Compressed air uses up to 40% of the electricity in a plastic factory, yet it only delivers 10-15% of the energy it uses.

COMPRESSED AIR

expensive but easy to control

Energy audits of the New Zealand plastics industry in 2007 and 2008 have found that injection moulding companies use between 5-15% of their total electricity on compressed air. Pipe/profile extruders and thermoforming companies use 20-40% of their electricity on compressed air.

This guide contains three simple steps to reducing compressed air costs on your site.

Plastics company saves $40,000 in compressed air

A New Zealand plastics manufacturer has found that compressed air represents 38% of their annual energy bill - a cost of $120,000 p.a. The company is able to save $40,000 of these annual costs by fixing air leaks, reducing the pressure set point, and by using electric blowers rather than compressed air in some areas.

Three Steps to Compressed Air Efficiency:

1 Reduce Demand

2 Optimise Supply

3 Continual Improvement

1 Reduce Demand

Repair leaks

Why?

Compressed air leaks are very common. It is not unusual to have leakages of 25% or more in a plant. It is a constant battle to keep these leaks in check.

A small compressed air leak of about 3mm could be costing you around $700 a year. (based on 7 bar pressure, operating 40 hours a week, at 10c/kwh). Variable speed drives (VSD) are extremely efficient at handling variable compressed air loads. If you operate a VSD and have air leaks then the energy efficiency potential is even more pronounced.

What you can do

- Measure air compressors load / unload times during non-production days to estimate compressed air loss due to leaks.
- Conduct simple and repeated walk-round surveys, with leaks tagged and repaired as soon as possible.
- If you are a 24/7 operator schedule annual ultrasonic leak detection audits.
- Isolate any redundant pipework - this is often a source of leakage.

$1,500 to fix leaks saves Auckland injection moulder $11,677 a year

One New Zealand injection moulder found that their compressor running on a non-manufacturing day had to operate at **35%** capacity just to hold pressure. This was due to significant leakages totalling **1.4m³** per minute.

Fixing these leaks cost **$1,500** and saved the company **$11,677** per year on their energy bill.

Because the company is a 24/7 operation they never get the opportunity to listen for leaks and many leaks go undetected. One solution to this is to commission annual ultrasonic leak detection audits. An audit might cost between $500 and $1,500, but finding just a couple of small leaks will cover the cost of the audit.

Stop unnecessary use

Why?

Because compressed air is so expensive and inefficient you should try and stop using it unnecessarily.

What you can do

Check every application of compressed air to see if they are essential or just convenient. Some common changes that can be made are:

- Stop staff cleaning down floors with compressed air wands – replace with brooms or electric dust blowers
- Avoid using compressed air to dry finished product when electric blowers can do just as well for a fraction of the cost
- Fit high efficiency air nozzles - payback can be as short as four months.
- Consider the use of electric tools instead of compressed air tools.
- Don't use compressed air for conveying granules or products.

Reduce pressure

Why?

Your pressure may be set unnecessarily high. Have you ever thought about why it is set at the level it is?

Reducing your pressure set point could save you significant energy costs. As a rule of thumb, every 0.13 bar of pressure you can drop will save 1% on the cost of operating your compressor.

What you can do

- Only look to reduce your pressure AFTER you have repaired any compressed air leaks and stopped any unnecessary uses.
- Try dropping the pressure set point of your compressor by 0.1bar. If this causes no problems for your manufacturing keep slowly dropping the pressure.
- Remember that in some cases a machine can be rated for a 7 bar supply but pressure reducers are fitted inside the machine.

Changing to electric blowers saves NZ firm $21,000 a year

Switching from using compressed air to electric blowers for drying and cooling extruded product will reduce compressor energy consumption by 2/3rds at one New Zealand plastics manufacturing plant.

For an initial conversion cost of **$18,000** this initiative will save the company around **$21,000** every year – about 6% of their total annual energy spend.

Leaks can account for the biggest losses in compressed air systems

Reducing pressure by 1 bar saves injection moulder $2,700 a year

An Auckland injection moulder has a 75kw VSD compressor.

Compressed air use in the plant consumes 388,700 kWh per annum, costing **$44,000** every year.

The pressure set point was 9 bar. After repairing leaks the pressure set point was reduced from 9 to 8 bar, resulting in estimated savings of more than **$2,700**, or 6.2% of compressor running costs.

2 Optimise Supply

Consider your compressor location

Why?

The further away your compressor is located from where the air is being used the harder the compressor will have to work.

What you can do

- Site your compressor close to where the air is most needed. If you have a large site, it might make sense to use smaller compressors where air is needed at a distance from the main compressor.
- Make sure pipework is not undersized – this causes resistance to airflow and pressure drops.
- Avoid sharp corners and elbows in pipework as these cause turbulence and therefore pressure drops.

Use compressor controls

Why?

Fixed speed rotary screw compressors are only efficient if they are correctly sized and running constantly near 100% load. Running a compressor that is too large for your needs could be wasting thousands of dollars in electricity.

