PR19 Challenge Report **#5**

WATER CONSUMPTION

Read our latest PR19 Challenge Report and discover:

- How water companies are performing against the challenge of reducing water consumption
- The latest innovations which could help make a difference to water use
- Case studies of work undertaken to reduce consumption

GOAL 6

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PR19 Challenge Report **#5**

FOREWORD

James Brockett, Editor, WWT

Welcome to the fifth in our series of PR19 Challenge Reports, which look in detail at each of the 14 common performance commitments which will be used to measure the performance of water companies in England and Wales in the five years that follow the price review in 2019.

This report focuses on water consumption – how the industry can help drive down the amount of water used by householders and other customers at the point of use.

Here, we take an in-depth look at some of the key statistics involved in water consumption, and present some of the news stories that have recently made the headlines related to this issue. You'll find some examples of the work that is being done in the industry to reduce water use, and thoughts on some innovative techniques that might make a difference in future.

We hope this report provides an essential introduction for the newcomer to the subject of water consumption, while also being a useful information resource for those involved on the front line in the industry.

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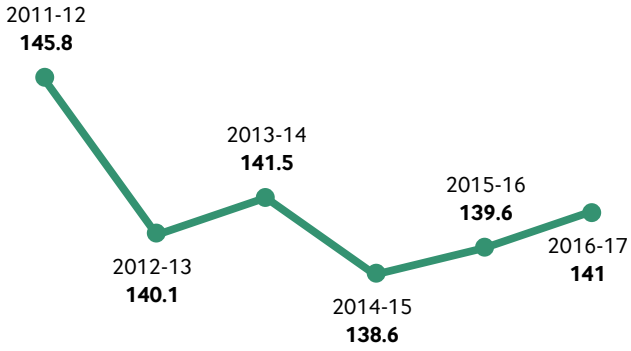
WATER CONSUMPTION

With the twin challenges of population growth and climate change putting the pressure on water resources in the medium to long term, reducing average household water consumption is a key strategic objective for the UK water industry, which is why it is one of Ofwat's common performance commitments for the regulated water utilities in PR19. Average consumption across the country – at 141 litres per day per person per day – compares unfavourably to similar countries such as Germany (121 litres) and the UK government has set an aspirational target for the sector of 130L per person per day.

Metering is the strongest tool in the box for reducing consumption, with metered customers using 33 litres less per day on average. This is reflected in individual water company figures - Southern Water has rolled out metering the most aggressively in recent years (from 52.2% metered in 2011 to 85.6% in 2016) and has seen the biggest drop in consumption over the same period. By contrast, consumption among companies which have not pushed metering have flatlined, or even increased, in recent years. The issue has a higher profile in the south and east of England as these areas are more water-stressed.

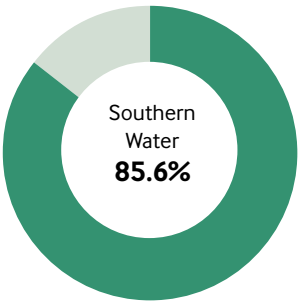
As well as metering, water companies will be looking to drive numbers down by promoting water-saving gadgets, deploying educational campaigns (including in schools), and tackling customer-side leakage.

Water consumption per person per day - England and Wales - last 5 years

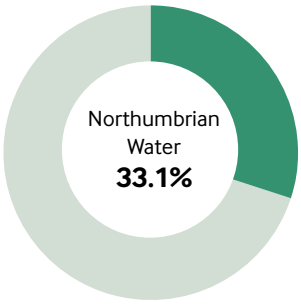


UK government aspirational target - 130 litres
(source: CCWater)

Highest proportion of meters:



Lowest proportion of customers metered:



141
litres per day

The average water consumption per person in England and Wales 2016-7
Source: Discover Water

Customers with a water meter use
127
litres per person per day

Average water use for all customers England and Wales
141
litres per person per day

