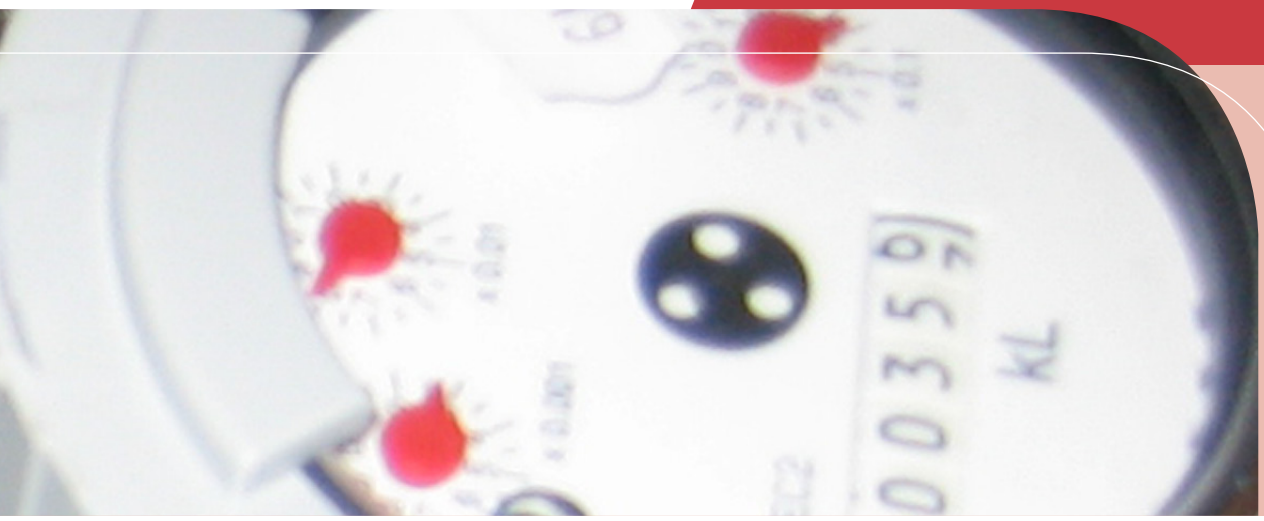


What are Smart Meters?
Fact Sheet

This fact sheet has been prepared by the Water Efficiency Specialist Network Committee. The intent of this fact sheet is to provide interested groups and individuals with information about aspects of water flow measurement and smart meters.

Background

The saying "if you can't measure it, you can't manage it" may suffer from overuse, but rarely is it an inaccurate observation. Australia, being the driest continent in the world, suffers from periodic drought conditions that make water availability a key national issue. Water utilities and industries around Australia have been under growing pressure to address water shortages caused by population growth, severe droughts, and uneven distribution of water resources caused by climatic changes.

Ever-increasing water demands coupled with dwindling water supplies have posed great challenges to water industries to seriously consider the efficient management of water resources. After decades of inadequate metering of water use, organisations have realised that accurate, adequate and reliable measurement and monitoring practices of water consumption are essential for management of sustainable water resources (Willies et al., 2010). This fact sheet provides information on current measurement methods adopted by utilities and technological improvement and innovation that occurs in this field.

Why do we need advanced metering?

The technical sophistication of meters for measuring water flows has increased markedly in recent decades. There are a number of metering options for liquids, including permanent and temporary meters, various mechanical meters, and an increasing array of non-invasive metering techniques such as the use of Doppler and ultrasound techniques (Butler, 2008). There is no conduit type (pipe or channel), no conduit material or diameter, and no moving liquid which cannot be measured.

A key issue for utilities and consumers is the frequency and temporal spread of water meter reads. Most utilities record water consumption data manually on a monthly, quarterly or half-yearly basis. While monthly data provides better data set for high levels of water usage, quarterly or half-yearly data collection provides a 'lumpy' dataset in which a whole year of water consumption is lumped into only two or four sets. This infrequent data collection is sufficient for billing purposes, but gives limited information on actual water use behaviour, leakage and seasonal variation.

