Business Resource Efficiency Guide

Benefits of Water Metering and Monitoring for the Food & Drink and Hospitality & Food Service Sectors

Our vision is a world without waste, where resources are used sustainably.

We work with businesses and individuals to help them reap the benefits of reducing waste, develop sustainable products and use resources in an efficient way.

Find out more from the WRAP Resource Efficiency Helpline on 0808 100 2040 or at www.wrap.org.uk

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1 Introduction

This guide describes the benefits of metering and monitoring water use in a food and drink or hospitality and food service business. Knowing how much is used and where it is used are the first steps towards controlling and reducing the amount needed. By using less water, organisations can save money on water supply costs, wastewater disposal charges and other associated costs, such as, energy for heating and chemicals for treating water.

The guide is intended to help all organisations consider and evaluate a variety of water metering equipment and practices. It will help smaller businesses understand how best to monitor water use by using information from their water bills and reading their meters, and larger businesses consider whether they would benefit from installing additional meters (sub-meters) and automated meter reading technology. The types of organisations that can benefit include:

- hospitality and food service operators, such as restaurants, pubs and hotels; and
- food and drink manufacturers.

Identifying and evaluating cost-effective water saving practices is best undertaken as part of a wider water saving programme. Further information on how to manage such a programme is outlined in Saving Money Through Resource Efficiency and further details are given in Tracking Water Use to Cut Costs. Both guides are available from the WRAP website[1].
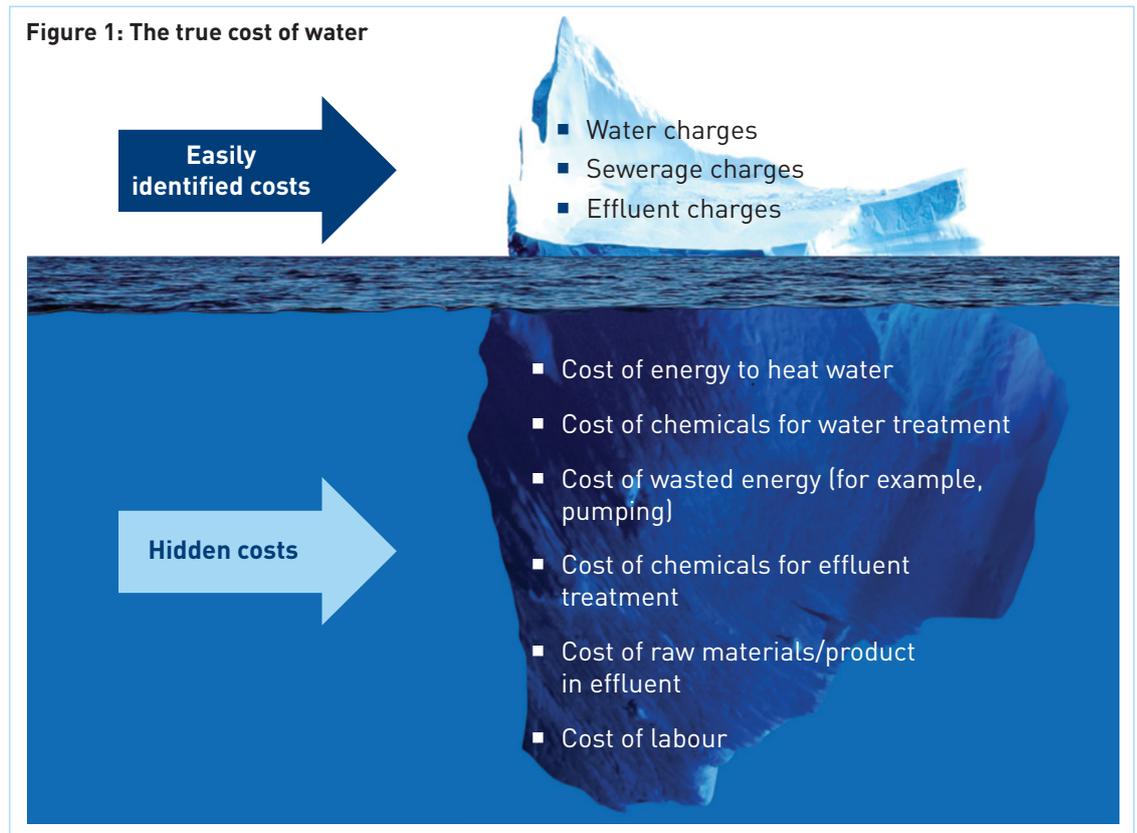
1.1 The business case for reducing water use

There are many business benefits to be gained from improving water efficiency, including reduced:

- water supply costs;
- wastewater disposal costs;
- raw material or product loss in effluent streams;
- water treatment costs; and
- energy costs for pumping or heating water.

