



Mining Industry

Tapping Innovative Sealing Technologies to Reduce Water Consumption

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As the energy transition accelerates, the mining industry will play a critical role in driving progress. Mining operations supply the essential building blocks for many clean energy systems, including the lithium and graphite that enable wind, solar and geothermal power technologies.

Unsurprisingly, the demand for these critical minerals is skyrocketing as 2050 net zero deadlines inch closer. In one [World Bank Group report](#), experts estimated that more than 3 billion tons of minerals and metals will be required to limit global temperature increases to below 2°C. According to the group's calculations, this demand could cause mineral production to increase nearly 500% over the next three decades.

Although increased mining activity is critical to supporting the energy transition, it also raises key environmental challenges. One of these challenges is water consumption. According to the [World Bank Group](#), the mining industry consumes as much as 11 percent of global energy use. Among the world's six largest mining companies, 70 percent of projects are located in water-stressed countries.

In 2015, the most recent year for which the United States Geological Survey (USGS) has published data, the mining industry [withdrew approximately 4,000 million gallons](#) per day — a figure representing roughly 1 percent of the nation's total withdrawals. Groundwater constituted 72 percent of the withdrawals; 65 percent of that groundwater was saline. Approximately 77 percent of the mining industry's surface water withdrawals involved freshwater.

Water, climate change and the future of industry are inextricably linked. With the rise of extreme weather events, the world's thin water supply is becoming more scarce and more polluted. According to [UNICEF](#), nearly two thirds of the world's population experiences water scarcity for at least one month each year. Half of the global population could be living in water-scarce areas by 2025. This water scarcity doesn't just impact billions of people; it also has direct implications for the global food supply, energy security and sustainable development. Simply put, water conservation is critical — and the mining industry has the opportunity to drive clear progress.

The complex nature of mining operations can make it difficult for organizations to reduce water usage. However, one area in which operators can achieve measurable improvements is through innovative sealing solutions. Today's mechanical sealing technologies are rising to the challenges of the energy transition, helping mining organizations reduce water consumption while improving reliability. This innovative category includes not just mechanical seals, but seal face treatments and water monitoring and control devices that are used reliably in mining operations around the globe.

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The Importance of Water Conservation in the Mining Industry

In today's industrial landscape, water conservation is an essential aspect of any comprehensive sustainability strategy. However, the benefits of water stewardship extend beyond environmental impact. By reducing water consumption, mining operations can also enhance their overall efficiency, avoid HSE risks and strengthen their bottom line.

Enhance operational efficiency

Operational and energy efficiency are closely linked. By optimizing resource consumption, organizations can enhance the overall effectiveness of their operations. Similarly, enhanced reliability leads to enhanced resource efficiency.

Improve groundwater management

Whereas poor groundwater management can destroy a mine's viability, better management can maximize it — all while reducing the risk of an unsafe working environment.

Reduce expenditures

Pumping large volumes of water requires major capital expense, particularly as water costs increase. By eliminating unnecessary water consumption, mining organizations can reduce operating expenditures and strengthen the economics of their operations.

Within a mining company's water conservation plan, sealing solutions play a surprisingly significant role. Environmental concerns are one driver for mechanical seal adoption across the mining industry.

A Shift From Packing to Mechanical Seals

For decades, packing was the preferred choice of OEMs and operators. However, packed pumps are prone to high shaft wear and excessive leakage. This results in unnecessary water consumption and premature bearing failure — the latter of which ultimately leads to higher maintenance costs and a shorter mean time between failure (MTBF).

Recent advancements have attempted to address packing shortcomings by replacing first-generation yarns such as cotton and jute with carbon and graphite yarn packings. But despite improvements in packing technology, the mining industry is increasingly looking to mechanical seals to optimize reliability, maintenance and water consumption. The advantages of mechanical seals are particularly pronounced on critical pumps that require elevated levels of maintenance, such as filter feed and tailing pumps.

Mechanical Seal Function

Mechanical seal technologies rely on a thin film of lubricant between a rotating and stationary set of flat wear faces. Regardless of whether lubrication is provided by the pumped fluid or an introduced liquid, medium consumption is extremely low. The set of seal faces prevents the materials inside the pump from escaping into the atmosphere.

Along with these seal faces, support components including springs, O-rings and drive mechanisms work together to deliver effective sealing. Through correct design choices and proper engineering, organizations can minimize — or, in some cases, eliminate — the need for external water.

Reliability and Maintenance Benefits

Every day, mechanical seals are performing reliably in harsh mining conditions across the globe. These advanced seals have dispelled the myth that mechanical seals cannot meet the demands of the industry's tough operating environments. Recent innovations have taken mechanical seal reliability to even greater heights, utilizing abrasion-resistant materials such as duplex, super duplex and 27% nickel chrome to maximize reliability in complex mining applications.