The timely collection and analysis of water use data, and the timely relaying of these data to the water user, can result in significant changes in water use behaviour. The benefits include immediate leak detection and consequent remedial action that can save precious quantities of water. The data is also invaluable in designing water efficiency and reuse systems (Butler, 2007) and for the improvement of demand management policies and programs (Giurco et al., 2008).

Smart meters are one step closer to bring this dilemma into real-time monitoring of water use, with the added benefit of letting the users know where they use the water most in a dwelling, for example, shower or bath.

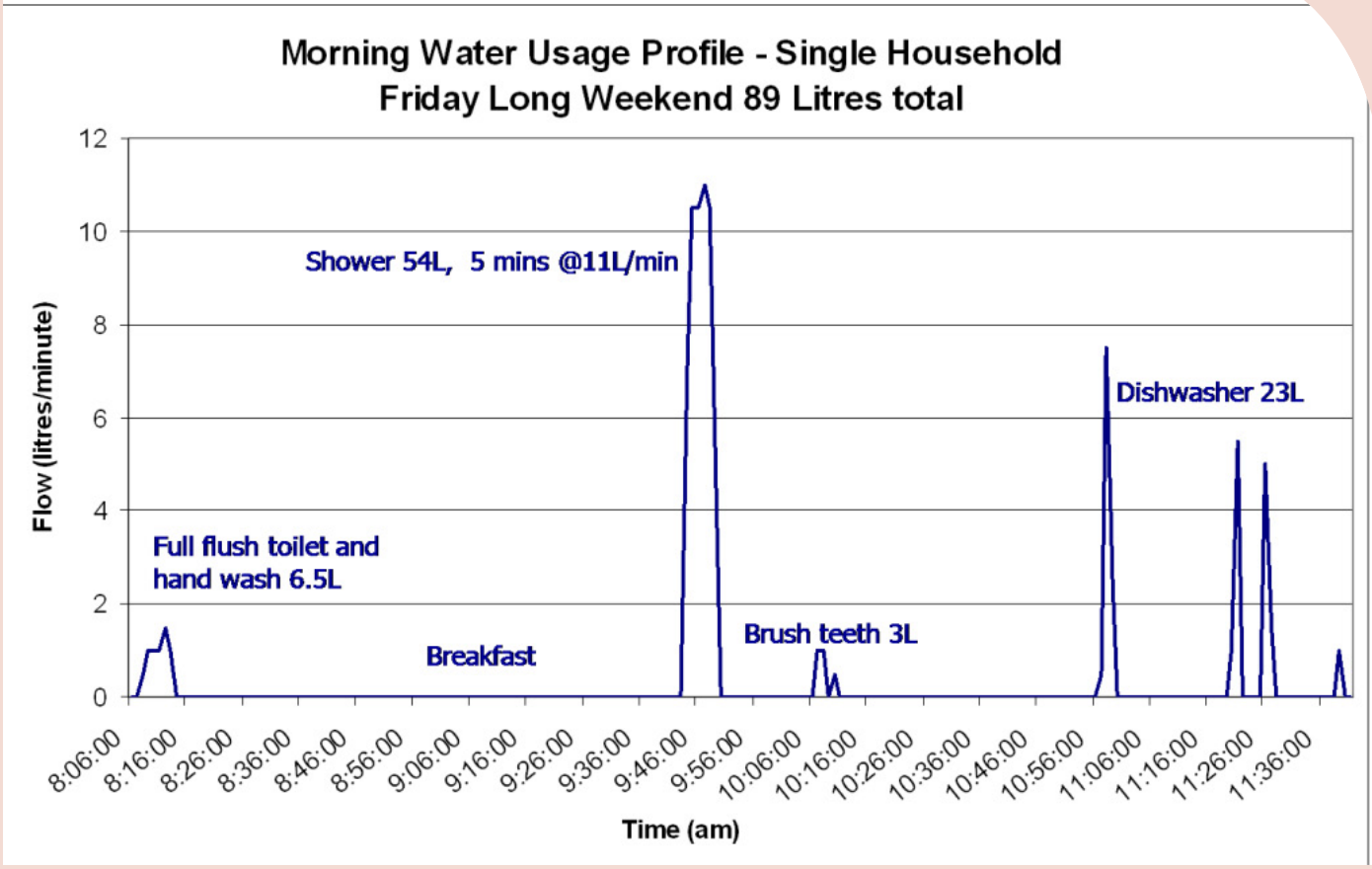


Figure 1: Itemised water use events based on intensity, duration and frequency.

