European Benchmarking Co-operation

Learning from International Best Practices

2013 WATER & WASTEWATER BENCHMARK

Participants 2013 exercise

Belgium
- Aquafin
- Brussels Wastewater
- De Watergroep
- Pidpa
- Société wallone des eaux
- VIVAQUA

Denmark
- VCS Denmark

Estonia
- Tallinna Vesi

France
- Eau de Paris
- STEA Paris

Germany
- Hamburg Wasser

Greece
- EYDAP S.A.

Italy
- Mediterranea delle Acque
- SMA Torino S.p.A.

Japan
- Sewerage Utility, City of Yokohama

The Netherlands
- AVG
- Brabant Water
- Dunea
- Evides
- Oasen
- PWN
- Vitens
- Waterbedrijf Groningen
- Waternet
- WMD
- WML

Norway
- Oslo kommune VAV

Poland
- Aquanet
- MPWIK S.A. Wroclaw

Russian Federation
- OJSC Mosvodokanal

Singapore
- PUB

Spain
- aqualia / Lleida
- Canal de Isabel II Gestión

Sweden
- Sydvatten A.B.

Switzerland
- SIG

United Kingdom
- Dwr Cymru Welsh Water
- Northumbrian Water
- Severn Trent Water
- Yorkshire Water

United States
- Charleston Water System

Cover photo: El Atazar Dam & Reservoir, Spain.

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Foreword

Now, in its seventh year of existence, EBC's benchmarking programme has entered a challenging phase.
Next to its core activity – organising annual benchmarking exercises for water- & wastewater utilities in (primarily) Western Europe – EBC has expanded activities in 2012 to Eastern Europe and Africa and became involved in benchmarking projects in Romania and Kenya. Furthermore, in 2013, requests for assistance to establish and implement national/regional benchmarking programmes have been received from colleague associations in Bulgaria and Poland, from the EU Task Force for Greece and from the World Bank/IAWD related to the Danube Water Program.
All this clearly demonstrates that demand for benchmarking – a tool to improve water services – is growing. It also shows that in a relatively short period of time, EBC has become a renowned initiative in benchmarking and performance improvement and is accepted as a valuable partner for national water utility associations and governmental institutions.

Western Europe: EBC's core market

In Western Europe, EBC's benchmarking programme continues to attract utilities who want to compare their performance with their peers and who are eager to participate in a utility network where they can learn from best practices and innovative solutions. In 2013, 40 companies from 18 different countries joined EBC's annual benchmarking exercise. Over 80 utility company representatives actively participated in the traditional benchmarking workshop which this time was co-organised by host company Canal de Isabel II Gestión from Madrid.

Benchmarking through national/regional hubs

Over the past few years, EBC has experienced that water utilities from Eastern European countries hesitate to join the programme due to language barriers, significant performance differences and cost levels. Recent trend however is that these utilities more and more want to connect to the Western European network in order to benefit from Western performance references and good practices. Responding to this trend, EBC and ARA, the Romanian national water association, some years ago outlined a plan to facilitate – in a joint effort – benchmarking in Eastern Europe with EBC in a role as knowledge-, training- and service centre and ARA or other involved national water associations as primary responsible body for the benchmarking, running exercises as much as possible by themselves (local ownership).

The recent calls for assistance from Eastern Europe now offer a unique opportunity to further develop the European benchmarking network in this direction (capacity building), in a joint effort with national water associations and financiers.

EBC Foundation

Last year EBC announced plans to transform the present Project Consortium into a Foundation to better secure the focus on the core activities, to operate more independently and to reduce financial risks for the founding partners. This transition takes more time than expected; the increase of market demands from Eastern Europe and – connected to that- the necessity to upgrade (and finance) EBC's data systems asks for a thorough preparation. It is anticipated that the establishment of the new Foundation will take place shortly.

EIP Water Action group

EBC is convinced that the benchmarking instrument helps to improve performance of the European water sector and contributes to reaching the EU-targets, for instance in the area of resource efficiency. To get a "European status" for the EBC Foundation and increase EU-funding options, EBC has applied for the status of an EIP Water Action Group. Through this instrument, the programme can further develop, for the benefit of the industry and its stakeholders.

