Operating

How to adopt a new approach to energy

Over a 15-year lifecycle, energy can account for 40 times more than the purchase cost.Steven Brambley argues that the key to preventing such costs is to build energy into processes of specification,quotation,validation and performance measurement – in short, taking a wider view of 'energy' usage for a business.

Back in the early part of the 20th century, Henry Ford advocated the sound principle of investing money in equipment that would give not only a process benefit but a financial return that would pay for itself. His approach is as apt today as it was then, especially when applied to the case of investing in energy efficient equipment. It is financially and environmentally wasteful to continue spending money on energy, when an investment in efficient systems can pay back the outlay in the short term and bring continued returns over the medium and long term.

When it comes to motor driven systems, the mistake of focusing on purchase price is short-sighted and financially penalising. For a typical motor, the energy it will consume in the first year will cost more than three times the purchase price. Over a 15-year lifecycle, the purchase price is less than 3% of the total expense, whilst energy accounts for over 40 times more than the purchase cost.

An energy efficient solution may indeed increase the initial purchase price, but this shouldn't be a barrier to a sound investment, if the lifetime cost is reduced. A high efficiency motor may increase the purchase cost by 20% for example, or a Variable Speed Drive may even cost as much as the motor itself to purchase, but the energy savings can be significant enough that the investment is paid back in less than 12 months and the on-going savings contribute to an improvement to the bottom line which continue year-on-year.

As an illustration of the importance of considering lifetime costs in motor driven systems, table 1 gives a typical example, comparing a standard system with a high efficiency system. The figures shown are for a small system, but could be multiplied by a factor of 10, 100 or 1000 depending on the sizing and scale of the project.

The standard system may initially seem the most attractive; being half the purchase price of the more efficient system, and many buyers will not get past this point in the decision process.

However the 33% reduction in energy costs means that both systems cost the same by the end of the first year and the high efficiency system costs 29% less over 10 years.

Figure 2 demonstrates that the relatively small increase in purchase price is quickly recouped and dwarfed by the savings in energy. If we assume that the costs of energy will rise over time, the savings are even greater. Quotations for machinery, ventilation equipment, pumping systems and conveyors will all too often focus on the purchase price but rarely will the supplier be asked to estimate the annual energy costs so that a true comparison can be performed.

Table 1.

System	Purchase cost	Annual energy cost	First year cost	10 year cost
Standard	£20,000	£60,000	£80,000	£620,000
High Efficiency	£40,000	£40,000	£80,000	£440,000

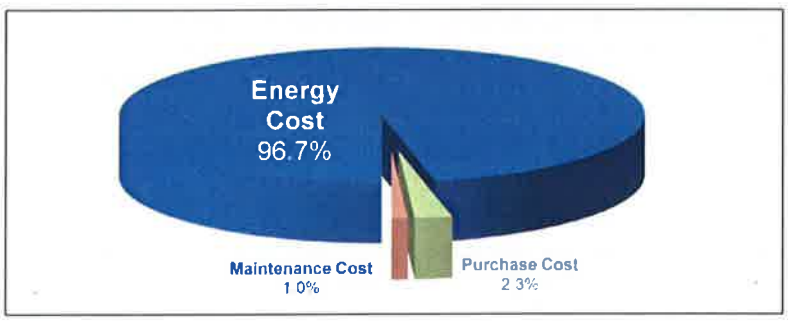

Figure 1. 11kW IE3 Motor, 4000 hours per year, 15 year lifecycle. Source: Almeida, EuP Lot11.

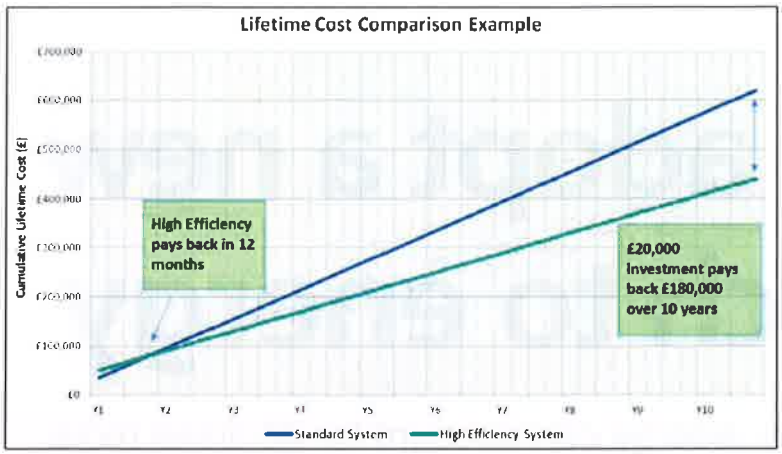

Figure 2. Comparison of the lifetime cost of two motor driven systems.

Figure 3. Comparison of returns on £20,000 invested over 10 years.

Table 2.