Increased reliability also translates to clear maintenance optimizations. By transitioning from gland packing to mechanical seals, mining operations can eliminate weekly or even daily maintenance schedules on tailings lines. This can enable organizations to experience between 12 and 18 months of uninterrupted operations, or even multi-year runs on the filter feeds. By requiring less maintenance and decreasing equipment downtime, mechanical seals can deliver significant cost savings.

Water Consumption Benefits

To gain optimal life out of entry-level packings, a typical mine can use anywhere from 60 to 120 liters (15.85 to 31.70 gallons) of gland service water per pump, per minute. Upgrading from packing to mechanical seals delivers measurable water savings — to the tune of 1 million gallons per pump, per year.

This water conservation not only reduces operational costs, but also enhances overall efficiency at a time when more countries than ever are adopting stringent environmental regulations.

Mechanical Seal Innovations for Water Conservation

John Crane has devoted the last century to delivering technologies with reliability and sustainability at the core. Our portfolio includes mechanical seal solutions proven to help mining organizations achieve their operational goals without depleting the world's water supply.

Single and Double Slurry Seals

To process materials, mining operations use large volumes of water, harsh chemicals and gases. Moving coarse materials and thick slurries can be damaging to pumps due to a high concentration of abrasives and particulates. Designed to work continuously in hostile environments such as mines, today's slurry seals can resist the destructive effects of ores, limestones, phosphates, kaolin clay, lime mud, rock salt, sludge, sand and gravel.

John Crane's slurry seals dramatically increase the mean time between repair (MTBR), reduce energy consumption and enhance the efficiency of critical equipment. By operating with reduced or no flush, these cost-effective solutions also deliver tangible water savings.

Type 5840

Designed for the rigorous demands of general mining processes, this seal's robust primary ring design and secondary sealing elements make it an ideal general-purpose seal for slurry applications.

Type 5860

This slurry seal is designed to operate reliably in the harshest abrasive slurry environments, including underflow pumps, tailings pumps, mill circuit pumps, and cyclone feed and discharge pumps.

With advanced materials and robust components, John Crane's mechanical seals are engineered for maximum reliability, less maintenance and lower water and energy consumption. These benefits extend even further when paired with seal face technologies.

Seal Face Technologies

John Crane's seal face technologies dramatically improve the MTBR of mechanical seals by enhancing and sustaining seal face lubrication. These seal faces leverage advanced micromachined patterns that match the required lubricating features for each seal application, delivering precisely the right fit for each mining operation.

John Crane Diamond®

This seal face technology generates less heat, reducing the need for cooling water and, due to its low friction, also reduces energy consumption on the motor.

Upstream Pumping

This seal face technology nearly eliminates cooling water requirements and removes the need for a high-pressure water line, all while extending mechanical seal life and lowering the total cost of ownership.

Advanced Water Monitoring and Control Devices

John Crane's advanced monitoring and control technologies equip operations to optimize reliability, uptime and energy efficiency as they reduce seal water usage.

Safeunit™ and Safeunit™ Ultima

These technologies monitor and control seal water flow and pressure, reducing seal water by up to 80%. Compatible with packing and mechanical seals, these solutions can also predict seal and packing failures — giving operators a critical advantage in both reliability and water consumption. Safeunit Ultima is designed specifically to stand up to the requirements of harsh mining environments.

Smartflow and Smartflow IG

These intelligent seal water control systems automatically adjust to new operating conditions such as alternating pressure and temperature. Through these intelligent optimizations, the system only uses seal water when cooling is truly required. This saves as much as 97% of seal water when compared to flow meter-regulated control systems.

Using Sealing Solutions to Reduce Water Consumption

By providing the foundational elements required to accelerate progress in clean energy systems, the mining industry plays a mission-critical role in the energy transition. But with demand for critical minerals increasing rapidly, these water-intensive operations must find new ways to conserve resources as they scale production. Once a second choice to packing, mechanical sealing technologies are gaining widespread adoption due to their ability to help mining operations reduce maintenance, decrease water consumption and enhance reliability.

From advanced slurry seals and seal face technologies to advanced water monitoring and control devices, John Crane features an extensive portfolio of mechanical seal technologies for mining operations. Every day, these innovative solutions equip mining organizations to meet the challenges of the energy transition with reliability and sustainability at the core.

[Contact John Crane's experts to explore how mechanical sealing solutions can help your mining organization minimize water consumption and maximize reliability.](#)



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