Customers without a water meter use
160
litres per person per day

Water consumption per person per day - by water company England & Wales

Water & sewerage companies	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Anglian	145	136	135	133	135	136
Dwr Cymru	152	144	14 5	142	139	145
Northumbrian	146	141	141	142	145	141
Severn Trent	125	121	129	126	130	132
South West	135	137	137	135	137	136
Southern	157	143	141	135	132	131
Thames	161	155	156	151	149	146
United Utilities	132	128	129	130	130	139
Wessex	140	136	138	139	138	141
Yorkshire	136	133	136	133	133	135
Water only companies						
Affinity	158	149	155	148	152	155
Bournemouth	146	142	144	138	134	144
Bristol	142	141	144	143	141	144
Cambridge	141	133	130	131	131	133
Dee Valley	138	136	133	130	135	135
Essex & Suffolk	153	147	152	151	151	152
Portsmouth	160	149	148	146	143	145
South East	167	159	156	148	161	151
South Staffs	136	128	131	129	129	127
SES Water	169	162	167	161	158	160

Source: CCWater/Discover Water

In the News

Waterwise report hails water efficiency progress

21st November 2018

The UK water industry is making progress on its ambitious water efficiency goals, but there is plenty more to do, according to a report from the independent water-saving organisation Waterwise.

The report 'Waterwise Water Efficiency Strategy One Year on – how is the UK doing?' set out to measure the progress made against the Strategy's vision, which is a UK in which all people, homes and businesses are water-efficient. It was launched last night (November 20th) at an event in London with speakers including Rachel Fletcher (Ofwat), Sebastian Catovsky (Defra), Stephen Bird (South West Water), Eifiona Williams (Welsh Government), Andy Hughes (Water Plus) and Nicci Russell (Waterwise).

The report welcomed the relative absence of hosepipe bans during one of the driest summers on record – with only United Utilities and Northern Ireland Water having to apply for restrictions and only the latter putting a ban into practice – as a positive sign that resources are being used better. Other highlights from the first year of the strategy included the formation of a leadership group on water efficiency and customer participation to drive top-down buy in from water companies and supporting research; the inclusion of per capita consumption (PCC) options in draft water resource management plans and the likely setting of PCC targets for England; evidence provided to government on the water efficiency of new homes; and a major review of labelling and standards for water-saving products. Priorities for the coming year include joining up water and energy efficiency targets across the UK; a stepping up of communication efforts and campaigns with consumers; and further work with water retailers and wholesalers to tackle barriers to reduce non-household consumption.

Waterwise Managing Director Nicci Russell said: "Water companies, government, regulators and other stakeholders have worked closely with us in delivering against the Strategy, and it's great to see the level of ambition currently in the sector. But as ever, we'd like to see even more - believing that water efficiency can help deliver across water companies' strategic promises to customers, not just resilience of services and environmental improvement. We're also thrilled that the Strategy and its Steering Group have recently won two prestigious awards - the 2018 Institute for Civil Engineers Chris Binnie Award in Sustainable Water Management and the International Water Association's Project Innovation Award (taking bronze out of 160 entries from 45 countries)."

NI Water accepts hosepipe ban interpretation was 'too broad'

29th October 2018

Northern Ireland Water has admitted that it exceeded its powers when attempting to prohibit a wide range of activities as part of its hosepipe ban this summer.

The utility implemented the ban between 29 June and 19 July, informing customers that they were prohibited from carrying out a range of activities with a hosepipe, including watering gardens, filling swimming or paddling pools and ponds, cleaning private leisure boats and motor vehicles, cleaning walls or windows of domestic premises, and cleaning paths or patios of domestic or other non-commercial premises.

However, NI Water has now accepted that the law in Northern Ireland currently only allows for the prohibition of hosepipe use in relation to watering private gardens or washing private cars.

A company statement read: "During the water supply issue that took place throughout June and July 2018 NI Water imposed a hosepipe ban restricting the use of water, for certain specified purposes by domestic customers.

"NI Water imposed the ban under Article 116 of the Water & Sewerage Services (Northern Ireland) Order 2006. In imposing the ban, NI Water's primary aim was to reduce unnecessary consumption so as to ensure that customers remained in supply. NI Water is grateful for the co-operation of customers during this time.

"Following the lifting of the ban on July 19th NI Water conducted a review of their interpretation of their powers under Article 116. As a result of this review, which included getting further legal opinion, NI Water now accepts that its interpretation of Article 116 was too broad and that it therefore had sought to ban certain activities that were not envisaged under the legislation, as currently drafted.

"Accordingly, NI Water wishes to apologise to its customers for any inconvenience caused during this period. NI Water would again emphasise that at no time did it seek to mislead the public, rather its primary aim was to ensure all customers remained in supply and that businesses could function efficiently."

