

Climate Change and the UK Water Industry: Stepping up to the Challenge **By Dan McCarthy**

EXECUTIVE SUMMARY

Climate change is a global issue with many local and regional ramifications. Nations face unprecedented challenges as demands upon natural resources grow, populations increase and global warming accelerates. Extreme and increasingly unpredictable weather conditions are more commonplace, and the need to reduce carbon emissions is acute.

A plentiful supply of clean water is something many consumers take for granted in the UK. Yet for the water sector, the provision of this essential service has become increasingly complex as the realities of climate change have a greater, more measurable impact.

In Britain weather and rainfall patterns are changing, with two contradictory effects: water scarcity and flooding. The problem of scarcity -- resulting from hotter, drier summers -- is exacerbated by an increase in demand for water. The need to tackle the dual challenges of scarcity and flooding are set against the backdrop of a need to reduce greenhouse gas emissions. The development of a long-term water management strategy needs to take all of these complex issues into account.

Household water demand has been increasing since the 1950s, due to population growth and changes in the way we use water in the home, and is now more than half of all public water supply.

Source: *Future Water*, Department of Environment, Food and Rural Affairs, February 2008

Responses to these challenges are beginning to take shape, and many of the calls to action presented in this paper are now being heeded. Government, the water sector, consumer groups, business and the public will have a role to play in the future of sustainable water management. Collective thinking and cooperation between these groups will be necessary to lead an education initiative that aims to change the way people think about how they use water. But education is only part of the picture; cooperation with food and farming industries alongside new building, planning and environment regulations and guidelines are also key to a secure water future.

CHALLENGE 1: WATER SCARCITY

Although water scarcity is a global issue, it has distinct local and regional manifestations. In England, demand for water is at an all-time high: the average person uses approximately 150 litres of water a day – around a tonne of water a week. But increased consumption is only part of the problem. Climate change projections predict drier summers, and legislation to protect the environment is likely to mean some traditional extraction points can no longer be used. An additional problem is that as water levels in rivers and aquifers fall, the concentration of pollutants increases, further limiting the number of usable water sources.

By 2050 the UK can expect to experience up to 25 per cent wetter winters and 40 per cent drier summers, with an increase in frequency and intensity of extreme weather conditions, such as very high temperatures or heavy downpours of rain.

Source: *UK Climates Impact Programme, Measuring Progress Technical Report*, June 2005

At present scarcity is a regional issue,¹ and some areas of the UK are far more water-stressed than others. Currently the South and East of England are hardest hit in terms of decreased rainfall, which is exacerbated by having higher levels of evaporation in hot, dry summers and, in the case of the densely populated South East, having the highest levels of demand. These levels of demand are due not only to a growing population (by 2015 it is estimated that London will have an additional 800,000 citizens) but also because of changes in the way people live: the number of single-person households has doubled since 1971; and if the trend continues, by 2021 they could account for 35 per cent of the UK total.²

On top of this trend, there is non-domestic usage: electricity generation alone uses 9 billion tonnes of water per annum, while industry accounts for 2.1 billion and farming 0.2 billion.³

Another issue that affects water scarcity is leakage, which although down by a third in England and Wales, still requires further reduction. Almost a quarter of water entering the distribution system is lost in

¹ <http://www.environment-agency.gov.uk/subjects/waterres/1341275/1688901/?lang=e>, The Environment Agency.

² www.wateruk.org, Water UK.

³ <http://www.defra.gov.uk/environment/water/strategy/pdf/future-water.pdf>, *Future Water: The Government's Water Strategy for England*, Department for Environment, Food and Rural Affairs. February, 2008, p. 35.

this way, which is significant given that emissions associated with making it fit for consumption account for about 10 per cent of the water industry's total greenhouse gas emissions.⁴

Responses to water scarcity

To overcome these challenges and meet government and regulatory requirements, significant investment in water utilities' infrastructure is critical. Maintaining water supply throughout the year may be increasingly difficult in some regions; and imaginative, joined-up thinking from all relevant stakeholders will be a prerequisite where this is the case.

As nearly all of this investment will be funded from domestic and business users' water bills, affordability is a key issue. A challenge for all stakeholders will be to educate consumers to think differently about the way they use water, the amount of water they use and the cost of providing a high-quality supply.

