The European Benchmarking Co-operation (EBC) is a not-for-profit benchmarking initiative that facilitates utilities in improving their services through benchmarking and learning from each other. EBC is governed by a Board consisting of representatives from Dutch (Dutch water utility associations), Danube Water Program (joint capacity building program of the World Bank and ADB for the Danube region, Austria), European benchmarkers (national water utility associations), Nordic (Nordic-Russia-European water utility associations) and Western (Western water utility associations).

EBC Foundation annually organizes benchmarking exercises for water & wastewater utilities in Europe and beyond. Next to the core programme for water- & wastewater utilities in Europe, EBC facilitates regional benchmarking programmes in the Danube region in close collaboration with the local national water associations. Participants in these regional programmes are forced to choose the benchmarking level that matches their aspirations and availability, which offers quite detailed indicators for deeper analysis. Participants can apply the IWA Performance Indicator System. This provides a standard for benchmarking and exchange between the different programmes.

EBC offers a learning-orientated utility improvement programme. To serve both large and small utilities, experienced and less experienced ones, EBC has developed a Performance Assessment Model with three different levels of detail: basic, standard and advanced. While at the basic level only elementary statistics and performance indicators are investigated, the advanced level offers quite detailed indicators for deeper analysis. Both levels choose the benchmarking level that matches their aspirations and availability of relevant information. For key performance areas, utilities are aligned with the IWA & AWWA benchmarking frameworks and exchange information and best practices.

To secure the high-quality standard of the programme, EBC and the participating utilities closely work together on data collection, data quality control and data reporting. In the performance improvement step, utilities meet their peers in the annual benchmarking workshop where they exchange knowledge and best practices in technology, management and operations.
The European Benchmarking Co-operation (EBC) is a not-for-profit benchmarking initiative that focuses on water & wastewater utilities in improving their services through benchmarking and learning from each other. EBC Foundation is governed by a Board consisting of representatives from Danube Water utility associations, Danube Water Program (joint capacity building program of the World Bank and ADB) for the Danube region, Austria, Euro-Eurasian service basin of national water utility associations, Nordic Water-Finno-Scandinavian Water utility association and Vatten-Danish water utility association.

EBC Foundation arranges benchmarking exercises for water & wastewater utilities in Europe and beyond. Next to the core programme for water utilities, the EBC Benchmarking programme also facilitates regional benchmarking for water utilities in the Danube region in close collaboration with the local national water associations. Participation in the benchmarking programme is open to all water & wastewater utilities in Europe and beyond. Next to the core programme, EBC offers a learning-orientated utility improvement programme. It consists of two consecutive steps: performance assessment and performance improvement.

EBC offers a learning-orientated utility improvement programme. Experience tells us that incremental steps of performance assessment, performance improvement, and learning from each other are necessary. To reach these three steps, EBC analyses the carbon footprint and asset management.

To ensure the high-quality standard of the programme, the EBC benchmarking team and the participating utilities closely work together on data collection, data quality control and data reporting.

In the performance improvement step, utilities meet their peers in the annual benchmarking workshop where they exchange knowledge and best practices in technology, management and operations.

What does EBC's benchmarking programme offer?

EBC offers a learning-orientated utility improvement programme. Experience tells us that incremental steps of performance assessment, performance improvement, and learning from each other are necessary. To reach these three steps, EBC analyses the carbon footprint and asset management.

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In the performance improvement step, utilities meet their peers in the annual benchmarking workshop where they exchange knowledge and best practices in technology, management and operations.
Learning from International Best Practices
Total number of consumers supplied with drinking water by the participating utilities:
79,540,964
Which equals to 16% of the EU28 population!

Total number of consumers connected to a WWTP operated by the participating utilities:
59,911,003
Which equals to 12% of the EU28 population!

Annual turnover of the participating drinking water utilities:
€ 5,398,961,549

Annual turnover of the participating wastewater utilities:
€ 3,918,698,840

Annual investment by participating drinking water utilities:
€ 1,750,351,681

Annual investment by participating wastewater utilities:
€ 1,482,497,147
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Safe and reliable water services are essential for society. From this perspective, in 2017 EBC Foundation continued its mission to provide benchmarking services to water- and wastewater utilities across Europe.

Benchmarking is all about measuring performance, comparing with colleague utilities operating in similar conditions, and jointly finding ways to improve the services. Improving by learning from each other and by a common search for solutions is key in EBC’s benchmarking programme. Disclosing available knowledge and experience in the water sector can be very beneficial. After all, what is common practice for one utility, can be new to another.

In this search for good practices, one should not just look at traditional performance areas like water quality, customer service, non-revenue water, or energy consumption. EBC’s 2016 benchmarking workshop in Poznan clearly marked that stakeholders today expect more from water- and wastewater utilities than providing safe drinking water and treating wastewater to safely return it to the environment. Utilities should be professionally managed and operate in an effective and efficient way. New challenges that utilities are facing carrying out their duties are for instance climate resiliency, (cyber)security, the demand for resource recovery and transparent communication.

