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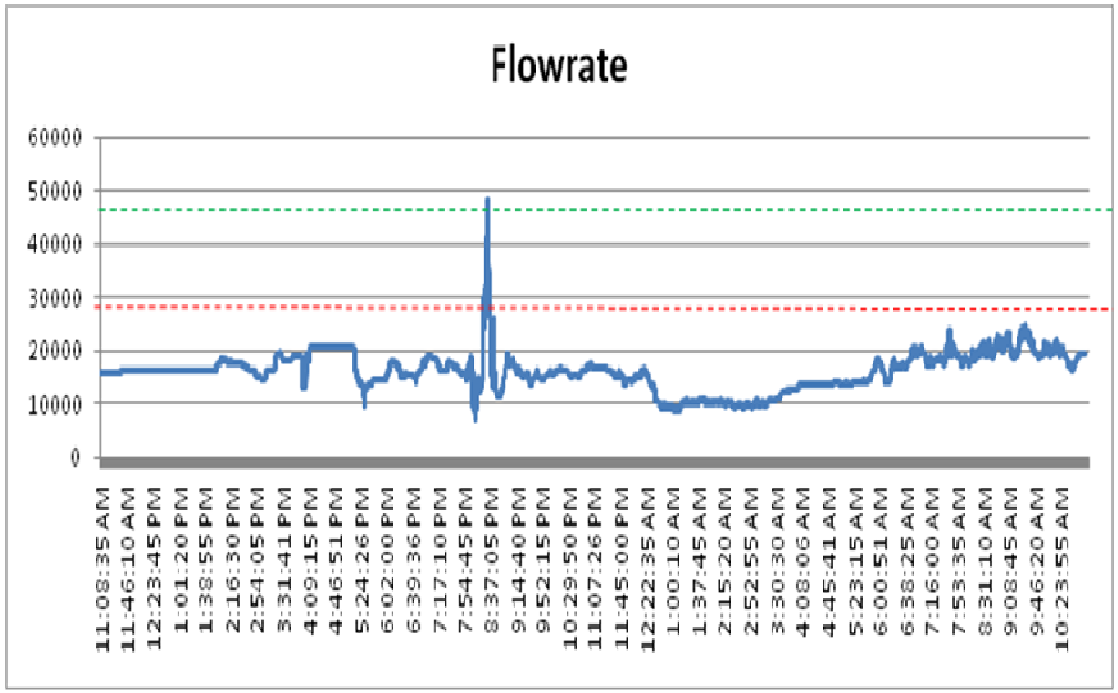
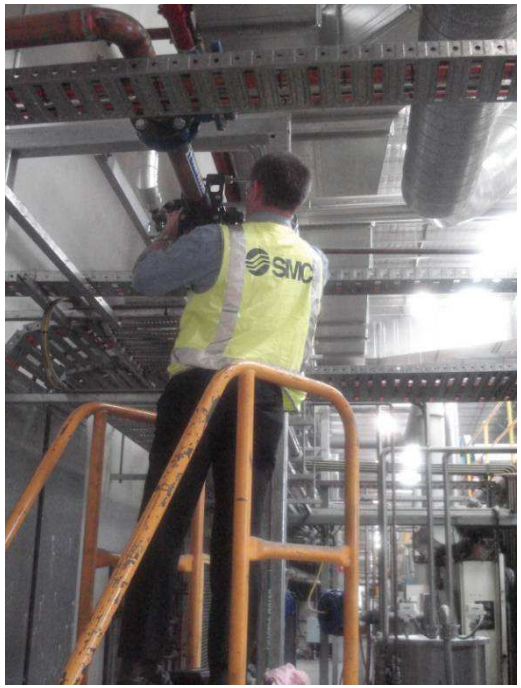
Understanding Consumption can identify Waste



