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features

PWC warning on huge UK water sector job threat from automation

Consultancy PWC released an assessment of the potential impact of automation on jobs in the UK in March, highlighting a huge threat to the water sector. Overall the assessment found that 30% of jobs may be at high risk of automation by the early 2030s, but for the water, sewage and waste management sector the figure was almost 63%, the highest of all sectors identified in the study.

The assessment was set out in PWC's UK Economic Outlook for March. It reported that around 10.4 million jobs are likely to face a high risk of automation by the early 2030s. Most analysis in the report focused on the largest employment sectors. Of these, transportation and storage is expected to be hardest hit, with 56.4% seen as being at risk, equivalent to 0.95 million workers. For water, sewage and waste, the 62.6% at high risk is equivalent to 0.13 million workers.

Research over recent years has sought to estimate the likely impact of computer-based advances on employment. Findings have differed considerably, with one key study putting 47% of total US employment at high risk, but with another using OECD data putting only around 10% of jobs at high risk. The PWC study aimed to build on both of these pieces of work.

The PWC study reports that, as far as individual workers are concerned, the biggest differentiating factor affecting prospects is education. The risk for those with a standard education ('GCSE', typically studied to the age of 16) was estimated at up to 46%. In comparison, around 12% of those with at least an undergraduate degree face high risk. Most people are educated to a standard between these two categories, and it is this group that represents the highest numbers at risk in real terms.

The figures place the UK below the US and Germany in terms of the proportion of the total jobs at risk. For those countries the figures are 38% and 35%, respectively. The figure for Japan is 21%.

Suez targets industrial growth in acquisition of GE Water with CDPQ

French utility group Suez and Canadian institutional investor CDPQ (Caisse de dépôt et placement de Québec) have announced they are to purchase GE Water & Process Technologies in a €3.2 billion all-cash deal.

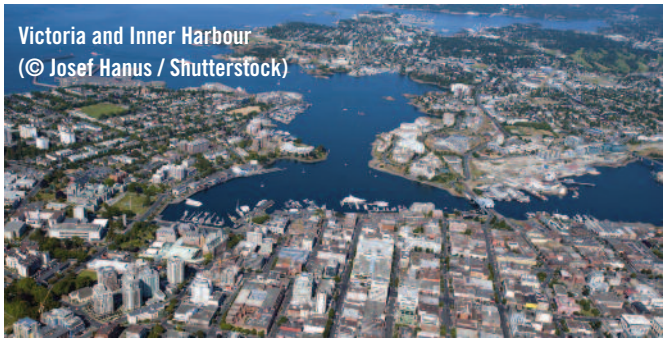
GE Water generated around €2.1 billion in revenues in 2016, and the purchase from General Electric Company will see Suez and CDPQ make the acquisition in a 70:30 joint venture.

In its announcement of the deal, Suez highlighted the greater access to industrial clients that will result, as well as an increased presence in the US and emerging markets, stating that the move will reinforce its position in the €95 billion worldwide industrial water market.

In the statement from Suez, CEO Jean-Louis Chaussade is quoted as saying: 'I am very proud to announce the acquisition of GE Water, which will accelerate the implementation of Suez' strategy by strengthening its position in the promising and fast-growing industrial water market.'

According to Suez, the industrial water market is expected to grow at 5% a year.

Flagship Canadian waste-water projects get underway



Victoria and Inner Harbour (© Josef Hanus / Shutterstock)

A $765 million series of projects are getting underway to deliver a comprehensive set of improvements for wastewater management in the Capital Regional District centred on Victoria, British Columbia, Canada.

Implementation begins this month with the start of a $385 million project for the construction of the redesigned McLoughlin Point Wastewater Treatment Plant in Esquimalt, to the west of downtown Victoria. This will provide tertiary treatment for the wastewater in the core of the region. It is being funded by the federal and British Columbia provincial governments and the CRD and includes a pipeline from Ogden Point, in the port area of Victoria, to the plant and a new marine outfall into the Juan de Fuca Strait.

Two further projects will complete the programme, which is due to be finished by the end of 2020 and is receiving investment totalling around $459 million from the two governments. One of the other projects will provide a sludge residuals treatment facility to produce Class A biosolids. The other will deliver a conveyance system to carry wastewater from the core region to the wastewater plant and residual solids to the residuals treatment facility.

The federal government is providing up to $120 million towards the treatment plant through the Building Canada Fund – Major Infrastructure Component and up to $50 million towards the conveyance system through the Green Infrastructure Fund. The Government of British Columbia is providing up to $248 million towards the three projects. The remaining government input of up to $41 million, towards the residuals facility, is to come from P3 Canada, the national public-private partnership programme, through the P3 Canada Fund.

The federal funding forms part of the government's commitment to an expanded infrastructure plan. Under its budget of last year and subsequent autumn economic statement, it is to provide more than $180 billion in infrastructure over 12 years. It is also to establish the Canada Infrastructure Bank, with a stated aim of 'increasing investment in growth-oriented infrastructure, transforming the way infrastructure is planned, funded and delivered across the country.'

The autumn economic statement added $81 billion to the original infrastructure spend. Of this, $21.9 billion will be spent over 11 years on green infrastructure, including climate-related energy investments, water treatment projects on reserves, and construction of infrastructure to help manage the risk associated with floods and wildfires. The government had announced in its Budget 2016 proposals to address the water needs of First Nations communities, including addressing health and safety concerns, ensuring proper facility operation and maintenance, and ending long-term boil water advisories on reserves by investing an additional $1.8 billion over five years.

US water infrastructure at strong risk of failure

All key types of water infrastructure in the US carry a strong risk of failure, according to the latest assessment by the American Society of Civil Engineers.

In the 2017 edition of its Infrastructure Report Card, the ASCE grades drinking water, dams, inland waterways and levees all at 'D', with wastewater scoring only slightly better at 'D+'. The D grading denotes 'poor, at risk', and the ASCE's explanation of this category states: 'Condition and capacity are of serious concern with strong risk of failure'.

While the grades represent averages for the country, the D grading denotes that infrastructure is in a poor to fair condition and 'mostly below standard, with many elements approaching the end of their service life'. According to ASCE, the grading also means 'a large portion of the system exhibits significant deterioration'.

On drinking water, ASCE notes that the quality remains high, but adds that 'legacy and emerging contaminants continue to require close attention'. It highlights that there are an estimated 240,000 water main breaks a year across the US, wasting over two trillion gallons of treated drinking water.

Investment in wastewater treatment means the condition of this infrastructure is seen as improving. However, ASCE cautions that more than 56 million new users are expected to be connected to centralised wastewater treatment plants over the next 20 years. The cost of meeting current and future demands is put at $261 billion.

In its assessment of dams, ASCE warns that around 15,500 have a high hazard potential - 17% of the 90,580 dams in the country.

Last year ASCE warned that if the country's infrastructure investment gap is not addressed by 2025, the economy would lose almost $4 trillion in GDP and this would resul in a loss of 2.5 million jobs in 2025, according to its report 'Failure to act: closing the infrastructure investment gap for America's economic future'.

ADB estimates doubling of infrastructure needs for Asia

The Asian Development Bank has set out its latest projections of infrastructure investment needs, putting the total need at more than $1.7 trillion per year – double its estimate of 2009.

Investment of $1.5 trillion a year is needed for the region to maintain its growth momentum, a total of more than $22.6 trillion through to 2030. The figure rises to $1.7 trillion a year and a total of more than $26 trillion to 2030 if the costs of climate change mitigation and adaptation are taken into account.

The estimates are set out in the report 'Meeting Asia's Infrastructure Needs'. According to the bank, some 300 million people in the region lack access to safe drinking water, while around 1.5 billion lack access to basic sanitation. It puts water and sanitation costs at $800 billion for the period up to 2030. This compares to $14.7 trillion for power, $8.4 trillion for transport, and $2.3 trillion for telecommunications – all climate-adjusted figures.

