

Smart. Safe. Sustainable.

Achieving the digital mine



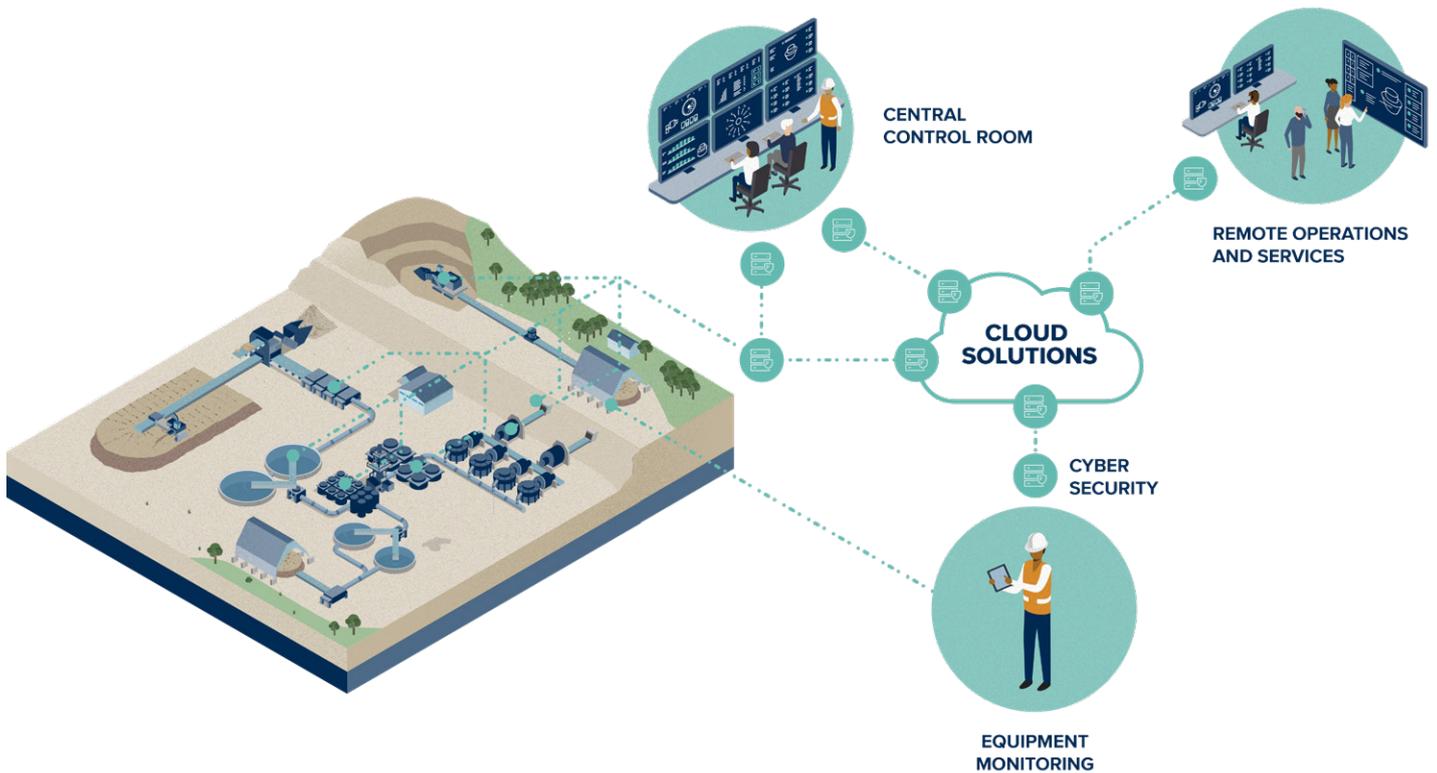
**What is
the digital mine?**

**What benefits
does it bring?**

**And how do we
achieve it?**

We take up these critical questions and provide our answer here.
Not in abstract terms. But in the form of our proven solutions.
Solutions that are making a difference, today, at mines around
the world.

