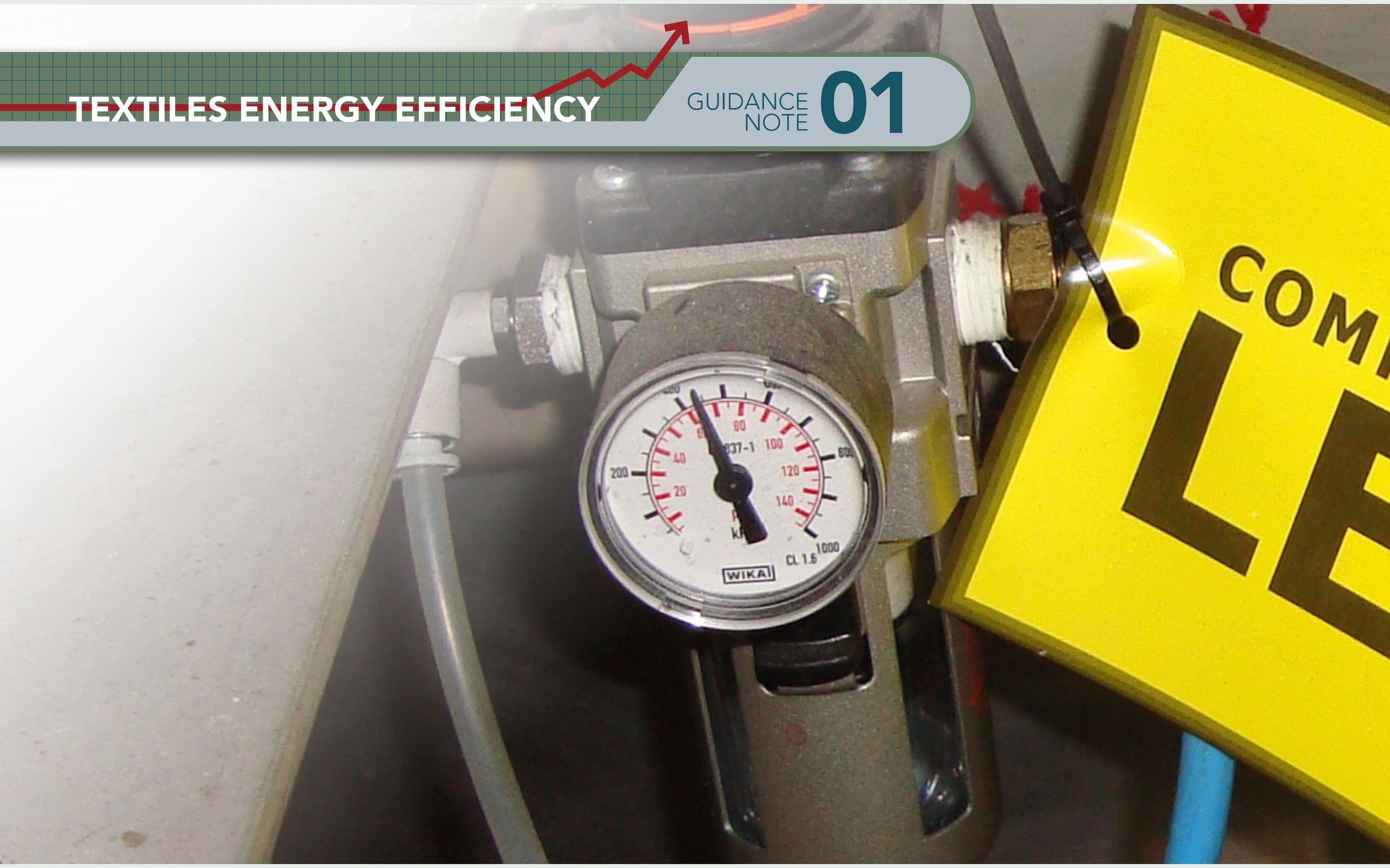

COMPRESSED AIR

Compressed air often accounts for more than 10% of textile companies' annual electricity use. It is referred to as the "forgotten utility", as the true cost of generating compressed air is often not realised.

Compressed air systems are usually only between 10% - 15% efficient. As a rule of thumb, for every one unit of compressed work output, eight units of energy input are required at the air compressor. As a result, it is important to design and install the system correctly from the outset. Given the inefficient way these systems use energy, small reductions in compressed air use can often result in large energy savings.

This best practice guidance note provides some simple tips and real-world examples of how to design and use compressed air systems more efficiently within textiles plants.

