

Air supply with IT efficiency

Erwin Ruppelt and Michael Bahr, Kaeser Kompressoren GmbH, Germany, present new IT for more efficient compressed air supply.

Today's industrial firms have a level of automation that would hardly be possible without the use of compressed air. This energy source has the advantage of excellent flexibility, but it is not cheap to produce; which is where systematic cost management comes into play (Figure 1).

A compressed air supply failure in a modern industrial plant can be just as catastrophic as an electrical power failure. The main requirement of an advanced compressed air supply is therefore maximum reliability. This is closely followed by optimum cost efficiency, as 18% of the average manufacturing plant's energy supply is consumed by electrical motors used to produce compressed air. Consequently, efficient monitoring, control, cost analysis and continuous cost management are essential for a reliable and efficient compressed air supply.

In order to achieve maximum dependability, the four most important elements of a compressed air system (air production, treatment, distribution and consumption) need to be in tune with one another. Shortcuts, such as simply exchanging individual components, do not create the desired effect.

An optimised cost structure

Figure 2 illustrates the cost structure over a five year period of an optimally planned compressed air system with air cooled compressors; electricity costs of 8 cents /kWh; 6% interest; 7 bar operating pressure; and specified air quality (remaining oil content: 1; particle carryover: 1; remaining water content: 4, in accordance with ISO 8573-1).

The chart shows that the largest proportion of the total air costs (69%) is consumed by compressor electricity and air treatment.

Increase efficiency, but how?

Whoever tries to look for a panacea where one compressed air solution suits all air needs will be searching in vain, as no two companies' air supplies are the same. When looking to modernise an air system, every aspect needs to be taken into consideration, even the existing air distribution network. These networks, whether ring or spur, plastic or metal, not only affect pressure drop and air leakage losses, but also compressed air quality.

Air demand also depends on various other factors, including single shift operation with irregular duty

cycles; two shift operation with intermittent fluctuations; lower air demand for night shifts; and three shift duty cycles with relatively constant air demands, etc. The circumstances are as varied as the number of uses for compressed air. Air qualities, ranging from dry to purest air, are also part and parcel of the many air applications.



Figure 1. Compressed air system in a modern manufacturing plant. Comprehensive optimisation of the compressed air supply saves the company approximately € 70 000/yr in energy costs.

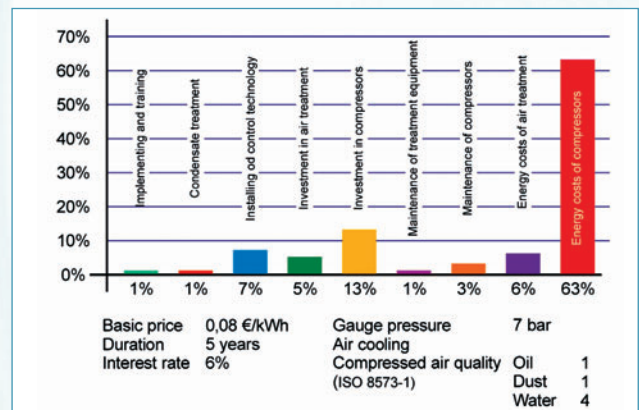


Figure 2. Cost structure of an optimised compressed air system.

