

Go easy on energy

While the world's attention turns to wind and wave power, there are many simple, cheap and effective ways for plant engineers to drive cuts in energy consumption. Dr Tom Shelley reports

Above: Biopark Terneuzen, in the Netherlands
Below: Biopark's greenhouses are supplied with post process CO₂ by a fertiliser plant
Centre: Marion Ohio recycled steel works: tuned for energy, using cheap automation



The oil price might fall below \$100 per barrel, taking other energy prices down with it, but it may also climb to \$200, according to energy industry insider Mike Brooks of St Omer Consulting. The point: plant managers should be planning projects to deliver energy savings right now – and not just incremental improvements, but serious cuts, taking advantage of new and existing technologies.

For example, significant energy can be saved across all sorts of conventional plant operations, simply by introducing proper automated monitoring and control. It need not cost a fortune, as a striking example at Marion Steel in Marion, Ohio, shows. Now owned by Nucor, the scrap steel recycling plant uses National Instruments' LabView 'soft' instrumentation package to manage a massively power-hungry electric arc furnace.

"When we purchased the Marion facility, operators relied on estimates to determine the amount of steel placed in the furnace, often causing the metal to be overheated," says Dave Brandt of Nucor. "This resulted in an unsatisfactory end product that had to be recycled again, costing time, money and energy. To reduce the number of reheats, we developed a low-cost weighing system, using LabView and NI's Compact FieldPoint controllers, that now accurately calculates the quantity of steel for each burn."

Knowing the precise amount of scrap metal in the furnace allows Nucor to calculate the electricity required to heat the furnace. Since deploying the new system, out of more than 6,000 melting

operations last year, the plant only had to perform 10 reheats, which, according to Brandt, was "far less" than in 2006. It can't be difficult to work out the cost/benefit sums for all sorts of plants – even those with significantly smaller energy requirements.

Meanwhile, if it's lower grade heating or cooling that concerns you, one criminally under-used way of drastically reducing the need for external energy is to extract it from, or pump it into, the ground. Admittedly, until recently, the snag has been the need to dig deep trenches for the heat exchanging pipes, but new company Greenfield Energy is now offering technology that essentially involves only drilling single, blind-ended holes.

Deep heat pumps

It's worth noting that a variation of just 1°C in a single cubic kilometre of rock equates to about 560GWh of energy, or more than 70,000 tonnes of coal for conventional burning operations. Also, heat pumps only require a fraction of the amount of energy they deliver or remove – so this is a key solution for energy saving.

Greenfield is run by ex-oil industry engineers, who know most of what's worth knowing about drilling. What's more, it offers not only to drill the holes which, according to chief technology officer Dimitriy Zaynulin, need only be 200–450m deep (modest by oil industry standards), but also to install all hardware, in exchange for a long-term supply and operation contract.

Nobody has installed a full system yet, but the



approach has been computer modelled by one of the UK's leading academics in the field, and tested to death by the Building Research Establishment. So there is no doubt as to the viability of this patent pending technology.

On the other hand, another way to save significant energy is to think ahead and work with others – particularly industrial neighbours. The idea is simple enough: what is waste from one business becomes feedstock for another. Positioning all contributors on the same site cuts out transport



costs and maximises the energy value. Such is the concept behind Biopark Terneuzen, established in the Netherlands in February 2007 in the Ghent-Terneuzen Canal Zone.

The venture currently involves several industrial companies. Yara, which supplies mineral fertiliser, offloads waste heat and some 70,000 tonnes of clean, post-process carbon dioxide per year to a local 250 hectare horticultural greenhouse complex to encourage plant growth. Then Nedalco, which produces bio ethanol from local agricultural products, receives residual starch for its processes from Cargill, a provider of food, agricultural and risk management products and services.

Next, Heros, a recycler of waste and residual products, is scaling up its existing waste water purification plant at Sluiskil to supply purified water to the greenhouses. Finally, Rosendall Energy, a local producer of biodegradable diesel, provides waste water to Heros, while taking some feedstock from locally grown rape seed and – along with the greenhouses and Nedalco – delivering waste biomass back to a local biomass power plant.

Making that work for you is as much about management commitment as technical capability: it tends to fall outside most employees' and managers' remit. But even relatively small projects

can make a significant difference to overall energy consumption, CO₂ exhaust and mutual cost.

Finally, we come to mechanical improvements – and they are simple and legion. It is a sad fact that most organisations still continue to neglect obvious opportunities. Wythenshawe-based Brammer, for example, surveyed 330 manufacturers across 10 countries in Europe and found that, while 60% are planning or implementing energy savings, very few are considering motors, bearings or belts.

Further, it found that, although 78% of managers are focusing on energy savings for their production processes, 59% are unlikely even to consider changing electric motors. This despite the fact that, according to the Carbon Trust, 65% of a typical plant's energy consumption is due to those motors.

The facts are clear: although swapping motors to more efficient types makes some saving, moving over to planetary gearboxes from worm drives – or, alternatively, installing variable speed drives, so that motors only turn pumps or fans as fast as your plant requires – can result in very significant savings. Indeed, Brammer estimates the potential for energy savings at 15%, which equates to £5.85 billion, or 47.27 million tonnes of CO₂ annually across the EU.

However, this figure, which is probably conservative, is in addition to the total possible annual savings anticipated by respondents, which were £4.72 billion or 43.27 million tonnes of CO₂. And, given that most were not considering mechanical power transmission products in their plans, the true potential total annual savings across the EU could be as high as £10 billion, meaning more than 90 million tonnes of CO₂ saving.

With EU industry consuming 40.9% of electricity and 37% of natural gas, embarking on serious, but relatively inexpensive, energy-saving projects could therefore have a huge impact on national energy bills. With energy increasingly expensive, and liable to become more so, surely it makes sense to move from thoughts to deeds. **PE**

Pointers

- Low-cost software-based instrumentation and control equipment can massively reduce energy consumption, especially on hungry plant
- A new era of heat pumps is beckoning, using deep drilling technology from the oil industry
- Working with industrial neighbours can provide energy and cost win-wins: it's worth considering
- Upgrading motors, bearings and belts can make a disproportionately big energy difference

Politics and oil prices

Mike Brooks, managing director of energy and finance specialist St Omer Consulting (and formerly finance director of Trinity Energy, following 20 years with Shell) expects ongoing volatility in the energy market. "In the short term, I think the energy price will come down. But it doubled in a year and it can halve in a year, because supply is inflexible in the short term, so changes in demand have a big effect on price.

"If the demand in China starts to falter at the same time as new production comes online, the price could well fall below \$100. And while we might like some kind of cap and collar arrangement, the energy companies are not interested and the range could be \$80 to \$200, with gas prices following.

"But price is not the only problem. We should also worry about energy, in terms of long-term security of supply. A lot of gas, for example, is in the hands of the Russians, and we should not forget that Russia turned off the gas supply to Ukraine in 2005–6 for political reasons. We should be making efforts to be seriously economical with energy, in both the short and the long term."