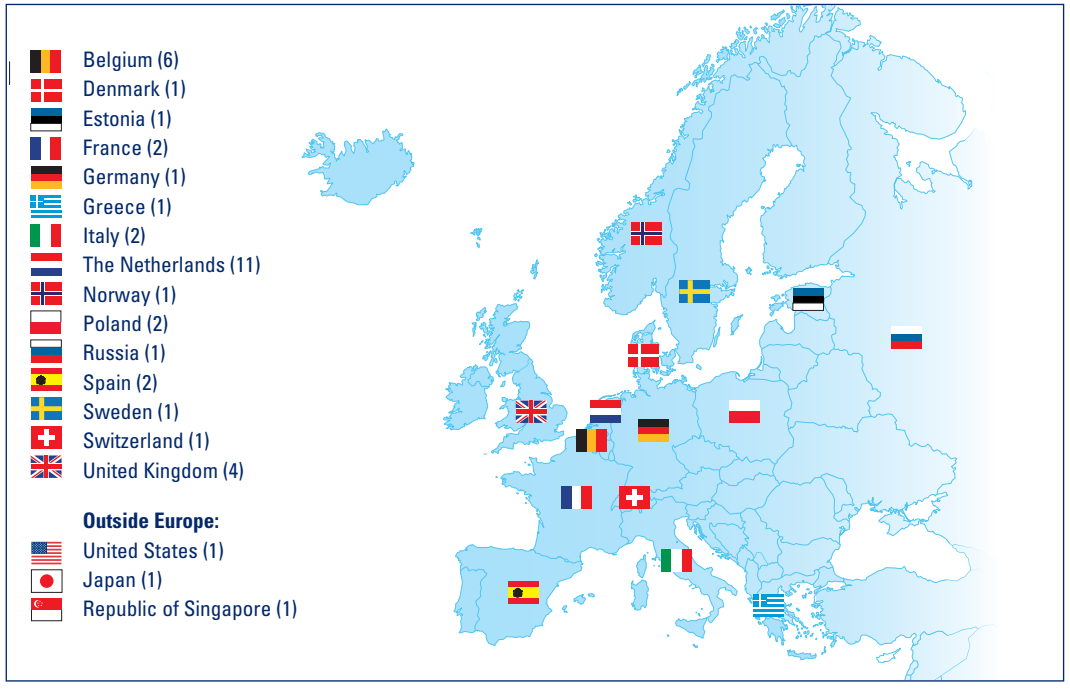
To conclude, we expect 2014 to be a challenging and successful year for EBC again!

Carl-Emil Larsen, CEO DANVA
(Danish Water and Wastewater Association)
Chairman of EBC's Steering Committee

Introduction

EBC's international benchmarking exercise 2013

Since 2007, the European Benchmarking Co-operation (EBC) operates an international benchmarking programme with the objective to improve water- & wastewater services. In 2013 EBC organised its seventh international benchmarking exercise, welcoming 40 participants from 18 countries. Three of these utilities are from outside Europe (Japan, Singapore, United States). This year's exercise analysed data concerning 2012. The project was coordinated by Vewin (Association of Dutch Water Companies) and supported by Accenture.



Early 2013, European water utilities were invited to join EBC's benchmarking exercise. On the 8th of May, 11 delegates of different companies attended the orientation & training workshop in Copenhagen. Eventually, 40 utilities decided to participate and data collection started in June, using the dedicated EBC internet portal. After the initial collection phase, data were subjected to three rounds of analysis and correction, resulting in a validated data set used for the final company reports and this public report.

To make the benchmarking programme accessible for all water utilities, EBC developed three levels of participation (basic, standard and advanced). The different levels make participation interesting for water utilities with very advanced data collection, as well as companies that have just started collecting basic performance data. EBC supports the participating utilities with the data collection- and validation process to assure high data quality.

In the current benchmarking exercise, several improvements have been made in reporting the results to the participating utilities. First of all, Climate Footprint was featured for the second time. After a first pilot in 2012, the current exercise took the Climate Footprint analysis a step further. Secondly, extra information on running costs was included for a better interpretation of the finance & efficiency results.

On the 24th and 25th of October, over 70 delegates of the participating utilities gathered in Madrid for the annual EBC workshop hosted by Canal de Isabel II Gestión, S.A. The annual two day event provides participants with a platform where they can discuss performance gaps and exchange good practices and ideas for improvements and innovations. A total of fourteen sessions were dedicated to the numerical results of the benchmarking exercise (performance assessment) and to best practices (performance improvement). Accenture, together with EnergyPoints, hosted a presentation on energy productivity and environmental performance. Royal HaskoningDHV presented on the NEREDA-process, a remarkable technological innovation leading to reduced energy consumption and lower costs. Host company Canal de Isabel II Gestión, S.A organised a very insightful visit to its storm water facilities and to one of its wastewater treatment plants.

After the workshop and the last corrections in the database, final reports were sent out at the beginning of December. Participants can generate additional reports using tools available on www.waterbenchmark.org, tailoring the data set used to their specific needs.

The delegates of the 2013 EBC workshop in Madrid

DRINKING WATER

Drinking water

This section contains an overview of this year's performance assessment on drinking water services. Data of other services that the participating companies provide (i.e. wastewater) are excluded. The EBC programme distinguishes five performance areas: water quality, reliability, service quality, sustainability and finance & efficiency. Additionally, specific attention is paid to indicators relevant to asset management. This report shows a subset of the available performance indicators for the drinking water service to illustrate the key findings.
The group of utilities that participated in the 2013 exercise is different from the group of utilities that participated in 2012. Hence, the current group level results cannot be compared with those from last year's exercise. In the individual company reports, however, companies can track changes both in their own and in their peers' performance.

Water quality compliance is high

Water quality is generally seen as the most important aspect of the drinking water service. People need clean and safe water as a basic necessity. 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 an absolute comparison of this area. However, the variation between the national standards is limited, since the majority of the participating utilities originates from Europe, where national standards are based on the European Drinking Water Directive. Water quality compliance is very high across the EBC group. Most companies score close to 100%. 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 public health is at risk.