What are the processes involved in smart metering technology?

A smart meter is a normal water meter connected to a data logger that allows for the continuous monitoring of water consumption. As opposed to conventional systems in which users get the information on water usage months after the events occurred, a smart metering system can provide real-time water consumption or sufficient data points to determine usage patterns (Butler, 2008). Smart metering is, therefore, the provision of near real-time information enabling customers to understand and monitor their water use and assisting the water utility to manage its network and provide better customer service (Doolan, 2011). When a water event occurs, such as a person taking a shower or using a washing machine, the event creates several pulses in a water meter that are logged by a data logger in a pre-determined frequency. These pulses can then be analysed manually or using special purpose software that can disaggregate the water events and assign them to various water uses according to a number of user-defined parameters such as flow rate, volume and time (Mead and Aravinthan, 2009).

For example, a shower would be defined as having a peak flow rate between 7L/min and 15L/ min and at least two minutes long but less than 20 minutes. Dishwashers and washing machines have distinct cycles that can be obtained from the manufacturer.

Figure 1 explains how some events such as toilet flushing, dishwasher, basin and shower use can be discerned from the data obtained from smart metering technology using discrete patterns of those specific events. To be more accurate, these need to be correlated with the user maintaining a diary of use for the first few days to determine exactly which data spike correlates with which fixture. Subsequently, the users will be able to get an understanding of itemised water consumption that happens in their dwelling in near real-time rather than waiting for the next water bill.

Advances in methods for data capture, transfer and analysis have improved the resolution of water volume data and made transfer and collection of data substantially more time efficient. Giurco et al. (2008) consider smart metering to have the following key elements: real-time monitoring, high-resolution interval metering (≥10 seconds), automated data transfer (e.g. drive by, GPRS, 3G) and access to data from the internet. Figure 2 explains the process of acquisition, capture, transfer and analysis of water flow data.