This year, EBC made additional efforts to assist utilities in reaching these goals by:
- issuing an additional questionnaire on climate resilience, which was used as input for the annual Western European benchmarking workshop;
- adding (cyber-) security to the agenda;
- upgrading the online platform for better self-analysis of trends and improvement potentials, enabling to benefit more from EBC’s annually increasing performance database;
- promoting the use of EBC’s online discussion platform, where participants can raise questions and initiate discussions.

**Western Europe**

47 Utilities from 20 different countries participated in the annual benchmarking exercise for Western Europe this year (IB2016). Five of them – Bergen (N), Helsinki (FIN), Santander (E), SIACH (L), Trondheim (N) and Warsaw (PL) – were new to the programme or returned after some years of absence.

On 9 & 10 November 2017, 90 utility representatives (including delegations from the regional programmes in the Danube region) gathered in Ħal-Luqa, Malta for the annual benchmarking workshop. The water- and wastewater company of Malta, Water Services Corporation, kindly offered to host and sponsor the workshop which was opened by the Maltese minister on Energy and Water Management Mr. Joe Mizzi. Attendees could choose between several parallel sessions, focused on five main themes. Three of these were suggested by the participants in the benchmarking programme (asset management, energy efficiency and utility management) and two were put on the agenda by the EBC-team (cyber)security and climate resiliency). The assessment results, related to the five themes, were addressed and discussed, followed by presentations of good practices by participating delegates and by the Dutch National Security Advisory Centre. The workshop programme offered delegates ample time to catch up, challenge, question, network and discuss with their colleagues.

**Danube Water Program**

In 2017, the Danube Water Program continued its capacity building activities for the water sector in the Danube region. EBC Foundation and The International Association of Water Supply Companies in the Danube River Catchment Area (IAWD) concluded a contract to support the utility benchmarking activities under this programme in 2017 as well as in 2018.
Within the Danube Water Program, an additional benchmarking programme was introduced for utilities that would like to share good practices and experiences with colleagues from across the region. The Danube Region Benchmarking Hub offers additional learning opportunities for utilities that are already participating in one of the existing regional programmes, and also to utilities in the region who are not part of one of the existing programmes yet. In total, 60 utilities from the Danube region were involved in a utility benchmarking effort that was facilitated by EBC Foundation and local partners. In December, the regional hub for the former Yugoslavia region organised its annual workshop in Bosnia Herzegovina; the regional hubs for Albania/Kosovo, Bulgaria and Ukraine will follow early 2018.

**Upgrade of EBC’s online data reporting tool**

All participants in EBC-facilitated benchmarking programmes have access to an online data reporting tool. This tool offers utilities the possibility to perform additional analysis, look into a more extensive set of indicators (the company reports just show a selection) and create new graphs. In 2017 the platform underwent an upgrade, adding new functionalities and changing the layout into a crisp design. EBC Foundation is confident that the upgraded online tool will be even more helpful to utilities than before. A more extensive description about the upgrade is available at page 42.

**2018: A new opportunity to join the network!**

Of course the work does not stop here, as service improvement never ends! EBC will continue looking for ways to better serve participants in their efforts to improve their water services.

I would like to use this opportunity to encourage utilities across Europe to join EBC’s benchmarking programme and become part of this unique peer utility network. Please continue inspiring each other by sharing your experiences in managing and operating water services, and in exploring and applying new technologies and innovations. With your input, enthusiasm and support, it is possible to further develop the programme and the network and offer customers the services they expect from us!
Introduction

Since 2007, the European Benchmarking Co-operation (EBC) operates an international benchmarking programme for European water- & wastewater utilities, with the objective to improve their services. This publication briefly reports on EBC’s core programme for Western Europe.

In 2017 EBC organised its 11th international benchmarking exercise, welcoming 47 participants from 20 different countries. Three utilities are based in countries outside Europe (Oman, Singapore and the United States). The 2017 exercise processed data from 2016. The project was coordinated by EBC and supported by ABF Research in Delft, the Netherlands.

EBC offers three levels of participation (basic, standard and advanced) to make the benchmarking programme accessible to all type of water utilities, no matter if they are used to advanced data collection, or just begin with basic data collection. During the data collection process, participants are supported by EBC through an expert helpdesk which contribute to a high quality of the data.

The benchmarking process started early 2017 with an invitation to European water utilities to join EBC’s benchmarking exercise.
The data collection started in May, using the benchmarking platform www.waterbenchmark.org. As always, EBC paid a lot of attention to the data quality. After the initial collection phase, with several checks online, the submitted data were subject to three rounds of analysis and correction, resulting in a validated data set which was used for the final company reports and this public report. Data entry results that could not be verified by the EBC team were deleted from the dataset for the public report.

Like every year, in the 2017 benchmarking exercise improvements have been made in the set of questions and in the reporting. Definitions of various indicators were clarified and an new online data reporting tool was launched.

On November 9th and 10th, 2017, some 90 representatives of the participating utilities and a delegation from the regional benchmarking programmes in the Danube region gathered in Valetta, Malta for EBC’s annual benchmarking workshop, which was hosted and
co-organised by the Water Services Corporation. The two-days event provided participants with a platform where they could exchange good practices and ideas for improvements. In total, over 20 sessions were dedicated to discuss numerical results of the exercise (performance assessment) and best practices (performance improvement). Also, Water Services Corporation organised a site visit to its Reverse Osmosis Site at Pembroke.