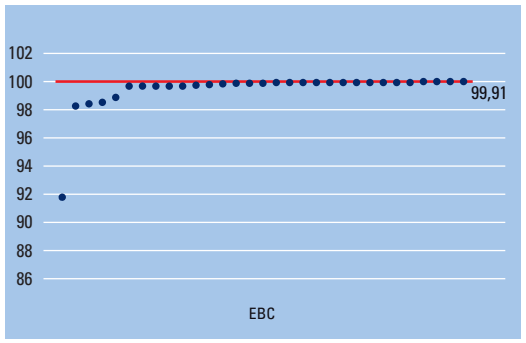


Figure 1: Quality of supplied water (%)

Each data point represents the score of a participating utility. The horizontal line shows the median value. According to the programme's Code of Conduct performance comparisons in this public report do not show participants' names. Note that the number of data points varies per figure, because not all participating utilities have submitted a full dataset.

Reliability varies largely

Reliability is a second essential aspect of a drinking water service. Customers expect a continuous supply of clear and safe 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 EBC group. A large group of participants is clustered around the median value of 12 failures per 100 km mains, per year. Factors that might influence the mains failure rate include network condition, age, soil condition, traffic load and water pressure.

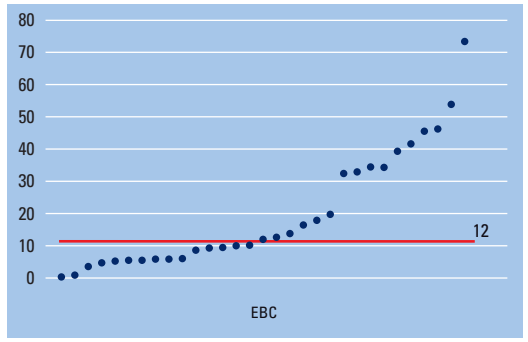


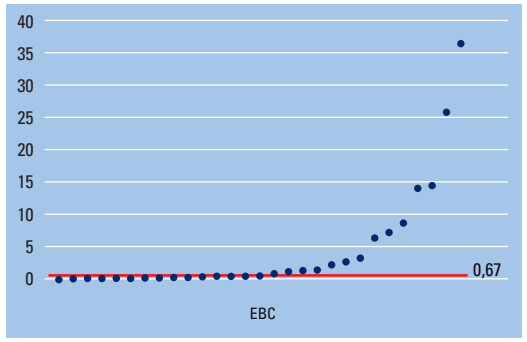
Figure 2: Mains failures (No./100km)

In addition to mains failures the programme also considers distribution losses and customer minutes lost, to determine reliability from the perspective of the customer.
It is worth mentioning that an improvement in monitoring may (at first) cause an increase in mains failures, as more failures are properly registered.

Service Quality good, with quite some room for improvement for some

If the service of a water utility is not up to the customer standards, the customer can file a complaint. Hence the number of complaints filed by utilities' customers is an adequate measure for service quality. Figure 3 displays the complaints that 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 measured but not taken into account in this indicator. The majority of the EBC group scores very well with a median of 0,67 complaints per 1.000 properties.

Figure 3: Service complaints per connected property (complaints/1000 properties)



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

Sustainability

Sustainability is a key point on the agenda of any (water) utility's agenda. 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: households spend around 0,6% of disposable income on water services

Water is a basic necessity, and customers usually do not have a viable alternative for their local water supplier. This unilateral reliance leaves it to the utility to make sure its product is affordable. Therefore, EBC measures social sustainability of the drinking water services by showing the water bill as a share of the disposable household income. In the current EBC group this ranges from 0,28% to 1,00%, with a median of 0,61%.

Environmental sustainability: large variations in electricity use

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 5 shows the electricity used by pumps for abstracting, treating and distributing water, per m^3 that is produced. The use of electricity is influenced by the type of water resources, service area geography and the type of treatment processes. Pumps are the most voracious consumers of electricity, which makes their efficiency an important factor in the electricity use. This benchmarking exercise shows a median electricity usage for pumping of 0,46 kWh per m^3 water produced.

Figure 4: Share of water bill in disposable household income (%)

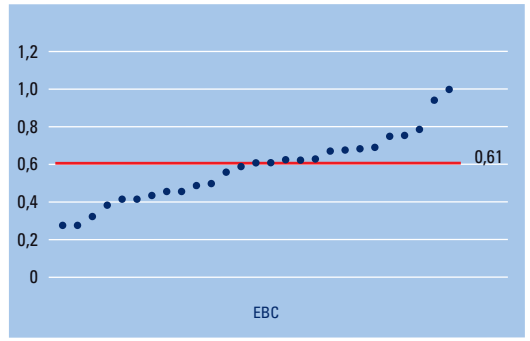
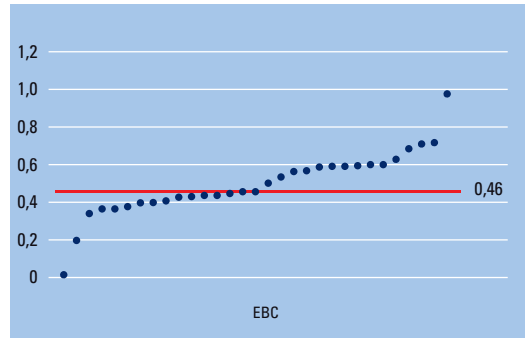


Figure 5: Electricity use per m^3 water produced (kWh/m^3)



Last years' edition of the EBC benchmark featured a pilot climate footprint analysis, which has been extended in the current exercise. The climate footprint analysis measures the total set of greenhouse gas (GHG) emissions related to the drinking water service. This is for instance measured by the kilograms CO_2 per m^3 direct revenue drinking water. The participants of this years' EBC exercise show a broad range of scores from 0,01kg to 0,50kg CO_2 equivalent per m^3 drinking water, with a median of 0,19kg.