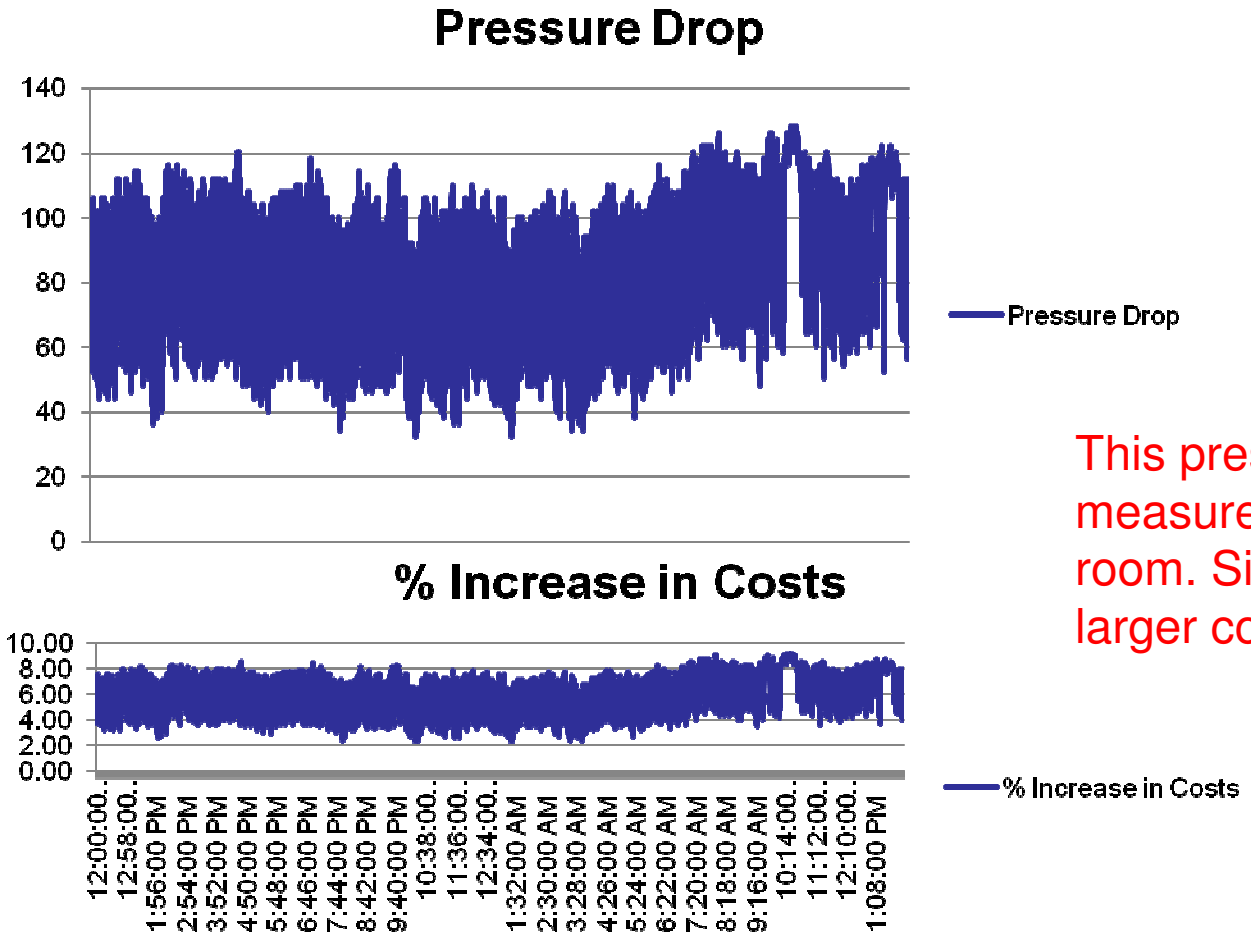


The Cost of Wasted Compressed Air

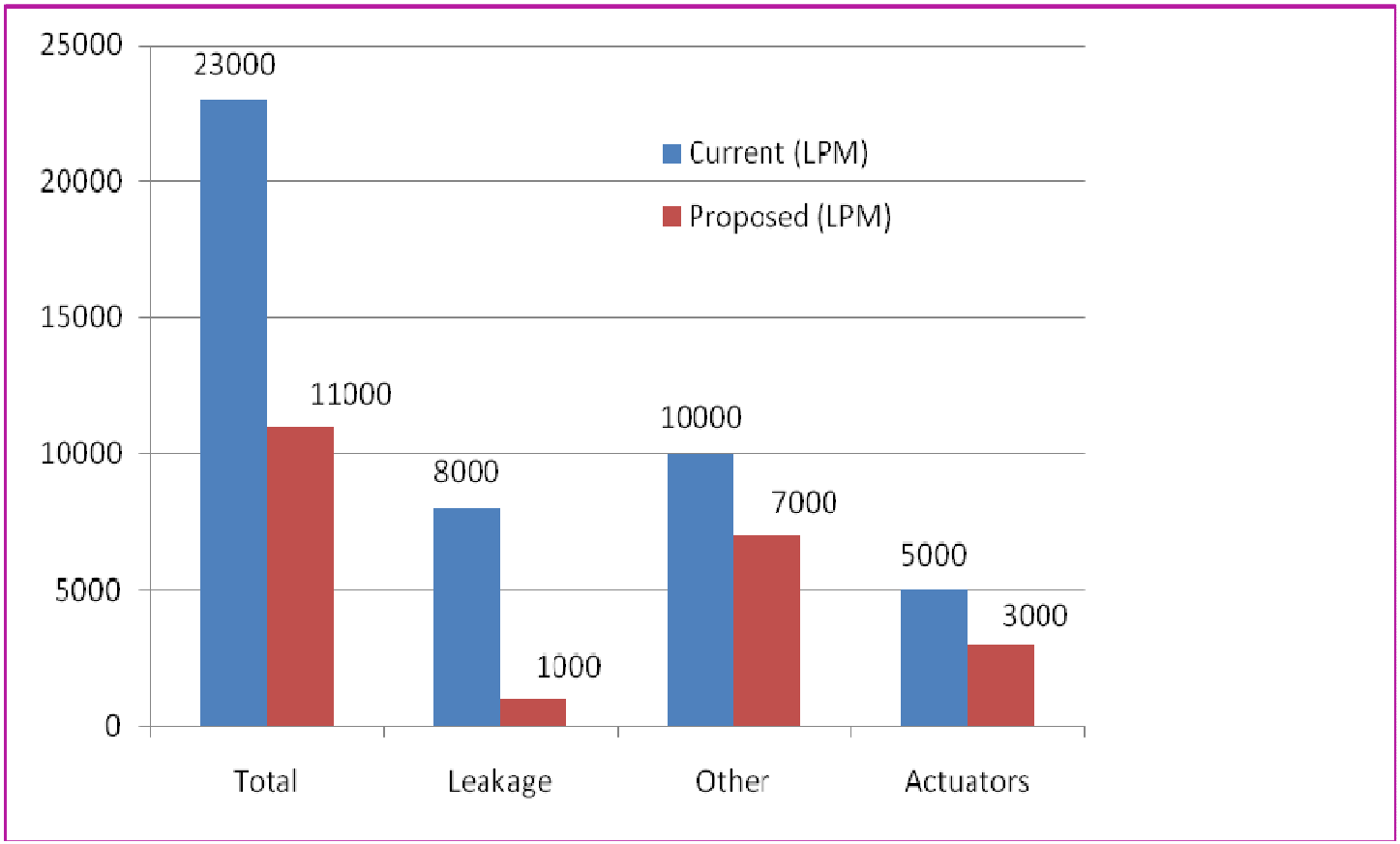
(Typical Site Compressed Air Energy Reduction – Stage 1) / Site				
	Current System	**Unproductive (includes leakage)**	**Potential for Saving**	**Corrected Consumption**
Average Flow Rate	30,000 LPM (1000cfm)	10,000 LPM (350cfm)	8000 LPM (280 cfm)	22,000 LPM (720cfm)
Specific Power Consumption	8kW/m^3/min			
Annual kWh (8600hrs/year)	2,058,840	686,280	549,024	1,509,816
Annual kWh Cost (@$0.06/kWh)	$123,530	$41,180	$32,941	$90,589
CO_2 Emissions	1673 tonnes CO_2	557 tonnes CO_2	446 tonnes CO_2	1227 tonnes CO_2

