
The digital water utility

White paper on the potential of smart metering



The digital water utility does not belong to a theoretical future. It is here today, bringing a large number of benefits along with it.

The digital water utility arises from recent and ongoing technological advances, which are radically changing utilities' capabilities, providing an overview of the entire distribution network, all the way to the consumer.

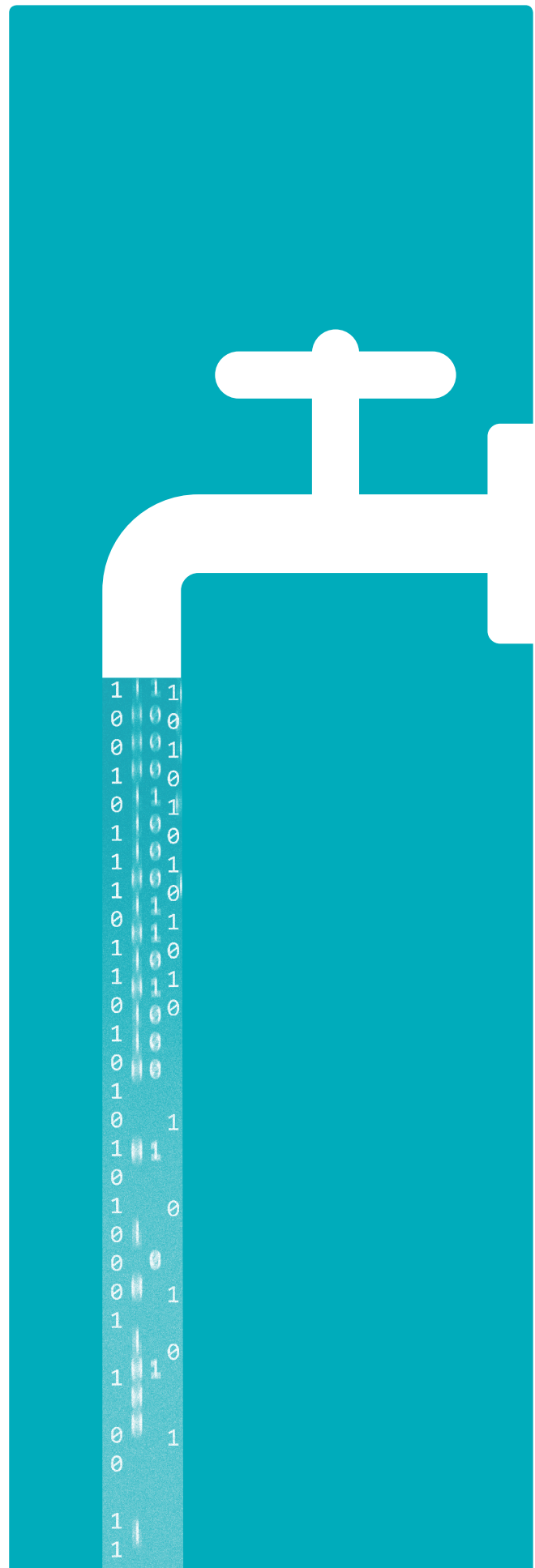
It is not just a question of greater precision and consumption metering. Smart water metering also holds the potential for improving relations with your customers, for optimising operations, for quality management, revenue protection, asset management and much more. It is about making the right choices and the right investments.

In other words, smart water metering and the digital water utility provide total transparency in the distribution network and thus concrete benefits within six overall areas:

- Operations
- Quality management
- Revenue
- Customer relations
- Administration
- Asset management

