

Keeping in step with sustainable mining through optimised ventilation

Mining is a key contributor to global growth, enabling existing and emerging technologies through the provision of key metals and minerals. However, like many energy and natural resource sectors, mining faces challenges in how to do this, both in terms of the technologies and techniques required to access resources and the need to improve sustainability through energy efficiency.

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This is certainly being experienced within the Nordic mining community. A pipeline of new mine developments shows a readiness to fulfil global material demand, and mine expansions indicate a future for deeper underground operations. There is a notable shift towards electrification and away from fossil fuel-based equipment, driven by national ambitions to meet global environmental commitments.

When it comes to underground operations, one thing remains constant and that is the need to provide a safe working environment for personnel within the mine. Ventilation is a core function of a mine and the systems that have been developed to provide vital air and to remove toxic gases and fumes, are not immune to the need for advancement. This is particularly relevant since ventilation costs (including heating and/or cooling) can reach up to 50 percent of the total energy costs within a mine. Gains in ventilation system efficiency have a significant impact on operational costs and profits.

Managing air quality

Of course, the move towards the electrification of mine vehicles and equipment will reduce the volume of fumes that needs to be diluted or extracted, and thus the amount of ventilation required. However, air quality is not solely connected to diesel particulates. Blasting, for instance, emits particulates and the systems need to adequately bring the zone back to workable levels before operations can continue safely. This means

there will always remain a requirement to manage the quality of the air and certain component levels, even though the volumes and frequency of dangerous elements will differ. Heating is an additional factor in Scandinavian mines, and the cooling of ventilation air will become increasingly important as mines become deeper and/or exploration strengthens in more challenging climatic conditions.

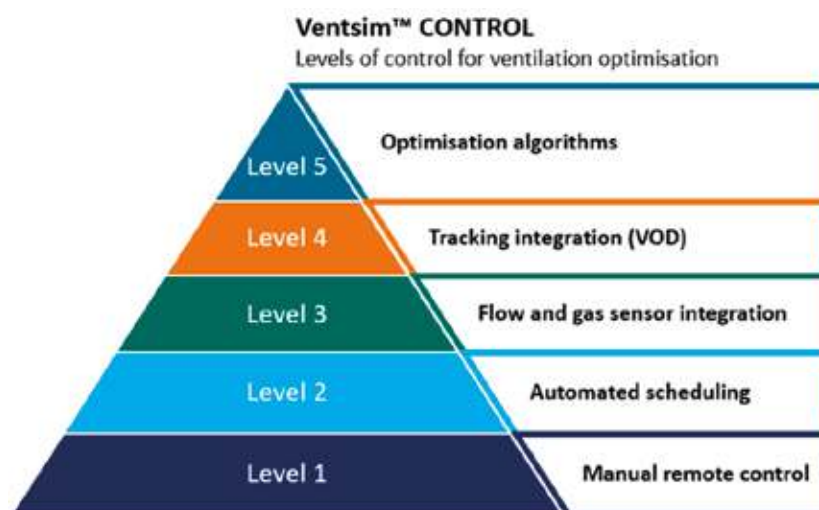
This all points to the need to have a system which is able to fully meet demand while at the same time being flexible enough to minimise over-use and costs. As a company which focuses on mining ventilation, Howden expanded from its hardware base (fans) to address the wider scope in response to these developing requirements. Ventsim is recognised as the leading design software

for underground ventilation. The Ventsim Control product is designed to optimise ventilation by adjusting airflow and energy consumption to reach and maintain peak efficiency.

Improving safety underground

Prior to controlling the equipment, the first step when improving safety underground is the remote monitoring of the conditions. Data on gases, airflow and temperatures form the basis for understanding the mine. This information is key following blasting while preparing for re-entry. The live simulation of the readings in Ventsim Control assists in building a bigger picture of the safety environment underground.

Control over the ventilation system is scalable. It starts at a manual level,



Ventsim Control offers operators a scalable ventilation management solution



Ventilation air needs to be responsive to working temperatures as well as specific activities.

where the operator uses the Ventsim Control interface to turn fans on or off remotely and to modify their speed or to set the percentage levels on regulators. Settings stay the same until manually changed, which means there is still a high dependency on user management. However, this is already a significant gain when compared with the hours required to adjust underground equipment. It also partially removes the risk of human error by being able to check that the fan has been turned off prior to blasting. The automatic action log of Ventsim Control improves accountability by keeping track on when and who has performed tasks.

The next step up is to set automatic schedules and events, so that Ventsim Control automatically changes underground fan and regulator settings as part of a schedule, like shift changes, or planned events, such as blasting.

Real-time conditions

A more advanced use is to apply set points for airflow, gas levels, and/or temper-

ature. Ventsim Control reads real-time conditions from monitoring stations, and then automatically adjusts underground fan and regulator settings to maintain set points. The ventilation system is then running in direct response to the changing dynamics of the mine and is delivering in line with actual requirements.

For full Ventilation on Demand (VOD) however, the system needs to be able to react to operational activity within the mine and not just environmental conditions. To enable this, Ventsim Control



Monitoring stations allow the system to operate on real time information.

uses dynamic tracking to determine requirements for airflows, gas levels, and temperatures, based on the personnel and vehicles in each area. Tagging and tracking technology gives complete visibility of people and equipment, increasing safety as well as the ability to optimise ventilation. Ventsim Control reads real-time conditions from monitoring stations and automatically adjusts underground fan and regulator settings to maintain safe and comfortable working conditions in dynamic environments.

Complete infrastructure optimisation comes when Ventsim Control extends its management to the main ventilation fans. This level of optimisation controls the ventilation system as a whole, using advanced control strategies designed for mine ventilation applications, and by adjusting main fan settings to maintain the levels required and maximise energy savings.

Achieving the goal

Operational improvements within mine ventilation have never been as important as they are now, since the need to increase efficiency is being driven by commitments to responsible resource extraction as well as business imperatives.

Efficiency within ventilation means minimised air and energy use in relation to production, and reduced downtime as systems react fast to blast gas. The realisation of the goal necessitates a fully, automated tool which integrates operational data with powerful analytics of all the components of the ventilation system. Ventsim Control provides precisely this, bringing tangible benefits to mine operators.

Reductions in costs

Current users have seen significant reductions in underground ventilation costs in the range of 40-55 percent, and an equally strong decrease in the cost of surface ventilation electricity (over 70 percent in one case). There are many other examples of positive gains where mines are deploying heating or cooling, with savings of 20-40 percent. This indicates that operational mines can achieve rising efficiency targets with relatively short returns on investment. As mines expand, the system can also be expanded by adjusting to the new parameters of the mine. For new developments, Ventsim Control delivers a stronger operational basis as well as the potential for lower capital expenditure because ventilation equipment is more accurately sized for its likely usage. ■