The traditional workshop dinner was held in the fortified city of Mdina. During the dinner, the Benchmarking Co-ordinator of the Year Award was handed to Jyrki Kaija (Helsinki Region Environmental Services Authority) and to Katherina Sargioti and Stelios Samios (EYDAP). The EBC-team congratulates the winners of this year’s award and encourages them to continue their good work!

Right after the benchmarking workshop, participants could make the last corrections in their dataset. Final reports were distributed early December.
This section contains an overview of this year’s performance assessment on drinking water services. Data of other services that the participating companies may have provided (i.e. wastewater or gas distribution) are excluded from the analysis. In EBC’s benchmarking programme, the indicators are divided into five performance areas: water quality, reliability, service quality, sustainability and finance & efficiency. This public report only shows a subset of the available performance indicators for the drinking water service to illustrate key findings. In the ideal situation the group of participants that compares performance would be the same over time. The group of utilities that participated in the 2017 exercise however differs from the one in previous years. Hence, the current group level results cannot be compared with those of previous years. In the individual company reports, participants can however track changes both in their own and in their peers’ performance.

Service coverage
The percentage of resident population served by utilities of the current EBC group is high. Most utilities in the group serve 100% of the total resident population. The median value for the group is 100%.

Figure 1:
Population coverage (%)

Water quality
Water quality is generally seen as the most important aspect of the drinking water service. Consumers need safe and clean water as a basic commodity. To assess the water quality of the participating utilities, EBC measures the percentage of quality tests in compliance with national regulatory standards. Since the standards for water quality differ between countries, test compliance does not allow for an absolute comparison. However, the variation between standards is limited, since the majority of the participating utilities originate from Europe, where the national standards are based on the European Drinking Water Directive.

Water quality compliance is very high across the current EBC group. Most companies score
close to 100% and the median value is 99.96%. It is worth mentioning that a non-compliant test does not necessarily mean an imminent health risk for the consumer. It can for example be a non-hazardous flaw (i.e. an abnormal colour). Furthermore, many regulatory standards contain a safety margin, so that a case of non-compliance does not necessarily mean that public health is at risk.

**Reliability**

Reliability also is an essential performance indicator for a water utility. The customer expects a continuous supply of safe and clear water. EBC uses mains failures as an indicator of reliability. Mains failures are breaks and leakages of mains pipes, valves and fittings leading to interruption or low-pressure supply. Results of reliability vary widely within the current EBC group with values ranging from 0.8 to 106 failures per 100 km. Factors that may influence the mains failure rate include the network condition, soil condition, traffic load and water pressure. It is also worth mentioning that an improvement in monitoring failures may (at first) cause an increase in mains failures, as not in all cases failures are currently properly registered. The median value is 12.8 No./100 km.
In addition to mains failures the programme also looks at distribution losses and (at the advanced level) at customer minutes lost. Utilities in the current EBC group face distribution losses between 0,5 and 66,4 m³ per km mains length per day. The median value for the group is 8,8 m³ / km / day. Failures may also occur without the customer noticing.

**Service Quality**

If the service of a water utility is not up to the required standard of the customer, the customer can file a complaint. Hence the number of complaints filed by utilities’ customers is an adequate measure for service quality. EBC measures service complaints. These complaints are related to the actual supply of drinking water, including water pressure, (medium to long term) continuity, water quality and (short term) interruptions. Complaints on billing are also measured but not taken into account in this indicator. The majority of the current EBC group scores very well with a median value of 0,67 complaints / 1000 properties.

The emergence of social media also created a new channel of communication between consumers and utilities. Many water utilities are increasingly using social media to better inform their customers. Hence, through these new channels, mutual understanding is facilitated and formal complaints may be prevented.
Sustainability

Sustainability is key on the agenda of many water utilities. It can be approached and measured in various ways. The EBC programme uses the widely recognised Triple Bottom Line approach, which investigates social, environmental and economic sustainability.

Social sustainability

Water is a basic necessity, and customers usually do not have viable alternatives to their local water supplier. This unilateral reliance leaves it to the utility to make sure its product is affordable. Hence, EBC measures social sustainability of the drinking water services by showing the water bill as a share of household consumption expenditures. In the current EBC group this ranges from 0.22% to 0.72%, with a median of 0.43%.

Environmental sustainability

The EBC programme measures environmental sustainability through several indicators, which include electricity use for water production, energy recovery, inefficiency of use of water resources, the reuse of treatment residuals and climate footprint. Figure 7 shows the electricity used by pumps in the abstraction, treatment and distribution of water, per m³ that is produced. The use of electricity is influenced by the type of water resources, geography and treatment processes. Pumps are the most voracious consumers of electricity, which makes their efficiency an important factor in the reduction of electricity use. This benchmarking exercise resulted in a median electricity usage for pumping of 0.49 kWh / m³.

Figure 6: Affordability based on household consumption expenditures (%)

Figure 7: Electricity use for production and distribution per m³ water produced (kWh/m³)
In terms of the climate footprint, scope 1, scope 2 and scope 3 indicators are analysed within the EBC programme. In the current report scope 2 is highlighted. Scope 2 emissions are emissions from the generation of purchased energy for own use by the utility. The participants of this years’ benchmarking exercise show a range of scores from -0,1 kg till 0,33 kg CO₂-equivalent per m³ drinking water, with a median value of 0,1 kg CO₂-eq./m³.

