



Making

Following last year's launch of sustainability guidelines by the Engineering Council, Steed Webzell takes a look at today's key issues and responsibilities

Energy conservation and recycling, paperless operations and zero waste to landfill. All three terms are in increasingly common use throughout industry. Some campaigns are self-driven by responsible plant operators; others are manufacturer-led or driven by the growing raft of standards and legislation. But, while no-one argues against the merits of sustainable industry, in the real world there is almost always a cost associated with such initiatives.

As Marcus Dodsworth, technical service division manager at family-owned engineering partnership Shenton Group, puts it: "Ultimately, available capital has to be spent in a manner that keeps the ship afloat. However much we subscribe to the green agenda, and however much we want to act responsibly on climate change, the blunt truth is we have to attend to our basic business profitability."

That said, the good news for sustainability is that several carbon reduction technologies are capable not only of improving a plant's environmental standing, but also of paying for themselves – and sometimes remarkably quickly. Combined heat and power (CHP) systems that allow heat and electricity to be generated simultaneously from a single site-based packaged unit provide an excellent example.

Scorpion Power Systems' (part of Shenton Group) CHP offering is based on a natural gas engine-driven generator. Waste heat from the engine is absorbed via a water jacket and heat exchanger, and the heated water then connected to an existing plant heating system where it supplements boiler firing. Electricity generated can then be connected

to the mains system to boost or replace power purchased from the grid.

"As a rule of thumb, producing 1kW of electricity creates 2kW of usable heat energy," asserts Dodsworth. "Our CHP systems capture most of the waste engine heat, making them over 84% efficient." So, if your annual electricity costs are in excess of £200,000 and the plant has a constant need for hot water, for example, a CHP system like this could save around £40,000 per year, according to Scorpion's calculations.

Meanwhile, Ener-G also champions CHP systems for sustainable heat and power, and cites a recent installation at BV Dairy in Dorset as an example of just what can be achieved, particularly when CHP is used in conjunction with pioneering liquid anaerobic digestion (AD) technology. Its high rate AD plant has been designed and built by Clearleau, while Ener-G is supplying and operating the CHP technology (hired for a two-year period, prior to capital purchase) that will burn the biogas and convert it into renewable heat and energy.

Energy from effluent

Indeed, when this plant becomes fully operational later in August, BV expects it to generate more than 75% of the site's electricity. In fact, the 190kW CHP system will be capable of generating 1,539MWh of electricity and 1,685MWh of heat per annum from effluent, so reducing the dairy's reliance on fossil fuels and pushing it well on its way to a targeted 65% reduction in its carbon footprint.

But CHP is not the only game in town when it comes to sustainability. The A-B InBev brewery at

BV Dairy in Dorset is using combined heat and power (CHP) with pioneering liquid anaerobic digestion plant



sustainability pay

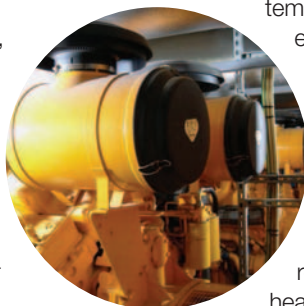


Magor in Wales engaged the services of Lorien Engineering Solutions to tackle its energy consumption, and went for a programme of no fewer than 40 projects affecting just about every aspect of its operation, including the utilities and packaging plants. The brewery now reports a combined payback of less than 18 months, with, for example, an energy efficiency improvement of 12.2% per hectolitre of beer produced between October 2008 and March 2010, and water usage per hectolitre reduced by 20.7% during this last year.

Team effort

It didn't come easy, though: much of Magor's success was due to the hard work of the whole brewery team. Everything from leak detection and repair programmes to rewriting operating procedures to minimise water and energy losses was undertaken. One of the more novel projects also tackled the energy-intensive process of conveying spent grain by installing a low pressure compressor system, while another involved replacing low- and hi-bay lamps and fittings with new induction lighting. And Magor also installed carbon dioxide vaporisers that use waste heat from its secondary refrigerant plant, instead of steam.

Tackling wasted energy in the form of steam losses is another classic for the many plants that use it for space heating, process heating, hot water, humidification etc – and there are sustainable solutions here. “Typically, of the money a plant spends on producing steam each year, around 45% is lost, when up to 40% could be recovered by using reliable steam traps,” says Grant Bailey, sales and marketing director at Thermal Energy International.



He also refers to equipment such as TEI's Flu-Ace, which can recover up to 90% of heat otherwise lost via a boiler's exhaust flue, while also reducing carbon emissions and energy bills by up to 20%, NOx and SO2 emissions by 20% and 90% respectively and particulates by 50%. TEI installs a condensing heat recovery system adjacent to the boiler stack, which drops the flue gas temperature below the dew point and extracts energy through a heat transfer bed.

Essentially, the unit taps into the existing flue and passes the flue gas through a short tower, equipped with a direct contact spray system. The shower passes over a heat exchanger at the base of the unit, recovering both sensible and latent heat, while flue gas flow is maintained via an automated variable speed, induced draft fan at the tower outlet. Hot water at up to 63°C accumulates in the tower's receiver, where it is treated before being used for boiler water make-up, CIP (cleaning in place) or any other hot water service. It can also be coupled with the economiser to preheat the boiler feedwater after the feed pump.