According to the bank, regulatory and institutional reforms are needed to make infrastructure more attractive to private investors and generate a pipeline of projects for public-private partnerships (PPPs). It says countries should implement PPP-related reforms.

Global water and sanitation needs in the spotlight

Countries have increased their budgets for water, sanitation and hygiene over recent years but in most cases financing available is not sufficient to meet national targets, according to a United Nations assessment released this month.

The water and sanitation financing gap was also the focus of the Sanitation and Water for All Finance Ministers' Meeting, co-hosted by the World Bank during the 2017 IMF-World Bank Spring Meetings. This represented the first high-level meeting of the Sanitation and Water for All multistakeholder partnership to be held since the launch of the UN Sustainable Development Goals and focused on how to address a gap put at $114 billion a year until 2030.

According to the UN-Water Global Analysis and Assessment of Sanitation and Drinking Water (GLAAS) 2017 report, published by the World Health Organization, countries have increased their water, sanitation and hygiene (WASH) budgets at an annual average rate of 4.9% over the last three years. However, it found that 80% of countries report that WASH financing is still insufficient to meet nationally-defined targets for WASH services.

UK government calls for domestic competition evidence from regulator

The UK government has called on Ofwat to work with it to build the evidence base on extending retail competition for water services to individual households in the draft of its latest strategic guidance to the economic water sector regulator for England and Wales.

The Water Act 2014 created powers for the government to publish a statement setting out strategic priorities and objectives for the independent Ofwat to reflect in the way it regulates.

According to the draft, Ofwat should as a priority challenge the water sector to offer the best long-term value for money in securing resilience. With some 12% of customers said to be struggling with their water bills in 2015/16, a further priority for Ofwat is to challenge the sector to do more to identify and meet the needs of customers facing such difficulties.

Investor change for Thames Water as Macquarie moves out

Australia's Macquarie Group announced in March the sale of its stake in the holding company of the Thames Water, with a consortium of investors from Kuwait and Ontario, Canada taking up the share in what is the UK's largest water company.

Macquarie European Infrastructure Fund 2 (MEIF2) and two other funds managed by Macquarie agreed to the sale of a combined 26.3% interest in Kemble Water Holdings Ltd, the holding company of Thames. According to Macquarie, MEIF2 represents most of the interest and decided on the divestment because the fund is approaching maturity.

The stake is being taken up by OMERS – the Ontario Municipal Employees Retirement System – and Wren House, the infrastructure investment vehicle of the Kuwait Investment Authority sovereign wealth fund. The OMERS investment is through OMERS Private Markets, which brings together two of its investmet divisions – Borealis Infrastructure and OMERS Capital Markets.

Water utilities – what is your energy strategy?

Keith Hayward looks across the water utility energy landscape at some recent developments and technologies.

Introduction

The motivations behind the efforts of an increasing number of water utilities to drive down their energy use vary across the world, covering cuts in overall energy use and in reliance on fossil fuels. One driver is simply the cost of energy, which is coming under increasing scrutiny as utilities look to a greater extent at the whole life costs associated with operating their assets. There are other drivers too.

One of the most ambitious current moves in Europe is being taken by municipal company Aarhus Vand, which serves some 300,000 customers in the Danish city of Aarhus. It is aiming for its Egaa wastewater plant to produce 50% more energy than it uses, as part of a goal for the utility of being energy positive and having a carbon footprint of zero by 2030. The utility set itself this goal after the city as a whole set a target of getting its carbon footprint in balance by 2030. (June 2016, p13)

Meanwhile, in the US, municipal wastewater treatment plants are now referred to as water resource recovery facilities (WRRFs), reflecting a shift in outlook on their role. The Water Environment Federation states on its website that WRRFs can account for 30-40% of total energy consumption for local governments, adding: 'Many WRRFs have begun steering away from their dependency on foreign oil by researching wind, solar, and hydroelectric power, as sustainable solutions are needed quickly.'

Whatever the motivation, it is abundantly clear that there are already huge opportunities for driving down this energy use, with greater opportunities on the way.

Renewable energy sources

Renewables are transforming the energy supply landscape. Like all energy users, water utilities will increasingly have the opportunity to turn to green energy suppliers. They can also exploit renewable technologies directly themselves, as many utilities already do, with the prospect of benefitting from the higher efficiencies and lower costs that are coming thanks to progress with the technologies and larger volume production of components.

Solar

Not only do water utilities need power, they also tend to have space available, making solar photovoltaic electricity generation an appealing option. Impressive roof-mounted installations have for some time been a feature at a number of utilities in the US, for example. Developments in the technology continue to progress, including the emergence of use of new materials such as graphene.

One solar option that has taken off to a considerable extent in Japan, and which is starting to be picked up elsewhere, is the use of floating solar systems. Deployed on a reservoir, these can for example be used to meet the energy needs for pumping. (February 2017, p14-15) Recent projects in Europe have included the 12,000 solar PV panel system for the UK's United Utilities and the 23,000 panel system for Thames Water on the Queen Elizabeth II reservoir near London. The latter is a 6338 kWp (kilowatt-peak) installation. These were provided by Floating Solar UK, a venture involving French company Ciel et Terre, supplier of the Hydrelio system for deploying solar panels.

Japan's lead on the use of floating solar is reflected in the fact that most of Ciel et Terre's installations are located there. A 13,744 kWp installation is due to open at Japan's Yamakura dam in spring next year. Growing use elsewhere includes a large installation due to be completed this year in Pei County, China.

The potential of solar power is perhaps most prominent in the emergence of solar desalination. Sisyan LLC (http://renewabledesalination.com/), working in Baja California Sur, Mexico, notes on its website: 'In the last six years, solar panel prices have dropped 75% to around $0.50 / watt. They are projected by SunEdison to fall under $0.25 / watt by 2030.' The company says that to date its pilot projects have desalinated some 22 million gallons.

Other renewables

Utilities can also make direct use of other green power sources. This includes use of wind turbines and of various forms of hydropower. Together, they can deliver substantial reductions in carbon emissions.

As an example, the Ebswien utility operating the 680,000m^3/day wastewater plant serving Vienna, Austria is currently undertaking an ambitious overhaul of the plant. (February 2016, p19-21) This follows on from a renewable energy project begun in 2006. Measures in this renewables project included installing a Kaplan turbine at the outlet of the treatment plant, producing up to 1.3 million kWh a year. A hydrodynamic screw was added upstream of this, adding around 0.5 million kWh a year. Solar, solar thermal, and wind power systems were added. Together the renewables replaced the traditional sources for 11% of the plant's 63GWh/year power needs.

Renewables can also be used on the water supply side, including exploiting hydropower opportunities in supply networks. For example, where water utilities need to manage the pressure

in their supply networks, they can do so by using pressure reducing valves. These work by dissipating energy. An alternative approach is to use technologies that reduce the pressure and generate electricity at the same time, such as the Difgen system offered by Zeropex (www.zeropex.com/products/difgen/).

Energy-efficient pumping

More than anything else, water utilities are in the business of moving water around, whether that be clean or dirty. That puts pumping right at the heart of what they do, meaning it deserves a special mention in relation to efforts of water utilities to reduce the energy they use.

Recent responses from major pump manufacturers in this respect include Xylem's launch last year (June 2016, p24) of its Flygt Concertor intelligent wastewater pumping system and its Flygt FGC400 wastewater pump controller. The Concertor operates in 2.2 to 7.3 kW pump range and the company claims that savings of up to 70% compared to conventional pumping systems can be achieved. The company also announced last month that the first North American installation of the Concerto intelligent wastewater pumping system had been installed for DC Water in the US.