Those solutions answer the how – the third question we
started with. But before we get there, let's explain what we
believe the digital mine is and what its benefits are.



The digital mine is ...

Smarter: The digital mine is based on data. But more than that: it's about using that data to empower better decision making. Connected and monitored as never before, the digital mine offers full transparency of operations. Problems can be easily identified and corrected; performance bottlenecks can be addressed; and productivity maximised. The end goal is nothing less than complete system-wide improvement.

Safer: Predictive maintenance. Remote operation. Autonomous equipment. Perhaps the most obvious benefit of the digital mine is that it reduces the time human operators and maintenance personnel spend in hazardous environments. And it means that, when human-machine interaction is required, it can be better planned and managed.

Sustainable: The digital mine is a more energy efficient mine. It can extract more from less. It needs less water and better manages what it does use. In other words, the digital mine is also a more environmentally sustainable mine. In fact, we believe the mining industry won't be able to meet sustainability goals without digitalisation.

So how do we get there? Read on to discover our suite of digital solutions that are making the digital mine a reality.

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 Ultimately, we want to give customers a better night's sleep, safe in the knowledge that their plant and equipment are operating as they should.

ANDERS NOE DAM
 Head of Product management and development in Digital Business at FLSmidth

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ECS/ControlCenter™

Empower productivity and sustainability

To succeed in today's digital world, you need a reliable and trusted process control platform. Our latest ECS/ControlCenter™ software platform is just that. Providing complete plant control, it helps secure plant operation 24/7 – 365 days a year. Backed by full lifecycle support from engineering to upgrade, it's the foundation for a more sustainable and productive mining operation.

Key benefits

- Improve plant performance and reliability
- Increase troubleshooting ability
- Enable progress toward sustainable operations
- Integrate third-party equipment and systems
- Upgrade systems with no downtime

The ECS/ControlCenter platform is the digital heart of your operation: an advanced, reliable, adaptable and secure software platform that provides the ability to control anything from machinery to whole mine sites. It enables you to get the most out of your equipment and empowers operators to make smart decisions.

With the ECS/ControlCenter software, problems can be identified quickly, reducing the risk of downtime and energy wastage. Human error is avoided with an improved operator interface that filters out unnecessary information. Collaboration is made easy with the inbuilt electronic logbook and notification system. Finally, its advanced cybersecurity protocols mean you're protected against cyber threats and unintended software outages.

It's all designed to integrate with a range of hardware from major third-party control system brands. Controls from different brands can also be combined seamlessly into the same system, allowing you to maintain a consistent operating structure across equipment and production lines.

If you're interested in reading more about our control solutions, take a look at our [ECS Process Control Solution](#), [ECS Product Control Solution](#) for FLSmidth machines, and [ECS Machine Control Solution](#) for third-party equipment – all powered by ECS/ControlCenter. Or check out our advanced process control solution, [ECS/ProcessExpert®](#).



ECS™ Process Control Solution

Raise performance with complete and reliable process control

There's no denying that managing day-to-day operations at mines and minerals processing plants is hard work! But your process control solution should not be. With user-friendly and flexible operator station architecture, our ECS™ Process Control Solution is designed to take the stress out of process troubleshooting and improvement.

Key benefits

- Maximise productivity and efficiency
- Improve troubleshooting and reduce downtime
- Enable fast data sharing and transparency
- Designed to work with a wide range of third-party hardware

With a track record in automation stretching back more than 40 years and backed by our in-depth expertise in the mining and minerals processing sector, the ECS Process Control Solution is tailor-made for the unique challenges that face the industry. Well-known features include trending, alarm management and data logging for a complete full-featured process control option. The result is a more-efficiently managed mine with less downtime.

