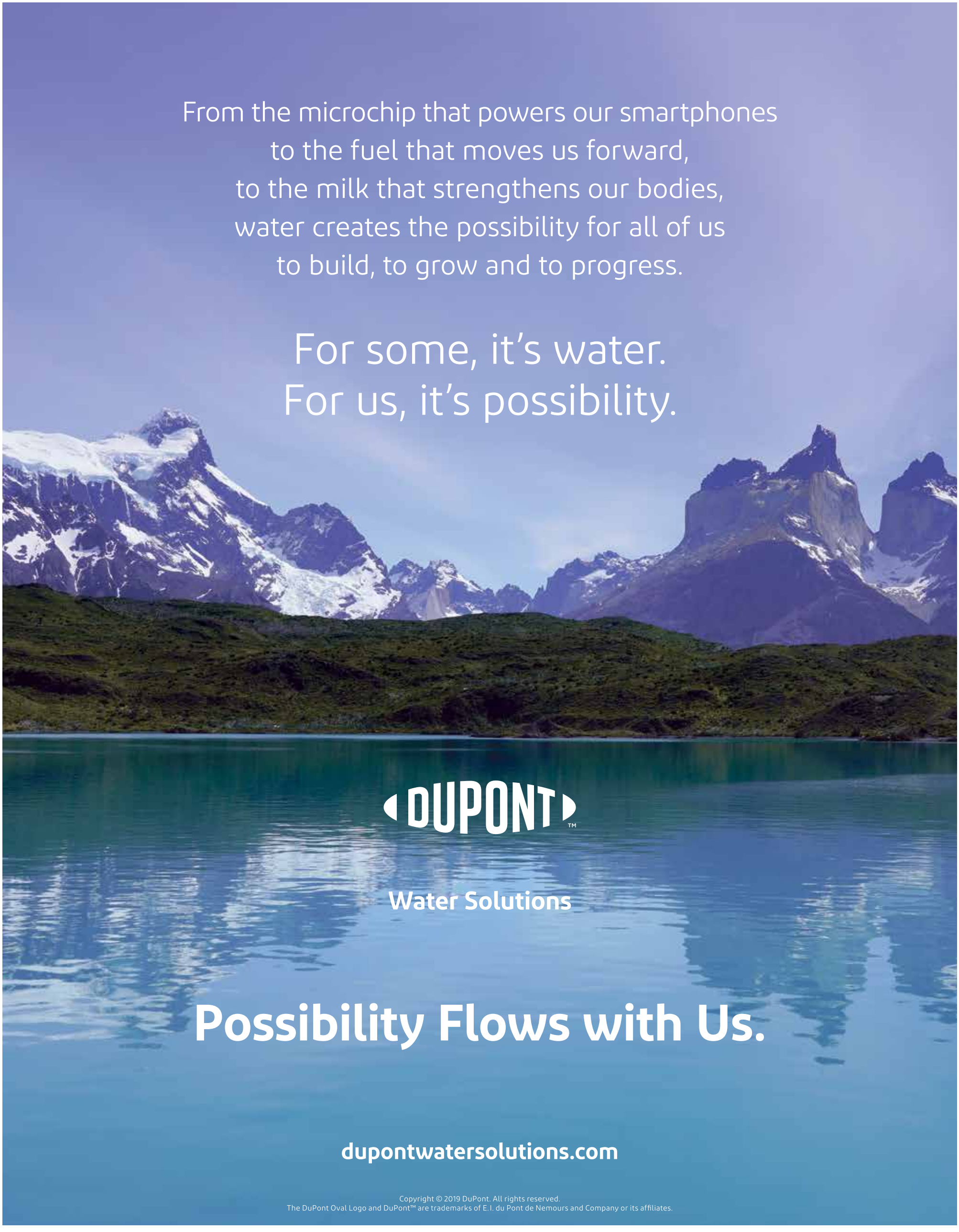
FUTURE OF WATER



FUTURE
OF WATER

Distributed in
THE TIMES

Published in association with
WORLD ECONOMIC FORUM
BRITISH WATER

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VALUE

Why busting the myth of abundance is so vital

Consumers must realise that water is becoming increasingly scarce, but there are challenges in communicating this important message

Nick Easen

If you had to put a real price on a jug of clean tap water, what would it be? Nothing or little, because access to it is a human right? But if the tap runs dry, then does it become a priceless commodity? There's no doubt that if mankind was forced to put a true price on water – its real environmental, economic and societal value – we would respect this life-giving compound a great deal more.

Water is crying out for its own "ocean plastic moment", when our water courses are too chocked full of rubbish, too parched to flow or deluged in the wake of climate crises. Only then will we sit up and think how vital water is on a global scale. It's something most of us take for granted, because there's a myth of abundance.

"We now live in a world of 'peak water,' where we over-tap, pollute and abuse our most precious resource. We need a fundamental change in the way we think about water," says Peter Gleick, founder of the Pacific Institute.

This comes at a time when mankind faces the perfect storm of issues from micro-beads in rivers, more pesticides and fertilisers from farm run-off, swelling human populations with a lack of safe sources and pathogen-filled water, not to mention more water "day zeros" from Chennai to Cape Town. Globally, the sector needs to convey a clear message about the challenges it faces.

"The public sector has few incentives to communicate that water is increasingly scarce due to increasing demand. What country, city or utility wants to announce that there isn't enough water for economic or business development? What water utility wants to increase rates to promote conservation and reuse, unless regulated to do so?" says Will Sarni, chief executive of Water Foundry.

Access to clean water is enshrined in a United Nations resolution, yet at the same time this right is abused. To date there's also chronic underinvestment in infrastructure, much of which is invisible and underappreciated. The Organisation for Economic Co-operation and Development estimates $1 trillion in annual investment is needed. At the same time, the sector isn't attractive to private finance as returns are low.

"It's water management, stupid," exclaims Monika Weber-Fahr, executive secretary and chief executive of the Global Water Partnership.


Mrjn Photography/Unsplash

That's because many of the water crises we now face are born out of poor management, exasperated by a lack of data, yet water governance and ownership are sensitive topics, all because it involves a multitude of players. Water is a real nexus issue.

"Water management fails because it's done in isolation, not taking into account the linkages between land, fresh water, coasts and the oceans," says Ruth Mathews, senior manager at the Stockholm International Water Institute. "We need governments, companies and individuals to account for the water they use and listen to the voices of those often ignored, the poor, the vulnerable, local people and the environment."

Innovation in public policy can go a long way to driving change. Just look at how Israel, Singapore and the Netherlands manage every drop. Water conservation and reuse is mandated and supported by pricing. The future of water is also digital. Water technologies are now transforming the industry just as they did the energy sector.

"So many of our problems don't just require technical solutions, but improvements in real management, and even here, we're seeing efforts to move away from old thinking and 20th-century institutions towards more effective and equitable water management," says Dr Gleick.

And time is of the essence. According to the UN, there's expected to be a 40 per cent shortfall in fresh-water resources by 2030; that's a lot of water. By 2050, GDP growth rates could decline by 6 per cent due to water-related impacts on agriculture, health and incomes, with a loss of $4.5 trillion, according to the World Bank.

"If we understand the true scale of risk and the subsequent economic consequences when water impacts on human activity, we might value it more and make better-informed economic, development and business decisions about water," says Tom Williams, director of water at the World Business Council for Sustainable Development.

