May 2021

Briefing note

EurEau

Drinking Water Supply and Leakage Management

Effective asset management of water supply infrastructure and management of water losses from the distribution system are critical parts of the water suppliers' role.

An agreed EU framework for calculating a water balance is a critical first step in leakage management under the 2020 Drinking Water Directive. Leakage reduction is a tool for addressing water scarcity in many parts of Europe and reduces Greenhouse Gas emissions and resource use. The water sector is therefore committed to reducing these to enhance sustainability.

Summary

- Water scarcity is a concern for parts of Europe and is likely to become more pressing as the impacts of climate and demographic change alter the availability and demand for water.
- Drinking water service providers face competing pressures for limited water resources, from sectors such as agriculture, industry and recreation/leisure amenities. The water sector actively supports the sustainable use of our resources.
- EU Legislation (DWD recast) has given leakage a legislative footing, providing for its assessment and, in due course, will set a threshold value (TV) based on EU wide reported figures. Thereafter, the DWD will require action plans from Member States for effective leakage reduction. Therefore, the demand for new investment giving complete and reliable data on leakage calculation will become a legal obligation for large water operators.
- EurEau sees that effective asset management of water supply infrastructure and management of water losses from the distribution system are a critical part of the water suppliers' role.
- Leakage reduction is just one of a suite of tools available to address the issue of water scarcity.
- An agreed EU framework for calculating a water balance is a critical first step in leakage management.
- Leakage should be assessed according to standardised international frameworks and methodologies so that comparisons can be made. However, this is a complex task because countries use different plumbing systems.
- Any leakage reduction targets should be assessed locally and based on sound judgement taking full account of economic, social and environmental externalities.
- There is no 'one-size-fits-all' solution to address leakage as the local environment sets the boundaries for sustainable leakage levels and effective procedures. Thus, a positive trend or stable good performance of the water utility's level of leakage is a better reference value for the performance than the EU level target value.
- Leakage can be an important indicator for the quality of water distribution infrastructure. Addressing leakage will have benefits in terms of improving the infrastructure and maintaining security of supply.

Table of Contents

1. Background

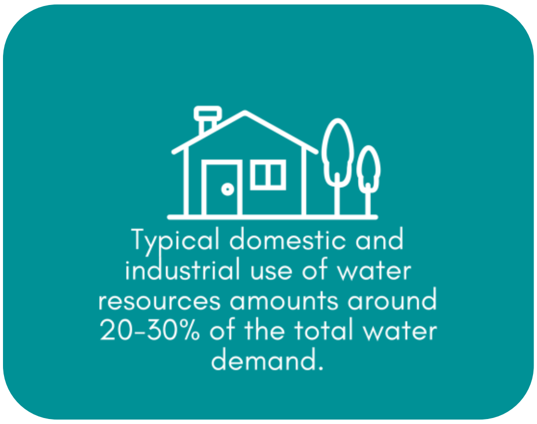
The growing interest in the major water resource imbalances throughout the world is well documented. Public awareness regarding water quantity has led customers and NGOs to call for changes to how society uses water.

The European Commission, in responding to public concern for effective and efficient use of water resources, has included the monitoring of leakage in the 2020 Drinking Water Directive recast. This approach was received very positively by the European Parliament and the Council.

Many of our members operate in areas of water stress and are significantly impacted by water scarcity. Members are making the necessary efforts to cope with variability in operating conditions while taking into account local economic, societal, and environmental factors and within their available tariff funding.

We strongly advocate a holistic 'two-track' approach, combining demand management and supply management measures in parallel. Since water resources are local and their availability varies to a great degree, any one-size-fits-all solution should be avoided.

Leakage reduction can help address the imbalance between water demand and water supply but is only one component within a suite of available policy tools to do so. We consider that leakage reduction is not a panacea and that full account should be taken of the local economic, social and environmental factors when incorporating leakage management within an efficient supply management plan.



We believe that the management of water losses from the distribution system is a critical part of the water suppliers' role. Water utilities acknowledge that the actual level of leakage can also be an indicator of the overall quality and integrity of the water supply system.