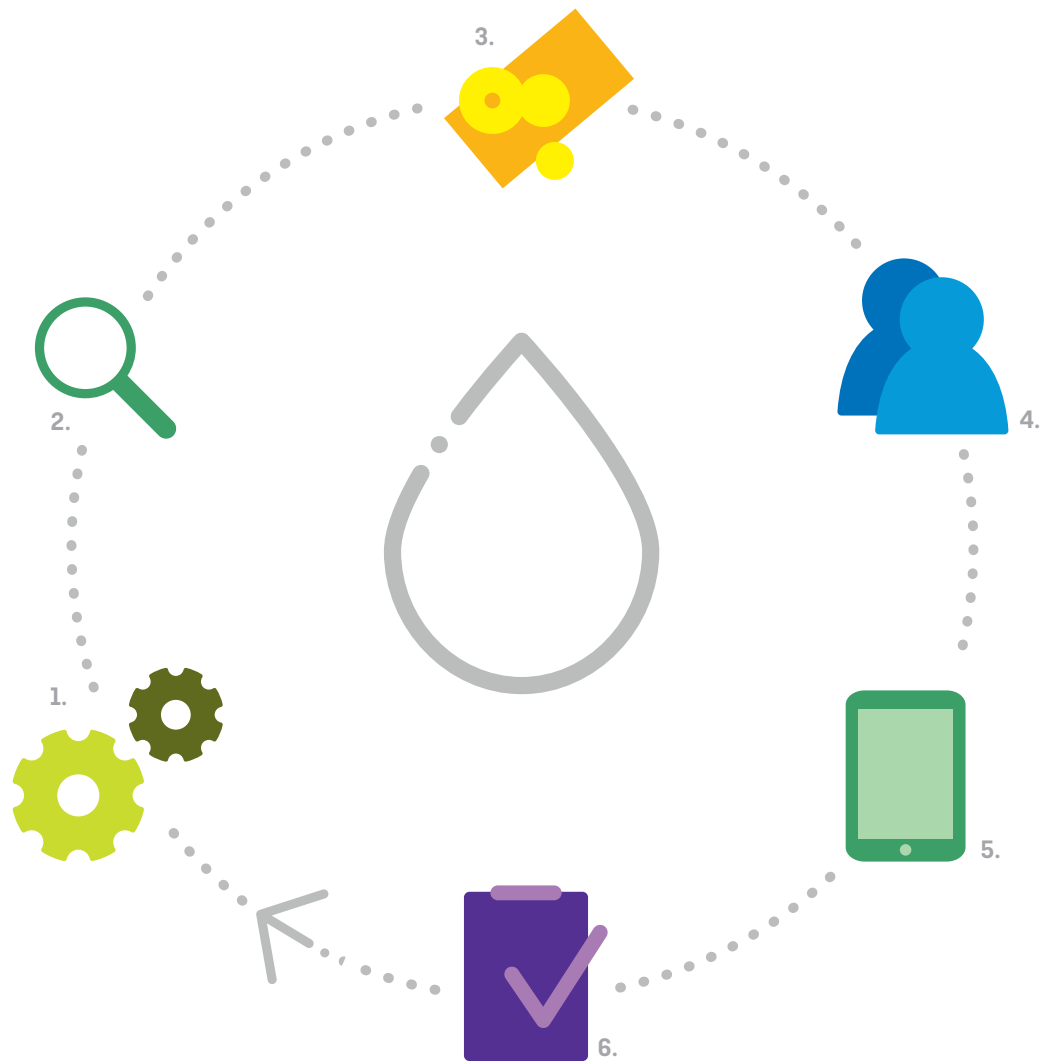
This white paper is intended to provide inspiration, and we will review each area, exploring the benefits and possibilities within the water utility industry.

Imagine if ...



Smart metering provides benefits within many areas

1. Operations
2. Quality management
3. Revenue
4. Customer relations
5. Administration
6. Asset management



Imagine total transparency in the distribution network ... what benefits would you gain in the fight against water loss?

The digital water utility knows the exact consumption of every single user, and the precise volume supplied to the different supply areas and sections. Regardless of whether they are supplied from one or several supply points.



Working with water balances will change significantly. Instead of calculating the water balance of the entire supply area, daily calculations can be made for individual areas and always based on updated information about the consumption in the individual areas. Then, it is easy to compare the water loss in the individual areas. This automatically provides better prioritisation of resources for the active location of leaks, and the comparison is also included as a natural part of investment considerations (see "Asset management"). The prioritised efforts result in less water loss and fewer resources are used to identify leaks.

The water loss depends on the location of the leak, combined with the pressure and size of the leak. The faster you detect and stop the leak, the less water is lost.

Unfortunately, only 10 % of leaks are visible; the vast majority of leaks are invisible from above ground.

Source: [Miya-water.com](https://www.miya-water.com/en/facts-about-water-loss) - Facts about water loss

There is no manual work involved in calculating a water balance in the digital utility. The software, which reads all of the parameters in the system, updates the water balance on an ongoing basis for the individual areas using the latest 24 hours consumption.