"Investors now want more information about how companies are disclosing water-related risk to their business. One way to do this would be to highlight the proportion of revenues that are exposed to water-related risk. The impact of water risks are also showing up on company bottom lines."

We are certainly getting smarter at calculating the real price of water use in terms of extraction, treatment and transport, as well as energy use and associated carbon emissions. This paves the way for economies, global trade and businesses to attribute more value to this precious commodity.

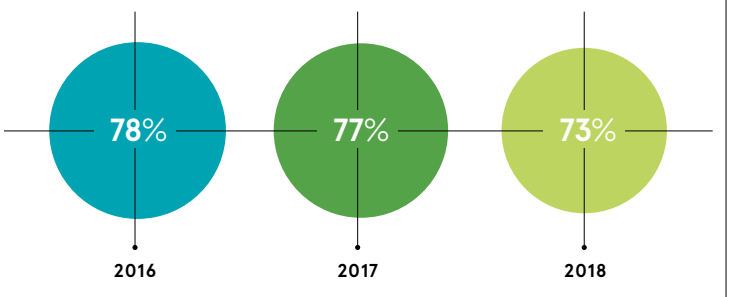
In time this could help boost demand for finance in water projects, which is currently weak while the number of bankable projects is small.

"We need to evolve in how we fund water infrastructure and innovation. Traditional approaches by the public sector or venture capital are not adequate. We need blended finance – low and high-risk capital – and patient capital to support water entrepreneurs," says Mr Sarni.

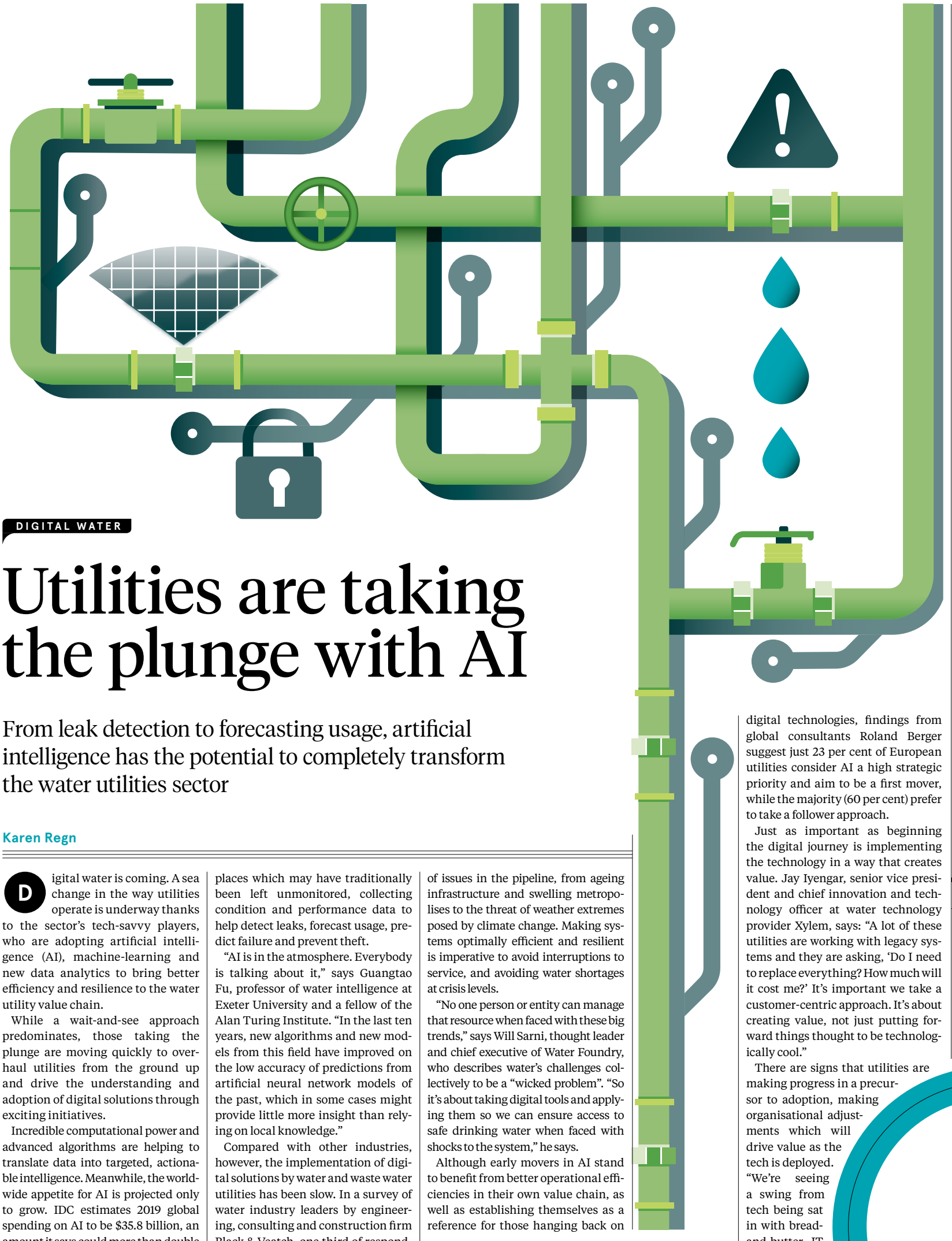
"Water stewardship in many cases is a corporate social responsibility function and not viewed as an enterprise risk and business opportunity. We need to frame water as an opportunity for the private sector." That reframing can't come soon enough.

CUSTOMER AWARENESS OVER POTENTIAL CLIMATE IMPACT GROWING

Percentage of UK water customers in England and Wales who are confident that their water supply will be available in the longer term without being subject to restrictions on use



CCWater 2019



DIGITAL WATER

Utilities are taking the plunge with AI

From leak detection to forecasting usage, artificial intelligence has the potential to completely transform the water utilities sector

Karen Regn

Digital water is coming. A sea change in the way utilities operate is underway thanks to the sector's tech-savvy players, who are adopting artificial intelligence (AI), machine-learning and new data analytics to bring better efficiency and resilience to the water utility value chain.

While a wait-and-see approach predominates, those taking the plunge are moving quickly to overhaul utilities from the ground up and drive the understanding and adoption of digital solutions through exciting initiatives.

Incredible computational power and advanced algorithms are helping to translate data into targeted, actionable intelligence. Meanwhile, the worldwide appetite for AI is projected only to grow. IDC estimates 2019 global spending on AI to be $35.8 billion, an amount it says could more than double to $79.2 billion by 2022.

Collecting an estimated 300 million pieces of operational data each day, the water sector is the ideal candidate for a big data optimisation makeover.

The advent of cost-effective sensors and the internet of things present a further source from which to mine data, as sensors can be deployed in places which may have traditionally been left unmonitored, collecting condition and performance data to help detect leaks, forecast usage, predict failure and prevent theft.

"AI is in the atmosphere. Everybody is talking about it," says Guangtao Fu, professor of water intelligence at Exeter University and a fellow of the Alan Turing Institute. "In the last ten years, new algorithms and new models from this field have improved on the low accuracy of predictions from artificial neural network models of the past, which in some cases might provide little more insight than relying on local knowledge."

Compared with other industries, however, the implementation of digital solutions by water and waste water utilities has been slow. In a survey of water industry leaders by engineering, consulting and construction firm Black & Veatch, one third of respondents say their data remains siloed and unintegrated, while 55 per cent consider their data management strategy to be strong and improving, though lacking full integration, making it difficult to understand what's occurring collectively across systems.

