

Compressor optimisation saves energy and improves productivity

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Of all of the energy utilities available to industry, the production of compressed air represents one of the largest opportunities for immediate energy and carbon savings on any site. Here Nigel Smith, Aftermarket Divisional Manager, for Atlas Copco Compressors looks at how to identify when a compressed air system can be optimised through centralised monitoring and controlling and what benefits this can, and can't, offer.

Concern with the price of energy is a world-wide management pre-occupation and its implications have forced industries to face up to financial reality and to re-evaluate their energy options. Governments have played their part in providing financial incentives aimed at reducing the additional costs of implementing energy-efficient technology and components, but not all users are taking full advantage of the possibilities.

In fact, some appear to ignore the opportunity to implement energy efficiency practice in the mistaken belief that increasing energy costs can only be compensated for by reducing maintenance expenditure. They may also feel that any significant reductions in energy consumption are only achievable with the acquisition of more energy-efficient equipment, a concept that takes on particular relevance where there is a multiple unit installation.

Two key elements influence system running costs: operating pressure and air leakage. Reducing either can save a considerable amount of money. Because of the wide pressure band, multiple machine installations operating in a cascade can be particularly inefficient. Leaks, on the other hand, have been estimated to waste as much as 30% of a compressor system's output and energy use. Most compressed air systems older than five years can have a leakage rate of around 20% of the total volume consumed. Even when an industrial facility is not operational, leakage continues and each 3 mm (0.12") leak is estimated to represent a staggering 42,000kWh of wasted energy per year.

The answer to achieving optimum performance and energy savings from an existing installation lies with intelligent compressor utilisation, the result of implementing affordable, efficient compressor management and centralised control methods - in a word, optimisation.

But how is the user to know if there is an energy-saving potential?

The best way to obtain accurate and reliable data is for an energy and flow audit to be carried out. The aim is to achieve any possible energy savings and to improve efficiency of the compressed air network. That objective needs to be realised through expert analysis and a comprehensive understanding of the air use. This is done by scrutinising every stage from compressed air production to point of use - and by carrying out a thorough assessment of maintenance requirements.

In practice, the audit not only provides an accurate account of a plant's air demand over a 7-day cycle (and determine energy costs and savings opportunities), it can also identify areas of air leaks, measure air quality against specific needs and, importantly, assess service programme effectiveness for compressors, filters, dryers and ancillaries.

From the result of the audit and the identification of improvement opportunities, it is then possible to introduce an optimisation plan - installing centralised control equipment that connects all compressors and quality air units while applying sophisticated software algorithms to operate the complete installation.

Depending upon the size and complexity of the compressed air installation, the optimisation programme may also call for networked intelligence – which incorporates 24/7 remote monitoring for condition-based maintenance. Whilst occasional energy and systems audits are still recommended to confirm that everything is operating at the appropriate levels, the controller will automatically optimise for large fluctuations in demand.

It is worth noting that although the audit procedure will reveal just how and where equipment performance can be optimised, if the installation has been over specified initially, i.e. is over-sized in terms of pressure and volume output for the compressed air requirement at the point of use, then optimisation cannot compensate for the energy consumption level.

So, what are the real savings and the real benefits to be gained from an optimisation programme?

For a start, industry surveys indicate that the average production facility can reduce its energy consumption by up to 20% by eliminating sources of waste, such as air leaks in the system, and by improving compressor utilisation. Maximum uptime and lower maintenance costs are a consequence of operating equipment at optimal levels as is a substantial increase in its useful lifetime, thus resulting in reduced capital expenditure.

One of the most prominent benefits of optimisation is the significant reduction in pressure band of the overall system. In a traditional multiple compressor installation, the load/unload pressures are offset to prevent compressors from starting simultaneously and to ensure stability in the air net. This not only limits the ability to closely match the air demand, but it creates a large pressure band. In contrast, with centralised control, the optimal mix of compressors is maintained, based on the calculated or measured air delivery. The resulting pressure band is a fraction of the non-regulated system – a difference that becomes even more important as the number of compressors increases.

The introduction of controllers also contributes significantly to reducing maintenance costs. Comprehensive, flexible machine sequence control ensures that installed machines are able to work in groups. The control unit guarantees that system running hours are equal across all machines in the same group. The result is fewer service visits and reduced costs as all machines can be serviced at the same time. The controller automatically shuts down machines during ‘non-production’ times such as nights, weekends and holidays.

Central controllers are available for all machine sizes and types, including VSD and centrifugal compressors and can be purchased outright or included under a planned maintenance contract. Dependent upon specification, they can offer unlimited control capacity and intelligence processing for up to 30 machines; both compressors and dryers.

The controller unit usually comprises a wall-mounted system independent from the compressor installation and equipment power supply. It works by anticipating system behaviour to ensure the optimum machines are used. By sampling, storing and analysing system performance, the controller makes the correct decision at all times, thus guaranteeing total system stability and cost savings. Simple timer controlled sequence selection improves the match between expected demand and machine priority, thereby reducing energy consumption.

In summary, a properly managed compressed air system with centralised control can save energy, reduce maintenance, decrease downtime, increase production throughput and improve product quality. As each 1 bar (14.5 psi) reduction in working pressure results in 7% direct energy savings (and a further 3% saved through leak reduction), the importance of accurate control and management is an obvious fact of compressor life.

Source: Atlas Copco