This gives a hint as to the potential in this area. The launch from Xylem came not long after it published a report on the gains that could be achieved from implementing improved pumping and other mechanical systems. The report, 'Powering the wastewater renaissance: energy efficiency and emissions reduction in wastewater treatment', looked at the gains that could be achieved from using technologies such as high efficiency pumping, variable speed pumping, variable speed blowers, high efficiency mixing, and optimised control systems. The research suggested that emissions associated with electricity use in wastewater treatment could be cut by around half by using readily available high efficiency technologies, and that 95% of these reductions could be achieved at zero or even negative costs. Looked at from a global perspective, the report found this could deliver a total yield of $40 billion in net present yield. (February 2016, p17-18)

Water supply and energy

The preceding aspects of water and energy, covering use of renewables and efficient pumping, are relevant to utility water supply activities. There are other issues of interest too for this side of the sector, not least the very fundamental point that energy use relates directly to water use. In other words, reduction in water use can contribute to a reduction in energy use. The ever-growing pressures on water resources means that water utilities are increasingly turning to demand management measures to reduce the demand for water. So these measures can at the same time contribute to a reduction in the utility's energy needs, and in fact it feeds through also to the wastewater side of the sector in terms of the volume of wastewater arriving at treatment plants. And it is not just about reducing the demand of customers. The high levels of leakage in most water supply networks represent an energy burden in terms of treating and pumping water that does not reach its desired destination. Fixing leaks therefore feeds back to a utility's energy balance.

Another aspect of this picture is that not all of a utility's greenhouse gas emissions stem directly from fossil fuel use. For example, groundwater can contain methane, which is released to the atmosphere following abstraction before the water is supplied. Methane is a more potent greenhouse gas than carbon dioxide, in fact having around 25 times the global warming potential. Dutch water utility Vitens operates one of Europe's largest groundwater treatment plants – Spannenburg. Working with what is now Royal HaskoningDHV, it developed and implemented a methane recovery scheme to reduce its carbon footprint by recovering and partially reusing some 1000 tonnes of methane annually, saving energy equivalent to 1250 homes.

Desalination

Energy requirements clearly also depend upon the demands of whatever treatment process is used. It is very much energy costs that ultimately determine the viability of deploying a particular technology. This has been one of the key issues around the use of membranes, not least their use in desalination.

The solar desalination system of Sisyan, for example, makes use of solar power, but at the same time it brings together energy efficient components on the process side. According to the company, it combines: membrane-based ultrafiltration pretreatment; variable frequency drives; axial piston pumps; axial piston motors; and reverse osmosis.

Research into this water sector quest for energy-efficient desalination continues. One of the latest efforts is the MIDES (microbial desalination for low energy drinking water) research project being funded under the EU's Horizon 2020 programme. Partners of the 48-month project, running from 2016 to 2020, include Aqualia and Fujifilm. It aims to develop the world's largest demonstration of microbial desalination cells (MDCs) as a pretreatment for reverse osmosis, with demonstration sites planned for Chile, Spain and Tunisia. According to the project website, (http://midesh2020.eu), all current reverse osmosis desalination units consume electric energy of at least 3kWh/m^3. MDCs treat wastewater and

generate electricity for desalination at the same time. The site says MDCs can produce approximately 1.8kWh of bioelectricity for each cubic metre of wastewater treated. This can remove the salt in seawater without additional energy input, or reduce the salinity to lower the amount of energy required to complete the desalination process.

Wastewater and energy

As with water supply, the use of renewables and of efficient pumping are both relevant to utility wastewater treatment activities. The wider energy opportunities for wastewater are based very much on the emergence of new treatment technologies and on the heat and energy content of the wastewater itself. This latter aspect is hardly new – the potential to use anaerobic digestion to produce biogas from sewage has a long history in the industry. But there is a minor revolution underway, with a growing number of utilities looking to make their wastewater operations energy neutral or energy positive, and even to use this as a foundation for energy neutrality for the utility as a whole.

The wastewater carbon footprint

For utilities looking at their wastewater activities and energy use as part of their carbon footprint, the picture is more complex than driving down energy use and shifting sources. Much of the carbon within the wastewater is ultimately returned to the atmosphere as carbon dioxide, due for example to the respiration of microorganisms during secondary wastewater treatment. This carbon would have originated from human waste, which in turn originated from food products. The short-term nature of this carbon cycle means this can be seen as a carbon neutral aspect of the footprint. It does nonetheless represent a release of carbon dioxide.

Of greater significance are the releases of nitrous oxide and methane that can occur. Nitrous oxide can be released during biological nutrient removal and has a global warming potential of 300 carbon dioxide equivalents. Methane, which is actively captured during biogas production, is also produced in the sewer and stripped into the atmosphere as the wastewater reaches the treatment plant. Methane has a global warming potential of 25 carbon dioxide equivalents.

These are just some of the complexities around wastewater treatment, which extend right through processing and management of the sewage sludge stream and the resulting sludge biosolids.

Decentralised treatment

There is growing interest in the opportunities for decentralised wastewater treatment. This can be at the property level, or can be at a localised level potentially under the control of a utility. From the perspective of a utility's centralised wastewater plant, decentralised treatment can help mitigate the growing demands placed on the plant's treatment capacity. It also helps in turn to mitigate the energy demands of the centralised plant.

At the same time, part of the growing interest in decentralised treatment systems is based on the emergence of technologies that offer high energy efficiency at small scale, including exploiting the heat and energy in the wastewater.

Sewage and sewer heat recovery

Linked in part to the growing interest in decentralised wastewater treatment, there is also now greater realisation as to the potential of exploiting the heat in wastewater. This can be at the individual property level, recovering heat before the wastewater enters the sewer. But it can also be downstream of that, involving the utility to a greater or lesser extent depending on whether, for example, sewer heat is recovered for use in a district heating scheme, or whether heat recovery is used directly by the utility.

Such recovery of heat does need to be linked to

The 23,000 panel floating solar installation on Thames Water's Queen Elizabeth II reservoir near Heathrow, London (credit: Ciel et Terre)

the overall performance of the treatment plant, since temperature affects plant performance. The more heat is extracted, the lower the wastewater temperature will be, potentially slowing microbiological activity or increasing heating needs. Research in this area, such as that undertaken by Belgian utility Aquafin, has confirmed there can be an overall net benefit, but it also highlighted a need for better understanding of the impact the temperature change has on nitrous oxide emissions, with their far greater global warming potential.

Wastewater treatment

Wastewater treatment is at the heart of the new thinking on water utility energy requirements. On the one hand this means looking to new technologies and to opportunities for far greater efficiency in areas such as pumping and aeration in order to reduce energy needs. It also means looking at the energy that can be extracted from the wastewater, especially through biogas production or from the sludge biosolids.

Energy extraction is not new. Indeed, a 2013 estimate for the UK water industry put the generation of electrical energy from sewage sludge at around 800 GWh/year. What is changing is the shift in expectation as to what can be achieved at wastewater treatment plants. Perhaps above all, it can be seen as a rethink of the use of the activated sludge process, now over 100 years old. This features aeration to drive the microbiological degradation of organic material, sometimes even using stages in which carbon is added to support nitrogen removal. The shift in thinking is to instead optimise the amount of carbon that is retained for biogas production.

There are a growing number of utilities and treatment plants that have made this type of switch. For example, Hamburg Wasser in Germany achieved energy self-suffiency at its main treatment plant in 2011. Meanwhile, VCS Denmark, which serves the Danish city of Odense, achieved energy neutrality by end of 2014.

The water company of the Danish city of Aarhus is another leading example of a utility making strong progress. Prompted in part by the fact that water and wastewater treatment processes account for some 25-40% of the municipality's electricity bill, Aarhus Vand has already upgraded its Marselisborg plant. It has reported that for 2016 the plant produced 40% more electricity than it required, as well as 2.5 GW of heat for the local district heating system.

