Wasting

The Carbon Trust reckons that UK companies are still wasting £1 billion worth of energy per year, largely due to unresolved plant optimisation issues and inefficiencies in energy generation plant itself. Brian Wall reports on ways forward

Grant Bailey, Thermal Energy International: steam has a lot of advantages, but more energy is lost in industry through steam wastage than through any other medium

Just a few years ago, energy management was not a core function for many industrial processing and manufacturing companies. However, today. unwavering increases in energy prices, together with ongoing public concern and legislation concerning carbon emissions, have together put energy management well and truly on the agenda for everyone.

In an announcement late last year, the Carbon Trust stated that, last summer alone, businesses were found to be emitting more than 8 million tonnes of CO_2 – the equivalent to Birmingham's entire annual carbon emissions and enough to fill the new Wembley Stadium a thousand times over. It also found that, across manufacturing, including the food, drink and chemical sectors, the amount spent on energy was £1.8 billion, of which 12% (£226 million) was believed wasted.

Training for energy targets

Ultimately, for any energy improvement initiative to be effective in the long term, it needs to have some form of monitoring and targeting at its centre. So says Vilnis Vesma, who has many years' experience of designing, installing, supporting and operating energy monitoring and targeting schemes – and providing training for existing or potential users.

"That way, a number of key benefits will be delivered, including signalling any unexpected excess consumption; providing objective estimates of savings achieved; and helping to forecast energy demand," he points out.

Vesma offers a course for those who want to implement a new monitoring and targeting scheme or make an existing regime more effective. It is intended for facilities managers, plant engineers, and works managers and engineers, as well as full-time energy managers.

At the end of the session, attendees should have acquired the appropriate techniques to:

- Detect exceptions with a simple routine report
- Prioritise them by excess cost
- Account properly for the weather, production activity levels and other quantifiable influences
- Reveal inefficiency and waste through analysis of past behaviour
- Focus energy surveys where there will be most benefit
- Verify and quantify the benefit of energy-saving initiatives and projects
- Forecast and track energy budgets accurately
- Benefit from enhanced benchmarking opportunities.

Further courses are scheduled for April and May. For more information: www.vesma.com/training/mtworkshop50.htm or email: vilnis@vesma.com

So where should plant engineers look to seriously dent that very poor picture? There are plenty of avenues – for example, installing variable speed drives on electric motors, large and small, to run pumps, fans, compressors and the like at optimum, rather than full, speed is an obvious avenue. What's more, if the drive manufacturers are to be believed (and, certainly, the physics makes sense), many such projects can be quickly self-funding – meaning two good reasons to start investigating.

Then there is heating and ventilating plant, where plant engineers and facilities managers alike would do well to examine the use of low-energy alternatives to conventional plant systems. We're talking about: the wide range of combined heat and power options, heat pumps and evaporative cooling plant on the heating/cooling side; air induction equipment for distribution; and the range of occupancy sensor technologies for switching energy consumption off when HVAC is not required.

Think holistically

And the same goes for lifts in buildings and also for lighting – low energy alternatives are readily available not just for new projects, but also retrofits when the time comes. It's a matter of being aware of the technology advantages and requirements, and being prepared to make the case.

But there is another very big, very popular and notoriously energy-hungry area on industrial plants of all kinds – and that concerns steam raising and transmission. Steam has been one of the most popular modes of conveying energy since the industrial revolution and rightly remains mainstream on pretty much every plant in every sector – from the utilities to sugar refining, pulp and paper production, oil and gas, petrochemicals, chemicals, food processing, synthetic fibre and textiles. The list goes on and on – and it is that scale of use that makes it so worth our serious attention.

And it's likely to stay that way. As Grant Bailey, sales and marketing director of Thermal Energy

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International, puts it: “As a heat transfer medium, steam has an advantage over fluids such as hot water and oil, as it is able to store and transport very large quantities of heat, which can then be given up at constant temperature as the steam condenses. The problem is, however, that more energy is lost in industry through steam wastage than through any other medium.” Indeed, studies back in 2000 suggested that steam systems were responsible for some 35% of all losses identified as suitable for intervention – and there is no reason to believe that percentage has changed much, if at all.

The operative words there, however, are ‘identified as suitable for intervention’. As Bailey points out, installing and maintaining simple steam traps (devices that discharge condensate and air from the line or equipment, without discharging the steam) may be enough to make an entirely feasible difference – by removing condensate, air and non-condensable gases to maximise heat transfer.

Simple enough? Sadly, around 10% of steam traps – particularly the mechanical devices – fail every year and many of those may go undetected for months or even years. “Traps that fail open result in a loss of steam and its energy,” asserts Bailey. “And where condensate is not returned, the water is lost as well, so the result is significant economic loss – directly via increased boiler plant costs and potentially also indirectly via decreased steam heat capacity,” he adds.

Steam leakage is a visible indicator of such waste but, more to the point, Bailey suggests that failed steam traps alone account for up to 11% of steam consumption on small or medium scale industrial plants, rising to an astonishing 55% in high steam usage processing industries. And that has a significant knock-on effect. “Steam traps need to be working at optimum efficiency, with a minimum impact on the environment,” explains

There is much to be said for the daily inspection round. You can’t beat good plant engineers’ eyes and ears

Sustainability goals targeted

New software, aimed at enabling plants to implement an energy management programme and to achieve sustainable goals, has been unveiled. The software, which comes from Wonderware Ireland, allows plant users to monitor energy usage, and detect and notify personnel of inefficiencies. Known as the Wonderware Corporate Energy Management Application, it connects directly to meters on a network, through industrial controllers, and accepts manual entry via a Wonderware InTouch HMI or mobile equipment.