Water professionals are under no illusion regarding the scale and complexity of issues in the pipeline, from ageing infrastructure and swelling metropolises to the threat of weather extremes posed by climate change. Making systems optimally efficient and resilient is imperative to avoid interruptions to service, and avoiding water shortages at crisis levels.

"No one person or entity can manage that resource when faced with these big trends," says Will Sarni, thought leader and chief executive of Water Foundry, who describes water's challenges collectively to be a "wicked problem". "So it's about taking digital tools and applying them so we can ensure access to safe drinking water when faced with shocks to the system," he says.

Although early movers in AI stand to benefit from better operational efficiencies in their own value chain, as well as establishing themselves as a reference for those hanging back on digital technologies, findings from global consultants Roland Berger suggest just 23 per cent of European utilities consider AI a high strategic priority and aim to be a first mover, while the majority (60 per cent) prefer to take a follower approach.

> **It's about creating value, not just putting forward things thought to be technologically cool**

Just as important as beginning the digital journey is implementing the technology in a way that creates value. Jay Iyengar, senior vice president and chief innovation and technology officer at water technology provider Xylem, says: "A lot of these utilities are working with legacy systems and they are asking, 'Do I need to replace everything? How much will it cost me?' It's important we take a customer-centric approach. It's about creating value, not just putting forward things thought to be technologically cool."

There are signs that utilities are making progress in a precursor to adoption, making organisational adjustments which will drive value as the tech is deployed. "We're seeing a swing from tech being sat in with bread-and-butter IT to seeing chief data officers and data scientists coming in as disciplines," says Mark Kaney, Black & Veatch's director of asset management for Europe.

"We're also seeing heads of innovation, innovation hubs, labs and shop windows helping organisations to keep pace, because as soon as they've got their head around one thing, it's moved on."

Partnerships are being built, bolstered by a widespread belief that solving water will require more than just relying on the industry's major players to address large-scale challenges.

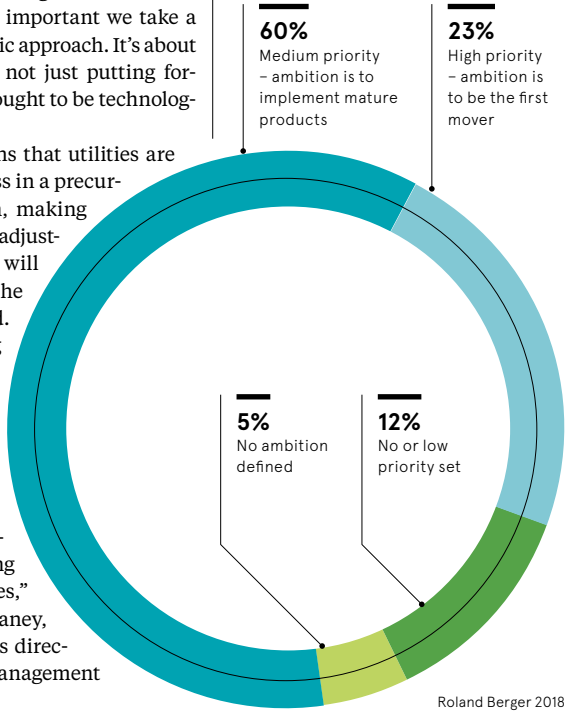
"They are the guardians of health associated with access to water; I want them to err on the side of being cautious," adds Mr Sarni. "It's a smart approach we're seeing right now from tech hubs and accelerators that are working very hard to identify innovative technologies, digital technologies in particular, and then working with utilities and the industrial sector and derisking those technologies, as opposed to a tech startup or provider trying to sell into a utility and get adoption at scale."

For organisations with less funding and AI expertise, multi-cloud, multi-provider products and services with embedded AI are making the adoption process easier. Black and Veatch's ECO-X cloud-based digital ecosystem enables integration with partners to provide digitally enabled asset management solutions across the asset life cycle. Subscriptions may be long or short term and ultimately the partnership provides flexibility and accessibility for utilities, while involving smaller digital enterprises and startups to drive innovation more quickly.

"This allows utilities access to that startup, but with the support of a large engineering company," says Mr Kaney, who believes a blend of large and small companies creates the diversity needed to drive innovation forward. "Each company culture and way of working has its advantages. Smaller companies are faster moving and that creates an amount of creative tension so you're always pushing each other to succeed. Everyone can feel they have a part to play and are engaged in finding the answer," he concludes.

AI APPETITE

Utility companies were surveyed over their strategic intentions for artificial intelligence over the next five years



Roland Berger 2018

Coming together to tackle global water challenges

Fast-growing populations around the world are accelerating a global water imbalance that is already causing major issues. What needs to happen to combat these challenges?

Scarcity of clean water is a huge challenge in the world today. Three in ten people lack access to safe water at home, according to the World Health Organization and UNICEF, and as the global population continues to grow the problem is only set to get worse.

Population growth accelerates the trends of industrialisation, urbanisation and climate change, increasing the amount of water people need and the energy they consume. A kilo of beef takes 20,000 litres of water to produce, while a car requires 200,000 litres. As industrial output and food consumption increases, so does the need for more water.

Part of the challenge is awareness. Media coverage may highlight water scarcity issues, but it often fails to frame the discussion around a solution and translate accountability to the masses. The issue of plastic pollution has shown how powerful it can be when people feel empowered to make small consumption changes in their own lives.

The other challenge is one for industry, namely bringing different stakeholders together to strategically manage water. Industrial uses are squeezed on one side between agricultural use and drinking water in terms of availability, and on the other by tightening regulations. Industry is a contributor to the whole value chain.

"We can all do something about it, but we have to work together in ways we haven't done before," says Alexander Lane, commercial director at DuPont Water Solutions. "If you think about the Ganges drying up and power plants being unable to run because of insufficient cooling water availability, we're already beginning to see this issue manifest itself.

"We need more tightly knit water communities involving industry, municipalities and authorities to help manage supply in basins, looking at sources of reuse and quality for all concerned. Particularly in remote areas supplying a community or industrial production, from one or two sources, it's important to manage it holistically rather than each stakeholder taking what they need without a view to the whole picture."

DuPont, the global specialty products company, is taking a leading role in tackling the global water imbalance. As a manufacturer and supplier of purification and separation technologies, the innovation it develops is a core component to help make water cleaner, safer and more accessible. The combination of ultrafiltration, reverse osmosis and ion exchange, in particular, is a powerful proposition when it comes to purifying water from a wide array of sources, including ground water, surface water, sea water and even waste water.

However, technology is only one piece of the puzzle. The bigger challenge is the requirement for better awareness and industry collaboration. DuPont supports the Brave Blue World Foundation, a not-for-profit initiative that will release a documentary this year to shift thinking around solving water challenges globally and inspire greater urgency, as well as optimism.

To encourage collaboration, DuPont works to bring people together on every continent around the world. It has worked with communities in the United States, helped treat water for people in Kenya and participated in decentralised water projects in Egypt.

"The value chain of stakeholders for each one is very different and it's important for us to work with each one of them effectively to be able to bring everyone together and bring a solution to bear, rather than just simply making a product sale," says Mr Lane. "It's vital that everybody is part of the conversation and we're working globally to bring some thought leadership to markets, as well as our technical solutions.

