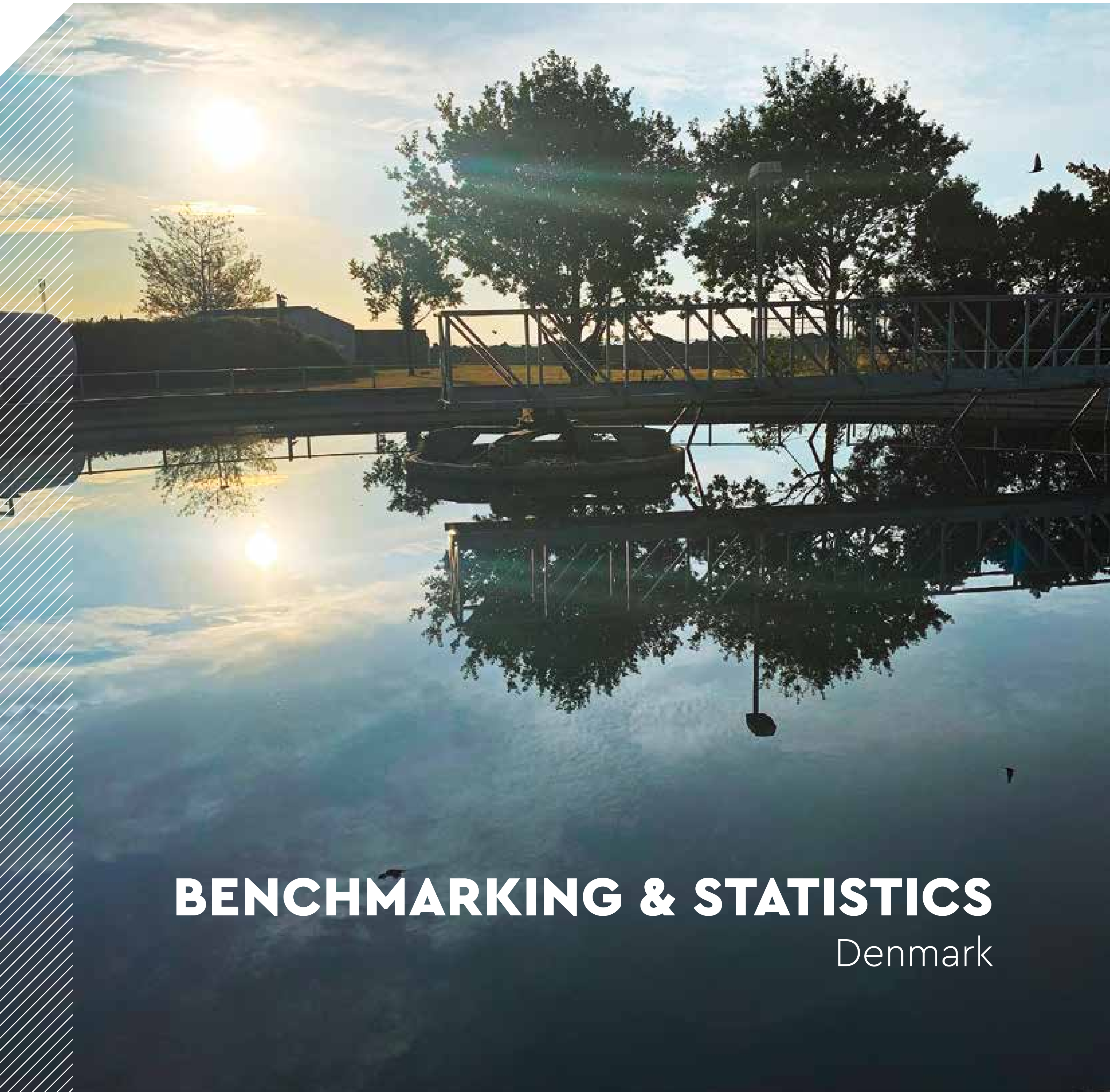
DANVA

WATER IN FIGURES
2020



BENCHMARKING & STATISTICS
Denmark

EDITORIAL

TEXT: CARL-EMIL LARSEN/ **PHOTO:** DANVA

The water sector as energy and climate neutral

The climate action plan for the water sector emphasises the message that Danish water technology can help find solutions to global climate challenges. The ambition of the political parties behind the agreement is for the water companies in Denmark to be energy and climate-neutral. The key figures for the water sector show that the water companies are already well on the way to achieving this.

The Danish Parliament has resolved that Denmark should reduce its CO2 emissions by 70 percent by the year 2030. The main greenhouse gas emissions from the wastewater sector derive from nitrous oxide in the treatment process. Nitrous oxide is 298 times more harmful to the ozone layer than CO2.

DANVA's members are already well advanced in the process, and DANVA's new strategy for 2020–2024, adopted by the annual general meeting in May, is a stepping stone on the way towards a climate and energy-neutral water sector. The water companies are part of the green transition through the innovation of resource efficient, digital and holistic solutions. These focus on greater efficiencies, energy optimisation, reduction of greenhouse gases and the production of green and sustainable energy. Equally, DANVA's members are seeking to become climate-neutral and thereby help meet the ambitious objectives set for Denmark.

The water companies are also ambitious concerning the requirements set by society for managing wastewater discharges. The summer of 2020 has seen a debate on overflows and discharges and, although the sector is only responsible for 10 percent of the average nitrogen outlet into aquatic environments (whereas agriculture is responsible for 60–70 percent), it is nevertheless critical that the situation meets the requirements of a modern society. If better treatment of wastewater is what is desired, the politicians must make the necessary demands.

Measured in fixed prices, the amount paid by an average household for drinking water and wastewater has remained very stable over the last 10 years. In 2019, an average family with average consumption paid € 757 for drinking water and wastewater, representing a decrease of 2% compared with 2018. Although the price of water rose on average by 2.6% to € 9.55/ m^3, this increase was offset by a drop in water consumption, which achieved its lowest level so far of 101 litres per person per day.

DANVA's benchmarking shows that the water companies act in an optimal manner and exactly in line with the wishes of the politicians at Christiansborg. It therefore makes a lot of sense to lower the bureaucratic burden on the water sector, which devotes a lot of resources to unnecessary administration and documentation. If the tariffs are reasonable, the targets met, and water customers satisfied, politicians should work to create a less zealous, resource consuming bureaucratic system, which, after all, only results in higher costs and higher water prices.

The key figures also show that Danes have access to tap water practically 24 hours a day, 365 days of the year. In 2019, average availability was in excess of 99.99 percent. Danes, on average, were without access to water for only 40 minutes out of the 525,600 minutes of the year.

Denmark has one of the lowest levels of water losses in the water distribution systems in the world and, apart from a slight increase in 2018, due to the very dry summer, water loss is again right down. In 2019, it was down to 7.29%.

Water companies are among society's most important actors and, with their targeted, efficient management, fully meet the expectations of customers, authorities and regulators. ■

DANVA and DANVA Benchmarking

DANVA, the Danish Water and Wastewater Association, is an industry organisation for drinking water companies and wastewater companies in Denmark. DANVA is a non-profit association, funded by its members and through income generating activities.

DANVA has been offering benchmarking to its members for almost 20 years. Benchmarking is a tool to provide an overview of the company's performance and to identify DANVA and DANVA Benchmarking areas where efficiency can be improved. The reporting to DANVA Benchmarking and Statistics forms the basis for the preparation of this publication. In total, 162 drinking water and wastewater companies have participated in the reporting to "Water in Figures 2020", with data from 2019. The participating drinking water companies collectively supply water to around 60% of the Danish population. Collectively, the participating wastewater companies handle and treat water from around 80% of the Danish population.

How much does water cost?

Half a litre of drinking water from the tap costs less than

0.48

cent

"How much does water cost?" and "Why does water cost what it does?". These are two good questions which DANVA is often asked and they are not that easy to answer. The price of water is not the same throughout the country. On the one hand, there are structural differences, such as geological conditions, different customer bases and large differences in investment needs, and on the other hand, the composition of the price may vary from company to company.

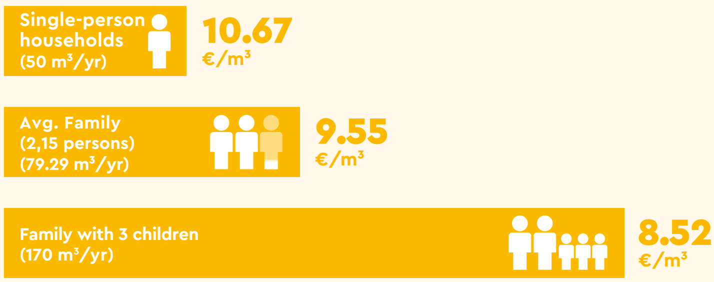
Legislation states that the companies are permitted to charge a fixed annual administrational fee and must charge a variable fee per m³ of water consumption. The pricing scheme therefore has a major bearing on the cost of one m³ of water consumed. Some companies charge a fixed annual base charge on water and/or wastewater, while others only charge for the amount of water consumed, and this results in considerable variation when the price for one m³ of water consumed is calculated. The fixed, annual base contribution is paid per household (and not for example per person). A set consumption amount must therefore be assumed in order to be able to state the cost of one m³ of water consumed. This is why we calculate that average price, is which an average household would pay based on average consumption. In this way, we can compare the price across companies regardless of the pricing scheme each company uses.

The average price for water in Denmark in 2019 was € 9.55 per m³, based on an average household size of 2.15 people with an average household water consumption of 101 litres per person per day. For a single person, the average price of one cubic meter of water is slightly higher, namely € 10.67 per m³ at a consumption of 50 m³, since the fixed charge increases the average price more at low consumption. The average price per m³ for a family with three children is somewhat lower, namely € 8.52 per m³, based on an annual consumption of 170 m³. The average water price has increased by 2.68% compared with the previous year's price of € 9.30/m³. The increase for the year was attributed to a number of issues, including the decrease in water consumption, which, due to the fixed charge, results in an average increase in the m³ price.

The price of drinking water covers the cost of groundwater protection, abstraction, processing and distribution of drinking water from the waterworks to customers. The cost of wastewater covers the operation and maintenance, renovation and extension of the sewer network, climate protection, operation and maintenance of treatment plants, as well as checks to ensure compliance with discharge requirements before being discharged to the recipient.

AVERAGE PRICE OF WATER BASED ON CONSUMPTION, 2019

€/M³



Simple average, based on 212 drinking water companies and 98 wastewater companies. The price includes VAT and fees. The average water price for 2020, based on the same water consumption as in 2019, is expected to be € 9.71/m³ for an average family.

Why are there differences in the water price?

How much does water cost?

The price of water depends on which water company you use. There are more than 2,500 water utilities and 98 wastewater utilities in Denmark. Contact your local water company to get your water prices.

The water price consists of a total of five elements:

- Fixed charge for drinking water (if any)
- Cubic metre price for drinking water
- Fixed charge for wastewater (if any)
- Cubic metre price for wastewater
- VAT and other fees

Why does the price of water vary?

There is quite a gap between the lowest and highest prices among the water companies. In general, the difference in total prices can be attributed to several factors:

- It can be relatively less expensive to supply water to water consuming industries than small customers, such as holiday homes.
- Geological conditions can make it more expensive to collect water from below the ground.
- In some places, groundwater pollution and scarcity of water resources may mean investing in new groundwater abstraction areas for water extraction.
- Some drinking water companies spend more than others on groundwater protection. Other companies are "born lucky", as their water abstraction areas are already in protected nature areas.
- The treatment requirements for wastewater depend, in particular, on the natural setting of the point of discharge for the treated water. Requirements are often higher for discharge to vulnerable recipients in freshwater areas than for discharge into the sea.
- Decentralised wastewater treatment in smaller plants is usually more expensive than central wastewater treatment at larger ones.
- Environmental conditions requiring additional measures.
- There is a significant difference in the level of investment from company to company. Currently, many companies are investing in new climate change adaptation measures in order to respond to the increase in rain volumes.
- The older a plant is, the more maintenance it requires.
- Differences in the level of service are determined by the municipalities and/or the companies themselves.

101
litres is the average amount of water a person uses per day in a household.

> Selected rules, national plans and reforms that have had an impact on the price and water consumption of a family:
> - 1987: Action Plan for the Aquatic Environment I – the plan was intended to protect the aquatic environment, both groundwater and surface water. The Action Plan for the Aquatic Environment gave rise to the need for major construction and upgrading of wastewater treatment plants.
> - 1993: Tax on tap water (DKK 5/m^3) as well as a penalty tax for drinking water companies with a water loss of over 10% – Act No. 492 of 30/06/1993 (Danish Ministry of Taxation).
> - 1996: Tax for wastewater – Act No. 490 of 12/06/1996 (Danish Ministry of Taxation).
> - 1996: Requirements for installation of water meters – Executive Order No. 525 of 14/06/1996 (Danish Ministry of Climate, Energy and Utilities).
> - 1998: Action Plan for the Aquatic Environment II – the plan was mainly intended to reduce nitrogen emissions.
> - 2004: Action Plan for the Aquatic Environment III – further reduction of nitrogen and phosphorus emissions.
> - 2007: Municipal reform – reduced the number of municipalities from 271 to 98, resulting in the merger of many water utilities.
> - 2009: The Danish Water Sector Reform Act – the separation of municipal water and wastewater supply activities into municipally owned public limited companies (water companies) and the introduction of price caps and efficiency requirements – Act No. 469 of 12/06/2009 (Danish Ministry of Climate, Energy and Utilities).
> - 2011: Introduction of drinking water charge of 8,97 cent per m^3 – Act No. 1384 of 28/12/2011 (Danish Ministry of Taxation).

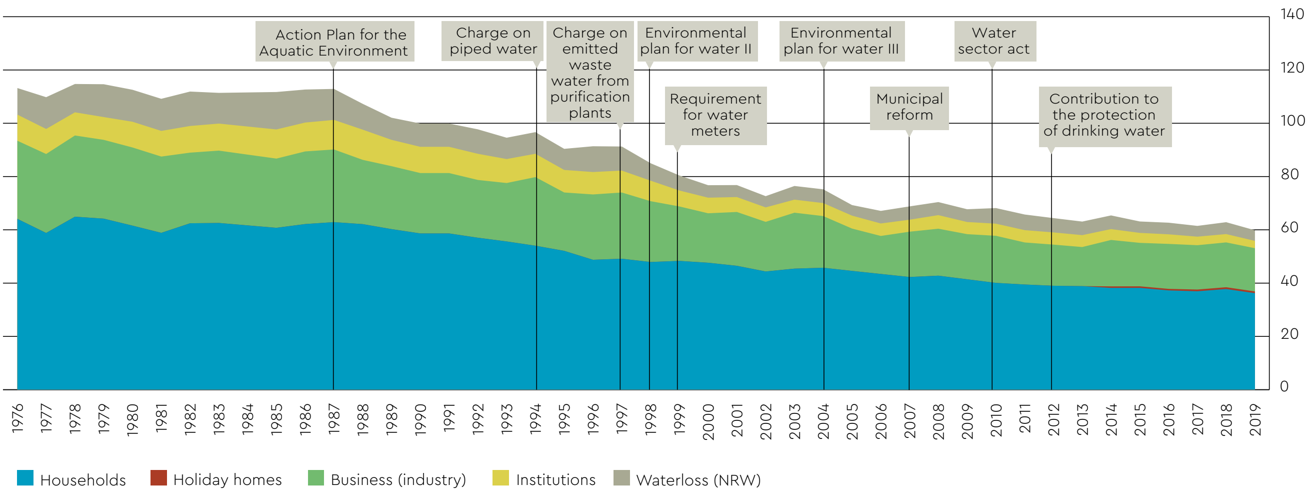
Water consumption reaches a **new record low**

In a household, one person uses on average 101 litres per day, which is a new record low. Since the introduction of Action Plan for the Aquatic Environment I in 1987, average water consumption in households has been constantly decreasing, though with small variations. The record temperatures of summer 2018 resulted in a slight increase in water consumption, but in 2019 it decreased again to its lowest level yet.

