

FUTURE OF WATER

03 WATER MUST BE A HUMAN RIGHT

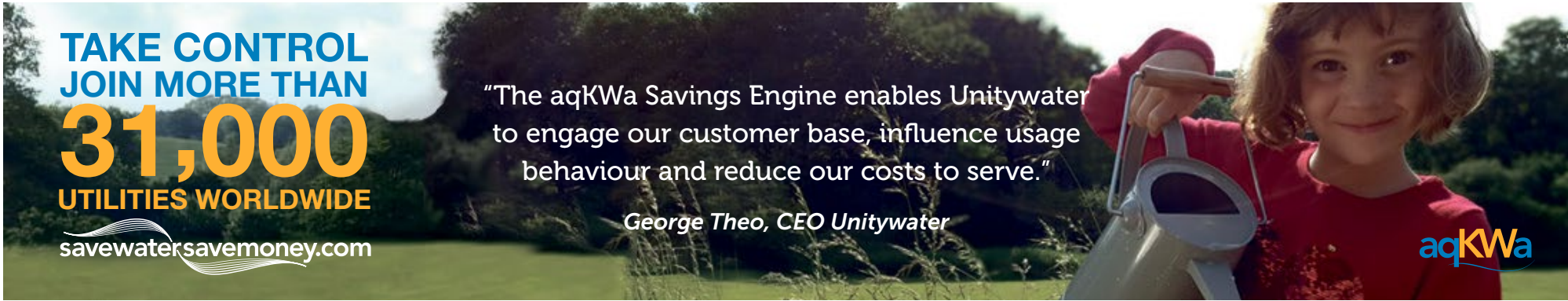
07 CITY WASTEWATER IS A RESOURCE

12 SAVING WATER TO MAKE A PINT

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Water and Sewerage Bills
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Investment
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The Environment
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Water UK represents and works with the major water companies in the United Kingdom. Our mission is to provide customers and communities with world-class services, enhancing the UK's quality of life.

For further information, please contact comms@water.org.uk



WATER UK
water.org.uk

FUTURE OF WATER

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HUMAN RIGHT

Water is a human right

As shortages worsen, safe drinking water and affordable sanitation is recognised by the United Nations as a human right

JIM McCLELLAND

For many, water scarcity is a problem in the post. By 2025, one in every two people on the planet will live with water stress.

For one in nine, the problem is already here. The World Health Organization estimates 844 million people lack basic drinking water; some two billion use a source contaminated with faeces.

In response, the United Nations made water and sanitation a matter of human rights, declared and defined, in 2010.

Justly, if belatedly, the human right to water has therefore been shoved into the spotlight on the global stage. As the climate change drama unfolds, however, gaps between awareness and action persist, says World Resources Institute analyst Samantha Kuzma.

“The UN officially recognises equitable, safe drinking water and affordable sanitation as a human right, and the Sustainable Development Goals (SDGs) ambitiously challenge us to provide this right to all,” she says. “Yet international attention has not translated into what is required – thoughtful, sustainable investments.”

Numbers are huge and shortfalls significant. A 2016 World Bank study estimated annual costs of providing water, sanitation and hygiene (WASH) services to SDG standards could reach \$114 billion, three times current investment levels.

Urgency unabated, the UN continues upping the ante, declaring 2018 to 2028 an international decade for action on water.

Making pledges, though, is one thing, delivering on them often another. So, whose responsibility is it to fulfil this promise of the human right to water? Does it fall to governments, the private sector or maybe transnational partnerships?

Water is a team game, albeit a political one, says Ms Kuzma. “The first step is establishing political will to make change happen,” she says. “Pressure must come from all – investors and financial institutions, diplomats, private companies, and citizens – both impacted and not.”

Big as the challenge may seem, success can be bigger. Following devastating famine in the 1980s, the Tigray region of northern Ethiopia invested heavily in grey and green infrastructure to provide almost 30,000 people with clean water. Irrigated land now totals one thousand times the area in



the mid-1990s and Tigray, once the poorest region of Ethiopia, has been self-sufficient in food production since 2007.

Rwanda is in turnaround too, transformed since the dark days of brutal civil war. Now almost three in five people have clean water and two thirds of the population a decent toilet.

Essentially, water challenges fall into two categories, explains Richard Munang, Africa regional climate change co-ordinator with the United Nations Environment Programme. “First are water infrastructure challenges, where the key issue is an inability to harness and distribute water from its sources,” says Dr Munang. “Second are water resource problems, where dwindling surface and subsurface sources are the issue. From the climate change perspective, our main focus is on water resource trends, especially in Africa.”

With a warming of 2 to 4C, the region will experience 60 to 80 per cent reduction of surface run-off by 2100 and groundwater recharge rates down between 30 and 70 per cent.

While policy might be the biggest driver of change, it is more a question of implementation and a joined-up holistic approach than new frameworks, argues Dr Munang. “Water policies need to reconcile and be implemented in synchrony with environment and forestry policies to ensure these ministries align their resources – financial, technical and technological – in restoring water-catchment sites,” he says.

Human rights issues around water are by no means confined to rural communities, however.

At 55 per cent already, the proportion of the world’s population living in urban areas is forecast to hit 68 per cent by 2050. Building urban water resilience is therefore key, says Mark Fletcher, global water leader at Arup.

“Many cities and towns are in low-lying coastal locations, so flooding and loss or deterioration of water

supply is a direct threat to human life, as well as the economic, social and environmental life of these communities,” he says. “Local authorities need to safeguard their citizens from climate-related risks, arising from either too much, too little or contaminated water.”

When it comes to water, not all threats to human rights are climate related; conflict is another critical factor.

In eastern Ukraine, shelling and gunfire is a daily reality, with conflict ongoing since 2014. Along the 500km frontline runs critical water infrastructure, which is regularly hit and damaged, affecting supply on both sides.

Campaigning under the banner of Protect Water Ukraine, Czech-based NGO People in Need (PIN) is working there with transnational partners to protect this infrastructure and help alleviate the suffering of civilians, ensuring vital supplies to schools, kindergardens and hospitals.

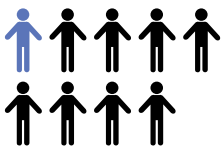
The initiative forms part of WASH efforts supported by the UK Department for International Development, European Commission’s Civil Protection and Humanitarian Aid Operations and Czech Ministry of Foreign Affairs.

Ania Okinczyc, country director for PIN in Ukraine, outlines the scale of the challenge: “Last year, on average, water infrastructure along the frontline was damaged every three days, with some 135 incidents in 2017 alone. This year, over four million people are at risk from outages and loss of supply.”

To make matters worse, Ukraine’s centralised heating systems need water to operate. So, as temperatures drop below zero this winter, hundreds of thousands of people will struggle to keep warm.

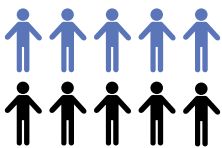
With fighting parties unable to agree a ceasefire, however, fixing damaged water pipes, filtration and pumping systems is not just a matter of engineering, but civilian protection too, concludes Ms Okinczyc. She says: “Since 2014, twenty-five water workers have been injured and nine killed trying to make vital frontline repairs.”

From climate to conflict, Ethiopia to Ukraine, the problem of water is simultaneously global, yet local, and the solution the same. Responsibility is shared, risk is not. However, were water to become the next big human rights success story, that is something we could all drink to, literally. ♦



1 in 9

people on the planet live with water stress



1 in 2

will live with water stress by 2025

Tech can prevent the blue planet

Emerging technologies have the potential to supply previously unobtainable data and provide solutions to global water shortages

NICK EASEN

Earlier this year Cape Town came within a few drops of Day Zero when the taps are turned off. A serious drought was only just averted. This year, already the fourth hottest ever, is not a one off. Europe’s heatwave and drought have decimated crops, and could lead to spikes in food prices; California has been up in flames again, while Japan saw dozens of deaths from sweltering heat.

“This is the new norm,” explains Alex Mung, head of Water Initiative at the World Economic Forum (WEF). “We’re seeing the impacts of drought and abnormally hot temperatures around the world. We have seen such scenarios before in São Paulo and this year in Sydney where water reached record lows, raising urgent questions about the security of the city’s water supply.”



Water has ranked in the top five risks for seven consecutive years in the World Economic Forum’s *Global Risk Report*. And if you look at the headline threats to humanity and the planet over the next decade, as pinpointed by 1,000 experts, all but one are linked to water. These include extreme weather, natural and man-made disasters, climate

change, biodiversity loss and ecosystem collapse.

These events destroy lives and livelihoods, and water is at the heart of the issue.

“Water insecurity will continue to cause ripple effects across global supply chains from manufacturing to agriculture, it will strain geopolitical ties and it will place untold pressure on the world’s poorest populations,” warns Mr Mung. “The resilience of our society, both in terms of economic growth and human security, must be addressed through a water lens.”

While other global risks have peaked and subsided, water has stubbornly remained. It is the ultimate public goods challenge, complex and inter-connected across many aspects of society.

Tackling the issue requires collaborative, cross-sector solutions and a shift by all stakeholders to place a higher value on water.