Pressure Drop is the reduction in available pressure resulting from flow restriction and will influence power costs to generate compressed air

This is an actual example from a QLD manufacturing site where incorrect filtration setup increased operating costs by up to 9%.



This pressure drop was measured in the compressor room. Site wide it is a much larger cost.



Cutting Costs by 50%

Some Facts Associated with Compressed Air

- **10% of all power generated in Australia is used to compress air**
- **25~30% of electricity at most sites used in compressing air**
- **14kPa (approx 2psi) pressure drop = 1% of electrical power**
- **4 deg c lower (compressor) inlet temp = 1% power saving**
- **75kW Compressor will generate 113 litres water in 8 hours***

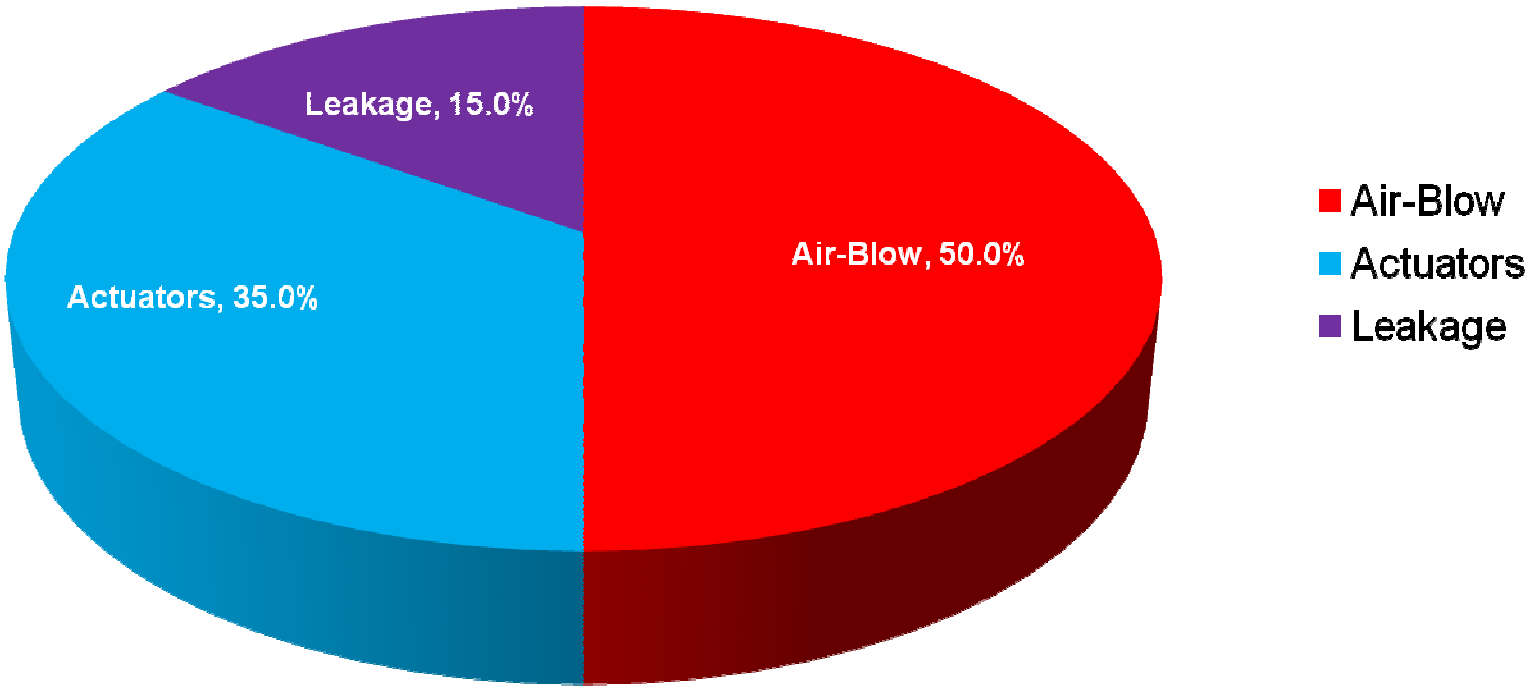
*** @ 7 bar, 30degC Inlet Temp,80% RH**

It takes 8hp electrical energy to produce 1hp of pneumatic energy

GLOBAL WARMING

- Industry Contribution of all CO_2 : 40.3%
- Industrial Energy From Electricity : 78.0%
- Industrial Compressor Electricity : 30.0%