Aarhus Vand has now turned its attention to its Egaa plant, where a project is being implemented with the aim of shifting from a 2.9 GWh a year power requirement to the production of 50% more electricity than the plant uses. (June 2016, p13)

The overall aim for the Egaa plant is to optimise the carbon expended during treatment of the wastewater and the amount of carbon passed to the digestion stage for biogas production. The original plant did not have primary treatment. Instead, a microfiltration carbon harvesting step is being added, using filters from Norwegian company Salsnes Filter to remove approximately 60% of COD at the inlet. This will use polymer dosing. According to the utility, ferric chloride could have been used and removed an expected 70-80%, but this would leave insufficient organic

Construction progress at the Egaa wastewater treatment plant, Denmark, implementing ambitious energy improvements (credit: Aarhusvand)

matter to achieve denitrification for nitrogen removal in the second stage of treatment. The secondary treatment stage will feature the EssDe (Energy Self Sufficient) process of Demon, provided under licence by Sweco. This process uses anammox (anaerobic ammonia oxidation) bacteria for nitrogen removal, with the Egaa installation requiring it to operate as a cold anammox process in the Danish climate. Egaa will also include a new anaerobic digestion plant, with a CHP plant and Organic Rankine Cycle unit, and a Demon plant to treat digestate and feed back anammox bacteria.

This Danish expertise has been picked up in the US, where there is an established interest in wastewater plant energy efficiency. Danish companies AVK, Danfoss, DHI, Landia, LINAK, Nissen Energiteknik, Stjernholm and Grundfos have formed an alliance called Water Technology Alliance Chicago. This is leading a project to upgrade the Glenbard wastewater treatment plant in Chicago and will deliver a demonstration plant due to be completed in 2019. The project aims to combine improved wastewater treatment with substantial reductions in energy consumption. (December 2016, p21)

The Chicago project will also incorporate the use of an ESCO energy services company financing concept. This allows the utility to implement the upgrade and then pay the technology provider for it through the energy savings made. The potential of such an approach to accelerate deployment of energy efficiency measures was highlighted by Al Cho, Xylem VP Strategy and Business Development, speaking to Aqua Strategy about the water sector energy efficiency opportunity. (February 2016, p15-16)

The Austrian capital, Vienna, provides another leading European of utility wastewater energy ambitions. (February 2016, p19-21) Following on from the renewables project at its Simmering plant, utility Ebswien is part-way through a €250 million overhaul. The 'E_OS – Energy_Optimisation Sludge Treatment' scheme, which is due to be completed by the end of 2020, aims to reduce carbon dioxide emissions by 40,000 tonnes / year while providing biological nutrient removal at the 680,000m^3/day dry weather flow plant. The existing primary sedimentation and first biological step are being replaced. A whole new sludge treatment system featuring six 30m high digesters is being constructed. A co-generation plant will use the 20 million cubic metres of methane produced a year to generate 78GWh of electricity and 82GWh of heat, generating all the energy the plant requires for wastewater treatment.

Treatment processes

Many improved treatment process can potentially contribute to this transformation of the wastewater plant energy balance. These include technologies to improve the delivery of oxygen during secondary treatment, as is the case with membrane aerated biofilm reactors (MABR). This technology uses membranes to deliver oxygen by diffusion, cutting the energy requirements for oxygen delivery. For example, GE (Suez) states that its ZeeLung (www.gewater.com/products/zeelung delivers 'a four times reduction in energy compared to conventional fine bubble aeration systems in use today'. Other suppliers of MABR technology include Emfcy (www.emefcy.com/solutions/?a=turn-key-wastewater-treatment/) and Irish company OxyMem (www.oxymem.com/oxymem-mabr/) the latter claiming similar efficiency gains.

They include technologies that bring a more fundamental change in approach to treatment, such as the Nereda process, which is based on developing a fast settling granular sludge. (www.royalhaskoningdhv.com/en-gb/nereda/). Royal HaskoningDHV states that Nereda delivers a 50% saving on energy costs. Recent developments for Nereda include the announcements this month that Hach is to be a preferred technology supplier for the process, and that the first Nereda plant in Australia has opened.

They also include technologies to improve sludge processing and biogas production, including the use of thermal hydrolysis, such as the Cambi Thermal Hydrolysis Process. Clearly the need for any additional treatment can impact energy demands, such as the use of advanced oxidation technologies for micropollutant removal. And the treatment energy equation extends through to thermal treatment for sludge solids processing.

Other contributions to energy efficiency

Possible actions to improve a water utility's energy profile don't end there. There are others, both in terms of the equipment and technologies that can be applied and the strategies and frameworks that can be used to approach the whole area of energy.

Data and control

The water sector is catching on to the potential of 'big data' to support smarter, data-driven operations and decision making. This links with progress in sensing, communications and modelling technologies, all of which stand to contribute to energy improvements.

As an example, utility Aqualia has been undertaking a pilot project at its Lleida wastewater plant. (June 2016, p25) Israel-based IBM Research has implemented machine learning algorithms at the plant as part of the IT giant's First-of-a-Kind programme. Results released last year revealed a 13.5% cut in electricity use alongside a number of treatment improvements, through the system delivering recommendations every two hours to the plant operators.

This interest in energy is being reflected in the functionality that can now be incorporated into wastewater simulators. For example Canadian company EnviroSim Associates added energy use functionality and user enhancements to its BioWin software. (April 2016, p27) BioWin 5.0, launched in February of last year, allows users to calculate power requirements and track energy requirements, covering blowers, mixing, pumping, heating, and surface aeration. The new functions included the possibility to generate power / energy use plots automatically and to track the power required to pump various flows taking account of factors such as pipe material. It allows, for example, exploration of onsite CHP engine power generation and heat recovery options.

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Management frameworks

The interest in energy means management systems can take account of it in, for example, triple bottom line reporting or whole life cost investment planning. Management tools such as energy audits can be used, with developments in this area including the testing of a new European sewage plant energy audit method as part of the ENERWATER research project. (August 2016, p25) This area extends to the ISO 50001 Energy Management System.

The water sector has also been accumulating and sharing its experiences on energy management, especially in the US. For example, the results of a survey carried out by the Water Environment Research Foundation (now the Water Environment & Reuse Foundation) and funded by the New York State Energy Research and Development Authority highlighted the lessons drawn from five utilities, in Melbourne, Philadelphia, Los Angeles County, Johnson County, and Ithaca / Dryden, New York, who had each achieved 21-75% energy neutrality. (April 2016, p31)

These five had each taken a lead as energy neutrality champions in their wastewater treatment activities. Success requires the input of staff and managers, as well as external stakeholders such as governing boards. In terms of technical approach, the survey identified the benefits of using co-digestion. More broadly, it recommended that utilities seek to gain support from communities and politicians by spreading a message of 'green renewable energy'. It also highlighted that the chances of success are greatly influenced by having a clear energy plan with goals, collaborating to get expertise, and being aware of costs and exploring funding opportunities.

Conclusion – the urgency for action on carbon emissions

One of the biggest challenges utilities face is the need to balance energy with other priorities. Wastewater treatment plants, for example, need to meet their water quality targets, or respond to other emerging needs, such as the potential for water reuse or nutrient recovery. There may also be long-term questions around the role that wastewater plants should play. For example, Denmark has made massive progress with renewables, especially wind power, which alone supplied over 40% of the country's electricity production in 2014. As this transformation progresses, should the carbon in wastewater instead be used as a feedstock for bioplastics production? In the meantime, and for most countries, there is a pressing need to curb carbon emissions, and there is clearly scope for the water sector to makes its contribution in this respect.

Innovating to seize the wastewater treatment aeration opportunity

UK-based company Bactest is now seeing early deployments of its innovative technology for optimising wastewater treatment plant aeration. **Keith Hayward** spoke with CEO **Annie Brooking** about her approach to building the company.

Bactest CEO Annie Brooking

'Where microbiology meets computer science' is how Annie Brooking sums up her company, Bactest. 'We measure the respiration rate of bacteria – that's what the core technology is able to do,' she adds. 'We take that respiration rate and then do interesting things with it, that makes for useful business products.'