An idling compressor can draw up to 40% of full power. You should make sure that compressors are switched off when not needed.

VSD compressor could save Waikato firm $12,500 a year

An energy audit of a Hamilton plastics company revealed the opportunity to replace an old rotary screw compressor with a new VSD compressor and save 111,500 kWh per annum.

Two rotary compressors were being used on site, with one of these acting as a backup. Both compressors were oversized for their roles. Replacing one of the screw compressors with a VSD, then using the VSD compressor as the main air source and the remaining screw compressor as a backup will initially cost the company a one-off $20,000, but will deliver savings of **$12,500** every year.

What you can do

Here are three possible options for optimising compressor control:

- **Variable speed drives**
  If your plant has a variable demand for compressed air then a variable speed drive could save you significant energy costs.

- **Cascading systems – alternative to VSDs**
  In some cases investing in a variable speed drive compressor does not make economic sense. In this situation two screw compressors of different sizes can be used in combination to deliver a similar effect.

Turn fixed speed compressors off when compressed air is not required

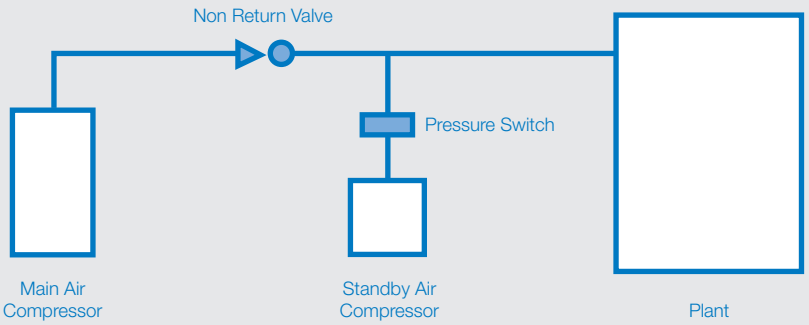
Compressor cascade pays back for injection moulder within 7 months

A Waikato injection moulder currently uses a 25HP modulated rotary screw compressor that runs continuously. This type of compressor has fewer moving parts and is cheaper to maintain. However, it is very inefficient at delivering low volumes of compressed air. Most of the time this compressor is delivering about 10% of its capacity. Occasionally there is a need to supply a particular machine that raises this consumption to 90% capacity.

Replacing this compressor with a VSD compressor would save energy but cost around $25,000 and take a long time to pay for itself.

Instead, the company is installing a small reciprocating air compressor to supply air when loads are low, and keep the larger compressor for when loads are high. Installing a simple non-return valve and an internal pressure switch controls the switching between the compressors.

The system has a one-off set up cost of about $2,500 and will save **44,000kWh**, or **$4,474** every year.



PLASTICS NEW ZEALAND

Maximising the growth and success of plastics-based technology in New Zealand in an economically, socially and environmentally responsible manner.

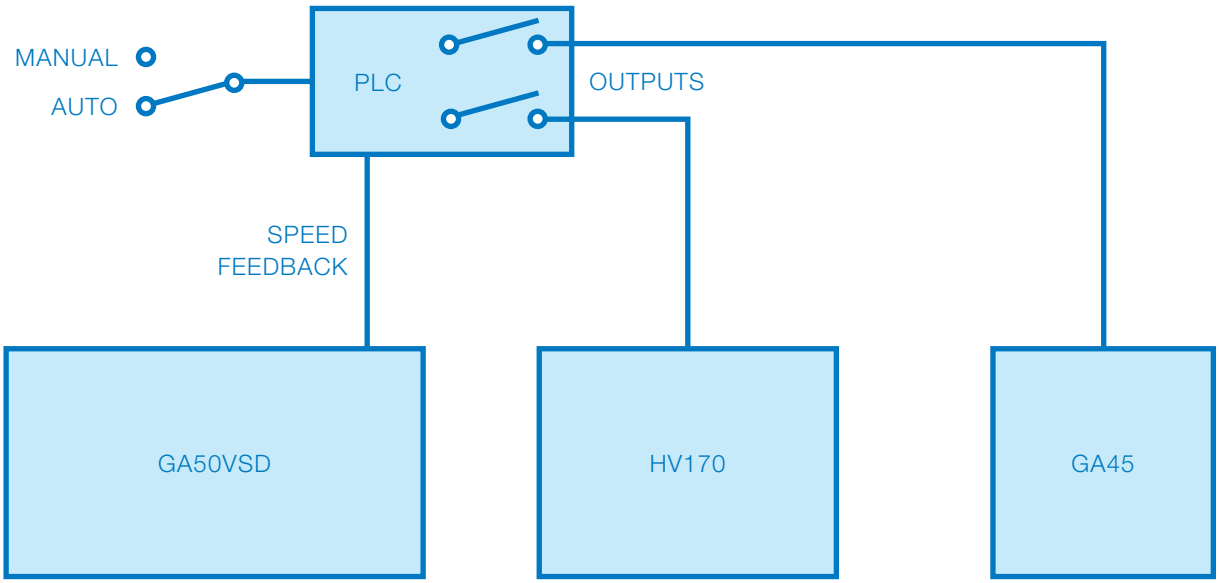
What you can do (continued)

- **PLC controls**
  In a situation where you have multiple compressors on site and a variable load profile, efficiency can be improved by using a central computer control. This is particularly useful if you have a mix of VSD and rotary screw compressors. By using a relatively simple PLC you can ensure that the compressors supply air to the plant efficiently through the entire range of compressed air requirements.

