The Benefits of Ultrasonic Smart Water Meters

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Historically, water meters have used mechanical flow measurement technologies such as single jet, multi-jet, rotary piston and Woltmann types. These technologies have been around for more than 100 years and are well accepted and well understood. These meters have mechanical dial displays which are typically manually read every three months and the water utility generates a quarterly bill from these readings.

Figure 1: Typical rotary piston mechanical water meter.

Any mechanical device which has moving parts can wear over time, and the accuracy of mechanical meters can deteriorate over the life of the meter. Also, the mechanical components can seize, making the meter inoperable. Key factors which contribute to increased wear and reduced accuracy include having an undersized meter that is running at the top end of its flow range, high levels of free chlorine in the water and higher water temperatures.

For these reasons, mechanical water meters must be regularly field tested to ensure that they fall within the required accuracy levels. Studies have shown that in some cases, mechanical meters have to be replaced within 10 - 12 years due to deterioration in accuracy. In extreme cases, mechanical meters are replaced after 7 years.

There are a number of problems associated with this process. Human error can result in incorrect readings being recorded. In some cases, the meter cannot be located, or it has become overgrown and inaccessible or it cannot be reached for other reasons such as dogs and snakes and a bill is generated based on estimated usage.

Over the past decade, the water industry has started to investigate the benefits of smart water metering. This has typically been done by physically attaching electronic data collection and transmission devices onto existing or new mechanical meters, essentially a hybrid technology that still has many of the physical limitations of mechanical meters. Alternatively, mechanical meters with built-in data loggers and transmitters have been used.

Smart water meters can be remotely read in a number of ways. The most basic is Automated Meter Reading (AMR) using a hand-held reading device. This improves the reading accuracy and reading speed but still requires someone to physically walk past all meters, and is still usually done quarterly. The hand-held device is connected to a computer at the water utility, the data is downloaded and a quarterly bill is generated.

The next step up is to use a reading device mounted in a car or truck which significantly increases the speed of reading but still requires vehicles to drive past all meters. This is still usually done quarterly, but the frequency can be weekly if the devices are mounted on garbage trucks. These devices can also transmit the data back to the water utility via 3G/4G/GSM networks.

The real benefits of smart water meters are achieved when the data from the meter is transmitted directly to the water utility via a fixed communications network in an Advanced Metering Infrastructure (AMI) system. This allows the data to be transmitted daily or even more frequently and dramatically increases the usefulness of the data.

There have been numerous trials of different types of hybrid smart water meters using different types of AMR and AMI systems over the last 10 years. In most cases, particularly with AMI systems, these early devices required proprietary communications networks and software solutions to transmit and process the data. This had significant cost implications for the scale-up of the technology. With many different combinations of water meters, data transmitters, data communication methods and with the technology evolving rapidly, many water utilities and councils have taken a cautious wait-and-see approach to the adoption of smart water metering.

We are now seeing the introduction of the next generation of ultrasonic smart water meters that bring a number of advantages over the hybrid approach.

The ultrasonic technology is static, meaning it has no moving parts. This means that it maintains its accuracy over the life of the meter, unlike mechanical meters. Improvements in ultrasonic technology and power usage means that battery life of the fully sealed meters is now 16 years.

These new meters also have fully integrated data collection and wireless communications modules, as well as inbuilt alarms for leaks, burst pipes and empty pipes, making the overall package very compact and cost effective.

Figure 2: Next generation smart ultrasonic water meter.