“Let’s face it, water is chronically undervalued and, in some cases, not valued at all. Only by embedding its true financial, social and environmental value into policymaking, governance, and financial and risk reporting can we instil a better mentality,” says Mr Mung. “Take wastewater treatment and reuse: when water is valued properly, there are incentives to fully capture the benefits of a circular economy which can bring about a range of new innovations.”

Emerging fourth industrial revolution technologies have the potential to unlock a wealth of previously unobtainable data about water systems

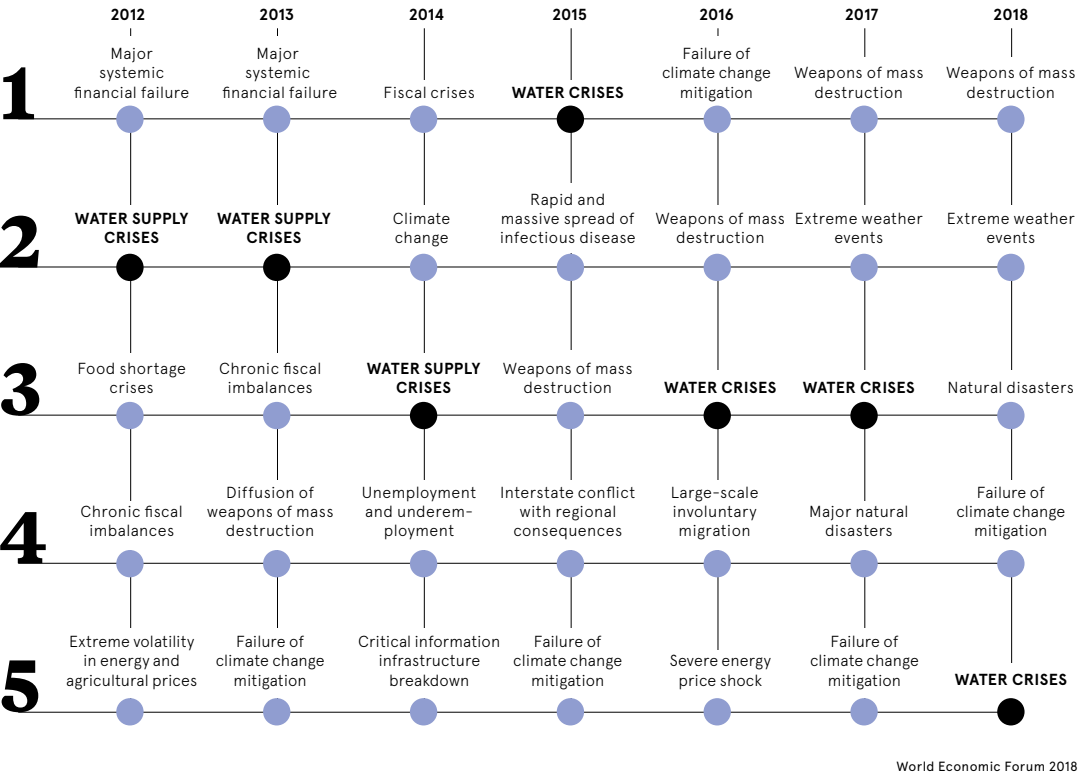
It is widely agreed that a business-as-usual approach cannot address global water challenges in the future, nor will our current strategies sustain the world’s thirst much longer, particularly when the population hits eight, nine or ten billion in the coming decades. Yet cold, hard data on how our water systems function is still lacking.

“A key challenge is obtaining and accessing a complete, up-to-date picture of supply and demand to understand competing needs and trade-offs. Too often, issues of data access, fragmentation and quality constrain decision-makers,” explains Mr Mung.

Technology such as satellite imagery and other Earth observation tools can help. In 2021, the Surface Water Ocean Topography mission, a joint satellite mission between Nasa and France, will use radar technology to provide the first global survey of Earth’s water, measuring how bodies of water change over time.

Top global risks in terms of impact

Water has remained a top-five risk for the past seven years



running dry

Insight

Transforming the sector

The World Economic Forum's Water Initiative is exploring how to harness fourth industrial revolution technologies to transform the water sector in collaboration with the World Bank's Water Global Practice and the Swiss Agency for Development and Co-operation. Called Water Security Rewired, the platform is looking at how to scale progress in a number of areas.

Digital tech is transforming traditional water and wastewater systems, particularly when it comes to operational efficiency. From intelligent applications that identify and remotely repair leaks, to virtual and augmented reality tools to help train employees, new solutions are being developed to manage systems remotely, saving time and resources.

Elsewhere, the shift towards off-grid and hybrid systems for water and wastewater treatment is also helping to extend water services. Such systems are enabled by promising technologies including the internet of things (IoT), remote sensing and artificial intelligence, which support real-time and remote monitoring of system performance, water use and quality.

New sources of water data enabled by technological advancements in areas such

as the IoT, remote sensing and blockchain can radically improve transparency around issues of water availability, use and quality. By getting more accurate and larger volumes of water data into the public domain, advanced technologies can help address information asymmetries and empower more confident decision-making at all levels of society.

Advanced technologies such as remote sensors, drones and blockchain have the power to disrupt and reimagine water intensive supply chains. From operational efficiencies to new business models, technology-enabled solutions are helping companies and investors to understand and quantify water-related risks and opportunities, and devise new strategies to address them.

Advances in material science are poised to diversify water supplies and lower dependencies on vulnerable sources. The far-reaching uses of nanotechnology, for example, could unleash new water sources at scale bringing benefits in the form of expanded desalination capabilities, improved wastewater treatment or even the rehabilitation of deteriorating infrastructure.

The satellite will survey at least 90 per cent of the planet, studying lakes, rivers, reservoirs and oceans roughly twice every 21 days.

In the agriculture sector, companies such as Microsoft are demonstrating how precision irrigation using smart sensors in fields can give information about soil conditions. Crop data, coupled with drone images of fields, and the use of artificial intelligence to interpret data and model a heat map of the crop area, can all help ensure water is used optimally in food production.

"Emerging fourth industrial revolution technologies – machine-learning, artificial intelligence, advanced sensors, satellite imagery, robotics and others – have the potential to unlock a wealth of previously unobtainable data about water systems at the global, regional, watershed and local level," says Mr Mung.

"Combined with new forms of public-private collaboration, these technologies can support decision-makers across industry, government and civil society to balance trade-offs, identify common priorities and make smarter investment choices."

The WEF believes leveraging emerging water technologies into the mainstream cannot be left to startups, accelerators and investors alone. New research is also desperately needed to explore the implications of emerging tech in areas ranging from ecosystem management to sanitation and water risk disclosure.

"Governments must remain at the centre of the water innovation agenda. They are ultimately responsible for ensuring technologies are developed responsibly. Public authorities will also need to develop new policy frameworks for how emerging technologies are tested and refined," says Mr Mung.

Any killer water app will also need to be scaled up, derisked and endorsed at all levels. "Building a strong culture of innovation is critical for the global water community's ability to fully harness the fourth industrial revolution. Without this, technology-enabled solutions will still be developed, but likely by a select few and not necessarily in a way that gets to the root of water challenges," he says. ♦

Commercial feature



Bewl Water Reservoir, near Lamberhurst in Kent, shared by Southern Water and South East Water

Building resilient water supplies in southeast England

The success of taking a regional water management approach in southeast England is now being promoted as an important step in building resilience across the country

In August, the Department for Environment, Food and Rural Affairs (Defra) released a joint letter with the support of regulators in which they set out the steps they think are needed to build resilience in water resources management in England.

This included increased ambition in company business plans for 2020 to 2025; regional water resource planning that transcends company boundaries and identifies optimum solutions for the region, and the nation as a whole. It also included greater use of markets and competition to ensure solutions are delivered efficiently; clear, joined-up direction from government and regulators, including developing a national policy statement and national framework for water resources; and a responsive regulatory approach to deal with issues as they arise.

It is clear from this list that the role of regional groupings for water resource planning and management is becoming crucial. It was acknowledged that "greater co-ordination of [regional] water resource management plans is required to meet the challenges we face".

The Defra guidance confirms the approach taken by the Water Resources in the South East (WRSE) group over recent years.

WRSE is a sector-wide partnership that has come together to examine and resolve issues to make the best use of water resources, by ignoring water company boundaries.

Formed in 1996, WRSE is going from strength to strength. It now covers

the area of London and the Home Counties, and comprises six water companies: Affinity Water, South East Water, Southern Water, SES Water, Portsmouth Water and Thames Water.

It works alongside the Environment Agency, economic regulator Ofwat, the Consumer Council for Water, Natural England, Defra, Canal and River Trust,

£627bn

contributed to the UK economy by southeast England, equal to 30 per cent of total output

19m

domestic customers and two million businesses are supplied by the six WRSE water companies

Greater London Authority and others.

WRSE's work has underpinned the regional development of a water grid with almost 60 transfers, within and between water companies, moving more than 100 million litres of water every day.

The group's work involves examining a range of different potential futures, covering extreme drought, climate change, water availability, population growth, environmental sensitivity and other factors.

World-class modelling is used to explore these future challenges to

determine how we can ensure water is still available for people without causing adverse environmental impact, and to identify the long-term solutions that will offer the best value for customers, society and the environment.

The aim of WRSE is simple: to find better or new ways of sharing water by using existing sources, pipes and treatment works, and developing new sources of water and bigger, longer pipelines to move it further around the region.