Total water consumption in 2019 measured in households, holiday homes, businesses, institutions and through water losses was on average 59.85 m^3 per person per year. Households accounted for 66% of the total volume of water sold. An individual uses an average of 36.88 m^3 per year, corresponding to 101 litres per day. The calculation is based on statistics supplied by 64 drinking water companies, which together serve 3.301 million inhabitants. The graph presents some of the laws and regulations which are believed to have influenced the decrease in water consumption and price trends. At first glance, it appears that Action Plan for the Aquatic Environment I in particular, with increased environmental awareness among consumers combined with an increase in the wastewater tariff, marked the beginning of the decrease in water consumption in 1987. The introduction of a drinking water tax on piped water meant that in the period from 1994 to 1998 one krone was added to the tariff each year. During the same period, domestic water consumption decreased by 10.5%. Water consumption in households decreased by 41% over the 31 years since the implementation of Action Plan for the Aquatic Environment I. ■

CONSUMPTION OF DRINKING WATER, 1976 - 2019

M^3/PERSON/YEAR



Since 2014, a new category of "holiday homes" has been introduced, which is included among the figures for households.
1976–1998: Special project: Modelling of water demand in Denmark by Nana Sofie Aarøe – data from 14–30 companies.
1999–2019: Data from DANVA's calculations for "Water in Figures" – data from 33–116 companies.

Composition of the **water price**

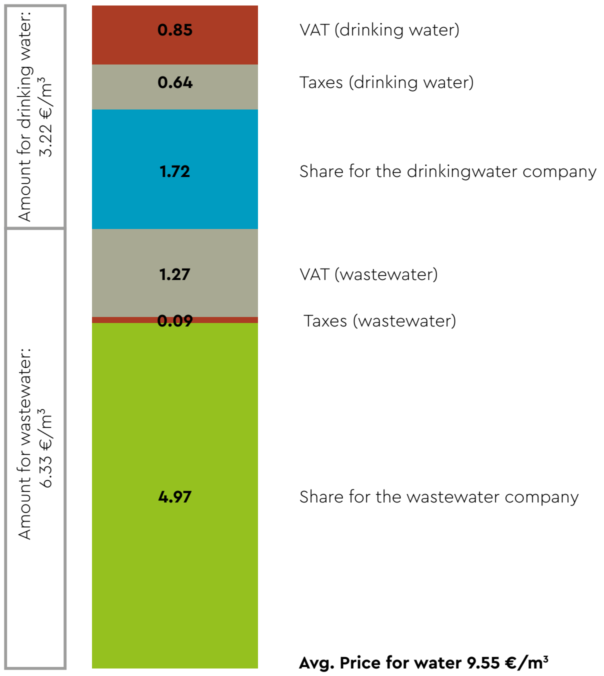
The average water price can be divided into the drinking water company's share and the wastewater company's share, plus VAT and other taxes. The other taxes are a tax on piped water and the wastewater tax.

Out of the total water price of € 9.55/m³, the drinking water company accounts for 18.0%, wastewater accounts for 52.1%, while 29.9% goes to the State in the form of VAT and other taxes. The price breakdown including taxes is as follows:

The work carried out by the drinking water companies comprises groundwater protection, abstraction of water from abstraction areas, processing and delivery of drinking water, and monitoring of water quality. The share of drinking water corresponds to 33.7% of the total average water price, amounting to € 3.22, of which € 1.58 is VAT and other taxes. 32% of the income the drinking water companies derive from the sale of water comes from the fixed charge and 68% from variable consumption. 92% of water companies apply a fixed charge.

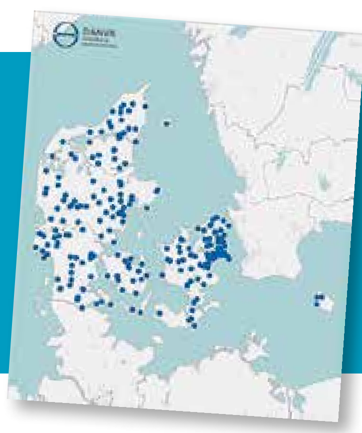
The work carried out by the wastewater companies comprises the operation of sewers, rain and stormwater management, operation of treatment plants and discharge to the recipient. The share of wastewater corresponds to 66.3% of the total average water price, amounting to € 6.33, of which € 1.35 is VAT and other taxes. The income of wastewater companies comes from the sewage disposal charge, which is split into 12% from the fixed charge and 88% from the variable charge. 63% of wastewater companies apply a fixed charge. ■

SHARE OF WATER PRICES BY CATEGORY, 2019



What does your water cost?

On DANVA's website, you will find an interactive map "Vandpriser på danmarkskort" ("Water prices on a map of Denmark"), which shows the water price for the 200 largest water companies and about 100 wastewater companies regulated by the the Danish Water Sector Reform Act. The map shows the m³ prices for drinking water and wastewater and the cost for households with average consumptions of 50 m³, approximately 83 m³ and 170 m³. The map is available at: www.danva.dk/vandprispaadanmarkskort



Discount for large consumers

Based on an economic growth plan adopted in April 2013, a political decision was made to introduce a wastewater discount scheme for industries with a large water consumption. The discount scheme, termed the "Three-Step Tariffs Model" (an incremental model), was phased in from 2014 to 2018 and is based on 3 incremental levels.

- Level 1 is the wastewater companies' regular tariffs for the removal and treatment of wastewater from households and industries.
- Level 2 provides a discount on the regular tariff for water consumption between 500 and 20,000 m³, corresponding to 20% of Level 1.
- Level 3 provides a further discount on water consumption over 20,000 m³ of water, corresponding to 60% of Level 1.

The Three-Step Tariffs Model has affected the wastewater companies in varying ways. It has been particularly important for those wastewater companies that have a greater proportion of large water consuming companies. They have had to give discounts to a large part of their consumers. The political decision assumed that the discount would be covered by greater efficiencies, but experience indicates that residents paid for some of the discount, as the tariffs for Level 1 have risen more than the average for the companies' many industrial customers. ■

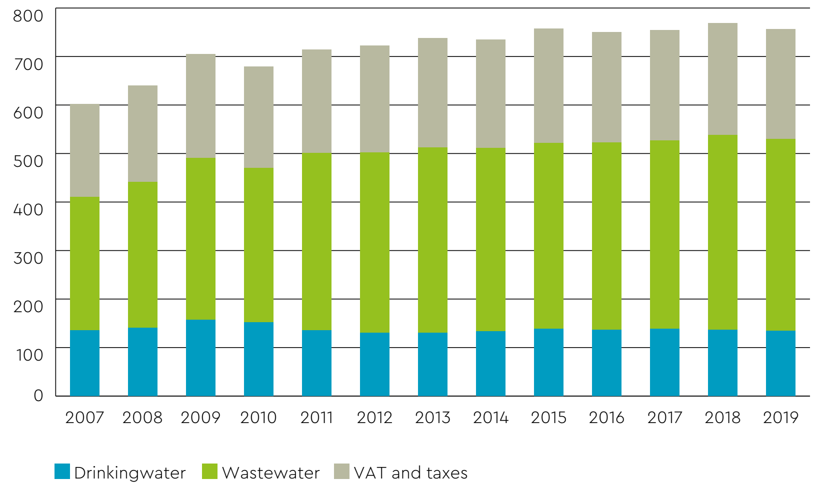
PHOTO: COLOURBOX.DK / GESTUR LEÓ GÍSLASON

Household expenditure on water has fallen

For an average Danish family of 2.15 people, with an average water consumption of 101 litres per person per day, corresponding to consumption of 79.29 m^3 in a year, the household's expenditure on drinking water and wastewater in 2019 was € 757. This is the price for being supplied with fresh, clean, inspected drinking water and for removing the wastewater that is properly treated before being discharged into the natural environment. This represents a slight decrease of 2% compared with 2018, but in general the expenditure of an average family household on water and wastewater has been at a very stable level for many years now. ■

AVERAGE HOUSEHOLD EXPENSES FOR WATER, 2007 - 2019

€/M^3 (2019 PRICE)



The estimate is for an average family of 2.15 people with an average consumption per person of 36.88 m^3/year.

Proportion of income

The United Nations Development Programme (UNDP) recommends that a maximum figure of 3% of gross household income may be used for clean drinking water, and, for drinking water and wastewater together, the maximum should be 5%.

According to Statistics Denmark (FU09), in 2018 the average gross income of a Danish household was € 85,555. The disposable income of an average family was € 59,520 and their annual expenditure was € 43,070. According to Statistics Denmark, such a family spends € 632 on water and wastewater, which equates to 0.74% of their gross income.

Of the expenditure of the Statistics Denmark average family, an amount of € 43,070 (1.47%) is spent on water and wastewater. By comparison, the family spends 2.36% on electricity, 3.77% on district heating, 1.75% on petrol, 1.65% on telephones and internet, 3.77% on clothes, and 4.73% on insurance. ■

We have A DREAM!


LARS THERKILDSEN, CHAIRMAN OF DANVA


ANGO WINTHER, DEPUTY CHAIRMAN OF DANVA

DANVA now has a new strategy with an adapted mission and new vision. The title is "Clean water for sustainable cities and society".

A vision is a goal which is so far into the future that it is hardly visible at present. It is a dream of a better future. And DANVA's dream is "Clean water for sustainable cities and society".

It is a beautiful dream. But, also a challenging one of its kind.

Water (and here we are obviously talking about both drinking water and wastewater) is currently polluted by many different activities and with xenobiotic substances – far too many to name. Despite this, in 2020 the water companies are delivering clean water to customers in Danish homes and to recipients in the Danish environment. The companies do so thanks to modern technologies, skilled staff and good management, and they do so at a reasonable price. We intend to continue with this, as dreams are a reflection of reality.

But if we are to dream, let us dream of a situation where sustainable cities and society (which, by the way, also comprises the water companies) do not pollute water resources and the aquatic environment at all, or if they do, then only minimally so.

The United Nations predicts that by 2050 two thirds of the world's population will be living in urban areas. Already today, cities account for 75 percent of the consumption of natural resources, produce 50 percent of the world's waste and 60 –80 percent of greenhouse gas emissions.

It's quite obvious that we need to change something. We need to change our dependence on fossil fuels. We need to do away with a linear economic model in favour of a circular one and reuse raw materials, so that we do not accumulate waste and we avoid competing for the same scarce natural resources. And, of course we need to reduce our emissions of greenhouse gases, so that we do not damage our global and local climate further.

The water companies must be part of delivering the green transition through innovation of resource-efficient, digital and holistic solutions within the overall water cycle. New solutions need to be part of developing smart, attractive and (not least) sustainable cities and societies. These will focus on greater efficiencies, energy-optimisation, reduction of greenhouse gas emissions and the production of green and sustainable energy, and the water companies must become energy and climate-neutral and take responsibility for contributing to the ambitious climate objectives set for Denmark.

Dreams are a reflection of reality and yet "Clean water for sustainable cities and society" is still a vision.

A vision that must be realised through forward-looking and coherent regulation. In the light of ambitious climate objectives, increasing demand for sustainable solutions and the need for a green transition, regulation needs to ensure that efficient water companies can deliver on a number of bottom lines. Regulation must ensure that the water companies are efficient and at the same time create scope for value-creating solutions in relation to day-to-day operations, long-term construction funding and innovative edge.

DANVA Vision

Clean water for sustainable cities and societies

2024 Objectives
DANVA will work to ensure that the water sector can lead the way towards green transition and create a healthy and sustainable society.

DANVA will make Denmark a pioneering country for sustainable water, wastewater and climate solutions. Biodiversity, resource-efficiency and integrated administration of the entire water cycle is prioritised.

The water sector is to inspire and motivate others to act – locally, nationally and globally.

DANVA will support innovation and technological development in the water sector and facilitate cooperation and knowledge exchange both nationally and internationally.

DANVA will work to establish the framework conditions needed to realise our vision: "Clean water for sustainable cities and societies".

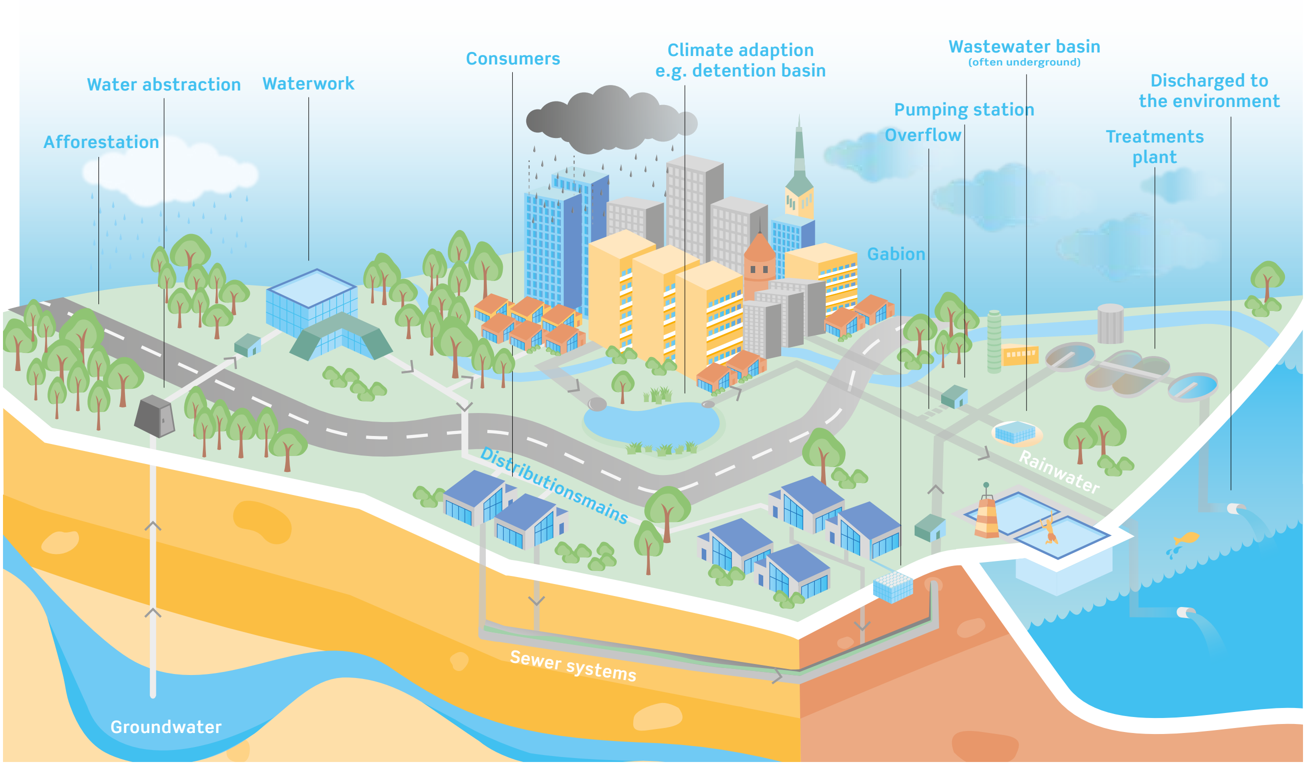
DANVA will support the water sector's focus on efficient operations, for the benefit of citizens, society, the climate and nature.

