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MARK THROWER MANAGING EDITOR



MODULE EIGHT
WATER MANAGEMENT

Using water more efficiently

By Joseph McClelland MBA BEng MEI



All industrial and commercial organisations use water. However, organisations often do not know how much they are using or that by using water more efficiently they could reduce what they pay for.

There are many different water companies in the United Kingdom, some dealing solely with water and others that work with sewage as well. With the exception of customers in Northern Ireland, users must pay for their use of water. Different companies lend their services to different locations throughout the country.

It is important to be aware of your water provider, and the options you have to pay for their service. It isn't possible to change to a different water company, though water rates tend to be similar from location to location.

The British company OFWAT (Office of Water Services) is a branch of the government that aims to regulate water rates between different water companies. They carefully study the actions and investments of different companies, and put pressure on them to offer fair water rates. Water companies offer a public service, and are therefore unable to operate independently without government scrutiny.

All industrial and commercial organisations use water. However, organisations often do not know how much they are using or that by using water more efficiently they could reduce what they pay for water supply and effluent disposal.

Sites that have not previously tried to save water can often reduce their water and effluent bills by up to 30 per cent by combining low- or no-cost opportunities with longer-term water saving projects. This is especially true for industrial applications, where large quantities of water are used.

The costs for water supply and effluent disposal have risen considerably in the last decade. They are likely to continue to do so as water companies seek to meet

the costs of complying with European Directives such as the Urban Waste Water Treatment Directive (UWWTD).

Reducing the amount of water used will save money in water supply charges. In most cases, it will also have the effect of reducing the volume of effluent discharges, which will cut trade effluent charges. This will reduce impact on the environment as well as saving money. Energy savings can also be achieved through reduced pumping requirements or having to heat less water.

Other benefits may include recovery of some of the raw material or product from your process or cleaning chemicals, which previously may have been lost in the effluent stream. This will have the added benefit of lowering effluent strength, which will reduce your trade effluent charges further.

Reducing the amount of water you use can also demonstrate continual environmental improvement.

Industrial Water Use

Using water for industrial processes is environmentally safe, and a cheap alternative for providing energy. When untreated water is disposed of carelessly; however, this may cause water pollution, a leading cause of death worldwide.

Commercial Incentives

With the cost of mains water rising,

companies are finding alternative sources of water or treating water on site to the quality required. If large volumes of water are consumed, significant savings could be achieved by obtaining water from sources other than a water company. Alternative water sources include:

- groundwater;
- river/canal water;
- rainwater/surface water; and
- internal water recycling.

Water companies in the UK use the Mogden formula to calculate the cost per cubic metre (m³) of discharging a waste stream to sewer for treatment at the receiving wastewater treatment works.

The Mogden formula impacts on the cost of discharge of modifying specific aspects of the effluent, such as chemical oxygen demand (COD) and suspended solids (SS), see the Mogden formula tool at www.wrap.org.uk/content/mogden-formula-tool-0

Additional costs also need to be taken into account as the true cost of water and not just the charge from the utility supplier are taken into consideration. The true cost of water and effluent should include:

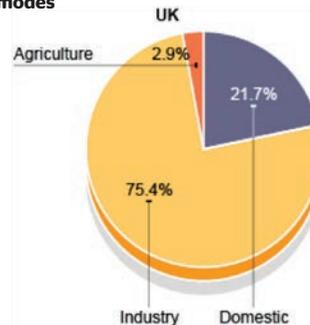
- energy requirements (i.e. for pumping, heating, chilling and heat losses);
- water treatment;
- labour;
- abstraction;
- raw material and product lost in effluent;
- capital and revenue: - costs associated with design and operation of effluent treatment plant; and - analysis of wastewater samples.

