

Your Water Meters Are Your Cash Registers

Water shortages has always been a major problem in South Africa, and one which will continue to provide challenges as the resource becomes scarce, especially with the impact of global warming. In addition, inefficient use and wastage of water directly contributes to the situation. For a water services institution this water loss usually translates into lost revenue. Indeed, it has been said that "Your water meters are your cash registers." It is imperative, therefore, to fully understand the significance of accurate meter reading as a leading factor in water demand management and revenue generation. Deleen Wilson reports.

A United Nations study suggests that South Africa will have between 25 and 50% less surface water available by 2080, while a study by the Department of Water Affairs and Forestry indicates we will have run out of fresh water by 2020, should we continue to use water the way we do. Despite government's intention of providing drinking water for all in the next ten years, unless we stop wasting it, this task will become much more difficult in the future.

Of all the water on the planet, 96.5% is saltwater in the oceans. The remaining 3.5% is freshwater, of which ice and snow is 70% and groundwater is 29.6%. The remaining 0.4% of freshwater is comprised of the world's lakes, rivers, dams (0.26%), biomass (0.1%) and atmospheric moisture (0.004%). These figures highlight the issue of water scarcity.

Water is a socio-economic resource and it provides municipalities with a constant revenue stream. However, between 25% and 50% of water supplied via

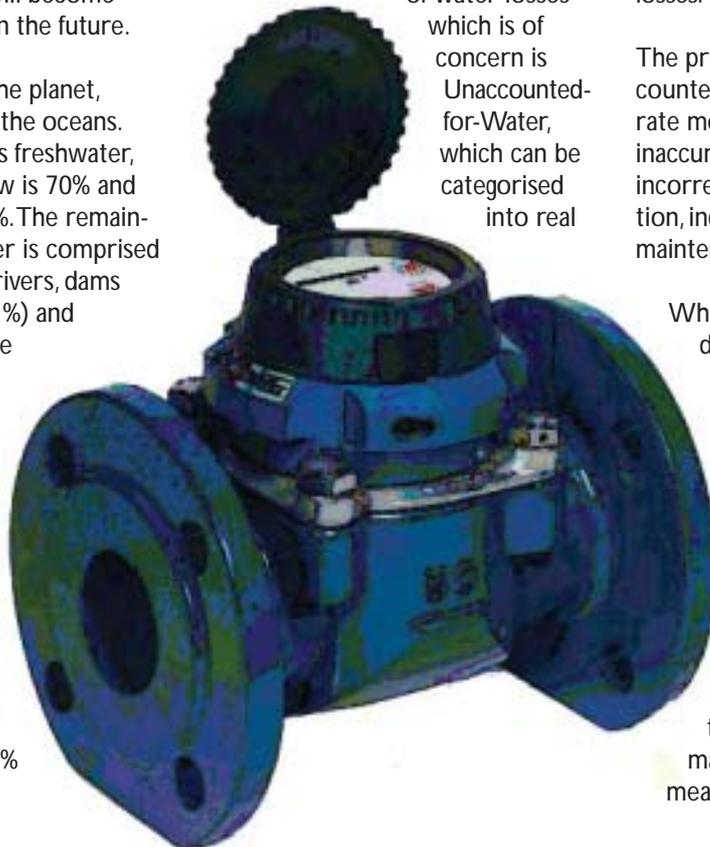
reticulation systems is not accounted or charged for, encouraging wastage and reducing the income it generates. Yet, with good management, these unacceptably high losses can be reduced by up to half, providing substantial improvements in income generated and encouraging water demand management.

In potable water distribution systems, the main component of water losses which is of concern is Unaccounted-for-Water, which can be categorised into real

and apparent losses. Real losses include leakage, pipe bursts, flushing, overflows, etc, while apparent losses are inaccurate measurements and the inaccurate reading of meters. It is not possible to effectively manage real losses until steps have been taken to manage the non-physical losses, as inaccurate measurements create a "garbage in - garbage out" scenario, and can result in incorrect actions being taken to curb the real losses.

The primary culprit of Unaccounted-for-Water is often inaccurate meters. The main reasons for inaccuracy are incorrect selection, incorrect sizing, incorrect installation, incorrect reading and lack of maintenance.