"We're very open collaborators and where we can we're trying to refresh our messages and really drive the conversation. UN Sustainable Goal 6 is access to clean water and goal 17 is new partnerships that are required to form new ecosystems. This means new ways of looking at problems and different stakeholders than have historically been around the table to drive new conversations and implement new solutions.

"Banks, governments, industry, technology providers; there are numerous people who have to come together and really make some of these things happen. There needs to be political will, financing and regulation, as well as the right innovation in the places that need it most. Framing it holistically and bringing down silos is really important."

Earth is 66 per cent water, which can give people the impression there is an abundance of water around. In reality, however, the supply situation is extremely fragile since only 2.5 per cent of this is fresh water. Over half of all global fresh water gets converted to waste water in the form of industrial, municipal and agricultural discharge.

GLOBAL WATER REUSE

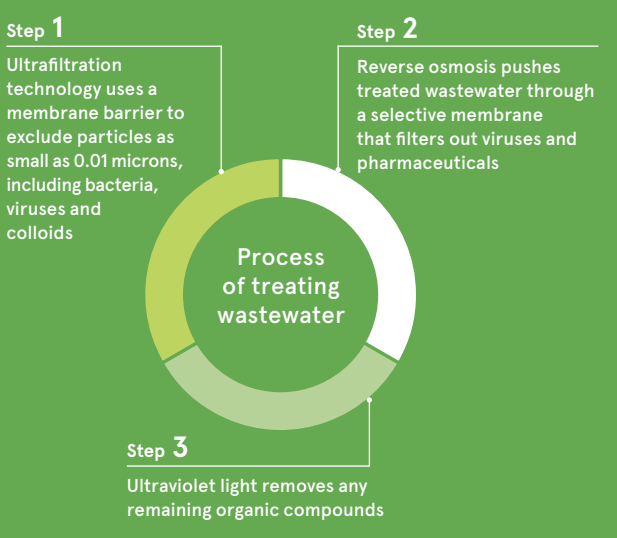
Wastewater reuse helps address growing global water scarcity

50%
predicted increase in global water requirements by 2034

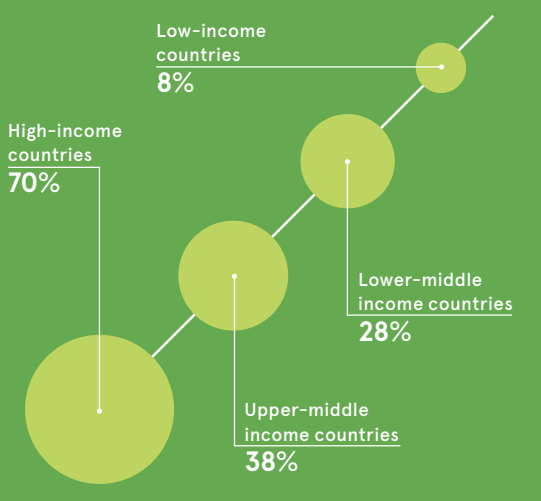
1 in 7
people globally do not have access to clean, drinkable water

50%
of the world population will face water scarcity by 2030, according to the UN

3-STEP PROCESS OF TREATING WASTEWATER



PERCENTAGE OF GENERATED WASTEWATER TREATED, BY COUNTRY



All statistics from DuPont, unless otherwise stated

Waste water reuse represents an affordable and sustainable source of water, energy, nutrients and other recoverable materials. Waste water is everywhere people are and in water-scarce regions it becomes a highly valuable resource.

In the context of innovation, enabling purification and reuse of waste water is a key focus area for DuPont. Minimal liquid discharge converts 95 per cent of waste water into a sustainable source of fresh water at a price point 60 per cent lower than conventional solutions. Such innovations promote a mindset that waste water should be perceived as a source of fresh water.

> We can do more about water scarcity by working together in ways we haven't before

"It's not just that we need a bit of rain and then everything will be good again," adds Mr Lane. "Eighty per cent of the water that is produced is released back to the environment. That's already a source of reasonably well-treated water that should be tapped, rather than just letting it go down the drain.

"We need to shift our thinking from linear to circular: reduce usage firstly, yes, but also then look at ways we can recycle and treat the water we have. Everyone is sitting down and talking around the doom, gloom and complexity, and somehow we have to try to re-energise and simplify the discussion."

As our planet is forced to sustain more and more people, there will be unprecedented demands on resources in the years ahead. Promoting the correct solutions to the issue and challenging historical behaviours are crucial to getting the world to a stage where everybody has access to clean drinking water. Creating a more circular economy means making things happen on a local, regional, national and global scale, and that can only happen with real collaboration across the board.

For more information please visit www.dupontwatersolutions.com

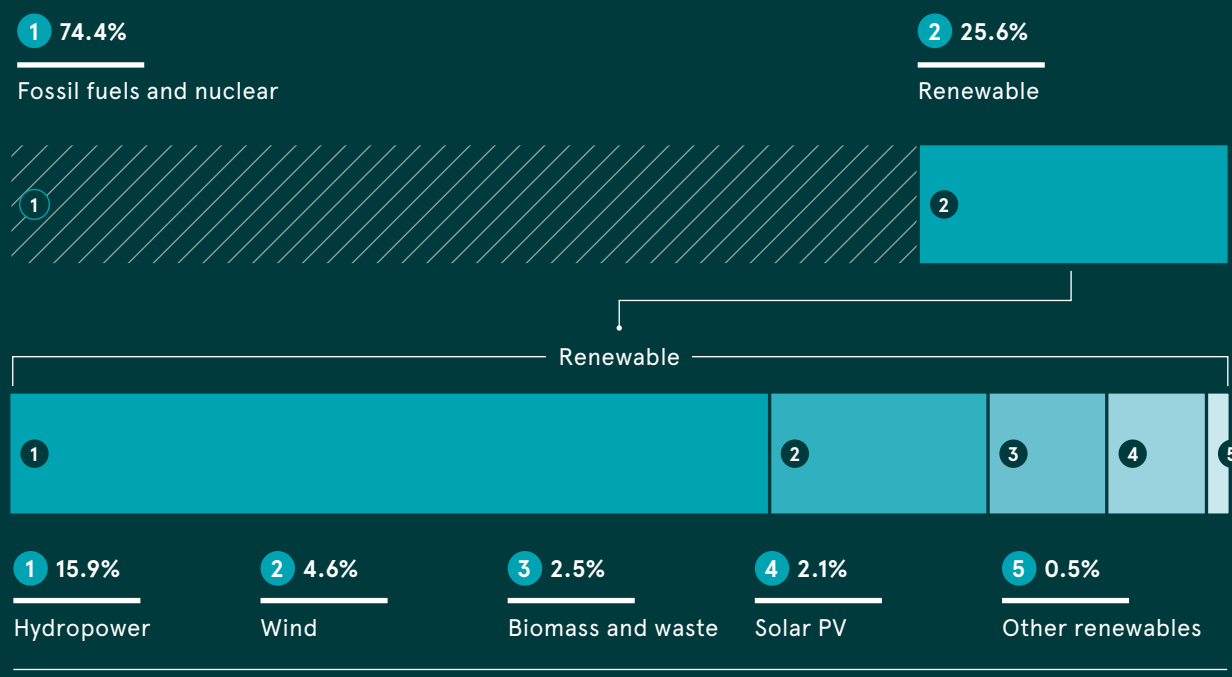
DUPONT™

THE POWER OF WATER

With electricity generation from hydropower sources reaching record heights in 2018, can hydropower help solve the climate crisis?