The DANVA mission:
- To unite all actors in the water cycle towards cooperation on sustainable solutions.
- To strengthen all who ensure consumer trust in water, efficient operations and high security of supply
- To tell everybody about the value and impact of Danish water solutions that help sustain life and health.

www.danva.dk/strategi2024

For now, it is just a dream, but over the next four years we at DANVA will work to turn this vision into reality, and we are also looking forward to working together with our partners over the next four years. ■

GRAPHIC: DANVA



The Danish **water sector**

All drinking water in Denmark comes exclusively from groundwater. The Danish drinking water sector is highly decentralised and consists of approximately 2,600 public waterworks. There are approximately 87 municipally owned drinking water companies, comprising in total of approximately 340 waterworks. The remainder are private, either as individual facilities or combined together into smaller utilities with several works. They are usually owned by consumers. In addition, there are approximately 50,000 small plants, primarily in the category "local water supply for single-family households". In 2018, the total pumped water volume for public waterworks was 377 million m^3, with DANVA members accounting for approximately 60% of the water volume [1]).

Wastewater treatment takes place primarily at approximately 110 municipally owned wastewater companies. There are also discharges from 311,000 residential premises in the category "scattered building development". These are permanent residences in open countryside, allotments and holiday homes.

In Denmark, 746 wastewater treatment plants over 30 PE were registered in 2018, which represents a decrease of 27 treatment plants compared with the previous year. The treatment plants had a total load of 7.7 million PE and a total capacity of 11.7 million PE. As much as 94% of wastewater treatment was at tertiary treatment plants, which is the most advanced type of wastewater treatment plant (MBND and MBNDK). Altogether, they discharged approximately 614 million m^3 of treated wastewater, with DANVA members accounting for 80% of the total volume. The treated water volume is highly dependent on annual rainfall, and the discharged water volume in 2018 was affected by the very dry summer of that year [2]).

Regulation of the water sector

The Danish water sector is based on the so-called "break even" principle. This means that a company's expenditure and income must balance, measured over a number of years. Water companies are financed exclusively through tariffs, and all activities, capital investments and operating costs are paid by their consumers.

Since 2011, the revenues of the water sector have been regulated by the Danish Water Sector Reform Act with a view to promoting its efficiency.

The Danish Water Sector Reform Act, which covers all drinking water and wastewater companies handling more than 200,000 m^3 of water annually, sets requirements on the establishment of an economic framework for each company. At the same time, the Act sets out a general efficiency requirement and, if appropriate, an additional individual efficiency requirement for companies handling over 800,000 m^3 of water.

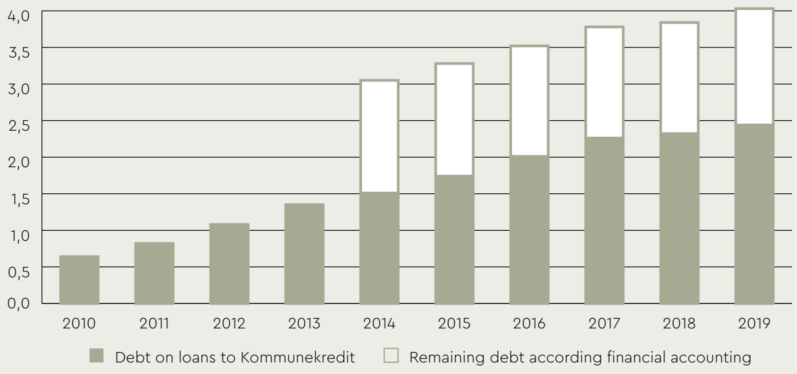
The Danish Water Sector Reform Act covers about 225 drinking water companies, which collectively sold about 267 million m^3 of water in 2019. These companies had a turnover of approximately € 634 million, operating costs of € 191 million, and invested € 266 million in 2019.

The Danish Water Sector Reform Act also covers approximately 109 wastewater companies, which collectively treated about 277 million m^3 of water sold from their catchment areas in 2019. The companies had a turnover of about € 1.22 billion, invested € 846 million, and had operating costs of € 410 million. ■

Sources: [1]) Groundwater Monitoring 1989–2018, GEUS, [2]) Point Sources 2018, Ministry of Environment and Food of Denmark.

DEBT ON LOANS TO WATERCOMPANIES

BILLIONS €



The outstanding debt on loans to the water sector based on the companies' annual accounts. The data derives from the financial statement balance sheets of all municipally owned water companies, plus Trefor Vand A/S, Verdo Vand A/S, Rønne Vand A/S and Videbæk Vand A/S. (177 CVR numbers). It has not been possible to obtain details of loans other than those issued by KommuneKredit for the period from 2010 to 2013. The water companies' total debt includes a smaller proportion of short-term debt, such as trade creditors, payables to group enterprises, mortgages and several smaller items.

Debt in the water sector

New investments in drinking and wastewater companies are much more likely to be financed through loans than was previously the case. This is a consequence of regulation of the water sector, where politicians and authorities prefer investments by the companies in new plants, pipes, climate measures and other assets which in the main are based on loans, in order to keep the drinking water and wastewater tariffs down. It is also evident from the graph above that the debt of water companies with KommuneKredit, other mortgage finance institutions and banks has been steadily increasing since 2010. Borrowing from KommuneKredit in particular has been on the increase.

Prices in line with costs

Water companies may only charge what it costs to deliver water to their customers. Given that investment in individual water companies varies from year to year, loan finance is an important tool for ensuring a stable price for customers. Because plants in the water sector last for a good many years, it is important that the bill is split appropriately between the generations. This happens automatically if customers pay for the annual costs incurred in delivering water to them and removing wastewater from their premises. These are, in other words, the annual operating costs, wear and tear at the plants and finance costs. This is termed cost-oriented pricing, and is something we in Denmark are extremely good at maintaining compared with other countries, where prices are often subsidised.

Lifetimes in the regulation are far removed from reality

Water company revenues are regulated via the Danish Water Sector Reform Act. Under this regulation, water companies are obliged to charge for pipes based on a technically feasible pipe service life of 75 years. In other words, the regulation assumes that pipes wear out at a slow rate and that the water companies will not therefore need to charge very much each year to cover the costs of same. The problem with this is that the actual service life is considerably shorter. DANVA's analyses show that the service lifetime of drinking water pipes is 66 years, and for wastewater pipes, 46 years. The reason for the shorter service life may be poor quality of the old pipes, but it is often due to the fact that the surroundings are under continual change, so that pipes are not in the ground for their entire technical service life. For instance, the sewer network is currently seeing major reallocation due to increasing levels of rainfall. The use of a too long service lifetime in connection with the charging of tariffs is problematic, as current customers are not thereby paying for the full costs of wear and tear at the plants. ■

PHOTO: KLAR FORSYNING

Economic trends

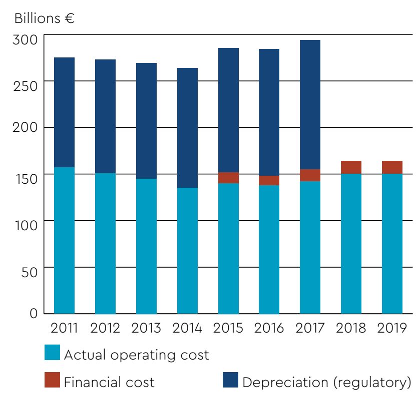
The following economic development graphs include all drinking water and wastewater companies regulated under the Danish Water Sector Reform Act having a billed water volume greater than 800,000 m^3.

Danish water and wastewater companies are by their nature monopolies which are regulated in order to imitate competitive conditions. All water and wastewater companies covered by the Danish Water Sector Reform Act are subject to a "break even" principle and are regulated based on their revenues, i.e. how much they may charge their consumers.

If expenditure exceeds revenue in certain periods, loans may be taken out for plants and, for municipal companies, for operational purposes but only to a very limited extent. This is because municipal companies are subject to a limited "overdraft rule". The Danish water sector therefore has a significantly greater need for working capital than sectors which are not subject to the overdraft rule.

Companies that bill more than 800,000 m^3 a year are also subject to TOTEX benchmarking. The benchmarking compares the companies' cost-effectiveness, and this can result in an individual efficiency requirement if the company's general revenues exceed its effective cost levels. In the benchmarking model, the companies' actual costs (FATO; operating, plant and financial expenses) are compared with their TOTEX net volume targets (OPEX and CAPEX net volume targets).

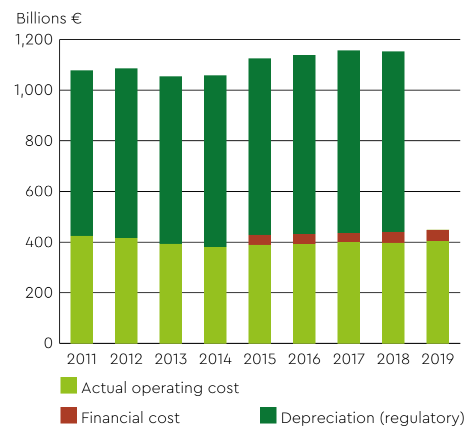
AFFECTED COST, DRINKING WATER



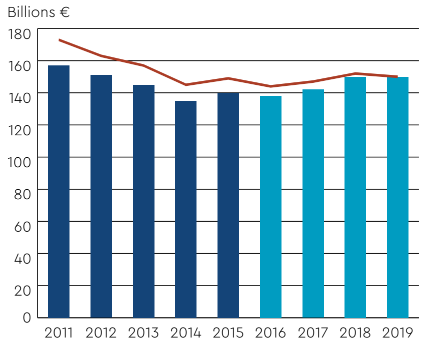
Total actual costs (FATO) are the costs on which the companies are benchmarked in the Danish Water Regulatory Authority's TOTEX benchmarking.

Depreciation is not included in the 2018 and 2019 graphs for drinking water, nor in the 2019 graph for wastewater, as these figures had not been published at the time this publication was being prepared.

AFFECTED COST, WASTEWATER

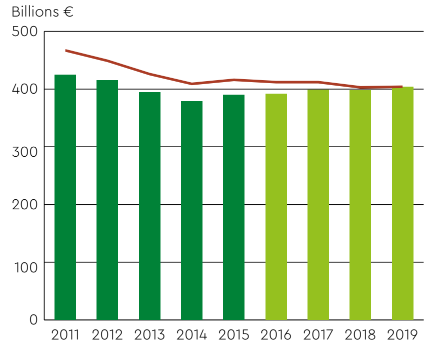


ACTUAL OPERATING COST DRINKING WATER

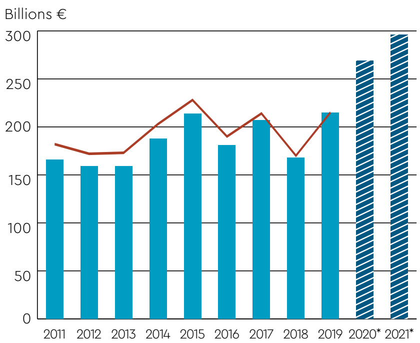


The actual operating costs are the part of the operating costs used in the overall financial benchmarking of the Danish Water Regulatory Authority.
Actual operating costs are calculated as operating costs from the audited financial statements excluding depreciation, less debtor losses, non-controllable costs, adjustment of provisions included in operating costs, and operating costs from associated activities and the emptying scheme, which is included in the general accounts. The definition of actual operating costs was revised in 2016, so that it is not completely comparable with previous years.

ACTUAL OPERATING COST WASTEWATER

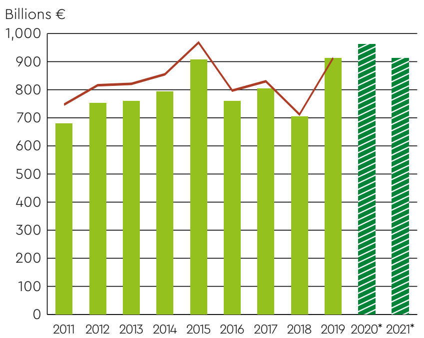


INVESTMENTS DRINKING WATER

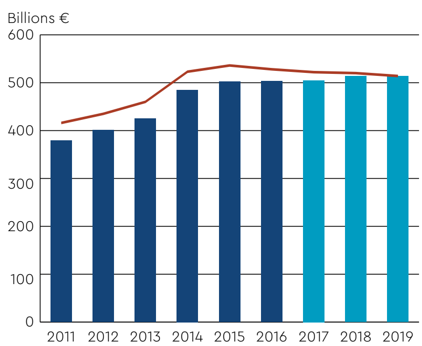


Investments are an expression of the expenditure borne by the companies during the year. This explains the relatively large fluctuations over the years, while depreciation has significantly smaller fluctuations, as investments must be depreciated for up to 75 years.
*Investments for 2020 and 2021 are budgeted investments reported to DANVA.
**Wastewater companies have not been benchmarked by the regulator for the current year (data year 2019). There is therefore no overall calculation of investments for wastewater companies in 2019. Investments for wastewater companies in the graph for 2019 have therefore been extrapolated for the 8 wastewater companies that do not report to "Water in Figures".

INVESTMENTS WASTEWATER**

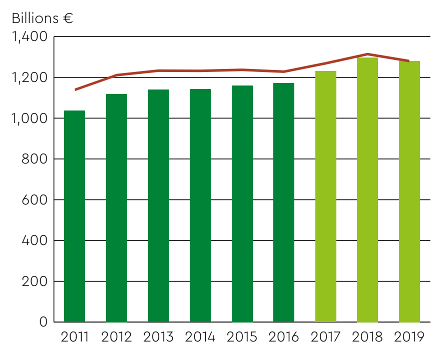


INCOME* DRINKING WATER



The incomes shown in the graphs consist of:
- Income from principal activities in the abstraction, processing, transport and delivery of water
- Transport, processing and removal of wastewater
- Other income from principal activities
- Financial income
- Profit from affiliated companies
- Profit from activities with statutory requirements for independent accounting included in the principal activities.

INCOME* WASTEWATER



Data for the above tables cover all water and wastewater companies with a billed water volume exceeding 800,000 m^3. This means it only applies to those companies that are covered by the TOTEX benchmarking of the Utility Secretariat. These involve 74 drinking water companies and 103 wastewater companies. The bars in the graphs are presented at current prices, whereas the curves are at fixed prices.
*The Utility Secretariat changed the definition of income in 2017. Prior to 2017, total income from primary activities was calculated in such a way that connection charges and other items were netted. Since 2017, the definition of income has been changed from "Total income from primary activities" to "Actual income". One of the major changes is the recognition of connection charges, which is assumed to be one of the reasons for the significant increase in income from 2016 to 2017.

TEXT: JENS PLESNER, DANVA / PHOTO: COLOURBOX.DK

NEW REGULATIONS for managing water from cloudbursts

Two steps forward – and two steps back for climate adaptation!

It is an important task for water companies and municipalities to be being able to manage the large volumes of water that comes with cloudbursts. The huge cloudburst over Denmark's capital district in the summer of 2011 resulted in damage costing around € 803 million in total.

Following this, the Danish Parliament passed legislation in 2013 that provided new and additional possibilities for water companies and the municipalities to manage the volumes of water associated with cloudbursts, followed by provisions for associated financing.

With the new legislation in 2013 it became possible for water companies to pay municipalities and private entities to establish other types of installations for handoling rainwater on the surface, compared to the traditional discharge to underground sewers. For examble, water companies could pay municiplaities to construct cloudburst roads, water courses and recreational areas to stor rainwater temporarily.

An evaluation conducted by the Danish Environmental Protection Agency in 2017 showed that such solutions at ground level amounted to, on average, 25% of the investment costs that would be necessary for constructing sewers underground to manage equivalent volumes of rainwater.