This years' pilot paid extra attention to scope 2, which consists of the indirect GHG emissions from the consumption of electricity. Water companies that deliver renewables to the grid (or to other third parties) avoid fossil energy and are granted with emission reductions.

Economic sustainability

While ensuring a safe, reliable water supply, and taking their environmental footprint into account, water utilities also need to make sure their activities are economically sustainable. In basic terms this means having sales revenues cover total costs by a ratio of 1 or more. A little more than half of the EBC participants meets this criteria. 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 in the long run.

Figure 6: Climate footprint per m³ direct revenue drinking water (kg CO_2-eq./m³)

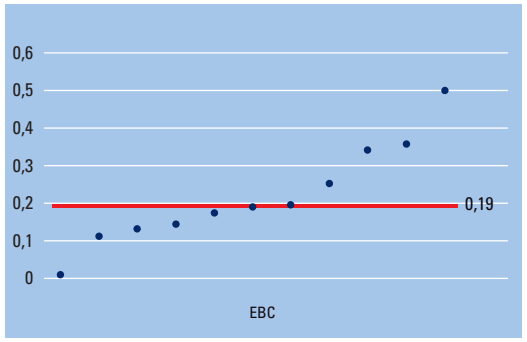
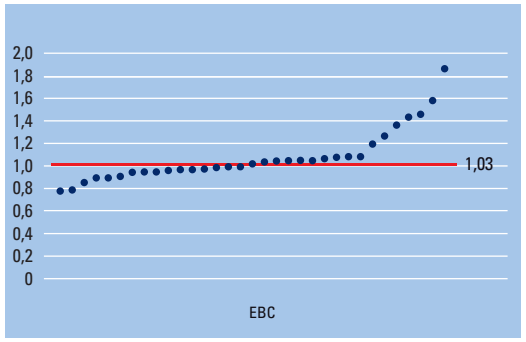


Figure 7: Total cost coverage ratio



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 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 m³ a household actually pays will often depend on its consumption. The median price of water for the current EBC group is € 1,28 per m³.

Personnel intensity is a relevant performance indicator on the efficiency side. It is measured as the number of full-time employees per 1.000 properties. The scores on this indicator are computed using a standard of a 40 hour full-time working week. In the current EBC group personnel intensity ranges from 0,41 to 1,41 FTE per 1.000 properties with a median of 0,79 FTE.

Asset management

Water supply is a capital-intensive industry, which makes asset management highly relevant. Monitoring, maintenance and replacement of assets is an important factor in a utility's sustained health. Network age is used as an indicator of asset management (keeping in mind that materials, soil, water pressure etc. should be taken into account as well). A median network age of about 36 years means that the participants' networks are about halfway along their technical lifespan. However, there is a wide variety within the EBC group with mains ages between 21 and 60 years.

Figure 8: Average water charges for direct consumption (€/m³)

Figure 9: Average mains age (years)

WASTEWATER

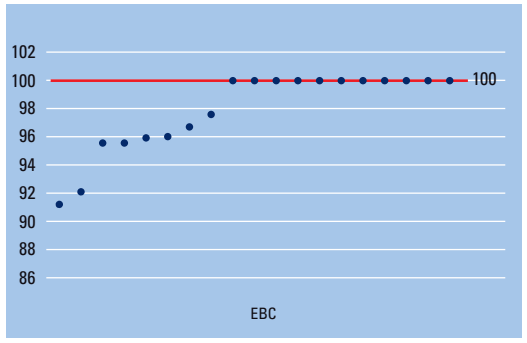
Wastewater

This section presents an overview of the performance comparison of the 2013 EBC exercise for wastewater services. For wastewater, EBC distinguishes the same performance areas as for drinking water: water quality, reliability, service quality, sustainability and finance & efficiency. The data are gathered on the wastewater activities specifically. This means that measures and costs of other services a participant may provide (i.e. drinking water) are excluded. The performance indicators shown in this section are only a subset of the available indicators. The group of EBC participants in 2013 is different from 2012. Thus, the group averages shown in this report cannot be compared with those of the previous year. Companies can track changes both in their own and in their peers' performance in the company reports.

Wastewater Quality: compliance with discharge consents is high

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

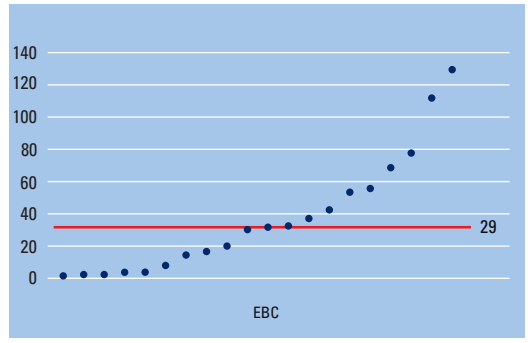
Figure 10: Wastewater treatment plant compliance with discharge consents (%)



Reliability: number of sewer blockages shows high spread within the EBC group

To assess wastewater reliability 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 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 provided by the water companies. Utilities can also reduce blockages by educating customers (especially on the issues of discharging fat and wet tissues). The results on sewer blockages vary widely within the EBC group: between 0 and 127 blockages per 100 km sewer, per year, with a median of 29.

