Sustainability – Why Energy Efficiency Can Be Difficult

Energy saving initiatives in the process industry (and the associated greenhouse gas reduction) have had a checkered history. In principle, it should be easy – the tools and techniques behind energy efficiency are well known and in general they can generate an attractive earning power. But, time and again, industry does not move on to new higher levels of energy efficiency. This paper looks at the reasons behind this and suggests approaches which can help break through the impasse.

Background
Energy improvement techniques and initiatives have been well known for many years and have been widely practiced - especially since the escalation of oil prices in the mid 1970s, which marked the end of "cheap oil". Depending on the relative cost of energy at the time, energy efficiency programs and capital investments have been a regular part of industrial life for most of the last 30-40 years. The techniques and technologies needed to improve energy efficiency are well known.

However, the universal feedback is that there are major issues surrounding the long term sustainability of improvement program benefits. Benefit erosion is the norm. Many companies (suppliers and customers) report complete erosion of energy efficiency benefits within 2 years of program completion.

Why is this? Typically an industrial sites energy consumption is driven by a wide variety of factors – operational, maintenance, culture, management...there is no single silver bullet that - fixes - energy. The operating environment is continually changing. Efficient energy operation requires continual attention to all these details – it's a house-keeping problem. Often a site will buy in a turn-key energy efficiency program, have it executed and not realize the requirements on their side to ensure that the gains are held long-term.

How does this come about?

The Factors that Determine Energy Efficiency
As has been indicated, energy improvement programs often fail to deliver long-term sustained energy benefits. While indeed there are single large CapEx items which can make a step change in energy performance (e.g. installation of a co-gen unit or heat recovery scheme), in general, a sites energy performance is driven by a large set of (sometimes conflicting) factors. These include:

- Adherence to operational targets (and understanding the deviations/ corrective actions).
- The role of maintenance in energy performance (equipment efficiency, reliability).
- Employed technology.
- The influence of design on performance.
- Cultural and competency issues.
- Planning and scheduling – balancing yield/ margin/energy.

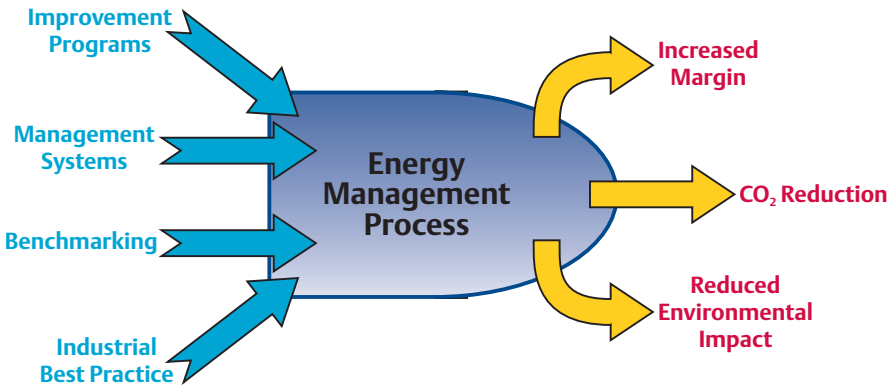
On many sites, as a result of this complex set of drivers, energy has simply "slipped through the gaps" over recent years. Energy performance has deteriorated at the expense of short term gains and budgetary pressures. This was not helped by low energy prices in the late 1990s and early 2000s. Lip service was paid to benchmarking indexes and in-depth understanding of the effect of the foregoing factors on benchmarks was not achieved. Management review became "explain away the difference" rather than "drive improvement".

Competing Priorities

In simple terms, energy saving appears attractive – solid understandable technology and good payback. So why doesn't it happen automatically? Fundamentally, it depends on whether a company or organization really wants to, and is prepared to tackle what can be competing priorities.

If not, then this cascades through the organization and it is common to find skewed and misaligned actions as a result. Therefore a picture emerges which shows a fragmented approach and in many cases no overall control of the factors which drive energy consumption. A continual re-assessment of performance is needed to keep on top of the conflicting factors which determine a sites energy usage. This requires tools, systems and above all a corporate commitment to operate in this manner.

Thus the issue is complex, as has been explained – there is no single instant solution. Energy efficiency requires attention to all the areas highlighted. It requires a combination of technology, plus procedural and housekeeping approaches and is being encapsulated in the new Global Management Standards on Energy and CO2 Management (e.g. ISO 50001). Detailed point solutions are typically simple and well known, but the overall management is a more complex picture.

