Case Study

Power Quality Beneath the Snow: Stabilizing Voltage in Alaska's Underground Mine

A leading silver producer and underground mine operator in the US faced low voltage problems and power quality challenges in one of his largest mines in Alaska. The underground mine in this case operates at 4160V, situated 2½ miles below the surface with an equivalent depth of -400 feet in elevation.

The harsh underground conditions exacerbate power quality issues, impacting equipment performance, safety, and operational efficiency. Low voltage levels can hinder equipment operation, while voltage fluctuations and power interruptions may disrupt production. Harmonics and electrical noise introduced by heavy machinery may pose further challenges, along with grounding issues and adverse temperature and humidity conditions.

The power issues in this case appeared in the capacitor room, located underground, close to the mining operations, serving as a central hub for managing and distributing electrical power throughout the mine. The customer sought assistance from Elspec to address these issues.

Solution

Elspec team in North America supplied and commissioned power quality solution with a NEMA 4-rated enclosure, providing advanced protection against dust, water, and harsh environmental conditions. The installation includes a 3200A circuit breaker, step-up transformer to a 4160V supply, TVSS (Transient Voltage Surge Suppression) for surge protection, and dual air-conditioning units to maintain optimal thermal conditions and reliability during continuous operation.

Results

Voltage Stability

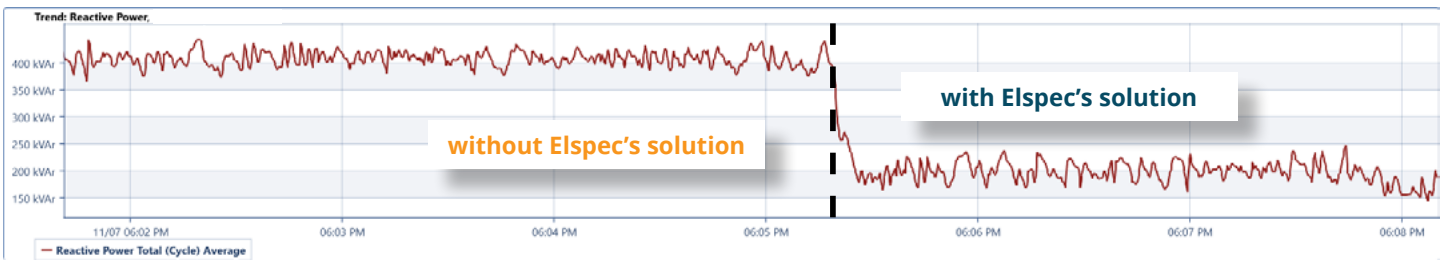
The system successfully raised the voltage from approximately 3960V to a stable 4160V. A 5% voltage increase brought the system back to its normal operating level.
This boost gives motors about 10% more torque, helping them start easier, avoid tripping, and run cooler. It also provides more stable power for drives and control systems, reducing the chance of brownouts or faults.

Reduced Current

Current was dropped from 200A to 100A, reducing feeder losses by ~75%.

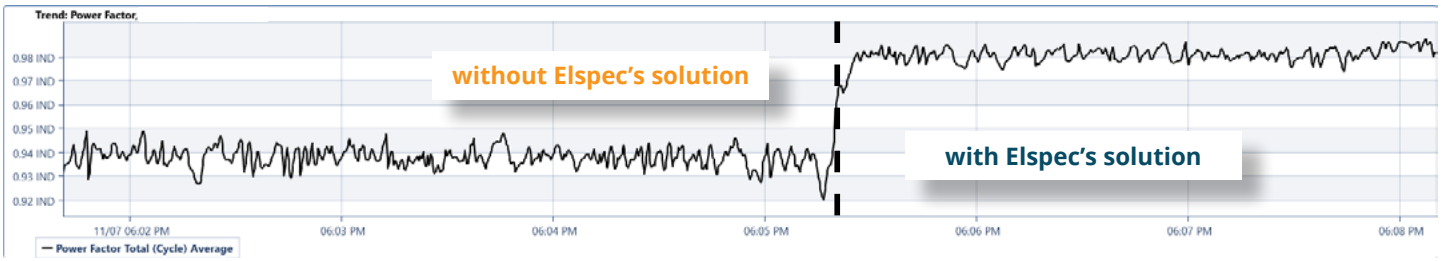
Optimized Reactive Power

The system supplied and balanced the reactive demand, lowering reactive power demand to approximately 80kVAr. This reduction minimized unnecessary energy circulation and improved overall system efficiency.



Power Factor Improvement

The power factor increased significantly from 0.93 to 0.99, ensuring near-unity operation. This improvement ensures grid compatibility, enhanced available capacity for active loads, and maximized the utilization of the electrical infrastructure.



Operational Impact

These improvements enhanced the mine's operational reliability, safety, and energy efficiency, particularly in the harsh underground environment where stable power is critical for continuous production.
The optimized capacitor room now provides steady voltage support and dynamic compensation, reinforcing the electrical backbone of the mine and contributing to smoother operations, reduced downtime, and lower operating costs.
In the underground mining industry, even the slightest power quality disturbances can impact equipment performance, safety, and operational efficiency. Elspec's power quality solution ensured reliable, efficient, and continuous operation deep below ground.

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