Simple PLC control reduces energy use by 70,000kWh

An energy audit of a New Zealand plastics company in 2008 revealed the opportunity to control their three air compressors more efficiently. The company has been advised that installing a $5,000 PLC will ensure that their one VSD and two rotary screw compressors operate in a much more efficient way. This improved control will save them an estimated **$6,700** a year in electricity.

Example of a compressor PLC setup



Use cold air intake

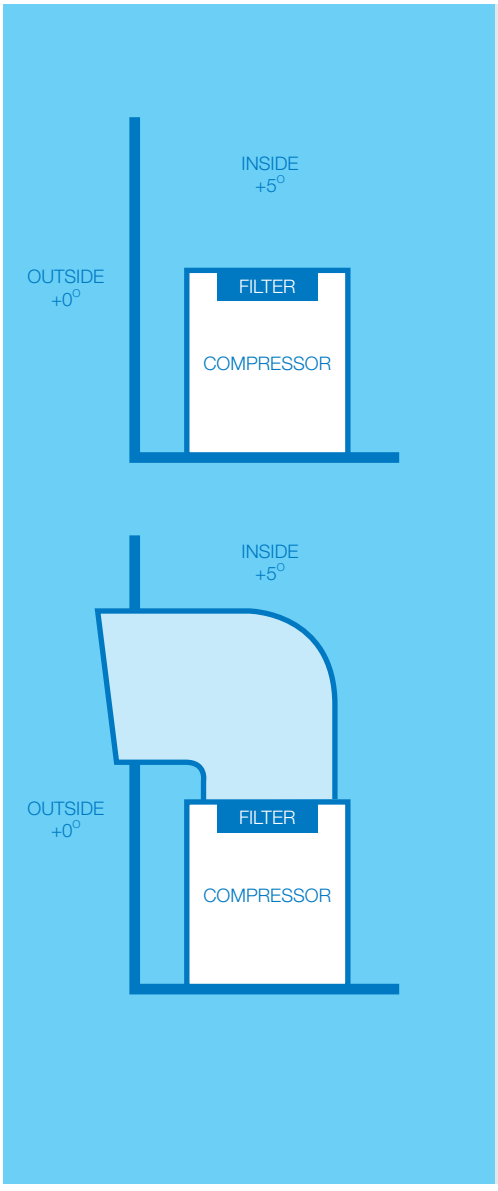
Why?

It is easier to compress cold air. Every 3°C reduction in air intake temperature to your compressor results in a 1% efficiency gain.

What you can do

- Always position compressor air inlets outside if possible. Simple ducting of existing compressors can be installed for minimal cost.

Having your compressed air system audited regularly will ensure maximum efficiency and energy savings.



Simple ducting improves compressor efficiency by 2%

By ducting cooler ambient air from outside an Auckland plastics manufacturer is able to improve the efficiency of their compressor by 2%.

Air temperature inside the compressor room was measured at 29.3°C while the outside temperature was 23.1°C. Using air that is 6°C cooler results in a 2% efficiency gain - saving the company more than **$1,300** a year in electricity.

3 Continual Improvement

Routinely assess your compressed air system following the steps above. As the production levels within your plant change you may need to make changes in your compressed air system.

Continually assessing your plants compressed air system will ensure that air is being delivered at its maximum possible efficiency. As a result it may also postpone the need for compressor upgrades, freeing up capital for your company.

The compressed air needs of individual plants vary greatly and solutions should to be tailored to those needs. Compressed air solutions should ideally be developed as part of an overall site energy efficiency project.

We highly recommend that companies undertake a detailed, Level 2 energy audit under the Plastics New Zealand Best Practice Energy Programme. Contact Plastics New Zealand to find out more.

Best Practice Energy Programme

Plastics New Zealand is a national trade organisation representing over 200 member companies.

It is estimated that the New Zealand plastics industry consumes more than 1.7 petajoules of energy per annum.

The Plastics NZ Best Practice energy Programme helps plastic companies to minimise their energy footprint through energy audits and practical actions.

Plastics New Zealand Incorporated
PO Box 76 378
Manukau City
New Zealand
Phone: +64-9-262-3773
Fax: +64-9-262-3850
Email: info@plastics.org.nz

PLASTICS NEW ZEALAND

Maximising the growth and success of plastics-based technology in New Zealand in an economically, socially and environmentally responsible manner.

EECA Energy Efficiency and Conservation Authority Te Tari Tiaki Pūngao

ENERGY NZ