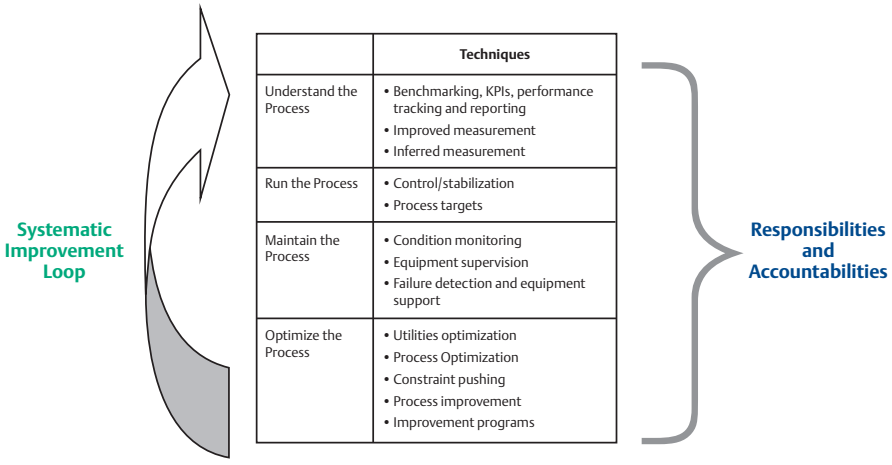


Tools and Techniques to Address the Issues

Fundamentally, the issues are control problems; both at a management level – using process data to analyze performance, detect shortcomings and drive improvement, and at an operational level – some using (advanced) control techniques to allow the process to be run closer to (energy efficient) constraints. Accurate, reliable plant energy measurements, plus a Distributed Control System (DCS) Process Historian, provide the foundation to build an integrated and consistent approach to energy management.

This must be complemented by a Systematic Management approach as an essential element in ensuring the long term sustainability of the energy efficiency savings and to drive the improvement program. This sets the entire site (and corporate) framework in which the differing levels of control operate. ISO 50001 has been developed as the International Standard for energy management by the International Organization for Standardization (ISO) in 2008, which is anticipated to affect up to 60% of the world's energy consumption. ISO 50001 specifies requirements for an organization to establish, implement, maintain and improve an Energy Management System, enabling the organization to take a systematic approach to achieving continual improvement of energy performance. It applies to all aspects affecting energy use, which can be monitored and influenced by an organization. Therefore it provides the procedural backbone for addressing the multi-facetted issues which drive a plants energy efficiency.

So the picture emerges of accurate and reliable process energy measurements, archived in a site-wide



process historian, accessed through modern user-oriented (PC) interfaces. Various control, modelling and data analysis tools utilize this data. Surrounding this is a formalized management process which determines the accountabilities and processes to ensure continuous performance appraisal and identification of improvement actions (which may be in any of the categories mentioned earlier in the paper).

A Practical Approach

Many energy management projects have foundered in the past by trying to be too “clever”. It is a perfect scenario for developing over-complex models and management processes. The multi-driver analysis presented earlier can induce a tendency to account for, and model, all the drivers.

The key approach is to adopt fit-for purpose, top-down vision, which defines the aims and provides the basic checks on management commitment and organization, in parallel with a bottom-up, step-by-step approach to technical problem solving.

- Review current energy. management effectiveness.
- Define management responsibilities.
- Develop simple performance review
- Identify and implement initial low level applications. Quick wins.
- Review and improve.

We see a dual approach needed for successful long-term sustainable energy efficiency: applied technology and the supporting systems. Experience has shown that good energy saving initiatives will not continue to deliver sustainable long term benefits without the framework of a sound management system. And high quality process measurement, data management, control and focused reporting, forms the foundation for any successful systematic energy management. New measurement techniques (e.g. through wireless technology) allow easy access to energy-related plant parameters, which were traditionally excluded from the plant instrumentation set. A good example of this is the new wireless steam trap monitor developed by Emerson Process Management, which facilitates low-cost monitoring of individual steam traps and hence prompt failure detection, repair and steam saving. Modern, easily configurable, data reporting allows focused user-relevant applications at all technical and managerial levels.

Current indications point to increasing energy costs in at least the short and mid-term. The issues around greenhouse gas emissions will not go away. Energy efficiency is back on the agenda. It is a tangible link between day-to-day industrial operation and emissions that can be influenced at all levels. Unless previous cycles are to be repeated, the adoption of systematic management techniques, based on modern measurement and control technology, is an essential strategy in ensuring long term sustained energy efficiency.

Emerson Process Management
12301 Research Blvd.
Research Park Plaza, Building III
Austin, TX 78759
www.EmersonProcess.com/IndustrialEnergy

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Process Management