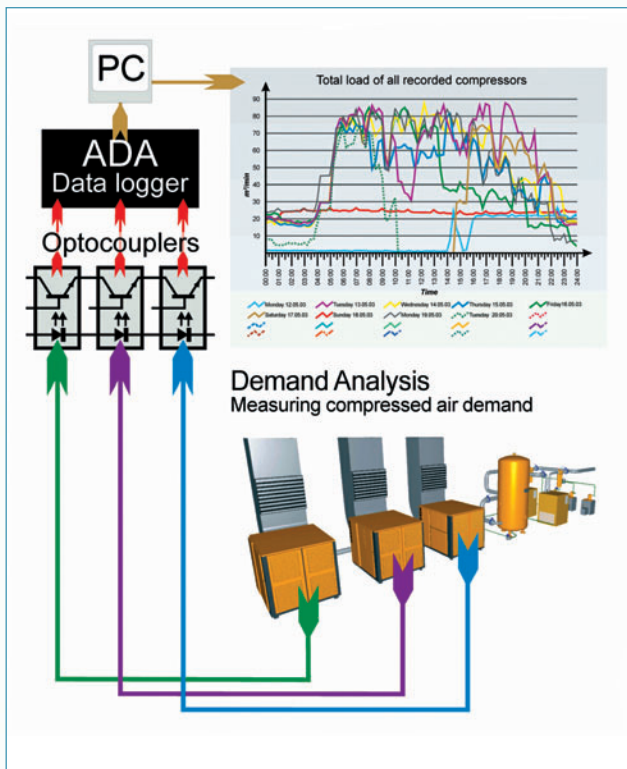


Figure 3. PC supported air demand analysis (ADA) aided by data loggers.

The diversity and scope of compressed air uses require each system to be designed/modernised on an individual basis. This process begins with thorough analysis.

Demand analysis: detailed planning

Whether installing a new system or modernising an existing one, it is always essential to determine the actual air demand. Modern analysis methods, such as PC supported air demand analysis (ADA), not only collect data

regarding fluctuating air consumption over a 10 day period (Figure 3), but also record the varying load phases of the compressor(s). The ADA data forms the basis for system optimisation via the specialised Kaeser Energy Saving System (KESS) software. The computer produces an optimised energy profile over the entire air consumption range, and determines the suitable control concept (peak load splitting, frequency control, etc). KESS also provides information regarding compressor sizing and interaction.

A cost profile is then created, detailing the compressor quantity, type, size and control type that the new optimised system should use. Of course, this calculation takes aspects such as cooling method, air receiver size and air pipeline diameter into consideration.

Air treatment is an equally important part of the planning process. The air treatment system must operate efficiently with minimal differential pressure and be able to cope with the demands of full and partial load conditions.

Finally, a 3D image with flow plan is generated, which forms the basis for construction of the compressed air system. This image can be displayed on the PC monitor to simulate system ventilation and access, and can be used for optimisation purposes even in the planning stage (Figure 4).

Flexibility in demand

The compressed air supply must be able to adapt to changing conditions at any time in a modern business. Modern control systems not only use, but also integrate cutting edge information technology to make tasks such as cost management and tailoring the compressor system to customer requirements much easier. They also help to maintain the air system's residual value.

Computers in control

Modern compressor controllers are PC based and enable all kinds of management possibilities. As they are able to communicate with master control systems, such as the Sigma Air Manager, via data bus, these industrial PC units are now the standard. The Sigma Air Manager acts as the

