Institution of MECHANICAL ENGINEERS

Challenges for Water Use in UK Industry

CONFERENCE PAPER – JUNE 2016

Dr J Baxter
Head of Energy and Environment

Contributors
Richard Newton – Textiles Services Association
David Seall and David Arscott – PyTerra

Introduction

The public supply of water in the UK is an established industry that has been very much business as usual and status quo now for some time. The key question therefore is whether it is 'future proof'? It is vital that we understand what will disrupt the status quo and what the disruptions will look like. There are many areas where the role of engineers in managing changing water supply needs will be critical, such as, making cities function, the natural environment, sanitation, new water systems and efficiencies in industry.

In September 2015, the UK committed itself to the 2030 UN Sustainable Development goals. There are seventeen goals with the sixth being: ***Ensure availability and sustainable management of water for all.*** Drilling down within this goal further, two targets are especially interesting and pertinent for the UK water markets, these are:

> *Goal 6.3*
>
> *"By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally."*
>
> *Goal 6.4*
>
> *"By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity."*

This short analysis explores the way we use water in industry, how it is managed and presents a case study about how we can treat water differently so that the UK water industry can contribute to achieving the sustainable development goals for 2030.

What is industrial water?

Water has long been an important part of our industrial landscape, it is used across the board in the production of electricity, manufacturing, oil, gas and chemicals and agriculture. The way in which it is used varies from cooling, cleaning, diluting, transporting, and not least, providing sanitation.

In recent years water management in UK industry has not been high on the Government agenda. The last clear public data on water in industry was for

England and Wales only and refers to 2006-7[1]. These data however provide us with the following information:

Approximately 6.5 billion cubic metres of water were directly abstracted for use by businesses. Energy, waste, water and sewerage accounted for 71 per cent of the total (4.612 billion cubic metres), most of it abstracted directly from surface sources. The next largest use was the fish farming industry (which abstracted 16 per cent of the total) and the manufacturing sector was third (accounting for 9 per cent).

Managing industrial water – the challenge.

Understanding how water is used in industry is critical to managing supplies in the future. Water is obtained for industrial uses in three principle ways. In some cases it is supplied by the mains, some through borehole extraction and some through surface water abstraction. In all cases, the water after industrial use must be cleaned either on site or transported to a water treatment facility that can deal with the potential chemical and biological loads in it. Water must then meet the appropriate regulatory standards to be discharged back into the environment. In 2010 the Waste and Resources Action Programme (WRAP)[2] looked into the sustainable management of water in the UK in an attempt to provide insight into the environmental impacts of abstraction and release of treated water back into the environment.

In recent years increasing incidence of floods and droughts have meant that the pressure on water use both globally and in the UK has been regularly discussed. The UK Government's "Future Water: A strategy for England"[3] provides a vision of a sector that needs to value and protect its water resources; that delivers water to customers through fair, affordable and cost-reflective charges; where flood risk is addressed with markedly greater understanding and use of good surface water management; and where the water industry has cut its greenhouse gas emissions. These sentiments are reflected by the Welsh[4] and Scottish[5] governments in their policies and strategies.

[1]http://webarchive.nationalarchives.gov.uk/20130123162956/http:/www.defra.gov.uk/statistics/environment/green-economy/scptb10-wateruse/
[2]http://www.wrap.org.uk/sites/files/wrap/PAD101-201%20-%20Freshwater%20data%20report%20-%20FINAL%20APPROVED%20for%20publication%20vs2-%2005,04,12.pdf
[3]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69346/pb13562-future-water-080204.pdf
[4]http://gov.wales/docs/desh/publications/150521-water-strategy-for-wales-en.pdf
[5]http://www.gov.scot/Topics/Environment/Water
[6]BBC Radio 4 Interview with Prof Carolyn Roberts, The Life Scientific, March 22nd 2016
[7]http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/508109/DOC/150316-15032016124609

Managing our resources is clearly vital as it is likely that in the future the UK will be more heavily populated putting further strain on water supplies. The role of engineers in managing water to ensure our farming and food manufacturing industries can cope under greater strain and continue to abstract water in a way that does not irreversibly damage the environment will be essential. There may be for example opportunities for industries in close proximity to use each other's waste water in order to minimise total treatment before discharge to drains or natural water courses. However, while charges remain small within their overall operating costs industries will take relatively few measures to significantly change their water use and may be reluctant to entertain complex technical risks for marginal economic gains.

Case Studies

Case Study: PyTerra Ltd

Globally, there is a call for those with responsibilities for water to take a holistic approach to managing water in order to meet an increasingly difficult balance between supply, demand and the environment. A feasibility study at an advanced stage in the South East of England may be able to demonstrate how this can be done, using leading edge technologies to sustainably exploit Natural Capital and contribute to the concept of the Circular Economy.

Technology company PyTerra Ltd is working in partnership with global environmental engineering consultancy WSP Parsons Brinckerhoff, the local Councils and Nature Partnership, to develop a highly innovative project which aims to tackle flood prevention, water supply capacity and quality, stressed local biodiversity, industrial cooling and even saturation of the local cemetery.

This is the first phase of a strategic catchment plan which could see a network of similar schemes delivering a wide range of water services, benefitting local businesses, communities and the natural environment.