Typical domestic and industrial use of water resources amounts only to 20-30% of the total water demand, with the remaining 70-80% taken up by agriculture and other sectoral uses. We call for the extension of leakage estimation and reduction policies to be applied to all sectors involved, in order to preserve these valuable water resources and minimise energy use and carbon footprint.

2. Drinking Water Directive recast

The Drinking Water Directive recast[1], addresses the issue of water leakage, for the first time in European legislation. It identifies that "the general lack of awareness of water leakages, which are driven by underinvestment in maintenance and renewal of the water

[1] Drinking Water Directive recast (2020).

infrastructure" and views leakage as an indicator of efficient water management and as a tool "to avoid over exploitation of scarce resources".

It calls on Member States (MS) to assess the leakage level nationwide and at least for drinking water suppliers serving more than 50,000 inhabitants. It proposes EU wide data collection using an internationally established index such as "ILI [Infrastructure Leakage Index] or other suitable indices", from which an "average" will be calculated.

MS above the average will have to establish action plans to reduce losses. It is also interesting that leakage is viewed as a factor to be taken into account in the distribution risk assessment.

The DWD plans that:

~ MS shall carry out a leakage assessment (at least by large water suppliers catering for above 50,000 people in a given area)
~ MS shall communicate these results to the Commission by 12 January 2026
~ the Commission will set a leakage threshold value (TV) (based on assessment results) by 12 January 2028
~ if the MS leakage value is above the TV then a MS action plan is needed within two years of setting the TV (12 January 2030)
~ annual information on leakage will be provided to the public.

An EU reference document - 'Good Practices on Leakage Management WFD CIS WG PoM'[2] - which was produced in 2015 as a technical document, was developed through a collaborative programme involving the European Commission, all EU Member States, and other stakeholders and NGO's. The document is an informal consensus position on best practice agreed by all partners and is a valuable reference document on leakage.

3. Management of our drinking water assets

A EurEau survey has revealed that there are:

~ over 2,000 utilities/water companies who serve a population of greater than 50,000 people
~ more than 30,000 individual utilities/water companies serving a population of less than 50,000.

It will be challenging for MS to devise a reporting scheme, which includes only those utilities/water companies that serve a population above 50,000.

These water companies rely mainly on the revenue generated from water charges to sustain their service delivery and investment. In addition, grants and transfers can serve as a subsidiary revenue stream to ensure their financial health.

This revenue stream must deal with a range of competing priorities including service delivery, drinking water safety, regulatory compliance, quality compliance and meeting demands for existing and new customer services.

[2] Good Practices on Leakage Management WFD CIS WG PoM.

Repairing leaks is part of the 'day' job of every water utility, however when faced with these competing demands for financial resources, securing investment in network pipe replacement, creation of district metering infrastructure and optimised pressure management can fall to the bottom of any priority list. An exception to this would be where investment is essential to prevent supply interruption, especially in water-stressed regions and during prolonged dry spells. Therefore, it is inevitable that the temptation to let the network assets age further is ever-present.

Customers rely on the continuous delivery of sufficient quantity and quality of drinking water to their homes and businesses every day. However, in most MS the cost of the drinking water delivered to the customer is very low, being of the order of €1/1,000 litres (€0.001/litre). This is in marked contrast to the cost of bottled water (€1-2.30/litre).

Because the cost to the customer is low, the necessary investments in repairing or upgrading networks often fail to be made as the cost of making even modest upgrades often significantly exceeds the cost of the lost water.

As clearly identified during the Covid-19 pandemic, water is a critical service for public health protection and sanitation, and heightened focus on the long-term quality of the network assets is both welcome and essential.

4. Leakage reduction supports EU policy initiatives

The most obvious and overarching reasons for reducing leakage is the protection and good quantitative status of raw water bodies and climate change adaptation. The following provides further reasons to support efforts and investment for leakage reduction.

Leakage reduction supports strategic water security

The majority of EU countries depend on surface and groundwater to provide water for human consumption. Groundwater is the only source that is adequately protected against airborne pollution. This type of pollution does not constitute a typical threat to water quality, but it can be catastrophic and almost impossible to reverse if it occurs.

The reduction of leakage from water supply networks becomes an even more important measure to safeguard groundwater and optimise its abstraction while all social needs are being met.