As well as the easily identified costs for the supply of water and wastewater disposal, there are many hidden costs associated with the use and treatment of water. The true cost of water may be more than three times the total amount charged for supply and disposal. Figure 1 shows the elements making up the true cost of water.

[1] www.wrap.org.uk

Figure 1: The true cost of water

Easily identified costs
- Water charges
- Sewerage charges
- Effluent charges

Hidden costs
- Cost of energy to heat water
- Cost of chemicals for water treatment
- Cost of wasted energy (for example, pumping)
- Cost of chemicals for effluent treatment
- Cost of raw materials/product in effluent
- Cost of labour

1.1.1 Calculating the true cost of water

When considering the benefits of reducing water use, it is important to calculate the true cost of water by taking into account the 'hidden' costs.

Hot water

All businesses use hot water in some way, whether it's for handwashing, in a kitchen or in a manufacturing process. The true cost of water includes the cost of the water and the cost of the energy to heat it. Typical costs for hot water per cubic metre (m³) are given in Table 1.

Table 1: Typical costs for hot water

Water type	Typical cost
UK mains supply[1]	£0.52 – £1.93/m³
Hot water (60°C) – gas heated[2]	£2.79 – £4.20/m³
Hot water (60°C) – electrically heated[2]	£8.63 – £10.04/m³

[1] UK mains supply based on standard 2014/15 tariffs.
[2] Energy costs at 4.2p/kWh for gas and 13.5p/kWh electricity, using a boiler with 90% efficiency.

Remember, additional costs will also be incurred for disposal of any wastewater to sewer, typically between £0.54 and £2.67/m³.

Treating water

Sometimes, water will be treated on site before it is used. For example, a food and drink manufacturer may use steam during processing and for cleaning or a hotel may need to chlorinate swimming pool water. Typical costs for water following different treatment types are given in Table 2.

Table 2: Comparable costs of treated water

Water type	Typical cost
UK mains supply[1]	£0.52 – £1.93/m³
Chlorinated water	£0.77 – £2.30/m³
Softened water	£1.02 – £2.43/m³
Demineralised/ deionised water	£1.92 – £3.80/m³
Condensate	£5.31 – £6.72/m³
Steam	£29.24 – £30.65/tonne

[1] UK mains supply based on standard 2014/15 tariffs.

2 How to monitor water use

Monitoring water use will help companies to better understand and manage consumption, identify opportunities to reduce it and save money. There are many benefits of monitoring water use including:

- highlighting water use trends;
- identifying increases in consumption that need further investigation – a sudden increase could indicate a leak; and
- establishing reductions in water use following the implementation of water efficiency measures.

Plotting water consumption data on a graph can help organisations to understand and analyse their findings. Figure 2 shows the water consumption for an example site where an increase in water use from March to August 2013 is apparent and is due to a leak. The Water Monitoring Tool on the WRAP website incorporates a set of spreadsheets that can be used to record water consumption data and generate graphs to illustrate trends.

The amount of data required will depend on your specific needs and the level of detail required. For example, a small coffee shop is unlikely to need additional metering to monitor its water use, whereas a manufacturing site may find it useful to install sub-meters on its production lines. These data can be obtained from a number of sources – water bills, water supply meter and sub-meters installed on site. These sources are summarised in Table 3.

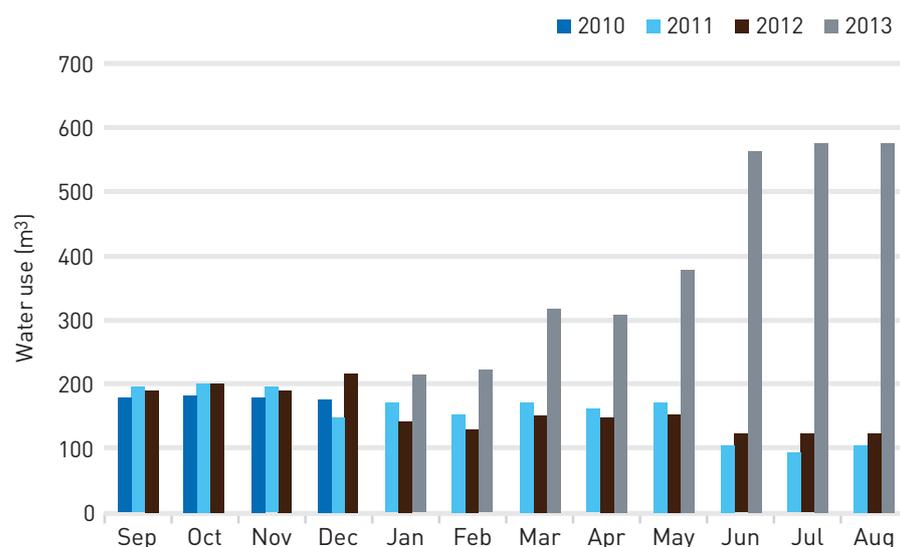**Figure 2: Graph showing trends in water use**