System	Purchase cost	Annual energy cost	First year cost	10 year cost
Standard	£20,000	£60,000	£80,000	£620,000
High Efficiency	£40,000	£40,000	£80,000	£440,000

Taking the example illustrated in table 1, we can see that the £20,000 invested in the high efficiency system brings a return of £180,000 over a 10-year period. It would be hard to imagine such a return on investments in cash, shares or property.

There is no question then that investment in energy efficient motor systems is a sound one, whether buying new equipment, spares, retrofitting controls or specifying for quotation. However, there are some barriers that get in the way of making the correct decision.

We have already covered the first one, awareness of the energy and lifetime cost of a motor driven system. There is a convincing argument for investment in energy efficient equipment, but there are still two hurdles to overcome: supply chain focus on selling price and a systematic approach to energy management.

Focus on price

This article has already shown that the energy costs involved in motor driven systems are so significant that the lifetime cost is a more important consideration than purchase cost. However, despite the mathematics, there is a deep-rooted culture of focus on purchase costs, and this is down to the fact that different parties pay the two expenses.

Motor driven systems, such as air handling units, refrigeration plants, food chillers or water pumps are often sold by machine builders, systems integrators or contractors, competing in a global market. The drive to compete on purchase cost is such that if there is a choice, the lower cost option will be taken, potentially at the expense of efficiency. The vendor does not pay the energy bill and is rarely under any pressure from the purchaser concerning the lifetime cost.

The purchaser is the one who could make a difference, but within their business they are rarely measured on energy consumption. The traditional job of a buyer is to negotiate the lowest purchase cost, but what happens after installation is not linked to their criteria.

The installing engineers, the maintenance team and the production operators are measured on uptime and throughput, but energy is often seen as a necessary cost and isn't a consideration in the specification or validation process.

Energy bills are often handled by accounts or administration functions, so the costs aren't viewed in terms of equipment efficiency and savings are often limited to negotiating rates with the energy supplier.

The key to changing to a focus on lifetime cost is to build energy into the process of specification, quotation, validation and performance measurement. If suppliers were asked to estimate annual energy costs on the quote, or 10-year running costs, it would give the purchaser information on the true cost of the system. At the implementation stage, the energy consumption could be measured to validate the system and ongoing energy consumption can become a performance measurable for the production and maintenance departments.

Systematic approach

Even where the energy saving potential of energy efficient motor systems is understood, the benefits are not maximised unless a systematic approach to energy management is implemented. What this means in practice is taking a wide view of the energy consumption within a business and having a proactive approach to reducing it.

In the first instance, it is good practice to have an energy management system and appoint responsibilities to drive change. A nominated energy manager, a board member champion, energy as a KPI, use of standards such as ISO50001 and using

Case study 1 – Industrial cooling system.				
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High Efficiency	£40,000	£40,000	£80,000	£440,000

Case study 2 – Airport baggage handling conveyor.				
System	Purchase cost	Annual energy cost	First year cost	10 year cost
Standard	£20,000	£60,000	£80,000	£620,000
High Efficiency	£40,000	£40,000	£80,000	£440,000

Case study 3 – Airport air handling system.				
System	Purchase cost	Annual energy cost	First year cost	10 year cost
Standard	£20,000	£60,000	£80,000	£620,000
High Efficiency	£40,000	£40,000	£80,000	£440,000

energy consumption as a performance indicator of key staff in relevant areas.

Such a system allows the expertise in a business to identify the priorities and those in charge of budgets to allocate funds based on the returns involved. It should allow a business to avoid common pitfalls such as:

- Seeing energy as a technical project for engineering departments without a budget.
- Sweating assets in the belief it saves money but consumes more energy.
- Purchasing energy efficient products, but not making big gains that system control brings.
- Viewing energy cost reduction as a tariff negotiation exercise with the energy supplier.

GAMBICA

GAMBICA is the UK Trade Association for the Control, Automation and Instrumentation industry, representing manufacturers and suppliers of motor control equipment. GAMBICA produces guidance documents on motor control and other subjects, which can be downloaded free of charge from – http://www.gambica.org.uk/technicalpublications

Case studies

To further illustrate the potential energy / cost savings involved and the payback times, below are three example case studies. By Simply reducing motor speed or automating the on/off cycle, significant returns on the initial investment are realised. These case studies are typical examples from actual installations, demonstrating realistic savings and payback periods.

Motors are used in so many applications and yet are often not visible or considered as such. You don't need to be a heavy manufacturing plant to benefit from improvements to motor system efficiency. Either hidden in basements or behind panels, almost every building has many motors that are driving the integrated systems within it. Fans and pumps are moving air and water around across many businesses and industries. Any refrigeration or chilling processes, air conditioning, ventilation, heating or fluid handling will have motors driving them. Add in lifts and hoists, conveyors, air compressors, automated machinery and processes and you may have more motors than you realise. ■

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