Metering

Metering is an effective tool that is growing in acceptance. For example, Anglian Water, which has 60 per cent meter coverage, did not experience significant supply issues during the most recent period of drought. This is despite being in the most water-scarce region of the country. However, there are concerns that the £750 million cost of installing a meter in every home might be better spent on other measures. Environment and consumer agencies will need to work alongside government and water companies to guarantee success if metering is to be encouraged.

Introducing the concept of compulsory metering throughout the country will be challenging as it could be viewed as an unpopular political issue. At best the uninformed consumer may associate it with rising costs and at worst as an assault on their rights to a basic utility. Sensitivity to the issue in terms of differentiating between the "can't pay" and the "won't pay" will be important. For all stakeholders the task will be a tough one to help people understand that just because water falls out of the sky, it doesn't reach our taps and toilets for free.

However, although there is compelling evidence that metering does work in terms of cutting consumption – trials indicate the demand for water drops by 10 per cent in metered households – it is only part of the solution. Investment in new water treatment technologies, leakage reduction measures, resource sharing

⁴ <http://www.defra.gov.uk/environment/water/strategy/pdf/future-water.pdf>, *Future Water: The Government's Water Strategy for England*, Department for Environment, Food and Rural Affairs. February, 2008, p. 31.

between stressed regions alongside a radical re-think on water management and usage will need to take place in tandem with any legislative imperatives.

Transferring water between regions

A National Grid – which would transfer water from areas with surplus resources, predominantly in the North, to the thirsty South – has been presented as a possible solution. Even though it sounds simple to move water around the country as need requires, the idea is fraught with complexities, both practical and environmental. Water is not light (a cubic metre weighs around a tonne); so any plans to transport it in large quantities over significant distances would need to take into account the significant capital, operational and environmental costs the scheme would engender.

In times of shortage, regional, rather than national, water transfer is becoming increasingly common. In the South East, where a mix of large and small water companies serve the public, the transfer of water between suppliers is used to ensure the demand/supply balance is met. The potential for more cross-company resource planning is currently being investigated by the Water Resources in the South East Group. Similarly, the Environment Agency operates several regional and semi inter-regional transfer schemes across England and Wales for the benefit of water companies. Examples include the Ely-Ouse in Anglia and the Shropshire Groundwater Scheme in Severn Trent's region.

Water efficiency

Getting customers to accept some responsibility for reducing consumption will be a key driver. Water efficiency will need to be promoted in the same way as energy efficiency so that consumers understand it as a way of controlling living costs and achieving a sustainable lifestyle. Too few are aware of how much water we use, let alone the cost to the environment of treating potable water and wastewater.

Consumer advocacy groups are joining forces with industry and government to promote water efficiency messages and promote new household behaviours, from fixing leaks, showering rather than bathing or filling bowls rather than running taps to installing dual-flush toilets, using rainwater butts for garden watering rather than hosepipes or heating water only when absolutely necessary.

This mission for consumer education will need to be supported in diverse ways, such as the government making recommendations on teaching children about water usage in schools or industry creating partnerships across sectors.

Legislation and leadership

Long-term, forward-looking legislation, produced in consultation with all stakeholders, needs to be, and is being, developed. For the first time, Ofwat, the water industry's economic regulator, has asked water companies to provide a 25-year strategic vision alongside the standard 5-year plan as part of its PR09 (Price Review 2009), linking pricing and provision of strategic planning. This is a positive measure for the industry as it means that the cost of long-term infrastructure, climate change adaptation and resilience strategies can be factored in to tariff levels for both domestic and industrial usage.

The good news is that in locations around the world where the problem of water scarcity is more extreme than in the UK, solutions are being implemented to successfully meet the challenge. These examples provide the UK water industry the opportunity to see what might be appropriate for its own situation. One example is South East Queensland, Australia, which is addressing the challenge of maintaining a supply of high-quality water during a severe drought, coupled with a steadily increasing population.