While Basil Bold, managing director of Invensys Metering Systems, South Africa - a division of the world's largest manufacturer of water meters, attributes the quote, "To measure is to know", to a Greek philosopher, he has unashamedly - and with only slightly tongue-in-cheek - adapted it to read, "To measure accurately is to know". Says Bold, "Good management begins with good measurement and no successful



Common installation problems causing waste and lost revenue



Insufficient straight pipe - perfect air trap



Dirt box too close to the meter



A very poor installation - bends in both the horizontal and vertical plane

business can operate effectively without good measurement. This is particularly true of water management, where accurate measurement of flows is fundamental to curbing waste and generating income.”

When addressing apparent losses, international water management companies adopt the 80/20 rule, whereby 20% of your customers (bulk water meters) generate 80% of the revenue. For example, 80% of Albertain's revenue is generated from only one consumer, and in Athens, 22 000 bulk meters (1.2%) generate 40% of the revenue.

INCORRECT METER SELECTION

Meter selection and management are generally neglected and given a low priority. This often leads to higher apparent losses. A key issue is not necessarily meter accuracy, but measuring range, or the turn-down ratio. A way of comparing the measuring range of bulk meters is to divide the minimum flow rate at which the meter will hold a given accuracy limit, into the flow rate at which the meter can be operated continuously at the stated accuracy. This is expressed as a ratio, e.g. 128:1, and is known as the turn-down ratio. The higher the ratio, the better the device.

Although accuracy must always be a key consideration, most reputable mechanical meters will exceed the generally accepted accuracy standard of ISO 4064 or OIML R49. The achievement of a $\pm 2\%$ error limit is not the issue: critically important is the flow range over which the device will maintain this accuracy. ISO 4064 performance standard for water meters is over 22 years old.

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Water meter design and materials of construction have progressed exponentially since the standard was drawn up, and modern meters are now capable of exceeding the minimum performance standard specified by 200% and more. It is not sufficient to simply state that the “meters must comply with ISO 4064”. Engineers need to compare the relative performance envelopes of different manufacturers, to ensure that they are getting good measuring value for their money.

The outward appearance of meters shows little evidence of change over the years, yet internally technology has advanced substantially, with the improvements to bulk mechanical meters typically providing the new generation with improved hydraulic geometry, a hydro-dynamically balanced rotors, and innovations such as multi-point calibration, which have substantially increased the range over which they can measure accurately. The larger manufacturers introduced bulk meters incorporating the latest technology some five years ago, during which time we have seen in excess of a 400% improvement in measuring performance, with turndown ratios typically increasing from 30:1 to 128:1.

FACTORS INFLUENCING METER SELECTION

A number of elements influence the selection of the correct meter for the job, including the measuring range, accuracy, durability, straight pipe requirements, price, upgrade path (AMR capability), cost/availability of a reliable power source (electronic meters), after-sales support, and the supplier's track record. The selection of suitable meters is not simply a matter of the cheapest price. Unfortunately, many water supply authorities sacrifice

quality and correct selection in favour of quantity, but the short-term financial savings are offset by the meter's lifespan of poor performance.

INCORRECTLY SIZED METERS

This is the major contributing factor towards apparent water loss. Mechanical meters are generally sized to match the pipe diameter, which is a fundamental error as it results in oversizing and an inability to measure low flows. Meter change-out programmes offer quick financial returns for the minimum amount of investment and effort.

AUTOMATIC METER READER

The latest development within the water meter industry is the much hailed and fastest moving technology related to bulk water meters, Automatic Meter Reading (AMR). The AMR removes the primary issues related to manual meter reading, including "hit & miss" reading cycles, incorrect readings, transcribing errors (e.g. x10, x100 errors), and the problem of manipulation and corruption.

The older generation of water meter registers were encapsulated in plastic and, therefore, not waterproof. The latest AMR registers are encapsulated within a glass/copper enclosure making it waterproof to IP 68 and, thus, finally allowing it to accommodate electronic intelligence. It is this - and not simply a remote reading via a pulse output - that has opened up the world of AMR.