Examples include Portsmouth Water and Thames Water each planning a new reservoir that can be shared with its neighbours, being developed in collaboration with Southern Water and Affinity Water respectively. This is critically important as much of the southeast region is officially designated as being in serious water stress.

In addition, there are potentially greater pressures and challenges than those faced by other regions in the UK.

Top of the list is the increased population in expanding towns and cities; relatively low rainfall, higher water use by customers; and rising environmental pressures to keep more water in its natural home of wetlands, rare chalk streams, rivers and underground aquifers.

Find out more about the group and their work at www.wrse.org.uk

Water Resources in the South East



Why buy when you can rent?

A growing number of companies in all sectors are benefiting from renting rather than buying water technology

In an increasingly unpredictable economic and political environment, with more demanding customers and shorter manufacturing contracts, companies that use water in their processes have been working to ensure they have a contingency plan in case their water supply is interrupted.

It's this awareness that has prompted a growing number of companies, from power generators to food processors, to develop an

effective business continuity plan in accordance with ISO 22301, the latest globally recognised standard, using Veolia Mobile Water Services ReAct Treated Water Security Plan.

ReAct, which provides customers with a free assessment of their water treatment requirements, identifies potential risks and prepares a response plan to minimise any disruption to their water supply, has been increasingly popular over the last few years.

However, recently more and more clients have come to benefit from a new service that Veolia has added to its comprehensive range of waste, water and energy management solutions.

"We've been responding to clients' emergencies and other problems for many years now, and they're always very grateful, but recently we've been talking to them about taking a more pre-emptive and strategic approach," says Mark Dyson, European general manager of Veolia Mobile Water Services, part of Veolia Water Technologies.

"We call it Multi-Year and it's essentially like renting a car. Instead of buying an asset, such as a water treatment plant, you rent it from us, based on a more flexible, pay-as-you-go model."

The growing list of clients of this service like the fact that not only does it help them to avoid making major capital expenditure commitments, but it gives them access to Veolia's expertise, which is born out of its pedigree in water technology. Multi-Year provides clients with a package of services that includes equipment rental service, monitoring, maintenance and the provision of spare parts and consumables.

"They get state-of-the-art technology, great reliability and the use of our emergency fleet in case of operational difficulty," says Mr Dyson. "We provide them with the quantity and quality of treated water that exactly meets their needs. Clients realise that they could buy the equipment to do this, but then fundamentally they're investing in a utility that provides limited value to their organisation. If you're a food manufacturer that makes doughnuts, for instance, you should be investing in another doughnut machine because that gives you a better return on investment."

He points out that Multi-Year is part of a growing trend for companies to take out an operational lease for equipment and to contract out peripheral tasks so they can focus on their core competences and skills. Companies also like the flexibility that Multi-Year offers.

More and more companies are seeing that they can benefit from the latest technology, economies of scale and our expertise by renting from us rather than buying

"It can be as hands on or off as customers wish," explains Mr. Dyson. "Some people like to take readings or monitor on a day-to-day basis, while others ask us to perform all the services for them."

A growing number of companies that want to be ready to exploit new opportunities, while moving quickly to avoid threats, are signing up for Multi-Year. One client, for example, has a three-year contract to make a vehicle for the North American market. Rather than invest in an asset that might well be redundant when the contract finishes, it is renting its water plant from Veolia on a Multi-Year contract. To help customers to be more flexible and fleet of foot, Multi-Year contracts are available from one year upwards.

"Take pharmaceutical companies," says Mr Dyson. "The life cycle of products is shorter, with manufacturers producing them for perhaps just two or three years. With the food and beverage industry, beer sales might rise around the World Cup and so breweries will need more treated water during this period. They can either buy an asset, watch it depreciate and then dispose of it, or they can come to us and rent it without having to go through capital procurement."

About us

Veolia group is the global leader in optimised resource management. The group designs and provides water, waste and energy management solutions contributing to the sustainable development of communities and industries.

Veolia Water Technologies is a subsidiary of Veolia specialising in water treatment solutions and providing the complete range of services required to design, build, maintain and upgrade water and wastewater treatment facilities for industrial clients and public authorities.

Veolia (listed on Paris Euronext: VIE) recorded consolidated revenue of €25.1 billion in 2017.

"Companies need to be more agile and they want to have contingency plans in place. More and more are also seeing that they can benefit from the latest technology, economies of scale and our expertise by renting from us rather than buying."

Halving costs, reducing risk

During the decommissioning process of a nuclear power station, the need for water naturally fell drastically. As a result, the on-site demineralisation plant was larger than required and costly to maintain.

So Veolia provided the customer with a MODI trailer mobile demineralisation plant. Its ion exchange demineralisation uses similar technology to the station's on-site plant, but at much reduced flow. For the customer, the benefits were guaranteed treated

water quality and, more importantly, off-site regeneration. This avoids the requirement for chemicals or effluent disposal, and the resulting health and safety problems, as well as interference with the defueling and on-going decommissioning work. The customer's costs have been reduced by up to 50 per cent compared with operating the on-site plant and it has also been able to remove the redundant demineralisation plant early.



Veolia Mobile Water Services provides temporary water treatment solutions to industrial clients, twenty four hours a day, seven days a week.

For more information please visit www.mobilewaterservices.com or call +44 (0) 203 567 7548

Treating city wastewater as a resource



Faced with a rising global water shortage, cities can no longer pour away precious resources and must recycle wastewater

FELICIA JACKSON

Water management in cities is a critical factor for sustainable growth and development. According to the Ellen MacArthur Foundation, a growing global population that is increasingly urban means demand for water is increasing at 2 per cent a year. With one in four cities already suffering water stress, by 2040 global demand could exceed supply by 50 per cent.

Historically water has been viewed as an asset and once used, whether in a consumer, commercial or industrial environment, it became waste. In a world of increasing resource scarcity, however, the way in which we look at wastewater is changing.

According to the Organisation for Economic Co-operation and Development (OECD), the key water areas to be addressed in any integrated water management system are reduced water use, reuse and sludge management. While rainwater harvesting, sustainable urban drainage systems, water efficiency, leakage reduction, smart metering and water tariffs all have a role to play, wastewater treatment lies at the heart of any closed-loop water management system.

As Rudy Rooth, principal consultant at DNV GL in policy advisory and research for sustainable energy use, points out: “The downstream side of the water cycle can add value to the smart city agenda through a number of avenues.

“Proper water management can give value to materials previously deemed harmful or even dangerous for the environment. For example, wastewater contains a lot of nutrients – nitrogen and phosphates – that can be recovered at the wastewater treatment plants and used in fertiliser.”

Ricardo Cepeda-Márquez, technical lead for water and waste at C40 Cities, says some 80 per cent of wastewater globally is released untreated. But he adds: “There are environmental urgencies in relation to sanitation and health, in the transportation and treatment of water, but there also strong near-term opportunities and concerns

about methane capture and utilisation from wastewater treatment.”

The methane from wastewater treatment is a near-term greenhouse gas issue as around 10 per cent of global methane emissions are from wastewater. There are also concerns that wastewater treatment is energy, chemical and transport intensive, so treating it as a resource makes economic sense.

In Auckland, for example, the city has a wastewater treatment target to make the energy system self-sustaining by 2050. This is being done by using the methane emitted in the system to generate energy, providing double benefit through the mitigation of greenhouse gas and air pollution. If the resources in wastewater can be valorised, it could shift wastewater treatment from a cost to a profit centre.

Another area gaining traction is the idea of effluent reuse for water supply. Chris Binnie, visiting

Proper water management can give value to materials previously deemed harmful or even dangerous for the environment

professor at Exeter University, notes: “As population grows and water resources resilience diminishes, there is greater need to consider effluent reuse. In UK there are already many indirect schemes, where the highly treated effluent is diluted with river water.

“Direct reuse is not used in UK, but is at Windhoek in Namibia. In the UK several water companies are planning more indirect effluent reuse schemes. Since effluent will be available during a drought, such schemes improve water supply resilience.”

This idea has proved unpopular in the United States and Australia, but with growing demand, there is an increasing need for such treatment. When Singapore introduced water recycled from sewage, it created a new brand, NEWater, to encourage comfort with high-grade recycled water. It is, however, still used primarily for non-potable industrial purposes. While Singapore does have its own reservoirs, around 30 per cent of the city-state’s water is now recycled, with the rest derived from desalination and imports.

Distributed wastewater treatment systems are also being explored by cities to cut the cost of transport and distribution. Andrew Newbury, a partner at Gowling WLG, explains: “Decentralised systems are all about dealing with the sewage near the point of creation. They avoid the need to develop costly sewerage networks that intermediate

between the point of creation and the point of treatment.”

Innovative developers are already getting in on the act. In Sydney’s inner-city suburb of Barangaroo, developer Lendlease has built a complex intended to be water positive, using a purple pipe system. This means the complex will minimise draw on the water infrastructure and carry out onsite cleaning, collecting and ideally feeding water back into the city system.