There are two discrete steps which should be taken to realise the full energy saving potential of your compressed air system;

1. Are you using compressed air efficiently?

The first step is to analyse your compressed air use. Often compressed air demand savings provide the greatest benefit with the lowest implementation costs. Because generating compressed air is such an inefficient process, small reductions in compressed air use will result in large energy savings.

2. Is your supply system optimised for your compressed air use?

Once your compressed air demand side has been addressed and all initiatives implemented, you can look at the compressed air supply side, to ensure that your compressed air system is set up optimally to meet your plants demand.

1. Eliminate unnecessary compressed air use

Unnecessary compressed air use can lead to higher demands and put strain on the network and supply of your compressed air system, causing follow-on inefficiencies in the system.

If your facility's supply system is struggling to cope, rather than purchasing a new air compressor, you should investigate the demand side of the system before making any upgrades. Implementing compressed air demand savings will often only be a fraction of the cost of a new air compressor and will provide the additional benefit of reduced operating costs for your plant.

Compressed Air Misuse

As the true cost of it is often hidden, compressed air is frequently used as an easy means of solving a problem. Although the use of compressed air often has a small capital cost, the ongoing energy costs are much higher.

The use of compressed air for product transportation, tank aeration, cooling and blow-down is not considered best practice and alternatives should be investigated.

If the use of compressed air is deemed necessary, it should be done efficiently through the use of high efficiency nozzles and air knifes. As a rule of thumb these devices will often use half the amount of compressed air to accomplish the same task.

Pressure Regulation

All compressed air uses should be regulated down to the lowest possible working pressure. Reducing the operating pressure of compressed air devices reduces their compressed air use.

Because many devices already have pressure regulators, optimising the pressure set points can often be done easily and with little cost.

Pressure regulator adjustments save $9,056 per year

A large manufacturing company had a number of pneumatic cylinders which were used in their processes. These cylinders were double acting, with compressed air used on both the out and in stroke.

A high pressure was required to move product on the out stroke; however the return stroke did not require any great speed or force so the pressure could be greatly reduced.

The cylinders already had return stroke pressure regulators; simply by optimising these, the site was able to **save $9,056 per annum** in energy costs.

Compressed air leaks

Compressed air leaks commonly account for between 20% and 50% of a textiles sites total compressed air use. Repairing compressed air leaks often has a very short payback period and can serve as part of a preventive maintenance strategy, as badly leaking equipment may cease to function correctly.

Textiles company identifies 31% of their compressed air use is due to leaks, costing $11,798 per year

A North Island textiles company which has a large compressed air network historically spent very little effort on compressed air leak repair. The site identified that compressed air may be costing them more than necessary and as a result commissioned an ultrasonic air leak survey.

The survey identified a total air leak rate of 2.76m3/min.

This equated to 31% of the site's total compressed air use. Upon repairing all the compressed air leaks identified, the site would **save $11,798 per year**.

A compressed air leak rate of 10% or below is considered best practice. Smaller sites should carry out routine audible air leak checks, while large sites may want to consider conducting ultrasonic leak surveys annually.

Machine isolation

If possible, when individual machines or parts of the plant are not in operation they should be isolated from the compressed air network. Normally this can easily be accomplished through the use of manual ball valves that are installed to isolate machines from the compressed air network when they are being worked on.

90% of compressed air leaks occur at the end use rather than on the supply network. Even with a rigorous compressed air leak prevention regime, it is impossible to completely eliminate all of a site's leaks. Isolating equipment will limit this air leak rate when this equipment is not in use.

Manual machine isolation saves $3,842 per annum

A New Zealand textiles company contained a number of knitting machines, each with a manual ball valve allowing them to be isolated from the compressed air network.

Due to the large amount of pneumatic devices on the knitting machines and their complexity, staying on top of compressed air leaks was proving to be difficult. As each machine on average only operated 70% of the time, the company was able to isolate the knitting machines when they weren't in use, significantly reducing the effect of the compressed air leaks.

Simply by ensuring that idle machines were isolated from the compressed air network, the company reduced their energy losses due to air leaks by **$3,842 per annum**.

2. Optimise your supply system

Once all of your demand based compressed air initiatives have been implemented, you can optimise your supply side to meet your site's new demand.

Although significant savings can be made through the acquisition of new technologies such as VSD (variable speed drive) / variable output air compressors, large energy savings can also be achieved by optimising your current compressed air technology often at very little cost.

Compressor Room Operating Temperature

In textiles plants, air compressors are often installed in plant service areas along with other services such as boilers, pumps and chillers. While keeping all of the plant services in one location may seem like a good idea, the energy input into plant service rooms generates a lot of heat. The higher the intake temperature, the less efficiently an air compressor will operate.