New regulations expected at the beginning of 2021

Due to problems with current regulations, new regulations have now been proposed, which are scheduled to come into force on 1 January 2021. One of the problems is that since 2016 water companies cannot pay more than 75% of the investment costs involved in discharging rainwater to surface solutions. The municipalities must therefore pay at least 25% of the part of the costs that relate to discharge of stormwater.

This has led to a sizeable drop in investment in cloudburst roads, watercourses etc. in towns and cities to deal with water from cloudbursts, although the construction of such facilities, as documented, is often much cheaper than providing sewer systems. In addition, climate change continues apace, with the result that it is ever more urgent to deal with cloudbursts in our towns and cities.

The new regulations will allow water companies to once again be able to finance 100% of the costs relating to rainwater handling investments in watercourses and cloudburst roads in urban areas, as was the case prior to 2016. The regulations also indicate that municipalities or water companies conduct socioeconomic analysis, to ensure that climate adaptation is undertaken to an appropriate level in socioeconomic terms.

The new regulations contain a number of good suggestions and will be capable of promoting climate adaptation. Unfortunately, however, there are also some elements that may stand in its way.

Savings on the water price are prioritised over damage caused by cloudbursts

Because they are by nature monopolies, the water companies are subject to financial regulation by a state regulator, the purpose being to make the companies ever more efficient.

The new regulations also envisage imposing efficiency requirements on climate adaptation projects on the surface. Up until now they have not been subject to efficiency requirements. The way in which the efficiency requirements are imposed on the companies will mean that instead of promoting climate adaptation, they will be a constraint. This is true in relation to climate adaptation both in the case of an extension/reallocation of the sewer system and in the case of investments in solutions on the surface, e.g. in a cloudburst road.

One of the problems is that the costs the water companies incur in establishing the climate adaptation facilities will not be covered. If a company is to implement a project that costs € 13.4 million, it has to collect the money from its consumers over the subsequent 25 years. However, because an efficiency requirement is imposed on the company each year, this has the consequence that over those 25 years it is only entitled to collect € 11 million from its consumers, even though the actual cost is € 13.4 million. The water company thus sustains a loss of € 2.4 million on this one project alone. This is not a sustainable solution.

The result will be that the water companies hold back their investment in climate adaptation and will have to finance climate adaptation by transferring money from other important tasks, such as treatment of wastewater from households and businesses.

More bureaucracy

In addition to the poorly designed efficiency requirements, the new regulations pave the way for extensive annual reporting and documentation requirements to the state financial regulator in respect of the individual water company's climate adaptation projects. Such requirements do nothing to promote climate adaptation by the water companies.

With this combination of efficiency requirements and documentation requirements, the draft new regulations prioritise short-sighted savings on water prices over the huge costs in terms of damage resulting from cloudbursts in conjunction with inadequate climate adaptation. This does not benefit the public! ■

TEXT: ANNELINE HØJRUP, JOURNALIST / **PHOTO:** KELD NAVNTOFT

An energy and climate neutral WATER SECTOR

The Climate Action Plan stipulates that the Danish water sector is to lead the way in becoming energy and climate-neutral. To ensure this, a Danish Paris model is being introduced where the companies announce their ambitions of their own accord. Minister of the Environment Lea Wermelin (The Social Democratic Party) expects great things.

It was a historic moment when in 2015 the UN's 195 member states signed the Paris Agreement, thereby undertaking to limit emissions of greenhouse gases and counter global warming. Under the agreement, each country made a legal commitment to submitting a plan for how it would work to reduce carbon emissions.

The Paris Agreement has now left its mark on the Danish "Climate Action Plan for a green waste sector". To ensure that the water sector

takes the international lead in becoming energy and climate-neutral, a Paris model for water is set to be introduced.

"In Denmark, the water sector – just like all other sectors – will help us meet our climate target of 70 percent in 2030. As part of the climate partnership for waste, water and the circular economy, the water sector has proposed a target of becoming energy and climate-neutral. And the fact that you have such high ambitions deserves the highest praise. So, we have simply taken your word for it", says Minister of the Environment Lea Wermelin.

She also expects the ambitious objective to benefit more than just the climate.

"At a global level, the Danish water sector is already known across the world for energy-efficient solutions. If the rest of the world acts like Denmark, we will save a huge amount of CO2 on a global scale. Not to mention all the green workplaces in Denmark that come with it – as well as the opportunity to reduce water shortages globally, and thereby extend a helping hand to achieving global targets", says Lea Wermelin.

Denmark is to show the way

The Paris model means that the water companies themselves must contribute with their own ambitions in the field of energy and climate.

"We will get an overview of how the sector as a whole can be expected to be on target, and that will hopefully also result in a 'race to the top'. I believe in the model, as we can see that those water companies that have focused on energy and climate targets have achieved singular results. Even now, many wastewater companies are producing more energy than they use, and this resonates at an international level", says the Minister of the Environment, making no secret of the fact that politicians have high expectations of the water companies.

"I have often been on promotion tours with Danish water technology and Danish companies, and I know that we can make a big impression on the world at large by showing the way here at home. The water sector can be the next wind turbine story. At the same time, I am well aware that not all companies will necessarily become energy and climate-neutral straight away, but that is all the more reason to learn from each other and share beneficial experience."

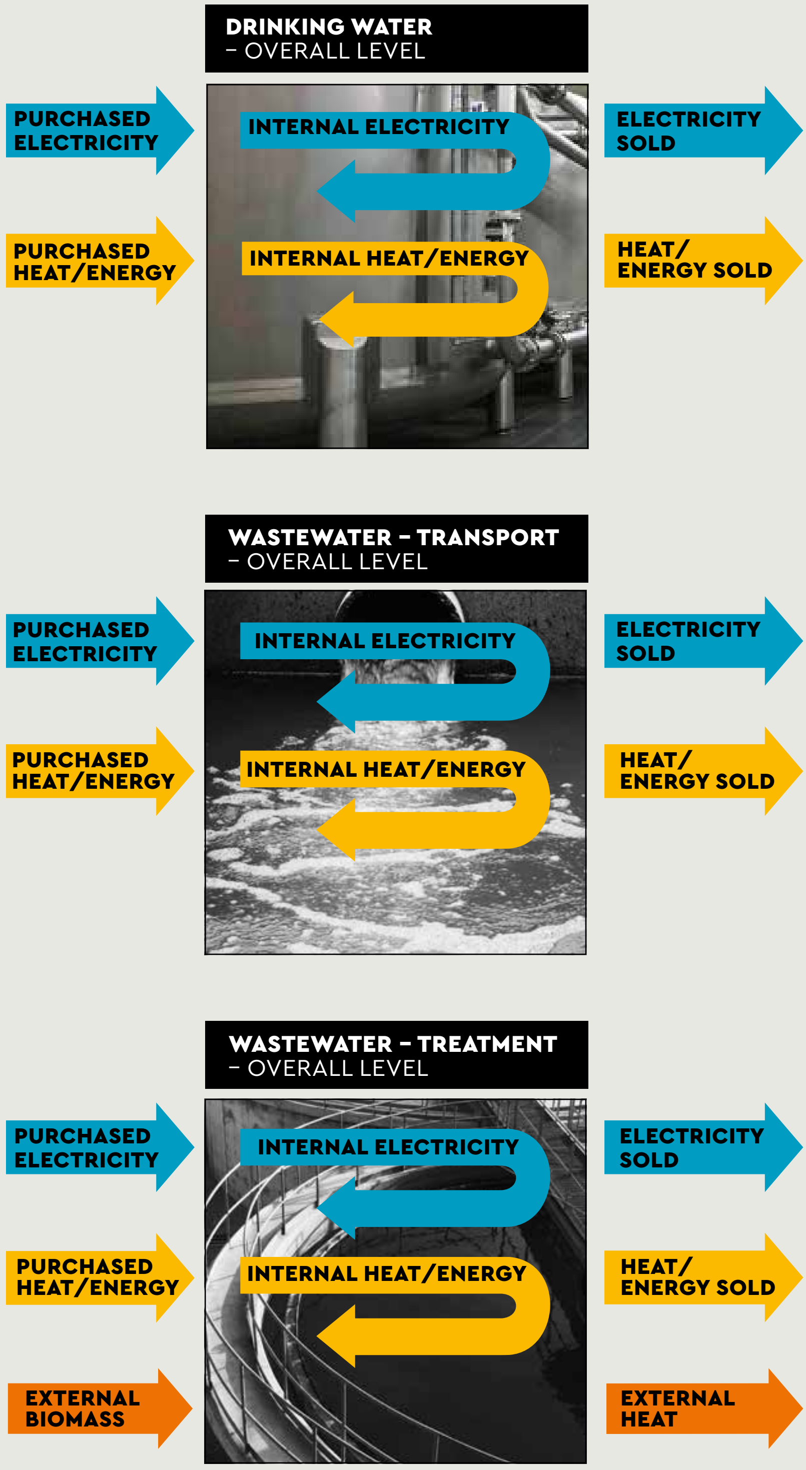
Template and guidance on the way

In terms of how the companies are to calculate and report their action, the Minister for the Environment promises to make tools available.

"Of course, it is important that it should be both simple and uniform. For this reason, a template and guidance designed to help are on their way", says Wermelin, who does not however expect that the Paris model ought to be made legally binding (unlike the Paris Agreement).

"Fortunately, when dealing with Danish water companies there is no need for the same legal instruments as when countries that drag their feet are to be measured against climate ambitions. We opt for a voluntary approach, and the fact that the proposal comes from the sector itself does of course give reasonable grounds to believe that we too will hit the target", she said. ■

FIGURE: DANVA



Calculation of **energy consumption**

For many years, the focus of Danish drinking water and wastewater companies has very much been on reducing their energy consumption. Based on several workshops and meetings, DANVA has prepared, in collaboration with the Danish Environmental Protection Agency, a common energy calculation method that allows energy consumption and energy production to be compared uniformly for the companies at a general level.

The calculation method is included in the mandatory performance benchmarking being undertaken by the Danish Environmental Protection Agency and to which all drinking water and wastewater companies covered by the Danish Water Sector Reform Act are required to report.

The calculation method calculates net and gross energy consumption based on water sold in the distribution network and the catchment areas of the sewer networks and treatment plants. It is an indication of how much energy is used when a resident purchases 1 m^3 of water.

The calculation method is based on three main streams: Energy in (purchased), self-produced energy used internally, and energy out (sold), plus, for treatment plants, external biomass in and external heat production. The designation "energy" covers both electricity, heat and other energy. All forms of energy are converted to kWh.

The calculation method allows overall key figures to be produced for the individual company:

- Net energy consumption: The difference between energy purchased and energy sold, kWh/m^3
- Gross energy consumption: The sum of energy purchased and self-produced energy used internally, kWh/m^3
- Net self-supply ratio: Percentage of energy sold in relation to energy purchased, %
- Total self-supply ratio: Percentage of energy sold and self-produced energy used internally in relation to purchased energy and self-produced energy used internally, %. ■

DRINKING WATER COMPANIES in DANVA Benchmarking and Statistics

In 2020, 75 drinking water companies reported data to DANVA Benchmarking and Statistics. The figures shown apply to 2019. Together, the companies have more than 1,885 water abstraction wells, comprising 170 source sites, 255 waterworks and 31,739 km of supply pipes. The participating companies abstracted about 218 million m^3 of drinking water and supplied 3.40 million people. The total investments and costs excluding taxes amounted to approximately € 208 million and the actual operating costs were just over € 143 million. (see the participants' basic data and overall key figures at the end of this publication).

The drinking water companies' actual operating costs remained stable

Actual operating costs of drinking water companies (FADO) neither increased nor fell compared with 2018. Actual operating costs for 2018 are € 0.63 per m^3 of drinking water sold. Actual operating costs are governed by the Danish Water Sector Reform Act's requirements for efficiency improvements, and they form the basis for comparing the companies' efficiency. Actual operating costs exclude VAT and other taxes, non-controllable costs and any selected associated activities. Since 2016, in connection with the implementation of the TOTEX regulation, there has been a change in the calculation of actual operating costs, which now includes operating costs for environmental and service objectives, part of the previous 1:1 costs and any selected related activities.

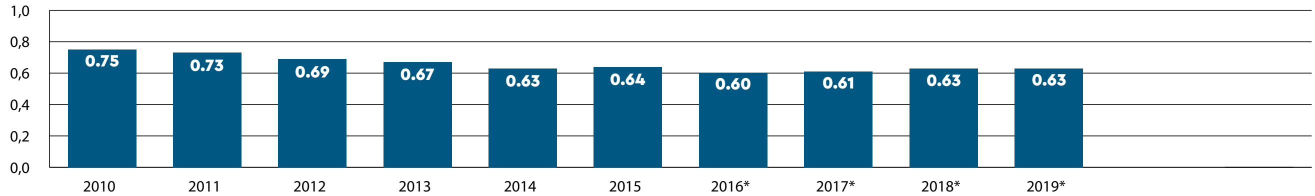
From 2010, since the implementation of the price cap regulation under the Danish Water Sector Reform Act, the companies only received efficiency requirements for the actual operating costs, so that they would aim to continuously minimise their operating costs. Following the switch to the TOTEX regulation, where the efficiency requirement includes both operating costs and investments, there is not the same focus on significantly reducing operating costs. It is always a balancing act between whether the companies should maintain their current equipment or invest in new equipment.

Total investments increased again

The statement of drinking water companies' investments implemented in 2019 show that after one year in 2018, where they held back on investments, the appetite to invest on the part of the companies has once again increased. In 2019, investments

OPERATING COSTS, 2010 - 2019

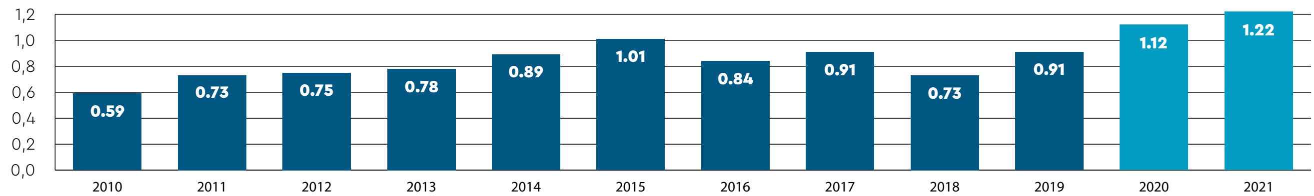
€/ M^3 SOLD WATER (2019 PRICES)



2010–2019: Actual operating costs (57–75 companies) *: New calculation of actual operating costs (FADO)

INVESTMENTS, 2010 - 2019

€/ M^3 SOLD WATER (2019 PRICES)



2010–2019: Implemented investments and renovations (54–75 companies)
2020–2021: Planned investments and renovations (66 companies)

accounted for € 0.91/m³, and there is a broad agreement that investments will increase substantially in the next two years, reaching an increase of 33% in 2021 compared with the level of investment in 2019.

The breakdown of expenditure and investments

In 2019, drinking water companies spent 32% of their actual operating costs on drinking water production (boreholes, source sites and waterworks), 33% on water distribution, 10% on customer service and 25% on general administration. There is a tendency for the proportion spent on general administration to increase, given that it was 22% in 2018.