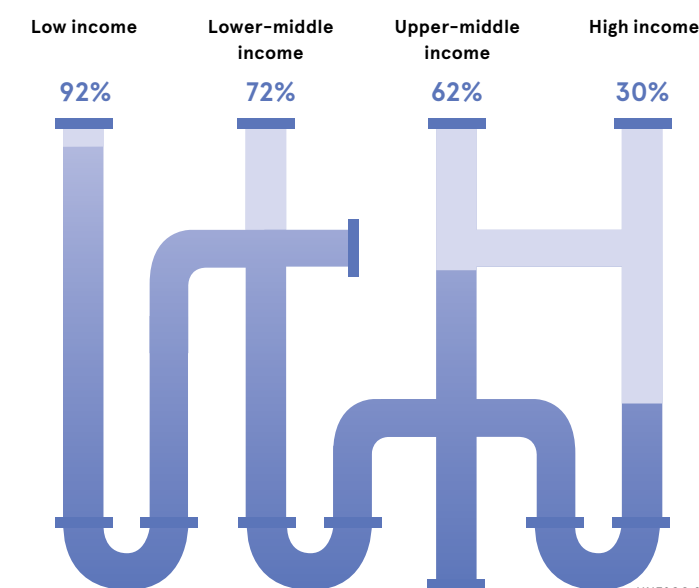
Mr Cepeda-Márquez concedes that some cities are wary of such approaches by developers, concerned that if there’s a problem, city officials will be held responsible. It can be difficult to retrofit existing infrastructure in large cities, but smart districts and developing cities are making progress in implementing these systems. Nonetheless, there is a growing focus on decentralisation and water independence while the concept of distributed wastewater treatment systems remains aspirational.

The complexity of the issues that water management brings to a city have seen the OECD launch its Principles on Water Governance, calling for water in cities to be managed in a sustainable, integrated and inclusive way. This requires water to be adequately governed across scales, authorities and policy domains.

Oriana Romano, policy analyst for the OECD’s Water Governance Programme, concludes: “Technical solutions to water-related challenges often exist and are well known; what is challenging is the political economy environment to put them into practice. The take-home message from our work on water governance is ‘fix the institutions that ultimately help fix the pipes’. In a world where both excess water and water scarcity are becoming critical issues, smart cities must find new ways to manage the challenge.” ♦

Untreated wastewater by income levels

Percentage of wastewater untreated



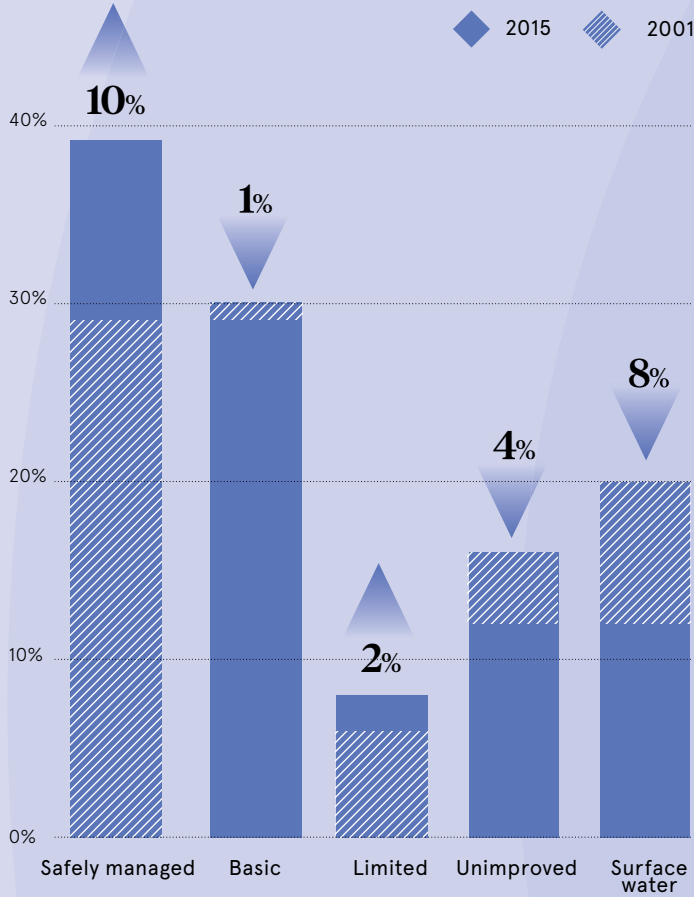
UNESCO 2017

WATER ACCESS

Finding a safely managed source of water is a daily challenge for more than two billion people worldwide, and water, sanitation and hygiene-related diseases such as cholera, dysentery and typhoid are still to blame for the deaths of one million people each year

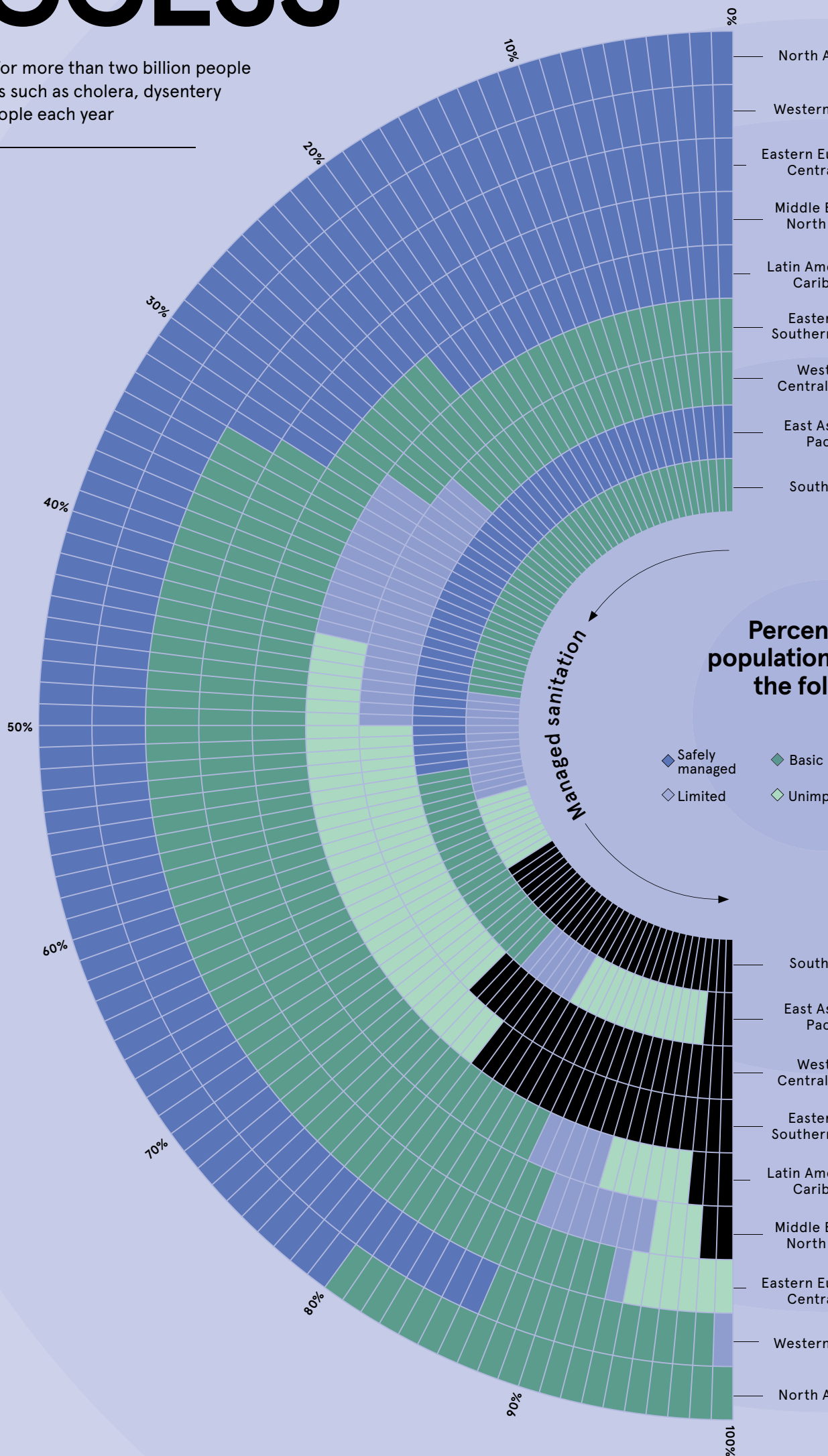
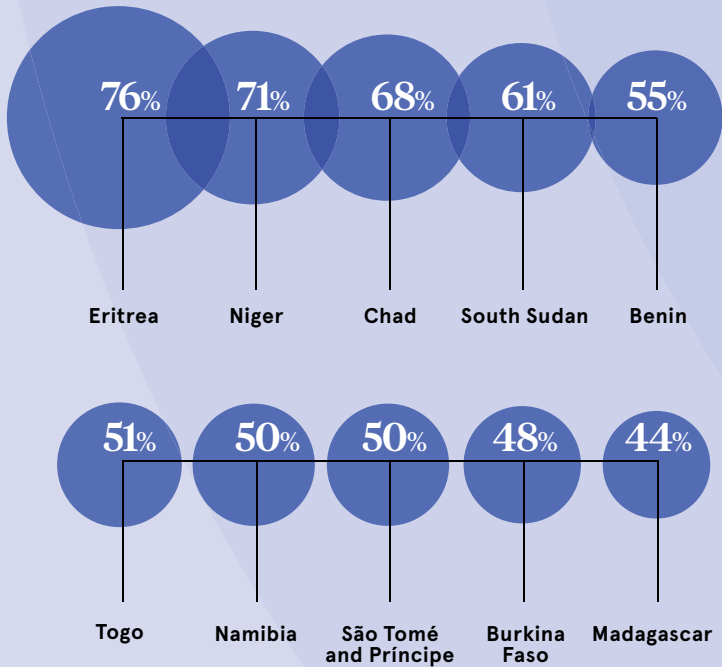
Global access to managed sanitation