Bailey puts the average figure for consumed energy wasted out of boiler exhaust stack alone at 18%, which, along with other losses, means that for every pound spent only 55p of energy is used. This, he says, can be regained not only by installing Flu Ace, but also Gem steam traps, resulting in waste typically reduced to 17% – so providing an extra 28p of energy for every pound and delivering 50% more energy for your money.

Of course, sustainability is about far more than energy-saving and energy recovery, important though these both are. It's also about reducing

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Pointers

- However much plant managers subscribe to a green agenda, it has to pay
- Some carbon reducing technologies do pay for themselves very quickly
- Natural gas combined heat and power typically creates 2kW of heat for every 1kW of electricity
- Anaerobic digestion technology can add biogas for the fuel
- Plant engineers should consider everything from steam leak detection and repair programmes to low energy lighting and new conveyor technology
- Higher efficiency boiler equipment, such as reliable steam traps or condensate recovery systems, can make a massive difference



Scorpion Power Systems' CHP offering is based on a natural gas engine-driven generator

product waste, particularly where landfill is concerned – and boiler manufacturer Vaillant is one company demonstrating what can be done, at its Belper plant, which has implemented a 'zero to landfill' project.

Back in 2006, the Vaillant production plant produced 350,000 boilers, but sent 361 tonnes of waste to landfill at a cost of around £50,000 (including landfill tax). In 2009, boiler manufacturing had increased to 400,000 units, but waste to landfill was slashed down to 92 tonnes. What's more, the effect of a focus on recycling made the project cost neutral, according to Jeff Perry, health, safety and environment manager at Vaillant. In fact, he says that the first five months of 2010 have now turned that around to a £21,900 positive contribution.

Waste to chipboard

How did the firm achieve such excellent results? Perry says most of the savings were generated by scrutinising waste products, such as batteries, oils, cardboard, plastics and wood. Regarding the latter, getting rid of waste wood was costing Vaillant around £4,000 per month in 2006. However, following the installation of a RotoKrush compaction system, today there is zero cost, as it is collected for recycling into chipboard. That investment in plant paid for itself within eight months, he says.

Meanwhile, some 10 miles up the road at cleaning products manufacturer JohnsonDiversey's Alfreton plant, is a factory already claiming to generate zero waste to landfill. Starting from the premise that 'clean products mean a clean planet', the company joined the WWF Climate Savers programme in 2008, pledging to invest \$19 million over five years to reduce its carbon footprint – and has since implemented a string of environmental projects, from automated lighting to waste and water reductions, as well as the use of boreholes and wind turbines. The result: overall, the site now wastes less than 1% of its raw materials input and

last year all but 10% of that was reused or recycled.

However, while Vaillant has around 250 employees and JohnsonDiversey around half that, what about some of the more modest SMEs? Paul Hawthorne, technical director at ram pump manufacturer EMS Industries (which has less than 30 employees), reckons size should be no barrier to sustainability initiatives.

"Many of our end users are water companies, which understandably are at the forefront of initiatives to push forward on sustainability," says Hawthorne. "However, we also have our own agenda. We appreciate environmental concerns, and have an obligation to take these on board and adapt our product designs accordingly," he adds.

EMS, which is one of SOE's industry partners, is currently re-examining the raw material content of its pumps, considering all kinds of recycling alternatives. Where green solutions on items, such as rubber ram seals, are technically challenging, the approach taken is not simply to brush them aside, says Hawthorne. Rather, it is to document the results and re-assess matters at regular intervals to see if a viable solution has become available.

"A more straightforward example regards the use of hydraulic oil," says Hawthorne. "We now offer biodegradable fluid as a customer option. However, there is obviously a cost attached to this, so adopting this sustainable approach ultimately boils down to customer choice."

Transport miles

Incidentally, he also indicates that the company is working hard scrutinising factors such as production processes and transport miles – pointing out that manufacturers' supply chains are well worth attention. "Mention sustainability to a small subcontract machine shop and you are usually greeted with blank faces. However, it's a challenge we must face, not least because this issue could become part of the vetting process for supplier selection. At present, we have to apply sensible barriers and take an incremental approach. It's difficult to achieve sustainable utopia overnight."

Interestingly, as technical director, Hawthorne is the EMS board member responsible for sustainability and the environment. However, some are now calling for a dedicated energy director for every plant. Energy supplier npower is one such and the organisation is doing its best to publicise the arguments, with a series of podcasts that examine the growing implications of excessive energy usage and also provide advice for plant managers on how to improve. Developed in conjunction with the Major Energy Users Council (MEUC), the podcasts include interviews with npower specialists and MEUC director general Andrew Buckley, on carbon reduction, energy purchasing, renewables and the energy gap. [PE](#)

Standard bearers

BSi has launched a new standard aimed at helping to establish systems and processes that improve energy efficiency, and reduce costs and greenhouse gas emissions. BS EN 16001 employs the same 'plan-do-check-act' approach as ISO 14001, but focuses specifically on the identification and management of energy.

The process starts with establishing an appropriate energy policy, conducting an energy review and thus identifying the factors that materially affect energy consumption. This is followed by facilitating planning, control, monitoring and measurement of energy consumption, as well as the establishment of energy saving targets.

Pilot adopters include Camfil Farr, a manufacturer that embarked last year on a mission to become the world's first sustainable manufacturer of air filtration equipment. Managing director Bill Wilkinson says: "We never used to pay much attention to our energy bills. However, since implementing the management system, we have been able to save over 20% in energy consumption year-on-year."