The Western Corridor Recycled Water Project in Australia is using the latest water treatment technology to construct three advanced water treatment plants, which, when completed, will produce a combined total of around 232 MLD of purified recycled water that will be used to meet the water demand of two local power stations. This in turn will free up water stored in a nearby dam for other uses. In addition, the Queensland Water Commission has been successful in introducing water restrictions and changing water-use behaviour that has seen per capita usage drop below 140 litres per person per day from a high of 300 litres per person per day before the drought. The project has gone a long way to ensure that this particular part of Queensland has a secure water supply for at least the next 50 years.

CHALLENGE 2: FLOODING

The reverse of water shortage is flooding. In summer 2007 the UK was hit by the worst flood crisis in 60 years. Record levels of rainfall resulted in river, surface-water and groundwater flooding, with thousands of homes and businesses affected. In some locations the average monthly rainfall was exceeded in a matter of hours; these are storm events of tropical intensity. Approximately 48,000 homes and 7,000 businesses were damaged, generating insurance claims of more than £3 billion. Power and water supplies were lost, railway lines, motorways and many other roads were closed; and large parts of five counties and four cities were brought to a standstill.

The emergency severely tested public service, emergency and utility infrastructures and highlighted the need for a consolidated, consortium approach to long-term, multi-stakeholder strategies.

Drought, too, has an influence on flooding because less water penetrates hard, dry soil than it does soft. In urban areas, paving over front gardens for off-road parking has increased dramatically, leading to higher levels of rainwater runoff. Similarly, in the countryside intensive farming methods and housing development on flood plains have contributed greatly to the risk of flood.

In addition, the Victorian sewerage infrastructure that is still in use was not designed to cope with the type of severe storm events that are becoming more common in the UK. Stormwater runoff is a source of pollution and carries many public health implications. If climate change predictions hold true, a 30 per cent increase in rainfall could occur by 2080. The problem is that the rain is likely to fall in intense storms that will overcharge stormwater drainage systems.

One non-structural solution to such runoff problems, for example, is being implemented as part of a larger stormwater management program in Kansas City, Missouri. The U.S. initiative is called 10,000 Rain Gardens; and the goal is to create sunken areas planted with native perennials that are specially designed to collect stormwater runoff and return it to the ground naturally and safely. Rain gardens present a green solution to an escalating environmental problem: flooding and stormwater runoff that carries surface pollutants and contaminants into overloaded storm sewers, streams and waterways.

In 2007 the UK government estimated that about two thirds of the flood damage in the country was being caused by surface-water runoff overloading drainage systems, while only a third came from river flooding. The fact that no single agency has overall responsibility for surface-water drainage is also an issue: it is a responsibility shared by the Environment Agency, local authorities and water companies. Strong communication and integrated strategies will be a major part of any sustainable solution to mitigate flooding in the future, as will learning lessons from locations like Hong Kong and Singapore, which already experience intense rainfall events in high-density urban areas.

Responses to flooding

As a result of the 2007 summer floods, the government commissioned an independent review of the flooding emergency by Sir Michael Pitt, whose interim report was published in December 2007. *The Pitt Review* concluded not only that the effects of climate change are here to stay, but also that strategies for

dealing with them should be treated with the same urgency as counter terrorist measures or flu prevention. The review also highlighted the pressing need for major financial investments from the government in a *national* flood prevention and response plan and brought to the forefront many of the ongoing issues the water industry faces.

Amongst its 15 recommendations and 72 core findings, *The Pitt Review* recommended that DEFRA urgently “share and develop a flood emergency framework.” The Secretary of State for the Environment, The Rt Hon Hilary Benn, MP, announced “a significant increase in funding for flood and coastal erosion risk management” and staggered increases in investment, rising from the current level of £600 million to £800 million in 2010-11.⁵

Extensive modernisation and much greater use of Sustainable Drainage Systems (SUDS) and Low Impact Development (LID) are now generally accepted as necessary augmentations to traditional drainage systems. Unlike pipes, which are fast but have an inherently limited capacity, SUDS work more like natural drainage systems and can play an important role in integrated water management.

By late 2008 planning permission will be required for paving over front gardens and only granted for applications that include porous solutions, such as gravel or permeable paving that allows precipitation to sink into the ground.

Ways to improve management of surface water as a resource include harvesting rainwater. This can be done using water butts on domestic dwellings or on large-scale commercial premises. Heathrow’s new fifth terminal, for example, has Europe’s largest rainwater harvesting system.

