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Case Study: Energy Efficiency Best Practice Compressed Air Systems

Murray Goulburn Co-operative Leongatha Plant

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Improving performance and saving energy in compressed air systems

By making changes to the compressed air system at their Leongatha plant, Murray Goulburn Co-operative (MGC) reduced their energy and maintenance bill by more than $147,000 per annum, abating around 1908 tonnes of carbon per annum and recovering the cost of the project within 2.4 years.

The opportunity: save money and energy

MGC are Australia's largest milk processing company. As one of eight plants located throughout Victoria, MGC processes over 37% of Australia's milk supply into quality products that are sold into both domestic and international markets.

As a major food processing company, MGC is a high user of compressed air, which accounts for a large proportion of the company's energy costs and greenhouse gas emissions.

The solution: review and upgrade the current system

MGC undertook a system-based audit to deliver energy savings and cost reductions through the improved use of compressed air.

Step 1: A compressed air audit, using state-of-the-art measurement technology from CompAir Australasia Limited, was undertaken. The ultrasonic airflow meter uses three-phase, portable metering to assess the efficiency of compressed air systems, gauging real-time measurement of air in greater detail without the need for plant shutdown or interruptions.

Step 2: Based on the results of the audit, an efficiency-improvement strategy was developed and implemented. This strategy reduced the amount of wasted air both in terms of air leak management and improved air demand-side practices.

Changes to the compressed air system included:

- upgrading the pipe and distribution network – the new pipework is polished stainless steel and the system valves are full bore (ball valve) types, reducing pressure losses to less than 0.8 bar.
- reducing air speed in some production lines
- installing a new air receiver in the UHT area of the plant to even out the pressures and airflows within the system
- repairing air leaks
- reducing the overall system pressure from 8.1 bar to 7.25 bar
- installing a new 5000 litre air receiver to flatten out air demand and reduce air compressor load swings
- installing a new, high-efficiency air dryer which uses steam regeneration for the purge cycle rather than compressed air, saving approximately 17% purge air losses.

Step 3: Two old-technology air compressors were replaced with a new Quantima air compressor to satisfy the corrected demand level and maximise efficiencies.

Improved technology and better processes were the key to the success of MGC's best practice solution.

Indentifying inefficiencies

The use of ultrasonic measurement technology allows compressor energy efficiencies to be analysed in greater detail than previous techniques allowed. These measurements, when used in conjunction with the measurement of static pressures over the total system, allow an accurate and in-depth analysis of the overall system to be completed and a targeted solution to be developed.

A better compressor

The Quantima air compressor has many features to enhance efficiency. Relative to 'standard' air compressor technology, the new compressor delivers a net power saving of approximately 20%. These savings are achieved in several ways:

- The compressor saves energy through its Q-drive – a centrifugal compression assembly that consumes significantly less power than conventional technologies.
- A single screw compression element, with only one moving part, spins in a magnetic field, eliminating friction that can result in energy losses and performance degradation.
- A variable-speed drive matches airflow to plant demand.
- The unique rotor and direct-driven compression elements are levitated by active electromagnetic bearings to allow the rotor element to reach speeds of up to 60,000 rpm.
- Low operating temperatures and bearing loads enable the use of maintenance-free sealed bearings, totally removing the need for lubricating oil in the compressor. One hundred per cent oil-free compression is guaranteed and maintenance and environmental costs associated with oil and oil filter changes are eradicated.
- By interfacing with the company's internal network, MGC engineers can view the status of the machine locally and make minor adjustments to keep the compressor running at peak performance.

The benefits: leaner, greener production

The total project cost of $350,000 is expected to reap a 100% return on investment in 2.4 years. The Department of Innovation, Industry and Regional Development provided $161,500 of funding assistance for the project. The project costs were:

- air compressor system audit using ultrasonic measurement technology – $30,000
- purchase, delivery and installation of a Quantima compressor (300 kW) and change-out of two existing compressors – $300,000
- technical assessment of project performance and documentation of project outcomes – $20,000.

The total annual savings were equivalent to 1,440,000 kWh and 1908 tonnes of carbon. The savings were achieved through:

- repair of leakage – 446,400 kWh of electricity input per annum
- system pressure optimisation – 79,200 kWh per annum
- reduction in unloaded running consumption – 633,600 kWh per annum
- improved compressor specific energy performance – 280,800 kWh per annum.

The maintenance costs of the overall system have also been reduced, mainly due to the lower requirement for filtration in the air systems.

To further reduce energy consumption and its reliance on the chilled water supply, the Leongatha site is also installing new water cooling towers. These will enable water to be taken straight into the air compressors and can be up to 8% more energy efficient than using a separate factory chiller to cool the mains water. This will save another 71 kW of installed power, yielding an additional $40,000 in power savings and 677 tonnes of carbon savings per annum.

Following the success of the Leongatha upgrade, MGC undertook a similar compressed air audit at the company's Cobram site in Northern Victoria.

The total savings identified by the audit represent approximately 29% of the total power currently used by the compressed air system. By attention to demand-side reduction measures through repairing the identified air leakage and optimising the air pressure of the system, savings of between 10% and 15% of the total power consumed by the compressed air system can be achieved. This represents a power saving of approximately 310,000 kWh per annum, which also reduces carbon emissions by 411 tonnes per annum.

The remaining potential, reducing unloaded running costs and improving compressor specific energy performance, can be achieved when compressed air supply and distribution systems are upgraded. Implementing these measures will deliver further electricity savings of 612,000 kWh per annum, reducing carbon emissions by a further 808 tonnes per annum.

The Cobram work was supported by Sustainability Victoria, who provided funding of $15,000. MGC plans to conduct system reviews at a further six sites.

For more advice

The Energy Efficiency Best Practice Guide to Compressed Air Systems is a step-by-step guide to gaining maximum efficiency from your compressed air system.

The ResourceSmart Business program helps businesses across Victoria improve resource efficiency and manage the risks and opportunities presented by climate change. For further information on making your business ResourceSmart, visit www.resourcesmart.vic.gov.au or call 1300 363 744.

"Like most industrial plants, we realised there is potential to save energy by repairing compressed air leaks, but in the past we haven't taken a systems approach to improving compressed air utilisation. The system analysis approach we have now instigated at the site has delivered real benefits, as it has allowed us to determine what the real determinants are in assessing the energy efficiency of the complete compressed air system; from air production right through to end use utilisation."

Mark Gurney, Group Maintenance Manager, MGC