The technology that supports this is threefold. Control of all the different flows uses a SCADA (Supervisory Control and Data Acquisition) system – a common systems tool used by water companies for their piped networks. But because it is being used here with natural freshwater systems, it needs to deal with greater complexity and be more adaptive to changing circumstances. This is where PyTerra's smart technology comes in. It takes real-time readings from wireless multi-parameter sondes (sensors) at all key locations on the water network, reading both flow rate and water quality. Five-day rainfall predictions are used so that the reservoir can be drained down in advance if necessary. Satellite data is used to identify key environmental parameters, such as topsoil moisture content. All this data is integrated into a hydrological model of the local catchment area so that the impact of different actions can be assessed.

This system responds to all the 'demand' side criteria agreed with those stakeholders who are participating. It will automatically send out instructions wirelessly to valves and sluice gates so that water can moved through the system to achieve the targets.

Such schemes provide a catalyst for economic development, using new infrastructure development to create engineering and environmental jobs, and then being able to use this infrastructure to support new and existing businesses to expand the range of available water services. The infrastructure will also support the use of new technologies supplied by local companies, such as wastewater treatment and sustainable energy creation. Ultimately, it will support the trading of water resources so that transactions can automatically result in the movement of water across a network.

Smart water networks are yet to become a common approach to addressing global water issues. Their use however can result in a significant step towards the sustainable exploitation of Natural Capital. They realise demonstrable benefits to local economies, create jobs and opportunities for improved wellbeing, and achieve protection and enhancement of natural environments. At the heart of this approach is the "democratisation of water", enabling more cost effective water services to be offered because water infrastructure can then deliver multiple benefits to multiple stakeholders including industry, the agricultural economy and local citizens.

Case Study 2: Textiles Services Association – Richard Newton

The industry and its achievements

The Textile Services Association is the trade association for the laundry, drycleaning and textile rental industries in the UK and represents the market leading companies (Berendsen, Johnson, Clean, Micronclean, Fishers and Synergy) together with the majority of independents and SMEs. Collectively they employ 35,000 staff, have an annual turnover in excess of £1 billion and process approx. 800k tonnes p.a. of hotel linen, healthcare linen, industrial and specialist work wear, dust mats and domestic laundry across some 250 sites.

This industry has spent years actively addressing the use of water in its processes and has successfully reduced water use by significant amounts.

Water and effluent disposal represents 2% of the total cost cake, with energy 9%, labour 45% and other costs (stock, transport, building, depreciation, etc) being 44%.

The water and effluent cost is nonetheless significant at £45M p.a. This industry aims to reduce consumption through innovation in processes and procurement leading to a more efficient and cost effective industry. An example of this is the use of:

Continuous Tunnel Washers

These computerised industrial laundry machines process large volumes of similar items on a continuous basis, saving labour and using less water. Laundry is pulled slowly through a series of compartments dealing with soaking, washing and rinsing. Water and washing chemicals flow in the opposite direction and are reused several times. Although not a new concept, recent improvements have made the machines more reliable and efficient, and compact versions are being developed to bring the technology within reach of smaller laundries

Discussion and Conclusions

1. The UK Government needs to publish more up to date data.

It should seek to understand more clearly, through the collection of comprehensive UK data, how and where water in industry is being used. This data should then be adapted to data and knowledge sharing platforms. Such interaction will encourage sharing of best practice; highlight where efficiencies and environmental management can improve; and clarify what is being wasted and why. The Institution suggests that this should be done in collaboration with the devolved administrations of Wales, Scotland and Northern Ireland leading to meaningful reductions in the use of water in manufacturing, energy and food production.

2. The UK Government and devolved administrations must raise the importance of water management.

Government has a key role in stimulating an industry to create disruptive innovations that can support an increasing population and reduce pollution to water courses. This should be done by including water in infrastructure developments more clearly and understanding the symbiosis of water with food, energy and waste infrastructures. The water industry is generally side-lined from development initiatives and merely expected to deliver when planning is complete. Government need to remind users that water resources are finite and should include the water industry in all national scale development discussions from concept stage to avoid unnecessary financial and environmental costs. Coordination could start from the current study by the UK Infrastructure Transition Research Consortium (ITRC) which highlights not just problem areas in each sector but, critically, their interconnectivity risks.

3. The UK Water Partnership needs a much higher profile outside the water industry.

As a public-private partnership it has a laudable aim to create growth and interest in the water markets associated with industry. It already uses innovative examples such as highlighted here to guide industry to more efficient, innovative and sustainable uses of water. In addition to supporting research, development, implementation, and export of technologies however it needs to engage UK consumers in the consequences of increasing consumption with erratic or reducing supply. It should also not shy away from calling for new legislation to reinforce positive externalities and help create supply chains around new innovations in both technologies and systems.

4. The Professional Engineering Institutions need to work much more in unison on water issues.

Of the 35 engineering Institutions registered with the Engineering Council at least 9 have an active interest in the water industry. These are:-

- The Chartered Institution of Building Services Engineers
- The Chartered Institute of Plumbing and Heating Engineering
- The Chartered Institution of Water and Environmental Management
- The Institution of Agricultural Engineers
- The Institution of Civil Engineers
- The Institution of Chemical Engineers
- The Institution of Fire Engineers
- The Institution of Mechanical Engineers
- The Institute of Water

There is no record to date of them working together to raise the profile of engineering in the water industry. Without this unified voice it is difficult to see how new graduating engineers see the water sector as an exciting space where innovation and change are happening and that they can contribute to the future of life's most vital resource.