Table 3: Sources of water consumption data

Source	Key points
Water bills (see section 2.1)	■ Most businesses receive a water bill that is based on actual use calculated from meter readings. ■ The frequency of billing can vary – monthly bills can provide a greater level of consumption detail than annual bills. ■ Other water sources, such as abstracted water or harvested rainwater, are not billed.
Water supply meter (see section 2.2)	■ Most businesses have a water supply meter installed. ■ If the meter is easily accessible, it can be used for regular manual readings. ■ Some water company meters are fitted with a data logger to enable remote meter reading and may offer access to online data.
Sub-metering (additional meters) (see section 2.3)	■ Sub-metering is not usually necessary on small sites, such as cafes and pubs. ■ Businesses that are not billed based on volume, such as an eating outlet in a shopping centre, may benefit from installing a sub-meter. ■ Sub-meters can help large or more complex sites to track specific areas of water use, such as hotel swimming pools, manufacturing processes or wastewater outlets. ■ Some businesses may benefit from installing a sub-meter to monitor water abstracted from a borehole or a rainwater harvesting system.

2.1 Water bills

Most businesses are metered and will receive bills regularly that detail water and wastewater charges. However, some businesses are not charged based on the volume of water used. In these cases, bills can be based on the rateable value of a property or, where businesses are tenants in a larger building, water use is charged as part of the property rental fees.

Water bills provide key information that can be used for monitoring water use including:

■ the volume of water used during the billed period;
■ whether the meter readings are actual or estimated; and
■ the number of days in the billing period (days between meter readings).

For monitoring purposes, it is good practice to use two actual meter readings – not estimated; this may mean that more than one bill is looked at. The time period between actual readings may vary. Therefore, it is important to normalise the data to enable like-for-like comparison:

Water use (m³/day) = water volume/number of days in billing period.

For further information on water bills, please refer to the WRAP guides Reducing Your Water Consumption and Tracking Water Use to Cut Costs.

2.2 Water supply meter

Most commercial and industrial properties have a metered water supply. Some sites have more than one incoming water supply and each should be fitted with a meter. A business is responsible for the water use recorded on its meter, including wastage, leaks[2] and unauthorised use. It is good practice to read meters on a regular basis to monitor how much water is being consumed.

[2] Leakage codes of practice are available from water companies. Contact details are available on the Ofwat website www.ofwat.gov.uk/consumerissues/watercompanies/map

2.2.1 How to read a meter

Water supply meters are often located at the boundary of a property. If the location of a meter is not known, then the local water company should be contacted for information. The first time a meter is read, it is recommended that the meter serial number is noted and compared with the number shown on the bill to ensure accurate billing.

Figure 3 shows a typical water meter display, the white digits refer to cubic metres (m^3) and the red digits refer to $1/10^{th}$ and $1/100^{th}$ of a m^3.
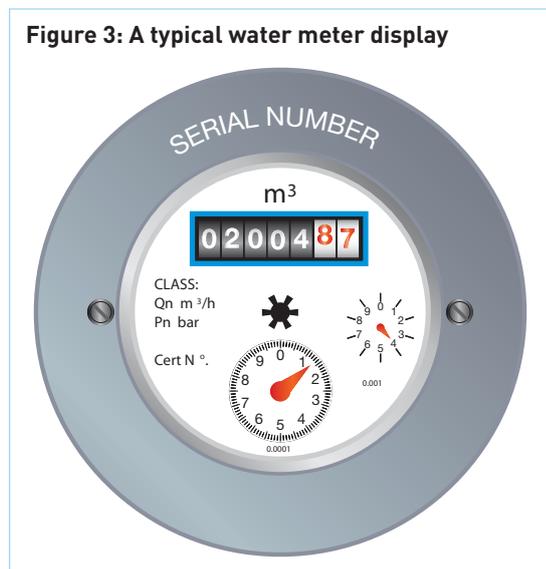
Figure 3: A typical water meter display

2.2.2 Recording and analysing meter readings

Recording meter readings on a regular basis (daily, weekly or monthly) will help to identify trends in water consumption. The Water Monitoring Tool on the WRAP website incorporates a set of spreadsheets that are easy to use, and will generate tables and graphs for weekly, monthly and annual water use for up to five separate meters.

