Case Study Compressed air
Compressed air

Demand Side Management: Saving power sustainably on an industrial scale

The industrial and mining sector contributes approximately 60% towards the maximum demand during national peak periods. Air compressors are responsible for approximately 9% of industrial demand, which merits further investigations into energy efficiency innovations.

It is common sense that these systems, which were never designed for any sort of efficiency, provide ample opportunity for cost reduction. Indeed, the implementations of a Real-time Energy Management System for the optimisation of compressed air networks (REMS-OAN) together with an On-site Information Management System (OSIMS) have shown that a large scope for sustainable energy efficiency projects exists.

Potential for energy efficiency on compressed air

An in-depth investigation into the compressed air networks of a specific gold mining operation reveals an average energy efficiency potential of 2.2MW.

The site consists of seven compressor houses that supply compressed air to ten shafts and five plants. There are 14 underground levels. Five are non-productive while the remaining nine are fully productive.

The compressed air system of the plant is an intricate arrangement consisting of surface compressors, pipe work, valves, drills, agitators, loading boxes, loaders, shotcrete, ventilation and other pneumatic equipment. Air is also distributed on surface where it is used by systems such as refrigeration plants, ore transportation and ore processing.

The installation of underground flow and pressure monitoring equipment, coupled with pressure and flow control valves, makes it possible to monitor, optimise and automatically control underground compressed air networks. The control valves are installed on those levels using the most air such as production levels.

Through the optimised control of the pressure requirement of each level, air wastage is minimised. When the demand for compressed air drops, a reduction in the supply of compressed air will result, assuming that supply and demand are integrated and both controlled by REMS. This in turn manifests itself as an electrical power saving as the compressors’ cut-back on absorbed power.

Improving the efficiency of air compression with the implementation of a REMS System, provides the possibility of saving the mine in excess of 13 700MWh per annum.

If this is translated into a cost saving at the prevailing price of electricity, it will deliver a reduction of more than R3.4 million.

Sustainability guaranteed

Normally the benefits of any energy-saving project gradually decline with time, as the awareness of these projects dwindles. Due to the failing of these projects, they tend to end up costing more to maintain than the cost benefits that are achieved.

Sustainability can, however, be achieved by implementing the OSIMS system. OSIMS uses information technology to keep clients involved in the DSM project management and to improve savings; it can also be used to help make the holistic project implementation more inherently stable, safe and sustainable. Without OSIMS, the sustainability of DSM projects cannot be guaranteed.

Cost versus return

With the recent slowdown in the global economy, mine management may be reluctant to approve such compressed air saving projects due to capital requirements. Payback periods could be longer than the client approval policy.

However, almost inevitable hikes in the price of energy, combined with the availability of energy efficiency funding from Eskom DSM, instantly renders the return on investment calculation more feasible.

Accurate control, reduced demand

The efficient use of compressors in the mining industry relies on the accurate and sustainable control of the compressed air demand through REMS and OSIMS. The benefits of such a system go beyond those of the mine alone. Eskom will also benefit from fewer supply constraints and lower carbon emissions. If such systems are applied uniformly across mining and other industries where compressed air is extensively used, a system go beyond those of the mine alone. Eskom will also benefit from fewer supply constraints and lower carbon emissions. If such systems are applied uniformly across mining and other industries where compressed air is extensively used, a multiplicity effect which substantially reduces demand will be visible.

Considerations: Accurate simulation essential to demonstrate savings potential

Achieving reduced energy consumption in mining compressor systems will require changes to the operation schedule. Managers will however, only consider such changes if there is a high level of confidence that they will not affect safety or production. A detailed and integrated control simulation procedure running successfully for the full mine operation is therefore required.

When building the simulation model for the mine air network, each level has to be simulated in precise detail. Importantly, all energy users must be integrated to arrive at accurate and optimised DSM and energy costs models. All simulated components are combined into a single integrated model that represents the integrated operation of the complete mine. This provides an accurate simulation corresponding to the actual conditions encountered in the mines air network.

The fully integrated system and control model for the mine is extensively verified with detailed measured data. The necessary update of the model is repeated until verification proves a successful computer model of the compressed air network.

Daily varying influences on the final electricity costs, which must inter alia be included in the system, are:

- Varying production schedules;
- Maintenance schedules;
- Demand control levels;
- Pressure demands;
- Flow demands;
- Production; and
- Health and safety.

A dynamic optimisation procedure is integrated using all the available component parameters to obtain an optimum schedule for these components. This will ensure minimum energy costs and maximum DSM, taking into account all the safety, health, operational, maintenance and other constraints.

For an assessment of energy efficiency solutions that will provide the maximum opportunity for implementation, call the Eskom Contact Centre today on 08600 ESKOM (08600 37566), and log a query for an energy advisor in your area to contact you.