In tandem with new surface-water management initiatives, traditional drainage systems need updating so they are better able to cope with changes in rainfall patterns.

As part of its *Making Space for Water* flood and coastal risk management strategy, DEFRA has commissioned numerous integrated urban drainage pilot studies across the country that aim to mitigate against floods through holistic and sustainable partnership approaches.

⁵ Source: *The Pitt Review*, December 2007.

These include work in the Sussex town of Lewes. Lewes is located at the point where the River Ouse passes through the South Downs, which makes it vulnerable to flooding. The original drainage system in the centre is very old and has had difficulties coping with recent storms. Initiatives in Lewes include detailed threat assessments, introducing hard defences along the river and constructing a 1.2 m diameter stormwater retention tunnel beneath the town centre.

This pilot study, in common with many others taking place across the country from Leeds and Birmingham to Hartlepool and Salford, aims to develop a strategic framework for future development and current asset management. Its partners include engineering, consulting and construction company Black & Veatch, East Sussex County Council, the Environment Agency – Southern Region, Lewes District Council and Southern Water.⁶

While surface-water management is a crucial issue for inland authorities, there are also Shoreline Management Plans (SMPs) that provide large-scale flood risk assessment in coastal areas. Again, the emphasis is on long-term sustainable solutions, collaboratively developed within a holistic paradigm. In Scotland, the Scottish Environmental Protection Agency estimates that some 30,000 homes and businesses are at risk from coastal flooding. It operates a 24-hour Flood Watch service that warns of flood in 12- and 24-hour cycles and, like the Environment Agency, offers online and call centre information. However, as in England and Wales, responsibility is shared by local authorities, water authorities, landowners and public emergency services.

When *The Pitt Review* is published in full and the 2008 UK Climate Impacts Programme is made public, the government plans to host a conference on floods so that the next steps can be discussed and explored between all stakeholders.

CHALLENGE 3: GREENHOUSE GAS EMISSIONS

Although the UK water industry emits less than one per cent of the nation's greenhouse gases,⁷ water companies are on the front line in terms of vulnerability to climate change – through the combination of flood and drought previously discussed. The industry will need to reduce its greenhouse gas emissions in line with other sectors. Paradoxically, however, many of the adaptation solutions for climate change are

⁶ *Making Space for Water*, Urban Flood Risk and Integrated Drainage, DEFRA.

⁷ <http://www.defra.gov.uk/news/2007/070426a.htm>, DEFRA press release.

comparatively carbon heavy. The challenge will be to achieve success while cutting emissions in line with European Union and government targets.

More than half, or approximately 56 per cent, of the water industry's emissions comes from wastewater treatment, and 39 per cent from clean water treatment and supply.⁸ This means that initiatives to reduce the reliance on end-of-pipe treatment will be an important factor in cutting industry emission overall, as will the development and investment in new, cleaner technologies.

The Climate Change Bill⁹ proposes to make legally binding CO₂ emissions reductions of 60 per cent by 2050 and 26-32 per cent by 2020 in the UK. According to the report, the 2050 figure could change to 80 per cent as it is in Scotland. This bill will work hand in hand with the Carbon Reduction Commitment (CRC), which is a mandatory emissions trading scheme that will require participation of any large business that has an electricity bill of around £500,000 per annum. Essentially the scheme will require companies to buy allowances for any non-transport CO₂ emissions and will have an impact on how water companies pay for and use energy.

We are seeing governments around the world starting to grapple with this issue. Australia, which is particularly vulnerable to climate change, provides a good example of what can be done. The government of Western Australia was the first Australian state to undertake a comprehensive assessment of what sustainability means for 42 areas of government. It produced a State Sustainability Strategy that is based on a Sustainability Framework. On a major wastewater upgrade and rehabilitation project that Black & Veatch is involved with in Perth, our team is seeing first hand how this sustainability framework is driving project decisions. As part of the work on the upgrade of three wastewater treatment plants, the team has used sustainability metrics – based on social, economic and environmental aspects – to help determine the feasibility of decisions under consideration.