Water consumption may vary over a period of time and be dependent on a number of variables, such as production levels or number of people at the premises – such as staff, customers and guests. To ensure like-for-like comparisons, it is a good idea to normalise data and express water use in terms of production (volume of water used per tonne of product) or workforce (volume used per employee). This benchmark of water use can be used to identify excessive consumption or to demonstrate genuine reductions in water use. Figure 4 illustrates total water consumption at an example site where water use is shown to increase over a year.
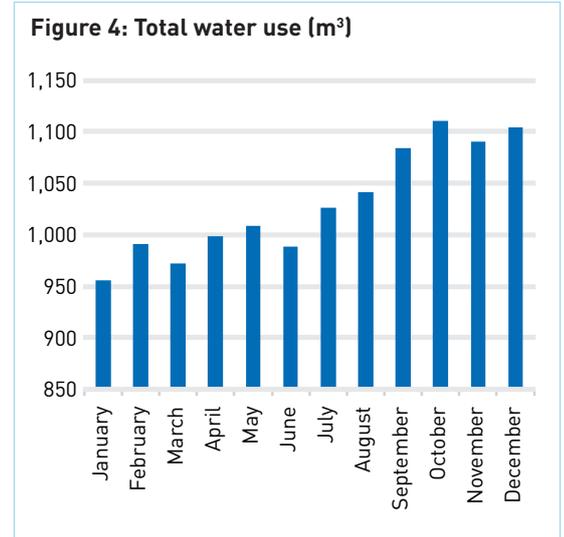
Figure 4: Total water use (m^3)

However, Figure 5 shows that, month-by-month, production water use (m^3 per tonne of product) is fairly consistent and the increase in water use is in line with an increase in production.

Table 4 shows how the production data (tonnes) were used to calculate the total water use to produce the graph in Figure 5.
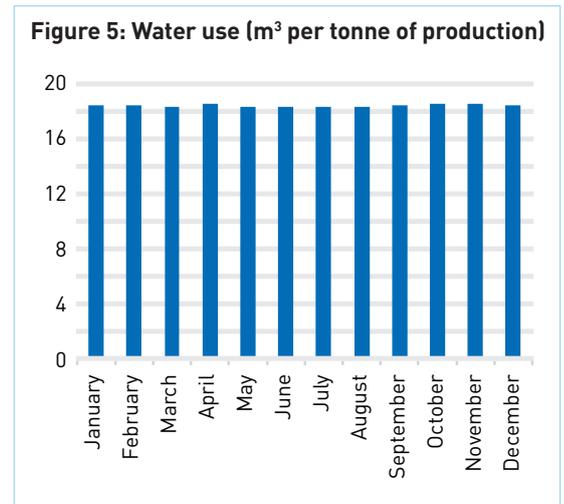
Figure 5: Water use (m^3 per tonne of production)

Table 4: Production level each month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Water use (m³)	956	991	972	999	1,009	989	1,026	1,041	1,084	1,111	1,090	1,104
Production (tonnes)	52	54	53	54	55	54	56	57	59	60	59	60
Water use (m³/tonne)	18.4	18.4	18.3	18.5	18.3	18.3	18.3	18.3	18.4	18.5	18.5	18.4

2.3 Sub-metering

To provide a more detailed overview of water consumption, it is worth considering the installation of additional meters (sub-meters). These can be installed at key points in a building or on a site to enable specific areas or processes to be monitored more closely. Areas where it may be useful to install a sub-meter include:

- parts of a building that use high volumes of water, such as commercial kitchens with large dishwashers;
- processes that use high volumes of water, such as production lines or cleaning-in-place (CIP) equipment;
- processes that use a significant amount of heated or treated water (higher cost water), such as a boiler house; and
- frequently used equipment, such as commercial/industrial washing machines.

2.3.1 Location of sub-meters

The best places to install sub-meters will depend on the activities undertaken at a particular site and the level of monitoring data required.

Small sites that cannot easily access the water meter or a tenant business may find it useful to install a meter on its incoming supply to measure total water use (providing this is permitted under the tenant lease agreement). However, in the main, the level of detail required for small sites is unlikely to warrant further sub-metering.

For larger sites, it may be necessary to install water meters at key positions to enable water consumption to be measured in different parts of the site. For example, in a hotel, the key water using areas may be the kitchen, leisure centre and laundry. Installing sub-meters in similar positions as those shown in Figure 6 would allow these areas to be monitored more closely.

On a processing site, key areas of water use could be manufacturing processes, CIP equipment and cooling towers. Figure 7 shows where sub-meters could be positioned for a food and drink manufacturing site.