Leakage reduction supports the Green Deal

Leakage reduction is a strong driver for both energy and carbon footprint reduction.

Where groundwater is used, the electric energy (not always available in 'green' form) for extracting it from deep aquifers is high. In the case of surface water used for the production of drinking water, the treatment processes at the plant requires the use of chemicals. Leakage reduction measures will result in the lower consumption of energy and chemicals, which would also clearly support the new Chemicals Strategy and the Green Deal.

Leakage reduction supports water distribution safety and security of water supply

Leakage results mainly from structural faults in the distribution network, cracks and holes in pipes, bad joints and faulty components in control equipment such as valves and pressure regulators, etc. Bad network conditions correlate with a higher number of acute drinking water distribution network repairs and water service cut-outs. Thus, good asset management is needed to guarantee and maintain the functioning condition of the drinking water distribution network. This assures a safe and secure water supply and minimises service cut-outs as well as promoting leakage reduction.

The operating pressure strongly influences the level of leakage. Active pressure management can be a tool for leakage reduction. However, there is a limit to how low network pressure can be set.

There are two different plumbing systems used in Europe. For low-pressure indirect plumbing systems, the minimum operating pressure is set at 15 metres head at the critical point in the network. For high pressure direct systems, the operating pressure is much higher (typically the usual pressure at house connection is in the range of 30–60 m head.

It is unrealistic to assume that a distribution network can be 100% free from structural faults and with zero leakage.

As long as a minimum pressure is maintained, water will leak out from the system, which protects it from potential hazards outside the pipes entering in the water flow and polluting it. A safety problem can arise if-and-when the pressure drops to zero or goes into a vacuum. Therefore, from the water safety point of view, it makes sense to reduce leakage by finding structural faults and repairing them. It must be noted that while pressure management does not solve the water safety problem, therefore, high network integrity must always be an optimisation target.

5. Determining leakage – the physical losses

A **water balance** aims to track and account for every component of water that is added to and exported from a water supply system within a defined period of time.

A water balance thus seeks to identify all components of consumption and losses in a standardised format.

A clearly defined water balance is the first step in assessing physical losses as part of non-revenue water and managing leakage in water distribution networks.

Leakage from the transmission and distribution mains may occur at pipes, joints and valves and may have very low to medium or high flow rates. Also, many small leaks are present within distribution mains. These aren’t easy to detect and not all, ultimately, lead to larger leaks which may eventually surface. Being small, they can remain undetected. Tiny leaks, particularly at joints, are undetectable if flow rates are very low and only costly network replacement can address these tiny leaks.

<table>
<tr><td rowspan="9">System Input Volume</td><td rowspan="4">Authorised Consumption</td><td rowspan="2">Billed Authorised Consumption</td><td>Billed Metered Consumption (including water exported)</td><td rowspan="3">Revenue Water</td></tr>
<tr><td>Billed Unmetered Consumption</td></tr>
<tr><td rowspan="2">Unbilled Authorised Consumption</td><td>Unbilled Metered Consumption</td></tr>
<tr><td>Unbilled Unmetered Consumption</td><td rowspan="6">Non-revenue Water (NRW)</td></tr>
<tr><td rowspan="5">Water Losses</td><td rowspan="2">Apparent* Losses</td><td>Unauthorised Consumption</td></tr>
<tr><td>Metering Inaccuracies</td></tr>
<tr><td rowspan="3">Real* Losses</td><td>Leakage on Transmission and/or Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility’s Storage Tanks</td></tr>
<tr><td>Leakage on Service Connections up to the measurement point</td></tr>
</table>

Figure 1: International frameworks for determining leakage exist as part of network water balance calculations

Leakage also occurs from service connections up to the point of the customer metre and also on the customer side. Service connections are sometimes referred to as the weak points of water supply networks because their joints and fittings exhibit high failure rates. Leaks on service connections are difficult to detect due to their comparatively low flow rates and thus often have long runtimes. Leakage as water loss from overflows from storage tanks is caused by deficient or damaged level controls. In addition, leakage may occur from masonry or concrete walls that are not watertight. Water losses from tanks are often underestimated and, though easy to detect, repair is usually elaborate and expensive.