Responses to Greenhouse Gas Emissions

Climate change requires the water industry to plan and manage many uncertainties. Issues around asset management and risk assessment are prominent and the challenge for the industry will be how to achieve these improvements while reducing its carbon footprint. The consensus is that a co-operative consortium

⁸ <http://www.defra.gov.uk/environment/water/strategy/pdf/future-water.pdf>, *Future Water*, DEFRA, p. 68.

⁹ <http://www.defra.gov.uk/news/latest/2007/climate-0313.htm>, DEFRA Climate Change Bill.

approach, which aims to reduce emissions from capital programmes in addition to operations, will be the way forward.

As the water industry representative body, Water UK¹⁰ has set a voluntary commitment for the water industry where 20 per cent of its energy use will come from renewable sources by 2020. The industry already uses renewable energy for about 14 per cent of its energy needs, and about half of that is generated on site.

In consultation with the government, Ofwat has enshrined the principle of reducing the sector's greenhouse gas emissions into its PR09 review process, which sets water prices for the next five years. In its desire to see emissions reduced, Ofwat has required companies to factor the shadow cost of carbon into all of their development plans and any related cost-benefit analysis.

In its position paper on PR09, the Consumer Council for Water (CCW) stresses the need to communicate the issues to the public clearly and simply so that they understand the consequences of wasting water in terms of climate change and how their money is being spent to mitigate the effects of global warming. The CCW will lead Ofwat's collaborative qualitative research so that the voice of the consumer is audible at the centre of activity.

In addition, there are now numerous development projects in place that will showcase new "eco town" developments with "water neutrality" as a centrepiece in terms of future water management. These new urban developments will include sustainable urban drainage and natural flood mitigation infrastructure, alongside eco-friendly technology, such as solar panels, to heat water within the new homes. Plans for water- and carbon-neutral eco projects¹¹ in the Thames Gateway as part of the 2012 Olympics are examples of showcase schemes for how partnership works. The £9 billion project, which covers a 40-mile stretch of land, includes proposals for two of the largest offshore wind-generation barrages in the world. The London Assembly has also made a renewables commitment on construction sites.

CONCLUSION

¹⁰ <http://www.water.org.uk/>, Water UK.

¹¹ <http://www.smartplanet.com/news/household/10000293/water-neutral-eco-region-planned-for-thames.htm>, Smart Planet.

It is impossible for a single sector to reduce the risk of flooding, manage the water supply, protect the aquatic environment and predict and adapt to impacts of climate change without the cooperation of other sectors. Coping with climate change requires a joined-up partnership approach to risk assessment and strategic planning.

Cooperation between the relevant stakeholders is underway in terms of legislation, strategy and the development of new technologies and infrastructure. The importance of collaborative partnerships between water companies and their consultancy and construction partners, government agencies and consumer groups is paramount and something that, in a time of unprecedented uncertainty, all stakeholders are acutely aware of.

Human ability to predict the weather is limited, and what may seem a priority now could be easily overtaken by unforeseen factors. It is likely, however, that in the long term, we will have to deal with increasingly extreme conditions from drought to flooding. In addition to having resilient emergency scenario plans, government and regulatory bodies should also allow for flexibility so that the industry can respond to issues as and when they occur.

For the water sector, significant investment is needed to upgrade infrastructure that was not designed to cope with the climatic conditions predicted. Affordability, however, is a critical issue.

Compulsory metering is most likely to be a matter of “when” and not “if.” The need is also widely acknowledged for complementary activities to address the demand supply balance – initiatives to reduce consumption, decrease further leakage and facilitate regional water transfers.

Consumer education is something all stakeholders are actively engaged in, and there is strong awareness that education initiatives will play a principal role in communicating the details and the importance of responsible water usage and consumption. The challenge will be to get people to understand that water efficiency will be as necessary as energy efficiency in a sustainable future. Those who have suffered sewer flooding or hosepipe bans first hand may be more willing to underwrite the costs of any capital investment programmes than those who have not, but the message is clear – the days are over when it was possible to use water as if there were no tomorrow.

For the water sector, the fact is that there is no single cure for climate change. Our response will need to be flexible, imaginative and, above all, collaborative.

Dan McCarthy is the President and CEO of Black & Veatch's global water business, based in Kansas City, Missouri. Black & Veatch's UK headquarters is in Redhill, Surrey.