Percentage of global population in 2015 accessing the following



Worst countries for sanitation

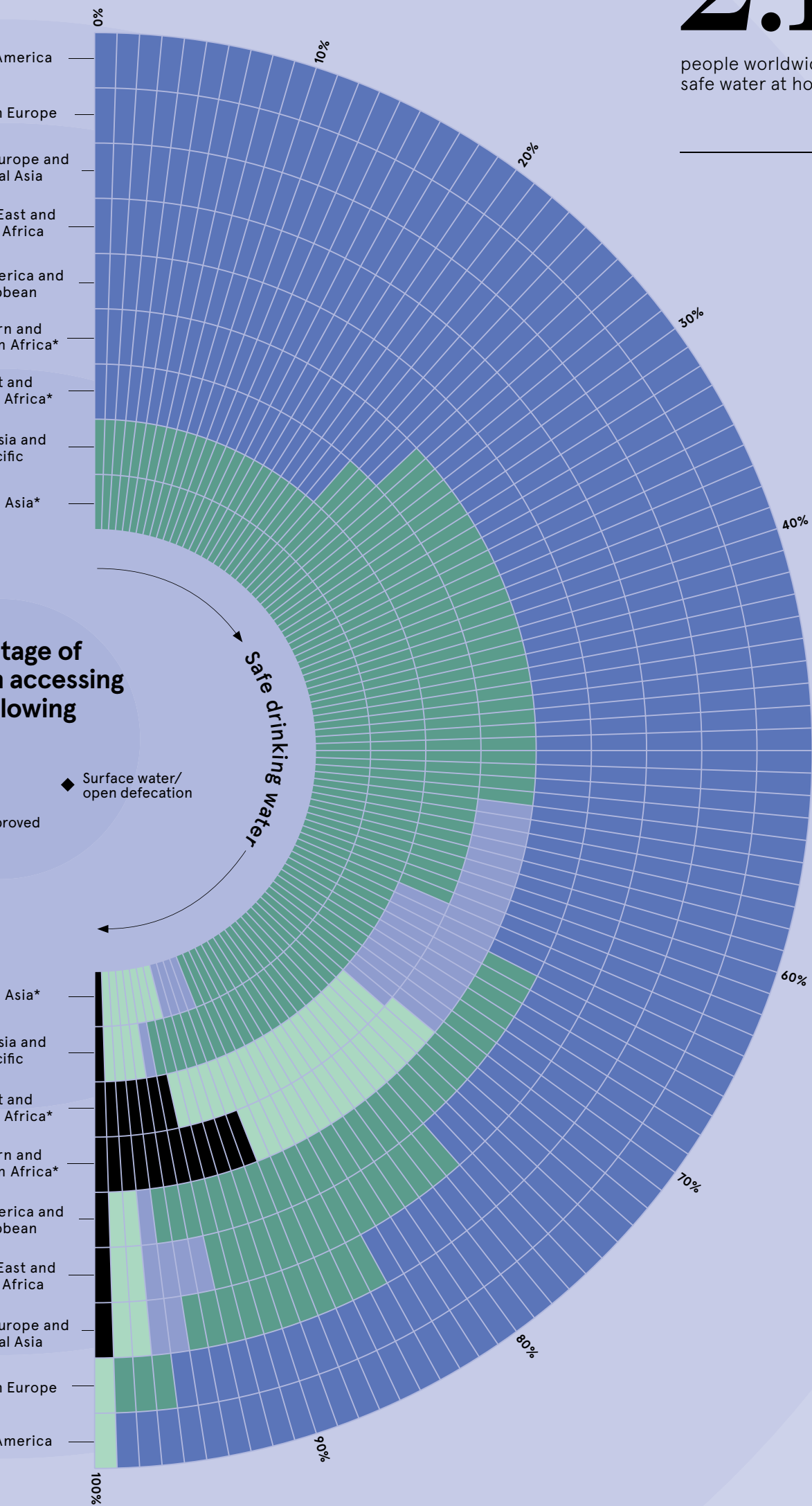
Percentage of population who still defecate in the open



2.1bn 4.5bn

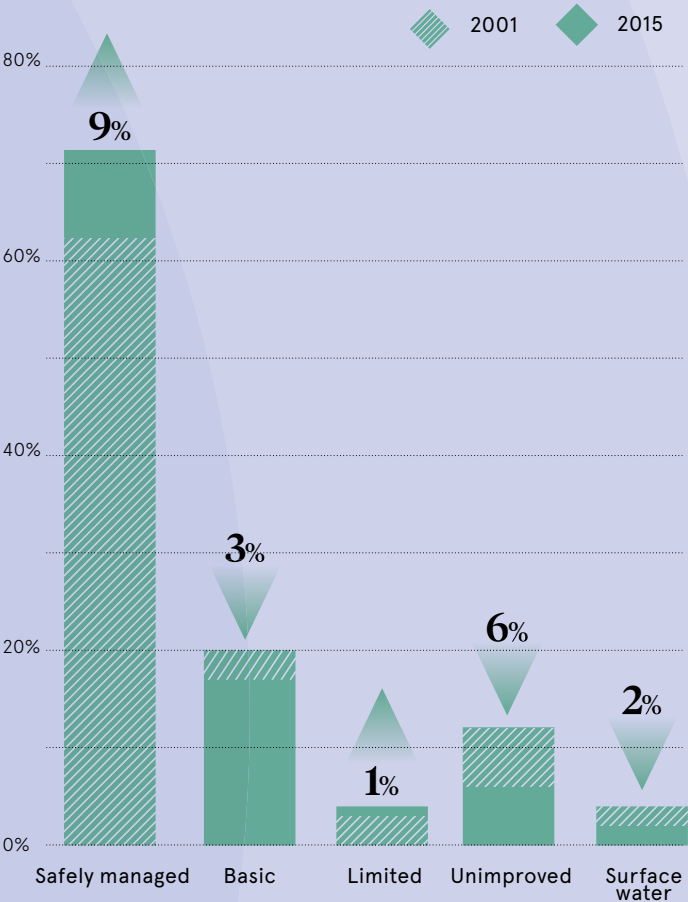
people worldwide lack
safe water at home

worldwide have no toilet at
home to safely manage excreta



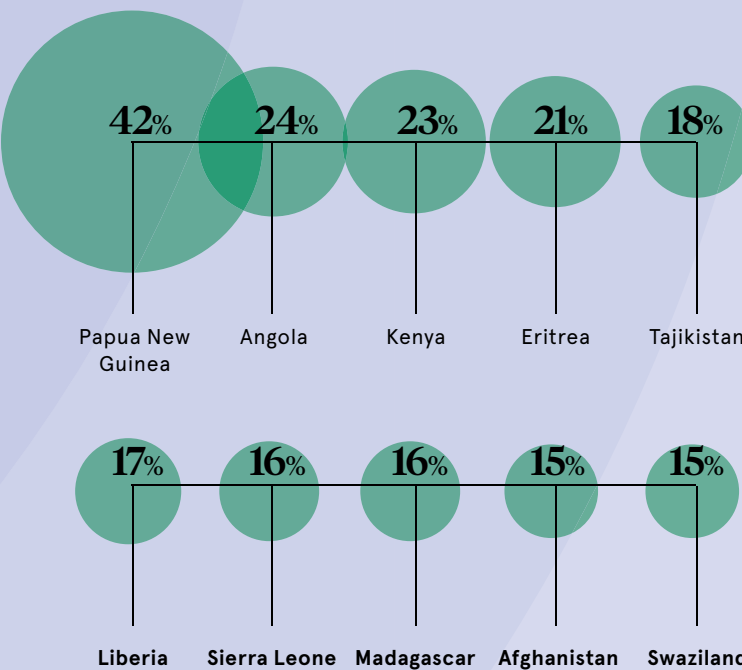
Global access to safe drinking water

Percentage of global population in 2015 accessing the following



Worst countries for drinking water

Percentage of population who still drink surface water



Commercial feature



Big data solves the water challenge

Customised management of irrigation not only increases crop yield, it also cuts water consumption

Water is becoming an increasingly important topic of conversation, whether it's too much because of flooding or too little through drought. With climate change exacerbating the age-old conflict of the food-energy-water nexus, farmers must find new technologies and processes to address old problems – they need to get smart.

This means taking advantage of the new technologies which are transforming industries around the world. Lindsay Corporation has put 40 years of crop and irrigation research into FieldNET. This is a proven technology platform, leveraging volumes of big data, cloud-computing capabilities and machine-learning to deliver growers one easy-to-use tool. It means real-time data can be used to understand and respond to conditions on the ground.

As John Atkinson, director of international business development at Lindsay Corporation says: "Our technology, more effectively than any other in the industry, is helping growers meet the increasing demand for food, feed, fuel and fibre production

through maximising the efficiency of irrigation. Doing this saves water and energy, cuts carbon emissions, all the while helping growers scale up their output or yield. This is beneficial to individual farmers, but it also ensures sustainability and stewardship of the land and environment."