**Figure 8:**
Climate footprint scope 2 per m³ direct revenue drinking water (kg CO₂-eq./m³)

---

**Economic sustainability**

While making sure that water is ample available to the public, and taking their environmental footprint into account, water utilities need to make sure their activities are economically sustainable.

The percentage of main rehabilitation is the share of the network that has been renovated or replaced because the conditions of the mains deteriorates. Utilities renovate or replace mains to keep the network fit for future use. Higher percentages of main rehabilitation can be caused by a higher average network age. Virtually all utilities in the current EBC group rehabilitate between 0 and 1,5% of their network. The median value is 0,6 % / year.

**Figure 9:**
Mains rehabilitation (%/year)
Economic sustainability also means collecting sales revenues to cover total costs by a ratio of 1 or more. About two thirds of the EBC participants meet this criterion. With a ratio below 1, utilities will have to rely on other sources of income (e.g. subsidies, reserves or income from other activities). These utilities are less sustainable on the long run. The median value for the current EBC group is 1,06.

**Finance & Efficiency**

The EBC performance assessment framework contains an extensive set of indicators on finance and efficiency. This set includes total cost, running cost, personnel intensity and charges. Since water utilities are committed to provide water of the highest possible quality at the lowest possible price, water charges are an important financial performance indicator. Average water charges for direct consumption are calculated by dividing total direct revenues by the sold volume. Many utilities have a tariff structure with a fixed connection fee and a variable rate per unit sold. As a result the price per m$^3$ a household actually pays will often depend on its consumption. The median price of water for the current EBC group is €1,29/m$^3$. 

**Figure 10:**
Total cost by sales coverage ratio

**Figure 11:**
Average water charges for direct consumption (€/m$^3$)
Personnel intensity is a relevant performance indicator on the efficiency side. It is measured as the number of full-time employees (fte) per 1000 properties. The scores on this indicator are computed using a standard 40 hour full-time working week. In the current EBC group the personnel intensity ranges from 0.31 to 2.07 fte per 1000 properties with a median value of 0.81 fte / 1000 properties.
'Czajka' wastewater treatment plant in Warsaw
This section presents an overview of the performance comparison of this year’s benchmarking exercise for wastewater services. We use the same performance areas as for drinking water: water quality, reliability, service quality, sustainability and finance & efficiency. The data is gathered on the wastewater activities specifically. This means that measures and costs of other services that a participant may provide (i.e. drinking water or district heating) are excluded. The performance indicators shown in this section are only a subset of the available indicators.

The group of utilities that participated in the 2017 exercise differs from the one in previous years. Hence, the current group level results cannot be compared with those of previous years. In the individual company reports, participants can however track changes both in their own and in their peers’ performance.

### Service coverage

The percentage of resident population in the service area of utilities in the current EBC group that is connected to the sewer system managed by those utilities is high. The median value is 99%.

![Figure 13: Resident population connected to sewer system (%)](image)

### Wastewater quality

The wastewater (in many cases mixed with storm water) that is collected by a utility needs to be treated. The treated water needs to be in compliance with discharge consents to minimize the negative effect on the environment. These consents vary between and within countries, which means the same percentage can have different meaning for the different utilities. The compliance within the current EBC group is generally high with a median value of 100%.
Reliability

To assess wastewater reliability the EBC is using sewer blockages as the main indicator. These blockages include all occurrences under the company’s responsibility, whether they are due to collapse, root ingress, grease or debris. Utilities within the current EBC group strive to improve monitoring. This may (at first) result in an increase in the detection rates, as not all blockages are currently properly registered. However, eventually this should improve the service of the water companies. Utilities can also reduce blockages by educating customers (especially in the case of blockages caused by grease). The results on sewage blockages vary widely within the current EBC group between 0 and 336 blockages per 100 km sewer, per year, with a median value of 13 No. / 100 km sewer.

Also the number of floodings from combined sewers show large variations within the current EBC group. The number of floodings per 100 km sewer vary for the vast majority of utilities in the current EBC group between 0 and 7,3 with a median value of 0,1 No. / 100 km sewer.
Service Quality

Service quality for wastewater services is measured using the same indicators as for drinking water. The customer can file a complaint if the service of a wastewater utility is not up to the required standards. The majority of the current EBC group scores very well with a median of 0.9 No. / 1000 inhabitants / year.

Different types of complaints are occurring in different part of the wastewater chain. For instance, blockages and flooding complaints occur more often in the collection and transport mains (network), while the treatment facilities are often faced with complaints due to pollution, odour and rodents.

Sustainability

Similar to drinking water services, the wastewater services are benchmarked on sustainability using the Triple Bottom Line approach which takes into account social, environmental and economic sustainability.
Social sustainability
The EBC programme measures the social sustainability of wastewater services by calculating the share of the wastewater bill in household consumption expenditures. This measure gives a good impression of the affordability of the wastewater services, accounted for differences in wealth between nations. The EBC group of current participants show a profound range from 0% to 1.09% with a median value for this indicator of 0.43%.

