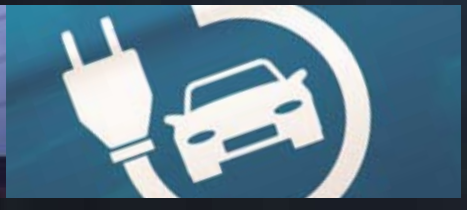
Water works:
The current reality

4

Twenty years from now, **water demand worldwide could be more than 50 per cent higher than it is today**[1]. Average river flows in summer have been forecast to drop by 50-80 per cent by 2050 in some parts of the UK, due to changing weather patterns[2]. **Increases in population and water consumption** are putting tremendous pressure on an infrastructure that is already stretched.





Part of a series of papers on IBM Smarter Energy

Climate change, new environmental pressures and changes in legislation – **the UK water industry is facing complex, interrelated challenges.** A smarter, more integrated response could be the best possible solution.

"Smarter" in this context means applying greater intelligence to the way assets are built and operated. It means developing the flexibility to adapt to change. It means collaboration with stakeholders, including consumers, agencies and regulators. **And it implies change on a scale that has not been seen before.**

WATER IN PERSPECTIVE

Water is a precious, national commodity. Although it is currently difficult to calculate accurately, it is estimated that around 3,300 million litres of water are lost every day in the UK through leakage, mainly due to distribution (water company pipe) losses. While the industry has made good progress on river water and bathing water quality, and in reducing the number of properties at high risk of flooding, further investment is needed to meet future needs.

Population growth is highest in water-stressed areas. The UK population is growing at around 400,000 per year and fastest in major cities, with particularly strong growth in the water stressed south-east of England. The need to match supply with demand, and to operate more efficiently, will be very important if the network is going to tolerate changing demographics.

The water industry is the UK's fourth largest consumer of energy. The current water infrastructure requires significant pumping and processing power, equating to around three per cent of overall electricity consumption and five million tonnes of greenhouse gas emissions annually. Approximately 20 per cent of total direct water costs stem from the energy involved in its supply, and energy demand in the UK could outstrip that supply by 2016. The industry needs to increase its use of renewable energy and reduce its energy intensity.

20%

of total direct water costs stem from the energy involved in its supply

Flexibility is required to adapt to climate change. Weather conditions in the future are predicted to become more extreme with a greater number of floods and droughts. Greater resilience and flexibility will be required in operations to adapt to these conditions.

Legislation has helped to drive change through the sector. But its future impact is uncertain and the consequences of new legislation on future investment may be negative. In 2009, the Cave review made it clear that there is an urgent need for greater competition and technical innovation, while the Walker review put the case for a fully metered system.

However, the way that competition is introduced and how the industry evolves needs to ensure that it remains an attractive long term investment.

Consumer behaviour needs to become part of the solution. Water is seen as a readily available and cheap commodity. According to the Environment Agency, 72 per cent of the nation's 18-24 year olds are serial wasters of water. There needs to be significant education and encouraged behavioural change to protect this valuable resource for the future.

How can the water industry respond to these challenges? What is clear is that there is no short-term fix. It is equally clear that the solutions adopted now must be capable of meeting long-term needs.

80%
of lifecycle carbon in the water industry is operational

A SMARTER WATER INDUSTRY

Smarter water management is about access, availability, reliability and exchange of relevant information to enable greater intelligence across the network. Typically, water management efforts have been hampered by a lack of useful data. Monitoring and control systems have often been isolated, with data scattered among many different sources and stakeholders.

While the challenges facing the industry are complex, there are solutions. The world is more instrumented and is becoming more interconnected and intelligent; the water sector can take advantage of this. Integrating existing and emerging technologies, and doing so intelligently, could hold the key to a more sustainable future for water.

At the heart of IBM's smarter water strategy is the harvesting and analysing of information, using the results to build a more efficient, more effective network. Everything from river basin and catchment management to smarter water networks and metering are involved, and these in turn can help influence the way we all use water. Information management in the water industry should evolve from isolated, intermittent, manual data gathering and multiple, disjointed data sets, to one that is proactive, automated, collaborative and executed in real time, integrating the results to create useful models.

Smarter use of meteorological data is a case in point, particularly in the management of wastewater and stormwater. IBM is applying a high-resolution weather forecasting capability – called Deep Thunder – for US utilities business Con Edison. Deep Thunder helps make it possible to anticipate potential damage and proactively mitigate the effect.

This can mean better resource mobilisation, quicker recovery times, more accurate communication with stakeholders and customers, as well as reduced emergency management costs.