Irrigation is the most basic factor in agriculture because its inadequacies are the most powerful constraints on any increase of agricultural production. When things go wrong, the effect can be dramatic. Research from the World Bank has estimated that since 2001 rainfall shocks have caused a loss of food production sufficient to feed some 81 million people, the equivalent of the population of Germany, every day for an entire year.

There is also extreme pressure on farmers to continue to drive output, in large part driven by a global growth in demand. The United Nations Food and Agriculture Organization has forecast that the world will need to increase output by 70 per cent, just to feed the estimated nine billion population expected by 2050.

Effective water management through irrigation can not only mean effective responses to fluctuations in the water supply, but also that higher-yielding hybrids can be used to take full advantage of the full growing season. In the end this all means one thing – higher returns.

Agribusiness is under pressure from a number of different directions, as every operation has to manage complexities and unique needs that require balancing profitability, environmental regulations, expansion and competition. At Lindsay Corporation, the focus is on ensuring that water is managed effectively to protect farming investments and drive return on investment. Mr Atkinson concludes: "Our offering is

unique because it is turnkey and fully integrated – it's not multiple systems cobbled together – ours is a single system, with a single source of support from start to finish."

What makes Lindsay special is its FieldNET Advisor tool, a cloud-based irrigation management system which delivers automated irrigation recommendations, which can be customised down to the individual field and zones within the field. In a trial, when compared to the control field, FieldNET Advisor provided a 3 per cent yield increase while using 17 per cent less water. Overall this resulted in almost \$35 per acre increased profit. Farmer Kendall David says: "FieldNET and FieldNET Advisor are game-changers towards creating sustainable irrigation practices."

As a turnkey solution, Lindsay doesn't just support farmers in managing irrigation, it offers a complete service for landowners wishing to convert land to productive agricultural use. Lindsay provides access to whatever might be needed, from research and feasibility studies to custom engineering and design of optimised irrigation systems, the hardware needed to make it work, and the technology layer, which delivers not only the water and energy savings, but also ensures efficient operations through time-savings.

For agribusiness, long-term, effective management and sustainable irrigation could be the difference between success and failure.

For more information please visit lindsay.com



90

number of countries Lindsay systems are operating in

4.8m

hectares of crops Lindsay systems irrigate worldwide

FOOD PRODUCTION



Feeding the world's poor and starving

Investment in improved supply chain management and precision farming techniques hold the key to banishing famine and malnutrition

JOE McGRATH

Last year, 124 million people around the world faced food crises that required humanitarian action. The figures from the United Nations Food Programme show that more than 39 million people starved as a result of droughts.

With so many people affected, it would be easy to assume that there is not enough food to feed the world's growing population, but this simply isn't true. While there is sufficient food to go around, many developed countries lack the farming and supply chain techniques to ensure that each harvest gets to the people who need it, before it spoils.

"Under nourishment doesn't happen from producing insufficient quantities of food," explains Guillaume Bonnel,

head of impact investing at Lombard Odier Investment Managers. "It happens because of logistical problems."

All the while, the potential for food shortages continues to grow, due to the increasing global population. The UN estimates that the world's population will rise from the current level of 7.6 billion to almost ten billion by 2050.

According to the UN's Food and Agricultural Organisation, around one third of the food produced in the world gets lost or wasted each year. This breaks down as 30 per cent of cereals, 40 to 50 per cent of root crops, fruits and vegetables, 20 per cent of oil seeds, meat and dairy, and around 35 per cent of fish.

"In developing countries, 40 per cent of losses occur post-harvest," says Stephane Soussan, a fund manager at CPR Asset Management.

In the poorest countries, harvesting techniques are often not as

How thirsty is our food?

Litres of water required to produce 1kg of the following products

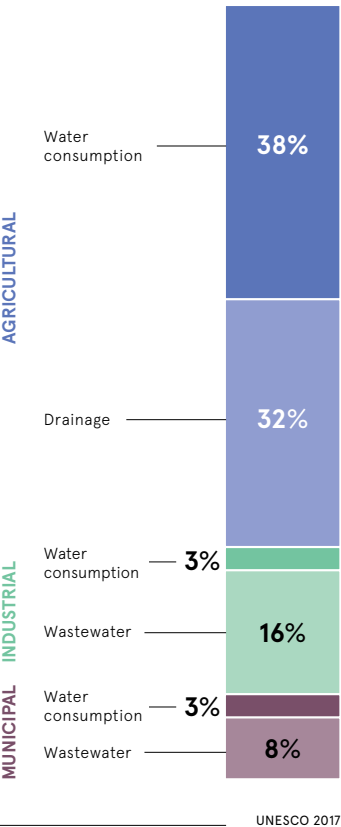
Beef	15,415
Nuts	9,063
Sheep/goat meat	8,763
Pork	5,988
Chicken meat	4,325
Eggs	3,265
Cereals	1,644
Milk	1,020
Fruit	962
Vegetables	322



Luis Tato/Bloomberg via Getty Images

Fate of freshwater withdrawals

Global consumption and wastewater production by major water use sector



sophisticated as those in developed countries, Mr Soussan says. This means that food spoils during the early stages of the supply chain or because storage and cooling facilities are not as efficient as they could be. Resolving these recurring shortages will require a combination of investment, technological innovation and education, according to the investment community.

Fund management groups believe they can make a solid investment return for investors while simultaneously helping developing communities that are the victims of poor food supply chains.

For Swiss fund manager Lombard Odier, one such investment has been in Kenyan company Twiga Foods. Kenya's poor road infrastructure meant that farmers saw high levels of spoiled fruit and vegetables when they transported their produce to market.

Having received investment, Twiga launched a smartphone app that enables buyers to order the food they need in advance of market day. Twiga set up a series of warehouses in strategic locations to keep the produce fresh and deliver it right at the time it is required.

The world's fund managers are also keenly aware of a shift in the way that people look at investing. Numerous industry surveys have found millennials are increasingly keen to see their investments play a part in improving society, particularly in areas of poverty or food scarcity. This could yet lead to further investments in improving food supply chains in developing countries.

Mr Soussan recognises that such investor pressure is not yet at the levels witnessed for other sustainability

Grassroots pressures are the first step in getting the global investor community behind this

investment priorities, such as climate change, but he believes there is potential for investor appetites to have a material impact.

"Investors, in allocating capital, can play an important role in true restructuring of the food chain," he says. "Grassroots pressures are the first step in getting the global investor community behind this. Any global restructuring will be dependent on how powerful these forces can become."

While resolving supply chain issues are a part of the problem, farming techniques will also need to be improved if they are to meet demand or serve impoverished communities, according to experts.

Precision agriculture – the use of technology to improve farm and production practices – will have a transformational effect in developing nations that currently witness the highest levels of food losses post-harvest.

"Most of the increase in agricultural production over the coming decades will come from yield improvement as increasing arable land is difficult," says Mr Soussan. "Precision agriculture will probably play a role in boosting productivity while preserving some resources by optimising or reducing the use of inputs like seeds, fertilisers and crop-protection products."

Encouragingly, the use of precision agriculture goes way beyond pure crop production and management. Advancements in technology could also enable livestock farmers to improve their results.

Dr Stefan Weiskopf, chief executive of farming intelligence group Antelliq, says he expects adoption of precision agricultural techniques to be rapid in the years ahead.

He explains: "There are several attractive secular growth drivers for animal protein production with precision agriculture: increasing demand for protein and smart farming adoption, constraints on production driving the need to produce more with less, food safety and supply chain efficiencies, and animal welfare."

"Unquestionably, these trends require the use of and investment in smart farming solutions, which can accurately monitor and calculate how much water or feed is necessary to operate farms in a cost-effective and environmentally sustainable way."

The latest international statistics on malnutrition make for uncomfortable reading, but evidence shows that the solutions exist through supply chain management and precision agriculture techniques.

For these solutions to be successful, there will need to be buy-in at global level from both government and investor stakeholders. Ultimately, it is these two groups that have the greatest opportunity to banish malnutrition for good. ♦

01 Watering large fields uniformly is very wasteful; precision technologies are being used to determine precisely how much water is needed in different parts of each field

02 Twiga Foods employee delivering bananas to a stall in Nairobi, Kenya; Twiga vendors are able to order exactly the food they need in advance of market day via a smartphone app to cut down on waste post-harvest



George Rose/Getty Images

BREWING



Alberto Pezall/NurPhoto via Getty Images

Cheering tale of saving water to make a pint

Beer-to-water ratios, eliminating second rinses and steam recapture, are now common parlance among brewery managers more used to talking about mash tubs and fermentation vessels

MARK HILLSDON

The UK beer industry has experienced rapid growth in recent years, thanks to a booming craft brewery sector. But despite this, four brewing giants – Anheuser-Busch InBev, Heineken, Carlsberg and Molson Coors – produce a sobering 88 per cent of all the beer drunk in the UK.

While most of their water stewardship programmes are focused on more water-stressed areas of the world, water efficiency in their UK operations is also a priority. Heineken, for instance, with breweries in Manchester, Tadcaster and Hereford, cut water use by 3 per cent during 2016-17, and looked beyond the brewery walls to the way in which their beer is dispensed.