Figure 11: Sewer and connection blockages (No./100 km sewer)



Service Quality: just over 1 complaint per 1000 inhabitants

Service quality for wastewater services is measured using the same indicators as those 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 EBC group scores very well with a median of 1,13 complaints per 1.000 per inhabitants. These complaints can be split into seven categories:

- Blockages
- Flooding
- Pollution
- Odour
- Rodents
- Customer account
- Other

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

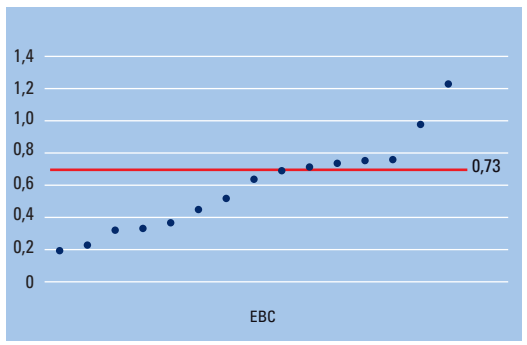
Sustainability

Like drinking water utilities, wastewater utilities are benchmarked for sustainability using the Triple Bottom Line approach, taking into account social, environmental and economic sustainability.

Social sustainability:
households spend less than 0.75% of disposable income on wastewater services

The EBC programme measures the social sustainability of wastewater services by calculating the share of the disposable household income spent on the wastewater bill. This measure gives us a good idea of the affordability of wastewater services, taking differences in wealth between nations into account. The EBC group participants show a wide range from 0,23% to 1,40% with a median value of 0,73%.

Figure 12: Share of wastewater bill in disposable household income (%)



Environmental sustainability

The EBC benchmark measures environmental sustainability with several indicators. Examples are the electricity used for as well as generated from treating wastewater, the percentage of the sludge generated in the treatment process that is utilized in a sustainable way, and the frequency of use of overflow devices to surface water. In this report we reveal the results for the energy consumption of wastewater treatment plants, as this is where energy consumption in the wastewater chain primarily occurs (as the collection of sewage tends to be mostly gravitational). The participants show a fairly distributed energy consumption per p.e. served between 22 kWh and 53 kWh, with a median score of 36 kWh. The energy consumption of the wastewater treatment plants can differ depending on the level of treatment, which in turn depends on local discharge consents.

Figure 13: Wastewater treatment plant energy consumption (kWh/p.e. served)

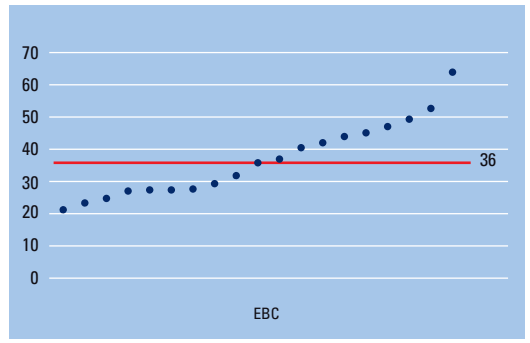
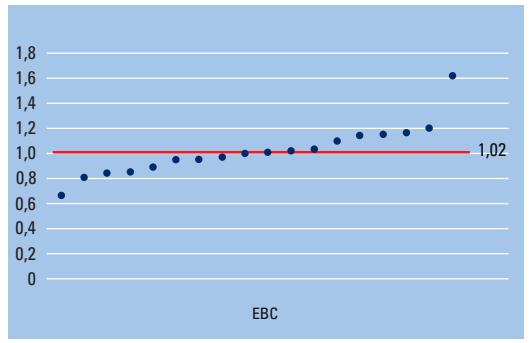


Figure 14: Total cost service coverage ratio



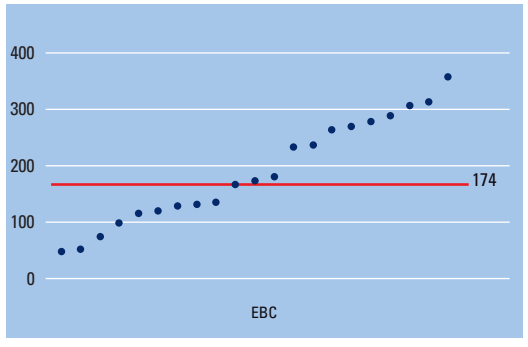
Economic sustainability

Like drinking water utilities, wastewater utilities need to make sure that their activities are economically sustainable. The EBC uses the total cost by sales coverage ratio as 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. A little more than half of the 2013 EBC participants scores above 1, making these utilities – at least for the year of analysis - economically sustainable. The scores range from 0,68 till 1,63, with a median of 1,02.

Finance & Efficiency

Finance & efficiency is a highly relevant topic. Wastewater utilities need to provide a high service at the lowest possible price. The amount of money charged for wastewater services per connected property varies widely among EBC participants. The highest charges registered are over seven times higher (€ 358 per property) than the lowest (€ 51 per property). A similar picture is shown when charges are corrected for purchasing power parity, which corresponds with the distribution we see in affordability. Cost reduction (and, consequently, lower charges) are an important goal for most wastewater utilities. This indicator is a good example of a performance area, where an exchange of best practices could be highly beneficial for many utilities.