In Europe, Ireland's Environmental Protection Agency (EPA) is using IBM WebSphere technology as part of a collaborative effort to launch an interactive water-quality map. The "Splash" web portal improves the service

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to the public by providing greater access to near real-time information on bathing water quality. The centralised data aids sharing among local authorities and compliance with the European Union's Bathing Water Directive.

IBM has also worked with the Marine Institute in Ireland, to create a real-time advanced analytics pilot that turns volumes of raw data into intelligent information, delivered via the web to multiple stakeholders in Galway Bay.

Called "SmartBay", this infrastructure incorporates sensors and computational technology to collect and distribute information on coastal conditions, pollution levels, water quality and marine life.

SmartBay provides information to public health agencies studying water quality, as well as researchers looking for real-time and accessible environmental data. It even lets commercial fishermen share information about potential hazards in the bay with the harbour master, as well as reporting their catches and estimated arrival time to local fish markets. These same benefits could be realised around any water catchment area or urban water network.

In addition, 20 per cent of the lifecycle carbon associated with water industry assets comes from their construction; the other 80 per cent is operational. Focusing on process solutions, such as pumping, could produce a healthy reduction in energy use. For example, by integrating real-time monitoring and process controls, and bringing them closer together, smarter pumping operations could allow water companies to continuously balance supply and demand at minimum cost. Real-time control reduces energy consumption, together with its associated costs and carbon emissions, and the ability to optimise pressure would mean leakage could be minimised.

Systems of this sort could enhance efficiency, with greater levels of automation for routine processes and alarm monitoring, whilst freeing up resources to tackle both planned maintenance and emergencies.

A SMARTER WATER CONSUMER

The industry and its customers need to change the way they manage information and the way they interact with each other.

IBM believes that at the core of this revolution is sharing of the right type of information to allow greater control and to change behaviour on water consumption. The Mediterranean island nation of Malta is working with IBM to build an intelligent network. The Maltese national electricity and water utilities companies – Enemalta Corporation (EMC) and Water Services Corporation (WSC) – selected IBM to design and deliver a nationwide smart grid to cover both water and electricity supplies.

The scheme is designed to replace 250,000 utility meters in Malta with interactive and intelligent versions by 2012. With near real-time monitoring of individual water consumption, smart metering will allow water companies to

Water: fundamental challenges

Infrastructure

- **Large capital programmes will need to be designed and delivered efficiently and effectively to make water assets fit for the 21st century.**

Engagement

- **Engagement: consumers and businesses must play an active role in managing their water usage.**

Environment

- **Environment: there is an urgent need to reduce energy use and greenhouse gas emissions while improving the quality of rivers and bathing waters.**

Climate change

- **Climate change: anticipating and responding to the impact of climate change on water availability, quality and consumption, and flood management, will become increasingly important.**

Finance

- **Finance: improvements to the water infrastructure and management systems must be delivered at an affordable price to consumers but needs to be attractive to investors too.**

Regulation

- **Regulation: changes in regulation can help encourage competition and innovation in the water industry.**

