Energy efficiency, Energy management

Easy-to-use maintenance tool offers generous energy savings for plants and helps reduce carbon footprint

Businesses across the world are facing the dual challenge of rising fuel costs and environmental energy taxes, there has never been a more important time to focus time and effort on reducing utility costs.

Sanid Usanovic reviews how a German food and beverage plant makes Fluke ii900 Industrial Acoustic Imager standard use in maintenance to make big savings in energy use.

For the efficient management of plant operations, the key considerations for the energy manager include product quality, safety, downtime, and of course energy use. A production plant in Germany has set a greenhouse gas emissions reduction goal of 25% by 2030 (using 2015 as baseline) and turned to the Plant Energy manager to help deliver that target.

One way of achieving that goal is to reduce energy use. The question is, how can the plant energy manager achieve this without impacting product quality, safety or downtime.

Reducing environmental impact

Manufacturing firms around the world are reviewing the efficiency of operations, to reduce costs, but also to drive down their environmental impact. Lead by sustainability officers' with the support of energy managers, efforts to lower energy usage are helping to decrease the environmental impact of production and contribute to global and local efforts to reduce climate change.

In 2011 the International Organisation for standardisation (ISO) introduced a new voluntary standard for designing, implementing and maintaining an energy management system. The development of ISO50001 was undertaken by a technical committee and like other ISO standards it is intended to be realised across various industries and encourages adopters to implement a Plan, Do, Check, Act framework for energy management. Since the Paris agreement of 2015 the drive for ever more sustainable operations and reduce the effect of climate change has accelerated.

This company is taking a stand against climate change and has committed to reducing greenhouse gas emissions. One important element of the program focusses on reducing the indirect emissions resulting from energy use at the plant. Specifically, this considers the emissions resulting from the generation of the electricity purchased by the company from the utility provider.

For the bottling plant in Germany, one area under review was how to tackle the energy

wasted through leaks in compressed air systems. The Carbon Trust estimates that UK industry uses over 10TWh of electricity to produce compressed air, making it the direct root cause of over five million tonnes of CO2 emissions a year (source: The Carbon Trust, 'Compressed air – opportunities for business).

Compressed Air resource

Approximately 90% of all companies use compressed air in some aspect of their operation, such that it is sometimes referred to as the fourth utility. However, unlike other utilities such as gas, electricity or water which are supplied to the site by an external utility's provider, compressed air is often generated on site. It is therefore the manufacturing companies' responsibility to ensure its efficient production and distribution.

While many people may view compressed air as being as free as the air around them, due to the nature of the process, a significant proportion of the energy used by a compressor to compress the gas is lost as heat. It is an energy intensive process, and the environmental impact that electricity production can have, make it anything but.

Once produced it is used to automate processes, package products, provide motive power or even to generate other gases on-site.

Clearly, waste of this expensive resource needs to be minimized. The priority is to set up a leak reporting and repair programme. This will give you an idea of where the troublesome connectors and lines are sited and allow you to formulate a repair strategy to ensure they are kept fully working.

The cost of compressed air leaks

The energy consumption at the food and beverage processing plant compressed air systems was at 300,000€. It is estimated that if there were no maintenance system in place at all that the losses due to leaks in the network would be between 25–30%. For the plant in question, implementing a maintenance regime from this starting point would represent potential energy cost saving of 120k– 150k€ per year. Whilst desirable, it is highly unlikely that any plant will achieve an 100% leak free compressed air system. The target for good practice is between 8%–15%, and for best practice is 6–8% energy losses due to leaks.

Maintenance Methods

When looking for leaks, it is important to bear in mind that there are some components of a compressed air system that are especially vulnerable, such as pneumatic cylinders, flanges, filters, tools, presses and drop hammers which should be checked first.

Some of the traditional ways of detecting leaks include listening for hissing sounds or coating joints with soap and checking for bubbles. The soapy water method is inefficient and inadequate for the size and scope of compressed air lines in a manufacturing facility. Whilst many cannot hear the hissing of air leaks in a quiet environment, let alone a functioning bottling plant. An improvement on the soap and water method was ultrasonic leak inspection.

Ultrasonic tools use microphones to identify the sounds associated with escaping air/gas in a range of about 38 to 42 kHz. They convert sound captured in this range into audible sound and therefore rely on human hearing to identify whether a noise is a leak or not. That makes the detection subjective, and reliant on enhanced skills and training.

Large manufacturing companies such as this one may choose to outsource checks and inspections for leaks in compressed air networks. Specialist companies will carry out annual checks that could potentially deliver what would be considered good practice levels of leakage, between 8–15%. However, to decrease the energy losses further by reducing leaks in the network, a new testing regime less reliant on annual checks through a third party vendor was sought.

The food and beverage production plant agreed to test the use of industrial acoustic imagers at the plant to check for leaks in compressed air systems. Recent developments in industrial acoustic imagers such as the Fluke ii900, mean they are equipped with an array of microphones, providing visualisation of sound field within an expanded field-of-view, that enables maintenance teams to visually locate air, gas, or vacuum leaks very quickly and accurately in compressed air systems. This means it is possible to detect the leaks even in noisy environments and from a distance and as such maintenance programs can be adopted whilst the plant is operational.

The leaks detected are then displayed on an LCD display making it possible for a user with little-to-no experience can start detecting leaks immediately. The acoustic imagers can evaluate the distance to the target and estimate size of the leak, making it easier to prioritize a repair schedule.

Solar loading and wind are environmental factors that must be considered. Solar loading occurs when one or more sides of a structure are uniformly heated by the sun, causing temperature differences to be masked over. Similarly, wind moving over a structure, can wash away thermal signatures, or create unexpected pressure differences which can leave some problems undetected.

The food and beverage production plant has started using the Fluke ii900 to locate compressed air leaks in:

- Conveyor systems
- Tubing, piping, flanges and valves in the Clean-in-Place system, the syrup maker, and the CO2 blender
- Hard-to-reach gated areas

The equipment is capable of reporting an estimation of the size of leak, and from that data it is possible to quantify an estimation of the energy cost to the company and calculate evaluation of the return on investment. Crucially for delivering a targeted reduction in carbon emissions, being able to quantify the energy lost is an important feature so that the reduction in greenhouse gases can be calculated.

"This innovative technology has excited me from the moment I first heard about it! The imager was primarily purchased for localizing leaks in our compressed air systems throughout the plant. We have already seen enormous energy savings." -Plant energy manager

The Future

As the price of energy continues to increase, the need to reduce energy costs and deliver on shared sustainability goals intensifies. Many more consumer goods manufacturing companies are taking on sustainability managers and energy managers to reduce waste and shine a spotlight on opportunities to run the plant more efficiently.

The maintenance teams at the plant are vital to the delivery of efficient operations and using tools such as acoustic imagers that can bring enhanced savings to maintenance routines and reduce energy costs is a quick win for all manufacturing plants with significant compressed air demands.

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