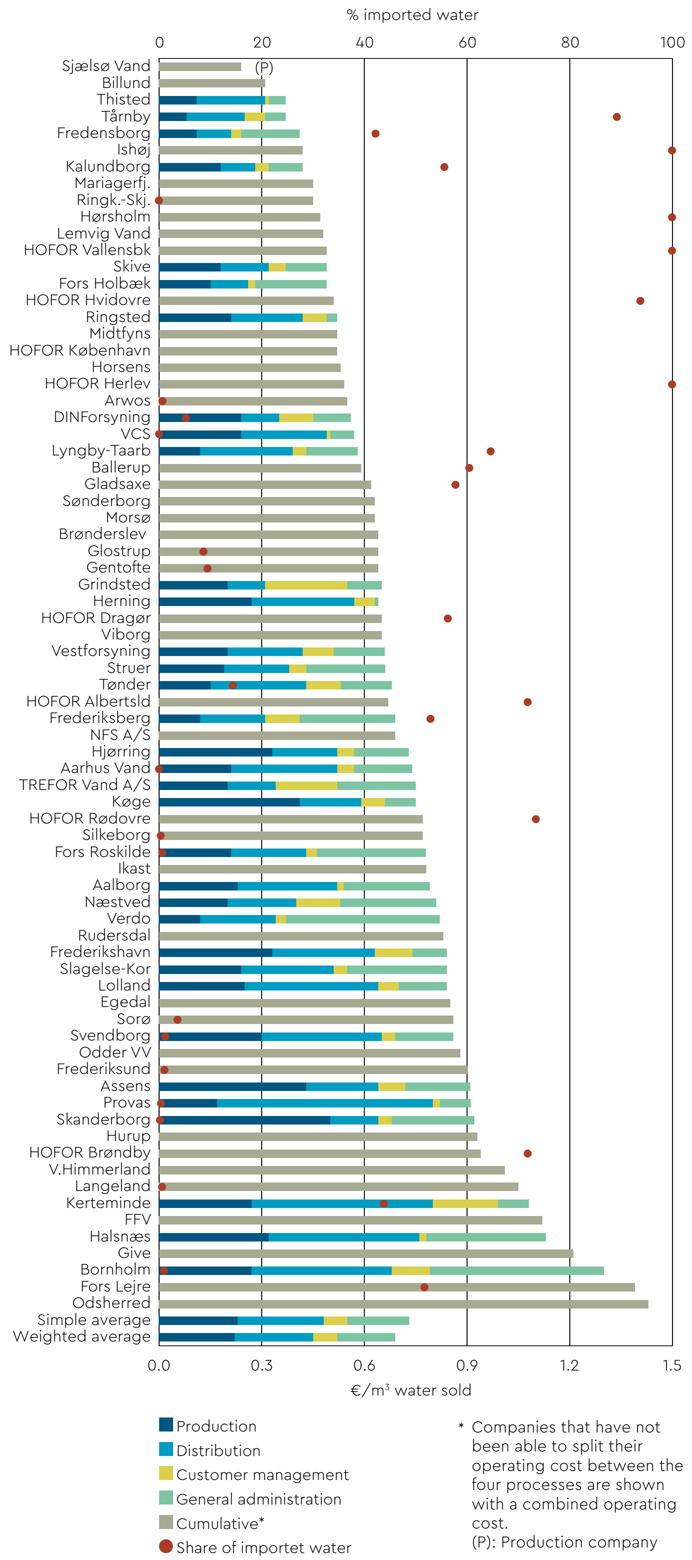
Investments are broken down as follows: 64% is invested in the distribution network and 33% is invested in drilling and waterworks. The remaining 3% is invested in other things.

For several years in a row, investments in drilling and waterworks have been at a historically high level of more than 30%, which may be due to several factors: Newly built waterworks, increased pressure on water resources due to the discovery of undesirable substances, which have led to the need for new source sites, the review of existing source sites and increased groundwater protection in the form of, e.g., drilling protection zones and afforestation. ■

Large variations in actual operating costs

The average actual operating costs for the production and distribution of 1 m³ of water sold is € 0.63, but, as can be seen from the graph, there is a very significant spread between the lowest and the highest of the operating expenses. The reason for this is the difference in framework conditions under which the companies operate. These include geological conditions, access to groundwater, the extent of groundwater protection and the necessary processing steps before the water is pumped into the mains network, all of which affects production costs. For distribution, factors such as population density, the size of the mains network and its proximity to customers, its condition and age have an impact on costs.

ACTUAL OPERATING COSTS, 2019



YOU CAN READ MORE ABOUT THE ENERGY CALCULATION METHOD ON PAGE 15.

The drinking water companies' net- and gross energy

The aim is for the Danish water sector to be energy-neutral or, even better, energy-positive, which means that the water sector delivers more energy to its environment than it purchases.

Currently the drinking water companies use a lot of power for pumping water from boreholes and through waterworks, as well as for pumping it into the mains network and water towers. In addition, in certain cases, there are additional pressure amplifiers located around the mains network.

The water companies' options for producing energy from normal water production are limited, but solar power can be produced. In certain cases, power from turbines and drinking water can be used in the production of heat for internal heating, selling to district heating operators or to private large-scale heat consumers.

Energy consumption in the drinking water companies

There is a big difference in how much electricity and energy is consumed by the Danish drinking water companies in supplying 1 m^3 of clean water to customers. The average weighted gross energy consumption (electricity and heat) for drinking water is 0.44 kWh/m^3 sold and the weighted net energy consumption is 0.43 kWh/m^3 sold. For most drinking water companies, gross and net energy consumption is similar, since only a small proportion of the companies produce energy, most often in the form of solar cells. The exception is Morsø Vand A/S, which has heat production based on a heat pump connected to one of the company's water towers, thereby producing more energy than is consumed in connection with drinking water production.

Electricity consumption (purchased electricity) averages 0.41 kWh/m^3 sold, and the companies themselves produce and sell electricity equivalent to about 0.45% of what they consume.

The road to energy-positive drinking water companies

There is still a long way to go before the drinking water companies are energy-positive. Below is a summary of energy purchases and production for the 75 drinking water companies that participate in DANVA's reports:

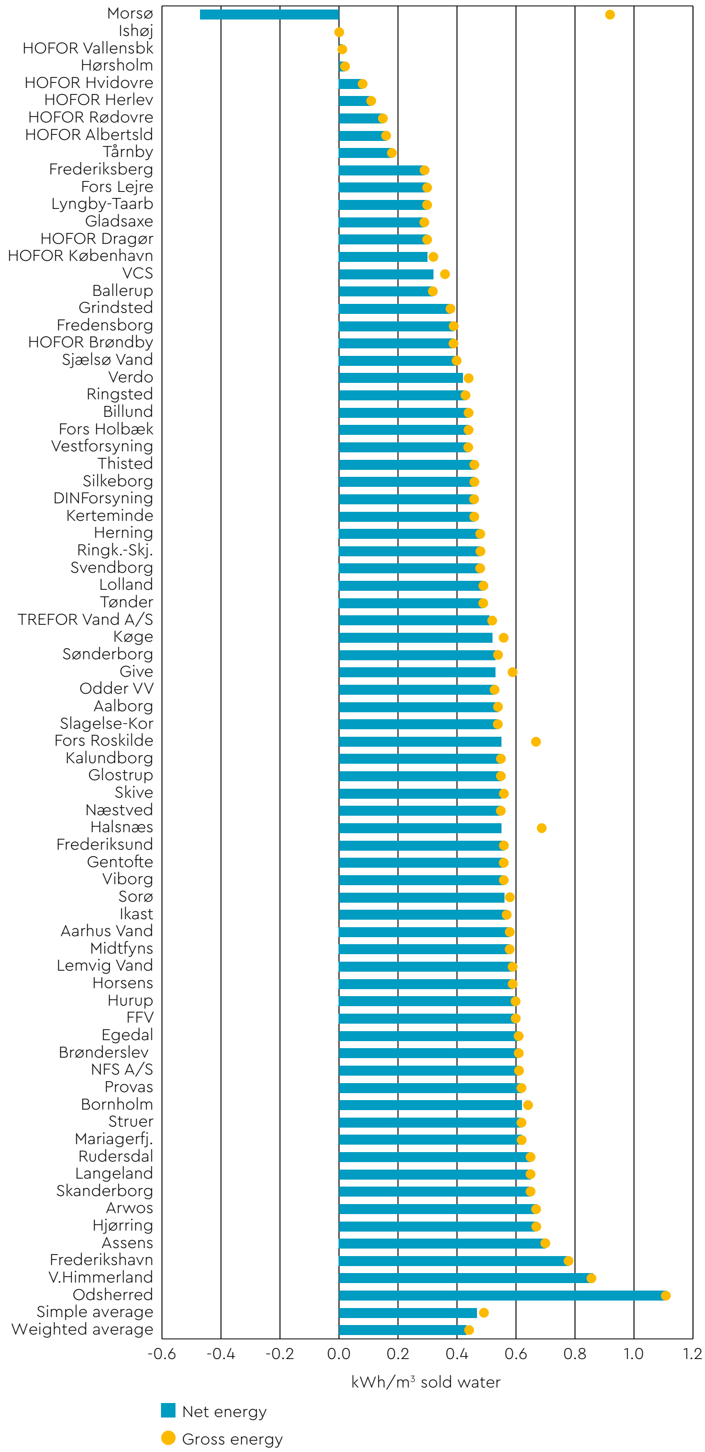
	Purchased energy kWh	Self-produced energy used internally kWh	Sold energy kWh
Electricity	95,975,125	1,446,999	427,206
Heat	3,696,041	18,767	720,000
Total	99,671,166	1,465,766	1,147,206

The net self-supply ratio, which is defined as the percentage of energy sold in relation to energy purchased, is 1.2%.

The total self-supply ratio, which is defined as the percentage of energy sold plus self-produced energy used internally in relation to purchased energy plus self-produced energy used internally, is 2.6%.

The companies will be energy-positive once they exceed 100%. ■

NET- AND GROSS ENERGY FOR WATERCOMPANIES, 2019



LARGE WATERPARK will be heated by cold drinking water

Ringkøbing-Skjern Forsyning is connecting a water pump to a big drinking water pipe – the solution is set to heat the future Lalandia holiday centre in Søndervig.

Along the route from Ringkøbing to Søndervig is a big drinking water pipe, which continues on to Hvide Sande. The pipe is 45 cm in diameter and supplies residential properties, holiday homes and, not least, the fishing industry, with clean cold water. The temperature of the water is between 7 and 9°C, and the plan is for the drinking water to heat the forthcoming Lalandia holiday centre with its associated waterpark in Søndervig. But there is a big difference between 7°C and the 28°C required in the waterpark pools.

The solution is a large heat pump designed to draw energy from the drinking water and supply 1.1 MW of heat. During the process, the drinking water in the pipe is cooled to a few degrees, but the heat in the soil will make the temperature return to its original level on its way to the consumers.

Ringkøbing-Skjern Forsyning came up with the concept for this solution, which Utility Manager Søren Jacobsen compares with a large ground heat plant.

"It is an innovative concept, as we are using the drinking water for heating, but apart from that the process is well-known and fully tried and tested. Looked at like this, it is just a big ground heat plant", says Søren Jakobsen.

Low cost and sustainable solution

Consultants from Sweco undertook calculations based on the use of other heat sources, e.g. by establishing a local district heating plant or directing air to a water heat pump. All solutions were calculated, and the heat pump based on energy from the drinking water pipe was not just the most sustainable solution, but also the one that was most economical.

"Sustainability is an important parameter for us, which is why we pride ourselves on having found a solution that does the job of supplying heat to Lalandia efficiently, economically and sustainably", says Søren Jakobsen.

Bioenergi Vest, another subsidiary of Ringkøbing-Skjern Forsyning, will own the plant and supply the heat. The water utility only supplies the water. However, the heat pump will not supply heat to consumers other than Lalandia. Nonetheless, it may be a precursor project for similar solutions around the country.

"There is a lot of focus in the water and wastewater industry on exploiting the energy present in water and wastewater. In the Lalandia heating plant, we have a project that is both feasible and realistic in many other locations. I believe we will be seeing far greater exploitation of the heat potential of drinking water in the future", says Jakobsen. ■

Drinking water **quality testing**

All drinking water companies undertake ongoing quality checks of the water pumped out to residents. The checks consist of analyses for selected chemical parameters, such as iron and manganese, but also for microbiological parameters, such as e-coli and bacteria counts. Drinking water companies take samples at the waterworks, on the pipe network and from the customer's tap. In conjunction with the supervisory authority, a decision is made as to the number of statutory control samples that must be analysed at an accredited laboratory and carried out over the course of the year. This decision will be based on the size of the drinking water company. In addition, the individual water company must stipulate any additional control samples if it would like more frequent sampling than is required by the supervisory authority. Such sampling may include more of the same type of samples called for under statutory requirements or other non-accredited control samples which the company can take itself.

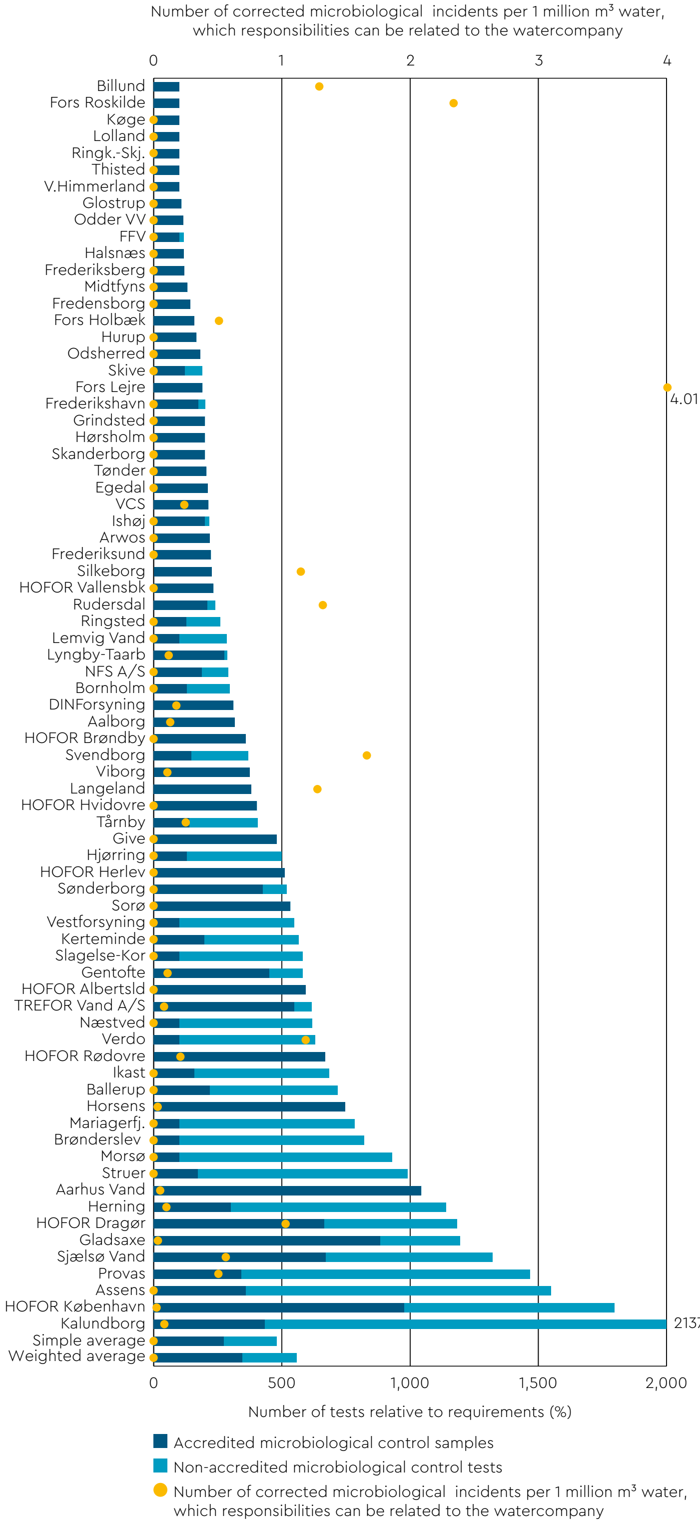
There is a substantial difference between the choices made by the companies. Some companies consider the statutory number of samples sufficient and others choose to add many additional control samples to their sampling schedule.