HYDROPOWER: WORLD'S LARGEST SOURCE OF RENEWABLE ELECTRICITY GENERATION

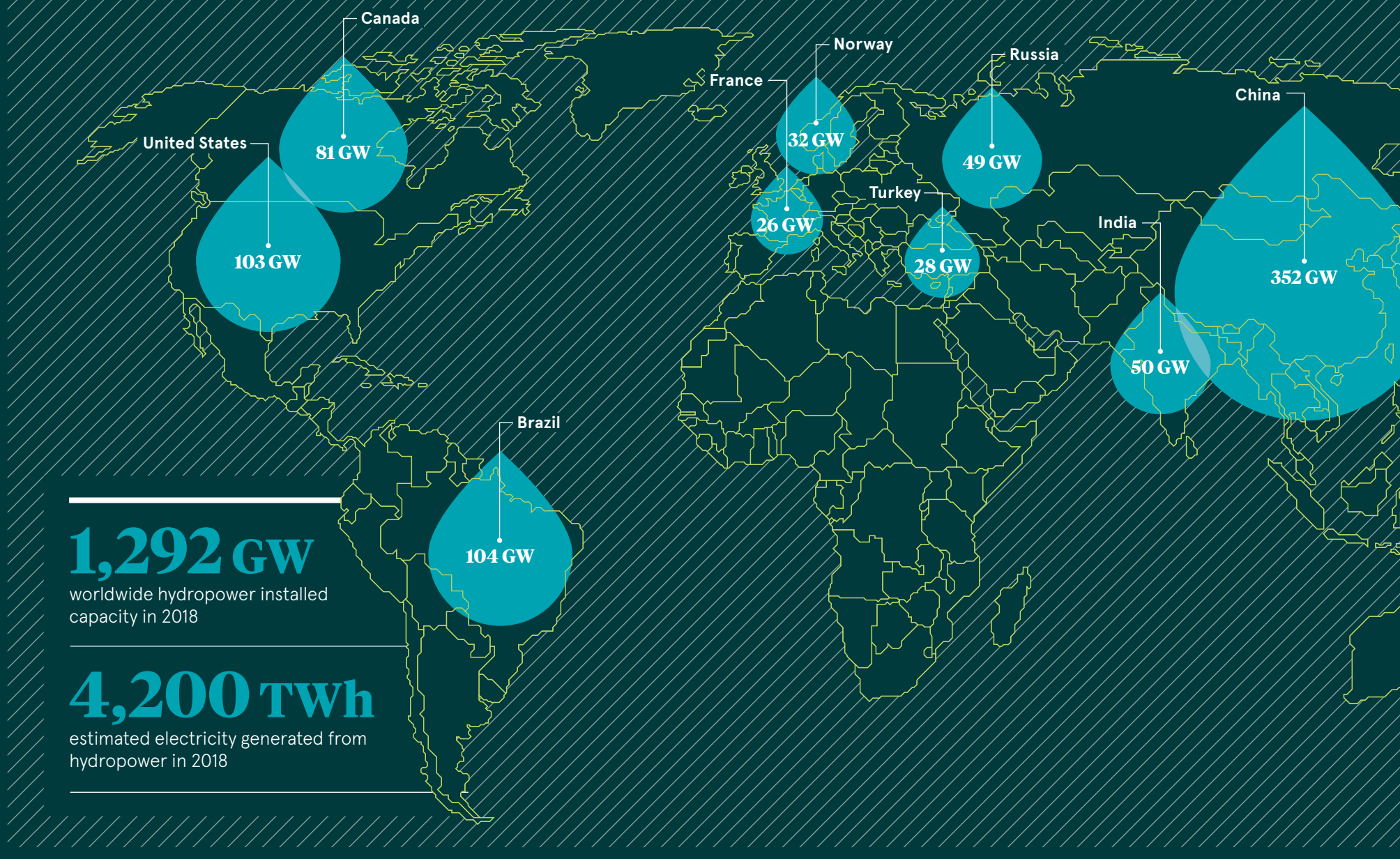
Breakdown of global electricity generation



IPCC 2014 / International Hydropower Association 2018

TOP TEN COUNTRIES FOR HYDROPOWER CAPACITY

Total hydropower capacity for 2018 (GW)



1,292 GW
worldwide hydropower installed capacity in 2018

4,200 TWh
estimated electricity generated from hydropower in 2018

GLOBAL AVERAGE INSTALLED COST OF HYDROPOWER PROJECTS ($/kW)

In 2018, the average cost of hydropower projects declined by 16 per cent, suggesting that hydro projects are becoming more affordable

IRENA 2019

International Hydropower Association 2018

Hydropower is not without its downsides, having a significant impact on people, communities and the environment.
The development of the Three Gorges Dam saw:

1.2 million
people displaced

13
cities flooded

140
towns flooded

1,350
villages flooded

International Rivers 2019

100 megatons
of carbon has ended up in the atmosphere in the past 15 years, according to scientists estimations, because hydroelectric power has failed during drought

IOP Science 2019

INTERVIEW

Tackling water: one of the riskiest global assets of all

An interview with **Callie Stinson**, project lead of the World Economic Forum's Water Initiative

Nick Easen

Last year it was Cape Town, this year Chennai has run dry. "Day zero", a time when the taps are turned off, is hitting another vast swathe of humanity. This time, a weak monsoon and bad water management are to blame. The frightening prospect is that 21 other Indian cities face a similar fate. There are increasing signs that a global water crisis is morphing into a climate emergency.

"Unfortunately, there are many other water-stressed and parched spots on Earth, from Somalia to North Korea," says Callie Stinson, leading the Water Initiative at the World Economic Forum.

"But while some places wrestle to fend off 'day-zero' situations, others, like Jakarta, struggle with the combined challenges of flooding, pollution and sea level rises. Today's climate and water issues are not separate or parallel threats, they are increasingly intertwined. Look at the headlines any day of the week and you see signs of climate change manifesting itself through water crises."

For eight consecutive years, water has stubbornly hit the top five risks in the World Economic Forum's *Global Risks Report*, as highlighted by 1,000 experts. The top risks for 2019 also include extreme weather events, failure of climate-change mitigation and adaptation, biodiversity loss and ecosystem collapse, and natural and human-induced disasters.

"Environmental risks are not only intensifying as weather patterns change, they are also becoming more closely interconnected, creating an increasingly complex challenge to our economic and societal resilience," explains Ms Stinson. "And water cuts across most of today's top risks; it's the ultimate nexus issue."

It's also a costly one. The World Bank and the Organisation for Economic Co-operation and Development forecast that global flood losses in coastal cities, exacerbated by climate change, will escalate to $52 billion a year by 2050. Add in the risks from sea-level rises, sinking land and flood damage for large coastal cities and this could top $1 trillion a year if they fail to adapt.

"Fortunately, there are a lot of new and exciting initiatives that are doing great work to build water resilience to climate change, in terms of disaster risk reduction or longer-term adaptation strategies. These draw upon innovative technology, data, finance and policy. People are waking up to the fact that water resilient societies are a big part of the climate equation," says Ms Stinson.

For instance, the Dutch government has created a resilience design challenge to address the issues tied to urban water stress in Asian cities. In the United States, the newly launched Adrienne Arsht-Rockefeller Foundation Resilience Center is working to provide a billion people with resilience solutions to climate change, migration and security-related challenges by 2030.

From the private sector, a global coalition of insurance companies, investors, asset owners, engineering firms and ratings agencies is emerging. These are being joined by governments and development institutions to mainstream and properly price climate risk into infrastructure investment decisions.

