Basic principles, tips and tricks

Energy-Efficient Compressed Air Technology

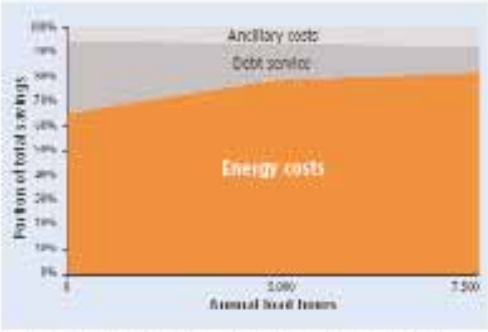
Compressed air offers many opportunities for energy cost savings. Here are the facts: Compressed air generation accounts for around 10% of industrial electricity consumption. Compressed air has many uses – as stored energy or as a process medium. It is, however; also true that compressed air can be a relatively costly form of stored energy if the opportunities for energy savings are not actioned properly. In this context, previously documented examples and case studies show that energy consumption savings of up to 30% are possible, even if you think that your current system is running efficiently.

Energy costs account for more than two thirds of the total cost of ownership

Increasing energy costs and the threat of carbon and emissions levies and taxes for businesses, mean that the performance and efficiency of compressed air systems have never been more important – especially when you consider that energy constitutes the largest part of the total life-cycle cost of a compressed air station.

Various studies on this topic have all concluded that around 80% of the total life-cycle costs can be attributed to energy use.

Surprisingly, in many cases, compressed air consumption is a completely unknown factor (70% in one survey), and only 20% of the surveyed companies had already tried to implement a process of optimising their processes and networks.



Energy costs account for the largest portion of the total costs of ownership.

To begin with: Measure your air consumption

The process of finding potential savings starts by capturing air usage data and making it readily available for analysis. While doing so, it is also important to account for the compressed air related energy costs, broken down into each production area's consumption. This process alone has led to savings of up to 30 to 40% in compressed air consumption and costs.

The biggest savings: Eliminating leaks

The aim of this white paper is to highlight the possible compressed air savings, and when looking at all of the options, eliminating leaks in the compressed air network is one of the most important consideration. Even in companies that maintain their installations well, up to 30% of the compressed air generated can be lost through leaks (statistics from the NRW energy agency: 10% in industrial networks, up to a maximum of 30%). As an example, a single leak with a diameter of just 2mm would lead to a loss of 0.4m³ per min in a 10 bar network.

This would amount to additional energy costs of thousands of Euros per year. And yet, it's a simple process to investigate the network for leaks using a purpose-made ultrasound measuring device. The time taken to recoup those additional energy costs incurred, while fixing leaks and regularly monitoring the network, is between six months and two years.

Example calculation of the possible cost savings by reducing leaks.

