



Compressed air leakage reduction

Air leaks are tireless consumers of compressed air, even after office hours and during the week ends. Even small leaks can entail substantial losses in electrical energy and may thus cause substantial energy costs. Dealing with them is often quite easy and a regular check on leaks is thus a good strategy to both minimize electricity costs and save money.

Compressed air: Versatile and energy-intensive

Compressed air is used for a large variety of applications, e.g. for powering pneumatic tools or as process medium directly used in production. On average, compressed air generation is responsible for about 10% of electricity demand in industrial companies. Electricity costs are an important aspect of compressed air usage since they easily hold a share well above 70% of the costs of an optimized compressed air station over a period of five years. According to estimates, energy demand at a nominal flow rate and a typical pressure of 7 bar is between 85 to 130 Wh per Nm³ of compressed air for a correctly

dimensioned and well managed installation. This typically translates into some 1 to 3 Euro-cents per Nm³ of compressed air, depending on the system performance and electricity prices.

Multiple opportunities for energy savings

Despite the substantial costs for providing compressed air, considerable energy saving potentials have been identified in the past. This concerns all parts of a compressed air system. While some measures like using high-efficiency compressor systems are usually relevant during the occasional major overhaul of entire compressed air stations, others are easily to

‘Stop turning money into thins air.’

Europe
(Food and Beverage sector)

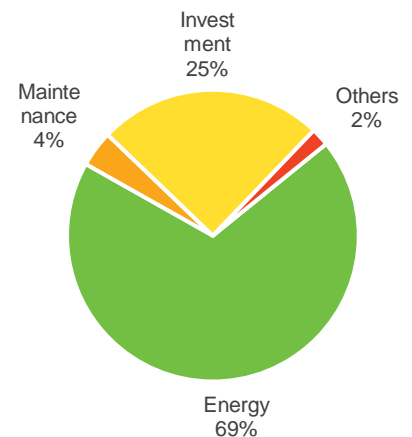
TRL 9

Investment
starting from 0 €

Annual savings per fixed 3 mm leak
900 €/a
9000 kWh/a

Main NEBs (Other benefits)
Improved performance
Less noise

Costs of an optimized compressor station within 5 years



implement also during normal operation.

BEST PRACTICES - MAINTENANCE

FACTSHEET

Reducing air leaks to save money

An usually easy to implement and cheap measure for normal operation is the reduction of air leaks. These have been identified as major sources of energy losses in compressed air systems. They originate from badly carried out installation work, worn equipment or a lack of sensitivity from the user, e.g. from semi-shut air valves.

Under typical pressure conditions, a 3 mm leak, for instance, requires approximately an equivalent of 3 kW in compressor input power while a 5 mm leak already requires more than 8 kW.

A particular challenge with air leaks is that they are always present in a compressed air system under pressure, even during the weekend when nobody is working. Thus, avoiding leaks can result in an average reduction of electricity demand for compressed air provision between 10 and 20% of the total energy demand of a compressed air system.

Air leak occurrence & detection

Air leaks may occur in all parts of a compressed air system, from air compressor to the end-use including:

- Couplings, fittings and valves
- Pipe joints, disconnections
- Pressure regulators and

Leak diameter [mm]	Losses [l/s]	Power [kW]
1	1.2	0.3
3	11.1	3.1
5	31	8.3
10	123.8	330

	Applicability	Gains	Potential savings
Air leakage and compressors optimization options			
High efficiency motors in compressor	25%	2%	0.5%
Speed control for compressor	25%	15%	3.8%
Upgrading of compressor	30%	7%	2.1%
Use of sophisticated control systems	20%	12%	2.4%
Recovering waste heat for other use	20%	20%	4.0%
Improved cooling, drying and filtering	10%	5%	0.5%
Overall system design incl. multi-pressure systems	50%	9%	4.5%
Reducing frictional pressure losses	50%	3%	1.5%
Optimizing certain end use devices	5%	40%	2.0%
Reducing air leaks	80%	20%	16.0%
More frequent filter replacement	40%	2%	0.8%

Figure 1: Savings from different EEMs on compressed air systems

- condensate traps
 - Tools and pneumatic equipment
- There is a variety of ways to detect or reduce air leaks:
- Especially larger leaks make audible noise and/or can even be felt in the near proximity
 - The use of soapy water applied with a paint brush used on suspect areas can be an easy mean to identify leaks
 - Leaks lead to ultrasonic sound emissions. The market offers acoustic detectors which can help to also localize such emissions from smaller leaks
 - Leaks can also be traced using particular gases

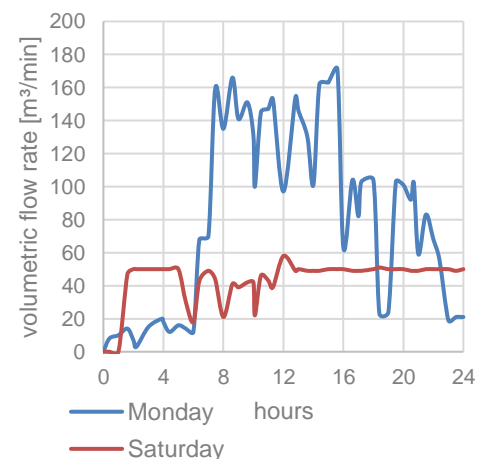
Another strategy to deal with air leaks is separating of parts of the compressed air network while production is not running, e.g. by automated valves or by adding manual switches, e.g. for idle times during the week-ends. This can also be a strategy if leaks are difficult to localize or fix.

Economics

Depending on the situation and strategy, detecting and fixing leaks is nearly free, yet can have a substantial impact on energy costs.

For instance, fixing a 3 mm leak with 3 kW in power requirement under 3000 hour operation leads to annual savings in electricity costs of:

$$3kW \times 3000h/a \times 0.1\text{€}/kWh = 900\text{€}/a$$



Opportunities and barriers to implementation

<i>Opportunities</i>	<i>Barriers</i>
Can be implemented at minor costs (often during normal operation)	
Improved performance	
Less noise	

References

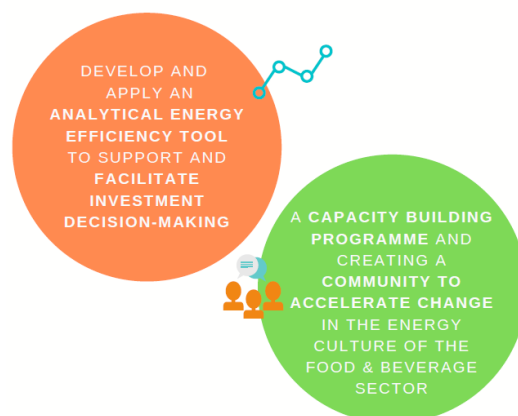
- [1] Fraunhofer ISI, Druckluft effizient, October 2003.
- [2] U.S. Department of Energy Washington, Energy Efficiency & Renewable Energy - Office of Industrial Technologies, Compressed Air Tip Sheet #3. December 2000..
- [3] Publications Office of the European Union, Best Available Techniques (BAT) Reference Document for Energy Efficiency. 2009.

About ICCEE

The project ICCEE, www.iccee.eu, funded by the EU programme Horizon 2020, aims at improving energy efficiency in the cold chain of the food & beverage sector and making it easier for the sector to:

- undertake energy efficiency measures across the entire supply chain and
- accelerate the implementation of energy audit results.

ICCEE follows a holistic approach that moves from a single company perspective to the assessment of the entire cold supply chain. Existing financing schemes for SMEs will be assessed: the optimal ones will support the implementation of energy efficiency measures. ICCEE objectives build on 2 pillars:



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