In mainland Britain, the Flood and Water Management Act 2010 considerably extended the range of hosepipe-related activities that could be prohibited during a hosepipe ban, but the new rules were not adopted in Northern Ireland.

NI Water CEO Sara Venning said: "The purpose and intent of the hosepipe ban was simple, to encourage customers to conserve water to ensure that everyone remained in supply.

"We welcome the Attorney General's advice in this situation and have taken it on board. We wish to apologise to our customers for giving them the impression that they would be criminally sanctioned if they broke the hosepipe ban, for example, by filling a paddling pool. That was never our intention and we worked hard in our communications during this period to seek the cooperation of the public.

"NI Water is satisfied that we had a legal right to put a hosepipe ban in place and we appreciate not only the good work of our staff but also the immense support from the public during that time.

"Given the extreme situation faced by NI Water and indeed all of our customers, our legal team examined the legislation, which is acknowledged by all to be outdated. Following that, we decided to ban certain activities in and around the garden. Otherwise, the strain on water resources would have been stretched even further and may have resulted in the ban being in place for a longer period.

"Following the lifting of the ban on July 19th, NI Water conducted a review of our interpretation of these powers. As a result, which included getting further legal opinion, we accept that our interpretation of Article 116 was too broad and had sought to ban certain activities that were not included such as washing paths, patios, walls and filling swimming pools.

> **We are now working in conjunction with the relevant authorities to have our legislation changed to ensure it is appropriate for Northern Ireland's needs.**

"We are now working in conjunction with the relevant authorities to have our legislation changed to ensure it is appropriate for Northern Ireland's needs.

"NI Water stands by the decision to put the ban in place, as the ultimate penalty was that thousands of our customers would have faced supply interruptions. The public reaction to the hosepipe ban was fantastic and it was undoubtedly due to their support that NI Water was able to avert any disruption; after all, this is a situation that affected each and every one of us. We cannot stress enough the devastating impact it would have had on our customers if the ban was not put in place."

Anglian uses behavioural science to help cut water use

21st June 2018

Anglian Water has seen per capita consumption (PCC) drop by 8 per cent in Newmarket with the help of a portal that 'nudges' customers with insights on their usage.

Anglian, which operates in a water-stressed area, has been running an 'Innovation Shop Window' in Newmarket where it trials new ideas in an effort to achieve goals including cutting water usage by over a third to 80 litres per person per day.

Between 2012 and 2016, Anglian commissioned a trial, allowing residents with internal meters in the East of England access to a Water Display, which is paired to their meter to measure their water use. From this trial, it learnt from its customers that giving them an easy way to understand their habitual water use would help reduce PPC overall.

Anglian then appointed Advizzo, a behavioural science software company, to support its customer engagement strategy, and the two companies jointly developed a water consumption portal that uses smart meter data to provide Newmarket residents with 'nudges', informing them of how they are doing in terms of water consumption and rating their use against similar households.

Advizzo provides the insights by analysing the smart meter data and educating residents through behavioural science techniques, such as social norm messaging and incentives. There is also a plan for the portal to provide personalised tips on how to lower water use, using data from an online consumer survey designed to "get to know" each individual household and its habitual consumption.

Water consumption among measured customers in Newmarket has fallen by 8 per cent, with the use of behavioural science estimated to be responsible for around a quarter of the saving.

> **We needed to change the way residents in the East of England think about their water use...**

Paul Glass, smart metering programme manager at Anglian, said: "We needed to change the way residents in the East of England think about their water use to help preserve the environment, and sustain resources in the long-term.

"With Advizzo, it's a win-win. Combining Advizzo with our smart metering programme means households are inextricably connected to their water use. They can reduce their consumption, and have peace-of-mind about their metered bill, while we help protect natural resources."

It was announced last month that Arqiva had completed the extension of its smart meter trial for Anglian in Norwich using the Sensus FlexNet two-way communication fixed network solution, allowing the meters to provide near real-time data, which had been an issue for UK companies.

Innovation Zone

Driving down demand

With drought and water resources becoming a subject of growing importance, we look at some customer-side options that can help reduce demand

▶ By Robin Hackett

Water resources are already a major concern across many parts of the UK, and the recently published UK Climate Projections 2018 data from the Met Office and around the world suggests summer temperatures could be up to 5.4C hotter by 2070 while average summer rainfall could decrease by up to 47 per cent over the same time period.