Figure 15: Average charges per connected property (€/property)



GOOD PRACTICES

Good practices snapshots

Dwr Cymru Welsh Water (UK) & Oasen (NL)
International employee exchange

Jodie King
Director of HR

In 2013, Dwr Cymru Welsh Water and Oasen Drinking Water agreed to take part in an international employee exchange, providing both companies the opportunity to tap into external best practices. The first exchange took place in October 2013, and involved the companies' distribution teams.

Oasen colleagues were welcomed by Welsh Water's central distribution team who maintain the water network in Cardiff, Newport and the South Wales valleys. They spent a week learning about how the company's many assets, including its network of pipes, treatment facilities, reservoirs and sewers, are maintained, and about the investments Welsh Water are making to ensure the company can continue to provide safe and reliable drinking water to its customers.

In return, colleagues from Welsh Water visited the Netherlands in November 2013 to review like for like Oasen's best practices and operational processes. Chris Jones, chief executive at Welsh Water, said: "The employee exchange provides a development opportunity for both the employees involved and for the overall business. We will use the exchange as an opportunity to encourage development of our staff by giving them experience in different working environments. "We hope the visit inspires staff from both organisations to enhance innovation and share best practices." Mario Wildschut, operations manager at Oasen Drinking Water added: "The employee exchange will be inspiring and give fresh, new energy to professionals operating within the water industry. Sharing knowledge is a smart, fast and efficient way to bring the water industry to the next level of innovation."

Oasen Drinking Water is a public company, owned by the local government in Holland. It employs 245 people and provides drinking water to 750.000 customers in the Netherlands. Welsh Water is a not-for-profit company responsible for providing over three million customers with a continuous, high quality supply of drinking water and for taking away, treating and properly disposing of the wastewater.

Oasen and Dwr Cymru Welsh Water distribution staff meeting up in Wales

Canal de Isabel II Gestión (Spain): Best practices in energy purchase

Fernando Arlandis
Deputy Director of Studies, Programmes and Corporate responsibility

Canal de Isabel II Gestión is responsible for the management of the entire water cycle within the Madrid Region in Spain. The goal of the company is to provide safe water to all its customers, and to actively contribute to the protection and improvement of the environment.

"Our company has been actively involved in the EBC program for the last four years, seeking not only a reference to our performance, but what is more important, being part of the network of European companies with more interest in improving their performance in all management areas.

At Canal de Isabel II Gestión, we highly value internal initiatives to improve processes and performance in all our activities, rewarding innovation and promoting best practices. We have identified 10 areas for improvement on which all employees are evaluated.
In this sense, we consider our company's participation in the annual benchmarking workshop as enthusiastic and motivating, because it allows us to explore innovative ways to solve our everyday problems.

In this year's edition, we decided to show our electricity purchase process, sharing our best practices in this area. Canal de Isabel II Gestión is a major consumer of electricity (around 450 GWh/year). However, due to southern European weather conditions, our electricity consumption varies heavily depending on actual rainfall and water reservoirs levels.
Dry years imply lower water intake to the reservoirs and greater use of alternative resources (pumping from rivers and wells). Due to this fact, last year electricity consumption rose significantly.
We also have a considerable generation capacity. Canal Gestión is the company with the largest installed capacity for production of electricity in the Region of Madrid: 81 MW. We have a balanced generation mix due to the fact that our hydro generation of electricity varies among years in the opposite direction from our electricity consumption. In addition to hydro-power, we also have cogeneration, bio-gas and micro-turbine generation facilities that are more stable sources of electricity generation.

Purchasing strategy: fixed vs. indexed price

Fixed price solutions give the ability to secure a set price per kWh during a designated contract term. Fixed price is a common buying option when seeking budget certainty. This certainty comes at a cost, which reflects the variable risk the energy provider must take on by offering a fixed price over a period of time. Timing is also important, because price varies throughout the year.
Up to 2012, we had a simple purchasing strategy: we issued a tender in September for next year's consumption in one "single shot". We used a fixed price scheme for approximately 500 facilities and all tariff periods (peak, base, valley), and eventually the signing process took at least two months. In 2013 we realised savings and better prices by reducing open positions for suppliers, through unbundling administrative-technical and economic aspects in the tender. This produced a comfort letter for provisional suppliers, and setting two rounds for the price auction. We established a € 500,000 reductions in the second round.
We have realized that the moment in time that you ask for a price is the main variable that will affect your electricity price. In our last tender, for 2014, some other measures were taken: selecting the "least margin" supplier first, and then choosing the best days to close the price in the market with 6 "clicks", closing a sixth of our estimated consumption at a time (a click is a closing order to the electricity broker to lock in a set price). This way, we have been able to obtain an average price based on six purchasing prices instead of a price in a single moment. Doing so, we are managing our price risk in time. Multi-click choice improves the price, but has a limit. Indexed Prices are lower in the long term. Additionally, you can convert an indexed price into fixed too.
In our tender for 2015 we are exploring the "Integrated Approach". We shall do a trial with variable prices, so part of the consumption will be contracted as Fixed Price, and the rest will be contracted as Indexed Price. Due to the fact that we sell our electricity to the same market that purchases our electricity, we will be able to use the "natural hedge" that the electricity market has.