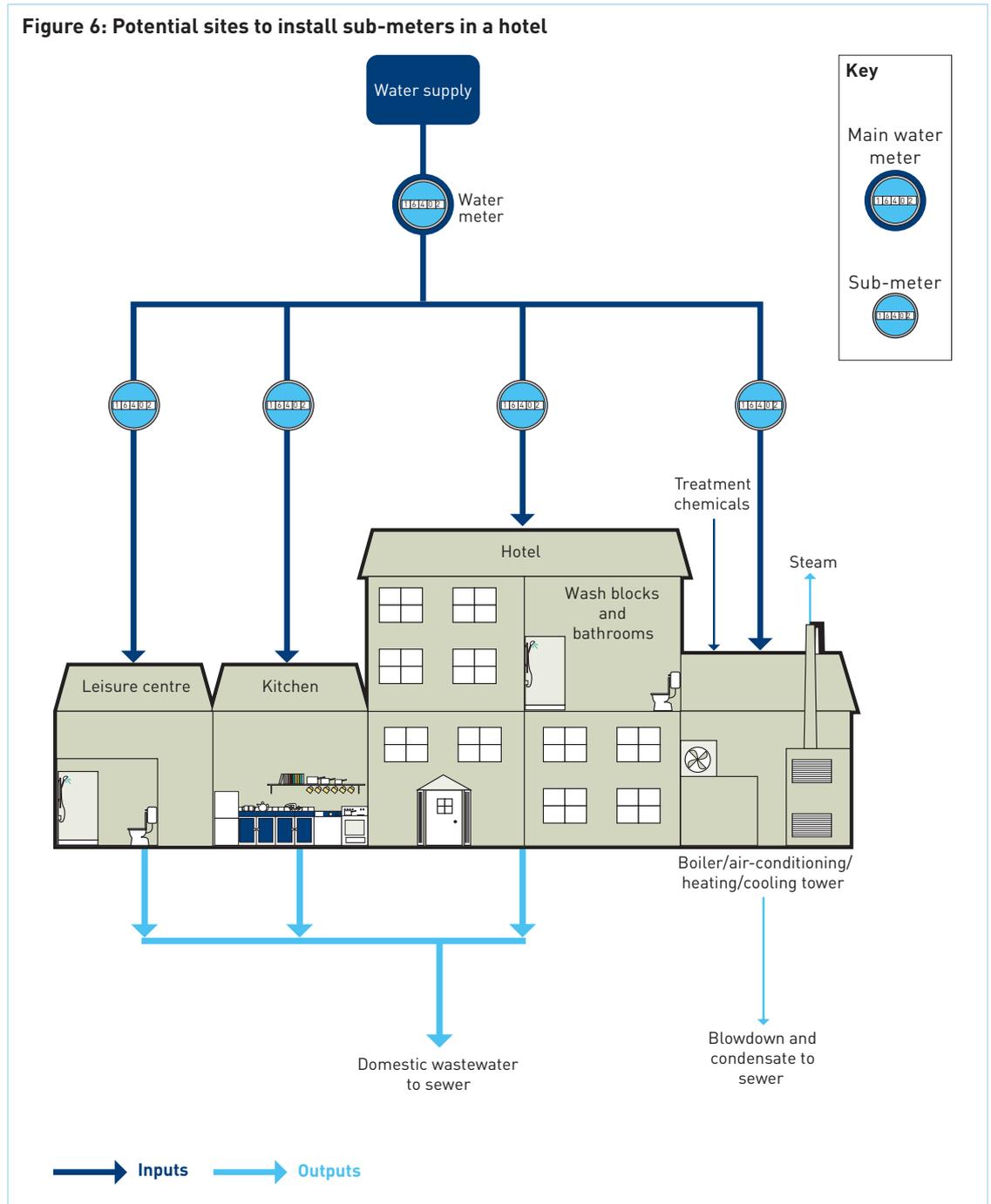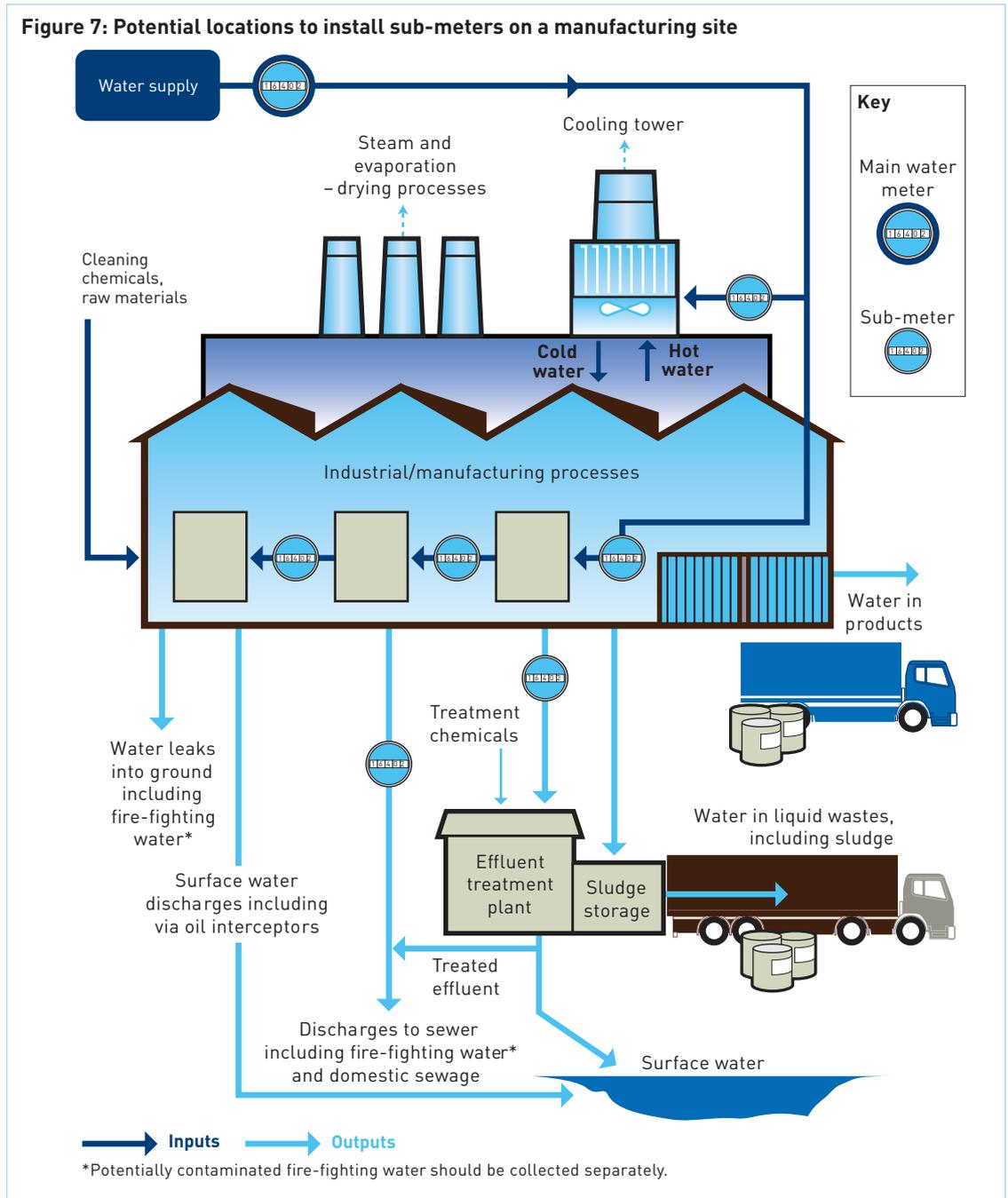**Figure 6: Potential sites to install sub-meters in a hotel**