This means that the digital utility is always up to date on any trends in water loss in every single supply area, and you can act as soon as an increase in the leakage in an area is registered. This results in low levels of water loss from leakages.

The digital water utility can also use night time consumption as an indicator of water loss. It is possible to deduct the actual consumption during the night to get an overview of the nocturnal loss. In areas with low consumption, the volume can, in many cases, provide a better understanding of the leakage level than a percentage.

At the same time, preset thresholds means that you do not actively need to react to water loss unless a threshold is crossed.

Continuous water balancing also ensures that the digital utility has a valuable record of the water loss in different parts of the supply area. A record which, combined with existing knowledge on pipeline's material, dimension and age, provides the opportunity for qualifying the theoretical assumptions about water loss in the distribution network, which can be calibrated with actual measurements from the field.

Imagine total transparency in the distribution network ... what benefits would you gain from managing the water pressure?

The digital water utility always has updated knowledge about the pressure in different parts of the distribution network.



Actual and updated knowledge about pressure enables you to optimise pressure, to ensure that the pressure is always optimal in consumer households. No more, no less. This provides a perfect overview of the demand for, and the impact of, expanding with pressure control valves and booster stations.

You can also monitor areas where low pressure leads to an increased risk of water ingress, which can be the result of broken or burst pipes. Thus, there is less need to operate with high safety margins on the pressure to avoid ingress.

The digital water utility also has a complete overview of damaging pressure surges in the network. These may result from unregulated pumps, fast-closing valves or similar. You can identify “sinners” and limit pressure surges in the network. Pressure surges are a major cause of burst pipes in the main pipelines and limiting these can lead to a significant reduction of operational costs.

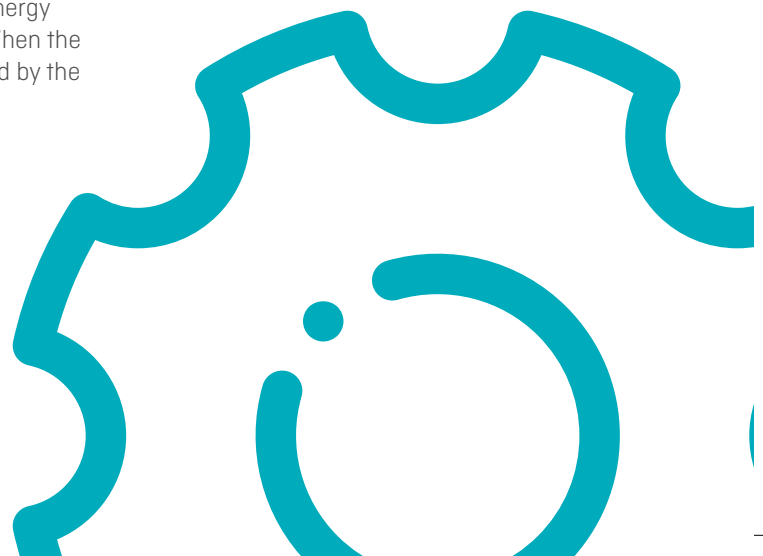
A reduction in the pressure will also have a positive impact on the water utility’s energy consumption for pumping out water. When the pressure is lowered, less energy is used by the pumps.

An optimal pressure “stresses” the pipes less, and the risk of bursts is reduced significantly. There is a direct correlation between pressure level and the total number of burst pipes. A 38 % reduction of the maximum pressure leads to a 53 % reduction in the total number of bursts.

Source: Thornton, J & Lambert, A - water21 (2006)

Optimised pressure management means that the average pressure in the network is significantly lower in the digital utility. A 10 % reduction in the average pressure leads to a leakage reduction of 10–20 %, which means water loss in the digital utility is significantly lower.

Source: Fantozzi, M - Pressure Management (2015)



Imagine total transparency in the distribution network ... what benefits would you gain from optimising the water utility's energy consumption?

The digital water utility knows precisely
when and how the customers are consuming water.



This knowledge can be used to optimise water distribution and create energy savings. In addition to energy savings, as a result of a reduced pressure in the distribution network, the excess capacity in the tanks and pumps can be utilised, e.g. elevated tanks and controlled pumping where the cost of electricity and the actual demand for water is considered.

Different projects show electricity savings on 10-15 %. This makes the water utility an important element in the intelligent energy system, where the environment can be supported by using excess electricity from for example, wind power.