Their SmartDispense system reduces the frequency of beer line cleaning, cutting water and chemical use by 75 per cent, and in 2016 the company estimates water saved amounted to 35 million pints.

The rest of the UK's beer comes from imports and around 2,500 independent breweries, from famous names such as Shepherd Neames, Marston's and Adnams, to a wealth of new craft breweries and those producing just a few barrels a year.

"British independent brewers are some of the most innovative, environmentally conscious business owners around," says James Calder, head of public affairs at the Society of Independent Brewers.

"There are examples all over the country of breweries using reed bed filtration systems, waste water to irrigate crops, grey water to clean equipment and steam capture systems from the boil.

"Making beer is a very water-intensive process, so wherever we can lessen the impact and use less, it helps brewers save some money, and helps the environment too."

When it comes to water efficiency, the water-use ratio is king. This is the total amount of water it takes to make a pint of beer and historically stood at around 10:1. While many of the really small breweries still hover around the 8:1 mark, large global brewers now claim around 4:1, while Adnams' latest figure is closer to 3:1.

With its steaming tanks and bubbling vessels, there are seemingly opportunities to save water at every

turn inside a brewery. Recapturing steam and condensation are two, as is limiting losses to evaporation by strictly controlling how long beer is boiled. "Just shaving 1 per cent of an evaporation rate of 5 per cent is a major saving," says Ben Orchard, environmental sustainability manager at Adnams.

Adnams' Southwold brewery has also introduced smart meters that can identify abnormal flows and help with leak detection.

But it's the perpetual cleaning where water efficiencies in beer making can really be made.

"Most brewers spend about 90 per cent of their time cleaning," says John Conod, front of house manager at Purity Brewing Company in Warwickshire. "To make good beer, you need really clean kit."

Purity uses a clean-in-place system, with tanks and vessels cleaning themselves, rinsing away detergents and caustics. "There's no one going round with a hose pipe swishing water around," says Mr Conod.

The systems have their own pH sensors and once the rinse water tests neutral, the machine automatically stops, cutting out the need for further rinses.

Adnams also use peracetic acid, a food-grade chemical, as a cleaning agent. As well as being fast acting, it doesn't foam and once applied breaks down into harmless by-products, which require minimal rinsing.

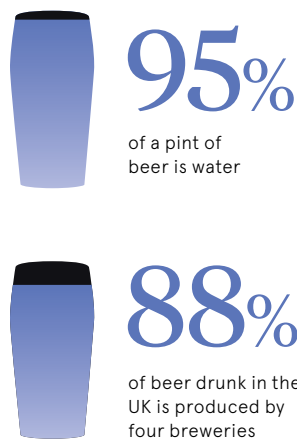
"It's a combination of these things which is ultimately how we can get to the low ratio," says Mr Orchard, who believes that while it may be a case that the bigger the brewer, the greater the water efficiency, smaller breweries have the flexibility to be more innovative.

Farr Brew is a micro-brewery in Hertfordshire, where wastewater, rich in biodegradable materials and nitrogen, is now used by a local farmer as fertiliser, rather than being taken away by a waste company.

Some small brewers, such as Purity and Staffordshire-based Freedom, have also developed their own wetlands as a way of dealing with wastewater.

Freedom also draws water from its own bore hole and any that doesn't leave as beer is channelled into a wetland water treatment system, which relies entirely on sedimentation and filtration. It first flows into an aerobic digestion pond, then through three swale ditches, before running into another, large aerobic digestion pond. Next it passes through a reed bed and a final ditch before returning into the nearby brook.

"We are using entirely natural processes," says Freedom's head brewer Jonathan Smith. "The water that we are using and then reprocessing is able to return into the environment less than half a mile from where we took it out of the ground." ♦



Making beer is a very water intensive process, so wherever we can lessen the impact and use less, it helps brewers save some money, and helps the environment too

‘Nationalisation carries risk which needs careful consideration against the positive work of regulated private companies’

The summer’s record-breaking temperatures, and the incredible hard work of companies to supply the water we all need, were powerful reminders of the increased pressures of climate change and population growth on water resources.

We need a strategic approach to secure water resilience while balancing enhanced supply infrastructure and demand management, points made in 2016 by the water industry in a 50-year look ahead on water resources planning and more recently the National Infrastructure Commission.

Current political debate on renationalisation of English water companies ignores how such a move would meet these needs. Questions about whether the industry is fit for the future and whether returning to public ownership is a real prospect must be objectively viewed in the context of privatisation’s historic record and future plans.

Before privatisation, the water sector was starved of funding, failing to deliver a good service and was damaging the environment. Companies have been at the forefront of a remarkable turnaround, achieved within a robust framework overseen by a trio of independent regulators.

They have invested £150 billion since 1989 and are currently putting in at least £8 billion each year. Customers are five times less likely to suffer supply interruptions, eight times less likely to suffer sewer flooding and 100 times less likely to have low water pressure. Leakage is down by a third since the mid-1990s, two thirds of beaches are now classed as excellent, compared with less than a third 25 years ago, and the UK has excellent drinking water.

The average bill is just over £1 a day, and after inflation bills have remained broadly the same since 1994 and are due to fall over the next few years.

On company financing arrangements, we have seen action from individual companies and widespread support for the water services regulator Ofwat’s direction of travel to promote change in this area.

But companies don’t take their role for granted and are passionate about doing more in the public interest. Aside from the challenges to resilience and managing water resources, they are in tune with customer and societal expectations on price and service, and continued environmental protection.

Companies have published ambitious, innovative proposals in their 2020-25 business plans. These exciting plans, a manifesto for water, saw groundbreaking engagement with more than five million customers to develop new ideas.

Plans will be discussed with regulators and could see companies commit to more than £50 billion spending over the next five years, an increase of 13 per cent from the current period; bills falling on average by more than 4 per cent in real terms; companies helping 1.4 million people struggling with paying their bills; leakage reduced by 16 per cent; and environmental improvements to 8,000km of rivers.

Two things strike me about the way ahead in conversations between companies, regulators, policymakers and stakeholders to support these ambitions.

Firstly, how far water companies need to work with each other to encourage further transfers of water from areas of surplus to deficit and with customers to unlock the positive impact they can have through changing their water use.

Secondly, the need to strengthen tools available to companies to step up to the next level. The National Infrastructure Commission has re-engaged discussion on improving national and regional arrangements for water-supply planning. We must also harness the role of public policy, such as the water aims in the UK government’s 25-year environment plan.

Nationalisation carries risk which needs careful consideration against the positive work achieved by regulated private companies working in the public interest and how they are addressing future challenges. In the face of many challenges ahead – infrastructure renewal, climate change, population growth – let’s build on what’s working.



Michael Roberts
Chief executive
Water UK

Digital innovation empowers property development growth

Water supply and sewerage lie on a critical path for developers, although the process of providing these services can be hugely inefficient. Now **Anglian Water** is among the utilities digitally transforming practices



Edem Eno-Amooquaye
Managing consultant
Curzon & Company

Water companies are looking to harness emerging automation technology and smart data to transform their services. Often this requires a new way of working, closely focused on defined business outcomes, effective innovation and proper collaboration.

Among them is Anglian Water, which has established close working relationships with a small group of expert companies to digitally transform its developer services business. This transformation will deliver process efficiencies and more than £20 million of savings over the next five years.

“Historically, our customers would come to us and say ‘we have a development and we need water infrastructure’ and then we would come up with a solution,” explains Iain Amis, head of developer services at Anglian Water. “With our project we will have visibility much earlier, when engaging with property developers is still just a thought for landowners wanting to sell, enabling us to be more proactive, strategic and efficient.”

Anglian Water has created two bespoke systems called Grosight and

Inflow, guided by transformation consultancy Curzon & Company, which helped to build the digital business case, sharpen the project strategy and support the organisation in effecting new ways of working. These smart systems are now live across the utility’s operations, with IT development led by Cognizant as part of Anglian Water’s EnterpriseWorks Management Alliance.

The systems fully digitise the application process, planning and asset delivery. They also provide advanced geospatial capabilities that include drawing polygons for developer services applications – the first such programme in a UK water utility – and offer automated workflow management. In contrast, many other utilities only digitise or outsource application submission and assessment, and some have no digital capability at all in their developer services businesses.

25%

of the UK’s water and sewerage companies have no digital capability in their developer services businesses

20%

utilise online customer portals for their developer services businesses

The success of the project in meeting measured strategic outcomes means its application has been carefully broadened. “We began with a focus on low-volume, high-complexity schemes, but realised these platforms will work for all our one-off customers,

our builders and our big developers as well,” says Mr Amis. He describes the work as “totally transformational” because the water company is able to provide developers with much better experiences and is ready to meet the customer service requirements of Ofwat’s new AMP7 DMeX measure.

“Grosight and Inflow are equipping Anglian Water with the capability to take a strategic approach to asset planning across the entirety of a water resource zone and recycling catchment area, reducing design costs by identifying site clusters and efficient solutions,” explains Edem Eno-Amooquaye, managing consultant at Curzon & Company. Better site visibility provides greater insight on the needs of property developers, enabling sustainability initiatives such as water reuse to be encouraged and cutting the cost of late changes.