The solution is likely to cover a range of approaches including new water supply infrastructure, water transfers and leakage, but there will also be a need to cut per capita consumption. Here, we've picked out a selection of recent innovations that could help customers understand and reduce their water use.

BrighTap (BrighTap)

BrighTap is a smart water meter sensor that attaches to a tap or shower head and tracks water usage and quality.

One cubic inch in size, it is powered by the water that passes through it and is designed to be easy to install and last for years.

Its display shows a real-time measurement of how much water has been consumed and the length of time water has been running, as well as offering a star rating on its quality and precise information on temperature.

There is also an accompanying app that boasts features including changes in water consumption and how usage compares to those living nearby, while users are offered tips on how to cut their consumption and who they should contact if there are any water quality issues.

Developed by Israel-based BwareIT, the product has already won awards – including the Innovation prize at Waterwise's Water Efficiency Product Awards – and the company has said it is due to launch in the near future, with a new design imminent.

Aloe (HYDRAO)

France-based HYDRAO launched its Origin shower head in 2016, which measures water flow and lights up the colour of the spray with an integrated multicolor LED system to offer a real-time indication of the volume of water used during the shower.

Powered by the water flow, the Origin is Bluetooth-connected and links to the HYDRAO Smart Shower, which allows users to customise water consumption thresholds and colours as well as recording progress on how much water and energy has been saved, featuring historical records on up to 1,000 showers.

Since the Origin was launched, HYDRAO has unveiled the First shower head, which is resistant to limescale and comes with an excess flow valve, and the Aloe shower head, which is the most efficient yet with a maximum water flow of 6.6 litres per minute as well as offering three 'multi-jet' modes.

HYDRAO, which sells its products to all EU countries and the United States, has been working with United Utilities' Innovation Lab programme in recent months to maximise the benefits its products can offer.

Innovation Zone
Water efficiency

GOAL 6
WATER CONSUMPTION

Waterblade Easy Chrome (Bamford)

The Waterblade can replace the nozzle on mixer taps that have an isolating valve, changing the flow to a paper-thin blade shape that drives significant reductions on consumption.

While a standard tap might use up to 20 litres per minute and those with an aerating nozzle fitted tend to use in excess of 5 litres, taps with the Waterblade nozzle use around 2.5 litres.

The idea emerged when Nigel Bamford was exploring ways to improve energy use within buildings as part of his MSc, and the concept was then developed at the University of Brighton using a grant from Innovate UK.

The original product won a Water Industry Award in 2016 for Most Innovative New Technology of the Year and it has since improved, evolving into the Waterblade Easy Chrome.

Introduced after two years of product development, it was created to improve performance, functionality and appearance and comes with a flow controller that sets the maximum flow at 2.7 litres per minute.

The flow controller means it is no longer necessary to set the maximum flow remotely, which had posed a small but increased risk at the point of installation.

Costing £10 for a single nozzle and designed to be easy to install, the product can be used in domestic properties, where the company predicts savings between £25 and £75 a year, as well as commercial premises – one office trial cited by the company saw a total reduction in water consumption across the building of 15 per cent.

"We now believe that the product has the necessary functionality to be very widely adopted," Bamford told WWT. "Early interest supports this belief."

Propelair (Propelair Ltd)

Propelair is an attempt to reinvent the toilet, making use of a new type of technology that relies on displaced air and water for flushing. The result is a flush that uses just 1.5 litres, as opposed to the UK average of 9 litres.

The cistern contains two sections – one for air and one for water – while the toilet lid is used to create an airtight seal. When the toilet is flushed, water enters the pan to wash it, followed by air from a specially designed pump, which pushes out the contents of the pan. The toilet is then ready to be re-flushed in around 20 seconds.

Designed to be maintenance-free over a lifespan over around 20 years' normal use, Propelair – which is suitable for new developments or refurbishments but can also be retrofitted to existing drainage systems – requires a small electrical supply, which can be mains or battery.

Essex-based Propelair Ltd was founded in 2001, achieved full production status and WRAS certification in 2013 and is currently seeking UK distribution partners as it seeks to continue its expansion.

Smartening Up

Smart metering shows signs it can bring significant improvements on water consumption, leakage and more. But what will it take to tempt companies outside water-stressed areas to get on board?