Take the commissioning of new equipment as an example. This involves extensive (and time consuming) testing and troubleshooting. But with the ECS Process Control Solution, your engineers have the tools and assistance they need to get the job done as expeditiously as possible – without compromising the integrity of the commissioning process.

Similarly with fault diagnosis, you want your operators to establish root cause quickly and accurately to both resolve the issue, before maintenance is required, and to stop it from happening again. Which the ECS Process Control Solution enables them to do. In short, it empowers your operations to perform at their peak.

Our process control solution is easy to install and upgrade – with little to no downtime required – while its open interface offers flexible visualisation, control hardware and smart asset integration. It's a fuss-free option designed to cater to your future needs, as well as to your needs today, no matter how your plant and equipment are set up. It also comes with access to round-the-clock support and troubleshooting from the FLSmidth team of product and process experts.

If you like the sound of this, you'll also appreciate our machine control solutions: [ECS Product Control Solution](#) for FLSmidth machines and [ECS Machine Control Solution](#) for third-party equipment.



ECS™ Product Control Solution

Unleash the full potential of your FLSmidth equipment

A product control panel's just a product control panel, right? Wrong! Our ECS Product Control Solution for FLSmidth equipment is so much more. It enables fast and flexible commissioning. It empowers rapid troubleshooting. And it's all combined with the benefits of an Industry 4.0-ready system.

Key benefits

- Expedite commissioning
- Facilitate rapid troubleshooting
- Integrate easily and flexibly with other systems, including third-party options
- Open the door to remote support and data analytics services

How does it do this? By giving your operators and engineers the advanced tools and assistance needed to effectively manage your equipment – including commissioning and troubleshooting – with speed and confidence.

It's also powered by our advanced [ECS/ControlCenter™](#) software platform, smoothing the way for full automation of your FLSmidth equipment. And because it's tailored for FLSmidth products, installation is easy – reducing wiring and installation efforts by up to 70% – and you can be sure it offers the highest possible level of protection and functionality.

It achieves all of this by incorporating a range of features that are normally found only at the plant level. So, alongside well-known features required of a machine-control system, there's advanced trending, on-board historian and stoppage root cause search.

And the differences with traditional control panels don't stop there. Our solution integrates seamlessly with OEM assurance, uses modern communication, and is built on uniform engineering standards. The result is a digital and connected product control software option that's fast, flexible, minimises downtime and helps your FLSmidth equipment reach maximum performance.

Do like the sound of these benefits but aren't running FLSmidth machines? Take advantage with our [ECS Machine Control Solution](#) for third-party equipment.



ECS™ Machine Control Solution

Get the most out of your third-party equipment

Your business has its own unique set up. It likely runs a mix of equipment and control system hardware from a range of manufacturers. We get that. Which is where our platform-neutral ECS Machine Control Solution comes into play. This fast and flexible equipment control system brings the benefits of our leading process control and digital solutions to your site – whatever make of equipment you're working with.

Key benefits

- Realise greater efficiency and productivity
- Commission equipment quickly and easily
- Improve troubleshooting
- Facilitate machine automation

Our ECS Machine Control Solution is designed to enable your operators and engineers to manage your site as efficiently and productively as possible. From diagnostics to operating instructions, information is available quickly and is easy to access from the machine control panel. It helps speed up time-consuming and time-critical processes, such as commissioning and troubleshooting.

It's also designed to make your life simple. Here's how.

- It comes pre-programmed, requiring only minor customisation on site. It's also compliant with industry standards and best practices, which helps further reduce commissioning time and risk.
- It integrates easily with numerous control hardware options (e.g., PLCs and I/O modules) to allow you to configure the system to your individual needs. This makes it easier to upgrade hardware in future, as you're not tied to a specific manufacturer.
- If desired, you can integrate it with your central control system to provide operators with critical alarms and status indications.
- Finally, it accommodates a wide range of customisation that can be applied by your operators using intuitive user interfaces and comprehensive function libraries. You also have access to remote programming support from our experts to help with any necessary modifications.