Water is heavy, and it takes a lot of energy to pump water out of the ground and further into the distribution network. Energy for water constitutes 3-4 % of the world's total energy consumption. Energy typically accounts for 25-30 % of the operational costs in a water utility.

Source: EPA, United States Environmental Protection Agency and ESMAP, Energy Sector Management Assistance Program

Imagine total transparency in the distribution network ... what benefits would you gain from new knowledge about the utility's water quality?

The digital water utility has a complete overview of when and how the customers consume water, and how the water flows around the distribution network.



The information about water consumption and different quality parameters in the distribution network provides completely new insights into assessing the water quality.

In the digital utility, concrete knowledge is used to assess changed conditions in the distribution network, which can be an indication of problems with pollution, leakage or water ingress and backflow. Through early warnings, the water utility has new tools to rapidly and effectively identify problems in the distribution network and limit consequential damage and expensive time-consuming examinations.

- In the digital water utility, the non-return valve in the installation is checked for correct operation. The meter provides an alarm as soon as the water begins to flow in the wrong direction, and the utility can react immediately.
- The digital utility uses the actual data on temperature to calibrate their hydraulic models, so they show a more accurate representation of reality.
- Continuous pressure measurements in the distribution network provides information about any bursts and risk of water ingress.
- The sensors in the distribution network rapidly provide feedback on any situations where the utility should react.

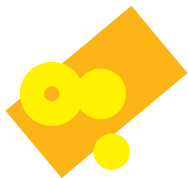
Future scenario 1: The combined knowledge about the water's temperature and the flow in the distribution net can indicate whether there are areas with non-flowing water, which should be rinsed through because of health concerns. This may be relevant in holiday home areas with a minimal total consumption outside the holiday season.

Future scenario 2: The knowledge about backflow and pressure provides an indication of ingressing dirt and foreign bodies from leakages. Using future sensors and knowledge about turbidity (water clarity), and other quality parameters, the utility will have an even better ability to assess the risk of pollution. Not necessarily through absolute measurements of specific bacteria and chemicals, but through measurements that show divergence from the normal conditions, and which should be examined in more detail.



Imagine total transparency in the distribution network ... what benefits would you gain in relation to an efficient settlement?

The digital water utility has access to all of the necessary information on the settlement of accounts – from ongoing settlements to final settlements after relocations.



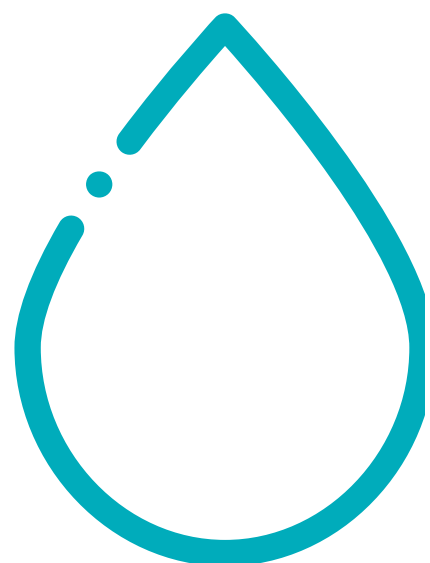
Remotely read meters eliminate the need to manually read meters or involve the customers in the form of reporting via letters, telephone or on the internet. The water utility has an overview of when and how the customers are consuming water, and all of the settlement information is accessible – regardless of whether it concerns the ongoing settlement or a final settlement for a relocation.

This creates an incredibly efficient settlement process, and you can eliminate many sources of error that result from the manual processes. The actual consumption figure from the water meter is transferred to the central system without any human intervention. All of the water meters are read without any involvement from the consumers, so you do not have to estimate the consumption. At the same time, any uncertainties about water balance are eliminated.

The fast and easy access to settlement data provides the option for settling according to the actual consumption on a monthly or quarterly basis, so that the customers experience cohesion and transparency between their consumption and settlement. This is an important parameter for encouraging customers to change their water consumption.

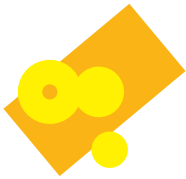
Water meters in the digital utility have no moving mechanical parts that age and become worn. Moreover, they have a very high degree of precision throughout their lifetime. The high precision also applies to very low flows, which mechanical meters often have difficulty in registering. All of the water is measured, down to the last drop. The digital utility can both streamline the processes surrounding settlement and increase turnover, because the smart water meters are precise and measure accurately, regardless of how much water is being used.

