



# Cut the energy hype

There is no doubt that plant engineers can cut costs by saving energy. But while some solutions are simple and ingenious, others are hype, warns Dr Tom Shelley

Although oil prices have come down, the recession is forcing organisations of all kinds to keep on cutting energy costs. One consequence is increasing numbers of companies seeing energy saving as a business opportunity – and hence the growing number of offerings available. But while most ideas are good and very workable, others, inevitably, are either naïve or downright fraudulent.

Using variable speed drives (VSDs) to power up pumps, fans and other equipment that does not need to run continuously at full power is clearly good thinking. Since power consumption of pumps and fans increases roughly as the cube of the speed, it follows that running at half speed uses about a quarter of the energy of running at full speed for half the time.

Corus Strip Products in Port Talbot, South Wales (left), proved the point when it installed ABB variable speed drives to control cooling water recirculating pumps on its hot strip and cold mills, as well as three dust extraction fans on its coke ovens. Annual energy saving was about £1 million, with process control and product quality improvements to boot. Not surprisingly, according to the latest statistics from analyst IMS Research, the worldwide market for low voltage ac and dc drives increased by 19.7% in 2007, relative to 2006, with positive growth forecast for this year, despite the recession.

## Real drive issues

However, it is not always enough just to connect a drive to an existing installation. Potential problems include the effects of resonant frequency bands and electromagnetic interference, as well as premature motor failure, due to using a frequency converter on a standard drive motor, rather than one designed for VSD duty (usually the result of stray bearing currents and failing bearing lubrication). On compressors, there can also be issues around retrofitting fixed speed machines with VSDs, but maintaining the regulation system (typically load/no load). Since the load-to-unload band is typically 0.5 to 1bar, air networks struggle with the regulation band around the machine's minimum speed. Equally, when the units unload, their separator vessels bleed down for unloaded running and, since re-pressurisation takes time, there's a risk of poor stability.

Greg Bordiak, technical officer at the British Compressed Air Society, says that retrofitting VSD controls to existing systems is hit and miss. "Fitting a controller to an older machine involves, in many cases, the need to fit a compatible electric motor. This is when the costs start to go up and the user starts to question whether he should have bought a new machine preconfigured for VSD operation. Yes, it is possible to retrofit [VSDs], but the results, if the original motor is retained, do not provide the same benefits as a new system. The running costs are

higher and the ability to provide the same speed controls is not always realised. All in all, it is a poor compromise over a new purchase.”

Moving on, another technology whose energy-saving benefit is still the subject of much argument is that involving magnetising the fuel feed to burners. Maxsys Fuel Systems is chief among its purveyors and it says the system works by applying “a finely calibrated magnetic field” to the fuel [oil or gas] in a combustion system [industrial boilers, ovens, dryers, kilns and furnaces]. “The magnetic field aggregates nanoparticles in the fuel, which prevents fouling of the burner exchange surface and enhances combustion, creating a hotter flame.”

**Magnetic attraction**

Latest company to claim that it helps is Goonvean – the largest privately owned producer of kaolin in Europe – which uses large amounts of gas for its dryers. The Cornish firm says it has achieved a gas saving of 6% since the magnets were fitted, enabling payback of the installation costs in 19 months. Alex Newns, process manager at Goonvean, says: “The technology performed even better than promised. Such a marked reduction in fuel consumption is a fantastic result. An added bonus is that the installation led to lower CO<sub>2</sub> emissions.”

Another apparently popular idea, however – but one that actually does very little to cut costs – is attaching small wind turbines to factory or plant roofs. Quite apart from possible damage to the building structure in the event of high winds, the payback time is very long, especially in urban environments, because of poor wind speeds. The fact is, wind power only makes sense where wind speeds are high, mains electricity is not available and the alternative (fossil fuel) has to be brought over long distances.

An excellent example is the installation of eight 6kW wind turbines made by the Scottish company Proven Energy to provide power for the Princess Elizabeth Station in Antarctica, where average wind speed is 53mph, with winter gusts up to 200mph. There, the



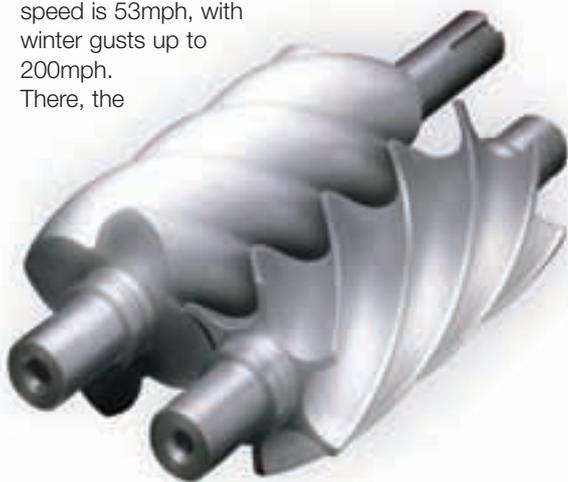
turbines have to withstand temperatures down to -90°C, which is why most such stations have previously relied on diesel generators: no wind turbines were robust enough. Incidentally, in addition to the turbines, the water supply for the Princess Elizabeth Station will use solar thermal panels to melt snow, using photovoltaic panels.

For plants not situated in remote locations, it makes more sense to consider simpler measures, many of which cost little or nothing. For example, time switches to turn off devices that are not in use; turning heating down a few degrees; and ensuring that temperature controls cannot be fiddled with, to avoid expensive temperature swings. Then again, air conditioning is a big energy consumer, so it's worth considering evaporative cooling instead.