Key

Main water meter

Sub-meter

Water supply

Water meter

Treatment chemicals

Steam

Hotel

Wash blocks and bathrooms

Leisure centre

Kitchen

Boiler/air-conditioning/heating/cooling tower

Domestic wastewater to sewer

Blowdown and condensate to sewer

Inputs   Outputs

Figure 7: Potential locations to install sub-meters on a manufacturing site

Water supply

Steam and evaporation – drying processes

Cooling tower

Cleaning chemicals, raw materials

Cold water

Hot water

Key

Main water meter

Sub-meter

Industrial/manufacturing processes

Water in products

Treatment chemicals

Water leaks into ground including fire-fighting water*

Water in liquid wastes, including sludge

Surface water discharges including via oil interceptors

Effluent treatment plant

Sludge storage

Treated effluent

Surface water

Discharges to sewer including fire-fighting water* and domestic sewage

Inputs   **Outputs**

*Potentially contaminated fire-fighting water should be collected separately.

3 Monitoring technologies

3.1 Types of meter

There is a variety of different water metering options, including permanent and temporary meters, mechanical meters and an increasing number of non-invasive metering techniques, such as ultrasonic meters. Table 5 summarises the most common meter types used in the UK. Before buying and installing any metering device or system, the following points should be taken into consideration:

- the level of accuracy required;
- the temperature, pressure, speed and level of contamination of the water;