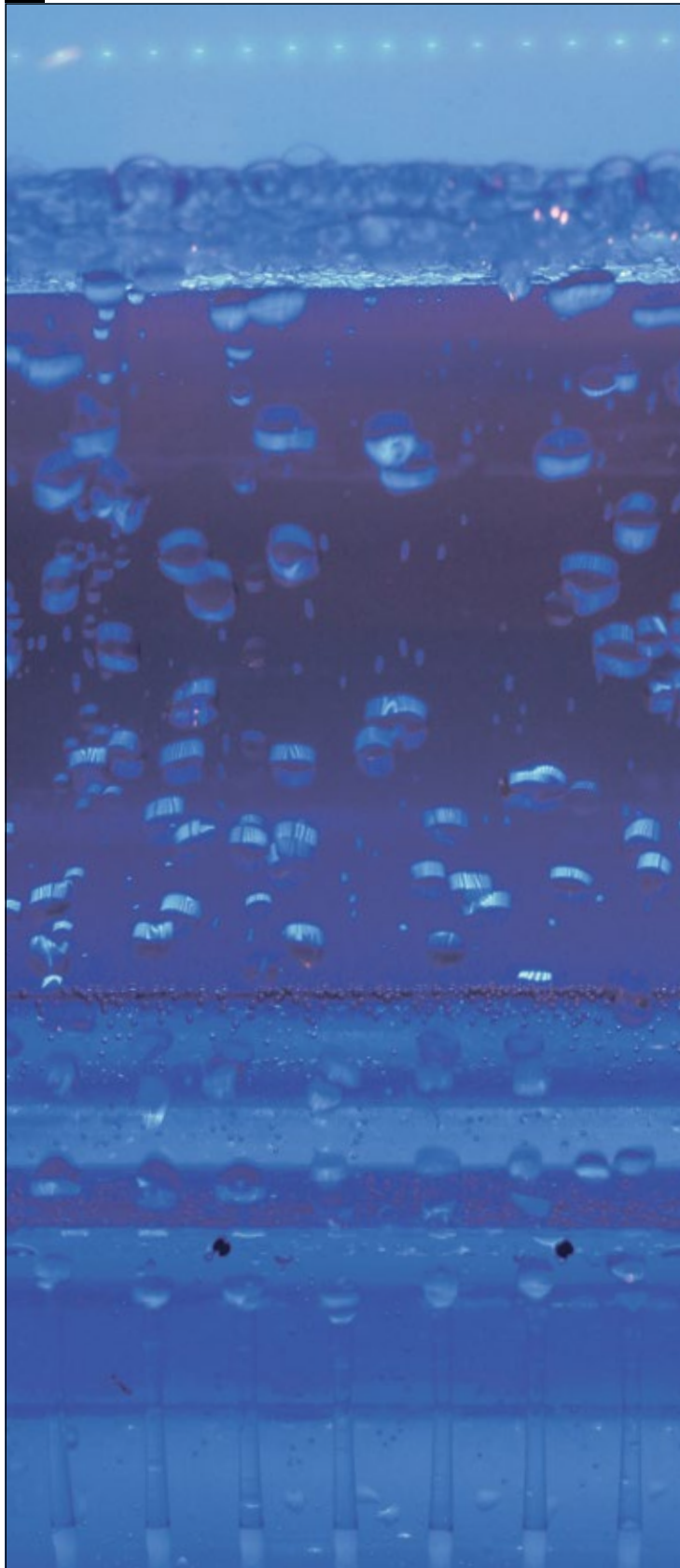
During the project, collaboration between business functions, IT and delivery teams has been essential. As guardian of the business case, Curzon & Company has orchestrated this collaboration and taken responsibility for grounding all technical requirements and design functionality in the reality of business benefits.

“Curzon & Company has led in defining the change management strategy to ensure the benefits of digitisation and new ways of working are embedded within the developer services business,” explains Mr Eno-Amooquaye. This critical role has served to provide assurance to both Anglian Water and the IT team throughout the life cycle of the programme.

To make the relationship work between separate companies, in such a crucial commercial context for Anglian Water, all the parties have focused on growing together. The process has proved to be highly efficient and open, with the customer at its heart.

To find out more about digital transformation that delivers leading-class business capability and performance please visit www.curzoncompany.com/sectors/infrastructure/

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SULZER

EARTH SCIENCE

Space missions uncover



Observing Earth from space can help governments manage water resources, mitigate man-made contributions to climate change and prepare for natural disasters

SHARON THIRUCHELVAM

The first colour photograph of Earth taken from space transformed our perspective. The image of our sunlit planet emerging from darkness in *Earthrise* would become an emblem of the environmental movement. It would show with breathtaking clarity just how abundant with water, in liquid, frozen and vaporous forms, our blue planet is.

Although many people would associate Nasa with space exploration, since the 1960s the agency has spearheaded dozens of observational missions dedicated to deepening our understanding of Earth. At this moment, a constellation of satellites orbit the planet, gathering data on oceans, ice sheets, terrain, atmosphere and freshwater.

Among them, the Gravity Recovery and Climate Experiment (GRACE) has proven one of the most consequential. Using methods similar to those employed by Nasa's Gravity Recovery and Interior Laboratory (GRAIL) mission, which mapped the surface gravity of the moon, GRACE was launched in 2002 to detect variations in the Earth's gravitational field and to act as a "space scale" that would measure variations in Earth's mass.

GRACE transformed the study of hydrology, enabling scientists to perceive changes in hidden groundwater aquifers, ice sheets, glaciers, continental drift, water content of large rivers and lakes, soil moisture, and moisture in the atmosphere.

It has provided 15 years' of uninterrupted data and given rise to 4,300 published research papers to date, an extraordinarily high number for a single Earth science mission. In

particular, it has enabled scientists to make predictions about natural disasters, weather variation and, most crucially, climate change.

Some of its most significant discoveries have revealed melting ice sheets and depleted aquifers are contributing to the Earth's rotational wobbles; a third of the world's underground aquifers are being drained faster than they can be replenished; and a few years of heavy precipitation can cause so much water to be stored on land that global sea level rise slows or even stops briefly.

Many more discoveries are expected to be made, which is why scientists breathed a sigh of relief when, on May 22, GRACE-FOLLOW ON, a joint project between Nasa and the GFZ German Research Centre for Geosciences in Potsdam, launched.

Like its predecessor, GRACE-FO's satellites do not carry measurement instruments, but are themselves the measurement instrument. Circling the Earth every 90 minutes, at an altitude of 490 kilometres and travelling at a speed of approximately 27,000 kilometres per hour, the satellites maintain a distance of around 220 kilometres and bounce microwave energy pulses between them, which enable the constant measurement of their relative distance to

Earth's water secrets



The GRACE Follow-On spacecraft launching on board a SpaceX Falcon 9 rocket in May at Vandenberg Air Force Base, California

NASA/Bill Ingalls



GRACE-FO satellites being assembled by Airbus Defence and Space in Munich

Airbus DS GmbH/A. Rutloff

Emerging trends in global fresh-water availability, published in the science journal *Nature* in May, finds that Earth's wetland areas are getting wetter and dry areas are getting drier due to a variety of factors, including human water management, climate change and natural cycles.

"We have been monitoring the GRACE for 15 years, but you really need a longer period to say with a lot of certainty which changes are part of the natural variability and which changes may be long-term trends, which is the first thing we want to use GRACE-FO to confirm," he says.

Earth science satellite missions, such as GRACE-FO, not only enable observations that would be impossible to make on the ground, but they also provide data on regions whose governments lack the material resources and scientific capability to undertake research in weather and hydrology themselves.

There is still one area of monitoring where data is lacking – water usage

"Some of the most vulnerable people live in areas where we don't have the data, and those areas happen to be less developed, and they don't have the ground-based or the airborne observations that are really critical for making accurate predictions of weather," says Dr Rodell.

His team at the Hydrological Sciences Laboratory are working on a new drought-monitoring product that will produce real-time drought maps and flooding risk. "It will show you the integration of atmosphere conditions over time and give you a sense of how deep a drought may be, or have we really recovered

from a drought or is it just that rains have helped to make the surface more wet, but you could easily slip back into a drought because the deeper soil moisture is still depleted," he says.

Satellite data also enables scientists to overcome co-operation issues between nation states, which is a major barrier to the effective management of large rivers and aquifers that cross borders. Launching in 2021, the joint US and French satellite mission Surface Water and Ocean Topography (SWOT) will bring oceanographers and hydrologists together as international partners to monitor river flow around the world, to make the first global survey of Earth's surface water.

This could have an enormous impact on river basins that lack usage agreements and those exploited by upstream nations to the disadvantage of those downstream, through providing hard data that can be taken to the negotiating table.

In theory, with greater knowledge of global ice and water change, governments could better manage their water resources, mitigate man-made contributions to climate change and help us prepare for natural disasters before they occur. Yet there is still one area of monitoring where data is lacking – water usage.

"There is really no way to do that from space and a lot of the information that we have around the world is voluntary or collected by states or national agencies according to self-reporting given by, for example, farmers or a particular industry," says Dr Rodell. Hydrologists still depend on people, businesses and states to co-operate and report their usage accurately.

Even Nasa's missions are not impervious to changing political headwinds. As recently as this summer, a question mark hung over several Nasa Earth science missions that had been slated for termination by the Trump administration, until a Senate committee restored funding. ♦



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