Legal Obligations

The following legal obligations apply to the use and disposal of water in the UK. Environmental Protection Act (1990) & Environmental Protection (Duty of Care) Regulations (1991)

This legislation concerns the transfer, treatment and disposal of controlled wastes. The legislation ensures that the producer of a controlled waste remains

Fig. 1 The graphic shows the basic components of the different connection modes



responsible for that waste during its transfer and ultimate disposal, even if by a third-party company.

Water Framework Directive (WFD)

The purpose of the WFD is to achieve 'good status' for all waters by a set deadline. The WFD introduced the concept of ecological and chemical protection as a minimum for all surface waters. One of the key milestones in the WFD is that 'true cost' water pricing policies had to be in place by 2010. This further promotes the 'polluter pays' ethos and requires that, where possible, costs must be allocated proportionately.

Water Resources Act 1991, as amended (England and Wales)

This defines the Environment Agency's (EA) role in water pollution, water resource management, flood defence, fisheries and navigation. It covers discharges to surface and ground waters, estuaries and coastal waters, and controls abstracting and impounding water.

Operators must not cause or knowingly permit any poisonous, noxious or polluting material or solid waste to enter controlled water unless they have consent from the EA.

Water Industry Act 1991

Consolidates previous legislation on water supply and sewerage services (including trade effluent consents) and opens up the market to allow private sector companies to compete to be appointed as water and sewerage undertakers.

Integrated Pollution Prevention and Control (IPPC)

This is a European Directive4 implemented in the UK by the Environmental Permitting Regulations (EPR). EPR prioritises efficiency over treatment, thus targeting point source emissions and in-process recycling.

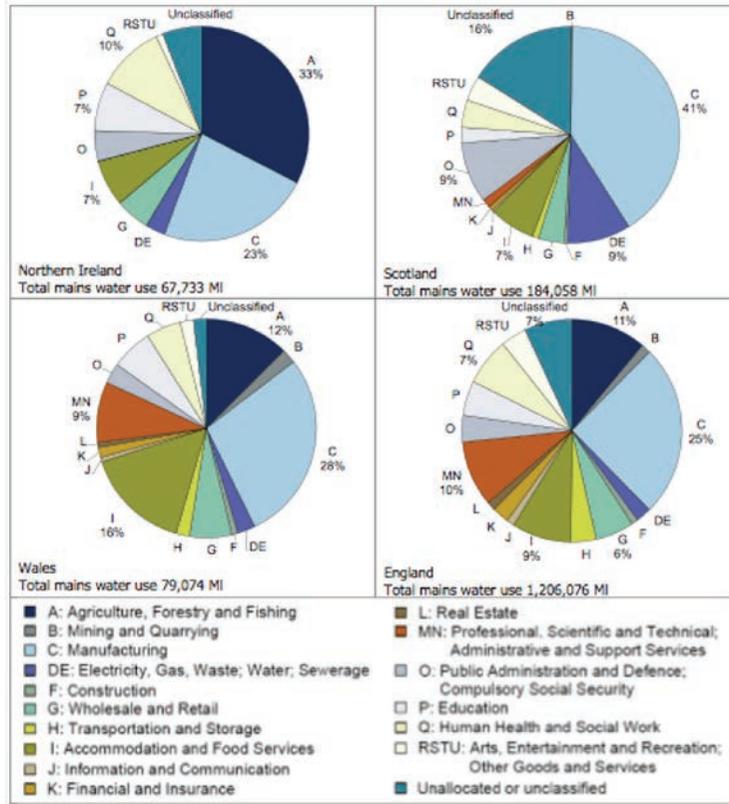
The EPR adopts a continuous improvement policy empowering a regulator to impose improvement requirements on sites that have already achieved authorisation under the EPR.

The EPR provides a consolidated system for environmental permits and exemptions for industrial activities, including water discharge and groundwater activities.

Water Management

Managing water use covers many elements, from initial investigations and commitment from senior management, through to implementation and continuous improvement.