Environmental sustainability
EBC’s benchmarking programme measures environmental sustainability with several indicators. Examples are the electricity used for treating wastewater as well as generating electricity from it, the percentage of the sludge generated in the treatment process that is utilized in a sustainable way or the frequency of use of overflow devices to surface water. In the current report we reveal the results for the energy consumption of the wastewater treatment plants as well as results for the climate footprint scope 2. The energy consumption of the majority of participants is distributed between 18.4 kWh and 56.8 kWh per population equivalent served. The median value for the current EBC group is 32.7 kWh / p.e. served by WWTP. The consumption of the wastewater treatment plants can differ depending on the level of treatment, which in turn depends on the local discharge consents.

Figure 18: Affordability based on household consumption expenditures (%)  
Figure 19: Wastewater treatment plant energy consumption (kWh/p.e. served by WWTP)

In terms of the climate footprint, scope 1, scope 2 and scope 3 indicators are analysed within the EBC programme. In the current report scope 2 is highlighted. Scope 2 emissions are
emissions from the generation of purchased energy for own use by the utility. Utilities in the current EBC group report values between -9.9 and 20 kg CO₂-equivalent per population equivalent. The median value for the entire group is 8.2 kg CO₂-eq. / p.e.

**Figure 20:**
Climate footprint scope 2 per population equivalent (kg CO₂-equivalent per p.e.)

**Economic sustainability**

Like with drinking water utilities, wastewater utilities need to make sure their activities are economically sustainable.

The percentage of sewer rehabilitation is the share of the network that has been renovated or replaced because the condition of the sewers deteriorates. Utilities renovate or replace sewers to keep the network fit for future use. Higher percentages of sewer rehabilitation can be caused by a higher average network age. The median value for sewer rehabilitation for the current EBC group is 0.51 % / year.

**Figure 21:**
Sewer rehabilitation (%/year)

Total cost by sales coverage ratio is an important measure for economic sustainability. With this ratio, one can identify if a utility is able to recover its costs from its sales revenues. These revenues consist of all charges to the customers for the collection, transport and treatment of
wastewater. With a ratio below 1, utilities will have to rely on other sources of income like subsidies, reserves or income from other activities. More than half of the EBC participants score above 1, making these utilities more likely to be economically sustainable on the long run. The scores range from 0 till 1,54, with a median value of 1,03.

**Finance & Efficiency**

Like with drinking water utilities, finance & efficiency is a highly relevant topic for wastewater utilities. There is a high variance between the EBC participants for the amount spent on sewage services per connected property. The average of the 3 highest charges registered is over 9 times higher than the average of the three lowest (€ 320 versus € 34 per property). The median value for the current EBC group is € 184 / property. Corrected for differences in purchasing power the gap between highest and lowest charges reduces to 6,8. Cost reduction (and, consequently, lower charges) are an important goal for most wastewater utilities. Hence this indicator is a great example of where exchange of best practices could be beneficial for utilities.
Personnel intensity is a relevant performance indicator on the efficiency side. It is measured as the number of full-time employees (fte) per 1000 properties. The scores on this indicator are computed using a standard 40 hour full-time working week. In the current EBC group the personnel intensity ranges from 0.26 to 1.85 fte per 1000 properties with a median value of 0.66 fte / 1000 properties.

Figure 24: Personnel intensity (fte/1000 properties)
GOOD PRACTICES
Service continuity has been on the agenda of Dutch water companies already for a long time, as this is - next to water quality - key to consumers. Following the development of a national guideline for reliability of water supply systems in the 1990's and - after 9/11 - the implementation of security measures, the water sector developed an integral Business Continuity Plan. Main aim of this plan is to secure water supply both on the short term and the long term, and both in normal conditions and in disturbed conditions.

The concept of a Business Continuity Plan has been adopted by the Dutch government and included in the Drinking Water Act of 2011. Since then, all water supply companies are required to provide a Business continuity plan to the Ministry of Infrastructure and the Environment for approval, at an interval of every four years.

In 2012, the first set of Business Continuity Plans was delivered. It turned out that all ten Dutch water companies submitted quite different plans in terms of content and layout. Therefore, the Ministry requested that the next edition of the Plan would be more uniform, as this simplifies control and supervision. In response, the sector drew up a joint table of contents and identified what parts should be included in the Plan. Additionally, a split was made in the Plan in meeting supply obligations under normal conditions and meeting them in a disturbed situation.
The current Plans first provide a general description of the utility and it addresses the following topics:

- business philosophy;
- organogram;
- offices and other buildings;
- service area;
- drinking water sources;
- production capacity and spare capacity;
- process automation;
- statistics on the network, age, diameters, material type and replacement plans;
- relationship with other internal plans such as an investment plan;
- co-ordination with key stakeholders and their plans.

The ‘normal conditions’ part first describes how the company plans to meet the demand for drinking water in the next 10 years. In this analysis, the company also pays attention to the more extreme situations: how to meet the demand on a ‘maximum day’ with a chance of occurrence once in every 10 years. Questions to be answered in this section are:

- Where are new residential areas planned and where will new industries be established?
- Where are regions with demographic growth and where does the population shrink?
- Where is the water used for? Is it also used for/by industries? Will this usage change in the future?
- How much drinking water can the company produce at the maximum. Is the capacity licensed and installed at treatment plants sufficient to meet demand?