Such examples underscore the fact that water cannot be tackled in a silo. A business-as-usual approach won't help mankind address the risks around water in the coming decades.

"We can't think about droughts or flooding beyond their impact on food security, migration, health or ecosystems. Yet the persistence of water and other environmental risks suggests that as these threats become increasingly intertwined, we need a more systemic and cohesive response," says Ms Stinson.

"Mobilising a joined-up approach to public-private collaboration is vital. It must be one that takes an integrated view of the challenges and the solutions. This will be critical for building water resilience across the global economy. This is not an option for the years ahead, it is a must-do."

Callie Stinson
Project lead of the World Economic Forum's Water Initiative

PRICE REVIEW

Providers under heavy pressure in latest price review

Ofwat's latest price review is its most thorough and stringent to date, so how are water providers responding?

Mark Hillsdon


GettyImages/CatherineFalls Commercial

Ofwat PR19 is the water regulator's most comprehensive and stringent price review yet and has been billed as a game-changer for the way in which the UK's water industry operates.

Delivered earlier this month, Ofwat PR19 is the latest judgment on the revised plans, known as draft determinations, of 14 water companies in England and Wales, with those of three others already fast-tracked in recognition of their high quality.

Created by the water companies in consultation with their customers, the plans are used to set price, service and incentive packages for the next five years, and revolve around the four key pillars of efficiency, resilience, innovation and customer service.

The latest determinations have been heavily scrutinised by Ofwat and as a result water companies are now expected to take advantage of falling costs and greater business efficiencies to find an additional £12 billion of spending above business-as-usual costs and planned investments.

Ofwat chief executive Rachel Fletcher describes the review as containing "seriously stretching goals for the sector", with targets including cutting pollution incidents by more than a third, reducing supply interruptions by almost two-thirds and staunching leaks that will save water equivalent to the needs of Manchester, Leeds, Leicester and Cardiff.

There are also measures to help 1.5 million customers who are struggling to pay, while water companies are expected to cut bills by an average of £50 a year.

Most water companies have remained tight lipped about the review and have until the end of August to object by providing evidence that it will prevent them from delivering services to customers and the environment. Final determinations will be released in December.

However, Shane Anderson, head of economic regulation at Seven Trent Water, one of the fast-tracked companies, says: "We enter every review expecting it to be demanding and it's right that they are if we're going to deliver the best possible balance of outcome for customers.

"One of the strongest ideas that has come out of this review, and industry-wide discussions subsequently, is social purpose: the idea that as a provider of an essential public service we have huge potential to deliver more for the environment and society."

Steve Mogford, chief executive at United Utilities (UU), whose plans also received an early seal of approval, agrees. "PR19 reflects a public issue around conscience and that means ensuring you behave appropriately," he says.

"All companies have different challenges. For UU, we have to work harder on things like deprivation, helping people who are struggling. We also have to work harder on issues of flooding because of the environmental conditions we have in the North West."

Resilience of supply was among key criteria in the review, with innovation seen as playing an important role in helping the industry maintain and manage a network of some 800,000 kilometres of ageing sewers and water supply pipes.

"PR19 has certainly placed even more emphasis on efficiency and innovation," says Mr Anderson, "but we believe it's important we drive change rather than just respond to challenge from regulation.

"Innovation is one area where we've been proactive to help ready ourselves for future challenges like climate change and population growth."

This year the company launched the World Water Innovation Fund, bringing together forward-thinking companies from across the UK, Australia and the Americas to create new ways to help manage water resources. "In the future, we want to see more industry-wide collaboration, both nationally and globally, something that Ofwat is also working towards," he says.

UU has also embraced innovation, from machine-learning packages, which help track the performance of their network, to sniffer dogs that can detect leaks.

Referring to Ofwat's 2014 price review, Mr Mogford says: "We were initially some distance from Ofwat's view on efficient costs, so we did a tremendous amount on capital programme costs and took an innovative approach to systems thinking."

As a result, UU cut its expenditure by £1 billion, the type of saving Ofwat hopes other companies will be able to channel into meeting the latest targets.

The review has also put the thorny issue of customer service centre stage. Mustafa Atik, energy and utilities expert at customer experience specialists Quadient, says that with so-called Open Water, when customers will have much more choice about who supplies their water, set to become a reality in the next few years, companies need to rethink their customer experience strategy or risk losing out to emerging competitors.

"Water needs to learn from the lessons of other utilities," he says. "The Big Four energy suppliers have seen their business drop, partly because they weren't ready for the explosion of consumer power that opening the industry created.

"Savvy water companies will be ensuring their customer experience is exemplary in the next few years, to ensure satisfied customers now and in the next decade. In any commoditised industry, customer experience is one of the last, true differentiators."

> **Savvy water companies will be ensuring their customer experience is exemplary in the next few years**

OPINION

‘Climate change and population growth are providing us with huge resource issues that need tackling urgently’

Reducing the amount of water lost through leaks has always been a priority for water companies’ customers, understandably so. A huge amount of work goes into this – finding and fixing leaks on thousands of kilometres of water main is an enormous task – but it’s no surprise Ofwat has imposed some tough sector-wide targets in its latest price review. It has equally high expectations around cutting pollution, supply interruption and consumption.

The water industry is seeking to build customer trust, which has generally improved in recent years, and will be focusing heavily on these critical areas, of course, with the support of the supply chain.

British Water members will be looking at how they can partner with water companies and key stakeholders to bring about real change and improvements, while continuing to provide the essential water and waste water services we rely on daily.

One of the challenges faced is maintaining our ageing infrastructure at a price affordable to customers. Minds will be focused on driving operational efficiencies over the next five years, rather than projects requiring big capital expenditure.

This will be underpinned by the use of data analytics, sensors, artificial intelligence and robotics to support leakage detection, flood resilience, asset management and water-resource planning. UK technologies and expertise have a major role to play in addressing global environmental challenges as well as those closer to home.

Our industry has a long history of world-changing innovation. As chief engineer of London's Metropolitan Board of Works, Joseph Bazalgette pioneered modern sewerage during the late-19th century, cleaning up the Thames.

British Water members continue to lead the way, creating new supplies, building treatment works, reusing and recycling water, laying pipes, preventing sewer blockages, detecting leaks, and cleaning up rivers and seas.

It’s a challenging time for the industry: we’re in critical water stress. Climate change and population growth are changing the global landscape and providing us with huge resource issues that need tackling urgently.

But it’s also an exciting time. British Water is looking to work closely with the water utilities, industry, academia and innovation hubs to connect across geographic boundaries. We have a real opportunity to collaborate, educate and innovate to change the way we do things for future generations.

I’m proud the UK was the first G7 nation to set a legally binding target to cut carbon emissions to net-zero by 2050, and that the water industry has an even more ambitious target of 2030. Our members are already finding ways to use less energy and close the resource loop by, for example, extracting biofuel and fertiliser from sewage and reusing waste water.

There is also some impressive collaborative work in catchment management, where water companies work with the supply chain, local authorities, farmers and landowners to encourage sustainable land management.

The industry also recognises public concern about micropollutants, including residual pharmaceuticals, reaching watercourses. Some of our members boast the expertise and technical capability to start to address this highly sensitive issue.

During the industry’s next investment cycle, from 2020 to 2025, I’d like the supply chain and water companies to collaborate even more closely to protect rivers and reduce water-quality risks.