One of those products is Shepherd, so named because, like a shepherd tending sheep, it manages the floc – it provides a way to monitor and help manage microbiological growth in wastewater treatment. It measures respiration in the aerobic treatment stage and provides a means to optimise aeration and deliver other benefits, such as monitoring for toxic loads entering the plant. Shepherd is currently being used by a number of water utilities around the world.

This innovation is the latest step in the evolution of an idea rooted in the founding of the company in 2001. 'The original idea was to build a mobile septicaemia test,' says Brooking. 'I've been the CEO of a medical devices company for a number of years and know how difficult it is to bring a medical device to market.'

Brooking became involved with the company in 2009 and saw the potential to use the technology platform in other markets. 'I liked the idea of what they were trying to do, but didn't really like the focus on the market too much,' she says. 'What we did is we went for unregulated opportunities in markets such as water and food testing.'

The result was a product known as Speedy Breedy, in this case named because of the way it grows test microorganisms and provides results rapidly compared to traditional laboratory methods. This came to market in 2013, offering users in sectors such as manufacturing, food and drink, and healthcare a range of tests to detect and quantify the presence of various microorganisms of concern.

The aeration opportunity

In 2011 the company managed to attract investment from the Low Carbon Innovation Fund. 'The reason they came in as the cornerstone investor was that we had an idea for a second product, using the same technology platform, that would be able to recommend the minimum safe aeration in wastewater treatment plant activated sludge lanes,' says Brooking.

This product, Shepherd, essentially monitors the microbial respiration rate, checking whether there is enough oxygen and food source present, and whether bacteria are dying because of a toxic load reaching the plant. 'We've got some very clever intellectual property around all this business of measuring respiration rates of bacteria,' adds Brooking.

The core proposition is that Shepherd uses the respiration of the microorganisms in the treatment process as a basis for making rapid and accurate adjustments of the aeration, resulting in energy savings. 'Typically, Shepherd pays for itself in less than twelve months, which is really rather revolutionary in the water industry,' says Brooking. In fact it can be much faster. 'We have had instances where the data has indicated that Shepherd would have paid for itself in eleven weeks on one site. On another site it would have paid for itself in four months,' she adds.

Currently there are Shepherd installations with Anglian Water, Thames Water and Scottish Water in the UK. Another was commissioned recently for Aqualia in Almeria in southern Spain. Also, a first system has been shipped to China through Bactest's distributor there, and the company has sold its first industrial

Bactest's Shepherd system (credit Bactest)

system, to Kimberly-Clark. 'Because Shepherd is so new, the water companies are looking at it to see whether or not Shepherd can do what we are promising,' says Brooking. 'We are promising that on sites of 100,000 population equivalents, there is a very fast return on investment,' she continues, adding: 'We are in fact offering free three-month trials that will prove that Shepherd really can pay for itself very quickly.'

Building business models

Bactest currently employs around 12 people, broadly comprising two mixed teams of computing and microbiology specialists, one focused on Speedy Breedy, the other on Shepherd. Both products are on sale, along with a third product, Speedy Breedy Seasure, which is used in the shipping industry to test the effectiveness of ballast water treatment systems. 'We're post-revenue, but we are pre-profit making at this point in time,' says Brooking.

'The good thing about all three of these products is that they are highly innovative and very disruptive,' says Brooking. 'The bad thing about these three products is that they are highly innovative and highly disruptive,' she adds. The challenge is therefore one of getting the products accepted and converting this acceptance into sales.

Brooking explains that all of the products are sold through distributors, in order to achieve market reach. Speedy Breedy is advanced in this respect, with 50-60 distributors in place around the world. These are non-exclusive agreements, with

The Shepherd unit and sensor head (credit Bactest)

different distributors tending to work in different sectors. 'They tend to have their specific markets that they look at,' says Brooking. Speedy Breedy, which she says is 'a complete laboratory in a box, about the size of a loaf of bread', sell for £3500. These are used along with consumable culture vessels, each pre-populated with different growth media depending upon the organisms that are being tested for. The culture vessels cost from £7.50 to around £10 each.

Shepherd units, on the other hand, sell for £40,000. The technology can be used both in municipal wastewater treatment plants and in industrial plants handling trade effluents. 'The trade effluent customers are different – very different – from the municipals,' says Brooking. Municipal utilities exist to treat wastewater, whereas for industries the wastewater treatment is secondary to whatever product it is they are producing. 'It's a necessary evil as a part of the manufacturing process, and so they think quite differently,' she adds.

'I've got a two-track strategy for sales with municipals and trade effluents,' says Brooking, adding: 'Clearly the municipals are slower to adopt new technologies than I guess we would all like.'

This hints at the challenge that technology companies face in getting their innovations into the municipal sector at a pace which allows them to sustain and grow their businesses. Bactest's cause in this respect is being helped by its relationship with Anglian Water. 'We are in fact across the road from the [Anglian Water] Cambridge wastewater site, which is quite a big site, and so we have several systems over there,' says Brooking. 'They've been extremely helpful. I doubt if we could have got as far as we have, as quickly as we have, without that relationship. It's very important for us.'

The Shepherd business model also includes providing software for dashboard-based data management. 'The idea in the water industry of having software as a service is very new,' says Brooking. This will provide revenue beyond the initial sale of the unit. 'We have two on-going revenue streams for Shepherd: one is software upgrades and support; the other is a Cloud-based management system, because of course we keep their data and that gets bigger and bigger,' she adds. 'I decided that we would give [customers] the dashboard in the first year as part of the package, rather than trying to sell it to them, because that business model is very new.'

Prospects and priorities

In Shepherd, Bactest is offering a tool for local management of treatment plants. This can include sending automatic emailed warnings to operators and to managers. 'The other major benefit that Shepherd has is that it's able to give an early warning on a toxic event, so that [operators] can take action to stop a plant from going down,' says Brooking. It provides insight based on the biological processes taking place. 'The customer gets a huge amount of knowledge about what's going on in the plant that they just didn't have access to before,' she adds.

'We do very comprehensive site surveys before we sell and install, so we won't sell Shepherd somewhere where we know it's not going to pay for itself quickly,' says Brooking. As an example, some sites do not have the capability to vary aeration. 'Then there really isn't any point buying a Shepherd,' she adds.

Growing interest in reducing energy use in the water industry suggests there is a general opportunity for Shepherd. 'Electricity is obviously priced differently in different countries. In some countries, electricity is very, very cheap, like in the Middle East, for example,' says Brooking. 'It's harder to prove a fast return on investment than it is in some other countries,' she adds, referring to the UK and Scandinavia as examples. 'I think the key there is to prioritise the markets based on the cost of electricity.'

'The key task ahead of us is to run trials in various different parts of the globe that prove that Shepherd can pay for itself in a very, very short period of time, and to set up a distribution channel in different countries,' she says, noting that in the case of the latter point this is likely to mean distributors already selling other equipment, such as aeration systems. 'They can add Shepherd to their portfolio to give the customer even more savings than they would have by optimising aeration,' she adds.

More information: www.bactest.com

Seville, very different to Manchester, where the activated sludge process was invented (© LucVi / Shutterstock)

Capturing the spirit of innovation in the water sector

New and improved technologies are all around in the water sector. Translating these into better end results for utilities and other end-users is another matter. **Keith Hayward** looks at a selection of the different approaches that are being taken to deliver innovation in water.

There are any number of drivers, opportunities and motivations for innovation in the water sector. Hard requirements such as tougher legislation can mean that change is needed. Commercial solutions providers push for new approaches to be taken up in order to build their businesses. Utilities may be looking to improve the service they deliver within limited budget constraints. Whatever the reason, innovation is a theme that resounds with the water sector – not least because of the extent to which it remains elusive.