The following section deals with the reliability and resilience of the system. The Dutch Drinking Water Act contains a quantitative guideline for reliability, stating that: ‘In case of failure of one element of the water supply system, the remaining supply capacity in centres of demand should be at least 75% of the maximum daily demand.’ Under this definition ‘one element’ is a (major) element that can be isolated from the system e.g. a pipe segment between valves or an element of the treatment plant, etc. Starting point is that one may expect that every element of the system can fail. Failure of multiple elements at a time is not considered under this guideline.

A centre of demand is defined as a cluster of 2,000 connections, which equals 5,000 inhabitants. In every centre of demand, on a 24 hours’ base, at least 75% of the maximum daily demand should be delivered. Only failures lasting more than 24 hours are considered.
For the analysis an hydraulic model is used, to simulate the effects of failure of each single element in a system and to check if the remaining supply is enough to meet the guideline – even on that one very hot day.

Experiences with the reliability guideline show that:

- single source systems are vulnerable;
- pumping stations are critical elements in the system;
- looped networks, with valves properly situated, enhance flexibility in operations;
- connecting isolated and neighbouring systems is an effective and efficient way to enhance reliability.

The next part of the Plan deals with ‘disturbed conditions’ and first describes the relevant hazards and threats. Hazards are defined as non-intentional accidents and disasters such as natural disasters and industrial accidents. Threats are deliberate actions of vandals, idiots, script kiddies but also terrorists and cyber terrorists.

The analysis of all hazards includes a list of more than 30 possible scenarios. The list is completed with more than 15 scenarios of deliberate human threats. All these scenarios have...
been assessed in a multidisciplinary team and plotted in a risk diagram. After this analyses the hazards and threats with the largest impacts are known. Next, measures to prevent an incident or reduce the impact are elaborated.

The government and the water sector specifically agreed on the desired level of security of the service. Starting points are amongst others:
- proportionality in the chain from source to tap;
- inherent secure systems and objects (security by design);
- measures should target at discouraging, detecting, delaying, and reducing consequences.

In case of threats and incidents with a (foreseen) large impact, a crisis organisation should be activated. Large impact incidents are for instance insufficient quantity or quality. But a crisis can also be about business assets, employees, information or nuisance to environment; practical examples are a big sink hole, loads of water on the street or a cyber incident. Not all incidents are considered a crisis. A malfunctioning house connection for instance is inconvenient.

A crisis can lead to social turmoil. As water crises can have a big impact for society, it is important to well organize the crisis management structures. Therefore, in the Business Continuity Plan water companies need to describe in detail how they have organised their crisis management organisation and procedures, to ensure that a crisis is resolved as quickly as possible in co-ordination with all relevant crisis partners.

In case of a very extreme scenario or incident in which the redundancy and reliability measures are insufficient and the system totally fails, the water companies are obliged to provide emergency drinking water to the population in an amount of 3 litres per person per day. For such a case, water companies have plastic bags of 10.000 litre available to distribute drinking water to the population with support of connected taps. When applying this emergency drinking water system, the municipality is responsible to point out at what locations the water needs to be distributed and maintain public order. At the same time, water utilities still need to try to supply water (of non-potable quality) through their networks for sanitary use, in order to prevent diseases.

The next set of Business Continuity Plans needs to be submitted in 2020. In 2018, the ten water companies will meet to evaluate their experiences and discuss possible improvements.
PARTICIPANTS EXPERIENCES
Helsinki Region Environmental Services Authority
Solving the challenge of benchmarking

Helsinki Region Environmental Services Authority HSY is a municipal body established by four municipalities: Espoo, Helsinki, Kauniainen and Vantaa. HSY produces waste management and water services, as well as providing information on the Helsinki Metropolitan Area and environment. We help inhabitants to act for a better environment.

Water services – the bread and butter of HSY
Water services cover approximately 68 percent of HSY’s operating revenue and engage over 420 of a total of 740 employees. HSY supplies high-quality drinking water to over one million inhabitants throughout the Helsinki Metropolitan Area, builds, maintains and operates a water- and sewer network and treats wastewater from households and industry to protect the Baltic Sea. Most raw water for the Helsinki Metropolitan Area arrives through the 120 km long Päijänne Tunnel. In 2016, 94.4 million cubic meters of water was pumped into the network, composed of 3.073 km of water pipes and 5.249 km of sewer. Altogether, HSY manages a network of 8.322 km.

Focusing on the future: wastewater as an energy source
Traditionally, treating wastewater consumes significant amounts of energy, but modern technologies make it possible to turn this into an energy producing process. The most common way to obtain energy from wastewater is by digesting organic sludge from the treatment process into biogas. In the Viikinmäki WWTP, biogas is used to produce electricity using gas engines and in the smaller Suomenoja WWTP biogas is purified and compressed for vehicle use in co-operation with Gasum, a Finnish natural gas company.
Next to biogas production, heat is recovered from the wastewater in different parts of the treatment process to make the plant even more energy efficient. Typically, good sources of the heat recovery are effluent water, ventilation air, compressed aeration air and heated sludge. In Viikinmäki, heat is even recovered from the exhaust of the plant’s biogas engines with ORC (Organic Rankine Cycle) technology. Furthermore, local energy companies Helen (in Helsinki) and Fortum (in Espoo) recover heat from the effluent leaving HSY’s treatment plants, with an heating potential for 70,000 single family houses in Helsinki and 20,000 single family houses in Espoo.

