ADDING VALUE TO VENTILATION

Neil Gordon, AirEng | The New York Blower Company, shares the benefits of remote condition monitoring and predictive maintenance for mine ventilation equipment.

Reliable, energy-efficient mine ventilation equipment is critical to maintaining safe, efficient, and cost-effective mining operations. After the capital expense of purchasing ventilation equipment, energy and maintenance are the two biggest operating expenses throughout the lifecycle of a fan.

However, even the best-designed ventilation systems will wear down over time and must be properly maintained, in order to ensure an energy-efficient operation and avoid unplanned downtime. Especially in harsh industrial environments – such as underground mines – fans and blowers are exposed to heavy, uneven dust loads, excess moisture in the airstream, and other adverse conditions that can reduce fan performance, cause declines in efficiency, and damage equipment if left unaddressed for too long. In addition, using more ventilation than needed increases power consumption and unnecessarily accelerates fan wear.

The benefits of remote condition monitoring

Remote condition monitoring and predictive maintenance capabilities can significantly reduce power and maintenance costs by giving users greater visibility into the performance of their equipment and help them to make real-time, data-driven decisions.

For example, remote condition monitoring gives users actionable data to quickly identify potential maintenance problems before they escalate to irreversible damage or unplanned downtime, as well as optimise power consumption and maintenance schedules based on

concrete data. Remote monitoring is a minimal additional upfront cost during initial fan deployment that reduces the total cost of ownership (TCO) over the lifetime of the equipment.

Over the past decade, as the Industrial Internet of Things (IIoT) has accelerated globally, remote condition monitoring has quickly become a popular solution to effectively manage and maintain mine ventilation equipment.

Figure 1. Full turnkey project for Newmont Tanami VR6 main ventilation fans with the installation of multiple monitoring systems.

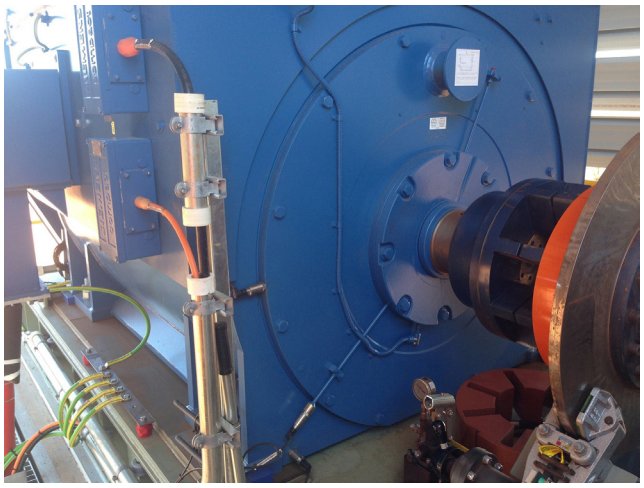

Figure 2. Newmont Tanami VR6 fan motor vibration sensors measure RMS vibration velocity and monitor temperature and vibration levels.

Figure 3. Newmont Tanami VR6 shaft collar pressure and air temperature monitors transmit real-time data with an automatic calibration.

Two of the most common types of remote condition monitoring include:

- Vibration and temperature monitoring.
- Pressure and flow monitoring.

The following are a few practical examples of how remote condition monitoring is being used in mine ventilation equipment and the value it can deliver for mining operations.

Drive reliability and reduce maintenance costs

Maintenance is most costly when it is unexpected. For a major mining operation, a sudden, unplanned breakdown of the equipment can cost over US$1 million/hr in lost productivity if work must come to a halt while the problem is attempted to be identified and fixed. Remote vibration and temperature monitoring not only helps prevent this worst-case scenario, but also reduces overall maintenance requirements under normal operating conditions.

Vibration and temperature monitoring

All industrial fans have a baseline level of vibration and temperature at which they normally run-up, run-down, and operate. These baselines vary by industry and are defined by ISO. The mining industry, in particular, requires relatively low setpoints for vibration.

While some fluctuation in vibration and temperature is normal and isolated spikes may not be cause for concern, sustained changes to the baseline are often the first indication of a potential problem. For example, excess moisture and heavy, uneven dust loads on the fan impeller will gradually increase vibration, reducing efficiency and eventually leading to premature fan wear or unexpected failure. Remote monitoring proactively identifies the upward trend in vibration so that it can be investigated and resolved before major damage can occur.

In order to do this, vibration and temperature sensors are installed at the fan shaft and bearings to monitor for changes, and alarm thresholds are set to trigger alerts (for example, a text message to an operator's phone) if the temperature or vibration levels exceed the defined thresholds. Personnel can then follow up on the alert to quickly diagnose and resolve the issue before it escalates into a bigger problem. This is one example of predictive maintenance.

Remote monitoring enables predictive maintenance and overall equipment effectiveness

While preventative maintenance plans rely on regular, scheduled maintenance, predictive maintenance uses real-time data from the equipment itself to reliably predict and prevent major problems that can lead to costly unplanned downtime. Predictive maintenance also eliminates human error in capturing or interpreting the data, in order to reduce the risk of expensive mistakes.

Beyond providing real-time visibility and enabling immediate intervention, remote monitoring also allows users to track trends over time, in order to continuously improve the efficiency of their operations. For example, with data captured via remote sensors, users can measure and improve overall equipment effectiveness, which is the calculation of total availability, performance, and production quality.

Overall, remote condition monitoring and predictive maintenance enables users to be proactive rather than reactive. This ultimately reduces overall maintenance requirements and can help users achieve 98% equipment reliability, with shutdowns only ocurring in instances of planned maintenance.

Optimise power consumption

Power is a major cost associated with mine ventilation. While the capital investment of the equipment accounts for approximately 8% of the total cost of ownership – and maintenance accounts for approximately 6% – the remaining cost is power. As such, optimising power usage and ensuring fans are running as efficiently as possible has the biggest impact to the bottom line.

Airflow and pressure monitoring

Like remote vibration and temperature monitoring, airflow and pressure monitoring give operators more visibility into the fan's performance in real-time so that proactive adjustments that save significant costs over time can be made. With real-time airflow and pressure data, users can rapidly identify when a fan is running inefficiently and drawing more power than necessary. For example, if pressure exceeds a set threshold, the change triggers an alert to personnel to investigate why the fan is running inefficiently, so they can resolve the problem causing the excessive power consumption.

Remote monitoring enables ventilation on demand

Another growing trend in the mining industry is using remote environmental monitoring to enable ventilation on demand (VoD). By using only as much ventilation as is actually needed, VoD allows users to precisely control ventilation to ensure safety for mine workers while maximising energy efficiency. In total, intelligently optimising the ventilation can reduce power consumption by up to 50%, savings that add up over the lifetime of the fan.

Conclusion

Incorporating remote monitoring and predictive maintenance capabilities into mine ventilation equipment upfront improves the reliability and efficiency of an operators' solutions, significantly reducing the total cost of ownership. Partnering with a knowledgeable and experienced ventilation equipment manufacturer can help operators customise a reliable, cost-effective solution for applications. GMR