COMPRESSED AIR CONSUMPTION IN INDUSTRY



Reducing Demand = Reduced Energy/Costs

Air Leakage = 15% of Total

Repairing Air Leakage will save 15%

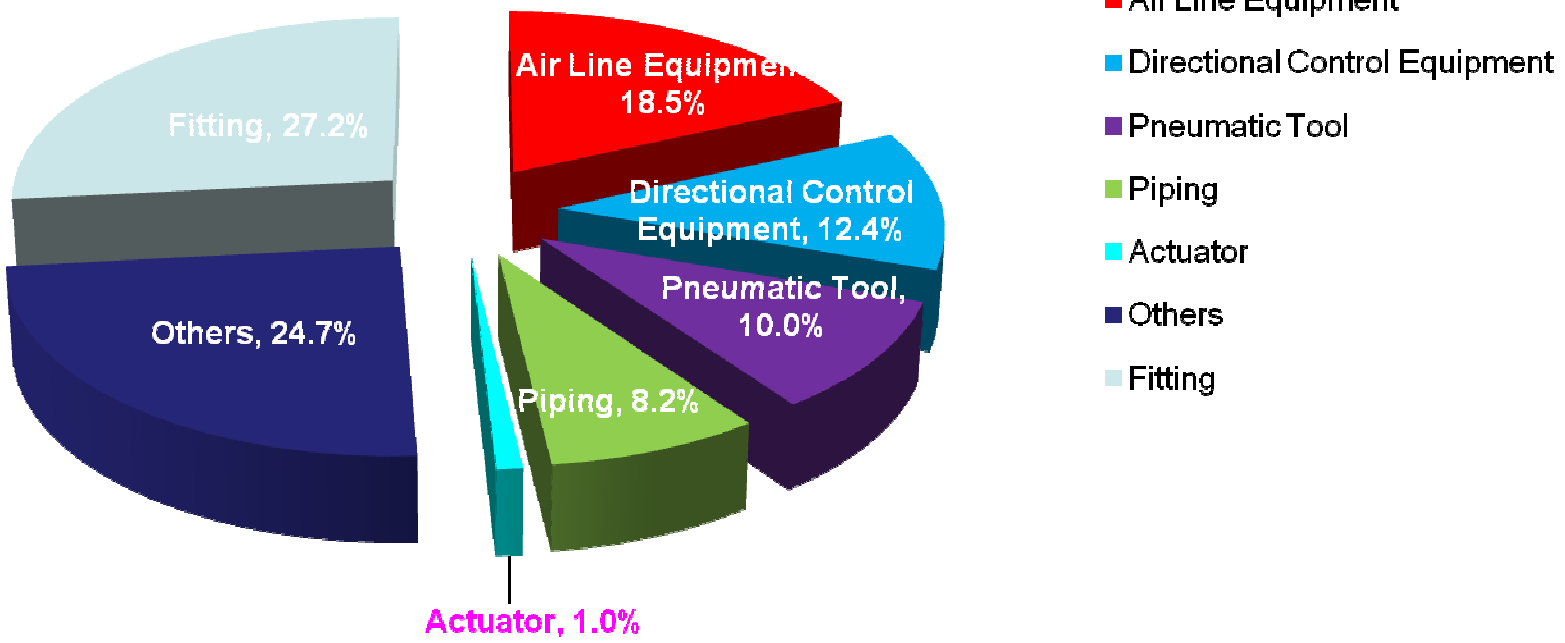
Air Blowing /. Nozzles = 50% of Total

Efficient Nozzles and Design save up to 50%.