Low flows constitute a significant share of all consumption in a standard home. Different studies have shown a difference in accumulated water consumption of around 8 % when compared to meters with a start flow of 2 l/hour and 10 l/h, respectively.



Imagine total transparency in the distribution network ... what benefits would you gain from choosing the right meters for the right customers?

The digital water utility has a complete overview of when and how the customers consume water, and thus on whether the water meters are dimensioned correctly.



An excessively large water meter leads to lost revenue because low flows cannot be measured with sufficient precision. On the other hand, a water meter with dimensions that are too small is also problematic, if a customer's water consumption, e.g. in an industry, is limited to very high peak loads for brief periods of time, the meter may reach its maximum flow limit.

The digital utility has a precise knowledge of the minimum and maximum flow over time, and thus can choose the correct meter sizes. This means that you can protect and optimise the water utility's revenue. It tackles the general "80/20 challenge", where the majority of a water utility's costs are fixed and independent of the customers' consumption. This happens because money is bound up in expensive underground assets, while revenue is primarily a variable determined by consumption. Correct measurement is therefore important for managing the variable revenue base.

Case: The global focus on reduced water

consumption in homes, industries and agriculture will lead to reduce water consumption in many countries.

The reduced water consumption may mean that many water meters will be incorrectly dimensioned for their installations. Especially if the utility goes ahead and replaces meters with meters of the same dimension as part of their on-going meter replacement programme.

Water consumption in Danish homes

has fallen by 15 % in the last ten years. There are several reasons for this development: Water saving campaigns, water saving installations, increased environmental awareness and the price of water are some of these reasons. On average, a person uses 38.9 m³ domestically per year, the equivalent to 107 l per day, in comparison to 1989, when water consumption in the home was 174 l per day.

Source: DANVA

Imagine that you and the customer have a complete overview of water consumption ... what benefits would you gain through a more proactive dialogue?

The digital water utility provides its customers with online access to information about their hourly water consumption. This creates increased awareness of how water is consumed during the day, and they can easily relate to deviations – even on several platforms.



Taking the initiative to save water will be directly rewarded in the next bill, as the digital utility, in the future, will be able to charge for the ongoing actual consumption. Customers who do not follow consumption on a weekly or monthly basis will be informed of their consumption and on how they compare with similar customers.

The direct information safeguards the customers against unexpected events, for example if the water consumption deviates from thresholds, which they have personally defined in accordance with needs, or if the water meter reports problems in the installation.

The strong connection between consumption and settlement – and a more proactive dialogue – means the digital utility receives fewer service calls. The water utility can also base their response to events on facts and achieve a positive dialogue with customers based on easy accessible background knowledge.

Imagine that you and the customer have a complete overview of water consumption ... what benefits would you gain through a dialogue about saving water?

The digital water utility measures all of the produced and sold water and provides the customers with online access to their water consumption. This makes the impact of water saving initiatives immediate and transparent.



Different tests have shown water savings of 3-5 % in homes just by displaying the water consumption. The transparency ensures that any problems with leaks or bursts in the installation are discovered much quicker, which limits any expensive consequential damage. Overall, it minimises the global loss of water and improves the management of our water resources.

There are still areas in the world where water is not measured. Studies show that water consumption typically falls by 17 % by introducing measurement.

The increasing challenge of finite water resources means that even more focus has to be placed on water-saving initiatives. The world population will increase from seven billion to nine billion people by 2050. The middle class is growing, and it is expected that by 2030, the world will already need 50 % more food, 45 % more energy and 30 % more water.

Source: UN's High-level Panel on Global Sustainability

Imagine that you and the customer have a complete overview of water consumption ... what benefits would you gain through optimising the water utility's operations?

The digital water utility can move and minimise the peak loads, that are used to dimension many parts of the utility's network. This provides better utilisation of the distribution network.



By smoothing out the peak loads across both a 24-hour period and a full year, the water utility is better able to utilise the distribution network, and can postpone or completely avoid heavy investments in new infrastructure. Focusing on water loss and reduced water consumption can perhaps remove the need for establishing new waterworks.