	Status	Proportion %	Red. Factor	Target	Proportion %	Difference
Compressed air consumption						
[illegible]	[illegible]		[illegible]	[illegible]		[illegible]
[illegible]	[illegible]		[illegible]	[illegible]		[illegible]
Leak calculation for a year						
[illegible]	[illegible]		[illegible]	[illegible]		[illegible]
[illegible]	[illegible]		[illegible]			
Cost calculation for a year						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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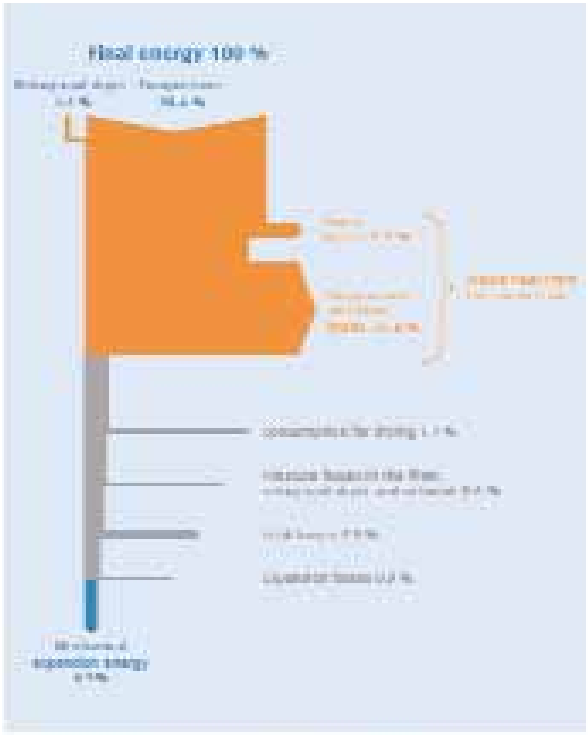
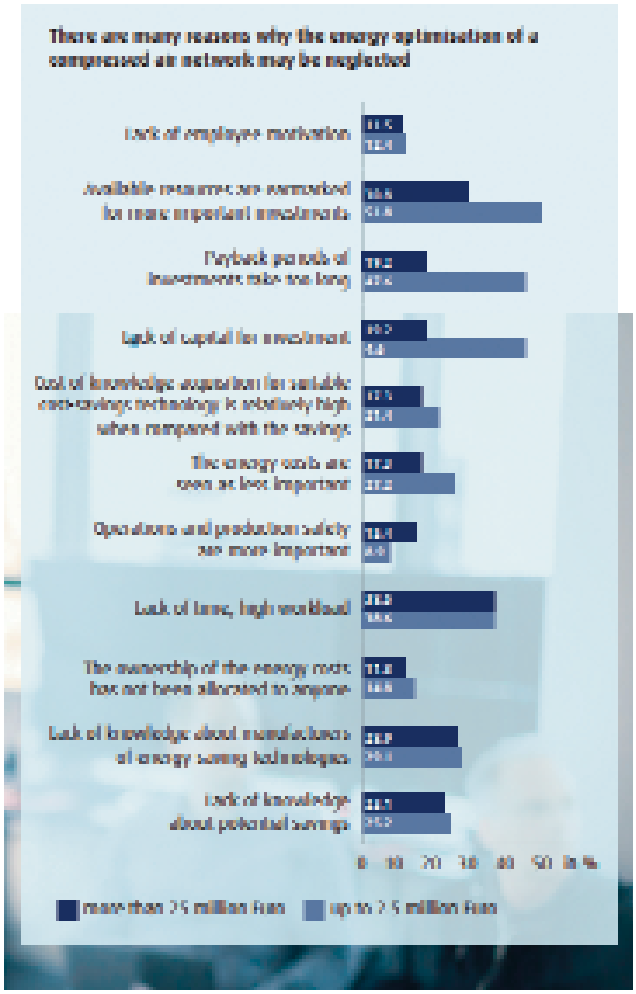


A compressor only converts around 3% of the consumed electrical energy into mechanical expansion energy.



Compressed Air Generation Efficiency

When planning and optimizing compressed air systems, always consider that a compressor converts only around 7% of the electrical energy consumed by mechanical expansion energy. The majority of the energy is released as waste heat, resulting in a very low-efficiency rating, compared to an electrical drive. It is, therefore, all the more important to use the available energy efficiency and maximize all possible energy saving options.

Pressure increases and energy usage correlate at a ratio of 2:1. This means that for every 1 PSI increase in system pressure there will be a 0.5% increase in energy consumption of the compressed air system. For example, increasing system pressure by 20% (perhaps from 100 PSIG to 120 PSIG) will result in an energy increase of 10%. Conversely, reducing the pressure of the compressed air system has the same effect. If we can solve inefficiencies and reduce the main line pressure by 20 PSIG, we will reduce the energy requirement by 10%.
Compressed Air Handbook, Compressed Air and Gas Institute, pg. 211

Inaction costs more in the long run

In practice, there may be many reasons not to take action and look for cost savings, however this shouldn't prevent decision-makers from considering the points raised in this article.

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