Running FLSmidth equipment? Check out our [ECS Product Control Solution](#).



ECS/ProcessExpert®

Increase production and cut costs

As miners face increasingly complex mineralogy, remote locations and a global scarcity of experienced, qualified staff, cost control is more important than ever. Our ECS/ProcessExpert® advanced process control solution uses AI technologies to optimise plant operations, enabling you to increase production and reduce a range of the most pressing cost drivers.

Key benefits

- Increase production
- Improve energy efficiency
- Lower process and quality variability
- Reduce downtime

In many ways, the ECS/ProcessExpert platform is your ultimate assistant. It constantly monitors process conditions and immediately responds to changes. But because it can make adjustments more frequently and accurately than any human operator, it can more effectively manage and correct disruptions. In doing so, it is able to maximise production, while minimising wear and reducing energy consumption.

The platform combines a range of well-known control techniques, such as model predictive control, with symbolic and non-symbolic AI, based on machine and deep learning algorithms. Operators are kept informed using decision trees, which help explain the system's decision-making process. Further transparency is provided by the PXP Insights module. This automatically calculates the operational and environmental benefits of using the system and converts them into meaningful KPIs.

We also understand that, in this complicated world, no-one can know it all; the importance of collaboration is therefore increasingly being recognised. In this spirit, the PXP DataBooks module allows your data scientists and AI engineers to integrate any machine or deep learning algorithms that they have developed and trained into ECS/ProcessExpert applications and control strategies.



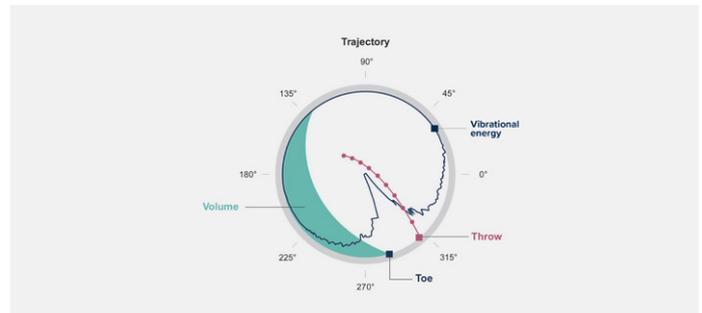
LoadIQ Smart Sensor Technology

Optimise mill loading

Do you need to increase the capacity of your mill – but without a costly upgrade? LoadIQ is the solution you're looking for. Using a system of smart sensors and AI, it ensures you make the most of your grinding system. Throughput increases of 3% to 6% are being seen in concentrators around the world with some achieving a 10% and more improvement in tonnage.

Key benefits

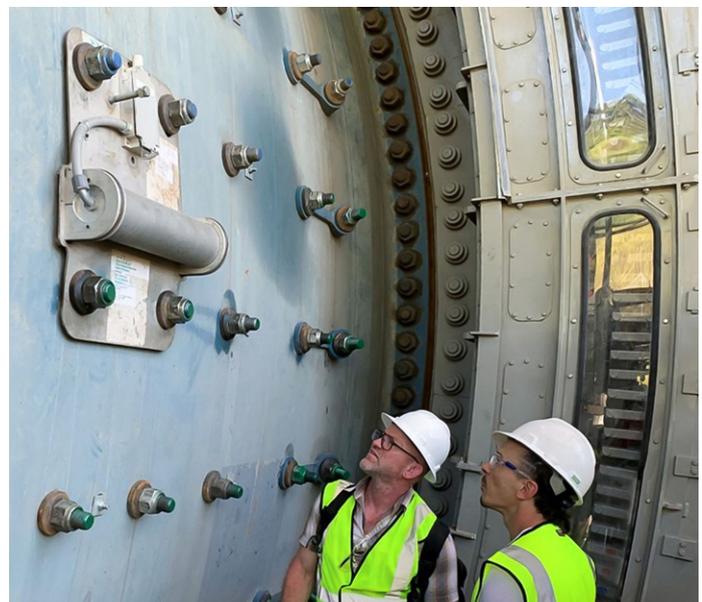
- Maximise throughput for all grinding conditions
- Extend liner life
- Prevent overloading
- Increase energy efficiency
- Improve the stability of mill operations