As a rule of thumb, for every 3°C above ambient, the air compressor efficiency drops by 1%. It is not uncommon for compressor rooms to operate over 10°C above ambient temperature. This means that the air compressor efficiency will drop by more than 3%.

Reducing the intake temperature of an air compressor is often easy, either by adding more ventilation into the compressor room, or by ducting the air compressor's intake air from outside.

Compressor Supply Pressure

Normally, compressed air devices are designed to operate at 6.0 bar(g). To ensure that the entire plant receives a pressure of 6.0 bar(g), an air compressor pressure set point of 6.5 bar(g) is recommended. This allows a total pressure drop of 0.5 bar over the dryer, filters and distribution.

As a rule of thumb, for every 1 bar overpressure, the air compressor efficiency drops by 7%. It is common for facilities to have a supply pressure of between 7.0 bar(g) and 8.0 bar(g), resulting in an air compressor efficiency penalty of between 3.5% and 10.5%.

Over-pressurisation can also result in increased air use through unregulated air users and compressed air leaks. If there are some small air users with specific compressed air pressure requirements, consider installing high pressure boosters or another compressed air system.

Pneumatic pressure boosters save $5,464 per annum and improve machine reliability

An Auckland manufacturing company had a compressed air system with a single pressure set point. Their system was operating at 8.0 bar(g) to ensure that there was an adequate pressure for their printing machines to operate.

As these printing machines only required pressure and did not use much compressed air, pneumatic boosters were able to be used to boost the pressure of the air being supplied to the machines, allowing the system pressure to be dropped to 6.5 bar(g).

Not only did the site improve its compressed air generation efficiency, the printing machines operated more reliably as they were constantly being held above their 8.0 bar(g) pressure requirement. This initiative saved the company **$5,464 per annum.**

Non-production energy use

Many sites do not operate 24 hours per day, 7 days per week, yet their compressed air systems can operate continuously due to small demands which require compressed air when major plant is not in operation.

Pressurising the entire compressed air network by running a large air compressor outside of production hours is not an efficient way of meeting this compressed air requirement.

Instead, a smaller backup air compressor based where the air is required should be used with a non-return valve so that the compressor does not try to pressurise the entire network. This backup air compressor can be set at a lower pressure set point than the main air compressor so that it will start automatically when the main compressor shuts down.

2.2kW air compressor saves $2,633 per year on energy alone

A South Island plant operates 24 hours per day, 5 days per week. Over weekends the plant leaves their compressed air system in operation so that one small machine can operate outside of production hours.

Instead of operating the entire network, a small 2.2kW air compressor was purchased and installed. This air compressor **saved $2,633 per annum** on electricity as well as providing significant maintenance savings.

Compressor capacity control

There are many forms of compressor capacity control that vary in efficiency based on the type of air compressor and their turndown rate. Generally speaking, for rotary screw air compressors (which are the most common form of industrial compressor), inlet modulation is the least efficient form of control followed by load / unload control, with VSD and variable capacity being the most efficient.

Compressed air audit finds $57,816 per annum energy saving through compressor replacement

A company was operating a single compressed air network with a 160kW load/unload rotary screw air compressor meeting the plant's compressed air requirements.

The air compressor was aging and its efficiency was dropping. Upon conducting a compressed air audit, it was discovered that the air compressor was no longer unloading correctly and was using significant amounts of energy when it was unload.

Instead of spending money on repairing the aging compressor, it was recommended that a new VSD compressor be installed and the old compressor kept as a backup. This saved the company **$57,816 per annum** in electricity.

Purchasing a new, efficient compressor to replace a working model is often not justified, due to the high upfront capital cost. However, when purchasing a new air compressor the most efficient model available should be selected to reduce a plant's ongoing costs.

Textiles Energy Efficiency Programme

This information has been made available thanks to Textiles NZ and the Textile Care Federation working with EECA to deliver energy efficiency to New Zealand textiles companies.

Textiles NZ membership comes from four contributing sectors: textiles, carpet, footwear and apparel. Textiles NZ works with companies to build a sustainable industry that can successfully compete in the international marketplace.

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Multiple compressor control

Efficient multiple compressor control is essential on sites that have more than one air compressor. It is important to set the system up so that it supplies air as efficiently as possible over the required range of operating conditions. To ensure this, the most efficient air compressor at turndown, such as a VSD air compressor, should be set as the "trim" compressor.

If the site has many air compressors and a wide compressed air demand range, a PLC air compressor controller should be considered. These units have the ability to manage multiple air compressors and ensure that the most efficient combination of air compressors is run to meet any particular demand.

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