100 kW Micro turbine inside the distribution network (Griñón, Madrid, Spain)

Royal HaskoningDHV (NL)
Nereda® innovative wastewater treatment technology

Arnold Zilverentant

The Nereda® aerobic granular biomass is an innovative wastewater treatment technology for biological nutrient removal that is considered to be a game-changing innovation offspring of the conventional activated sludge process (CAS).

Aerobic granular biomass has several advantages over conventional activated sludge flocs. These include excellent settling ability resulting in better biomass retention and higher biomass concentrations and the ability to withstand large variations in flow and load. As a result compact reactor design reduces plant footprints and total treatment costs significantly.

Following research initiated by Professor Mark van Loosdrecht from Delft University of Technology (DUT), STOWA (Dutch Foundation for Applied Water Research), Royal HaskoningDHV and six Dutch Water Boards joined forces in the Dutch National Nereda Development Program (NNOP). To scale-up the aerobic granular biomass technology for municipal applications, at Epe WWTP a Nereda® system was implemented. In parallel two Nereda® demonstration plants (Gansbaai, South Africa and Frielas, Portugal) were instrumental in the scale-up.

The Epe WWTP was designed and constructed by Royal HaskoningDHV in 2010-2011 Three Nereda® reactors handle flows of on average 8.000 m^3/day and with peaks of 36.000 m^3/d. The plant has to meet stringent effluent limits even at temperatures of 8°C. For start-up the influent to the Nereda® system was progressively increased to 100% over a period of four months, whilst granules were building-up within the bioreactors. This 'granulation period' included winter months with wastewater temperature well below 10°C. The full scale results showed not only the average but even the 95%ile figures meeting the stringent demands. Industrial discharges create large fluctuations in the feed, most notably pH-values frequently peaking above pH 10. Such peaks caused complete loss of nitrification in the CAS system.

The Nereda®, showing remarkable process stability, was never influenced by these peaks. A key advantage of Nereda® is the reduced power consumption. At Epe, the introduction of the Nereda process reduced the energy consumption from 3.500 kWh/d to 2.000-2.500 kWh/d.

A benchmark proves this to be >40% less compared to similar sized conventional plants in the Netherlands. This energy efficiency was also shown at the demonstration plant at Frielas. The Frielas WWTP is a 70.000 m^3/d plant in Greater Lisbon, suffering from several operational constraints, especially bulking sludge. To validate the applicability of Nereda one of six CAS reactors was retrofitted into a Nereda® to run in parallel to the remaining five.

Main drivers were:

- providing a robust and efficient operation under realistic field conditions;
- achieving a substantially lower electricity demand;
- evaluating the feasibility of applying higher hydraulic loads and achieving nutrient removal without future need for increasing reactor volume.

The Nereda® proved to achieve a much better stability, better effluent quality (at 2,5 times the loading rate) and nearly 50% reduction in overall energy consumption (of which 35% through more efficient aeration). Additional benefits of Nereda® have proven to be its stability at high and fluctuating salinity and the high degree of recovery of biopolymers or alginate.

Nereda® is currently applied at a dozen industrial and urban wastewater treatment plants, all showing significant improvements with regard to process stability, effluent quality (typically TN < 5 mg/l, TP <1 mg/l), and energy savings (>35%), compared to CAS processes. Another 40 plants are in various stages of design, construction, and commissioning in countries like The Netherlands, Australia, Poland, South Africa, England, Ireland and Brazil. With tank-sizes similar to the world's largest SBR tank volumes, the technology is mature and ready to be applied. It can meet stringent demands at appreciable lower CAPEX and OPEX, and smaller footprints than existing solutions (for more info: nereda@rhdhv.com).

PARTICIPANTS EXPERIENCES

Participants' experiences

Sewerage Utility of the City Yokohama (JP)

Shuhei Okuno
Manager of Sewerage Project Coordination Division, Sewerage Planning Coordination Department Environmental Planning Bureau

In 2013 EBC welcomed a participant from Japan: the Sewerage Utility of the City Yokohama. With a population of 3,7 million the City of Yokohama is the 2nd biggest city in Japan. The Sewerage Utility of the City Yokohama is the second utility from Asia in the predominantly European EBC programme.

We asked Shuhei Okuno how they came in contact with EBC, what the current state of benchmarking in Japan is and what their first impressions are of the EBC programme.

"Last year the Japanese Ministry of Land, Infrastructure, Transport and Tourism (MLIT) set up the study committee on benchmarking for wastewater utilities. In this committee, we studied various examples of benchmarking initiatives, of which one was the European Benchmarking Cooperation (EBC). As part of the activities of the study committee, an international seminar on benchmarking for wastewater utilities was held in Tokyo in February. One of the keynote speakers brought us in contact with EBC.

Recently a study of nationwide benchmarking in Japan was initiated. We are currently preparing for a trial benchmark which targets 64 sewerage utilities. The trial project will be finished before the end of March and we plan to expand the target scope to all the sewerage utilities, numbering approximately 1,500 utilities nationwide.

We were really impressed by the diversity of EBC's utility network, which comprises municipal companies, public corporations, private companies and other organizations that are responsible for water and/or sewerage works. The presentations were also very useful. The sewerage utilities in Japan are not accustomed to benchmarking. Hence presentations of the benchmark learning-tension curve and analysis methods for energy management will be very useful for convincing the sewerage utilities in Japan to get started with benchmarking.