Still skeptical? There's no denying that previous tools aimed at optimising mill loading were not always reliable. LoadIQ is different. Its smart sensors use vibration analysis to precisely model the internal dynamics of a mill. Mill volume, impact intensity, ore trajectory and charge toe position are measured in real time. These data are then used to correlate maximum breakage rates to the incoming ore types, as well as to determining current liner profile.

This is then translated into an optimised target mill load, which LoadIQ sets and adjusts automatically in real time, as conditions change. Tracking liner life also allows you to reduce excessive liner strikes by minimising velocity or load capacity – reducing downtime and unplanned costs.

So far, so technical. But the numbers don't lie. LoadIQ is benefitting miners around the world – right now. It's easy to use and simple to integrate with any control system or grinding strategy. The bottom line: you can now boost mill profitability without excessive CAPEX.



Cyclone State Sensors

Detect, prevent and correct plugged or roping cyclones

Ineffective cyclone control results in a number of unwanted consequences – from roping and plugging of the cyclone to reduced flotation recovery and excessive wear on downstream components. In short, it hits your bottom line with increased downtime and reduced throughput. Improving cyclone control can therefore bring major benefits to your minerals processing operation.

Key benefits

- Stabilise and precisely control cyclone operations
- Improve classification and flotation recovery
- Avoid roping and plugging
- Improve reliability of downstream components
- Install sensors quickly and easily

Our cyclone state sensors (CSS) are designed to address the cyclone optimisation challenge. Sensors are installed to monitor cyclone operation and detect undesirable conditions using vibration analysis. Alarms are immediately sent to the control centre, re-enabling operators to respond quickly with corrective action before any major process disruption occurs.

As a knock-on benefit, quick resolution of disruptive events also improves the availability of on stream analysers, which are often taken down when exposed to excess material, as a result of these events.

The CSS solution is, however, more than just the sensors; it's a control system too. Proprietary software takes the data received from the sensors and – with the help of fuzzy logic and model predictive control – is able to select and tightly maintain operations within desired set points. This advanced process control ultimately makes it possible to stop process disruption, such as plugging and roping, from occurring in the first place.



BulkExpert™

Optimise dry bulk handling operations

We understand the daily battle faced by mine and stockyard operators: the constant need to process as much material as possible at the lowest possible cost. BulkExpert™ is our unique solution. Proven in applications around the world, it can increase throughput by as much as up to 20%, while reducing operating, labour, maintenance and energy costs.

Key benefits

- Optimised, remote and safe operation
- Increase reclaim throughput & overall equipment efficiency (OEE)
- Extend equipment lifetime
- Increase sustainable operations

BulkExpert is an advanced automation system, designed specifically to optimise stacking and reclaiming operations. A 3D scanner creates an accurate full-terrain visualisation of the stockpile in near real time. This enables the system to keep track of manual material movements – such as work being done by bulldozers – and to adapt stacker/reclaimer operations to ensure your equipment and stockyard is always utilised as efficiently as possible.

Quality management is also improved by accurately tracking the make-up of the pile and providing a view not only of the surface, but through it. The operator is therefore always aware of what material is in the pile and where it is located.

For unmanned automated operation of the stacker/reclaimer, the 3D scanner is complemented by a high-precision RTK GPS sensor that detects the actual position of the machine. Based on the data from the 3D model and GPS positioning system, BulkExpert can simulate the best possible stacking and reclaiming operation in advance – allowing for overall optimisation of machine movement and consistent material flow.



