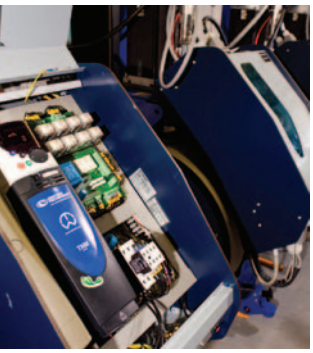
Hard bargain

Electric motors are responsible for by far the lion's share of electrical energy consumed throughout British industry. Brian Tinham examines options for cost and energy saving



Mark Maher, project engineer with Eriks

Talk to any variable speed drive (VSD) manufacturers' salespeople and they'll provide you with a similar pitch for their wares. By installing an intelligent device that regulates the speed and/or torque of your electric motor-driven plant, they say, you'll recoup the costs – in terms of energy – within months. Indeed, the investment (for that's what it is) will pay for itself many times over before the motor's end of life.

Yet ask plant engineers and managers, and while there are certainly zealots who insist they have proved drives' potency time and again, there are also sceptics who point to hidden costs and limitations. Others suggest that high-efficiency motors are a safe bet for improving energy performance, especially given the problem of over-sizing with existing motors. And there are others again who contend that motors and drives are not the only games in town.

This matters. Electric motors are widely believed to be responsible for about two thirds of the UK's industrial energy consumption and around a quarter of total UK electricity output. Just as important, the purchase price of a motor typically represents only 2–3% of the total spend – the rest being the lifetime cost of electrical energy.

So, on the one hand, there can be no doubt that there is a huge amount to go for, and, on the other, the laser focus should be on running costs. The issue is where to prioritise, and the truth is that plant engineers need to adopt an holistic approach.

That said, for Steve Brambley, deputy director of GAMBICA (the Association for Instrumentation, Control, Automation & Laboratory Technology), there is no contest. VSDs offer by far the biggest potential for cost and emissions savings – and that's on everything from pumps and fans to HVAC systems.

"GAMBICA supports higher efficiency motors as part of the solution to energy saving, but, if that's your only focus, you'll achieve limited improvement," he insists. "Typically, IE2 [Equating to earlier EEf 1] motors consume maybe 2–3% less energy than older standard motors, while premium IE3 units may be 3–5% better. But VSD control can deliver double digit improvements of 30–50%, or even higher, by turning down rotational speed and torque at source, or switching motors off when they're not required."

And the veracity of that thinking is borne out by the next phase of the Eco Design Directive, which originally mandated a minimum of IE2 motors in July last year, under the EU MEPS (European Minimum Energy Performance Standard) scheme. In January 2015, IE3 motors will be required in the range 7.5—375kW, unless a VSD is included – in which case IE 2 will be deemed just fine.

Brambley concedes, however, that while control is the key to serious energy savings, issues such as hours running and the extent to which a motor might be turned down or switched off without impacting

Drives play major part with Royal Shakespeare Company

The four-year, £112 million transformation of the Royal Shakespeare Theatre in Stratford-upon-Avon, which includes automation of back-drop and scenery movements, as well as lighting arrays, involved installing 100 ac drives and servo motors.

Dutch theatre automation company Trekwerk was responsible for renovating the over-stage installation, covering 60 winches, plus hoists for 30 light arrays, and using Control Techniques' drives throughout. All of the winches were fitted with CT 15kW Unidrive SP ac drives, operating in servo mode and twinned with Unimotor 190 fm servo motors equipped with double encoders for precise positioning and speed control.

RSC's head of automation Adam Harvey explains that, in all, 46 drives were fitted to 60 winches. Any of them can be configured for duties ranging from lifting scenery to controlling flying actors. Each winch drive has been fitted with an SM-Applications Plus module programmed to control all winch motions, with the load calculated internally, based on current drawn by the motor and checked against a load cell for safety.

the process, are also important. He also agrees that any energy-saving improvement project should consider the whole driven system, if only because there are other factors, too, that invariably offer incremental, but quick and often cheap wins.

Mark Maher, senior projects engineer with maintenance and repair specialist Eriks, points to three opportunities: power transmissions; antique motors; and automatic controls. "Vee-belts are often poorly set up and technicians get away with it, because they're very forgiving. But, if they're not aligned and tensioned properly, there's excessive frictional losses and pulley wear," he explains – adding that modern belts with Kevlar chords enable greater tension, reduced slip and longer life. "We offer belt tensioning gauges and laser alignment tools, and recommend that belts and pulleys are inspected annually, depending on criticality."

We can do better

As for old technology, Maher lists slip ring motors, mechanical-, belt- and hydraulic-variators, most of which are inherently inefficient and poorly documented – meaning that upgrading to new motors is almost certainly sensible. Incidentally, he also suggests that, where re-sizing is being considered, remember that many motors are more energy efficient at three quarters load than fully loaded, so don't be too enthusiastic.

Then controls: and Maher's observation is that, while VSDs tend to be thought of as the first port of call, sometimes there are simpler options. For example, with conveyors, if the objective is on/off only, an optical sensor and switching on clear conveyor countdown may well be enough.

Returning to VSDs, however, Brambley speaks for many when he suggests that the biggest barriers to uptake that could transform industry's energy efficiency are twofold. First, businesses' short termism means that many are reluctant to invest at all, no matter how robust the proposition. They prefer instead to go the cost-cutting route. And secondly, purchasing managers' unflinching focus on how much motor systems cost to buy, rather than to run – in spite of the proven importance of the latter – forces exclusion of any add-ons.

"Energy saving is making yourself more competitive in preparation for growth," he argues. "Cost saving is not spending, but, instead, laying people off and reducing the business' ability to grow. It makes no more sense than purchasing looking only at the cost line."

On this point, Brambley worries that, for as long as the market works by machine suppliers competing on price alone, nothing is likely to improve. "One way to change the situation is to insist that quotations include lifetime costs with estimated long-term savings. Given that break-even is generally less than a year for a VSD installed on motors above 5kW in a variable torque application, the approach would be compelling."

And one final thought on high efficiency motors: although the Eco-Design Directive is wide-ranging, some argue it should be more so. Currently, exemptions include all motors above 375kW, ATEX motors for use in notified hazardous areas and existing motors now coming up for repair or remanufacture. Can that be right?

Yes, large motors tend to be more efficient, but they consume greater energy so even a small percentage improvement could make a substantial difference. Meanwhile, savings on motors running at full speed in hazardous area applications must surely be persuasive in the long term.

And where is the sense in allowing old, inefficient motors simply to be renewed? It's bad for the environment, the economy and, in the end, the plant's own finances. PE

Above and left: drives, motors and controls in action at the Royal Shakespeare Theatre

Steve Brambley, drives specialist with GAMBICA