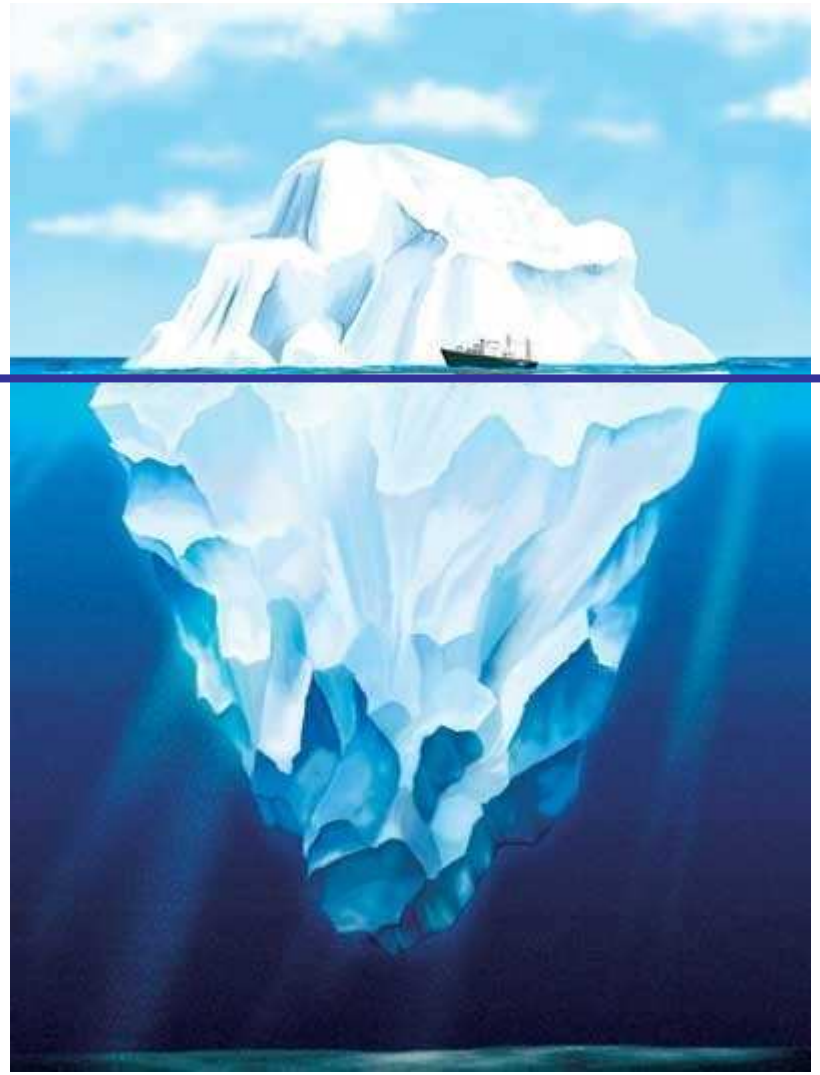
Actuators = 35% of Total

Pressure and Flow management can save up to 40%

Typical Air Leakage Profile



Leaks &
Compressor
Efficiency



Pressure
Management

Flow
Management

Circuit /Design

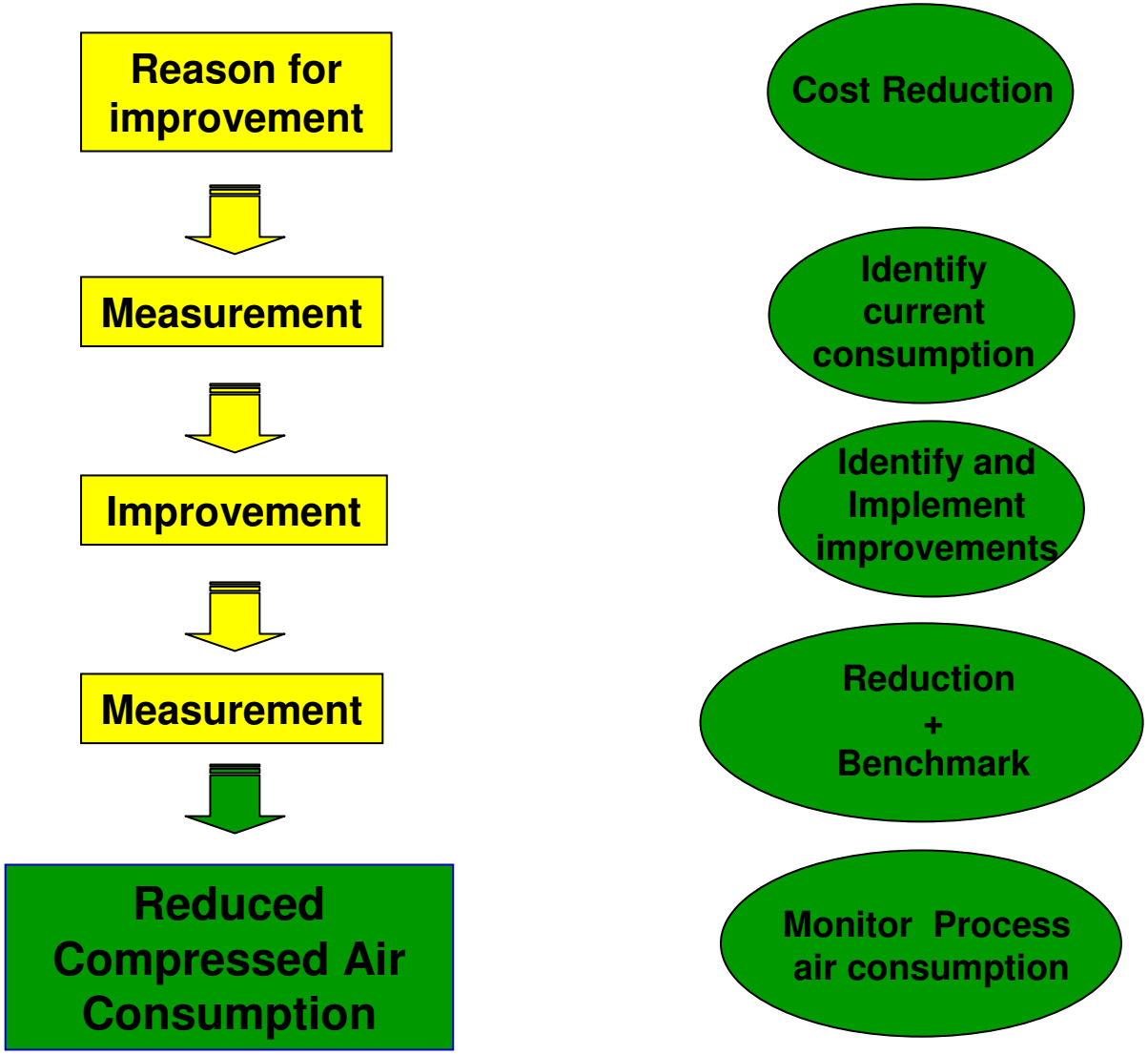
Component
Selection

Consider all areas of compressed air efficiency

What is a compressed air demand survey ?

- Mainline Filtration Assessment (Pressure Drop Analysis)
- Air Quality Assessment including Dryer Assessment (Dew Point analysis)
- Compressed Air Reticulation Assessment (capacity, efficiency and pressure drops)
- Analysis of Air Consumption and Pressure Profile for (nominated) Processes.
- Leakage Assessment - flow measurement
- Recommended Process Improvements with detailed savings
- Identifying Compressed Air Benchmarks for nominated processes
- Recommendations for Continuous Monitoring of Flow and Pressure for processes

What is the energy saving process?



Typical leakage Costs

Compressed air energy losses can be quite substantial even from what we would consider small leakage sites.

Hole Dia. mm	Air Leakage L/S	Compressor Power (kW)	Cost/yr
0.4	0.19	0.06	$60
1	2.1	0.23	$360
1.6	3.1	0.52	$900
3	10.95	3.36	$3300

Line Pressure 7 Bar

Leakage constitutes only one part of the savings- but is the most identified compressed air waste.