I strongly believe we need to engage customers each step of the way and drive awareness of the amazing work done in our industry, of the huge improvements in drinking water quality and the environmental standard of rivers and bathing waters, but also the water stewardship role we all have, particularly around reducing consumption.

I’m optimistic. People are focusing more and more on protecting our natural world, and water plays a vital role. Where will we be in the next 20, 50, 100 years? Our members are already thinking about that and planning for it.

Lila Thompson
Chief executive
British Water

Tackling water loss

One third of the world’s drinking water is lost from leaking pipes, however effective tools to stop this are available today

Water loss through leaks and non-revenue water are a global issue of monumental scale. A 2018 Consumer Council for Water report revealed that in England alone more than three billion litres of water are lost from leaking infrastructure every day, making water leakage the number-one concern for UK water utilities’ customers.

Despite significant manpower-driven efforts to reduce leakage, it has actually continued to increase in recent years. The UK government has now put forward the scary scenario that the country could face water shortages by 2050. This is why it has pushed water regulator Ofwat to exert pressure on UK water utilities to step up their efforts and reduce leakage by 15 per cent over the coming five-year asset management period (AMP7) and force heavy investment programmes.

Due to the cost of pipe replacement, which can be hundreds of thousands of pounds per mile, finding and fixing leaks as early as possible is the only way to reduce water loss sustainably. But present methods are not suitable as armies of leak operatives assisted by low-technology tools can only scratch the surface.

“A host of new methods and technologies are available – satellite imagery, tracer gas leak detection, drones and smart metering, to mention a few – and can be useful tools in the toolbox of any utility. However, we maintain that the most effective approach remains the large-scale deployment of fully correlating acoustic sensors on the water network,” says Uri Gutermann, spokesman of leak detection technology specialist Gutermann.

Full correlation means cloud servers receive daily time-synchronised sound recordings from the pipe network which they systematically correlate with each other and can hence automatically identify even small leaks, based on their unique noise profile, and pinpoint their exact location on the pipe.

“We were the first to introduce full correlation in fixed networks 15 years ago and have since installed more than 300 projects around the world,” says Mr Gutermann, emphasising that commonly seen knee-jerk investments and quick-fix strategies are not sustainable long-term solutions.

“Leak reduction should be a long-term strategy and so should the investment decisions in leak detection technology. There is no reason why a significant, sustainable reduction in water loss can’t be achieved depending on how densely you install fully correlating loggers and how quickly you react to leak alarms.”

The third-largest city in France, Lyon, covered 1,200 kilometres of pipe network with Gutermann loggers in 2015 and reduced non-revenue water from 21 to less than 14 per cent in just three years.

“We can see a paradigm change in the UK too,” says Mr Gutermann. “In recent months, several UK water utilities have started to deploy Gutermann loggers on a large scale to monitor critical neighbourhoods or entire towns and cities permanently.”

Gutermann places the utmost importance on data availability and result accuracy of a permanent monitoring solution. For this reason, until now its technology has relied on its own radio infrastructure to lift data from underground pipes to above-ground data servers.

“The need for radio repeaters installed on lampposts has remained a necessary nuisance to achieve maximum system performance,” Mr Gutermann concedes. “We are therefore excited about the launch of our NB-IoT logger at the start of the fourth quarter this year, mitigating the need for repeaters and gateways, and significantly reducing system purchase and maintenance costs.”

Gutermann has identified NB-IoT as the most suitable internet of things communication technology for its purposes that will enable the company to send data straight from the logger underground to servers above ground through the cellular network, while maintaining a logger battery life of more than five years. This complements an overall vision to focus on a water leakage problem that is global in its extent, but especially critical in the UK.

Mr Gutermann concludes: “Leak detection technologies have come a long way, with permanent, correlating acoustic solutions being the most cost and result-effective method, and soon to be even more attractive through the harnessing of the internet of things in combination with cloud computing.

“If utilities adopt a strategic mindset in deploying modern, fully correlating acoustic fixed networks, I’m confident we can overcome the concerted global crisis that is water leakage.”

>30%
of potable water is lost globally through leaky pipes

3.2bn
litres of water are lost in England and Wales every day

300+
fixed network systems from Gutermann worldwide with fully correlating noise loggers

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GUTERMANN

RESPONSIBILITY

Understanding the true meaning of water stewardship

Water-intensive sectors, such as those in manufacturing and production, are under more pressure than ever to take greater responsibility for their water consumption

Jessica Brown

The safe provision of drinking water is a human right. But this is under increasing threat, not only due to drought, climate change and growing populations, but also increased consumption by consumers and water-intensive industries alike.

Water remains one of the most important corporate social responsibility (CSR) initiatives a business can have. And those transparent about their efforts can benefit from competitive advantage, brand awareness, and improved trust with customers, employees and stakeholders.

But water conservation problems are an increasing risk for businesses themselves. The World Resources Institute says more than a billion people currently live in water-scarce regions and this could rise to 3.5 billion by 2025. Meanwhile, Nasa has found that 13 of the world's 37 most important groundwater basins are depleting much faster than they can be recharged.

One of the first steps companies can take is changing to a more sustainable supplier. The commercial market of the UK water industry was deregulated in 2017, allowing businesses to change providers, regardless of where they're located.

However, only a fraction have switched, despite the opportunity to save money on utility bills. Only 36,000 small-business owners in England switched water supplier between April and August 2017, out of a possible 1.2 million. One year on, less than 5 per cent switched, according to data from Market Operator Services, which operates the new water market.

> **As we go into a climate-uncertain future, businesses need to work together on issues around water scarcity**

Vincent Mundy /Bloomberg via Getty Images

AB InBev

Brewer AB InBev invests in reducing the amount of water it uses to make beers and improving the resilience of the watersheds where it operates, particularly if facilities and local communities share high water risks.

It's aiming for measurably improved water availability and quality in all its communities in stressed areas and has committed to working with local stakeholders.

It benchmarks and shares efficiency best practices between its 200-plus production facilities, such as technology for treating effluent water, which enables the company to reuse water for non-product production processes, such as cooling tower or boiler water make-up.

AB InBev has partnered with the Nature Conservancy and WWF to provide water security in some of the most high-risk watersheds globally.

Deregulation only works when businesses take advantage of it. Aside from price, incentives to switch include driving up customer service and improved efficiencies, including tailored services to meet individual customers' requirements and added support.

"Coca-Cola's UK bottler applied for, and was granted, a self-supply licence so they could deal with wholesalers of water rather than retailers," says Liz Lowe, Coca-Cola's UK CSR manager. "This cuts out the middleman, improves relationships and is more agile."

There are many benefits to companies operating in water-intensive industries going above and beyond their CSR initiatives. Victoria Romero, Proctor & Gamble's scientific and sustainability associate communications manager for Northern Europe, says P&G has reduced its water per unit of production by a quarter since 2010, with solutions such as using rainwater and reusing utility reject water that would otherwise go to the sewer.

"Several fabric care plants located in Mexico, Pakistan, Czech Republic and the US have found unique circular approaches to beneficially reuse water from one process and feed water into another process," she says.

"A recent circular example is the Port Qasim plant in Pakistan, located within a water-stressed region, reusing water used to clean and flush holding tanks back into the manufacturing process."

Scarce water will cost businesses more and be less reliable, therefore many recognise they must focus on water stewardship for the survival, not just reputation, of their business.