Since the level of progress and involvement of water operators with leakage is not the same across EU countries, the most important step is the collection of reliable and complete data required to proceed with the necessary calculation of performance indices. To this end, the recent DWD recast provides the legal framework and drive for all.

The International Water Association (IWA) has developed a well-established and internationally accepted standardised format to estimate water losses.

The methodology is simple but requires the application of certain rules and procedures in order to produce reliable estimates. District Metering Areas (DMAs)/Zones, metering at input and consumption points with a well-determined structure is a key requirement in managing networks and prioritising leakage activities.

Leakage - the physical water loss from the network - together with commercial loss (apparent losses) are key components of the water balance. The sum of these two components in many cases is reported as Non-Revenue Water (NRW). A third constituent component of NRW is the Authorised Unbilled Consumption which normally constitutes a small part of this.

The assessment of losses in a network by carrying out water balance calculations, namely *water in minus water out* is termed as a **'top down' approach**.

> Leakage together with commercial loss are key components of the water balance. The sum of these two components in many cases is reported as Non-Revenue Water (NRW).

The assessment of leakage in a network by adding up the leakage assessed on the individual network components, such as DMAs (mostly making use of 24h real flow/pressure time measurement data), service reservoirs and trunk mains, which are based on actual field measurements is termed as **'bottom-up' approach**.

A bottom-up approach is more costly in terms of the infrastructure required (metres etc. and data transmission infrastructure measurement) and also the people needed to manage and verify a large volume of real time data.

The application of the different approaches produces estimates of different accuracy and reliability. Metering accuracy, pressure data and validity of assumptions made can strongly influence the validity of the estimates produced. Uncertainty analysis shows that relatively small errors in the computational model parameters can result in much higher errors relating to the final analysis outcome. Therefore, collected data has to be evaluated with caution and not without having reviewed the method and circumstances used for their derivation.

6. Leakage indicators

The reporting of the leakage estimate is based on a number of indicators. These indicators are calculated with different formulae using components of the water balance.

Based on the latest EurEau survey, our members use 16 different indicators. Three are universally used.

The most commonly used indicator is measurement by volume. This is either m^3 or m^3/km.

The second most commonly used is percentages. However this is open to significant inaccuracy.

The third indicator is the Infrastructure Leakage Index (ILI), however, this is only used by a very small number of large water providers due to its heavy data collection costs and its sensitivity to 'average' pressure in the network.

ILI is a detailed non-dimensional operational index (Current Annual Real Losses/Unavoidable Annual Real Losses) that assesses the overall efficiency of management of Real Losses (leakage) in a system at its current operating pressure. It is not widely used, despite the fact that some utilities across the EU, use it either to report or evaluate their performance in relation to international statistics. A summary of ILI is included in Appendix 1 of this report.

The DWD recast makes clear reference to this indicator, therefore, it deserves close consideration and evaluation together with other relevant indicators, such as litres/service connection/day/m pressure, if it, or any other extensively used indicator, will become a standard indicator(s) for reporting leakage.

All the indicators used have pros and cons, therefore due consideration must be given and explanations attached, particularly when addressing the public. Moreover, for those indicators used to report to the EU, the framework established for the water balance calculations as well as the uncertainty analysis must be attached.

One very important point to underline is that no one single indicator gives an absolute picture about the utilities of a single country, especially as an average or even as a weighted average. It is more important over time to observe the trend and record the rate of improvement rather than the absolute value of any single index.

7. Reporting

The majority of EU countries have schemes for collecting data related to leakage. In most cases, the data is collected by a national authority or agency such as a statistics agency. In fewer cases, this role is covered by the national association or a national utility.

In most cases, there is a national law or regulation requiring data collection. However, the level of response to this requirement or the level of data consistency and accuracy is not clear. Despite the fact that data must be communicated to central agencies or authorities, our questionnaire showed that there are only a few national schemes or norms established for the network water balance and leakage calculations and certainly there is no EU guideline on this.

Leakage reporting can be a political issue both at national as well as at international levels. In particular, high levels of non-revenue water creates discontent. Also, at an international level, reporting high leakage figures can damage a country's image with the international community as well as the Sustainable Development Goals score monitored by the UN. It is no surprise that the IMF and other international financial institutions have efficient water resource management high on their agenda.