Approximately 90% of the 75 drinking water companies that participate in DANVA Benchmarking and Statistics take more microbiological samples than their agreement with the supervisory authority requires. In total they have completed 13,747 accredited analyses, of which 98.6% met all requirements. If just one analytical parameter on a water sample exceeds the quality requirements, it is recorded as an "incident". However, this does not mean that the water is detrimental to human health. Usually, it simply means that there are conditions that need to be further investigated. In 2019, the companies found that 198 samples exceeded one or more microbiological parameters. Of these, 119 (60%) were down to circumstances for which the companies were responsible. The remaining non-conformances were found to be down to conditions pertaining to the private consumers' installations upstream of the tap.

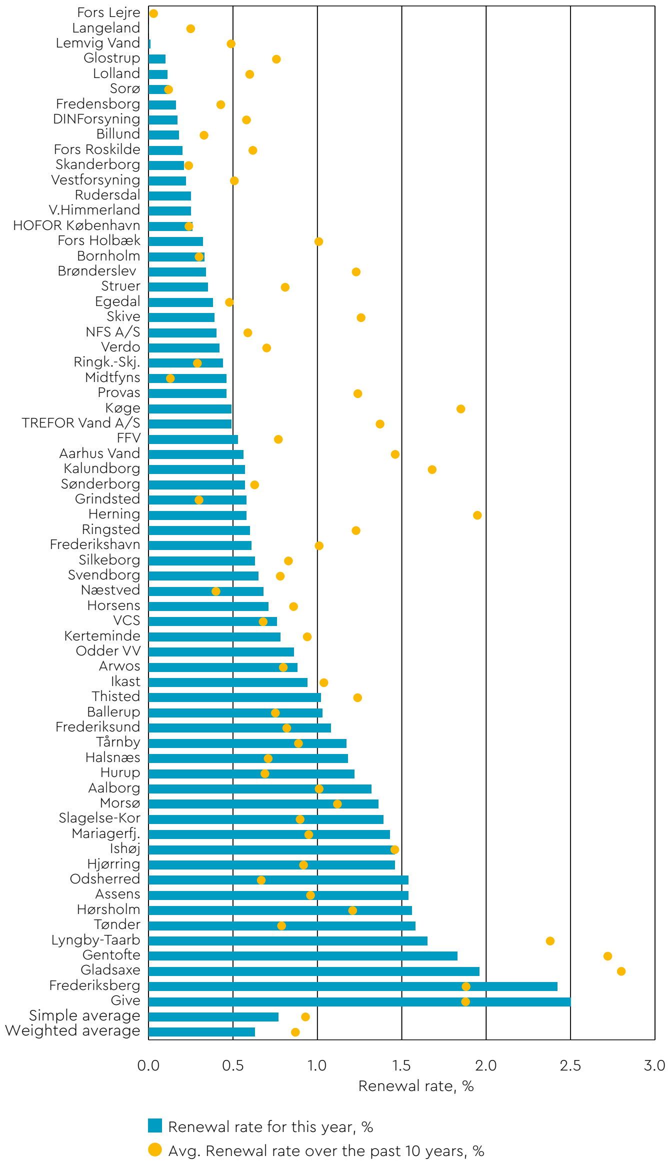
In 2019, 6 companies had to issue a boil-water advisory to their customers due to exceeding the microbiological parameters. The 6 incidents concerned 3,213 water meters in total.

The key figure "Number of corrected incidents per 1 million m³ of pumped water" is an expression of the number of incidents a company experiences per 1 million m³ of pumped water, corrected for the additional risk involved in taking more control samples than is statutorily required. ■

MICROBIOLOGICAL WATER QUALITY ANALYSES, 2019



RATE OF RENEWAL OF DISTRIBUTIONS PIPES, 2019



Renewal of **the pipe network**

The pipe network's renewal rate shows what percentage of the pipe network was replaced/renovated in the last year compared with the average per year for the past 10 years. There are many factors, such as materials, geological conditions, surface load and age, that have a bearing on when the pipe network should be renewed. Other important factors are that many infrastructure and construction projects often require water companies to relocate or extend their water pipes even if they are not at the end of their service life. This may also be the case where a road is dug up to renovate a sewer pipe or the district heating – the water pipe is included in some cases to avoid having to dig the road up again later.

30 companies have reported the average age of pipes that have been dug up. In total, they dug up 128 km of water pipe with a weighted average age of 58 years. The expected service life is 75 years. ■

Statement of bursts **on the pipe network**

A burst pipe in the network will probably mean that there will be customers who do not have water in their taps. This means of course that the companies try to reduce the number of burst pipes and the duration of the interruption. There is a substantial difference among the participating companies in the number of burst pipes that are recorded on the pipe network. Bursts are divided into two categories:

- Self-arising bursts in the mains network or the communication pipes, where the pipe's age, material, tapping saddles, geology and the quality of work performed are often the cause of the burst.
- Bursts due to external conditions, where the burst is often due to excavation damage caused by a contractor in connection with excavation work.

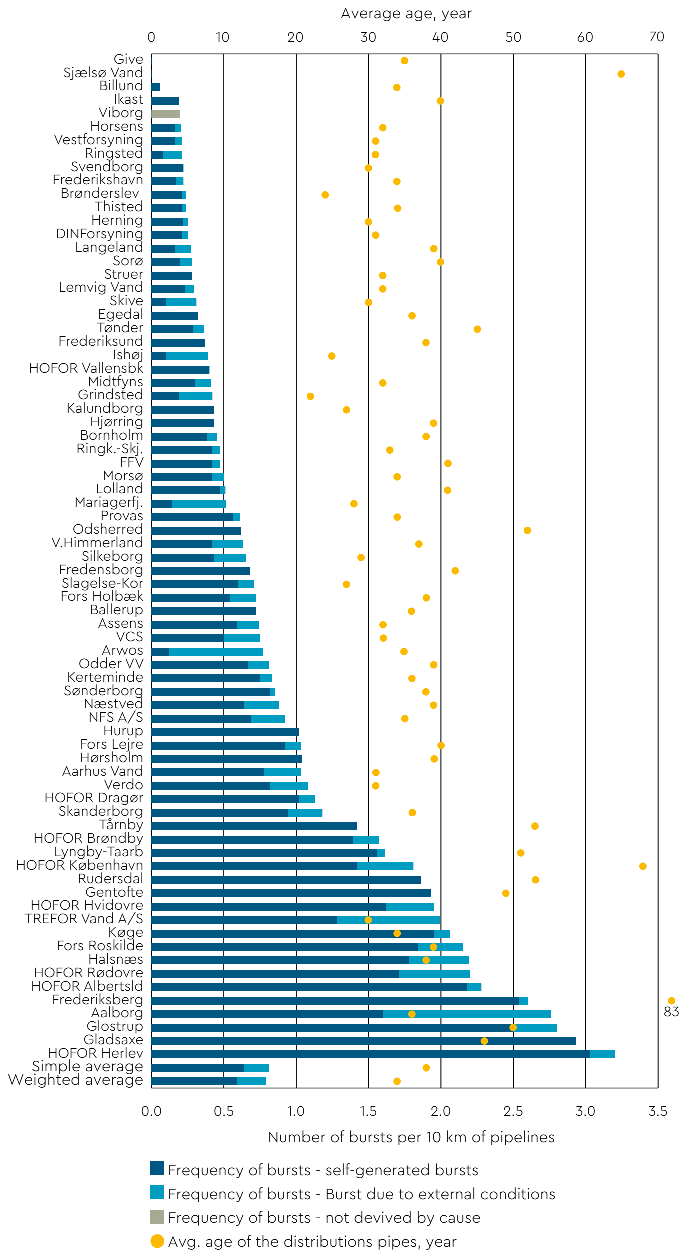
The graph shows self-arising bursts, as well as bursts due to external conditions on the mains and supply pipes. It is calculated as the number of bursts per 10 km of supply pipe. The bursts are distributed over the entire pipe network from the waterworks to the customer's water meter. The bulk of the pipe network belongs to the water company. The last few metres from the property boundary to the water meter, called the property supply pipe, belong to the landowner.

The 75 companies participating in DANVA Benchmarking and Statistics had a total of 2,557 bursts in 2019. This is an average of 34.1 bursts per company. It is slightly less than in 2018, where the record summer temperatures resulted in a record number of bursts at 38.8 bursts on average per company.

The bursts recorded involve more or less the same number of bursts in the branch lines as in the main and supply pipes. No less than 20% of the bursts were due to external conditions.

16 companies recorded bursts in the private property supply pipes. These companies had approximately 948 bursts in their own pipes and were aware of 217 bursts in the private property supply pipes. This figure could actually be significantly higher, as the companies are usually only aware of bursts when the landowner, not being able to find the stopcock during the repair, seeks advice and guidance from the water company or anticipates the water company repairing the burst in the property supply pipe. 86% of these bursts on private property are classed as self-arising bursts. ■

BURST FREQUENCY ON THE MAINS, 2019



Experience gained from a DANVA benchlearning course

PETER NORDAHN, VERDO

I registered for DANVA's benchlearning course entitled "What impacts the costs of drinking water?", as I needed to dig deeper into the details behind our costs. I was looking to gain a better understanding of what really impacts the costs and where we could make efficiencies.

DANVA facilitated an exercise in which analysis groups were set up for us and had defined what exactly they wanted to analyse. Once the groups had found a common way to calculate costs, DANVA provided the companies with a spreadsheet to report their costs. The results were reviewed in a workshop where the data from the companies could be compared. It was clear that the costs of repairing bursts in pipes constituted to a major share of all their costs.

In the group I was in, we wanted to find out if there was any potential for reducing costs relating to burst pipes. We wanted to identify the costs of repairs within and outside of normal working hours. We used extracts from timesheets (normal time and overtime) plus project costs (materials and contractor etc.) from 2017, 2018 and 2019. In addition, we calculated the number of bursts so as to obtain the cost per burst.

We encountered various challenges, as each of us had to extract our own data. Time recording is one such challenge. For instance, staff can be dispatched to an inspection job which then turns out to be a burst pipe, but no attention is paid to changing the time recoding so that it is recorded as a burst instead of an inspection job. The variation in calculating hourly prices is another challenge, which we nevertheless tried to render as uniform as possible in order to obtain comparable analysis results. We also found out that the recording of external costs was subject to a degree of uncertainty, as well as some variation in the recording of products from stock. Last but not least, we found considerable variation in how companies organise their jobs, and how individual companies record costs. Some companies have their own warehouse and materials, whereas others purchase in-house from a group company. Similarly, there are differences in how hours are recognised in relation to the relevant duty schedules (during/outside of normal working hours).

The lessons we learnt from this analysis were as follows:

- A cost-based approach is critical, as is the correct posting of items, if an accurate overview of costs is to be achieved.
- Bursts outside of normal working hours are significantly more expensive than those occurring during normal working hours.
- It can be a good idea to assess whether a repair can be postponed to the following day.
- It might be interesting to extend the analysis to include how much water is lost due to night-time bursts (the marginal costs for additional pumping).

It should be mentioned that the companies could not directly differentiate between the costs for bursts during and outside of normal working hours. It is estimated that 85% of bursts are repaired during normal working hours (with 15% being repaired outside normal working hours).

Based on these assumptions, the average costs incurred for repairs were as follows:

Time	Number of bursts	Cost per burst	Hours per burst
During normal working hours	128	€ 2160	4.4
Outside of normal working hours	23	€ 6150	18.7

DANVA benchlearning in brief

DANVA is developing ongoing benchlearning courses (BLF) for those participating in DANVA's benchmarking project. The aim of the BLFs is to help companies use data from e.g. DANVA Benchmarking to identify potential for development and to implement measures to exploit it.

The courses have been held as workshops with typically 6 to 8 companies registered for each. They are based on the individual companies' own figures/performance. This means the lessons from the individual courses can then be used directly in the companies. Another learning angle is of course the exchange of experience between the participating companies, and the BLFs are designed to focus on this form of knowledge sharing/sparring. Great importance is also attached to dialogue between the companies' finance and technical departments about what results in the best solutions for the companies. This increases understanding between different departments of the companies with a view to optimising procedures.

Some of the benchlearning courses DANVA Benchmarking has held are: "Effective investments", "What drives costs for the sewer network?" and "What drives the costs for drinking water supply?"

Water loss is **dropping again**

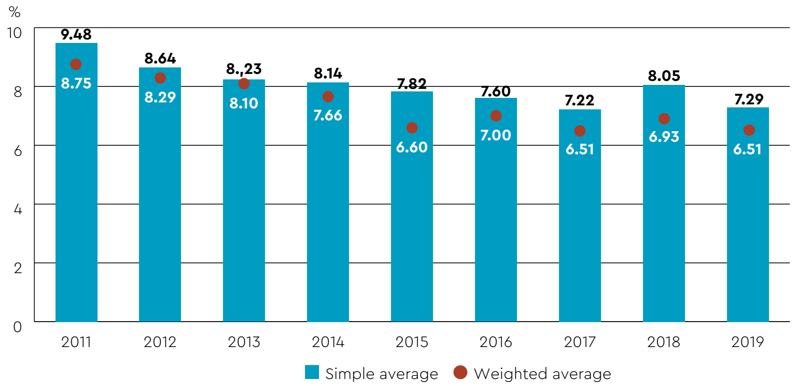
One of the features of Danish drinking water companies is the very low amount of water loss. For the 50–52 drinking water companies that have participated in DANVA Benchmarking over the past 9 years, there has been a steady decline in water loss from 2011 to 2019. The sole exception was a rise in 2018, which can be attributed to the record temperatures of the summer of that year, resulting in the ground being extremely dry with "shrinkage" in the pipe network and many more burst pipes. In 2019, water loss decreased again to the same level as in 2017.

The companies are continuously working to reduce water loss, and the steadily decreasing water loss over the past 9 years is an achievement which is further highlighted by the fact that a national decline in water consumption over the same period by about 8% means a percentage increase in water loss. This underlines the considerable efforts undertaken by the companies, which are still improving in their ability to trace leaks and repair and maintain the pipe network. In 1996, a general requirement for the installation of water meters was introduced for all water consumers. In 1993, a penalty tax was introduced for companies with more than 10% water loss, measured as the ratio between the water pumped out and the amount of water sold. These measures have had a major impact on the Danish water industry, making Denmark one of the countries with the lowest water loss.

Different calculation methods

Water loss can be measured in several different ways: as a percentage, water loss per km of supply pipe, or in more detail as an infrastructure leak index. Water loss as a percentage or in m^3 per km of pipe is calculated as the difference between the volume of water pumped into a company's own distribution network and the volume of water sold to its consumers. This calculation also includes volumes of water used for flushing in connection with pipe renovation work, fire-fighting and similar purposes, which cannot be regarded as a direct loss. The Infrastructure Leakage Index goes rather deeper and compares the actual water loss into the ground to the water loss that is "unavoidable", which is calculated on the basis of the size of the plant and water pressure. ■

NON-REVENUE WATER (WATER LOSS), 2011 - 2019



Average (%) based on 50–52 drinking water companies which have participated in DANVA benchmarking over the past 9 years.

