AECOM

STRENGTHENING RESILIENCE

THREE WAYS TO CUT ENERGY USE

Water companies are hugely dependent on energy to treat water and pump it to and from their customers, costing them a lot of money and potentially impacting on the quality of their services. Head of Process Engineering **Pascal Harper** looks at three ways to make water processes more efficient so that they use less energy as a result.

The water industry is very energy hungry. Remarkably, as much as one per cent of all energy consumed in the UK is used to treat sewage. And that results in big bills for water companies and their customers along with the emission of millions of tonnes of carbon.

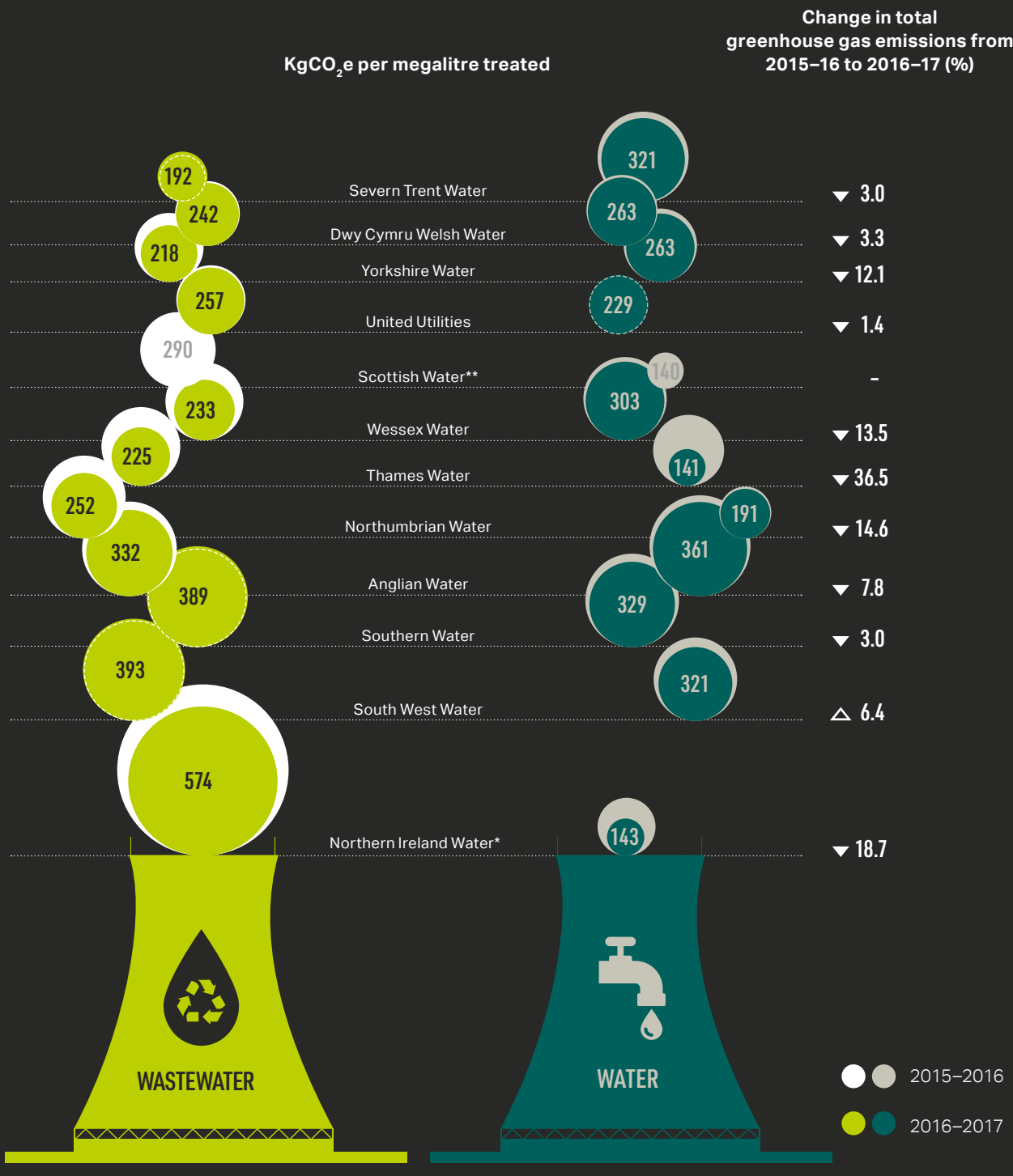
With energy prices in the UK on the rise, this heavy dependence is reducing UK water companies' ability to deliver affordable and reliable services to their customers, having a big impact on their overall resilience by tying up money that could be better spent on improving infrastructure. Many believe that Brexit is likely to exacerbate things too.