The DWD recast will no doubt 'shake the scene' of leakage reporting for the first time. Although the Commission has not dealt with this subject in depth, they are expected to be more involved if poor local and national figures are reported.

A recent poll amongst EurEau members indicated that by far, most countries prefer to report losses in m^3 or as percentages to the supplied or abstracted water, with m^3/km (losses/network length) coming a close third. ILI is the least popular indicator, only used by some large water companies. From the same poll, it is evident that a national harmonised framework, rules for calculating the water balance and reporting the indicators is not always established. Even in the cases where a national framework exists, the compatibility between the different systems is not known. Significant differences may exist in the calculation timeframe, the level of data reliability required and the uncertainty evaluation.

Most of the utilities serving more than 50,000 people can produce and report data regarding water abstraction and consumption as well as data for network length and number of connections. For the group of smaller utilities, this capability is limited and probably not as reliable as a proper reporting would require. 'Small' utilities must not be underestimated; they supply approximately 50% of the EU population.

8. The financial perspective

Water services in countries are funded through a combination of tariffs, taxes and transfers (the 3 T's). In many countries, the cost of the drinking water delivered to the customer is very low, being of the order of €1/1,000 litres (€0.001/litre). This is in marked contrast to the cost of bottled water (€1-2.30/litre). Where a country's public policy requires that tariffs are maintained at an artificially low level, the essential investment in water services must be supported through taxes and transfers.

Over the last half century, the economic cycles of growth and recession (recession of the 1980's, growth in the 2000's and economic crash in 2008-16) have varyingly affected the ability of water services investment from the public purse and have affected countries to a different degree. Decisions on investment priorities, where public finances are constrained in recessions, have resulted in reduced capital investment in water networks with scarce monies being directed to social supports/health etc.

These essential short-term reductions in investment due to recessions where capital investment is funded directly from the public purse have a direct and cumulative effect on the current condition of water services networks (both drinking water and waste water) in each country.

Due to different plumbing systems in countries (high pressure direct/low pressure indirect) the short term reductions in taxes and transfers from recessions have contrasting impacts. Low-pressure indirect systems are more tolerant of short term reductions in investment but cumulatively over a long time, suffer higher impacts on leakage levels.

Countries have different service delivery models and levels of maturity.

The "mature" water companies use the asset investment model whereby investments in the water network (often borrowed using repayable loans paid back over a long time) increase the value of the regulated asset base which in turn is funded through the tariffs/taxes./transfer model. This is the optimum model for long term improvement of network condition leading to reduced leakage levels.

It also reduces the operational costs over time, through reduced numbers of bursts/outages. However, as set out above, we are where we are now in terms of the historical investment or lack of investment in different countries in water networks.

Previous economic downturns have affected different countries to varying degrees and implementing the leakage provisions in the new DWD means countries are starting from different current network leakage baselines. Smaller water companies may not have access to such a sophisticated financial model tariff structure, where the value of the asset base forms part of the tariff/taxes/transfer calculation. Because network replacement is disruptive to business, traffic movement etc. replacement/upgrading of networks must be viewed as a long term objective requiring decades of sustained capital investment.

Reducing water losses is a complex, long term and costly task which will never result in absolute zero leakage. Factors driving local water stress and scarcity including the resulting need to reduce leakage vary greatly both across Europe and within each country.

The control of losses has an overarching economic component and is intimately linked with the issue of funding and investment for maintenance and the replacement of water infrastructure. Leakage control is also inevitably subject to the law of diminishing returns and has to take full account of local economic, social and environmental conditions. From this point of view, any targets should be set at the local level, under the principle of subsidiarity.

Operating at lower levels of leakage results in lower operating costs for a water utility in terms of water production and distribution. Conversely, reducing leakage costs money.

There is an economic judgement to be made between the cost of water, the cost of water lost due to leakage, and the cost of measures employed to reduce leakage.