ECS/PlantDataManagement

Turn data into smart decisions

The Industry 4.0 era is profoundly changing the mining industry. Connected devices and systems allow the collection of huge amounts of data on machine performance and health in real time. Smart sensors are opening up another world of optimisation possibilities. But how do you manage all this data? More importantly, how do you get it to the people who need it, in a form they'll understand?

Key benefits

- Enable better decision making to boost performance
- Collect and store data automatically, immediately and accurately
- Easy-to-use and customise to suit your needs
- Quick payback time

It's a challenge that our ECS/PlantDataManagement information management software is designed to solve. It automatically collects data and makes insights available within seconds on user-friendly dashboards. This makes it simple to identify opportunities for improvement and to manage performance. For example, energy consumption data can be collected and analysed to help increase energy efficiency – reducing costs and improving environmental sustainability.

The ECS/PlantDataManagement platform also produces a range of reports to suit the needs of your business. Automatic reports can be scheduled for defined time periods; the system also comes with a range of standard reports built-in to help get the process started. And as it runs on your browser, accessing dashboards, reports and analysis has never been easier!

The ECS/PlantDataManagement system includes our [ECS/UptimeGo](#) software, allowing simultaneous analysis of process, production, health and downtime data in a unified interface. Data are stored in an open structure, making it accessible to any common reporting tool; it can also be integrated with any business intelligence solution to consolidate and visualise data.



ECS/UptimeGo

Prevent unplanned stoppages

Globally, unplanned downtime costs businesses tens of billions of dollars each year in maintenance costs and lost production. But it doesn't have to be like this. ECS/UptimeGo downtime analysis software helps you discover what went wrong so you can take action to prevent the same thing happening in future.

Key benefits

- Increase downtime visibility
- Increase equipment utilisation
- Eliminate root causes of downtime

It's a nightmare scenario: something goes wrong with a key piece of equipment and a big chunk of your production is suddenly offline. In this situation, you can feel out of control of events. Which is where our ECS/UptimeGo downtime analysis software is your vital ally. By shedding light on the causes of unplanned stoppages through efficient downtime analysis, it empowers operators to improve the performance and reliability of mining operations.

The ECS/UptimeGo platform uses Pareto charts to express when and why unplanned downtime occurs, allowing operators to investigate patterns in sub-optimal performance. It also records what occurred before an outage, giving users more information to work with. To improve business management, the ECS/UptimeGo software keeps track of maintenance KPIs, as well as estimating the economic impact of downtime events.

A web-based application, the ECS/UptimeGo solution is easy to set up and comes with an easy-to-use graphical interface that is intuitive to use and quickly mastered. It can also be integrated with existing process control systems and paired with our ECS/ControlCenter process control platform for automated collection of stoppage-related data.



SiteConnect™ App

Access health and performance data on-demand

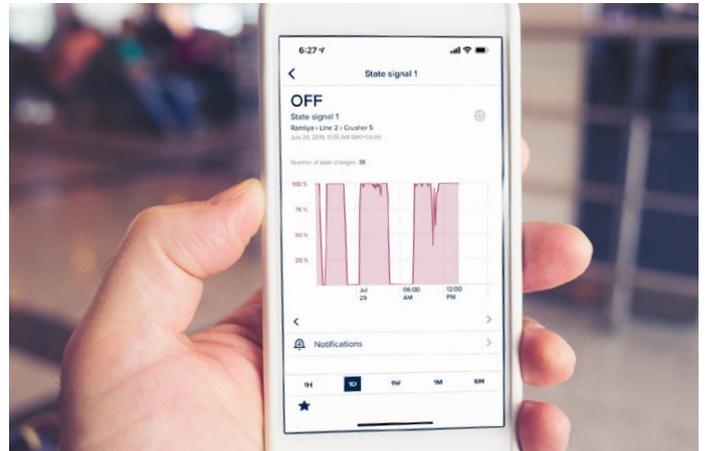
We live in an increasingly connected world: a world that can be accessed via our smartphones. Our SiteConnect™ mobile insights app brings that connectivity to the mine, enabling you to view asset performance and health data, anywhere, anytime.