▶ By Robin Hackett

It is still relatively early days, but the indications are that smart metering can deliver definite results in the sector. On water efficiency, metering of any sort appears to represent a straightforward path to cutting per capita consumption (PCC), and smart metering has shown evidence it can enhance those benefits.

The National Infrastructure Commission (NIC), the body set up to make recommendations to government about the country's long-term infrastructure needs, issued a report in April in which it recommended that Defra enable all companies – including those outside water-stressed areas – to implement compulsory metering by the 2030s. It also recommended that all water companies be required to consider the systematic roll-out of smart meters.

For many companies, though, there are still plenty of questions that must be resolved before there is a clear case for universal implementation. If there is no pressing need to conserve water, metering of any type – and particularly smart meters – will be weighed against cost, and any decision to adopt a new technology prompts concerns about when that technology might become outdated or even obsolete.

With the smart meters in use in the UK now, which communicate using radio frequency (RF) technology, companies can gain hourly readings. That brings a host of benefits: you can gauge the times of heaviest use, provide feedback to those with excessive consumption levels with the incentive of reducing bills, and leakage becomes eminently detectable. Also, while the NIC's report cited research showing that even standard meters reduce average consumption by 15 per cent, that rises to 17 per cent for smart meters, and trials have shown particularly strong advantages in any instance where the customer actively engaged with their meter data.

However, the hourly data from the current smart meters in the UK is not yet available in real-time – companies are having to wait until the following day before it can be accessed at this point – which might mitigate some of the benefits, such as leakage detection.

Simon Murray, who once chaired Water UK's smart metering network as well as sitting on the now-defunct smart metering advisory group for Ofwat, is currently working on software and app development in relation to metering in his role as water solutions manager at Wheatley. He is a long-standing advocate for metering but argues that the term 'smart meter' is a misnomer at this stage.

"Until you get real-time or at least semi-real-time data, it's never really going to be smart metering," Murray says.

"The technologies available today are simply smarter."

METERING FACTS

- While standard meters can reduce average water consumption by 15 per cent, the extra information provided by smart meters means they can reduce consumption even further, by 17 per cent on average, according to the National Infrastructure Commission.

- Around 50 per cent of homes in England are currently metered and this is expected to reach around 80 per cent by 2050, saving around 400 Ml/day. Nearly all homes are expected to be metered by around 2070 (NIC report)

- Southern Water has the highest rate of metering in the UK (88 per cent) following a large-scale compulsory roll-out in the last five years. However most of these are automated meter read (AMR) meters, which are read periodically from the street outside a house, rather than smart meters where data is updated constantly

- Thames Water has rolled out 240,000 smart meters made by Sensus (pictured below), which produce hourly data, since 2016. It aims to meter 75 per cent of household properties in London and 90 per cent in the Thames Valley by 2030

- Anglian Water has installed 6,000 smart meters in Newmarket as part of its Innovation Shop Window initiative. Following installation, it saw an 8 per cent drop in water consumption over 12 months. It has also identified 500 customer leaks as a result of the meters. Half of these were leaking toilets

THE TECHNOLOGY

While companies in the most water-stressed areas have a persuasive case to pay out for the current advanced metering infrastructure (AMI) devices, others may prefer to see how the technology evolves before committing their resources.

Globally, the Internet of Things (IoT) – and particularly the development of smart cities, in which radio and communications infrastructure is installed across an area to collect an array of data – is paving the way for improvements. Chinese telecommunications equipment manufacturer Huawei has already developed a system using narrowband (NB)-IoT, a low-power wide-area network (LPWAN) radio technology. According to the GSM Association (Global System for Mobile Communications), NB-IoT's advantages include low power consumption – with devices operating for up to 10 years on a single charging cycle – as well as low cost at the device end, secure connectivity and superior operation in bad coverage areas.

Huawei's NB-IoT 'Smart Water Solution' relies on inherited networks, upgraded from the existing 2G, 3G and 4G cellular base stations provided by operators. In Shenzhen, Huawei worked with Shenzhen Water, China Telecom and Ningbo Water Meter Co. to launch the world's first commercial NB-IoT-based smart meter reading project in March 2017, with further projects taking place in Yingtan and Fuzhou.

"Being an innovative solution collecting hydrological data related to the water supply and drainage systems in real-time, enabling water-level monitoring of rivers, channels, major water gates and enterprise sewage outlets, this solution helps water utilities make important decisions based on the data collected," a Huawei spokesperson tells *WWT*.