There can be some very fundamental issues that call out for innovation. Take Scottish Water, the public utility serving some five million people in Scotland. George Ponton is Head of Research and Innovation with the utility. He explains that the customers and the asset base are spread across a wide area ranging from cities to remote islands. Alongside this, the utility has a universal service and universal price model. 'In terms of asset base, 90% of the population is served by 10% of the assets in water and wastewater, which leaves an awful lot of assets providing water and wastewater services to very small communities,' he says. This presents big challenges in terms of cost and of availability of staff. 'There are some big drivers there for innovation,' he adds.

Local conditions can also frame the need for a new approach. For example, the activated sludge process has endured as a basis for treating wastewater since its invention more than 100 years ago. Frank Rogalla is R&D manager with FCC Aqualia, which provides water and wastewater services to around 25 million people in approximately 20 countries around the world, mainly Spain. 'The activated sludge process was invented in Manchester 100 years ago in a wet climate far away from Spain. What does it have to do with the south of Andalucia, where there is a dry climate and very different conditions?' he asks. His research efforts are very much focused on trying to identify 'gamechangers', he says. 'We try to adapt the technology and reinvent it for those new conditions.' This can mean Spain, or other countries such as Mexico or those in north Africa where the company works. 'Technologies invented in northern Europe do not always have an efficient application,' he adds.

Action on innovation

Just as there are drivers, opportunities and motivations for innovation in the water sector, so too are there barriers or blockages that seem to resist the

Isle of Skye, Scotland. 90% of Scottish Water's assets serve 10% of Scotland's population (© Nataliya Hora / Shutterstock)

moves in this direction. The water industry is seen as being conservative, partly because of the overriding need to protect public health. Often there are simply engrained traditional practices that may make it harder for innovative approaches to break through. For example, Rogalla notes that often detailed descriptions are set in the tendering processes for treatment plant projects, preventing alternative approaches from being considered. 'If you don't meet specifications, you cannot compete to offer the plant,' he says. In fact, contracts can effectively discourage innovation. 'Some of our contracts pay us according to the energy we consume, so the more we consume, the more money we make,' adds Rogalla.

Despite all of this, there are a growing number of actions aimed at overcoming such barriers and encouraging innovation.

Singapore-based Sembcorp, for example, works mainly in Asia, including China, with its water activities focused in particular on industrial wastewater treatment plants. 'We are going to set up a water hub in Nanjing, Jiangsu Province in China,' says Siah Keng Boon, who heads the company's R&D effort.

'As a commercial company, we have limited resources, so we need to prioritise what we want to do from the company perspective,' he says. 'A lot of the solutions that come and knock at our door are trying to look for problems,' he explains. The random nature of such approaches and a frequent lack of capacity on the side of the technology supplier to support further evaluation makes it difficult to evaluate many opportunities, says Siah.

The approach for China will be to adopt a 'living lab concept', says Siah. A central aspect of this is that Sembcorp will work to define and prioritise a number of core problem statements. It will work with the local government to confirm regulatory requirements and the compliance needs for the coming few years. Sembcorp will then seek technologies to meet these needs, and will provide test-bedding opportunities either at its own or government-related plants to help commercialise the technologies.

'Under this living lab concept, we will provide the problem statement, and then we will provide engineering support, because most of the technologies are not fully-fledged,' says Siah. 'We are able to provide the process know-how to assist the technology company to translate their technology into actual plant running.'

Sembcorp stands to benefit from the deployment of technologies that will help its own plant operation business. 'By doing this risk-sharing together, we are able to co-share the saving for additional turnover in the near future,' says Siah. 'Also in our organisation, we are developing a corporate venture to be a strategic partner to bring the technology to a commercial level,' he adds.

This approach of Sembcorp highlights one of the common themes around innovation: the need for clarity on the actual problem that the end-user faces and which needs to be solved.

Technology suppliers need to be more aware of what end-users want. 'In terms of understanding needs, I would say it is a bit of a mixed bag amongst technology companies,' comments Scottish Water's Ponton. 'There are some good examples out there of companies who come to us with early ideas and are a bit more open to what is the need and what is the application,' he says. He mentions, for example, treatment technology company Arvia Technology. 'They have been very open to what is the application of their technology into our specific needs, which is perhaps different from where they initially thought that the technology had an opportunity,' he says, adding: 'It has been refreshing to work with these kinds of companies, as they are a bit more agile and a bit more open to addressing the specific application.'

This need for responsiveness to end-user needs applies to technology suppliers of all sizes. Carlos Montero is Chief Technology Officer of Suez Water Europe. He says that the company has defined four strategic pillars for Spain: digital, sustainability, social, and innovation. On innovation, he says that the usual approach for the company has been to get many experts together and to debate and discuss priorities. 'This time we decided to do it differently. We did something that is very simple – asking our customers,' he says. This meant getting together representatives from sectors such as oil and gas, mining, agriculture, and municipalities and urban areas. 'We learned new things,' he says. The input helped Suez to shape, map out and prioritise from some 230 potential solutions.

Equally, utilities have an important role to play in ensuring that technology providers can better target the end-user needs. 'In terms of articulating the need, certainly the UK industry could be better,' says Ponton. He sees that part of the problem stems from utilities wanting to be seen to be fully in control in the eyes of the sector's regulators and other stakeholders. 'When it actually

comes to admitting what we need help with, we are not perhaps as good at that as we should be,' he says.

Sembcorp's approach for China also highlights the importance of test installations and early full scale applications in technologies gaining acceptance. Likewise, Rogalla notes the importance of Aqualia's wide network in exploring the potential of new approaches. 'Our model for innovation is a very open model,' he says. 'We only have in our team of R&D 30 people. We rely on the 7000 others to implement many of the projects.'

'That is the mechanism we use, and then systematically we try to find opportunities,' says Rogalla. 'We have a large array of technologies, [and] a large array of suppliers and partners that we work with.' Bactest, IBM, TaKaDu and BluewaterBio are companies that he mentions. The company also has '500 playgrounds' – the treatment plants it operates. 'Each treatment plant is an opportunity to put in a new technology,' he adds.

Rogalla also highlights the substantial amount of support that can be obtained through European Union funding, alongside the significant support the company receives in Spain from the national and regional governments. 'We participate in many, many research programmes,' he says. He notes the role of the EU's LIFE programme in supporting emerging technologies. 'LIFE is a fund that allows demonstration units, not only research, but to test and prove your technologies.'

Of course the operational performance of plants has to be maintained – an issue that Scottish Water's Ponton flags up. Plant operators do not want to see their discharge compliance threatened by new technologies. 'We have created a couple of test sites,' he says. Supported with some funding from the Scottish government, the utility has a water treatment plant that allows testing off-grid and a wastewater site.

Exciting opportunities ahead

The technologies that are emerging certainly hold exciting promise. The 'gamechangers' that Aqualia's Rogalla refers to include work to transform the efficiency of desalination. 'Right now we have a big Horizon 2020 project on reinventing desalination, trying to lower the energy cost by a factor of ten,' he says. On wastewater, the company is working on creating energy positive wastewater treatment plants that produce biogas to be used as a vehicle fuel.

Meanwhile, Scottish Water's challenge of serving small, remote populations is driving a search focused on the concept of sustainable rural communities. 'What is the opportunity for these communities to have water, waste and energy services in some form of integrated, closed loop model?' asks Ponton. There should be an opportunity to bring together technologies, approaches and business models to try to do this, he says, and this is something the Scottish government supports. 'There doesn't seem to be a lot of technology development in that space,' he notes.

The challenge for initiatives being taken around the world is to unlock the potential and deliver on these opportunities.

Article based on comments made during the 6th World Water-Tech Innovation Summit, London, 20-22 February 2017.

