Energy monitoring and targeting

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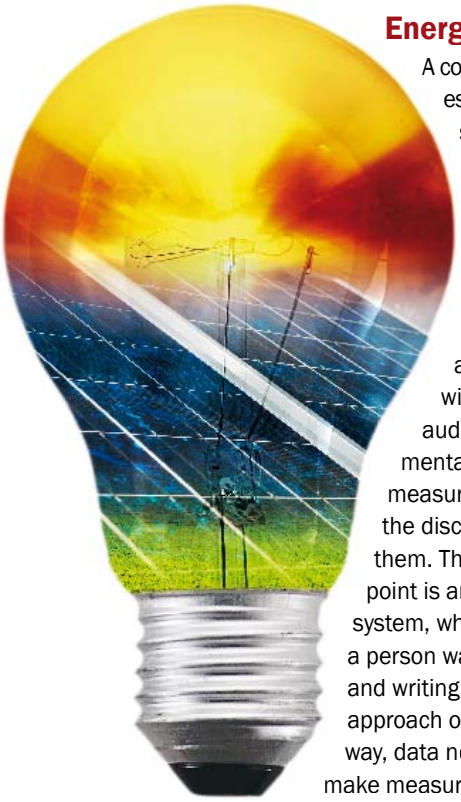
Saving energy through the obvious routes like lighting, pumps and motors makes sense. However, this article takes a look beyond the obvious solutions to a more focused look on the utilities side: water, air, gas, electricity and steam that one might be using in a factory or industrial area. As steam and air are often regarded by the user as free, these form the main focus of this article. The 7th Southern African Energy Efficiency Convention, to be held on 14-15 November 2012, will deliver more practical considerations such as this article gives.

Nationally and internationally, countries use about 10% of the total industrial electricity produced to power air compressors. Therefore in reality air is anything but free or cheap as often regarded by users. In practice, at the factory level, this may rise to over 25 to 30% of electricity costs being attributed to compressed air usage depending on the size and scope of the business. About 40% of fossil fuel, such as oil, coal and gas, is used in the industrial generation of steam. In addition, around 75% of the running costs of a typical compressor can be attributed to the energy required and therefore the electricity used. Any measures that can be implemented to reduce the consumption of compressed air, and steam, will have a direct impact on the utility power bill.

Another statistic is that due to poor maintenance, design and wastage, typically up to 40% of produced compressed air is actually lost or misused. Implementing measures to save up to 40 % of that 75% of a compressor electricity bill could add up to a significant amount of energy saved.



Energy management: a program

A company should always start by establishing a clear energy policy and strategy, as indicated in Figure 1. It often happens that a single person in a company is tasked with just "saving energy" without a clear strategy, tools or inadequate budget to achieve it – that is not the way forward.

What is required is a holistic approach involving all the staff with awareness, training, continuous audits, project development, implementation with constant reviewing of the measured and analysed data to facilitate the discovery of problem area and fixing them. The foundation or essential starting point is an energy management information system, whether in its simplest form, such as a person walking around taking meter readings and writing them down; or in a more modern approach on a computerized system – either way, data needs to be collected regularly to make measurements.

Meter readings taken on a weekly or monthly basis to compile a historical energy profile, are effective, but the data is too little and too old to be useful. For sure it is a stat, but it isn't energy management – more just historical reporting. A much more reliable and meaningful system requires data taken on a 30-minute or hourly basis and with an automated system, this is much easier than having an employee walking around collecting data every hour.

The more data collected, the clearer the energy profile that can be created. However, the more measurement points used, the greater the investment and therefore the Return of Investment (ROI), must be considered.

Example of energy saving opportunities

A typical example would be on a compressed air system where immediate savings can be realized. In the compressor house, measure total flow, output, energy consumption, and calculate the cost per kilogram of air or per ton of air. The compressor outlet filter is one simple example of an energy-saving opportunity; a badly maintained filter (ie, dirty or clogged) creates a pressure drop that, whilst not necessarily stopping the air supply, does waste energy – a typical rule of thumb is that 1 bar of pressure at the compressor output equates to approximately 6% of the compressor energy consumption.

Reducing unnecessary pressure drops anywhere in the air distribution system that allows you to reduce the compressor output pressure, will directly save you energy and therefore money.

Measuring air consumption at the compressor output and at strategic points in the distribution system and knowing the cost of the consumed air allows consumption to be managed, leading the user to reducing wastage and leakage.

With a boiler, measure the steam out, condensate return, feed water temperature and flow, as well as fuel consumption. These measurements determine the actual boiler efficiency, steam per kilogram of gas or oil, or whatever the fuel is. This information enables an informed assessment of the boiler, but it starts with measurements. In a similar way to the air plant, the consumption assessment of steam in kilograms is one way to measure and reduce leaks and losses.