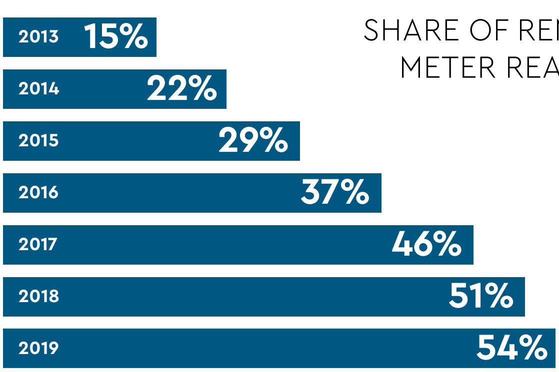
Steady rise in the proportion of remotely read meters

The water companies' switch from manually read water meters to remotely read meters brings a considerable reduction in the administrative burden associated with reading consumption and billing. In addition, they provide sound detailed data as a basis for pertinent knowledge in connection with leak identification. The level of service to residents can also be enhanced by e.g. allowing them to be able to monitor their own consumption online or be alerted in the event of unexpectedly high water consumption due to, for example, a burst water pipe at their holiday home.

The switch to remote meter reading is gaining ground, and the data from 55–66 drinking water companies with a joint total of 863,598 meters shows that the proportion of remotely read meters has increased from 15% in 2013 to 54% in 2019. There is a good deal of variation: of the 66 participating companies in 2019, 34 of them use remotely read meters in more than 95% of cases, whereas the proportion in 18 companies is less than 5%.

The definition of remotely read meters extends from the first models, where the reading is taken by driving past the meters on the road outside once a year, thereby recording annual consumption, to the latest smart meters, which can send consumption information to the companies every second. ■

SHARE OF REMOTE METER READING

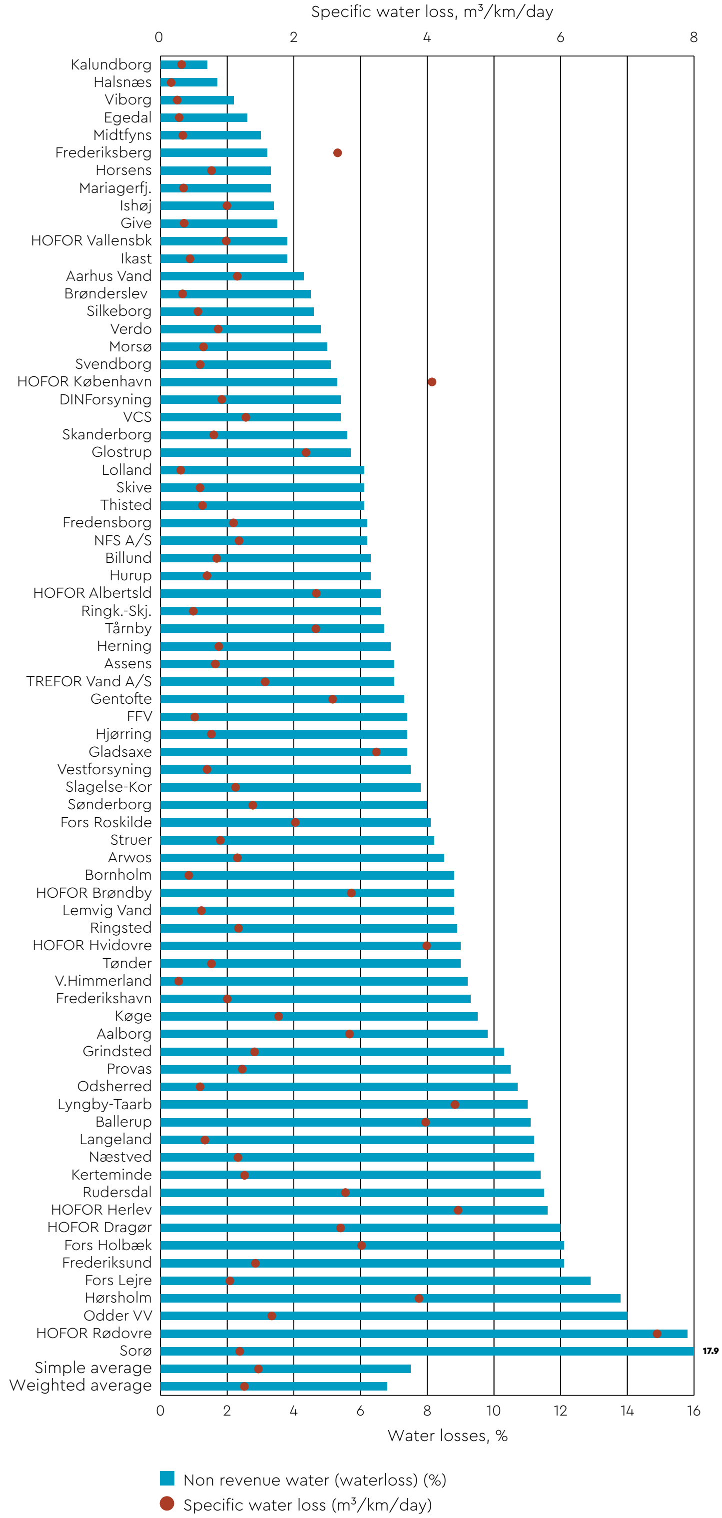


Water loss

Drinking water companies' calculation of water loss, also known as "non-registered consumption", shows significant differences between companies. The companies can compare with one another using two methods of calculation, expressed either as a percentage or as the specific water loss, expressed in m³/km/day. Companies with a large pipe network but lower water consumption have better results when it comes to specific water losses, whereas companies with higher water consumption from a smaller pipe network are ranked better when a percentage comparison is used. The actual calculation used for the companies may have minor fluctuations from year to year without any direct explanations being found. However, fluctuations can occur compared with the previous year especially when replacing consumption meters or pumping meters at the waterworks. Some companies also experience major pipe bursts which can affect the water loss balance by several percentage points before the burst is repaired.

If water loss exceeds 10%, the company must pay a penalty tax imposed by the Danish Tax Authority. ■

NON-REVENUE WATER (WATER LOSS), 2019



Note: No subsequent corrections to the water loss have been taken into account, e.g. water volumes used to flush the pipes in connection with contaminants. An exemption is required to be able to subtract these volumes of water from the water loss calculation.

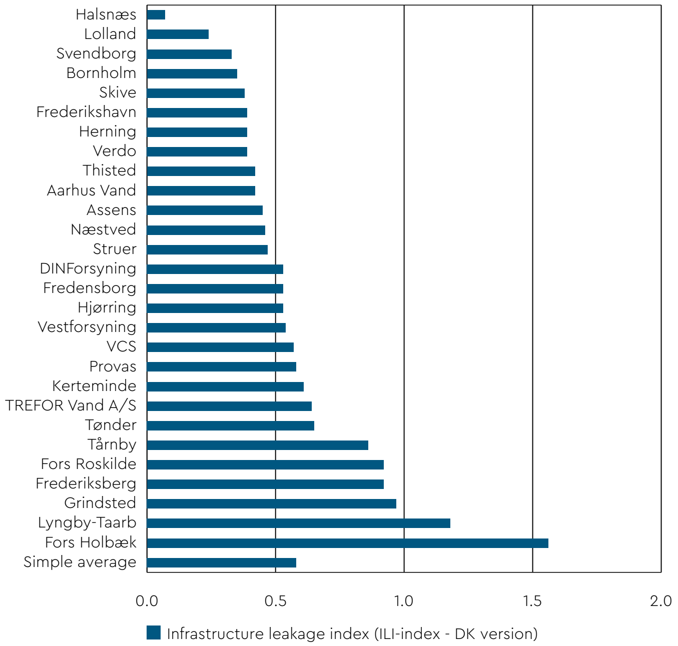
PHOTO: READY SUPPLY

You can read more about international infrastructure leak indices on the website www.leakssuitelibrary.com under "Global ILIs".

Infrastructure Leak Index (ILI)

Real water loss can be more accurately calculated and compared through the calculation of the Infrastructure Leak Index (ILI). This is an international water loss performance indicator developed by the International Water Association (IWA). It makes it possible to compare real physical water loss and unavoidable water loss between companies with different framework conditions and across national borders. Actual physical water loss is calculated as the difference between the amount of water sold and the amount of water pumped, minus authorised non-billed consumption (for example, flushing of the pipe network after repairs, water used for fire-fighting), as well as unauthorised consumption (theft) and meter measurement uncertainties.

INFRASTRUCTURE LEAKAGE INDEX (ILI), 2019



"Unavoidable water loss" is a calculation based on the size, density and water pressure of the pipe network, assuming that it is a well-run, healthy young pipe network. The calculation is based on what is technically feasible from a financially acceptable perspective. The ILI calculation is partly based on assumptions, such as the length of private property supply pipes, the average pressure in the pipe network and the calculation of water used for flushing. Measurement uncertainty is not included in the Danish calculations, which is why we call it "ILI index – DK version".

Reducing water loss

There are many different methods that can assist water companies reduce water loss, such as segmentation of the pipe network, which, if flow measurement is installed in the sections, provides significantly better data for leak detection, for example by analysing night-time flow measurements. The change to online remote metering can also provide very detailed and valuable data sets that can be used to detect water loss and generate an "alert" in the event of sudden unexpected water consumption. The companies can also improve their monitoring and the speed of repairs, as well as incorporating asset management in their renovation planning. ■

Customer **availability**

In terms of security of supply, one of the main objectives of the drinking water companies is to ensure that there is always water in the consumers' taps and that it is always clean.

There are many ways of influencing security of supply, e.g.:

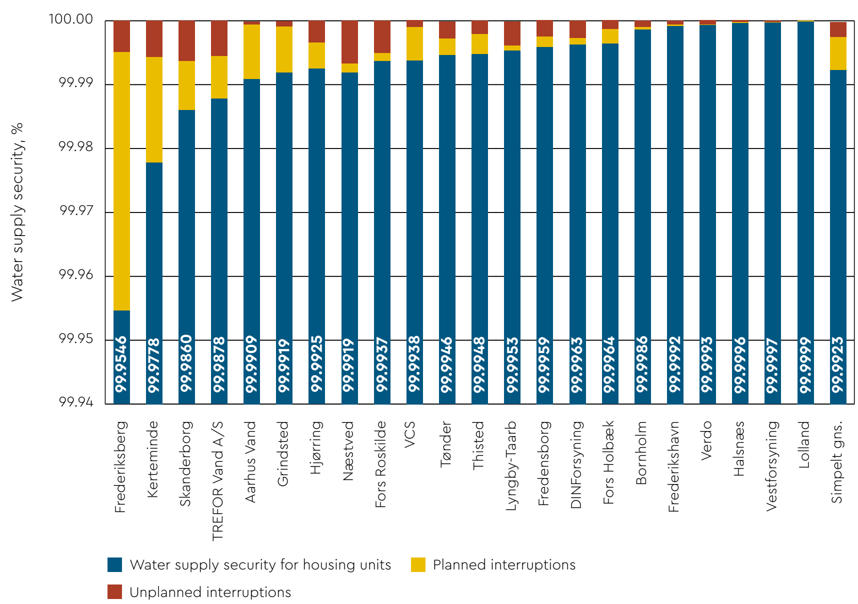
- Companies can ensure that they have sufficient reserve capacity to supply water if one of their waterworks malfunctions or becomes affected by contamination. This may be achieved via ring connections and excess capacity between a company's own works or via an "emergency connection" to another company, which can provide additional water in the event of mishap.
- Good pipe maintenance standards to avoid unnecessary shutdown of the water supply for customers, for example in the event of burst pipes.
- Segmentation and ring connections in the distribution network so that repairs can result in shutdown for as few customers as possible.
- Companies can also plan their renovation works so that the "downtimes" in relation to consumers is as brief as possible. They can also notify consumers via e.g. text messages, to minimise the inconvenience of not having water in the tap.

There is no clear definition or calculation method for measuring security of supply, but one way of measuring the impact of the company's work is to measure the availability of water to the customer. Availability is an expression of the proportion of the year for which the customer has tap water. If, each time a valve is closed that shuts down the water supply to one or more customers, the companies record the length of time that it has been closed and how many mailing addresses have been affected by this, an average number of interruption minutes per mailing address can be calculated. The records can be divided into two types:

- Unplanned interruptions are defined as interruptions to the water supply for one or more customers where the company has not notified the customer 48 hours in advance that they would be carrying out the work.
- Planned interruptions where the company has informed customers in advance that the water will be shut down in connection with planned renovation of the pipe network, replacement of valves etc. Planned works are works the company has notified more than 48 hours in advance; usually several weeks/months in advance.

Unplanned interruptions are one of the parameters included in the mandatory performance benchmarking carried out by the Danish Environmental Protection Agency. In addition, several drinking water companies have begun recording planned interruptions, which means that the average availability of water to customers can be determined. Availability to the customer can be calculated by taking the total number of minutes in one year and subtracting the average number of minutes per mailing address where there have been unplanned interruptions, as well as the number of minutes per mailing address where there have been scheduled shutdowns of the water supply. The average availability for the 22 companies participating in this calculation in DANVA Benchmarking is 99.9923%, which means that customers have only had to be without water on average for 40 minutes a year. ■

WATER SUPPLY SECURITY, 2019



TEXT: ANNELINE HØJRUP, JOURNALIST / **PHOTO:** MARTIN SYLVEST

WATER COMPANIES

are (maybe) to provide important data for the Danish SDGs

In September 2020, the Danish politicians were given 197 targets which, according to experts, should point the way for sustainable development in Denmark. One of the things the Danish targets call for that more data is collected from the water sector. It is now up to the politicians whether this becomes a reality.

Most actors in the water sector are acquainted with the UN's Sustainable Development Goal (SDG) 6 and know that it is about ensuring availability and sustainable management of water and sanitation for all. On the other hand, there are many doubts as to what, in concrete terms, the goal will lead to in Denmark over the years until 2030. Equally, it can be tricky to place the other SDGs in a Danish context. The Danish Parliament has therefore established a 2030 Panel which, in cooperation with the politicians, is to promote the UN's 17 Sustainable Development Goals.

The 2030 Panel's main initiative so far has been the world's first open Sustainable Development Goals project. The aim was to develop proposals as to how Denmark can and should measure progress towards the SDGs. Two essential principles for the Danish targets are measurability and data availability, and the 2030 Panel has therefore implemented the project in cooperation with Statistics Denmark.

"The process has included businesses, organisations, NGOs, experts and the Danish public. Debates, workshops and consultations have been held and these resulted in more than 6,000 inputs. These were then processed by experts and narrowed down to 197 Danish targets, which translate the UN's SDGs into a Danish context", explains Niels Ploug, Director of social statistics at Statistics Denmark.