How to navigate the digital water maze

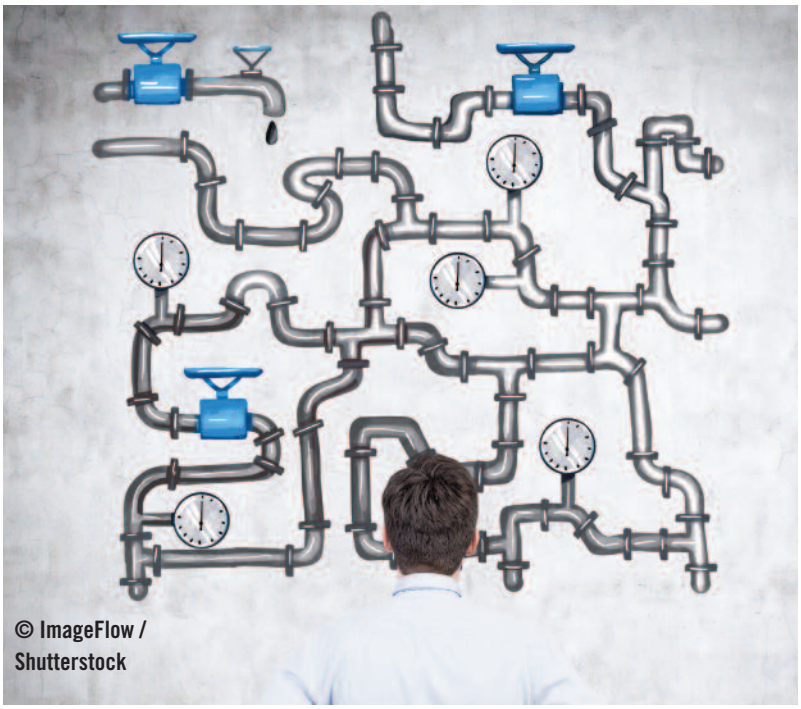
What do leading water utilities and providers of services and technologies recommend in order to steer a path through the maze of digital options and opportunities? **Keith Hayward** heard some suggestions.

1: Destination data

'Of course water is essential to life, but I would like it that we also start thinking about data becoming an extremely valuable resource for utilities,' says Naji Najjar, Global Water Segment Sales Leader at IT giant IBM. In fact, he sees that data will be of such fundamental importance to water utilities that they need to embrace this as part of their identities. 'There is a need for water utilities to drive towards what I consider is going to become like a digital utility,' he says. 'A digital utility has a completely different set of characteristics to the current utilities that exist now. Of course the infrastructure is going to be there, operational skills are going to be there, [but] there is a need for a different set of skills.'

2: A search for truth

Water utilities already generate data, producing it in different amounts and in differing qualities within the various activities across their organisation. Many have also invested in sometimes expensive IT infrastructure. But IBM's Naji Najjar notes that water utility executives generally face the same issues. 'They don't have a single view of truth in their organisation. There are black spots. There are different silos within their organisation,' he says. 'What we push actively is a fundamental first step to get a holistic, 360 degree view, which I call the situation awareness, taking all the data that the company has from the different systems,' he explains. 'This work is challenging… but it is feasible, it is being done. Some utilities have already done that.'



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3: Data for decisions

But why put such an emphasis on data? 'I think a lot of time when we discuss this data-driven, real-time, online, big data, we often lose our way in all this confusion of data analytics and all these kinds of things,' says Pernille Ingildsen, Chief of Projects and Planning at the Kalundborg Forsyning utility in Denmark. Her point is that this is not about data for the sake of data but about achieving certain outcomes. It is about utilities making smarter decisions, and she has captured this idea using the acronym MAD in a book published with co-author Professor Gustaf Olsson. 'We had a very simple framework that we called the MAD principle – you have to measure, you have to analyse, and you have to decide,' she says. 'To make smart interesting, you have to have all three components. If you just measure then you get a lot of data and its not helping anybody. If you make a lot of analysis but you do not act on it, it's not really interesting. So you really have to close the loop all the time and decide.'

4: A dose of realism

Francisco Cubillo is Deputy Director, Development & Innovation for the highly respected Spanish utility Canal de Isabel II, which serves some 160 municipalities. 'Always we have to rely on technology and data,' he says. He notes a paradox in the reality that utilities face. 'We have kind of a permanent gap between technologies and available useful data… We have technologies able to make very powerful analysis, and we have to use the current data that were not defined thinking of this technology,' he continues.

As an example, Cubillo considers the challenges of implementing an asset management plan. Age and deterioration are key factors for preparing a plan for replacing assets such as valves. Deterioration is influenced by the biofilm growth that is affected by local factors. Also, if one aim is to address bursts, this brings in a need to think not just of the likelihood of a burst occurring but to consider also the likely impact. 'We have the concept… but we don't have enough data in our network to be able to make this investment [decision],' he says. He points out that he is optimistic about the potential to exploit data, but sees it is important to understand the accuracy and certainty that can be achieved. 'Be sure what you are able to reach – don't create expectation that the technology or the current data are not able to provide,' he adds.

5: The data business

The emphasis on data brings a change in the way a utility views its instrumentation. Seth Vance, Global Business Unit Director – Software at instrumentation company Hach, notes that utilities often have concerns around up-front investment needs, and also face a challenge in keeping up with the latest technologies. He mentions that Hach has a line of flowmeters for which it has begun supplying data as a service. 'I think it helps allay some of these concerns,' he says.

This approach works for the supplier too. 'I also think it helps us as a business to be able to continue to invest in what we are doing. If we continue to see that revenue stream coming in, we can say, great, we are going to continue to invest in this idea,' he says, adding: 'It turns out to be a virtuous cycle for both the utility and the supplier.'

6: Open your eyes to the opportunities

Armed with this outlook, explore the opportunities that the data revolution is opening up. The growing business of Fathom, for example, is built on leveraging data and CEO Trevor Hill is a prominent advocate for digital opportunities. Picking up on Ingildsen's MAD measure-analyse-decide acronym, Hill sums up metering in the US, for example, as currently at around 10% for M, and 'basically zero on A and D'. He points also to the potential for use of IoT, pressure, temperature, and quantitative sensors in the distribution system, none of which have progressed very far either. 'One of the things we are working on right now is using billing and time of use algorithms to modulate pressure in distribution systems, which goes immediately to power savings,' he says, concluding: 'I think there is tremendous opportunity there.'

Article based on comments made during the 6th World Water-Tech Innovation Summit, London, 20-22 February 2017.

Singapore to validate smart shower water reductions

Singapore's national water agency, PUB, is to implement a smart shower demonstration project intending to confirm the reductions in water use that can be achieved by providing consumers with real-time information on their water use. To this end, it has launched a request for proposals to supply smart shower devices in a move aimed at helping push down the unit cost of producing such devices.

PUB's Smart Shower Programme demonstration project is due to begin in the first quarter of 2018. The utility says it plans to install smart shower devices in 10,000 new homes over the coming few years and to validate their effect on conserving water during showers.

According to PUB, a behaviour study it carried out with the National University of Singapore from July 2015 to March 2016 showed that households can save around five litres of water per person per day where smart shower devices provide real-time information while residents take their showers. It therefore sees that the successful use of such devices can potentially help households save approximately 3% of their monthly water bill.

The request for proposals aims to bring economies of scale to the production of smart shower devices. PUB says that it is also hoping to identify innovative ideas from the industry to improve the features of smart shower devices currently available. It says this includes exploring alternative ways of providing real time feedback on water consumption during showers, to achieve the intended reduction in water consumption. PUB says that it is also interested in innovations such as compatibility with other smart devices such as smart phones, tablets and laptops, in order to allow users to download data so that they can monitor their progress.

'Showering typically comprises 29% of a household's monthly water consumption. There is great potential to achieve substantial savings if we can change the user's behaviour during his/her shower time,' said Mr Michael Toh, PUB's Director of Water Supply (Network).

Further successes for TaKaDu

Israeli smart water network monitoring company TaKaDu has announced two developments in its continued growth – its first contract in the US, and a partnership with pump solutions company Grundfos to accelerate use of big data.