Wastewater treatment (especially nitrogen removal) is energy intensive and makes it difficult for a treatment plant to reach self-sufficiency. Both of HSY’s wastewater treatment plants have high nitrogen removal rates, in Viikinmäki (>90%) and in Suomenoja (>70%), and yet Viikinmäki currently covers more than 90 percent of its own electricity consumption. To achieve this, the Viikinmäki plant uses all listed energy production methods. On top of that, Viikinmäki plant has 886 solar panels installed on its roofs. And the work goes on...

**Solving the challenge of benchmarking**

The Finnish benchmarking system Venla started around 15 years ago by the Finnish Water Works Association (FIWA). Its basic level is meant for all FIWA members and an advanced level is available for those willing to pay for a more comprehensive benchmarking process. This national system has created a good basis for HSY to take the next step. However, benchmarking on national level is challenging since HSY is a much larger entity than the other Finnish water utilities. For this reason, HSY also participates in EBC’s cross-border utility improvement programme.

HSY participates at EBC’s standard level, which is more extensive than Venla’s advanced level and has filled HSY’s benchmarking needs so far. The tools offered by EBC are good, but there have been challenges as well. For example, EBC’s definitions are partly different from those used in Venla.

So far, some interesting conclusions could be made, e.g. consumer metering seems to be different in Finland compared to some other parts of Europe. Further, HSY’s water- and sewer networks are on average a few years younger than those of its Nordic reference utilities, and at the same time HSY invests less in renovation of its networks. This is a clear message for the long term investment plan: HSY must prepare to invest more in its networks to keep them in a good operational condition, now and in the future.
The Municipal Water Supply and Sewage Company in Warsaw (MPWiK Warsaw) is the largest water and sewerage utility in Poland.

The Company supplies water, as well as collects and treats sewage from Warsaw and neighbouring communities within the Warsaw metropolitan area, which is inhabited by approximately 2.5 million residents. The capital city of Warsaw is the sole shareholder of the Company.

In 2016, MPWiK Warsaw produced 122 million cubic metres of treated water. The Company has three modern water treatment plants in the area of its water supply operation, and maintains a water supply network with a total length of approximately 3,400 km. Raw water is drawn from underneath the riverbed of the largest Polish river, the Vistula, and from an artificial reservoir, the Zegrze Lake. The Company operates the largest infiltration well in Europe, dubbed ‘Fat Kate’ by local residents for its appearance and located in the Vistula river.

In 2016, MPWiK Warsaw treated 180 million cubic metres of waste water. The Company comprises four wastewater treatment plants, including ‘Czajka’, the largest such facility in Poland, processing approximately 390 million litres of waste water per day. The Company also operates approximately 3,300 kilometres of sewers.

In 2016, MPWiK Warsaw celebrated its 130th anniversary. It was in 1886 that the first modern water supply and sewerage system, designed by the English engineer William Lindley, was built in Warsaw. At the time, Warsaw was one of six European cities equipped with such modern facilities.

For over ten years, the Company has been involved in the ‘Water Supply and Sewage Treatment in Warsaw’ programme, co-financed by the EU. The total value of completed and
planned investments within the programme amounts to EUR 1.6 billion, of which roughly half is provided by the EU. As a result, all facilities operated by the Company have been thoroughly modernised and expanded, and nearly 900 kilometres of new water supply pipelines and sewers have been constructed. Complementing its broad investment program, MPWiK Warsaw continuously strives to improve service quality and operating efficiency.

The European benchmarking programme is a great opportunity for the Company to compare its key business indicators with those of other European enterprises. This will allow us to identify the areas where more work is needed, thus contributing to the improvement of our services and the quality of life of the local community. With that in view, MPWiK Warsaw joined the benchmarking programme in mid-2017. The indicators collected this year will be used to verify the correctness and accuracy of the data entered. Despite the short time available for this task, the results have already provided much valuable information, indicating in which areas we have achieved a high European standard, and in which areas further improvements are necessary. We hope that our participation in joint meetings of European water supply and sewerage utilities will facilitate an exchange of views and know-how, and will be a source of inspiration and innovation in our Company.

Infiltration well 'Fat Kate' in the Vistula River in Warsaw
At the end of each EBC-facilitated benchmarking exercise, utilities receive an individual company report. This management report presents a selection of the most important Performance indicators.

On top of that all participants have access to an online data reporting tool. This tool offers utilities the possibility to perform additional analysis, look into a more extensive set of indicators and create tailor made graphs. In 2017 this tool underwent a major upgrade, adding new functionalities and changing the layout into a crisp design.

How does it work?

