Non-Revenue Water - Supervision Boosts Efficiency

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LOSS MANAGEMENT

Budapest Waterworks provides 2 million citizens with healthy potable water each day. Potable water is a special consumable, its existence is a basic condition of our lives, yet it is a natural resource which our planet has always been in shortage of. For supplying on more than 5000 km long network, in various pressure zones, one of the key tasks is loss management.

Managing water loss in the water supply system of Budapest is a complex and determinative task for several departments of the company. The problem of losses deserves attention and appropriate actions to reduce avoidable stress on our valuable water resources.

The success of loss management depends on many different processes. It is essential to find the weakest link to increase the efficiency of non-revenue water reduction activities. There are two case studies below to show the importance of operation supervision.

PHYSICAL LOSSES – IWA

Real losses are water volumes lost within a given period due to leaks, failures and overflows of storage tanks. Real losses can be classified according to their location within the system, their size and their runtime.

The four components of loss-control can be seen in the picture (Figure 1). These are efficient tools, but which could be the most/less important for reducing physical losses? Is it possible to boost the efficiency of on-site activity by evaluating DMA consumption patterns, and the own-cost of water in each pressure zones? Above all, the control of physical losses is an operational, and technical responsibility. [1].

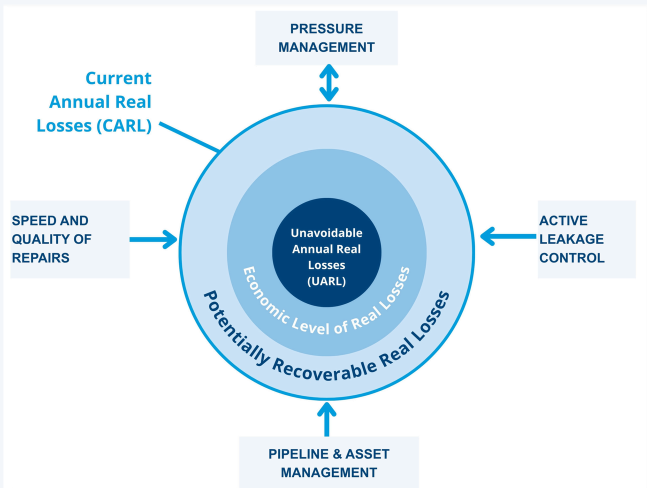

Figure 1 – Reducing tools of real water losses (source: IWA)

COMMERCIAL LOSSES – IWA

Commercial or apparent losses are about consumed water which is not registered as consumption. It is usually difficult to classify and to locate.

The four components of loss-control can also be seen in the picture (Figure 2.). These are the most efficient tools or aspects for reducing apparent losses, but there is less equipment or methodology available to manage them. While physical loss control is rather technological, apparent loss control is a kind of cultural challenge. Sometimes it is necessary to confront consumers or to change everyday habits for reaching goals in this field. On the other hand, reducing commercial losses can be more valuable, as it will increase the water revenue amount. [1].

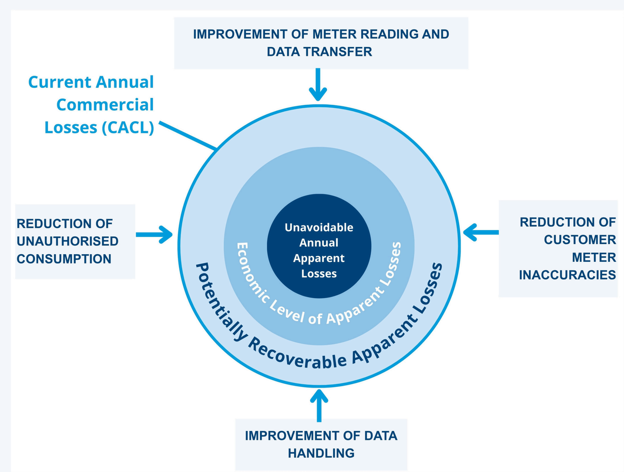

Figure 2 – Reducing tools of apparent water losses (source: IWA)

CASE 1: LEAKAGE LIFECYCLE

Hidden leakages could be detected by consumption monitoring, so it is essential for utilities to operate efficient supervision. There are several independent zones (or DMAs) represented by independent consumption patterns. The trend of these patterns is generally similar – as the average domestic consumption is the same.