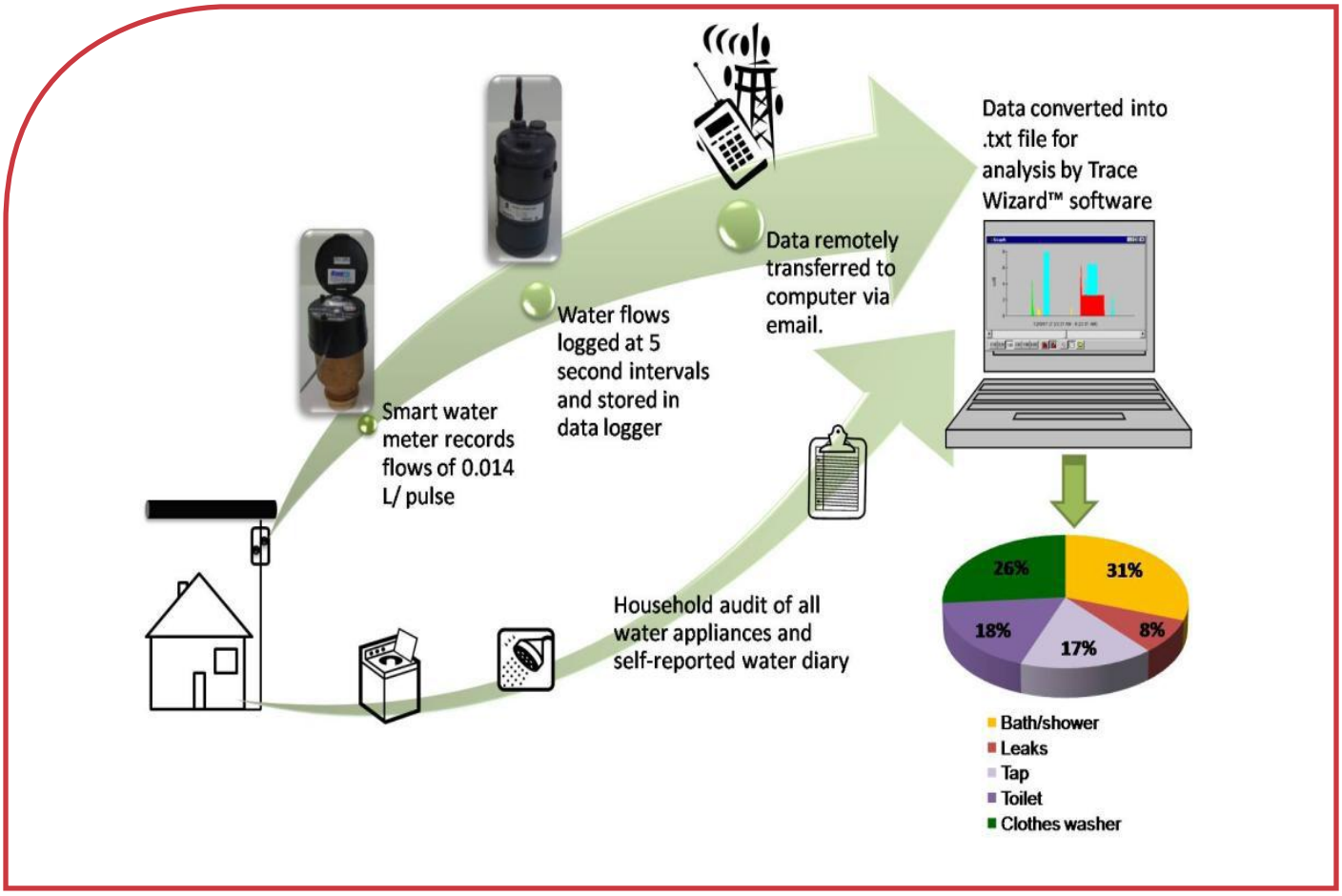


Figure 2: Schematic flow of process for acquisition, capture, transfer and analysis of water flow data (Beal et al., 2010).

Who uses smart meters in Australia and for what purpose?

Smart meters are used for quantifying end-use, assessing and evaluating the effectiveness of demand management programs and conservation initiatives, designing an end-use based pricing scheme, detecting leaks and monitoring the impact of pressure management, collecting information about a particular end-use and identifying daily and peak demand patterns.

Western Australia Water Corporation in Perth, Yarra Valley Water in Victoria, Toowoomba City Council and Gold Coast City Council conducted investigations on smart metering in their jurisdictions. Currently South-East Queensland (Urban Water Security Research Alliance) conducts end-use study incorporating the Sunshine Coast, Brisbane, Ipswich and the Gold Coast in Queensland.

oSydney Water and various consultants have been using smart metering technology since 1996 to conduct water efficiency audits for their business customers. They have also conducted research projects on residential use (Doolan, 2011) and houses with rainwater tanks (Sullivan, 2009).