In contrast to the annual company reports, the online tool offers access to all historic data. The utility coordinator is able to choose any indicator from the available large database. This makes it possible to customise one’s own analysis. The system offers a straightforward layout making it relatively easy to use.
**Added value**

The online system offers a wide range of table & graph options. Depending on the selected data, one can choose to present it for instance in a spider diagram, bar chart or point cloud. The latter offers an additional benefit: looking for possible correlations. After plotting two PI’s one can for instance generate a regression line through the data to see if the data is significantly correlated.

**Different graph options**

One can also use the graphs to display data of multiple years in order to look for trends in performance. This option could be helpful if a participant is looking for a peer utility who performs well in a specific area in order to support its quest to find best practices. Data availability and visibility of course depends on the period of participation and the chosen degree of transparency.

“I use the Data Reporting tool because it is very useful to select historical performance indicators and create graphs for internal presentations. In addition, it is very easy to manage. Definitely I would highlight its flexibility.”

David Peral Pozo
Benchmarking Coordinator
Canal de Isabel II

After the desired graphs and/or tables are customised one can easily export the data to several formats for further use. One can choose among others, to export it to Word in order to create a customised report on for instance Asset management or choose to export it as a PowerPoint in order to use the data for presentations within the benchmarking team or to the management of the utility. Export to Excel, PDF and even MP4 are among the different formats as well.
Endnotes

1) **Share of (waste)water bill in household consumption expenditures** is the percentage that the average (waste)water charges per property represents of the calculated household consumption expenditures.

2) **Average water charges** are calculated by dividing a company’s revenues (direct revenues, residential, non-residential, or revenues from exported water), by the number of m3 of authorized consumption, connected properties, or exported water (direct, residential or non-residential respectively).

3) **The total costs** are the sum of capital and running costs. Capital costs are defined as net interest plus depreciation, while running costs include personnel costs plus operational costs (external services, energy costs, purchased merchandises, leasing and rentals, levies and fees, exceptional earnings/losses, other operating costs).

4) **Average wastewater charges** are calculated by dividing a company’s revenue (fees for collecting, transporting and treating the wastewater), by the number of properties connected to the sewer system managed by the utility (in apartment buildings, each household/property is counted separately).
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December 2017
The European Benchmarking Co-operation (EBC) is a non-profit benchmarking initiative that facilitates water & wastewater utilities in comparing and learning from each other. EBC is guided by a Board consisting of representatives from Danish (Danish water utility associations), Dutch Water Program (joint capacity building program of the World Bank and IWA for the Dutch region, Austria), EuroEau (European federation of national water utility associations), Norwat (Netherlands water utility association) and Unlock (Greek water utility association). EBC Foundation annually organizes benchmarking exercises for water & wastewater utilities in Europe and beyond. To build upon the programmes for water utilities in Western Europe, EBC facilitates regional benchmarking programmes in the Danube region in close collaboration with the local national water associations. Participation in EBC's benchmarking programme is voluntary and the programme is aligned with the IWA & AWMA benchmarking frameworks and requires the full participation of the utility. This is provided for a balanced view on utilities’ performance:

- Water quality
- Reliability
- Efficiency
- Sustainability
- Finance & Efficiency

That does EBC's benchmarking programme offer?
EBC offers a learning-oriented utility improvement programme. The programme offers a three stage approach: performance assessment, benchmarking and learning from each other. EBC analyses the carbon footprint and asset management. EBC has developed a Performance Assessment Model with three different levels of depth: basic, standard and advanced. While the basic level offers quite detailed indicators for deeper analysis. Participants can choose the benchmarking level that matches their aspirations and availability.

EBC offers a learning-orientated utility improvement programme. It consists of two consecutive steps: performance assessment and performance improvement. To serve both large and small utilities, experienced and less experienced ones, EBC offers different levels of detail: basic, standard and advanced. While at the basic level only elementary statistics and performance indicators are investigated, the advanced level offers quite detailed indicators for deeper analysis. Both levels choose the benchmarking level that matches their aspirations and availability of relevant information. Two key performance areas are analyzed to provide a balanced view on utilities’ performance:

- Water quality
- Reliability
- Efficiency
- Sustainability
- Finance & Efficiency

To secure the high-quality standard of the programme, the EBC benchmarking team and the participating utilities closely work together on data collection, data quality control and data reporting. In the performance improvement step, utilities meet their peers in the annual benchmarking workshop where they exchange knowledge and best practice in technology, management and operations.

Participants 2017 exercise

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The European Benchmarking Co-operation

The European Benchmarking Co-operation (EBC) is a not-for-profit benchmarking initiative that facilitates benchmarking and learning among water and wastewater utilities in Europe. EBC is a joint initiative of the World Bank and IWA for the Danube region, Austria; and the European Federation of National Water Utility Associations, Wisem (Dutch water utility association), and Watenv (Greek water utility association). Wisem initiated the regional benchmarking programme for the Dutch water utility associations.

EBC encourages utilities to join together to exchange knowledge and best practices. The European Benchmarking Co-operation (EBC) focuses on the following options:

- Benchmarking
- Best Practices
- International Learning from
- Sustainability
- Service quality
- Reliability
- Water quality
- Finance & Efficiency

EBC's benchmarking programme offers a balanced view on utilities' performance:

- Water quality
- Reliability
- Solvency
- Sustainability
- Finance & Efficiency

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