

The benefits of smart ventilation

Ailbhe Goodbody spoke to Michael Gribbons from Maestro Digital Mine about how smart ventilation systems can translate into energy and cost savings for mining companies

Maestro's Vigilante AQS air quality and control systems and MaestroFlex regulators are used in over 90 mines globally

Ventilation systems are crucial to ensure safe working conditions in underground mines. They provide fresher, cooler air for mineworkers, as well as clearing toxic fumes from blasting and exhaust fumes from diesel equipment.

In deep and hot mines, ventilation is also required to cool the workplace for miners. The primary sources of heat in underground hard-rock mines are virgin-rock temperature, machinery, auto compression and fissure water, while other small contributing factors are human body heat and blasting.

A good mine-ventilation system is a real-time process that requires excellent balancing of climate controls and the dilution of exhaust gases and hazardous substances to ensure a safe working environment for staff. Ventilation raises are excavated to provide ventilation for the workplaces, and they can also be modified for use as emergency escape routes.

Ever-increasing energy costs and the need to conserve energy have prompted many mines to examine their operations and identify potential saving methods. Ventilation systems are a large part of the energy consumption of underground mines, particularly deeper mines – at some sites it can account for as much as 50% of the total energy consumption. Smart ventilation systems, which bring the supply of ventilation in line with the demands of the mine, can result in significant energy and cost savings.

"Shallow ore bodies are being depleted, and mines have to go deeper to generate their tonnage quotas," says Michael Gribbons, vice president – sales and marketing at Maestro Digital Mine, which serves the underground mine ventilation and automation sector. "Deeper mines require larger fans to overcome the increase in density of the air and also the pressure drop that relates to longer pathways. In many mines, fresh air is directed to locations with both activity and inactivity, all of which results in a larger energy footprint.



"Modern ventilation controls can help to reduce energy costs as well as increase production rates by getting the miners back to the face quicker and safer. The energy savings vary [according to] many factors, but can be in the range of 15% to 50%. Ideally, the mine should only direct air as and when required, depending on production and maintenance activity."

FACTORS TO CONSIDER

However, not all mines need the same level of control and a full system does not necessarily need to be rolled out at once.

Gribbons notes: "Several mines have attempted to install full ventilation-on-demand systems, but the record shows that on additional newer mines, they take a different approach. Proceed slowly and carefully."

Gribbons advises that the first step towards optimising a mine's ventilation system is to install a communication network in the mine. He says: "Without a network, very little can be achieved."

The next step is to install ventilation monitoring equipment to the network, and then to start monitoring the ventilation and verify that all the hardware is working and can be maintained. Gribbons explains: "Installation without a proper maintenance schedule will guarantee a poor result and abandonment of the next phase."

Following this, a supervisory con-

trol and data acquisition (SCADA)/programmable logic controller (PLC) or ventilation control system can be used to control the auxiliary fans remotely from a control room. Gribbons says: "Manual control can result in nearly 25% of the potential savings alone."

After this, flow elements can be installed on the mine level. "Typical flow elements can include airflow regulators, doors, booster fans, etc.," comments Gribbons. "Manual control from a control room can result in nearly 60% of the potential savings."

The next step is to track equipment and personal so ventilation set points can be established. Gribbons says: "The final step is install full ventilation control software that has the potential of saving the remaining 40% of the savings."

CASE STUDIES

Maestro Digital Mine aims to provide ventilation solutions to improve the underground work environment and extend miners' lives while still providing economical solutions to increase production, conserve energy and reduce greenhouse gases.

Maestro's Vigilante AQS air quality and control systems and MaestroFlex regulators are used in over 90 mines globally as part of a ventilation monitoring and control system. The company has developed ventilation solutions for some of the largest global mining companies including Barrick Gold, BHP, Newmont Gold, Glencore, Rio Tinto and Vale. ▶

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► For example, Glencore's Kidd Creek mine in Ontario, Canada, installed an underground mine ventilation control system that provides approximately 25,000MWh of electrical energy savings each year, which is equivalent to C\$2million (US\$1.6 million) per year in savings.

The Kidd Creek mine measures the airflow rate, airflow direction, blast gas concentrations and wet bulb temperature to ensure that the mine workers are kept safe and within the acceptable tolerances.

The system uses approximately 60 of Maestro's Vigilante AQS air quality stations and approximately 30 underground mine regulators.

In addition, Rio Tinto's Diavik diamond mine in Canada's Northwest Territories undertook an underground heating and ventilation performance optimisation project with Maestro. Before this project, energy

was 25% of the mine's cash costs; the project implemented changes such as lowering ventilation demand by retrofitting truck engines, installing auxiliary fan control and improved shift utilisation. This resulted in annual cost savings of C\$5.5 million (US\$4.3 million), and all savings were accomplished without incident.

Furthermore, another user of Maestro's equipment, Vale's Totten mine in Ontario delivered an efficient ventilation system with manual remote control capabilities.

The basic ventilation control system (VCS) was commissioned to achieve the airflow distribution defined by the production and development schedule and manually regulated from the control room as required, saving 25% of the total energy bill of the mine.

In order to maintain and enhance energy savings, the Totten mine then decided to implement a higher level

of automated ventilation control, which achieved an energy reduction of 50% when compared with the baseline established before implementation.

THE FUTURE

As for the future of smart ventilation, Gibbons suggests that Internet of Things ventilation sensors and Ethernet distributed controls are quickly becoming the only affordable alternative to a smart ventilation system. He says: "They both drive down CAPEX and allow for quick and simple integration by removing complex and expensive hardware, similar to what VoIP has done to the telephone business."

He concludes: "Electrification of mobile equipment will also reduce the ventilation requirements of a modern mine. Much of the air required in a mine is directly related to flushing out the off-gases generated from diesel equipment." ▼

The Vigilante AQS air quality station displays air conditions in the mine on a display to workers