- A $200/year leak is difficult to hear !
- If you can hear it is probably costing $300 or more !

Step 1. IDENTIFY MAGNITUDE AND LOCATION

One effective method is to record airflow against a known 'benchmark' flow rate or during period the process is not operating – Flowmeter measurement

Step 2. IDENTIFY SPECIFIC LEAKS.

Ultrasonic detectors can find mid to large sized leaks. The advantages of ultrasonic leak detection include versatility, speed, ease of use, the ability to perform tests while equipment is running, and the ability to find a wide variety of leaks. They require operator training and a level of familiarity. Each location must be tested.

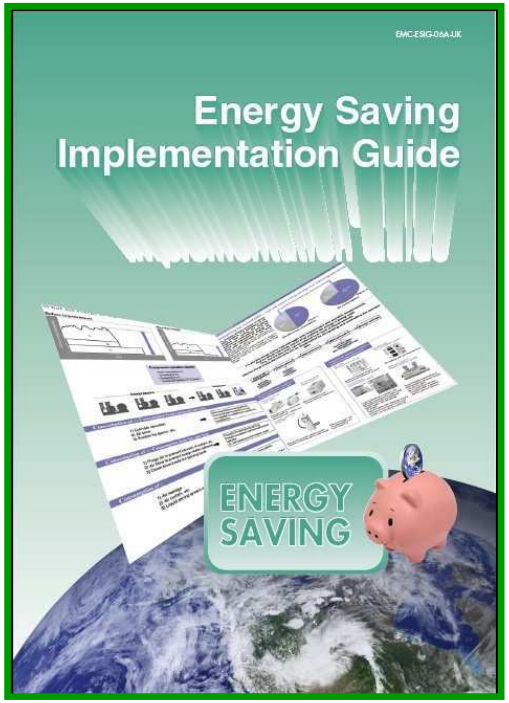
Compressed Air Processes should be designed with the following variables known:

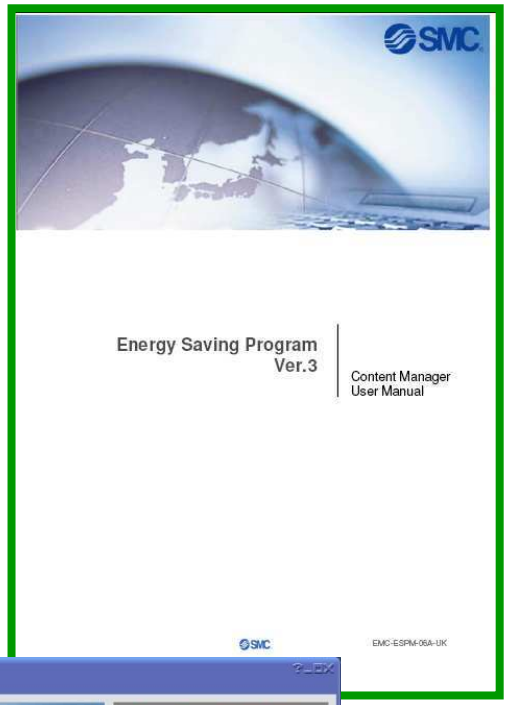
- **Pressure** –what is the minimum efficient pressure?
  - An increase of 100kPa above necessary increases energy usage by 8%

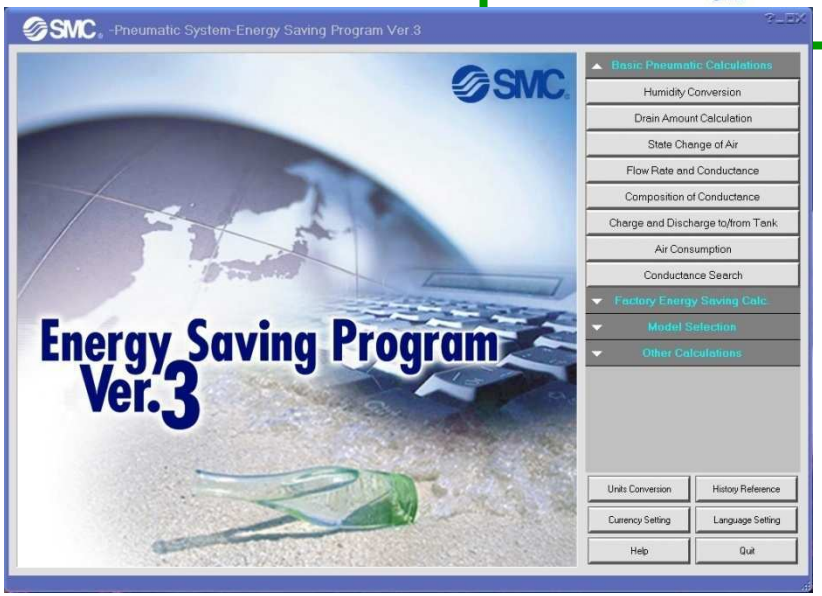
- **Air Quality** – use only the level of filtration required for the process.
  - Excessive filtration levels will increase pressure drop and losses.

- **Flowrate** – unless the Flowrate is known the correct line sizing cannot be determined.
  - Line sizing less than required will affect pressure drop and performance

  Often rules of thumb or *'general factory standards'* are applied which can reduce performance, waste energy and adversely impact on component life.