By considering the total annual operating costs at different levels of leakage, it is possible to estimate the point at which total operating cost is minimised. This point is referred to as the Economic Level of Leakage (ELL). **The ELL defines the value of leakage below which the costs of addressing leakage outweighs the costs of the water lost.**

Utilities should always first set their sights on components of non-revenue water where investments will generate the highest rate of return. Therefore, it is important to compare the components of non-revenue water not only by their volumes, but also by their financial impacts. Non-revenue water components have variable economic as well as social and environmental importance. Flushing for quality reasons or firefighting consumption is socially justified and accepted. Illegal water connections are not.

Derivations of the methodology exist, allowing water companies to take into account some of the environmental and societal impacts of addressing leakage – such as the costs of disruption to society from road works, effects on economic activities like tourism in water stressed areas or the carbon costs associated with treating or pumping of water. In these cases, a Sustainable Economic Level of Leakage (SELL) approach can be estimated. The SELL can result in different acceptable leakage levels than the ELL to reflect more accurately the actual costs of leakage.

It is interesting to note that a limited number of case studies[3, 4] have concluded that when the price of water production is low and the level of leakage is relatively low, there is limited financial scope for improvement measures and renovation investments to be planned for leakage reduction. It is also important to note that the cost as well as the technical effort for leakage reduction is related to the level of leakage in a nonlinear way. The lower the absolute level of leakage, the harder it is to bring about considerable improvements. Therefore, an EU average leakage index is not necessarily a safe approach for setting up National Action Plans for Leakage Reduction. A case by case analysis combined with an appropriate set of guidelines is a more reasonable strategy to be adopted at both national and EU levels.

9. Water losses and leakage reduction practices in Europe

Water losses vary greatly across Europe and the EU, with average losses in the supply chain ranging from less than 5% to over 50% of water abstracted[5]. A set of recognised factors explain these results, such as the age and maintenance of the system, the total length of mains, the number of connections, different national plumbing systems and local topography and thus hydraulic/pressure characteristics, the soil and climatic conditions, the water price at the point of abstraction and consumption, the active leakage control strategies and also the manner in which water is valued by society.

A recent survey conducted by EurEau has shown that the practice mostly used for leakage reduction is the 'Find & fix based on customer complaints' approach.

Other strategies such as active programs for leakage detection and repair, the development of District Metering Areas (DMAs) as a way to more accurately measure and manage leakage, optimised pressure management in the DMAs and customer leakage identified and free repair schemes are used by many water utilities across Europe.

In case that the distribution network is very old, badly designed and inadequate in terms of flow supply, extensive parts of the network are totally renovated. The latter is probably the most costly method and is not frequently followed due to the limits on available finance.

Substantial leakage reduction programs are now well established in a number of Member

---

[3] Cost–Benefit Analysis of Leakage Reduction Methods in Water Supply Networks - Suvi Ahopelto and Riku Vahala, Department of Built Environment, Aalto University, P.O. Box 15200, 00076 Aalto, Finland, Water 2020, 12(1), 195.
[4] Economic Analysis of Pressure Control for Leakage and Pipe Burst Reduction, Enrico Creaco, Assistant Professor, Dipartimento di Ingegneria Civile e Architettura, Univ. of Pavia, Via Ferrata 3, 27100 Pavia, Italy, and Thomas Walski, F.ASCE Bentley Fellow, Bentley Systems, Incorporated, 3 Brian's Place, Nanticoke, PA 18634 (corresponding author).
[5] Third Follow up Report to the Communication on water scarcity and droughts in the European Union COM (2007) 414 final.

States and are already delivering benefits. These programs are expensive. They require a task force of specialised external contractors as well as commitment and cooperation from key staff in the water utility.

10. Targets vs trends

The DWD clearly aims at establishing an EU leakage average based on national reported averages. However, most field experts agree that averages have limited value and importance since they can either hide extremes or present an unrealistic picture of the actual situation both at national as well as EU levels.

Realistic policies that aim to reduce water losses, improve resource protection and minimise energy and materials consumption must look closely at the local level and treat every case within the framework of natural, social and economic conditions.

Most EurEau members agree that non-deterioration and a clearly improving trend are far more important than achieving a specific target.