Water distribution is a similar area – there's hot water, flow distribution and temperature. Remember, as well

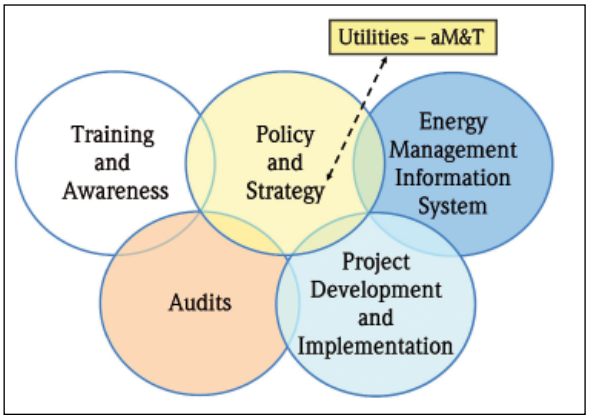


Figure 1: Policy and strategy forms the basis of successful energy management

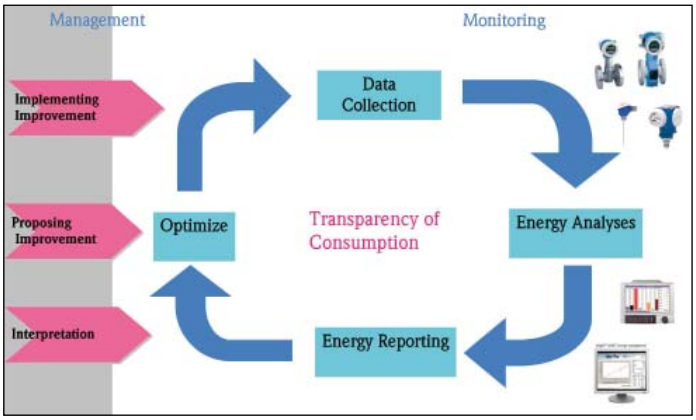


Figure 2: Energy management is a continuous process cycle

as consumption, energy is tied into the temperature of the water, so thermal lagging of the pipe walls is a good example where energy losses can be reduced at minimal capital costs. The same principle especially applies to steam pipe networks.

Energy management: a process

Energy management is all about collecting the required data in a meaningful, timely, efficient and accurate way and implementing intelligent analysis and actions. Effective and understandable reporting is required in the areas of finance, engineering and auditing to optimize the information received. The question is often posed as to what savings an energy management system will deliver. The answer is: 'Nothing, unless the data is correctly applied and corrective action plans implemented based on the analysed data.'

For an energy management system to work, it requires a plan, implementation and resources to take responsibility, a budget and investment into new equipment, or retrofitting equipment when required. Figure 2 illustrates that without the last leg in the energy management system, nothing is saved. It is an ongoing process and then, on completion of the process, it starts all over again.

After completing a project, for example improvements to a boiler, the results need to be measured and assessed to evaluate the effect of that change. Once the measurements are done, leaks and wastage can be found very quickly. The statistics for compressed air, and steam, are very similar: 20 to 40% losses are very common – leaks and wastage have to be kept under control to ensure sustained savings. One leak might be fixed, but then returns later, or moves further down the line. So a once-off leak report every 6 months, or every year, won't bring sustained savings. Used correctly, capital equipment paybacks can be as little as 6 to 9 months and is a worthwhile investment.

Strategy with software support

The three key areas in energy management to consider are: analysis, data collection and utility metering. There are many applications that, with the correct measurements, one can assess to see if it's efficient, or not, such as comparing a compressor's calculated and assessed efficiency, versus the manufacturer's specification, for example.

Software packages are available to produce reports to make it easier and transparent for users to be able to access. Ideally, an automated weekly or monthly report needs to be distributed in the right form to the relevant people in the organization.

ISO 50001 could be one of the elements in the implementation of such an ongoing system that will assess changes needed or detect problems as they occur.

By removing leaks and misuse, which provide immediate quick savings, with an ongoing process of optimization and measurement, one will reduce energy consumption in a process of continuous improvement which is efficiently managed by software.

The priority of these reports is to understand the energy profile and consumption on a daily basis. With this information the energy consumption can be viewed, and based on the tariff being paid, it might be viable to shift some of the load to cheaper times of consumption. This is very simple to see if the data report provides a good picture.

Once a standard process is in place that is monitoring consumption, savings opportunities can be developed and improved.

Conclusion

Accurate real-time measurement is essential. Without coordinated actions identified from the data analysis, savings will be minimal. But with coordinated actions, savings of up to 40% can be realized, dependent on the application, the payback period could easily fall within the one year time-frame. Employees need to be included and rewarded for making savings and recognizing areas of improvement.

Many people view energy management programs as an unnecessary burden and opt for "simpler solutions" such as installing, for instance, a variable speed drive on a compressor without investigating the "before and after" scenarios. However, without some kind of data reference or measurement in place, such ad hoc activities, whilst possibly bringing a measure of success, are not optimal and may even be a waste of investment for properly implemented energy management, energy monitoring and targeting, a systematic and orderly approach with accurate and real-time measurements is required.