Functions include recording plant consumption and demand at main and sub meters for a variety of energy types, including power, water, gas, air and steam. The system also associates detailed production output to energy usage, providing the key performance indicators needed for many energy sustainability and continuous improvement programmes.

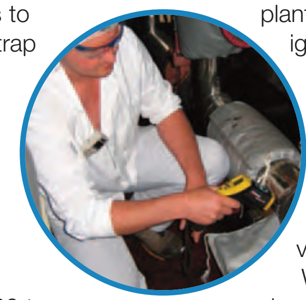
What’s more, the software can be installed in just days, according to Wonderware, while pre-built reports give managers, supervisors and workers clear visibility of how energy is being used within their operations.

Companies are able to create a variety of energy consumption web reports, based on time period, department, cost centre and operational events. Meanwhile, plant managers and engineers get real-time views of energy consumption, provided by InTouch HMI (human machine interface), offering an overview of the current state of energy usage.

Getting plant efficiency right starts with selecting the right technology for the application

Bailey. "For example, for each litre of heavy fuel oil burned unnecessarily to compensate for a steam leak, approximately 3kg of CO_2 is emitted to atmosphere."

How much steam (and therefore fuel and emissions) your plant is wasting depends on the number and nature of your traps. Steam traps have different sized orifices to suit different conditions, but, if a trap is leaking steam, the amount wasted depends primarily on the trap size and steam pressure. "The cost of waste will also depend on the number of traps and the operating time," adds Bailey.



Massive losses

"For example, a process plant with 200 traps – based on an average trap size of DN20 and a stream pressure of 14-bar g with 10% failing annually – will have steam wastage of 8,900 tonnes. If the overall cost of steam for this plant were £20 per tonne, the direct cost of ignoring these leaking steam traps would be £178,000 each year, which is equivalent to nearly a million litres of fuel oil through a 70% efficient boiler, based on 8kwh/litre. The cost to the environment would be 3,000 tonnes of CO_2 dumped into the atmosphere."

And here's another thing. At a time when UK manufacturers are under severe economic pressure, they are, not surprisingly, looking for ways of reducing overheads. However, many are reverting to cutting their maintenance budgets and engineering staff. And the upshot of all that? A spiral of ever-increasing plant problems – including increasing steam losses and escalating fuel bills, as mechanical steam traps fail open without intervention.

"This leaves management with two options," argues Bailey. "Either minimal maintenance – and watch the steam plume from the condensate receiver rise, along with the fuel, water and chemical treatment costs – or regularly test, repair and replace faulty mechanical traps at considerable ongoing cost."

So how can plant engineers overcome this particular difficulty? The answer is, first by taking steam traps seriously and conducting some kind of plant survey and audit, because people often ignore them – a degree of complacency that turns out to be costing steam users far more than many realise. But the second action is to recognise that, as with anything in engineering, the devil is in the detail – and that, in steam traps, what matters is understanding the various types available.

While thermostatic, thermodynamic and mechanical are extensively used, the fixed orifice condensate discharge alternative is now gaining ground. As Bailey puts it: "Instead of utilising a valve mechanism to close off steam for maximum energy and water conservation, the venturi orifice design effectively drains condensate from the steam system. As these traps have no moving parts to wedge open or fail, they provide the ultimate in reliability, necessitating only minimal maintenance and requiring no spares, testing or monitoring equipment."

Summing up, the hard reality is that, if plant managers push maintenance towards the boiler, but then forget about the rest of the steam distribution system – and, incidentally, also the scope for energy-saving condensate recovery, boiler feed water preheating etc – then they are bound to be wasting steam and fuel, as well as perpetuating their part in generating excessive emissions. Extending those thoughts to the wide range of other energy-consuming plant gives us all some clues as to where to start looking to change things for the better. PE

Pointers

- Steam traps are designed to minimise loss of steam
- Choose corrosion resistant types to prevent damaging effects of acidic or oxygen-laden condensate
- Steam trap must function at or near steam temperature since CO_2 dissolves in condensate that has cooled below steam temperature
- They need to operate against actual backpressure build-up in return lines
- They must remain free of dirt collected by condensate as it travels through the distribution piping and on to the boiler
- Particles passing through strainer screens are erosive, so steam traps must be able to function, despite dirt

Efficiency... to chilling effect

A chiller unit utilising a scroll compressor is set to save 15% energy demand, compared with traditional compressor designs, according to air conditioning manufacturer Rhoss. Scroll compressors pressurise the refrigerant between two interleaved spirals or scrolls, resulting in a design with fewer moving parts, less noise and reduced vibration, compared to other compressor types.

Variation of output is conventionally achieved by mechanical means – for instance, by splitting the cooling capacity of the chiller into several circuits. However, by using an ABB variable speed drive to raise the unit's efficiency at part load and improve its seasonally adjusted energy efficiency, Simonetta Lena, product manager at Rhoss. says the company has achieved better performance, with a simple, single circuit design.

The drive matches the compressor speed to the cooling load, so reducing input power. Also, the reduced speed results in lower flow through the condensers, giving the same effect as if the condensers were oversized and further improves efficiency. This delivers up to 15% lower energy consumption overall, compared to standard scroll compressors with on/off control. Variable speed also enables more accurate control of the compressor discharge water temperature, to ±0.5°C.

"The ABB standard drive offers all the features we need in a compact package," says Lena. "The result has been a very innovative and robust chiller. It has been severely tested in our R&D laboratory and we are very pleased with the result."