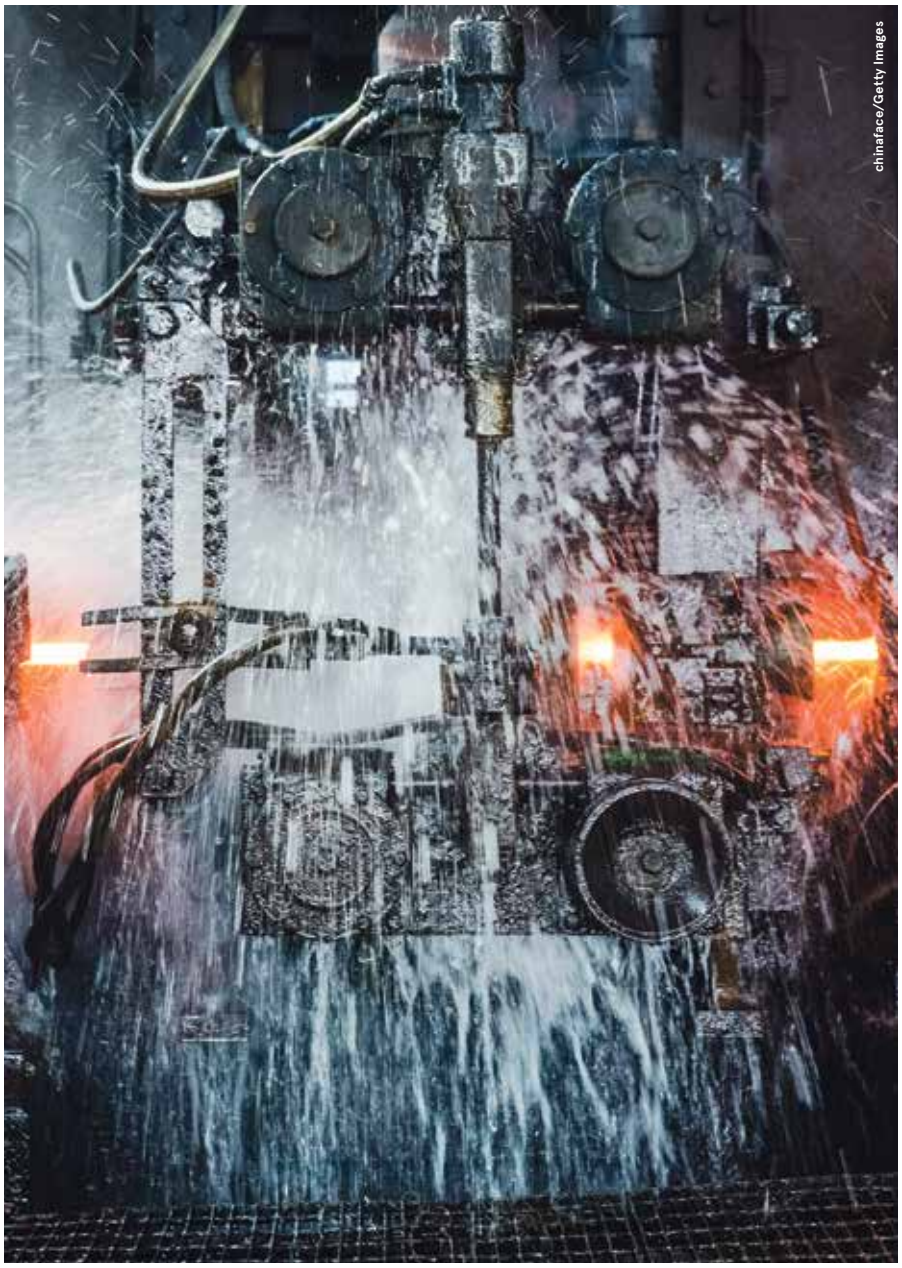
"Water is the main ingredient in all our drinks, without it we wouldn't exist," says Coca-Cola's Ms Lowe.

Businesses with water stewardship CSR initiatives can, therefore, benefit from knowing that the work they're doing is helping to secure their own future.

"A key benefit is securing the ability of our operations to produce quality beers into the future with sufficient and clean water," says Andre Fourie, global director for water sustainability at brewer AB InBev.

"In addition, water stewardship protects the local ecosystem and provides the local community with water and public health."

However, CSR initiatives don't come without challenges. "Launching good water projects is relatively easy," says Mr Fourie. "But impacting on watersheds at the scale of the challenge is difficult. Leveraging partners and financing is a major challenge, but also an exciting opportunity."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In times of increasing consumer expectations, businesses that don't do enough can face damaging consequences.

In 2007, for example, Coca-Cola was accused of causing water shortages in India. Though ruled to be unfounded, the reputational impact of the allegations "reverberated around the world", says Ms Lowe.

"It was important to us to make sure this could never happen again. It was a revolutionary moment when we redoubled our efforts around water stewardship and developed thinking that it wasn't enough to look after our own, we needed to look after the entire community and be viewed as part of the solution, not the problem," she says.

Businesses are seeing the benefits of working together to reach their CSR initiatives. For example, the Courtauld Commitment 2025, led by WRAP (Waste and Resources Action Programme), brings together organisations across the food and drinks sector to cut water waste.

"Water needs to be partnership and collaboration, not just businesses working in isolation," says Lowe.

"As we go into a climate-uncertain future, businesses need to work together on issues around water scarcity. It's going to be a huge issue, and businesses that aren't doing much now will have to address this and start working their way up the water-stewardship ladder."


Andre Silva Pinto/Shutterstock

Coca-Cola

Coca-Cola has six manufacturing sites in the UK and three are in areas of high water stress, including in East Anglia, where it sources sugar beet.

The drinks giant focuses on reducing water use in its factories, investing in technology such as cleaning bottles and lubricating conveyor belts with air, and harvesting rainwater to wash floors. Every site also has a risk assessment based on where it takes water from locally.

Beyond its factories, the company has a replenishment strategy and works with partners globally to ensure all the water used in production is given back to nature. It has achieved this every year since 2015.

EARTH SCIENCE

Space missions uncover Earth's water secrets

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

NASA/Bill Ingalls

01

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 last May when 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 within a micron, or approximately the length of a red blood cell.

Airbus DS GmbH/A. Ruttloff

02

01
The GRACE Follow-On spacecraft launching on board a SpaceX Falcon 9 rocket at Vandenberg Air Force Base, California

02
GRACE-FO satellites being assembled by Airbus Defence and Space in Munich

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

Areas of larger mass, such as mountains, exert a greater gravitational pull than areas of lower mass, such as basins; similarly ice exerts a greater gravitational pull than water in liquid form. As the satellites travel over areas of larger mass, the first satellite will accelerate causing the second to lag slightly behind. This variation in distance is the crucial measurement from which scientists can make inferences about the distribution of ice and water, and how it is changing.

In addition to the original microwave range-finder, GRACE-FO carries a new piece of equipment, the experimental Laser Ranging Interferometer, which is hoped to improve the accuracy of its measurements by up to ten times. "Better spatial resolution could help us to understand the sources of some of the changes we saw in the GRACE data," says Matthew Rodell, chief of the Hydrological Sciences Laboratory at Nasa Goddard Space Flight Center, Washington.

The most important aspect of the new mission, however, is its continuity. Dr Rodell has been observing freshwater supplies using GRACE data since the project's early days. His co-authored research, *Emerging trends in global freshwater availability*, published in the science journal *Nature* last 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.

"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 Typography (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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