The next graph (Figure 3.) shows the changes of daily potable water needs of a residential zone from 1st January 2025 till the end of April 2026. The case study is about the extraordinary increase in daily consumption. In 2025, winter demand was stable with weekly cycles (higher on weekends), then the summer demand was driven by garden watering – in line with rainfall and temperature data.

Monitoring the demand patterns is much easier in winter than during peak times, due to higher deviation. Therefore, it is difficult to identify the beginning of significantly increased demands. Additionally, demand increase seen from the standard progression of a hidden leakage is exponential until the pipe bursts. According to the experience of Budapest Waterworks, in off-peak periods a roughly 10% surplus should be considered significant.

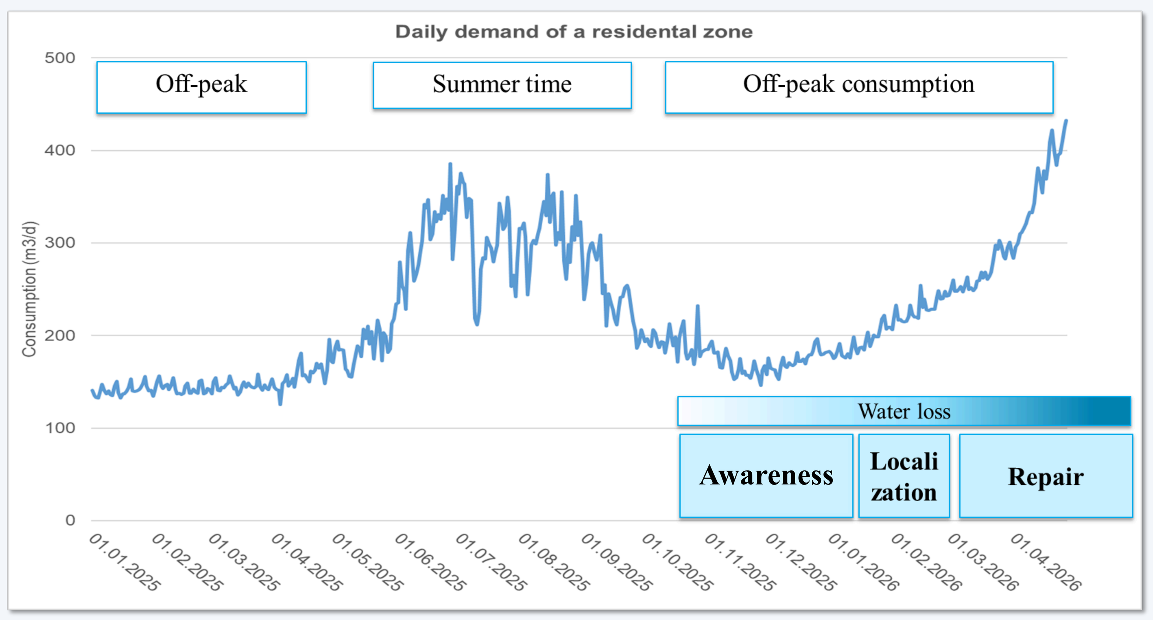

Figure 3 – Demand pattern of a residential, green zone with increasing water losses

There are **3 stages** of handling hidden leakages:

Awareness – The unintended water losses take place within the distribution system.

Localization – Identifying and narrowing down the exact location of a leakage event using ALC activities.

Repair – Lead time and the corrective actions.

Lessons learned

In this case, the awareness time interval (so when the leak occurred) coincided with the normal decrease of garden-watering season, so ALC work was carried out in February.

Currently the hidden leakage is identified and is waiting for repair. The urgency of repair activities is determined by their direct impact on the water supply. (Generally, such work can be completed faster!)

The amounts and costs of water loss are easy to calculate. These figures will prioritize the ALC Team's work and repair activities. Usually, several leaks need to be investigated in parallel.

Figure 1 shows the main tools for reducing real losses.