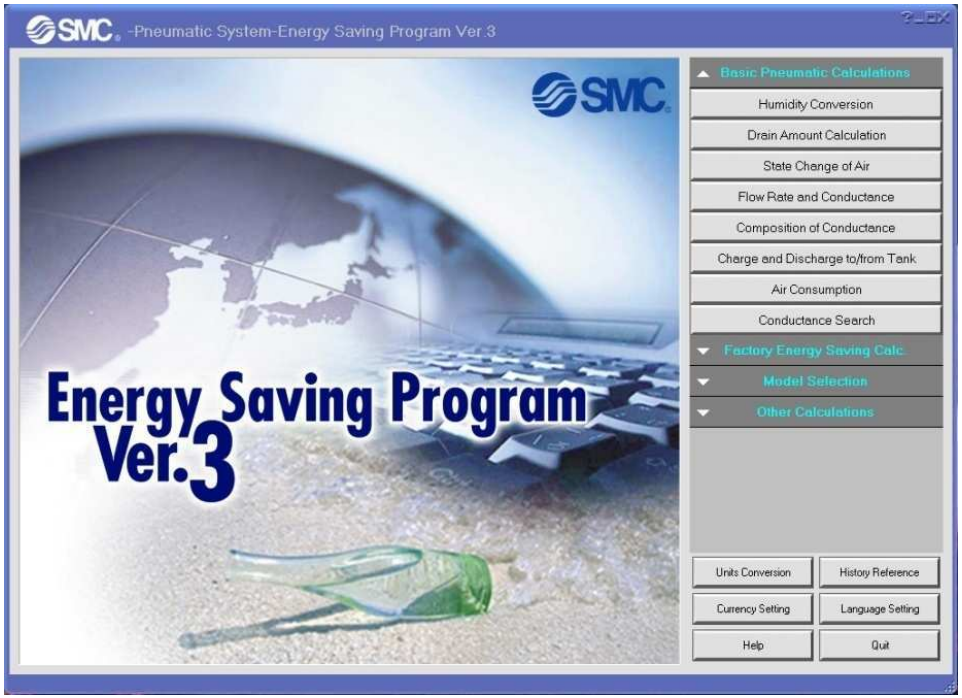




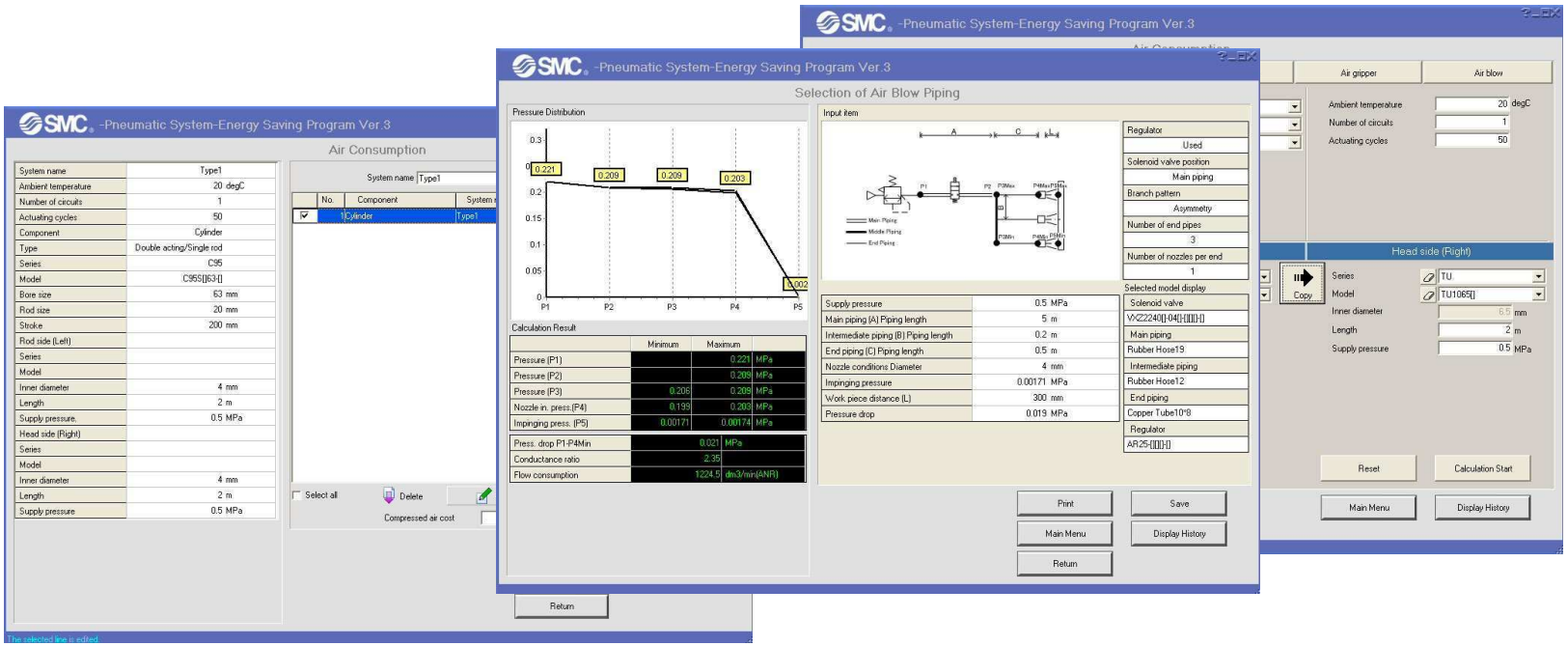


SMC COMPRESSED AIR EFFICIENCY TOOLBOX

Correctly equipment selection and operation can save energy and significantly reduce costs……



