daily operations. Risks can then be mitigated by adequately considering the transformed “day in the life of” (DILO) for different parts of the mine system, improving the overall design and reducing the burden of retrospective issue solving and training.

“ You can achieve quite a lot in a very short space of time by just spending a few days, literally, on site with end users and understanding how they want to operate this new equipment, what they do today, what are their current constraints? ”

Understanding how daily operations will change not only informs the design of electrification but also guides its rollout. When team leaders are familiar with the practical differences between the new equipment and existing procedures, they can educate and support their staff at key stages of the implementation process. One effective way to reshape behaviours and minimize incidents during the transition is to stay focussed on the *differences* between diesel and electric equipment on a daily basis.

“ When designing strategy and transformation, you need to keep close to the assets – this is where the most relevant ideas will come from, and this is where change can be stopped. ”

TRAINING AND CAPABILITY

Electric equipment will only deliver results if the workforce is equipped to work with it effectively. Although capability is not recognised as a primary electrification barrier in our research (with many respondents highlighting their workforce's forward-thinking mindset), training is still essential to set a common standard and baseline for the electric mine. This training (as identified in the change management plan) will not only include the daily operations and maintenance of new technologies, but will also extend to all other impacted roles, e.g., training the emergency response in battery fire risk and response.

Beyond the technical skills, training builds confidence and fosters enthusiasm. By investing in their staff's development, leadership not only reduces resistance to the transition but also demonstrates commitment to their people.



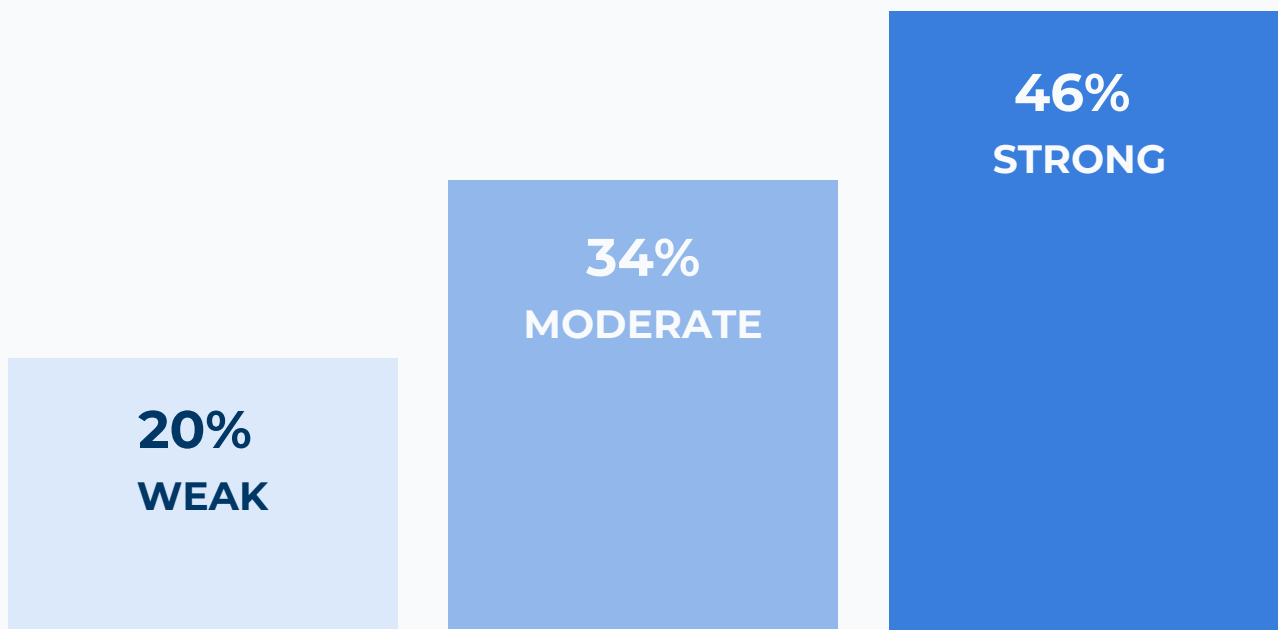
It's fine to train people, but they're really curious as well about what's actually under the bonnet. How does it work?



I want people to be comfortable walking up to an EV and going, "Oh, that's normal". You know what I mean? If it's parked the right way, if it appears to be plugged in correctly when it's charging, if it's making a noise, that's normal...

You really just have to say, "No, I need you to come with me and learn..." All they're really looking for is a safe way of learning how to do it, so that they can do it well. It's not that they don't want to do it, they just don't want to break it or mess it up.