If possible, while keeping the sufficient water supply, pressure management could mitigate the effect of losses.

But the other 3 tools could also be evaluated using this case study – the main development potential right now is the speed of repair.

CASE 2: ACCURACY OF METERS

Consumer water metering is fundamentally about accurately measuring the amount of water used, enabling fair billing and reducing water losses. The accuracy of measuring depends on many different parameters, such as the construction, operating range and age of the meters. In Hungary, the majority of consumer water meters are mechanical, and the legal validity period of water meters is 8 years.

Therefore, the correct selection of meters is essential. Figure 4. shows the standard (Class 2) requirements and typical load of the domestic meters.

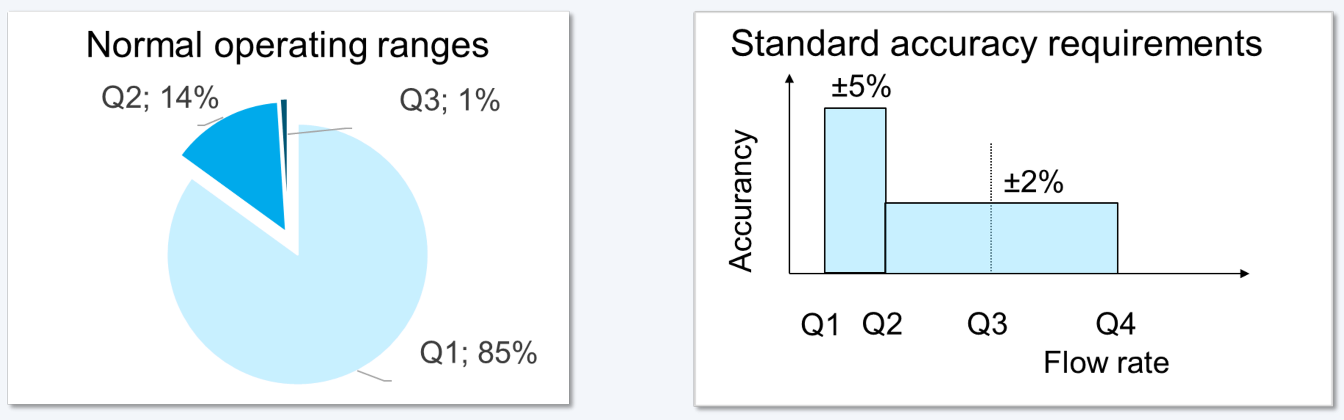

Figure 4 – Typical operation ranges compared with accurancy standards of residental water meters

Flow Rate Definitions:

Q1 – Minimum Flow Rate: the lowest flow rate that the meter must measure within the permissible error limits. Below Q1, accuracy is not guaranteed.

Q2 – Transitional Flow Rate: boundary between the lower and upper accuracy zones.

Q3 – Nominal Flow Rate: meter can operate continuously under normal conditions.

Q4 – Overload Flow Rate: the maximum short term flow rate that the meter must withstand without damage or loss of accuracy.

Lessons learned

Most of the demand is consumed under Q2 rate of meters, according to the experiences of Budapest Waterworks, while the sizing parameter is generally Q4.

Higher accuracy meters (Class 1.) are more expensive, which often causes use of cheaper ones. Higher consumption typically requires higher quality meters.

The replacement period can be up to 8 years. A significant part of the replaced domestic meters operate with lower accuracy at the end of their operating years. Mechanical water meters tend to under-register as they age.

Budapest Waterworks introduced 'Risk-based meter replacement strategy' to boost the efficiency of metering.

CONCLUSIONS

Non-Revenue Water is a complex KPI that shows the efficiency of several different processes covering the supply of potable water.

1. Let's find the focus – which activities need to be strengthened.
2. There are processes in water loss management (e.g. active leakage control) where the effectiveness of the process lies in its weakest link.
3. Supervision and centralized cooperation will increase the efficiency of activities.
4. The effort depends on appropriate field activities.
5. But the efficiency of field activities should be increased by assessments.
6. Loss management is a continuous, cyclical activity, not a series of independent campaigns.

References:

[1] Raimund Herz: Guideline for water loss reduction, IWA