Water companies can off-set some of their energy use by making their own energy through renewables or by turning wastewater sludge into biogas to power combined heat and power engines. But these aren't always cost-efficient or realistic options.

1%

of all energy consumed in the UK is used to treat wastewater

OPERATIONAL GREENHOUSE GAS EMISSIONS FOR THE UK WATER INDUSTRY



*Northern Ireland Water Annual Report & Accounts 2016/17
**Scottish Water Sustainability report 2016
***Irish Water use approximately 598GWh of energy per year

Source: discoverwater.co.uk/energy-emissions

To really drive down energy use — and become more resilient to things like energy price hikes and supply interruptions — water companies must look at ways to improve energy efficiency. Here are three innovative ways how.

1/ LEARN FROM OTHER INDUSTRIES' ENERGY EFFICIENCY

For decades, the manufacturing and pharmaceutical industries have been using statistical process control methods, a branch of mathematics, to intelligently measure and monitor their production systems to make them more efficient. It is a transferrable approach.

For example, in the water industry too much dissolved oxygen (DO) in an activated sludge plant can lead to wasteful electricity consumption. However, too little oxygen reduces the quality of effluent produced. This fine balance is difficult to maintain using current water industry control methods as they do not take into account multiple variables such as the concentration of what enters a system, or equipment wear. Through statistical analysis, which AECOM is currently applying within the water industry, it is possible to intelligently manage oxygen levels to break down sewage as efficiently as possible — optimising energy use.

This approach gives stretched operational and maintenance teams the foresight to prioritise and direct their resources toward solving issues before failures occur, avoiding potential regulatory penalties. Water companies can also use statistical control methods to determine average failure rates to inform whole life cost decisions and benchmark equipment, leading to better capital investment risk management decisions— for example, does process equipment brand 'A' cost more in whole life terms because it needs more manual intervention or energy than brand 'B', despite being cheaper to buy? Statistical control can be applied to any control variable, not just DO, including chlorine doses in water networks, pumping station levels and booster pressures in potable mains, to name a few.

"WE'RE HELPING A PAPER MILL DISCHARGE 65% LESS WATER BACK INTO THE ENVIRONMENT.
—

2/ REUSE INDUSTRIAL WATER

By encouraging industrial companies to reuse their effluent water, water companies will have to supply, treat and pump less water, cutting energy use and avoiding the need to upgrade treatment works and networks. We are working with a paper mill to develop a new system that both recovers water and fibre from its main process and reuses treated effluent as water as part of its paper production process. Using this system, the paper mill will discharge less water back into the sewer or environment and reduce supplied water by a massive 65 per cent.

This means industry can avoid treating larger volumes of wastewater to increasingly high standards as required by regulators — a highly energy-intensive process — while continuing to meet discharge consents. The knock-on benefit for water companies is that they too have to treat and supply less water. This provides existing treatment works and networks the extra capacity to cope with future demands such as population growth without having to spend money on costly upgrades.