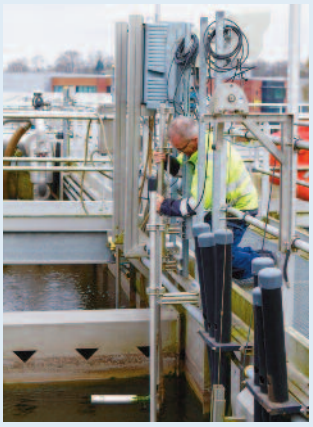
The US contract is with Knoxville Utilities Board, Tennessee, which serves Knoxville and part of surrounding counties in the East Tennessee Valley. KUB has implemented district metered areas across its network and added sensors and meters for flow and pressure monitoring. TaKaDu's cloud-based software-as-a-service, in a project being implemented by distributor Matchpoint, will provide a means of transforming the volumes of sensor data into near real-time analysis and alerts for network incidents.

The partnership with Grundfos is a move 'set to ramp up the companies' capabilities within digital water management systems', according to a joint statement by the companies. It builds on their work together on a joint pilot project at Danish water utility Frederikshavn Forsyning. The companies also state that 'future digital offerings leveraged by this partnership can help water utilities on a global scale to fulfil new operational targets for saving energy and water, as well as managing water network assets in the most economical way.

Royal HaskoningDHV and Hach collaborate on Nereda wastewater treatment

Netherlands-based consultancy Royal HaskoningDHV and US instrumentation company Hach have entered a preferred supplier agreement relating to the Nereda wastewater treatment process.

Nereda is an aerobic biological wastewater treatment process based on the formation of a granular biomass. Under the agreement, the companies will collaborate to have Hach's analytical instrumentation certified to test the quality of water treated with Nereda. They will also work together to improve the applicability of Hach instrumentation to Nereda-specific conditions and to contribute to the continuous improvement of the performance of the Nereda process.



Nereda installation in Epe, the Netherlands, with Hach instrumentation

According to the companies, Hach will deliver accurate and reliable analytics solutions supported by its innovative Prognosys predictive diagnostic system. Royal HaskoningDHV will actively support this process by providing technical know-how, performance data and access to its Nereda development and innovation facilities.

The Nereda process was invented by the Delft University of Technology in the Netherlands and developed in a public-private partnership between the University, the Dutch Foundation for Applied Water Research (STOWA), the Dutch Water Authorities, and Royal HaskoningDHV. There are currently 18 plants in operation around the world, with another 20 under construction or design.

Pure and Xylem collaborate in emerging markets

Xylem and Canadian pipeline assessment company Pure Technologies have announced an agreement under which Xylem will represent Pure's products and services to the water sector in the emerging markets of the Gulf Cooperation Council countries (UAE, Saudi Arabia, Qatar, Bahrain, Kuwait and Oman), India, Singapore and Malaysia.

Pure's water sector offerings include the SoundBall and PipeDiver free-swimming pipeline condition assessment platforms and the Sahara tethered inspection system. In a joint statement, the companies say they are both engaged in addressing customer challenges in water infrastructure, including non-revenue water, extending asset life, and reducing the risk of water main breaks. Xylem recently acquired smart metering company Sensus.

In the statement, Jack Elliott, President and CEO of Pure, comments: 'Pure has been active in these countries for several years and has established a reputation for technical excellence, value and integrity. Xylem's strong presence in these countries will help to grow the market for Pure's solutions.'

Patrick Decker, President and CEO of Xylem, comments: 'It is a natural extension of Xylem's strategic focus on driving growth in the emerging markets and offering smart water technologies to better meet our customers' immediate and emerging needs.'

Updates on European wastewater phosphorus recovery and sludge use

An updated list of full-scale references for the recovery of phosphorus from wastewater has been published by expert Dr Christian Kabbe of Kompetenzzentrum Wasser Berlin through the website of the EU P-Rex research project.

The list, which will be updated as uptake of phosphorus recovery progresses, includes full-scale references that are operational or are under construction or tendered.

The latest additions to the list include an AirPrex installation in Liverpool, Ohio, USA (due 2017/2018) and a NuReSys installation in Braunschweig Steinhof, Germany (SE/BS / AVB check) (due 2018/2019), both producing struvite, and a pilot installation of the Budenheim Extraphos process at MZ-Mombach, Germany, Wirtschaftsbetrieb Mainz, producing dicalcium phosphate (as reported in Aqua Strategy, December 2016).

Updated sludge data published by Kabbe includes German sludge disposal data for 2001-2015, showing an overall reduction in the amount of sludge produced over this time accompanied by a continuing increase in the volumes of sludge receiving thermal treatment. Figures for 2015 were approximately 1.8 million metric tonnes dry solids in total, of which approximately 1.13 million metric tonnes dry solids received thermal treatment. Of the total, 24% was treated by monoincineration, 25% was treated by co-incineration, and a further 15% as undefined incineration. Sludge processing routes by country aggregating data for 2012-2016 is also presented, highlighting a wide spread of approaches across the continent.

To download the updates, see: http://p-rex.eu/index.php?id=11

European research highlights five-fold flood risk increase at four degree warming

Researchers at the European Commissions Joint Research Centre and the Swedish Meteorological and Hydrological Institute have concluded that a 4 degree C global warming would bring increases in flood risk in excess of 500% to countries representing more than 70% of the global population and global gross domestic product.

Reporting their findings in a paper in Earth's Future, an open access journal of the American Geophysical Union, the researchers assessed the frequency and magnitude of river floods and the impacts of these for scenarios corresponding to 1.5, 2 and 4 degree C global warming.

The researchers report that a 4 degree C increase globally would mean countries representing 73% of the global population would face a 580% in flood risk and that 79% of the global economy would face a 500% increase in flood damages. A 2 degree C temperature increase is predicted to bring a 170% rise in population affected and related flood damages compared to current levels. The optimistic scenario of a 1.5 degree C increase – the ambitious target of the Paris COP agreement – is still estimated to result in a doubling of the population affected by flooding, with flood damages increasing by 120%.

The researchers conclude that the results indicate 'a clear positive correlation between atmospheric warming and future flood risk at a global scale'. The largest increases are predicted for Asia, US and Europe.

Alfieri, L., B. Bisselink, F. Dottori, G. Naumann, A. de Roo, P. Salamon, K. Wyser, and L. Feyen (2017), Global projections of river flood risk in a warmer world, Earth's Future, 5, doi:10.1002/2016EF000485.

reading

A fresh perspective on water in European cities

The European Commission has published the Urban Water Atlas for Europe, described as a 'first of its kind' publication combining information on best practices and viable solutions with an infographic-based approach to presenting the status of water in cities across Europe and with visual representations of water created by artists and children.

The atlas is one of the outcomes of the BlueSCities project, funded by the EU Horizon 2020 programme. It stems from a collaboration between the European Commission's Joint Research Centre, Fundació CTM Centre Tecnològic, KWR Watercycle Research Institute, the European Innovation Partnership on Water, and NETWERC H20 – the Network for Water in European Regions and Cities.

The atlas features a 'city blueprint' for 39 cities across Europe. This composite index developed by KWR Watercycle Research Institute of the Netherlands displays 25 indicators related to water, waste and climate change in a single infographic. These indicators are combined in an overall score for each location – the 'Blue City Index'.

An 'Urban Water Footprint' is also presented for each of these cities, combining domestic water use with the water use embodied in products consumed.

The atlas is complemented by two online tools that cities can use to help them manage water more sustainably. One is the City Blueprint tool, which cities can use to present up to 25 indicators on aspects of water management to help them identify their own strengths and weaknesses. The other is the City Amberprint tool, which aims to help cities assess progress on becoming sustainable by combining aspects such as environmental impact, quality of life, and risks.

Urban Water Atlas for Europe, BM Gawlik, P Easton, S Koop, K Van Leeuwen, and R Elelman (Editors), 2017, European Commission

Available for free download at: https://bookshop.europa.eu/en/urban-water-atlas-for-europe-pbLB0416950/