We are also seeing the development of more open and standardised communications networks such as Narrow Band IoT, LoRaWAN and SigFox which are low power, long range networks and these smart ultrasonic water meters are available in configurations that work with these open networks in an AMI system.
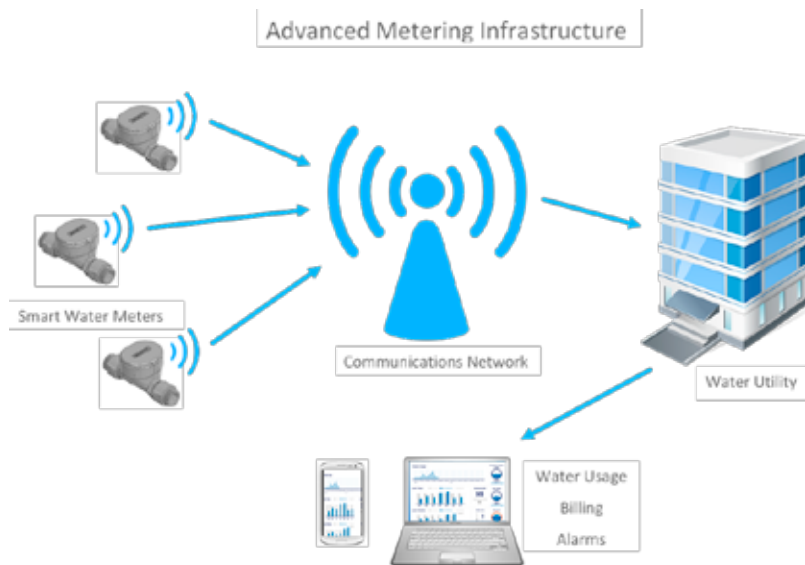

Figure 3: Advanced Metering Infrastructure system.

Smart water meters operating in an AMI system record and store water consumption data, usually on an hourly basis, and then regularly transmit this data once or twice a day through the communications network to a server at the water utility. The water utility uses this data to generate reports and visual displays of individual meter data as well as aggregated data that can be accessed by customers via internet or smart devices.

The water utility also uses this data to generate water bills.

In addition to the regular transmission of water consumption data, a smart water meter with inbuilt alarms will send an alarm at any time if it detects a water leak, burst water pipe, no water in the pipe or a problem with the meter. The water utility can immediately notify the customer of the problem.

Part of the reason for the slow adoption of smart water meters has been the difficulty in preparing a suitable business case and in quantifying the full benefits of smart water meters. Numerous studies have been conducted to identify the key benefits of adopting smart water meters with an AMI system.

The most obvious benefit is the elimination of the need for manual meter reading. This removes the direct personnel costs including WH&S costs, reduces reading errors and estimated bills and therefore reduces customer billing complaints and disputes.

Another key benefit is that studies have identified that a reduction in water consumption is achieved following smart water meter deployment. Firstly, through the identification of low-level water leaks which may have previously gone undetected and untreated. Secondly, customers have visibility of their water consumption in near real time and this has led to self-regulation of their usage. The ability to see and manage individual water consumption will become more important as there is a growing social desire to positively contribute to environmental issues and one of these is minimising water usage and wastage, particularly during drought.

The average reduction in overall water consumption following the implementation of smart water meters has been between 5% and 10%. This combined with the ability of the water utility to better understand water usage patterns allows for better network planning and and in some cases, allows for the deferral of new infrastructure investment.

The level of data supplied by smart water meters allows customers to better understand the impact of appliances and showering practices on their consumption of water. It also allows the water utility to better manage compliance to water restrictions during drought.

With the ability to immediately notify a customer of a water leak or burst pipe, the water utility is able to provide a high level of customer service and save their customers significant costs by being able to make repairs immediately rather than seeing a large quarterly water bill. As most water utilities also have a hidden leaks policy whereby refunds are given to customers where undetected leaks occur, there is also the potential reduction in liability to provide these refunds if the customer is immediately notified of the leak. Another associated benefit for customers is a potential reduction in insurance claims due to water damage.

Smart Water Meters offer the ability for a water utility to move to monthly billing, which improves cash flow for both the utility and the customer.

In strata properties, the level of data provided by smart water meters allows for far more efficient management of multiple water accounts and shared water usage.

In addition to all of the above benefits, ultrasonic smart water meters eliminate the problems associated with mechanical meters and provide stable accuracy over the life of the meter.

The introduction of the next generation of ultrasonic smart water meters and the rapid development of more standardised, open communications networks, combined with a better understanding of the full financial and social benefits of smart water meters will result in rapid change in the water industry over the next five years with the significant adoption of this exciting new technology.