Table 5: Common types of meter

Meter type	Comments
Velocity: ■ single jet; ■ multi-jet; and ■ turbine.	■ Usually provide a direct visual display of cumulative flow. ■ Available in different sizes – typically ranging from 15mm to 100mm diameter. ■ Often used on larger pipe diameters. ■ Suitable for higher flow rates. ■ Suitable for clean, low-viscosity fluids. ■ Ideal for sub-metering water supplies.
Reciprocating/rotary piston (positive displacement)	■ Often used in residential and small commercial applications. ■ Ideal for sub-metering water supplies.
Electromagnetic	■ Suitable for most water-based fluids, including those containing solids. ■ Insensitive to temperature and pressure changes. ■ Must be used in full flowing pipes. ■ Ideal for effluent flow measurement and for hygiene requirements, such as CIP equipment. ■ Technically, this is a velocity-type meter that uses electromagnetic properties to determine the water flow velocity, rather than the mechanical means used by jet and turbine meters.
Ultrasonic	■ Strap-on (or clamp-on) meters are non-invasive and can be useful for temporary flow measurement or surveys. ■ Clamp-on meters have no/low installation costs. ■ Some clamp-on meters are not appropriate for corroded pipework.
Compound meters	■ Used where high flow rates are necessary, but where, at times, there are also lower rates of flow that need to be accurately measured. ■ Compound meters comprise two meters and a check valve to regulate flow between them. At high flow rates, water is normally diverted to the turbine meter. When flow rates drop to where the turbine meter cannot measure accurately, a check valve closes to divert water to a smaller meter that can measure the lower flow rates accurately (typically a multi-jet or positive displacement meter).

- the condition and arrangement of pipework as the accuracy is affected by the proximity of valves, bends in the pipework and other items which affect flow; and
- the type of meter best suited for the application – for example, is hygiene important?

For water supply metering or sub-metering, positive displacement, or single or multi-jet (velocity) meters are most commonly used and are widely available. These types of meter are available in a range of sizes and are suitable for many different business needs, such as a hotel monitoring water use in the kitchen or a small food outlet tenant in a shopping centre. A qualified plumber should be able to advise on individual requirements.

The cost of meters and their installation varies according to the type of meter and monitoring system required. The costs of simple, manually read meters are relatively low. Automatic meter reading (AMR) systems tend to incur the most significant installation costs.

3.2 Automatic meter reading

Metering systems with AMR capabilities use hardware and software to collect the meter data for consumption and leakage alarm purposes. There are several benefits with AMR:

- data can be collected from difficult-to-reach meters;
- the human factor of remembering to read the meter is removed;

- data can be viewed in real-time or near real-time helping to identify leaks quickly;
- data can be collected more quickly, particularly if there are several sub-meters; and
- water consumption details are provided in more detail to enable greater scrutiny.

AMR can be beneficial for an organisation which has a large site with several buildings that are separately metered or a business that requires data analysis on a more frequent basis, such as a manufacturing facility that needs to compare the efficiency of several production lines.

AMR works by capturing the volume of water used during a specific timeframe, typically every hour (although options of capturing data in 15 and 30-minute intervals are available). The data are automatically transmitted to a central location or collected using a remote reading device. Once transferred to a software package, the data are analysed and graphs (see Figure 8) and reports may be generated automatically.

Some water companies offer business customers AMR with online access to view readings and consumption analysis. It may be possible to upgrade existing meters to provide AMR by installing a data logger and transmitter. Water companies will be able to provide advice about what options are available[4].

Figure 8: Hourly water consumption profile

Usage when the building is vacant. This could be a leak
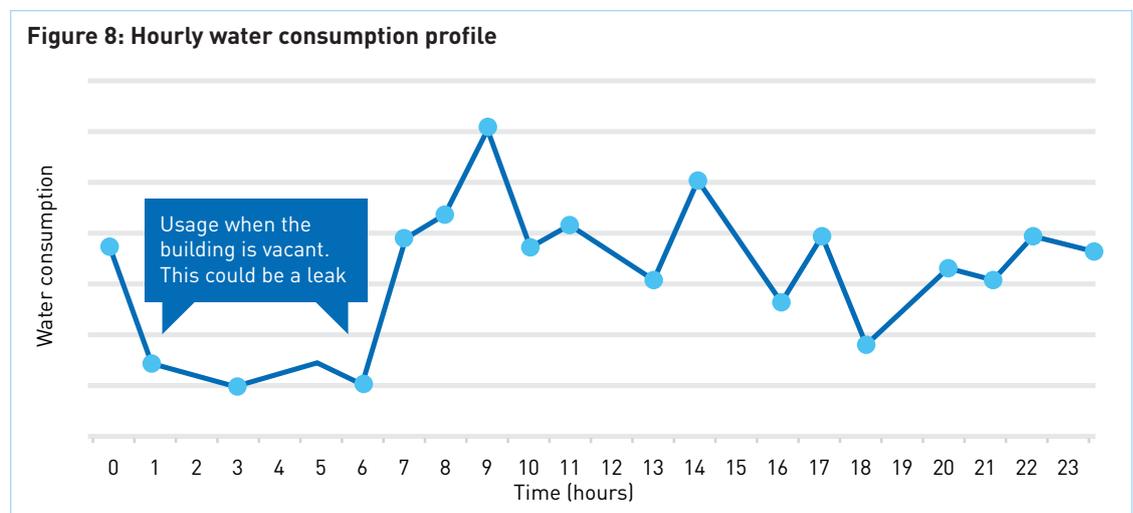
[4] www.ofwat.gov.uk/industryoverview/today/map