Key benefits

- Improve visibility of plant and equipment performance
- Respond quickly to unplanned events
- Optimise asset management

Worrying how your mine is doing when you're away from the site is now a thing of the past. With the SiteConnect app, data are sent securely, in real-time and in a user-friendly format, directly to your iOS or Android device. Stay informed by setting notifications for defined events, such as downtime or production shortages. And respond quickly to critical events – even when key team members are away from the mine.

Is your equipment functioning to its full potential? The app helps answer this question too. By allowing you to benchmark equipment and plant performance against historical trends and similar installations, you can clearly identify higher and lower performing assets. It takes the uncertainty out of optimisation, and empowers you to target actual bottlenecks and opportunities for improvement.





Online Condition Monitoring Services

Spot signs of failure early and take effective action

Data. The world is swimming in it? You collect virtual tonnes of its, every hour, even every minute, from your mines and minerals processing plants. Now it's time to put it to work. With our online condition monitoring services, we analyse, filter and interpret your data to help you identify and understand problems, and develop optimal responses to prevent escalation.

Key benefits

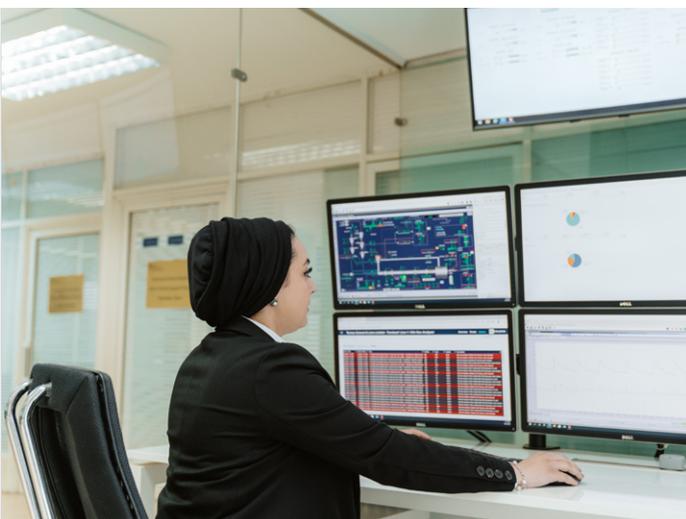
- Increase availability and reliability of equipment
- Gain greater understanding of process conditions
- Reduce OPEX
- Improve maintenance planning and safety

Most data collected today is 'invisible' – it languishes unloved and unused to its full potential. Our online condition monitoring services service change this, connecting your 'invisible data' securely to the cloud. Once on the cloud, it can be continuously tracked and trended in real time by our advanced diagnostic software, which uses AI and machine learning to monitor conditions and raise the alarm when undesirable conditions are detected.

Our digital expertise is a crucial element. But so too is our practical, human know-how and experience of the equipment and technologies at work at your mine. When an alarm is raised, our team of experts analyse the data remotely and suggest a recommended action plan to rectify the fault before it gets any worse. We also supply clear, regular reports with actions you can take to significantly improve equipment health.

It means that problems are never missed or overlooked. And that maintenance can be planned and conveniently scheduled, rather than undertaken as an emergency response to unexpected system disruption or failure. This not only improves the efficiency and effectiveness of maintenance – and thereby reduces OPEX costs – but also makes for safer, better-managed interventions.

We currently offer online condition monitoring services for crushing, grinding and tailings management.



Remote Services

Digital solutions to connect you to the expertise you need

Thanks to the power of digitalisation, we can be wherever you are. With advanced digital tools and secure cloud-based solutions, we provide a complete range of remote services, from on-demand troubleshooting to ongoing process optimisation. Online, at the end of the phone, and even in virtual reality.