The Smart Water Solution can be upgraded to 5G, and the spokesperson says that this means the system "is indeed future-proof", adding: "Already today, this existing standard provides for a broad range of applications associated with the Internet of Things. As the deployment of 5G gathers momentum and the cyclical replacement of water meters continues, the possible spectre of applications designed to optimise water management will enlarge even further."

Other LPWAN technologies, notably LoRa and Sigfox, can also help deliver next-level smart metering, despite concerns that – as unlicensed spectrum solutions – they are vulnerable to interference, while they also operate outside existing cellular infrastructure.

The security of water metering data is a growing priority for utilities, especially in the light of new GDPR regulations.

THE POTENTIAL

American business consulting firm Frost & Sullivan recently issued an analysis on the global smart meter market that predicated total installations will grow from 13.8 million units in 2017 to 82.1 million units by 2026, representing a major growth opportunity for IoT-enabled meters.

Frost & Sullivan's senior research analyst for energy and environment, Paul Hudson, says advanced water utilities around the world are now implementing smart water meter projects but – for now at least – cost remains one drawback for NB-IoT.

"It operates in a licensed bandwidth and hence the usage will incur a cost in comparison to other non-cellular LPWAN technologies like LoRa or SigFox, but the rapid rise in penetration of NB-IoT and its seamless connectivity alongside regular 3G networks is expected to bring down cost as the number of devices connected through NB-IoT increases," Hudson says.

Elsewhere in the world, utilities that have been early adopters of NB-IoT include Australia's South East Water and Spain's Aguas de Valencia; both have worked with Huawei alongside network provider Vodafone to develop the necessary network infrastructure and capabilities. To meet SEW's requirements, Huawei brought in Chinese device partners Huizhong and Sanchuan to develop its meters, which feature different sensors that measure flow, temperature, pressure and vibration. Both companies have seen positive results.

However, Hudson still expects the various technologies to be battling it out in the smart metering space for some time, and says newer markets like China, India and the Cooperation Council for the Arab States of the Gulf "could be potential growth centres of LoRa".

He adds: "Every LPWAN technology has unique capabilities in terms data speed, range and connectivity. End-users adopt these technologies based on their requirements, so at least for the next five years they would co-exist.

"But in the future, with the implementation of 5G networks, newer technologies capable of carrying a comparatively large amount of data coupled with better real-time access could disrupt existing LPWAN technologies. It could also be impacted by better battery technologies."

Murray, who has also worked on metering for Veolia, Affinity Water and Homerider, thinks the UK water companies would be tempted by the new technologies if the price is right but says – outside the water-stressed areas – they are biding their time.

Southern Water opted for AMR meters in its major metering programme

"For water in the UK there's no mandate to meter, let alone smart meter, and this has driven the situation where there is no common standard for this smart metering technology, so you have competing protocols and radio technologies," he says. "The industry's in that kind of quagmire of: 'Is it Betamax or VHS?' Which do they back? They want something that's interoperable, they want something that's long-lasting – 15 years' life, similar to the life of a mechanical meter – and they want it future-proofed."

Hudson says the decision to back any particular technology at this stage might be considered a risk but it depends on the long-term objectives of the water company in question, with leak detection, asset management and real-time usage notification all achievable using the currently available technologies.

"The degree of change of technology in the IoT-metering space is high and therefore factors like cost, number of connections and integration play a vital role," he adds.

It remains to be seen when the bulk of the UK water companies will be persuaded the time is right to adopt smart meters. Southern Water opted for automated meter reading (AMR) across its region between 2010 and 2015 when those devices – which can be read using drive-by technology – were the most advanced available but, even though there are now technologically superior options, it has reaped the benefits of that decision: with 88 per cent of its customer base now metered, there has been a 16 per cent reduction in water use.

Murray is confident that universal metering remains a matter of when not if, and Wheatley is already speaking to water companies about its vision to see meter data used for machine learning, which could provide predictions that avert problems before they happen.

"Meters used to be a cash register – it was a means of capturing consumption information every six months for a domestic property and sending a bill," he says.

"They could be a far more valuable asset, collecting more frequent data and producing more insight in terms of data. What's recorded and measured can be far more than just water consumption – they could measure ambient temperature and pressure. Having that sort of information and granularity, they could use more AI and machine-learning technology to really predict what's going to happen, and that's going to take the water industry into a new area. It could change everything completely."