Fig. 2 Mains water Use in the UK, by country, by SIC Sector



It is vital to have effective procedures in place to manage a water reduction programme, otherwise any improvement may become a one-off initiative with no follow-up; employees will not be motivated to continue good practices and the programme will lose momentum and fail.

Ensure your employees are aware of the total cost of water to your site – water is often an undervalued resource and some sites still believe it is 'free'.

Potential cost savings associated with water efficiency improvements are often the driver that motivates management to support a water use reduction programme.

Successful management involves identifying and initiating water saving projects; continual monitoring of water use and company/staff practices; and a timely, appropriate response to the information gathered.

The key issues and actions involved in managing water use successfully:

1. Obtain management commitment to water saving activities

Your business is most likely to make savings if senior management is committed to saving water.

It is also useful to identify at least one person in the company who will

be allocated the time and resources to 'champion' water saving initiatives. This person should take regular site tours during all of the shift patterns to establish where water is being used, whether procedures are being adhered to and where water is potentially being wasted.

It is important that key personnel such as your water champion, site engineer or site manager have access to water bills. Ensure that bills are not simply paid by the accounts department; check that they reflect actual usage.

2. Measure water use on your site

Create a water balance by gathering existing site water use data and marking the major water uses on a simple pictorial representation of your site.

To ensure robust data are obtained, consideration should be given to the development of an operational control procedure to monitor and measure water on site. The purpose of such a procedure is to provide methodologies to:

Monitor water consumption in a controlled manner. This would include instructions on:

- how to measure water consumption (e.g. electronically and/ or manually);
- the frequency of measurement (e.g. daily, weekly);
- where to record the data; and

• how to communicate the data. Demonstrate progress towards, and the achievement of, water efficiency objectives and targets.

3. Analyse results and identify areas of potential savings

Brainstorm and research ideas for reducing water use in certain areas. Involve all staff and consider including all appropriate contractors, such as cleaning staff, at this point as they may have good ideas. Identify water use reduction projects and assess the potential cost savings from them.

4. Set targets

Decide on your maximum budget. Set targets for the savings you want to achieve in each area. Set target payback times so that you have a timeframe in which to achieve the savings.

For companies that have/are implementing an EMS, these targets can be used in your management programme/action plan. For those that have not yet implemented an EMS, such targets could be used as a catalyst for a full EMS implementation programme.

5. Plan

Get detailed costs from suppliers for any new equipment you want to install and work out what resources you need for various activities.

Use all the information you have gathered to develop your action plan. An action plan will help you to assess your environmental performance, compare opportunities and prioritise actions.

6. Involve Staff

You may already have involved staff when looking for ideas for saving water. Keep them involved at all stages. It is vital for staff to feel that they are involved, consulted and informed; this improves motivation.

7. Implement improvements

This may include training staff, installing new equipment or fixing existing equipment and informing staff about best practice procedures.

8. Monitor, report and review

Once improvements have been implemented or adopted, it is important to measure and monitor regularly. That way, you not only check that you are hitting your targets, but you also identify any areas that need attention. Get feedback from staff and carry out regular inspections and surveys. Inform staff of progress and results, and be sure to report success stories.

Staff suggestions that directly result in water savings could be reported in company communications (e.g. a newsletter).

To achieve certification/registration to a formal EMS, you must provide documented evidence that you have

worked towards achieving the objectives and targets in your management programme/action plan. Monitoring, measuring, and reviewing objectives and targets are, therefore, key elements of EMS implementation. These processes enable you to identify whether or not the objectives and targets are realistic and achievable. If the process concludes that the objectives and targets are not realistic, a review will need to be undertaken to modify them and make them achievable.

Use your reviews as the basis for further action. Set future targets and use your environmental action plan for ongoing improvements.

Benchmarking

Benchmarking is the process of comparing the cost, cycle time, productivity or quality of a specific process or method against one that is widely considered to be an industry standard or best practice. Essentially, benchmarking provides a snapshot of your business performance and helps you understand where you are in relation to a particular standard.