Key benefits

- Highly responsive, 24/7 support
- Cost-effective and time-efficient
- Network of experts at your fingertips
- Plugs the gap created by skills shortages
- Data-driven insights to improve your decision-making

When equipment underperforms – or even fails – your productivity and profit suffer almost instantly. Our remote services enable an equally swift response, helping you reduce the stress and costs of downtime.

Our suite of digital tools brings our experts to your site, wherever you are. Make the most of their experience and knowhow to help solve your equipment and process problems, boost productivity and increase efficiency. Choose between on-demand and continuous support according to your needs. Either way you get a dedicated team of highly capable engineers at your service.

Remote services are ideal for emergency situations when you need an urgent response. But you don't need to be in crisis mode to get the benefit of remote support. Our ongoing monitoring and support help you fine-tune operations – using data from your equipment and insights from our experts to optimise performance and cut costs.

The ultimate aim? Maximum performance throughout the lifecycle of your equipment – with minimal disruption and a low total cost of ownership.

Remote services:

- Online condition monitoring services
- Augmented field engineer – using cameras or mixed reality smartglasses to see what you see
- Digital checklist tool
- 24/7 hotline
- SiteConnect™ app
- TCO tool

Our portfolio of digital solutions to power your productivity. The portfolio includes a variety of tools and services that connect, monitor and optimise performance.



Total Cost of Ownership Tool

Reliably forecast operational and maintenance needs

Operating a mine is never an easy prospect. But in an increasingly complex world, the challenges are becoming greater. Rising operating costs. More frequent and unplanned downtime. It's a headache. Which is why the ability to reliably and accurately forecast your operational needs can have a major impact.

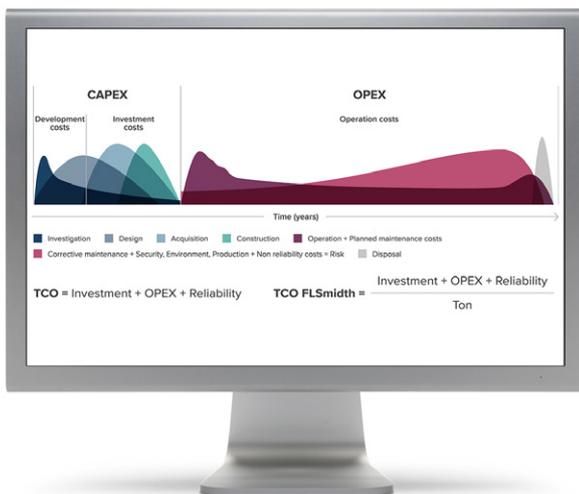
Key benefits

- Reduce the cost of asset ownership
- Increase productivity with higher asset availability
- Cut downtime and optimise replacement periods
- Improve safety with better maintenance planning
- Avoid unscheduled outages

Our Total Cost of Ownership (TCO) Tool offers you just that ability. It's a revolutionary predictive software package that simplifies the cost of asset ownership by calculating the lifecycle costs for flotation equipment, SAG and ball mills, gyratory and cone crushers, and screens. By analysing site performance data, the TCO Tool can predict when parts will need to be replaced and when inventory levels will need to be restocked.

What does this do for you? It reduces the risk of unscheduled outage and helps to optimise maintenance intervals. You see the benefits in terms of higher asset availability, as well as improved maintenance planning and inventory management. This ultimately helps lower the cost of asset ownership over its whole lifecycle.

Better maintenance planning also supports improved safety planning and management. Field engineers know in advance what tasks are coming up, and what they will need to safely complete the jobs – rather than reacting to unforeseen breakdowns.



FLSMIDTH

Mission Zero



TOWARDS ZERO EMISSIONS IN MINING



Zero water
waste



Zero
emissions



Zero energy
waste



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