"BY ENCOURAGING INDUSTRIAL COMPANIES TO REUSE THEIR EFFLUENT WATER, WATER COMPANIES WILL HAVE TO SUPPLY, TREAT AND PUMP LESS WATER, CUTTING ENERGY USE AND AVOIDING THE NEED TO UPGRADE TREATMENT WORKS AND NETWORKS.
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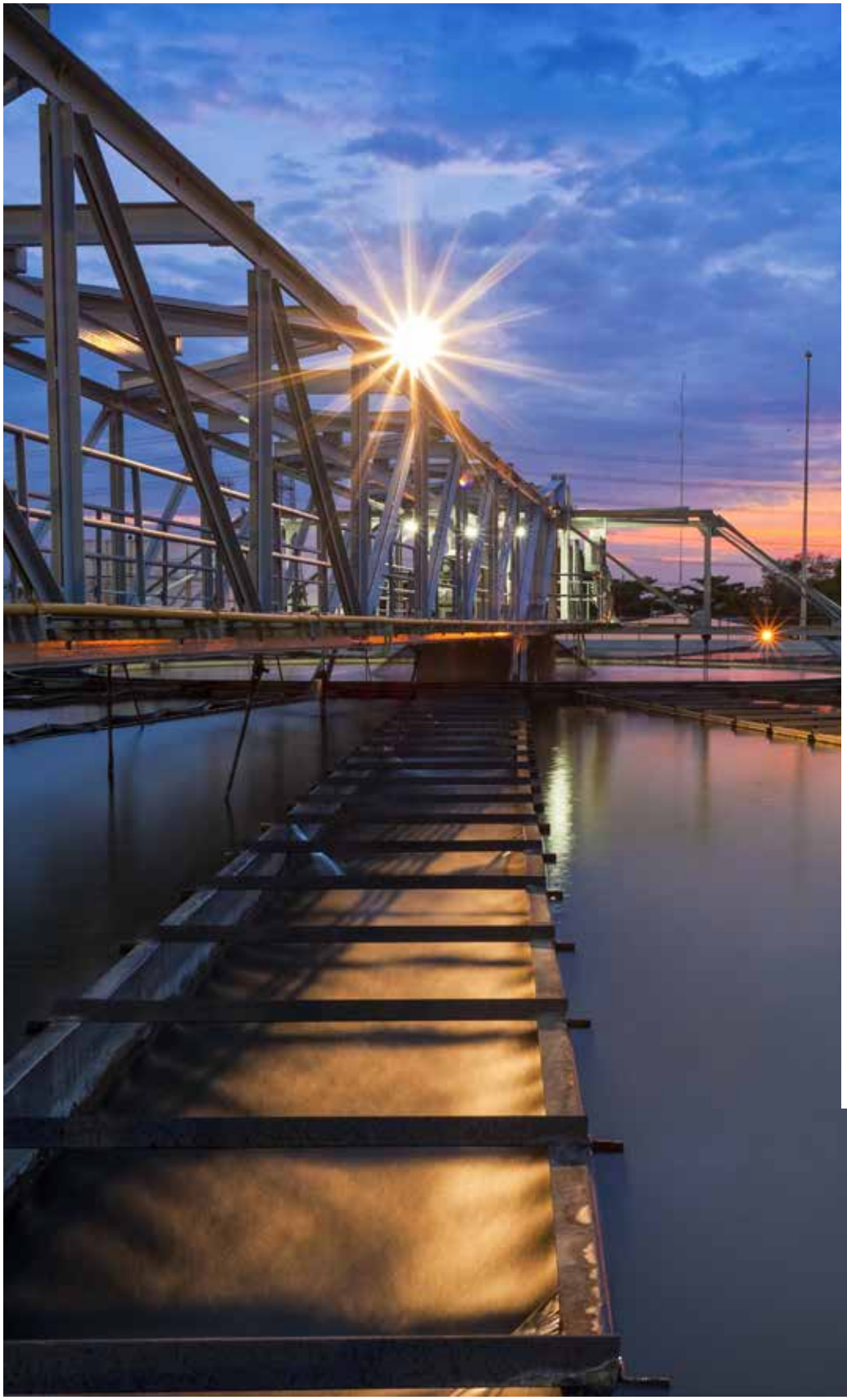

3/ INVEST IN MORE EFFICIENT KIT

Investing in more energy efficient equipment is another way to tackle high energy use. For example, water companies use a lot of electricity to pump air into wastewater, which is needed to treat it. Microbubbles, or miniature gas bubbles, speed up sewage breakdown because they have a large surface-area-to-volume ratio.

In partnership with the University of Sheffield, we are testing a fluidic oscillator device, which rapidly pulses air through conventional wastewater treatment diffusers to generate microbubbles, without using more energy. Fast vibrations caused by the fluidic oscillator 'flick' air bubbles off the diffuser into the water before they increase in size — a key problem for standard systems. The technology can be easily fitted to existing and new-build wastewater treatment plants. While still in development, the results indicate a 50 per cent improvement in the rate of oxygen transfer. This significantly reduces the amount of energy used to breakdown the sewage, drastically cutting costs and carbon emissions. WL

CLICK TO SEE A VIDEO ON WAYS TO CUT ENERGY USE.