

# Saving the earth

In the rush to save energy and reduce emissions, it's easy to forget the sheer range of potential solutions. Dr Tom Shelley reviews some of today's most powerful options

Sometimes it is surprising just how much energy, cost and pollution can be saved with very simple technical measures. Think, for example, about reducing friction in rotating machinery, using better oils and precision bearings. Then there are modern LED-based lighting systems. What about harnessing heat pumps and/or evaporative cooling, instead of conventional HVAC systems? And there is the huge variety of electronic controllers, variable speed drives and intelligent motor controls – all designed to transform the efficiency of motor-driven plant.

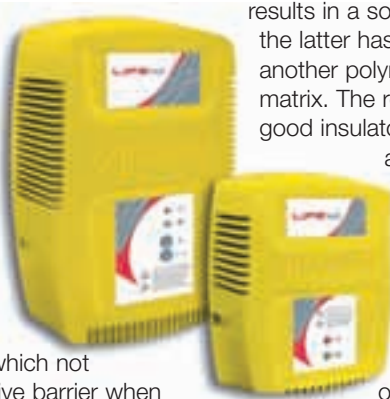
Much energy can be saved simply by using better lubricants. An extreme example is Hydralube's hydradynamic plasma fluid (HPF), which not only lubricates, but forms a protective barrier when friction causes components to get hot. The brainchild of Peter Dryden, a tribologist of more than 45 years' experience, HPF is claimed to reduce friction by 5–25%, compared with the best conventional oils, and to extend the lives of new and worn mechanical parts by 26%.

## Advanced lubricants

There are now other similar products, such as Merlin Plasma, but Hydralube remains the best known, and the company points to test results both from national laboratories and customers that support its grand claims. Customers endorsing its products now include Faccenda Group, which says that use of its lubricant in a gearbox on a chicken feather press at Brackley reduced energy consumption in a 55kW motor by 14% and extended the life of its press by a staggering two years. Similarly, United Biscuits in Glasgow reports electric current reductions in motors on gearboxes ranging from 6–18%, while Allied Bakeries in Cardiff

suggests as much as 8–25% energy savings.

Hydralube is made by forcing air bubbles through a polymeric matrix solution, spinning at 30,000 rpm. The air bubbles carve a path through the material, removing electrons from matrix molecules as they go, so creating the plasma. This results in a solid mass and a liquid, which, once the latter has been removed, is introduced into another polymeric solution, forming a stable matrix. The resulting HPF material is also a good insulator, and is suitable for food, water and pharmaceutical industry usage.



Bearings, too, can make a very big difference. Schaeffler, for example, claims that its latest range of Generation C FAG deep groove ball bearings results in 35% less friction than its predecessors, thanks to optimising the raceway curvature between balls and rings. The point: it pays to be aware of bearing options, not only when designing and specifying engineered solutions, but also when the time comes for maintenance and rebuilds.

Another completely different area where significant amounts of energy and money can be saved relatively simply is in lighting. For localised

**Centre: LifeTech battery chargers can cut energy usage by 20%, against conventional kit**  
**Below: LEDs are as bright as halogens, don't get hot, don't break, last for seven years and use a fraction of the power of other lighting alternatives**



lighting, LEDs are now as bright as halogens, don't get hot, don't break, last for seven years or more and use a fraction of the power of conventional alternatives. Idec Electronics' 24V units for machine tools deliver 300lux from a 12-LED unit, or 330lux with a clear lens, while its IP40 modules deliver 760 lux and an IP67 rated unit provides 560lux on a tool tip one metre away.

Equally, the technology for area lighting has also taken great strides – particularly in improving the efficiency of HID (high intensity discharge) lamps by introducing electronic controls within the lamp units that precisely control the electrical energy supply. US company HID Laboratories in California was first with the technology, but a similar approach is now available from Manchester-based firm ENER-G. You don't even have to purchase new luminaires: 'smart ballasts' can be retrofitted to existing lights, with energy savings up to 60% and lamp lives doubled.

**Power and heat**

Sticking with the electrical energy theme, for sites that use battery-operated fork lift trucks or similar plant, up to 20% power savings are available simply by switching from conventional to electronically-controlled battery chargers. These work at high frequencies (20–200kHz) to avoid the need for large copper coils, and electronically reduce voltage as the battery becomes charged, to avoid wasting power, overcharging and risking damage. Dan Crow, facilities manager at chocolate manufacturer Thorntons, says that when his site took on 30 new trucks with EnerSys batteries, and modern Hawker LifeTech chargers, projected savings were £14,000 per annum, against a £7,000 equipment cost.

Meanwhile, one of the biggest energy items for most plants is heating and cooling, and for sites with existing traditional HVAC systems, best advice is maintenance – particularly in terms of cleaning the coils. Vern Klein, sales director of air conditioning specialist Advanced Engineering, reckons there are cases where energy consumption has been improved 36% simply by removing coatings of dirt on the coils. AE uses a sprayer, with a range of cleaning products, including disinfectant, if required, or formulations for cleaning limescale. Don't use mechanical brushing: it will damage the fins and structure, warns Klein.

Heating costs can also be greatly reduced either by making use of waste heat in CHP (combined heat and power) schemes or by considering heat pumps, which move heat from the ground, water or air, using a reverse refrigeration cycle that involves a

fraction of the energy required to deliver it directly.

The earliest major example of CHP in the UK was the 1950 scheme to heat homes in Pimlico, using waste heat from Battersea power station. This was replaced by direct heating, first using coal and then gas in 1980. It has now been upgraded with two Caterpillar gas-powered reciprocating engines, each producing 1.6MW of electricity and 1.5MW of thermal energy, alongside three gas-fired boilers, each producing up to 8MW of heat. The electricity is used to power the installation, but, when there is a surplus, it is sold to EDF.

