Energy Efficiency

Equipment selection and system design play an important role in lowering the cost of producing compressed air, as does ensuring that the installed system is running as efficiently as possible.

With the energy costs associated with running a compressed air system usually accounting for around three quarters of its total lifecycle costs, and many users experiencing heightened electricity costs, optimising the energy efficiency of a compressed air system is paramount.

How to create efficiencies with your existing system
Some simple investigation may identify a number of ways that you can create energy efficiencies within your existing compressed air system.

1. **Compressed air demand**; what are your current and future compressed air demands? Changes in compressed air demand will change your compressed air requirement. Closely matching compressed air supply and demand will therefore be the most efficient configuration. By measuring, analysing and optimising the system load profile you will be able to see the demand on the compressed air system over a period of time.

2. **Compressed air use**; what do you use compressed air for? Is the compressed air system being used for any improper uses such as for cleaning purposes? These should be eliminated.

3. **Compressed air quality**; what level of air quality is required and is this the same across all points of use? For example if breathing air is required in only one area, then it may well be more cost effective to have a compressed air system just for that point of use, rather than supplying the entire compressed air system with this same level of air quality.

4. **Energy consumption**; how much energy is the compressor using? Electrical measurements can be taken which can be used alongside the operating hours of the compressor to calculate the kWh/annum.

5. **Compressed air leaks;** can waste up to 50 percent of the compressed air produced by a typical system. Identifying and fixing leaks can therefore go a long way to improving the energy efficiency of a compressed air system.

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The table below provides an indication of the actual cost of an air leak.

Equivalent Hole Diameter (mm)	Quantity of air lost in leaks (L/s)	Annual energy waste (kWh)	Annual cost of leaks ($)
0.4	0.2	133	13
0.8	0.8	532	53
1.6	3.2	2128	213
3.2	12.8	8512	851
6.4	51.2	34040	3,404
12.7	204.8	136192	13,619

Source: Sustainability Victoria (2009): Energy Efficiency Best Practice Guide Compressed Air Systems

An initial assessment can be made by simply walking around the factory at the start or end of the day when all machinery is switched off. Hissing sounds will indicate air leaks. Alternatively you could brush soapy water over suspected leaks. Bubbling would confirm a leak. However, neither of these methods are full proof and you will not be able to assess the severity of the leaks.

A more thorough assessment can be made by using a device such as an Ultrasonic Leak Detector (USLD). This non-invasive hand held device can precisely pinpoint a leak and its volume.

Leaks will reoccur. It is therefore important that leak detection becomes a regular task to ensure energy efficiencies achieved are long term.

6. **Pressure drops;** between the compressor and the point of use is another efficiency culprit. Any pressure drops can be identified by using a pressure gauge. If any drops are discovered, it is worth first reviewing the compressed air distribution method. Pipe layout as well as the diameter of the pipes can both contribute to pressure drops in the system.
7. **Storage;** it is important to assess the size of your compressed air receiver. Changes to your compressed air demand may mean, for example, that the compressed air receiver is too small. This will mean that the compressor will be running longer than it needs, creating additional and unnecessary energy consumption.
8. **Compressed air treatment;** maintaining the integrity of compressed air treatment equipment will also impact on the all up energy efficiency of a compressed air system.

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How to design an energy efficient compressed air system

Please refer to the CAAA Factsheet: Compressed Air System Design for tips on designing an energy efficient compressed air system.

Investing in new equipment

In some cases upgrading ageing or inefficient compressed air equipment may be the best way to achieve optimum energy efficiency. This includes considering;

Variable speed rotary screw compressors

Where the demand for compressed air fluctuates, it may be worth considering implementing a rotary screw compressor with variable speed drive which precisely matches the volume flow to the compressed air demand. The result - only the exact amount of compressed air required at any one time is produced, optimising energy consumption.

Control systems for multiple compressors

The energy efficiency of a compressed air system with multiple compressors may also be optimised by implementing a compressor control system.

Advanced compressed air controllers are able to monitor and control all components within a compressed air supply system for optimum efficiency, improving pressure values and automatically matching output according to demand.

Whether improvements can be made within an existing compressed air system or by investing in new energy efficient equipment, the best way to ascertain this is by first undergoing a comprehensive audit.

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