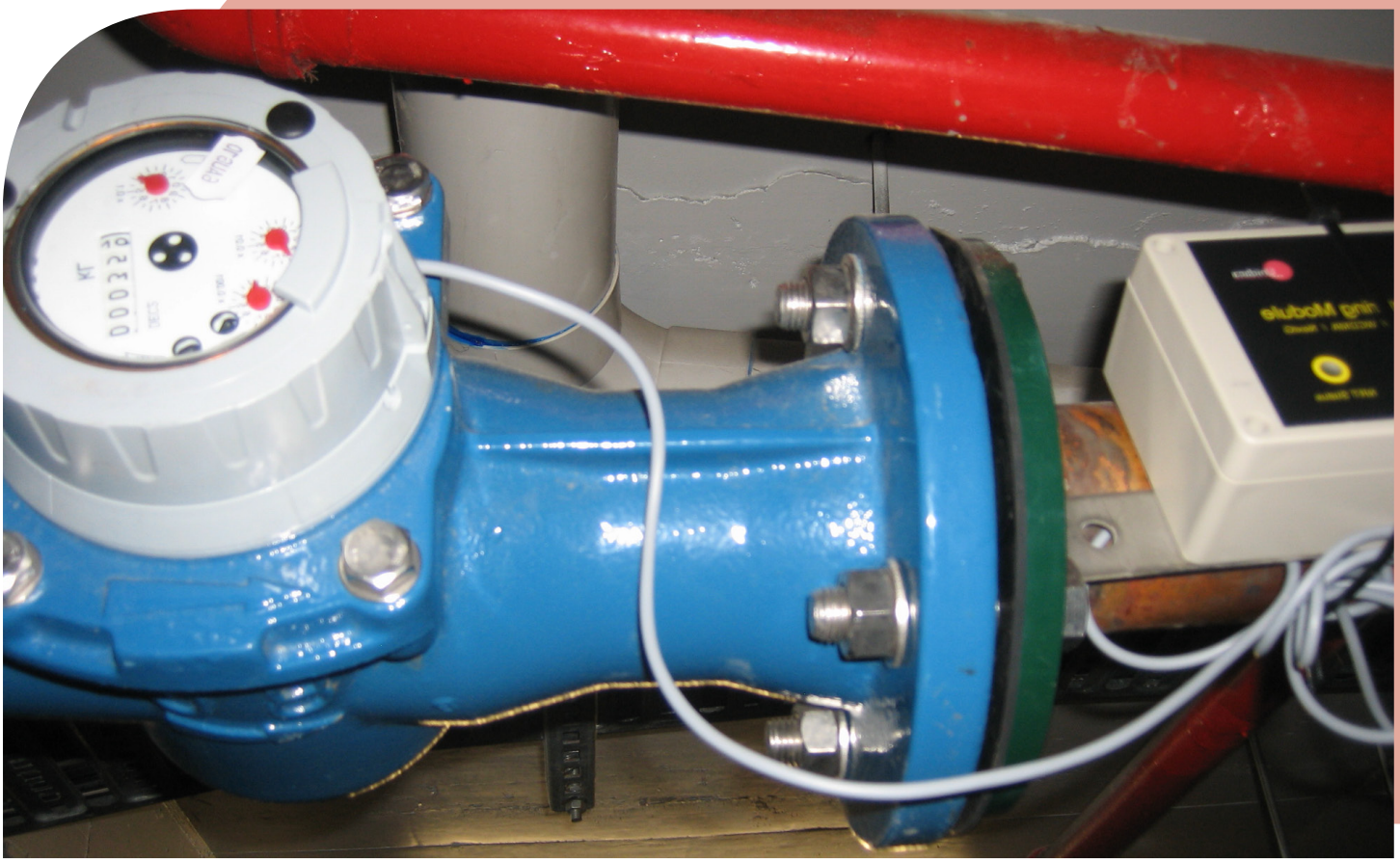
Wide Bay Water Corporation trialled the application of smart metering in Harvey Bay that aimed at providing customer consumption data for the first time at city-wide level, replacing 20,000 domestic water meters within their jurisdiction with a smart metering system. The system is designed to improve leak detection and enhance the understanding of customer water use patterns at the household scale. They hope that improved innovation in remote meter reading will enable 'time of use' billing (cited in Giurco et al., 2008).

The Smart Water Fund in Victoria funded a project in 2005 to install water meters on shower heads with a display for users to see their consumption. The trial resulted in an average 14.8% reduction in water use in showers with the meters fitted compared to those without.

What does the future hold?

While smart meters are employed for various research purposes at the moment, the innovation continues in data capture, transfer and analysis, which can pave the way for real-time monitoring of water use. Commercial and industrial users have adopted the technology as a facility management tool and are beginning to compare their data with billing records. Real-time monitoring extends the end-use approach to include rapid analysis, interpretation and presentation of data by end-use to provide immediate customer feedback and enable householders to alter their behaviours.

As data loggers can cost around $1,000 each, plus the ongoing data transfer costs and software fees, real-time monitoring has not been economically efficient in any significant scale to date when compared with manual meter reading. It is likely to be an area of future innovation and cost competitiveness as monitoring technology and data management systems advance.



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