Smaller-scale CHP operations are also seeing growing uptake. The Shenton Group, for instance, in Andover has installed one such system, called Powerthem, both to power and heat its building and to demonstrate what it can do for others through its subsidiary, Scorpion Power Systems.

Operations manager Marcus Dodsworth says: "We spent three years researching engines and eventually teamed up with General Motors." The engine chosen is a 1.8 litre, spark ignition, gas fuelled V8, which Dodsworth describes as having been heavily re-engineered for CHP. In practice, heat is recovered from the water-cooled cylinder head and exhaust manifold, using tube and shell heat exchangers. The engine produces 75kW of electrical energy and 140kW of heat, typically raising water temperature from 76°C to 85°C, although Dodsworth claims it is possible to get water exit temperatures up to 90°C, "which makes absorption chillers more efficient". All components are enclosed in an acoustic enclosure, reducing noise to 68dB(A) at 7m. The group has applied to the Carbon Trust for interest-free, four-year loans to cover the installation cost.

Moving on to heat pumps, ENER-G has joined forces with Italian manufacturer Robur to supply

**Left: Schneider Electric's free guide to energy efficiency**  
**Below: Powerthem's surprisingly powerful CHP unit at Shenton's Andover site**



## Pointers

- Simply changing to more advanced lubricants can cut energy dissipation by 5–25% and reduce wear
- Similarly, bearing choices can have a major impact
- Guidance on lighting needs revision, in favour of LEDs and smart HIDs
- Electronically controlled battery chargers for mobile plant can save their cost in just six months
- With HVAC plant, first clean the coils, but then think other technologies and combined heat and power
- As the Carbon Reduction Commitment bites, look at heat pumps, especially gas absorption types

**ABB's massive range of variable speed drives: tools for every requirement**

gas absorption heat pump (GAHP) technology. The concept of absorption cooling was pioneered in the late 18th century and the origins of Robur's LPG-fired systems dates back to work carried out on domestic refrigerators for the US-based Servel company by Albert Einstein. Andrew Hill, product manager at ENER-G, claims energy consumption reductions of 50% and exemption from the climate change levy as key advantages. Regulatory benefits also include cost savings relating to the new Carbon Reduction Commitment (CRC), improved building energy certificate ratings (EPC and DEC), points for BREEAM assessment, and compliance with Part L2A and Part L2B of Building Regulations.

### Gas absorption

ENER-G's services include a free feasibility study, project design, and system specification, installation and commissioning. "While traditional heat pumps use a compressor to convert the gaseous refrigerant into a liquid state, absorber and generator systems transfer the refrigerant into an absorbing fluid and then liquefy it," explains Hill. "This means that only a small supply of energy is required to pump the refrigerant solution around the fan to circulate the air, which substantially lowers both energy costs and CO<sub>2</sub> emissions," he adds.

Finally, we must consider modern control systems, and particularly the variable speed drives (VSDs), soft starts and intelligent motor controls that run pumps, fans, compressors, escalators and the like, not only at the speed required, but with ideal power provision. Glenn Howlett, technical services manager with gas pressure boosters manufacturer Utile Engineering in Northamptonshire, points to the value of moving from a vee-belt system driving its pressure-boosting fans (with speed controlled by geared pulleys and direct-on-line starting) to VSDs.

"We had looked at VSDs some years ago, but, at the time, we could not justify the cost," says Howlett. That changed, he says, with the arrival of ABB's machinery drive, which enabled VSDs to be used, even in Utile's smaller turbo gas boosters. Apart from achieving obvious energy savings, without the gears site engineers can now change speed parameters

quickly and easily. And there are diagnostics: "Previously, if a machine stopped, the panel would illuminate a fault warning lamp, but we would not know where that fault had occurred. In contrast, the ABB drive logs all faults, allowing us to look into them more closely."

However, even more can be done. Dr Peter Wenzel, of digital plant communications organisation Profibus International, cites one automotive body factory, which, he says, was consuming 20kW of power even during idle times. For him, that demonstrates the value of selectively switching off portions of plant, even during production, if they are not required. "Switching off a device, such as a laser, even for just 30 seconds, can be profitable," he says, explaining that Profibus International is developing an energy-saving Profibus 'profile' called Profienergy, the first release of which should be available by the end of this year.

### Fieldbus factor

And on the fieldbus theme, BG Controls, which majors on environmental controls in offices, factories and public buildings, points to a recent project – the Environmental Energy Technology Centre at Waverley, Rotherham. There, a sensor-controlled natural ventilation system monitors temperature and CO<sub>2</sub> in all offices, providing controls to open and close the windows. Its under-floor, heat pump-driven heating and cooling system is connected to the building management system and the other controllers, using the building services industry's de facto fieldbus standard BACnet. That system also allows BG to remotely monitor the system from its own service centre.

Those interested to learn about even more ways to save energy and money in buildings by improving control can download a free 45-page Energy Efficiency Application Guide from the Schneider Electric web site, [www.schneider-electric.co.uk](http://www.schneider-electric.co.uk) or call 0870 608 8 608.

As for cutting-edge developments, apart from micro wind turbines and photovoltaic units – which today remain far-fetched – one relatively new idea worth a closer look is EARS (exhaust air recycling system). Invented by Chris Bosua in Melbourne, Australia, it captures exhaust air from pneumatic tools and returns it to the compressor, conserving both residual pressure and the energy put in to dry the air – while also, by the way, reducing noise.

Equipment is available in the UK from Tom Parker in Preston. David Spedding, Manchester College's lead curriculum manager for automotive and engineering courses, which recently installed EARS, says that the workshop has benefited from a 70–75% reduction in noise, while energy savings are expected to reach a handsome 40%. **PE**