Internal benchmarking is a comparison between similar operations in your own organisation. External benchmarking is a comparison with best practice achieved by others in the industry.

Benchmarking can be used by a business as an indication of how it is performing in terms of water consumption and effluent generation (i.e. product loss) compared with the rest of its sector.

Objectives and targets

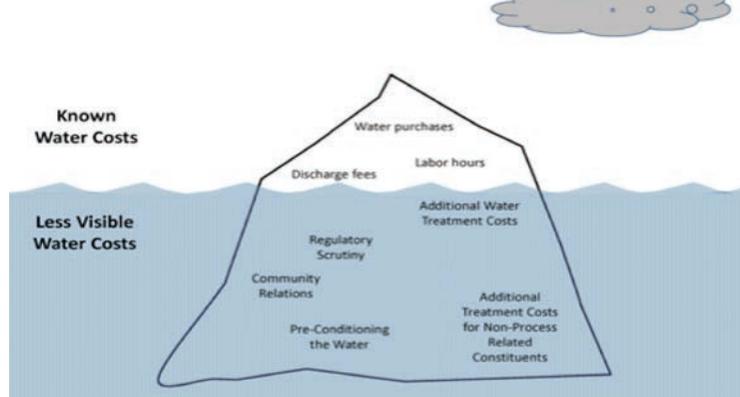
Objectives are the overall aims that a business will set to reduce its water consumption on site. However, this alone will not bring about a reduction in water use. Short-term goals need to be set to achieve the overall objective of reducing water use. These short-term goals are referred to as targets, which are derived from both internal and external benchmarking.

Benchmarking data also provide assurances that the target associated with the objective is realistic and achievable.

Benefits of benchmarking include:

- A useful tool for highlighting areas where there might be discrepancies.
- A simple way to express performance that can be used as a tool to communicate to staff the need to manage resources.
- It encourages improvement and makes it easier to identify opportunities to reduce wastewater.
- It helps to manage variable costs and to develop key performance indicators.

Fig. 4 Variables affecting optimal water use



Key performance indicators

Key performance indicators (KPIs) are essential to any successful benchmarking campaign. KPIs are financial and non-financial measures that can be used to help a business define and evaluate how successful it is, typically in terms of making progress towards its long-term organisational goals.

Measuring KPIs

- KPIs can allow management to see the performance of a company or department in one place.
- A team can work together to a common set of measurable goals.
- It can be a very quick way of seeing the

actual benefits and improvements from a strategic objective.

- Decisions can be made much more quickly when there are accurate and visible measures to back them up.

KPIs are an essential element of water management implementation as they provide normalised numerical values to the environmental performance of a business. Normalising data is key to monitoring the success of any environmental programmes in a business, such as water efficiency projects.

Process water use

Typical usage of water by an industrial site is likely to be greater than the theoretical minimum. The degree by

which a particular site exceeds this minimum is usually determined by a number of variables.

In developing optimal water use values it is critical to understand some of the factors that contribute to variability within the industry, or even in the same factory. For each industry type, some of the variables have been identified. The list is not exhaustive and other variables that may be impacting on water use include the following:

- the availability of water (particularly where subject to drought restrictions);
- the cost of water;
- commitment of top management;
- seasonality arising from rainfall, customer demand or other criteria;
- scale of production;
- production rate inefficiencies through bottlenecking or use utilities;
- process technology;
- frequency of product or brand changes;
- wash-down practices; and
- location

The implementation of improved water management will be influenced by these variables and the cost of implementing water reduction measures as compared to the potential cost savings.