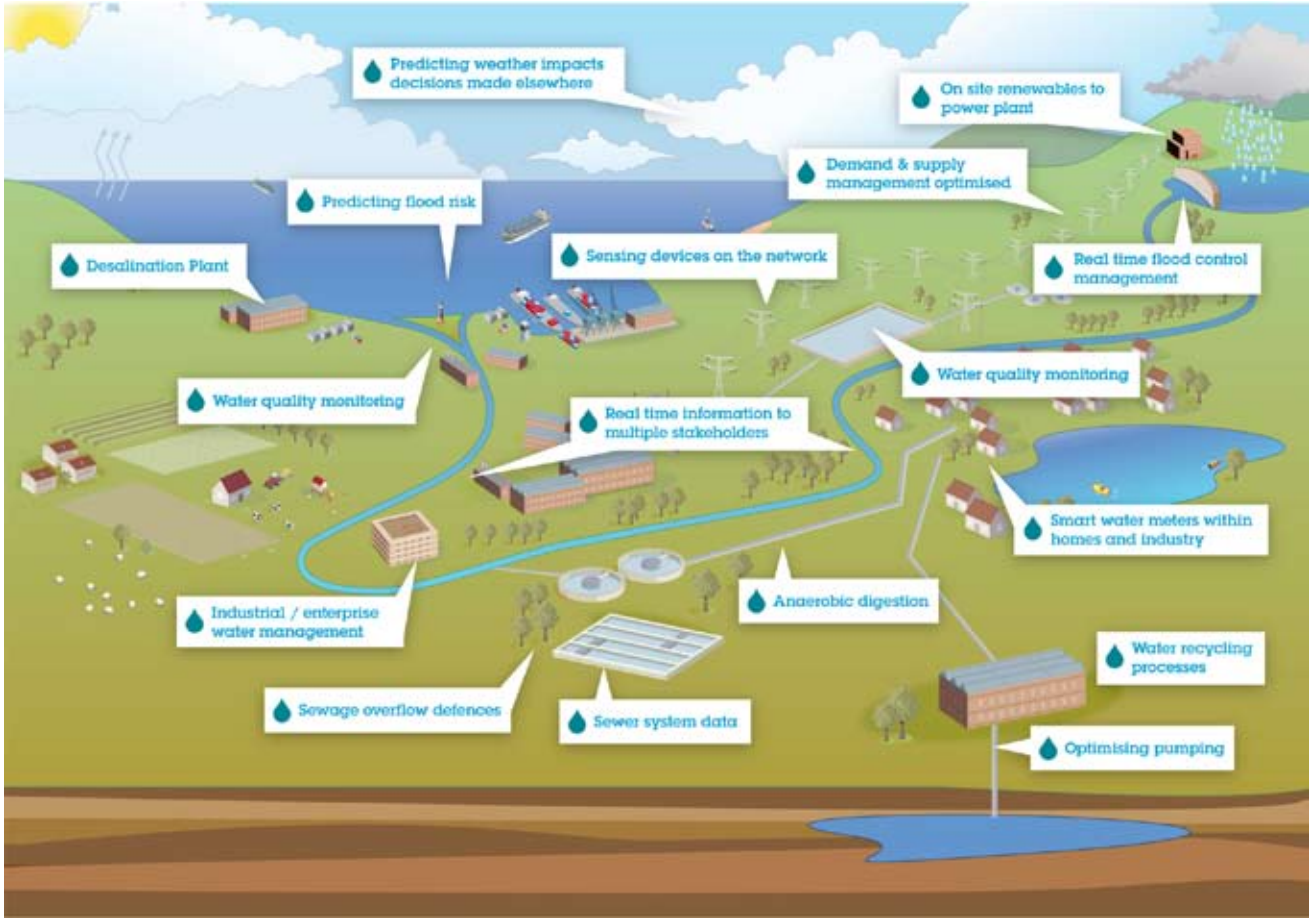
develop a far greater understanding of their customers' behaviour and needs. WSC will also be able to detect customer supply pipe leakage remotely and in real time, thereby improving the service for customers and reducing operational costs.

Smart metering will also bring the cost of supply into clearer focus and make it possible for EMC and WSC to allocate network capacity more effectively.

As more information is made available to customers, their expectations of how they interact with water companies should change. At the same time, business models will need to adjust to the new market conditions, which in turn is likely to require greater levels of innovation in the industry. The interconnected, intelligent water companies of the future are likely to need to be able to interpret their customer requirements in order to predict their behaviour. Smart meters will help them achieve that goal.

72%
of 18-24 year olds in the United Kingdom are serial wasters of water

And as pressure on water resources intensifies, relationships of this sort will play a critical role in managing demand. New technologies are already improving the effectiveness of capital programmes. And it is becoming increasingly clear that investing in intelligence, as well as physical assets, is essential to controlling costs and improving efficiency in the water sector.



Smarter water: the solution

Smarter catchment management

- From coastal waters to drainage basins, smarter catchment management means engaging every stakeholder, including water companies, local businesses, local authorities, regulatory agencies and the general public. Smart solutions make it possible for stakeholders to access and share information, and to collaborate, optimise, protect and enhance the resource.

Smarter water supplies

- Increasing intelligence and network visibility could help align demand and supply, and optimise operation – by monitoring how much is coming into and going out of the network, the system could be made more efficient and waste could be reduced. This is essential if the flexibility required to cope with climate and regulatory changes is to be achieved.

Flood and storm water management

- Improved network visibility and management can help enhance water quality while integrating meteorological data. In addition, drainage basin mapping will support predictive stormwater and flood management strategies. For example, if a severe weather front is on the move upriver, what is the risk of flooding downriver? How will storm drains and sewage outflows cope? And what impact will this have on the water quality in the area.

Smarter customer engagement

- Shifting customer behaviour to become part of the solution in creating a sustainable water industry in the UK. Improving collaboration and engagement through technology such as metering or self-serve portals

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