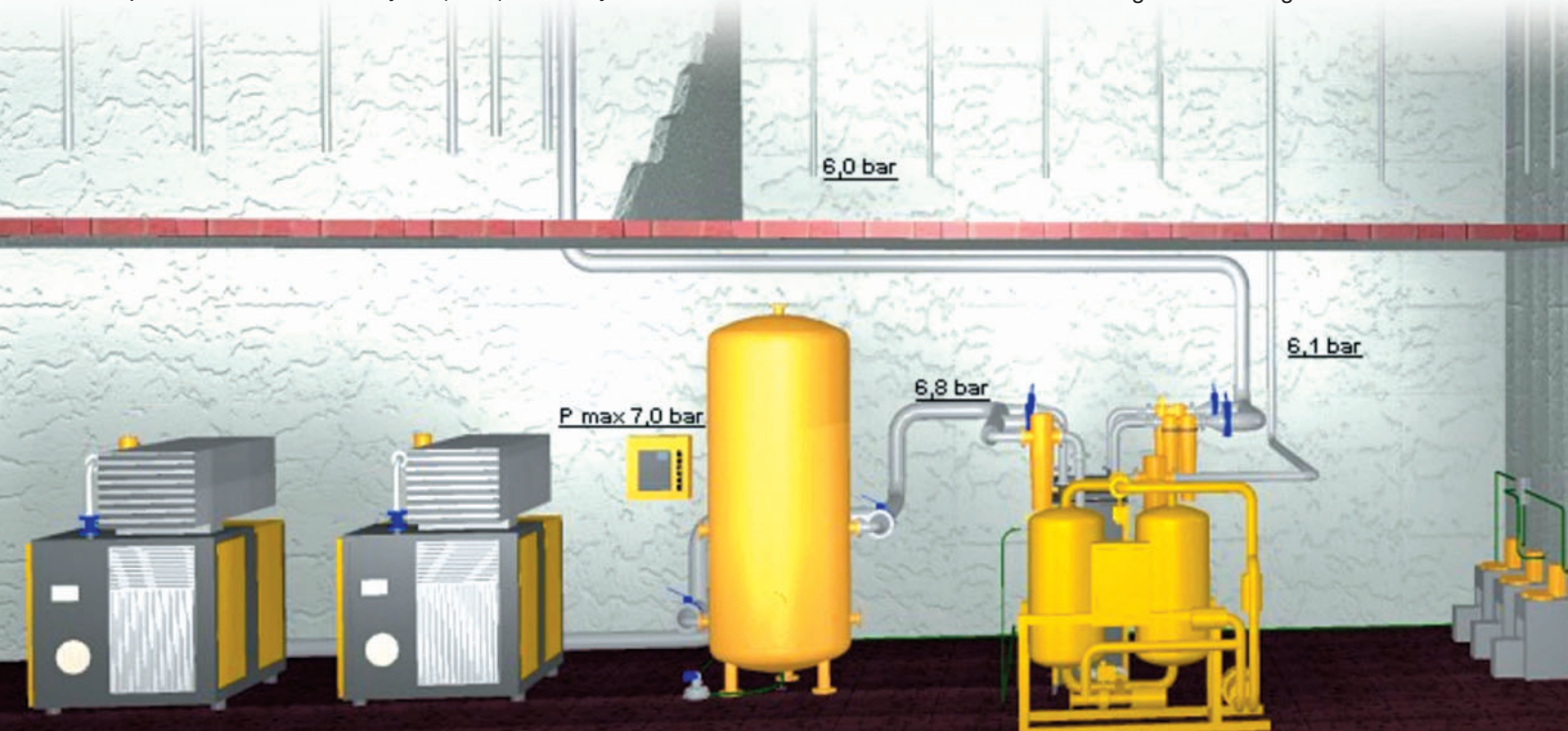


Figure 4. The analysis calculates differential pressure in the compressed air network and treats the air installation as one whole system.

conductor of an orchestra by ensuring perfect interplay between every major component of the compressor system.

Cost and operating transparency

A key advantage of this control architecture is that it can be adapted to changing needs at any time via a simple update, which is far quicker and easier than changing the compressor hardware. The Sigma Air Manager is also capable of much more, as it is not only an extremely versatile, energy saving compressed air management system, but is also a web server (Figure 5). This feature means that all compressor system operating data can be displayed over the internet via an ethernet or modem connection without the need for additional software. All that is required is a PC with an internet browser, as the Sigma Air Manager provides ready to read HTML pages.

By calling up data from the Sigma Air Manager's long term memory, it is possible to carry out a thorough online air audit. At the click of a mouse, the system enables the user to answer the question of how much a cubic metre of compressed air actually costs.

This powerful control system offers effective compressed air management and control at relatively low cost to a wide range of users. It is not therefore restricted to use in large companies.

Through access to detailed information regarding their compressed air costs, increasing numbers of air users can recognise and take advantage of potential savings measures. This cost transparency brings all concerned ever closer to achieving the goal of reducing the amount of energy consumed for compressed air production by 30% or more (Figure 6), which benefits both the environment and the balance sheet. ■



Figure 5. The Sigma Air Manager is a powerful integrated master controller and web server providing everything for effective compressed air management and control.

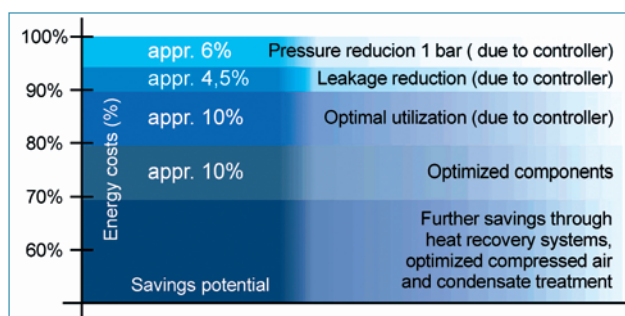


Figure 6. Compressed air systems have an average saving potential of 30%, which can be realised through various optimisation measures.