"Your water meters are your cash registers, silently generating revenue day and night, if they are measuring accurately"

AMR meters can be read in a number of ways, including an inductive pad using a hand-held computer, "walk-about" or "drive-by" radio read or even by cell phone. AMR also brings with it a hardly noticeable change, but one of major significance - the fact that mechanical meters may now be flooded or buried without fear of malfunction, which makes them infinitely more resistant to vandalism. Flooded meter pits lead to recurring costly meter reading problems or, more

commonly, lack of meter reading problems. Advanced register design and AMR technology negates these problems, saves money and resolves the major problem of insufficient straight pipe up and downstream of the meter when installed in an inverted U configuration.

Mechanical bulk meters require unobstructed straight pipe upstream and downstream of the

meter to ensure accuracy.

The amount of straight pipe required is dependent on the meter type and design, with some meters requiring less than others. Generally, a minimum length of five pipe diameters upstream and three pipe diameters

downstream is required. The

WS meter is the only bulk Woltman meter that requires no straight pipe upstream or downstream of the meter as the flow profile is conditioned within the meter.

Bold concludes, "Your water meters are your cash registers, silently generating revenue day and night, if they are measuring accurately." Simply by fitting the correct meter, your cash registers could be ringing with even more vigour! 

CASE STUDY

SABESP São Paulo, Brazil - Pilot Project (1997)

Currently, the SABESP (São Paulo, Brazil) risk/reward contract is the largest contract in process anywhere in the world, the value of which exceeds \$20million dollars. SABESP supplies water to 22 million people in São Paulo state. They experienced a progressive deterioration in their bulk consumer billing meters, which were their primary revenue generators.

354 bulk consumer meters were selected for change-out, of which six were under-sized (larger meters were fitted), 248 (70%) were over-sized (these were inaccurate at low flows and smaller meters were fitted - oversized bulk water meters are a worldwide phenomenon.), and 100 were correctly sized, but not necessarily accurate (these meters were renewed and re-calibrated, or replaced totally).

Sophisticated optimal sizing and maintenance software was undertaken, which provided a number of options over the full range of performance, from theoretical to empirical. These options include purely theoretical meter sizing, based on flow rate design parameters for a zone, district, or end user; semi-theoretical, using information such as billing records; and empirical, making use of logged data. Associated software matches the expected flow profile at a given location to the meter providing the best overall accuracy, and performs a financial analysis to determine whether the selected meter will produce a positive return on investment.



São Paulo - SABESP supplies water to 22 million people in São Paulo state

PAYBACK

The average payback period was two months, although in 83 cases it was actually less than one month. Payback was calculated on the total capital outlay on each meter installed i.e.:

- Cost of the initial evaluation to determine the correct meter type and size - utilising meter sizing software and logging (where necessary)
- Cost of the replacement meter
- Cost of removal of the old meter and installation of the new meter.

The costs are weighed up against the expected increased revenue derived from better measuring accuracy and measuring range. A meter change-out programme begins with the analysis of the billing records and the meter data base, but cannot be successfully implemented without site inspections and prioritisation.

A second critical component of a successful opera-

tion is follow-up reading and logging. This ensures that the project stays on track and that the change-outs are being selected and sized correctly, in order to produce a maximum return.

PROJECT UPDATE AS OF JANUARY 2002

- Total estimated meter replacement 26 711
- Meters replaced to date 16 809
- Number of meters replaced undersized 720 (4%)
- Number of meters replaced oversized 14 278 (85%)
- Number of meters - no size change 1 811 (11%)

The results to date have confirmed the findings of the initial pilot study, 85% of all meters were oversized, resulting in substantial revenue losses at low flows. In excess of 100 meters are being changed out daily, and the additional revenue generated has exceeded all expectations.

SIZE/PAYBACK RELATIONSHIP

Greater focus should be placed on the large diameter meters in a reticulation system. Because of the high volumes metered, small measurement errors result in large volume errors and large potential financial losses.

Example

300 mm meter @ 1/2 Qn = 700 m³/h
 In one month will measure = 504 000 m³/month
 2% error = 10 080 m³/month
 @ +/-R2.50/m³ = R25 200/month
 Cost of replacement (say) = R15 000
 Payback period = 18 days