EcoCooling, for example, has been working with data centres and server equipment manufacturers to develop a modular system for retrofitting its equipment to data centres and server rooms. These days, IT equipment needs to be operated in the range 10–35°C and EcoCooling's evaporative systems provide air at 18–22°C. Compare this: systems installed to cool Warwickshire County Council's Kings House Bedworth server room now cost £1,680 per year, instead of £18,000 for the original refrigeration-based air conditioning system.

Another key area to look for energy savings is in mechanical systems. For example, a 0.6mm misalignment in a coupling can result in as much as 8% power loss, so it's worth checking during

**Above: Proven Energy's wind power in Antarctica  
Left: Hylec's wind generator system  
Far left: high energy usage at Corus Strip  
Below: Atlas Copco's energy-saving screw**



**Pointers**

- Power for pumps and fans increases as the cube of speed, making the case for variable speed drives
- Variable speed drives on compressors is less easy: in many cases requiring a compatible electric motor
- Maxsys fuel conditioning is strange, but seems to work extremely well
- Evaporative cooling can shave 90% off conventional air conditioning costs
- Look for misalignment, worn vee belts, wrong bearings and lubricants

maintenance. Similarly, vee-belts can waste up to 20% of energy input through simple wear and slip. Using modern transmission systems monitoring equipment – such as Sensdata's instruments, which indicate problems like these in real time – can help maintenance engineers direct their activities better and eradicate the problem.

Equally, simply changing pulley sizes to ensure that a fan or pump runs at a more appropriate duty point can also often make significant savings. And improving lubrication to reduce friction is a simple, cheap investment. Apart from changing lubricants according to recommended schedules, it is also worth considering the benefits of better quality products, or moving to oil splash, instead of grease, where appropriate. Cockerzie Power Station (operated by Scottish Power), for example, tested Belzona Polymers' Belesta LC lubricant on a gearbox involved in crushing 28-tonne batches of coal per hour and found that adding 5% to conventional mineral oil resulted in an 8% power saving, equating to 55,000kWh less consumption.

### Waste to energy

Then again, thinking about your building, just as with houses, good heat insulation in roofs and around pipes is always an excellent investment. And while we're on the subject of heat, combustible rubbish that can be turned into energy kills two birds with one stone – by eliminating disposal costs, while also extracting useful value.

Apart from industrial-scale municipal waste to power plants, it is worth noting that Lorien Engineering Solutions, based in Lichfield, is participating in a programme to power 11 of the National Trust's locations with biomass. At the first site, Sudbury Hall in Derbyshire, cranes had to be used to lift new biomass boilers into an external courtyard, prior to installation in the basement of the 17th century stately home. The biomass wood chip



## Abbey Corrugated accredited by the Carbon Trust

A heat recovery system from Spirax Sarco has helped Abbey Corrugated become one of just 12 organisations across England and Scotland to be awarded the Carbon Trust Standard. Abbey says the installation has been the most valuable energy-saving project to date in its ongoing energy reduction campaign. It reduced the amount of gas burnt in the company's boiler by almost a quarter.

Abbey produces 160 million sqm of corrugated board annually at its site in Blunham, Bedfordshire. It uses most of its plant steam to heat the plates and rollers in its three corrugators. A skid-mounted FREME (flash recovery energy management equipment) system, from Spirax Sarco, recovers the energy in condensate and flash steam from around the plant, and uses it to preheat the feed water to the boiler. Supplying hotter feed water reduces the amount of work the boiler needs to do in order to raise steam.

First, hot condensate passes into a separation vessel where some of it flashes off as steam. Next, the condensate and flash steam each pass through a separate plate heat exchanger, where they heat the pressurised feed water. The flash steam also condenses and the two streams then recombine before returning to the boiler feedtank.

Before the project, water entered Abbey's boiler at around 68–70°C. It now arrives at between 138 and 142°C, according to the company's facilities manager Paul Gale. "There was a lot of work going on at the time, but it's fair to say that the savings from this project were in the region of 25% of the gas used by the boiler. This was one of the first projects we carried out in an intensive four years of energy savings. The system has since proved to be very reliable and we've had no issues with it since commissioning was completed."

Abbey has managed to reduce its carbon emissions by around 15% during its campaign. The company says it used a wide variety of approaches, from promoting good practice among staff to investing in a range of energy-saving equipment.

The Carbon Trust standard is to be linked to the government's carbon trading scheme – the Carbon Reduction Commitment (CRC). Participants in the CRC must purchase carbon allowances to cover their emissions. Revenue from the purchased allowances is recycled to participants, based on their ranking in the CRC emissions reduction league table. Organisations holding the Carbon Trust Standard certificate for the CRC period will receive an improved league ranking and therefore an increased share of the recycled allowances.



pellet system is expected to save the Trust the equivalent of 83,000 litres of oil per year: around £58,100 and 222,000 kg of CO<sub>2</sub>.

But even if oil continues to be the fuel, there is still an opportunity to save about 10% of the cost of gas oil or light fuel oil – by switching to recycled oil. Nobody is suggesting burning old engine oil, but the OSS Group has developed a product derived from waste oils called NexGen CFO (clean fuel oil), with a sulphur content of 0.5% that conforms to BS 2869. **FE**

**Left: One of the new biomass boilers being lowered into place at the National Trust's Sudbury Hall, in a project with Lorien Engineering Solutions**