Calculating Efficient Compressed Air Requirements……



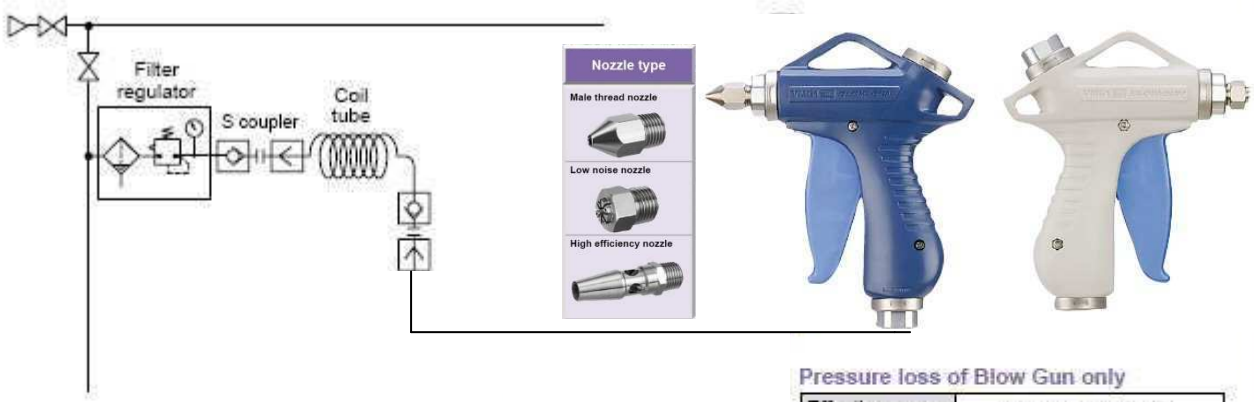
Correct Selection of Air Nozzles and Blow Guns

Series KN air nozzles

Configuration	Without nozzle	KN nozzle fitted
Nozzle size	Ø4mm	Ø1,5mm
Regulator pressure - P_1	0.4MPa	0.25MPa
Outlet pressure - P_2	0.08MPa	0.225MPa
Collision pressure - P_3	0.002MPa	0.002MPa

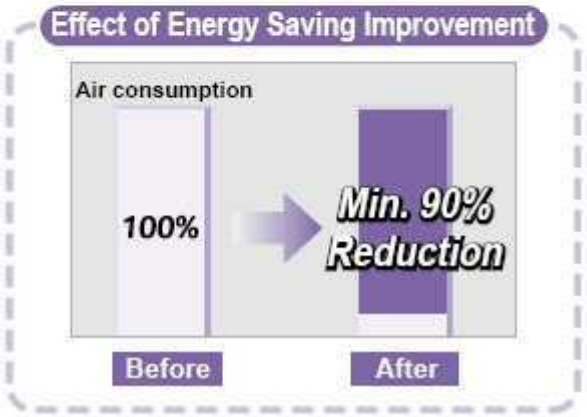
Reduce Air Consumption up to 70%

Energy Efficient Blow Guns



Pressure loss of Blow Gun only

Effective area (mm^2)	Upstream side S_1: 30 Nozzle side S_2: 2.8
Effective area ratio	$S_1 : S_2$ = 10.7 : 1
Nozzle size (mm)	ø2
Number of nozzles	1
Supply pressure	0.700MPa
Regulator pressure	0.300MPa
Outlet pressure	0.297MPa
Pressure loss	**0.003MPa**



- **Low Noise**
- **Low Pressure**
- **High Efficiency**
- **Reduced Energy**
- **Increased Safety**

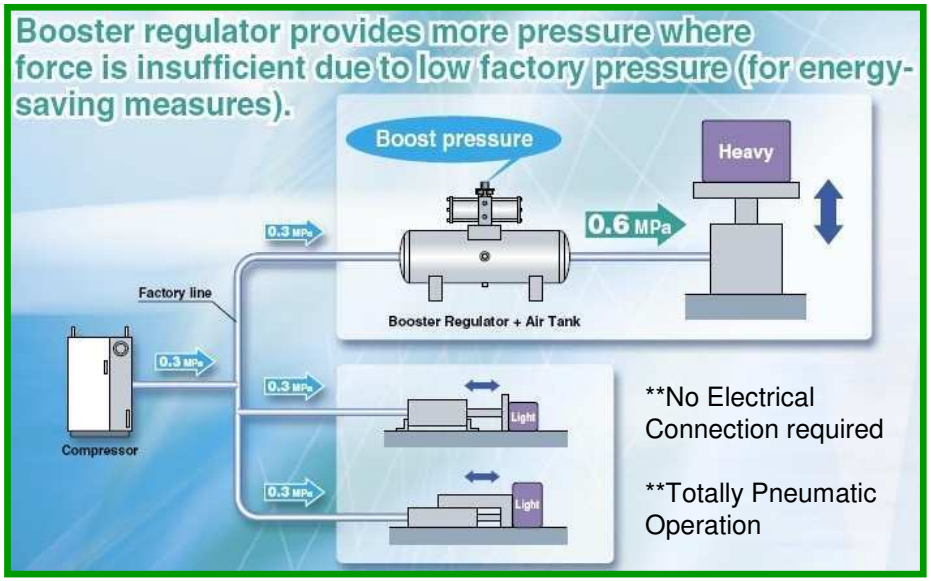
Reducing Pressure

Some factory processes require higher pressures –

Typically we adjust the compressor output pressure to this ‘higher value’

Higher Pressure = Higher Energy Consumption

Consider using a pressure booster at the point of application. This will reduce energy consumption by 8% for every 100kPa of pressure



Measuring Pressure and Flow

Pressure and Vacuum Switch

High Flow Air and Liquid Flowmeters

Low Flow Air and Inert Gas Flowmeters

Low Flow Air and Inert Gas Flowmeters

- **Dual Colour Displays**
- **Analogue Outputs**
- **Digital (NPN or PNP Outputs)**
- **12 -24vdc Powered**
- **Accurate**
- **Can set Alarm Outputs**
- **Easily set to required parameters**