WATER COMPANY VIEW

"We get more meter reads in one day than we used to get in a year from our historical base of two million meters"

STEPHANIE BAKER,
METERING MANAGER
THAMES WATER

"The Thames Water area is classified as seriously water-stressed, and this will only increase as the population we serve grows – by 2045, we forecast that we will be serving another 2 million people. At the same time, the amount of water that we can take from rivers and underground sources is reducing, due to changes in the climate and the need to protect the environment.

"As a result, we predict that there will be a shortfall between the amount of water available and the amount of water we need equivalent to the water needed by over 2 million people by 2045 unless we take action.

"In 2014, the case for smart metering was approved through our water resources management plan and, after an initial trial, we commenced our rollout in January 2016. Since then we have installed over 240,000 smart meters, which are firing back over 5.8 million hourly meter reads per day. To put that into perspective, that is more meter reads in one day than we used to get in a year from our historical meter base of over 2 million meters.

"The value lies in the data and how this can help us manage our network. We're analysing hourly meter read data to quickly identify where there is water continuously flowing through a customer's meter for a sustained period. This is a good sign that there is a leak either on the customer's supply pipe or within the home such as a dripping tap or a leaking loo.

"Now we can accurately identify this, quantify the size of the leak and potential bill impact, we can proactively engage our customers about getting that leak fixed, or taking up our free customer-side leak repair offering.

Thames Water has installed 240,000 smart meters since January 2016

"We have already saved almost 11 million litres of water per day by fixing customer-side leaks identified using smart meter data, and that's the amount of water needed by 77,000 people. This is where our investment in smart technology is paying back.

"Still, we're only really at the beginning of our journey to understanding just how valuable the data can be. We're developing a much clearer picture of the balance between customer usage, leakage on our network and leakage on our customer's pipes. This simply wasn't possible before, with only around a third of our customers metered, and reads being collected twice annually.

"Going forward, we will be looking at how we use meter data to mitigate and manage the impact of events on our network and, additionally, how we can combine meter data with the many million data points we already collect to develop the insight we need to take action where it matters most. We're at the early days in terms of harnessing that and I think there's a lot more we can do in terms of influencing behaviour and using that data to help us mitigate and manage events, such as picking up low-level main-side leakage in an area before it becomes a major event and even managing pressure in the most efficient and economical way.

"Traditionally the industry has considered that customers with a water meter use between 10 and 15 per cent less water than an unmetered customer. With smart meters, we hope to exceed this by changing the way we interact with our customers and using regular and real-time data, year-round, to help them to save water, energy and money in their homes. In the future, we'd like to move to being able to provide people with usage alerts when their water use behaviour changes, or they reach a daily maximum they can select as well.

"We have already received interest from around the globe about our smart metering programme, and as technology evolves and utilities embrace the Internet of Things, I can only expect that in the future we will see almost all water companies harnessing the value of smart meter data to engage their customers, manage demand, and control their network."

Rainwater spin-out companies offer innovative path

BY DR SARAH WARD, PETER MELVILLE-SHREEVE & PROF. DAVID BUTLER
UNIVERSITY OF EXETER

Researchers from the University of Exeter's Centre for Water Systems are putting the latest rainwater harvesting and SuDS thinking into practice via two innovative spin-out enterprises

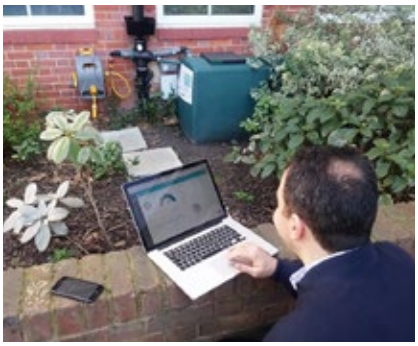
Translating research into usable outputs yielding benefits for society is never easy, but researchers from the University of Exeter's Centre for Water Systems are taking the rainwater management scene by storm – founding two innovative spin-out enterprises supported by a range of organisations and catalysing change in the offer to market by developing and testing a range of new products and tools.

Research into alternative water supplies such as rainwater harvesting (RWH) systems has been ongoing in the Centre for over a decade, since Professor David Butler joined in 2006 from Imperial College London.