Despite the fact that a 'target' is always useful to have as a reference or focal point, the attainment of the target must not discourage or penalise those that are not achieving it while progress is made. Moreover, it is well established that for the utilities that are close to the target, marked progress is both difficult and expensive. For those close to the target, non-deterioration is probably equally difficult and expensive. It is worth noting that the 'improvement approach' is also embedded in the Taxonomy Regulation as a criterion for environmental achievement.

It has to be realised that leakage reduction is an investment and labour intensive process. Different utilities have different capabilities and constraints. A positive trend is a clear indication that the issue is being followed, and effort and capital is spent towards minimising water losses. Therefore the relevant EU funding instruments can make realistic and sound choices where and how to boost performance.

11. Water losses vs Non-Revenue Water

In polling EurEau members, it became evident that some members prefer to reference the Non-Revenue Water (NRW) rather than water losses in reporting leakage.

The main water balance factors makes it clear that the real difference between these two parameters is the 'Unbilled Authorised Consumption'.

Clearly NRW represents income loss and thus it is a management burden. Utilities deliver high quality services to customers based on fair and adequate pricing, as well as investment to the infrastructure longevity.

On the other hand the 'Unbilled Authorised Consumption' can be considered the as 'social' dimension of water supply. In a number of cases, unbilled or reduced price authorised consumption is provided to firefighting, public buildings, welfare institutions or marginalised groups of people.

It must also be underlined that 'unbilled' does not mean 'free'. The unbilled water has a cost and this has to be funded somehow. In some cases, this is borne by the state, in some by the municipality and in others, by all the billed customers. Taking that the consumption is authorised, the above is a social issue to be resolved by the utility management and society as a whole and is not an environmental, resource protection and energy minimisation issue.

12. Taking account of externalities

In the move towards sustainable development and to accommodate local water scarcity situations, EurEau acknowledges that externalities must be taken into account to help determine leakage reduction targets.

Leakage investment strategies only make sense in the long run and will affect customer bills, in addition to resource and water quality protection. Understanding the true price and value of water - as well as the full benefits of leakage reduction - will be essential to aid the decision making process.

There are other legal incentives or obligations besides the requirements of the DWD for water providers to take account of external costs and benefits such as pipe manufacturing and transportation, traffic disruption, low pressure, supply interruption, noise etc. Examples of externalities include:

- avoiding problems with the infrastructure in towns and rural areas. Leakage can cause undermining of roads, railways, houses and other buildings. Proactive or preventative activity will avoid damage to the infrastructure
- reducing the costs of embedded carbon in materials used plus chemicals and energy needed for the treatment and pumping of water
- conservation of biodiversity or recreational water quality and other environmental services.

There is much EU legislation and major policy initiatives to be taken into account. Naturally the WFD has a prominent role. However, the Green Deal, Zero Pollution and the New Circular Economy Action Plan are new major pillars of EU environmental strategy that will impact on the strategy for leakage reduction and leakage target setting strategy. Depending on the varying local circumstances these strategies may be complimentary or conflicting to leakage reduction.

13. Conclusion

EurEau members are committed to undertaking their fair share of the leakage adaptation measures and to demonstrate the continuous improvement of water supply integrity to meet customer demands.

The implementation of the DWD has been the absolute base for protecting water quality and ensuring safe water for all EU citizens. We understand that water supply planning is a long term action and must not result in an imbalance between supply and demand, nor in unaffordable water prices. In this context, leakage reduction is one of a suite of policy tools available.

The current state of affairs regarding leakage is not harmonised in terms of field practices, calculation, technical background and procedures, data reliability and targets. The same is true even for individual countries in some cases. Therefore, the conditions are not right for establishing a single indicator to calculate an EU average and then establishing action programs for those countries above this average.

EurEau believes that a harmonisation process must be established in order to achieve a basic level of leakage estimation, technical background, competence and proficiency. This will take time and certainly will require investment. Considering that the Commission is open to having a productive dialogue on this matter, we call on them to set up a Task Force which will develop a harmonised framework and draw on the experience of the European water associations under the EurEau umbrella.

We recommend that Member States set targets based on local sustainability goals including investment needs, economics etc. This experience should be used as the starting point for setting targets at EU level. In that way, we are laying the foundations for a robust framework providing experience and data to support the EU decision.