4 Further information

WRAP offers independent, practical and proven guidance through information resources, such as case studies, guides and an informative website (www.wrap.org.uk).

4.1 WRAP water efficiency support packages

- **The Rippleffect**
  The Rippleffect support package provides a wealth of free advice and support to help businesses save money by using water more efficiently. Please visit www.wrap.org.uk/rippleffect for more information.

- **The Federation House Commitment**
  Specifically aimed at food and drink manufacturers, the Federation House Commitment is a voluntary agreement that aims to help reduce overall water use across the UK food and drink industry by 20% by 2020 (compared to a 2007 baseline). Please visit www.fhc2020.co.uk for more information.

4.2 Water efficiency tools and guidance

WRAP's Business Resource Efficiency hub includes water efficiency tools and guidance. Please visit www.wrap.org.uk/brehub for more information.

4.2.1 Guides

Useful guides to help embed water minimisation in a business. www.wrap.org.uk/bre-guides

- Saving Money Through Resource Efficiency: Reducing Water Use
- Reducing Your Water Consumption
- Tracking Water Use to Cut Costs
- Water Minimisation in the Food and Drink Industry

4.2.2 Online resource efficiency tools

Useful tools to help embed resource efficiency in a business. www.wrap.org.uk/bre-tools

- Water Monitoring Tool
  This tool can be used to easily record and track where water is being used in an organisation.

- Mogden Formula Tool
  This tool calculates the charges water and sewerage companies apply for the conveyance and treatment of effluents discharged to the public wastewater network.

4.2.3 Case studies

WRAP resource efficiency and water efficiency case studies www.wrap.org.uk/bre-cs

4.3 Support available from water companies

Water companies may be able to provide support to business customers to help them monitor their water use, for example:

- data detailing consumption trends;
- access to online readings; and
- enable a data logger to be fitted to a water meter.

Water companies have details of the support they provide and contact details can be found on water bills.

The Water Act, introduced 14th May 2014, will open up competition in the water market and from 2017 businesses, charities and public sector customers in England will have the freedom to switch their water and sewerage supplier. This means businesses can seek out the most competitive deal, and offers an opportunity to consult suppliers on particular value-added services such as water efficiency advice.

4.4 Useful links

- Resource Efficient Scotland
  www.resourceefficientscotland.com
- Water Technology List
  http://www.hmrc.gov.uk/capital-allowances/fya/water.htm
- Energy Technology List
  http://etl.decc.gov.uk
- Waterwise
  www.waterwise.org.uk
- Environment Agency
  www.gov.uk/environment-agency
- Energy Saving Trust
  www.energysavingtrust.org.uk
- Carbon Trust
  www.carbontrust.co.uk
- Market Transformation Programme
  http://efficient-products.ghkint.eu

4.5 Policy guidance from the Department for Environment, Food and Rural Affairs (Defra)

- Water resource management (including water abstraction management and drought plans)
- Water efficiency
- Greening Government Commitments

WRAP (Waste & Resources Action Programme) works in England, Scotland, Wales and Northern Ireland to help businesses and individuals reap the benefits of reducing waste, develop sustainable products and use resources in an efficient way.

Since its creation, WRAP has funded projects that will, over their lifetimes, deliver over 120 million tonnes of waste diverted from landfill and over 20 million tonnes of CO_2 equivalent greenhouse gases saved. Visit www.wrap.org.uk for more information on all of WRAP's services.

What support can you get from WRAP?

UK businesses could save £23 billion per year and help create and protect jobs by improving the way they use resources.

WRAP provides a range of free resource efficiency support for organisations including:

- WRAP Resource Efficiency Helpline on 0808 100 2040;
- online tools and guidance;
- online training initiatives;
- tailored business support for recycling companies;
- case studies; and
- guides.

Visit www.wrap.org.uk to find out more.

We hope that you have found this guide helpful on your route to greater resource efficiency. Don't forget that WRAP is here to help you to improve resource efficiency. Visit the website at www.wrap.org.uk or contact the WRAP Resource Efficiency Helpline on 0808 100 2040.

www.wrap.org.uk/brehub

recycle