In recent years, Dr Sarah Ward and Pete Melville-Shreeve have in turn added to the rainwater research base through their doctoral studies, which Ward completed in 2010 and Melville-Shreeve will complete in the coming months. Both returned to academia after stints in the water industry (at a water company and consultancy, respectively) and were keen to produce practical applications from their research. Hence in 2015, both established spin-out companies to embed their research in practice to generate impact.

Dr Ward's enterprise, RainShare (www.rainshare.co.uk), is run using a social enterprise philosophy and explores service innovation to generate multiple gain through sharing roof runoff across a portfolio of RWH services representing fresh new business models. Since 2014, RainShare has received funding and support from social enterprise specialists UnLtd to install a pilot scheme in Exeter, business mentoring from start-up specialists Canopy and most recently, a comprehensive package from InnovateUK's Women in Innovation scheme.

Water storage used in RainShare's pilot installation in Exeter



A recent OTA installation. Rainwater is available for the community to re-use in their green space, while the live data stream enables OTA to maximise the system's stormwater management benefits.

Challenging conventional ways of sharing and trading runoff, RainShare also aims to reconnect communities with water through the highlighting of everyday practices that don't need potable (mains) tap water – like irrigating gardens and allotments, flushing toilets and washing cars. Ahead of the curve in terms of where rainwater management in the UK currently is, RainShare is currently collecting data from the pilot installation, which will help prove the business case for further schemes – essential for getting to the early-adopting 1% who will immediately benefit from RainShare's services. The pilot installation diverts runoff from the roof of a house to adjacent allotments to enable plants to be watered without the use of mains water and keeping rainwater out of sewers. Working with Transition Town initiatives in the local area, the aim is for the next installation to be larger in scale – such as sharing runoff between terraced housing and a community centre or between a warehouse and an office block.

Meanwhile, Melville-Shreeve's enterprise, Over the Air Analytics (OTA), was established to provide turn-key retrofit sustainable drainage (SuDS) installations. The OTA team deliver rainwater management installations on a bespoke basis using in-house design software which builds on R&D completed at the Centre for Water Systems. Furthermore, OTA has developed a real-time monitoring system

Research: Rainwater Harvesting

RainShare gathers roof run-off water and makes use of it for the community

to enable its SuDS systems to be connected and monitored via its cloud-based hosting platform. OTA has just completed installation of retrofit systems in London through collaboration with the Future Cities Catapult. The OTA strategy is to maximise rainwater reuse whilst enabling stormwater control to be achieved.

"At OTA our goal is to provide SuDS with multiple benefits," says Melville-Shreeve. "Put another way, we see rainwater as a resource, but design our systems to manage the threats of pluvial flooding. To date, we've incorporated rainwater reuse at every scheme we've installed. It's a complex process and so we have built a team of design engineers, community engagement officers and installation specialists to meet our customers' needs. Maximising rainwater reuse is a top priority within the UK's SuDS guidance, and as our climate and urban environments change, it's only going to become more important in the years ahead."

Delivering impactful research that highlights best practice in smart and participatory approaches to rainwater management, based on real-world data from monitoring and engagement, is key to the Centre's work. This work has been co-produced through collaboration with a range of industrial partners such as Severn Trent Water, South West Water and a range of small to medium enterprises and approaches regarding potential collaborative projects are always welcome.

Rainwater Research

In addition to the RainShare and OTA spin-outs, the University of Exeter's Centre for Water Systems rainwater research has also underpinned:

- **The testing, development and launch of the RainSafe device – a novel miniaturised treatment train to bring harvested rainwater to potable standard at the household scale (www.h2ozone.ie)**
- **The testing, development and launch of the FlushRain device – a novel downpipe-located RWH system with loft-located storage (www.flushrain.co.uk)**
- **The development of new tools for financial assessment that incorporate end-user perspectives on the design of RWH systems and prioritisation of costs and benefits**
- **The development of a decision support tool for the optimal design of RWH systems**
- **Evaluation of integrated water management interventions at Severn Trent's Urban Demonstrator under the TWENTY65 Project**
- **Re-evaluating existing design standards on the sizing of rainwater tanks to cater for both water supply demand and flood storage**
- **Investigating the potential impact of RWH on urban flood resilience through rainfall runoff modelling.**

Dr Sarah Ward is the founder of RainShare