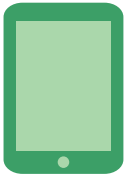
Transparency in the digital water utility creates awareness of how consumption is developing, and thus insight into the possibilities for moving or optimising the consumption. For example, through different tariffs for different times of the day or year. It can often be difficult to assess the full consequence of a new tariff structure, which must create the desired demand/response impact and at the same time, maintain the necessary revenue for the water utility.

The level of knowledge in the digital utility creates predictability. From the very beginning, you can assess the consequences and see the demand/response impact. It is also possible to integrate and manage water use processes and products automatically on the basis of the digital services from the water utility. Just as the use of electrical appliances, in the future, can be managed in accordance with price signals on the electrical grid.



Imagine total transparency in the distribution network ... what benefits would you gain from streamlining the daily administration?

The digital water utility can streamline initiatives
and spend time on preventive actions.



Resources, which were previously taken up by tasks like meter reading and following up on missing customer readings, are now freed up and can be used for other value-creating activities, which have a positive impact on the water utility's efficiency.

Far fewer visits in the field are required, because you can evaluate many on-site tasks before driving. On the basis of the accessible data, customer inquiries about settlement, pressure or temperature are answered quickly. In those cases where a field visit is necessary, the technician is much better prepared for the specific task because he has already had the opportunity to become familiar with the circumstances.

Early warnings about potential problems such as frost damage, means that the water utility can proactively contact customers and avoid expensive field visits. This saves money and creates improved customer relations.

In a concrete example from a Danish water utility, the annual settlement process for 3,200 customers takes about two whole calendar months. In the digitised water utility with 3,200 customers, this work can be done in 1-2 working days.

Imagine total transparency in the distribution network ... what benefits would you gain in the work with asset management?

The digital water utility utilises network data to prioritise between components in the network when it comes to the ongoing replacement and renovation.



In the future, the digital water utility will be able to constantly assess individual components in the network on the basis of a number of parameters. These parameters partly express the risk of a burst on the components and partly the consequence of any burst.

In addition to age and type, you can among other things, use the following to express the risk of a burst on the individual components:

- Digitally registered burst record
- The pressure, which the component has been exposed to throughout its lifetime
- The scope and size of the pressure surge, which the component has been exposed to
- The flow that has passed through the component

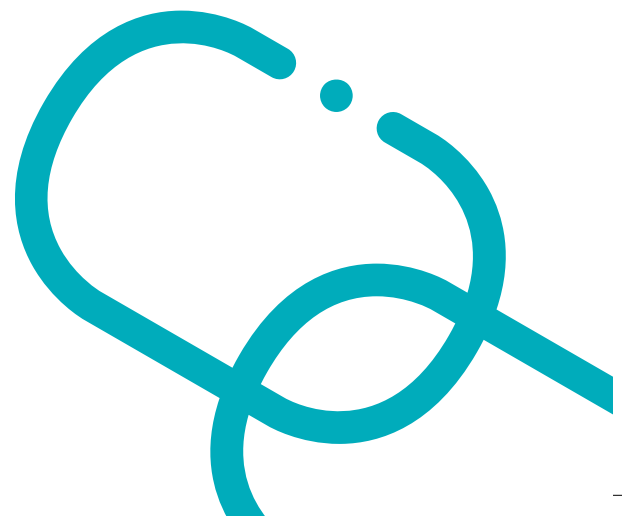
The system automatically records all of these parameters. The water utility can therefore always assess the risk of a burst on every single component on an informed basis.

The digital water utility can on an ongoing basis, replace parts with a high likelihood of bursting. This can lower both capital costs and the operational costs thanks to fewer acute bursts.

Risk assessment is one benefit. The ongoing analysis for individual components in the network is another important benefit. The consequence analysis is included in the prioritisation of the replacement of the individual components and is calculated automatically on the basis of the data from the network. The system calculates how many consumers are affected by a burst on each individual component.

The consumer records are also created with industry codes, so the system is able to take into account the sensitivity of the affected consumers in the consequence calculation.

This creates the basis for conducting a prioritised replacement of components, which for example are critical for the supply of a local hospital. By utilising the data from the network, the digital utility achieves a high level of supply reliability and financial benefit.



Kamstrup A/S

Industrivej 28
8660 Skanderborg
Danmark
T: +45 89 93 10 00
F: +45 89 93 10 01
info@kamstrup.com
Kamstrup.com

Think forward