Appendix 1

Infrastructure Leakage Index (ILI)

The text of the DWD regarding the issue of leakage references the indicator ILI (Infrastructure Leakage Index), developed by the IWA as an index allowing the comparison of the level of leakage at an international scale. Despite the fact that the DWD text does not exclude an alternative (stated in Article 4 "or other appropriate method") it is well known that such a "method", agreed and accepted by utilities all over Europe, does not exist.

As stated above, ILI is the least popular index between EurEau members for a number of reasons. The main reasons are springing from the definition of the Unavoidable Annual Real Losses (UARL), a factor that is a denominator in the ILI calculation formula and therefore is an inherently non-linear factor (ILI = Current Annual Real Losses (CARL)/Unavoidable Annual Real Losses (UARL).

UARL is calculated by a formula based on the following parameters:

- Lm = mains length (km)
- Nc = number of service connections (main to property line)
- Lp = total length of underground pipes, property line to meter = Nc x lp/1000 (km)
- P = average pressure (metres).

There are three 'fixed' length parameters (fixed in the sense that they do not vary according to operating conditions) and one 'floating' parameter (floating in the sense that it varies daily, seasonally and by cultural events and habits).

The length parameters are certainly an obstacle because not all utilities have accurate and reliable data to present. This is mostly the case for the smaller utilities, serving less than 50,000 people. However, one can argue that given the incentive and the resources even small utilities can apply Geographic Information Systems (GIS) and in due time (not really soon) this information can become readily available across Europe.

The pressure parameter is probably the most difficult to deal with. The variability issue is evident and easily understood. However, there are also issues that create important arguments relating to 'principles'. Operating at higher pressure tends to increase the UALR and thus to lower the ILI value. Therefore, systems that operate at lower pressure are 'penalised' unduly. Moreover, pressure reduction is a widely applied strategy to reduce the actual losses and thus this strategy, in ILI calculation terms, can counter balance achievements made in the field. Many argue that lowering the pressure and thus reducing real leakage is kind of *sweeping the dirt under the carpet* meaning hiding the poor condition of the network and not investing enough to upgrade and maintain it. The argument is not totally unfounded but one has to look closely to the main objective of lowering the leakage.

The recent European Legislative Objectives, embedded in the Green Deal, concentrates in a single main them – Protection of the Environment.

Protection of the Environment

The Taxonomy Regulation is pointing to the same direction. Therefore, the main objectives of leakage reduction relates mostly with the "protection of the resource-water" and the "energy minimisation" in providing water supply

World Bank Institute Banding System Table

Technical Performance Category		ILI	Liters/connection/day (when the system is pressurized) at an average pressure of:				
			10 m	20 m	30 m	40 m	50 m
Developed Country Situation	A	1 - 2		< 50	< 75	< 100	< 125
	B	2 - 4		50-100	75-150	100-200	125-250
	C	4 - 8		100-200	150-300	200-400	250-500
	D	> 8		> 200	> 300	> 400	> 500
Developing Country Situation	A	1 - 4	< 50	< 100	< 150	< 200	< 250
	B	4 - 8	50-100	100-200	150-300	200-400	250-500
	C	8 - 16	100-200	200-400	300-600	400-800	500-1000
	D	> 16	> 200	> 400	> 600	> 800	> 1000

A	Further loss reduction may be uneconomic unless there are shortages; careful analysis needed to identify cost effective improvement
B	Potential for marked improvements; consider pressure management; better active leakage control practices, and better network maintenance
C	Poor leakage record; tolerable only if water is plentiful and cheap; even then, analyze level and nature of leakage and intensify leakage reduction efforts
D	Horrendously inefficient use of resources; leakage reduction programs imperative and high priority

About EurEau

EurEau is the voice of Europe's water sector. We represent drinking water and waste water operators from 29 countries in Europe, from both the private and the public sectors.

Our members are 34 national associations of water services. At EurEau, we bring national water professionals together to agree European water sector positions regarding the management of water quality, resource efficiency and access to water for Europe's citizens and businesses. The EurEau secretariat is based in Brussels.

With a direct employment of around 476,000 people, the European water sector makes a significant contribution to the European economy.

EurEau