HOW WOULD YOU DESCRIBE YOUR WORKFORCE'S CAPABILITY TO ELECTRIFY?



COMMUNICATE BY THE TONNE

DESIGN EFFECTIVE MESSAGES

Good communication starts from the top and should penetrate through the organisation (and any external stakeholders) consistently. While communication style and content should be tailored for each stakeholder, the overall message should be simple, meaningful, and memorable (e.g., an elevator pitch). Marketing departments usually focus on outward engagement but can be used to support the leadership in crafting the initial communication strategy – as can the change champions.

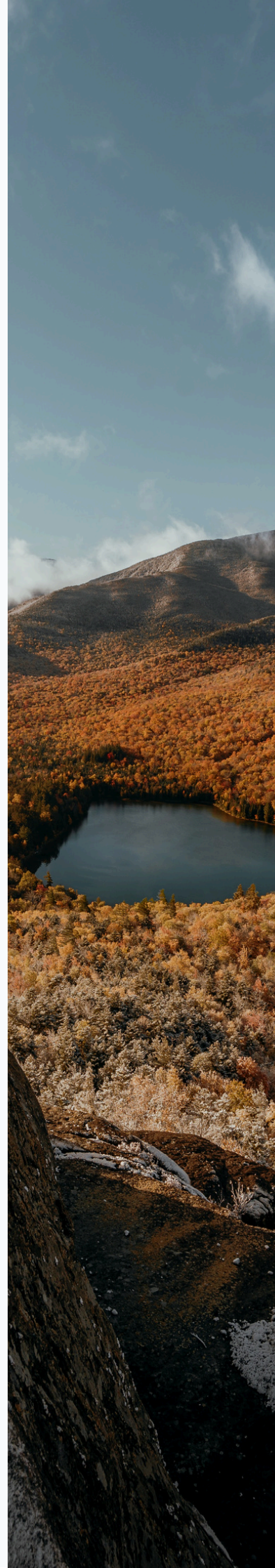
“ People respond naturally to messages that are simple, authentic, plausible and give energy – they can smell corporate BS a mile off, and this just leads to wariness which makes the positive engagement necessary for any transformation a real challenge. ”

CONSISTENCY IS KEY

No matter how long leaders spend strategically planning their messaging, it can easily get twisted or drowned out as it progresses along the organisational “telephone line”. To avoid this, each level should allow ample meeting time to pass the message down and make sure it is well understood. This understanding can be checked by occasionally sitting in on ground-level communication sessions.

“ The night shift supervisor can be your most effective advocate (or not!) ”

The worst thing you can do is say nothing. Even if there are no major updates, releasing regular communications reminds everyone about the organisation’s commitment to electrification. As a result, key communicators are going to get bored of the messaging long before their audience does, and will likely find themselves having the same conversation hundreds of times with various stakeholders. In these cases, encouraging positive conversations at strategic nodes of interaction (e.g., site office or canteen) can help maintain willingness and momentum.



FOR PERSONNEL, IT'S PERSONAL

It is essential to recognize that emotions, whether positive or negative, play a significant role in the ultimate success of mine electrification projects. In any major transformation, the preconceptions and emotions (including subconscious ones) of all stakeholders will influence their behaviour, and must be therefore be managed as part of the change process.

In the mining industry, where there is a tradition of conservatism around physical risk and a strong emphasis on safety and productivity, the introduction of new electric technologies can trigger a wide range of emotions — from fear and uncertainty to excitement and hope.

Leaders may harbour serious uncertainties around how to electrify, and fear making mistakes that could damage assets, productivity, share price, workers, or their reputation. On the other hand, they may be excited about the opportunity to position themselves as industry leaders and deliver a real impact on the long-term health of their company, workforce, and environment.

Workers may experience fear and uncertainty about underground battery fires, misusing the new equipment/systems and breaking them or looking stupid, or becoming less relevant (or even redundant) in the new mine system. There may also be some ingrained climate scepticism to overcome. They may be excited about the chance to work in a healthier, more pleasant environment, for the job to become easier as tech advances, for the opportunity to upskill, and the novelty of using newer, faster equipment.

By thoughtfully acknowledging fear and uncertainty and strategically addressing them — whether through clear communication, training, or incentives — leaders can guide their teams through the transition with greater confidence and less resistance. In this way, the emotional landscape becomes not just a challenge to overcome but a powerful tool for driving engagement and commitment to the change process.



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