FOUR STEPS TO REDUCING NON-REVENUE WATER

By Mark Patience

Avoiding the high cost of lost water

Each year, an estimated 240,000 water main breaks occur in the U.S., according to the American Society of Civil Engineers. America's aging water infrastructure is in need of repair as precious water resources are lost. Aging, leaking pipe contributes greatly to the issue of non-revenue water (NRW), or water that is pumped and then lost or unaccounted for. Globally, on average 34% of pumped water ends up as NRW, according to the International Energy Agency.

The need to prevent NRW losses and protect precious water resources has become increasingly important. An advanced metering infrastructure (AMI) system can be a fundamental component of any NRW detection program.

STEP 1: DETECT LEAKS ACOUSTICALLY

First, acoustic leak detection is an important way that utilities can identify and account for non-revenue water. A dynamic combination of acoustic leak sensors, AMI technology and innovative data analysis software enables proactive leak mitigation. Using a communication module with an integrated acoustic leak sensor, water providers can collect and analyze vibration patterns from anywhere in the distribution system.

An acoustic leak detection system allows utilities to optimize their system performance with automatic daily surveying for distribution leaks. Utilities can lower pipeline repair costs by finding and repairing leaks before they become costly main breaks. This also reduces the risk of bacteria and viruses entering the water supply through burst pipe. By pumping and treating less water, utilities will prolong the life of their treatment and pumping facilities.

STEP 2: PERFORM DISTRICT METERING ANALYSIS

The second step to identifying NRW is district metering analysis. By grouping and aggregating data stored in an analytic software application, district metering can be performed via the following steps:

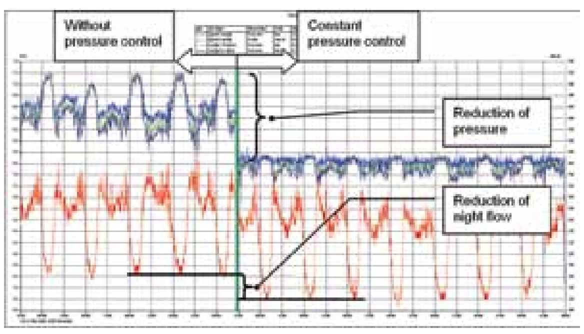
1. Identify the meter or meters that feed water into the district (i.e., the "master meter").
2. Identify the group of meters in the district and aggregate the total consumption of these meters on an interval-by-interval basis. Accrue the aggregated consumption of the district into a virtual meter.
3. Compare the net consumption of the master meter (the measured input to the district) with the metered consumption of the aggregated district (the measured consumption within the district) on a time-synchronized interval-by-interval basis, as shown in Figure 1. Any difference between the net consumption of the master meter and the aggregated consumption of the virtual meter is considered NRW, which can include leaks.

Once the district metering analysis has been conducted and the analytics application has ranked the various districts according to severity, utilities can prioritize where to look for leaks. Some software applications allow the results of the district metering analysis to be viewed graphically by comparing the graph of consumption from the district meter with the graph of the aggregated consumption of the virtual meter, as indicated in Figure 2.

Figure 1. Consumption of Master Meter Compared With Metered Consumption of Aggregated District

Figure 2. Comparison of District Meter & Virtual Meter

Figure 3. Reduction of Night Flow to Reduce Non-Revenue Water



STEP 3: MANAGE DISTRIBUTION SYSTEM PRESSURE

The third step for managing NRW is pressure management. A small reduction in pressure can mean a significant reduction in real losses through leaks. When activated during low-demand periods such as late at night or early in the morning, pressure management will not affect service levels and can reduce consumption in networks with no intermediate storage.

To effectively manage pressure, it is important to comprehensively evaluate a service area and gain an understanding of its background losses before introducing pressure control.

With a pressure management program, a utility's distribution system is broken down into pressure zones. Pressure is monitored at the inlet, average zone point and the critical zone point. The average zone point is a location that exhibits the average pressure rate for the zone. The critical zone point is a location where pressure is the lowest, usually the highest elevation in the zone.

The reduction of pressure greatly reduces the amount of night flow when the system is quiet. Figure 3 shows how night flow is reduced in conjunction with the reduction in pressure. The reduction of night flow reduces a utility's amount of NRW without even repairing a leak.

STEP 4: ANALYZE METER TAMPERS

With some AMI systems, a tamper flag is sent whenever the connection between the meter and meter interface unit is opened. More specifically, a communication module takes a consumption reading each hour, at the top of the hour, and places this reading into its memory. When this reading is taken, the module can detect if there is no connectivity to the meter register; and if this occurs, the communication module marks this account as having a potential tamper and includes a "tamper flag" with its next data transmission.

This data passes through the AMI collection engine and is accumulated in a data repository where tamper, leak and other data can be viewed in the user interface. The user has the ability to view the trended minimum consumption values over time (i.e., the "leak line") to see when the potential leak or tamper began, whether it is improving or getting worse, and the day that it ultimately was resolved.

When reported over time in this way, accounts with higher incidents of theft and related NRW may be spotted for further investigation.

By taking the preceding four steps, utilities can reduce NRW and thereby reduce the amount of water they have to pump and treat to meet current and future demand. This reduces the amount of energy required to pump the water, the amount of water lost and the amount of CO_2 produced. WWD

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