Through the benchmarking activities, we hope to share the challenges in sewerage management with other participating companies and find out about other insights on issues in the wastewater sector."

Northumbrian Water (UK)

Rachel Kirkup
Investment Evaluation Manager

Northumbrian Water is one of 12 major utilities supplying water and wastewater services in the United Kingdom. In 2013 the company participated in the EBC benchmarking exercise for the first time. We asked Rachel Kirkup about Northumbrian Water, its reasons for joining and how they expect to benefit from the EBC benchmark.

"Northumbrian Water treats and supplies drinking water to over 4.5 million customers across 3 separate geographic regions (300,000 in Suffolk, 1.5 million in Essex, and 2.7 million in Northumbrian) along 25,600km water mains. We also provide wastewater collection and treatment services to over 2.6 million customers through 16,700km of public sewers (or 30,000km including private drains and sewers).

We first came across EBC when our Financial Economic Regulator became aware of other UK water companies participating in EBC. EBC was identified as an ideal alternative when our regulator, OFWAT, recently scaled down its benchmarking activities. Joining EBC was a natural choice for us, as it is fuelled by like-minded individuals, and progressive companies driven by performance improvement aspirations.

We all aspire to be industry leader and use benchmarking to celebrate our achievements, but aspects of benchmarking provide an opportunity for you to tackle your weaknesses head on. Benchmarking forces you have a cold hard look at yourself, and motivates you to investigate and understand what truly drives your performance. Understanding your weaknesses naturally leads you seek out opportunities for improvement and ultimately best practice.

Joining EBC this year has allowed us to benefit from broader European performance data outside of the UK water industry, helping us re-evaluate our own performance, and target new areas for improvement.

During the EBC workshop in Madrid, we have been able to discuss performance issues amongst a much wider range of peers (previously limited to companies in the United Kingdom). The conference has given us a platform for sharing and learning with other organizations their experience, innovation and best practice."

Sydvatten AB (SE)

Fedja Rustempasic
Development Engineer

Southern Sweden Water Supply, Sydvatten AB, is a bulk drinking water company located in southern Sweden. Sydvatten AB is the only bulk drinking water company participating in this years' benchmark. We asked Fedja Rustempasic about Sydvatten AB, why they joined the EBC programme and how they experienced the EBC benchmarking exercise.

"Sydvatten AB is located in southern Sweden and is owned by 16 municipalities. The company was founded in 1966 and is the second largest water producer in the country, supplying drinking water to approximately 900.000 inhabitants. The company is subject to both municipal laws and the law of public water services, which means that Sydvatten AB is a non-profit company. In 2010 Sydvatten AB founded a research and development department, which has close ties with the Lund University, to gain long-term knowledge about water within urban society development.

The CEO of Sydvatten first heard about EBC during a visit to the Association of Dutch Water Companies (Vewin). Sydvatten AB has been involved in several national benchmarking exercises which are initiated by the Swedish trade organisation and only look at few specific areas (i.e. the usage of electricity within the water utilities).

Sydvatten AB wanted to get involved in international benchmarking, hence the EBC. This in order to widen the awareness of the company in existing drinking water related issues and trying to identify potential for improvement. Sydvatten AB is hoping to identify improvement potential in order to rationalize its utilities for water production and distribution, hence continuing to be one of the leading water production companies.

We would like to express our gratitude to the workshop host (Canal de Isabel II Gestión) for their kind hospitality. The overall impression of the benchmarking workshop was good, but we could identify a large obstacle when it comes to comparison with other utilities concerning the distribution process. This of course is due to the fact that we are a bulk company. It would be beneficial to us if there were other bulk companies participating in next year's EBC workshop."

Endnotes

1) **Share of (waste)water bill in disposable household income** is the percentage that the average (waste)water charges per property represents of the calculated household disposable income. The household disposable income is the amount of income left to a household after taxes have been paid, available for spending and saving. EBC's source for the calculation of household disposable income is Eurostat. It is calculated as the product of the mean equivalised net income (household income per adult equivalent) and the average number of adult equivalents per household.

2) **Average water charges** in EBC are calculated by dividing a company's revenues (direct revenues, residential, non-residential, or revenues from exported water), by the number of m^3 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** in EBC 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).

Colophon

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EBC

The European Benchmarking Co-operation

The European Benchmarking Co-operation (EBC) is a not-for-profit partnership of four European national water associations - DANVA (DK), FIWA (FIN), Norsk Vann (N) and Vewin (NL) - targeting at improving water services (water & wastewater). On behalf of the partners, Vewin coordinates the benchmarking programme. For Germany, aquabench GmbH acts as a regional EBC-hub. The University of Graz holds the same position for Austria. The mission of EBC is to provide a learning platform to interested (European and other) water utilities. Since 2007, EBC annually organises benchmarking exercises. Participation is on a voluntary basis. The EBC programme is aligned with the IWA & AWWA benchmarking framework and applies the IWA Performance Indicator System. This provides a standard for exchange between programmes.

What does EBC's benchmarking programme offer?

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 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. Participants can choose the benchmarking level that matches their aspirations and availability of internal information. Five key performance areas are analysed to provide a balanced view on utilities' performance:

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

Next to these key areas, EBC analyses the asset management area in particular.

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 practices in technology, management and operations. Last but not least, EBC encourages utilities to prepare Performance Improvement Plans for the implementation of improvement measures.

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