Significant reductions

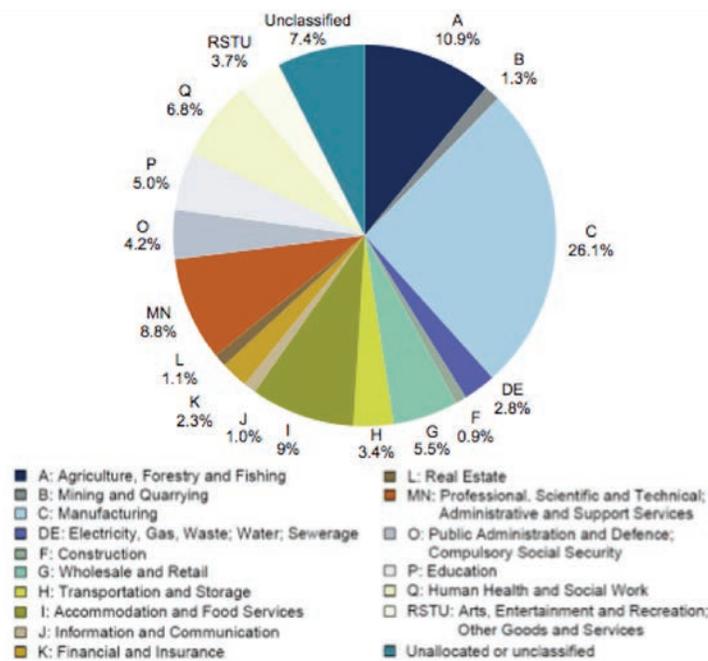
However, in relatively recent times many companies have created significant reductions in their consumption of water by applying a systematic waste minimisation approach, and reductions of 50 per cent are not uncommon. Other companies have altered existing systems so that although water consumption has not decreased, other improvements in water management have been obtained, for example a reduction in the amount of discharge.

These companies have achieved optimal water use in cost-effective ways that have sometimes reset the benchmarks for their industry. As technology improves and further developments are made, the benchmarks may change again. Therefore, it is impossible to accurately predict the absolute optimal water usage and this manual will need to be regularly reviewed and updated as further information is obtained.

References

- www.wrap.org.uk
- www.bbc.com/water
- 'Cutting Water and Effluent Costs' IChemE
- 'Water Use and Reuse' IChemE/ Envirowise
- R&D Technical Report W6-056/TR2 Part A: Industrial Component

Fig. 3 Proportion of Typical Total Annual Mains Water Use in UK, by Industry Sector



WATER MANAGEMENT

Please mark your answers on the sheet below by placing a cross in the box next to the correct answer. Only mark one box for each question. You may find it helpful to mark the answers in pencil first before filling in the final answers in ink. Once you have completed the answer sheet in ink, return it to the address below. Photocopies are acceptable.

QUESTIONS

1. What is the percentage share of total UK water use by industry?

- 21.7% 2.9%
 75.4% 35%

2. Which UK industry sector use the most water?

- manufacturing
 agriculture
 food services
 education

3. Alternative water sources are:

- rainwater/surface water
 river/canal water
 ground water
 all of the above

4. The Water Framework Directive concerns:

- the transfer, treatment and disposal of controlled wastes
 water pollution, resource management and flood defence
 to achieve 'good status' for all waters
 consolidates previous legislation on water supply and sewerage services

5. Which of these are successful water management issue?

- planning
 measuring use on site
 setting targets
 all of the above

6. Which percentage is considered not uncommon by applying a systematic water waste management programme?

- 20% 10%
 50% 58%

7. How many key issues and actions are involved in managing water successfully?

- 5 3
 7 9

8. The Mogden formula is used by water companies to calculate the cost of water:

- per litre
 per 1,000 litres
 per UK gallon
 per cubic metre

9. Which branch of the UK Government regulates water rates between different water companies?

- OFTEL
 OFGEM
 OFWAT
 OFCOM

10. Which UK sector use the least amount of water?

- mining and quarrying
 construction
 information and communication
 real estate

Please complete your details below in block capitals

Name (Mr, Mrs, Ms)

Business

Business Address

.....

.....

Post Code

email address

Tel No.

Completed answers should be mailed to:
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