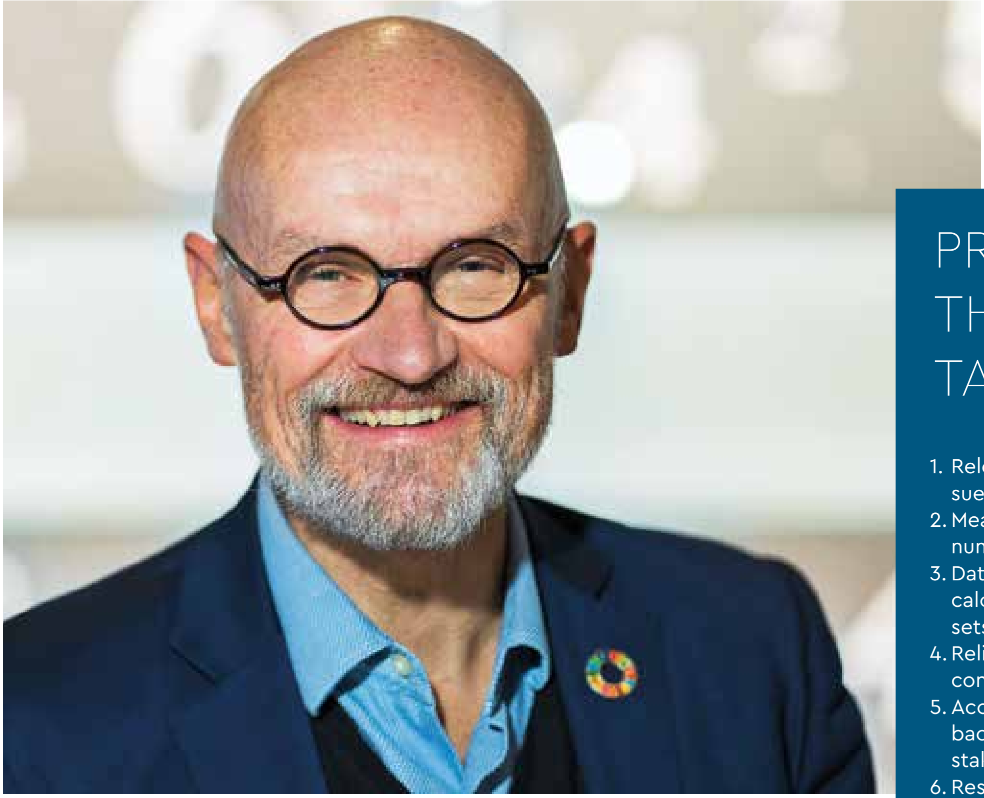
Focus on water quality

The 197 Danish targets have been collated in the report "Vores mål" ("Our Goal") which was handed to Minister of Finance Nicolai Wammen (The Social Democratic Party) on 9 September.

"It is anticipated that the politicians will soon embark on a new action plan for Denmark's sustainable development, and our hope is that they will implement many of the 197 targets. At all events, we have made

ABOUT OUR GOALS

- "Our Goals" has been devised by the 2030 Panel and Statistics Denmark. The intention is that the report will become part of Denmark's official targets for sustainable development.
- The 197 targets have been specified on the basis of more than 6,000 inputs processed by 52 of the country's leading experts.
- More than 150 businesses and organisations (including DANVA) and more than 30 municipalities and authorities submitted inputs for the targets.
- DANVA is considering how we can contribute to follow-up of "Our Goals", e.g. by collecting data from members.
- The project is being funded by the Danish Industry Foundation, the Lundbeck Foundation, the Nordea Foundation, the Rambøll Foundation, Realdania and the Spar Nord Foundation.
- You can read more at voresmaal.dk



PRINCIPLES FOR THE DANISH TARGETS

1. Relevance: The target mirrors the issue in a Danish context.
2. Measurability: The target is stated in numerical terms.
3. Data availability: The target can be calculated based on available data sets.
4. Reliability: The target's method and content are well documented.
5. Acceptance: The target receives the backing of researchers and other stakeholders in society.
6. Resources: The resources required to calculate the target are reasonable and appropriate.

it easier for them by presenting measurable data. So, if they like the menu, all they need do is tuck into the food", says Niels Ploug.

The SDG for water, SDG 6, has had 15 pages devoted to it in the report. There it is made clear right from the start that all residents in Denmark have access to stable, safe and clean drinking water in the home, as well as to toilet and hand washing facilities. Nor is there any uncertainty associated with the supply of clean water. For this reason, the Danish targets focus on quality, and this is where the Danish water sector comes into the picture. One proposal suggests for instance measuring the quality of the groundwater and the volume of water that is treated.

"The contribution of the water sector is not about setting any new direction, but qualifying follow-up of SDG 6 by supplying data. And with data, clear initiative options become still clearer", says Ploug.

Water across the Sustainable Development Goals

Water is also mentioned in other contexts. The reason is that the targets have been developed with an understanding that meeting one goal can be a precondition for meeting others. The project has therefore assembled the SDGs into three groups: Our Life (social, health, education), Our Society (sustainable economic development) and Our Planet, which among other things is about sustainable use of water and energy.

"How this lateral thinking and actions are to be initiated is up to the politicians. However, the municipalities and various industry sectors are at liberty to select their own targets from among the 197 and e.g. demonstrate with data on their website how they are evolving in these areas", says Niels Ploug.

Nor is it intended that the 2030 Panel would just sit back and passively await an announcement from the politicians.

"Although we may feel that Denmark is well placed insofar as the SDGs are concerned, the report shows that 47% of the targets have posted positive development since 2015, 31% have remained unchanged and 22% have seen retrogression. So, the 2030 Panel is now going to go away and discuss the report and identify particularly important targets and what action would be needed to see results", says Ploug.

DANVA has made an active contribution to the development of the Danish targets, e.g. in the debate "Clean water also in in 10 years as well", which you can listen to at voresmaal.dk/podcasts. ■

TEXT: MIRIAM FEILBERG, DANVA / **PHOTO AND FIGURE**: AARHUS VAND

YET ANOTHER STEP
towards sustainable water supply in Aarhus

Aarhus Vand will be the first water company in Denmark to gain certification under the SDGs

PER BACH, AARHUS VAND.

Aarhus Vand work towards sustainability principles in its day-to-day operations and the many development projects the company is currently engaged in. The water company has already an integrated certification in place related to drinking water safety, environment and the work environment.

Aarhus Vand has chosen four goals for its strategic focus:

Goal 6 – Clean water and sanitation
Goal 11 – Sustainable cities and communities
Goal 13 – Climate action
Goal 17 – Partnerships for the goals

Within these four SDGs, the company has defined a number of targets and specific actions to achieve the goals. This is the basis for the certification undertaken by Norske Veritas (DNV). By issuing the certification, DNV confirms that Aarhus Vand is taking targeted and measurable action.

The action needed to achieve the four SDGs forms part of the integrated management system of Aarhus Vand. DNV monitors progress in this respect once a year. DNV makes sure that the correct targets are still in place in terms of strengthening sustainability and that the action taken by Aarhus Vand is adequate to achieve them. "DNV is to make sure that we do what we say and develop in the way we say we will. We now have certification for this, and they will assess our progress once a year from now on", says Per Bach, Head of Process Management and SDG Action Manager at Aarhus Vand.

SDGs throughout the organisation

Over the coming years, Aarhus Vand intends to keep up the good intentions and ensure the SDGs are translated into action. The company must ensure knowledge about and commitment to the SDGs, at the same time as they are developing the new solutions. To achieve their goal, the entire organisation needs to be involved.

For SDG target 6.1 – clean water – the local target requires Aarhus Vand to ensure all customers have access to healthy and safe drinking water. As part of the certification, this is to be measured in terms of the following:

- No exceeding of threshold values, resulting in recommendations to customers to boil water
- No waterworks where measurable amounts of pesticides are found
- Aarhus Vand must be among the 50 cheapest suppliers of water and wastewater
- The number of microbiological water samples is to be published

The SDG 6.3 has, among other things, as its global purpose that wastewater is treated. At a local level, Aarhus Vand has the following targets:

- No exceeding the discharge requirements for treatment plants and waterworks where the requirements have a bearing on the aquatic environment and sea life.
- By 2025, the overflows for the Viby and the Aaby area must be reduced from 9–11 overflows per year to two overflows per year.

These targets are to be accompanied by specific action, such as benchmarking to ensure fair prices.

In terms of the partnership goal, Goal 17, Aarhus Vand has set itself goals for action in partnerships with e.g. technological development. In addition, the company has initiated action to enhance global activities that support the SDGs, e.g. secondment of staff, knowledge sharing and involvement in projects in various parts of the world.

SDGs in everything we do

Apart from the four goals for which the company holds certification, Aarhus Vand is also engaged in targeted action in respect of a further nine goals.

"We are focusing on making a difference in terms of all the SDGs, but we prioritise strategically. We are therefore the first water company in the world to gain certification in the UN's SDGs. It compels us to undertake concrete and measurable action where we are able and intend to contribute with sustainability of our own", says Per Bach, adding: "We would very much like to contribute via global partnerships. DNV requires that we should be able to assess how we stand on the following: How, how much and where? This is important, as otherwise it is all too easy just to meet target figures."

Aarhus Vand also wants to increase sustainability in the future. The new treatment plant, Aarhus Rewater and the company's new office building, will e.g. be subject to constant assessment as to which SDGs they support. Specific requirements for sustainable purchasing, maintenance and similar activities will be imposed. "We have committed ourselves to this in respect of the world at large and the certification body in particular, and with our concrete ambitions for four SDGs, we can maintain our intention to apply SDGs in everything we do", says Per Bach in conclusion. ■

TEXT: MIRIAM FEILBERG, DANVA **PHOTO:** BLUEKOLDING

The world's first wastewater turbine is attractively located in the apparently natural setting of the turbine house in the Stenderup forest 50 metres from Lillebælt.

SUSTAINABLE DEVELOPMENT GOALS AS PROGRESS INDICATORS

PER HOLM, BLUEKOLDING

BlueKolding is owned by Municipality of Kolding, who is working systematically on the circular economy and the UN Sustainable Development Goals. This requires that we do the same. So, when we had to devise a new business strategy for the next five years, it was clear that we should use the SDGs as a framework for our work on the strategy.

DANVA has talked to BlueKolding's CEO Per Holm about the work on the SDGs.

How do you implement the SDGs?

We incorporate the SDGs in the implementation of our strategy and set specific targets using them as a basis. The strategy has two main pathways: One relates to our core areas as a utility company, and the other relates to our development and new areas of work and business. In pathway two we work on using both wastewater and other natural resources to produce e.g. heat, which contributes to SDG 7 – Affordable and clean energy.

An example is the wastewater turbine which is placed on the outflow pipe from our central treatment plant for Lillebælt. The pipe has a fall of 35 metres, and we use it to produce electricity in a turbine located at sea level. The turbine entered service on 5 October 2019 and delivers climate friendly electricity corresponding to the consumption of 150 households.

Many view the SDGs as very nebulous, but here is a clear example of what we can do for the SDGs. In the future, we will be more and more active in how we use the goals when prioritising initiatives and projects. This means the goals will increasingly determine both the operations and development of BlueKolding.

Do you do anything differently after having worked according to the SDGs?

We use the SDGs as progress indicators of our initiatives, and we also use the goals for generating ideas. We have more relevant projects in our project portfolio than we can implement, and we use the SDGs as a basis for prioritising them. Our initiatives are now based even more on sustainability considerations, so we contribute to the SDGs e.g. by exploiting the resources in sewage sludge and protecting water boreholes by planting trees.

We have prioritised the SDGs and work mainly with SDGs 6, 7, 13 and 14. When we sit down to look at the terms of reference of a project, we can use the goals to screen it. If it e.g. relates to SDG 13 on CO2 reduction, we also select suppliers and cooperation partners based on their inputs in that area. The award criteria of a call for tenders may involve us having to look at the environmental profile of the tenderers and what documentary evidence they can provide pertaining to working on reducing emissions.

What three things, based on your experience, would you pass on to others?

1. Make sure demands for suppliers are incorporated in calls for tenders.
2. Screen your project portfolio to identify those projects that meet the SDGs.
3. Train your staff to be able to deliver on the two areas mentioned above. ■

WASTEWATER COMPANIES in DANVA
Benchmarking and Statistics

In 2020, 87 wastewater companies reported data to DANVA Benchmarking and Statistics. The reported figures are for 2019. Together, the companies provide services to more than 5 million people and operate 456 treatment plants, which treat more than 670 million m^3 of wastewater with a load of 7.1 million population equivalents (PE). The companies have between them more than 80,800 km of sewer pipes with 2.25 million communication pipes. In total, the sewer system area accounts for about 250,000 hectares. Total investments and renovations amounted to approximately € 843 million and actual operating costs were just over € 372 million (see the participants' overall key figures at the end of this publication).

The wastewater companies' operating expenses

The statement of actual operating expenses of wastewater companies shows a slight increase of 2,7 cent per m^3 compared with last year. In 2019, the companies devoted on average € 1.46 per m^3 of water sold to operating costs. Actual operating costs are governed by the Danish Water Sector Reform Act's requirements for efficiency improvements, and they form the basis for comparing the companies' efficiency. Actual operating costs exclude VAT and other taxes, non-controllable costs and any selected associated activities. Since 2016, there has been a change in the calculation of actual operating costs, which in relation to how the old method, now includes operating costs for environmental and service objectives, part of the previous 1:1 costs, plus any selected associated activities.

Investments increase again

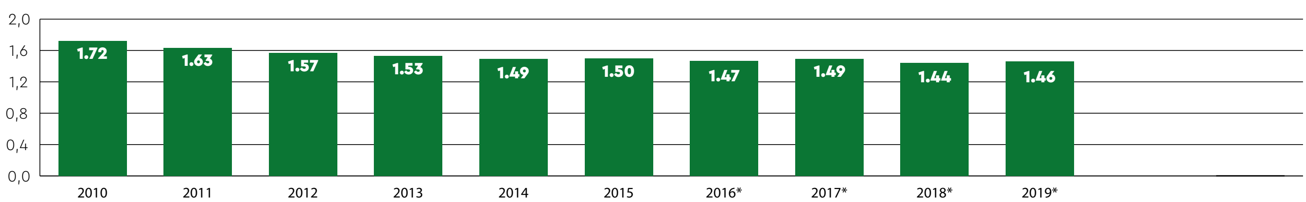
The calculation of wastewater companies' capital investments in 2019 shows a significant increase in their level of investment after average investments fell for four years in succession. In 2019, the companies invested € 3.32 per m^3 of water sold, which is an increase in excess of 35% compared with 2018, which saw the lowest level of investment for 8 years. All companies anticipate a similarly high investment level over the coming years.

Breakdown of expenditure and investment

The wastewater companies spend, on average, 33% of their actual operating expenses on the transport network, 47% on wastewater treatment, 5% on customer service and 15% on general administration. The operating costs for general administration have risen by 2% since last year. A statement of investments and renovations shows that 84% of the implemented investments and renovations are used for improvements and upgrades/augmentations of the transport network, while 14% are used for the treatment plants. The remaining 2% is used for other investments. ■

OPERATING COSTS, 2010 - 2019

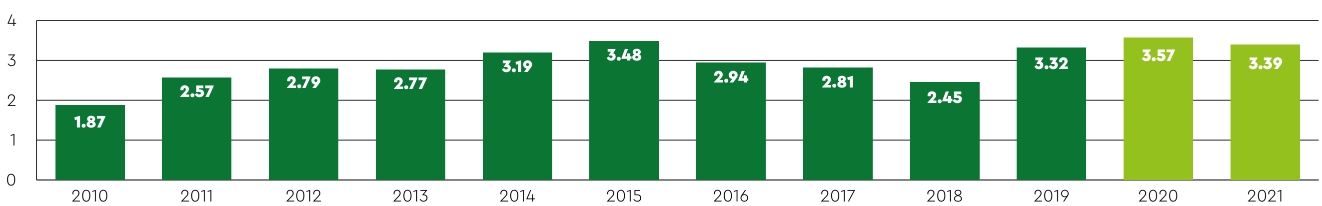
€/M³ SOLD WATER (2019 PRICES)



2010–2019: Actual operating costs (62–87 companies) *: New calculation of actual operating costs (FADO)

INVESTMENTS, 2010 - 2019

€/M³ SOLD WATER (2019 PRICES)

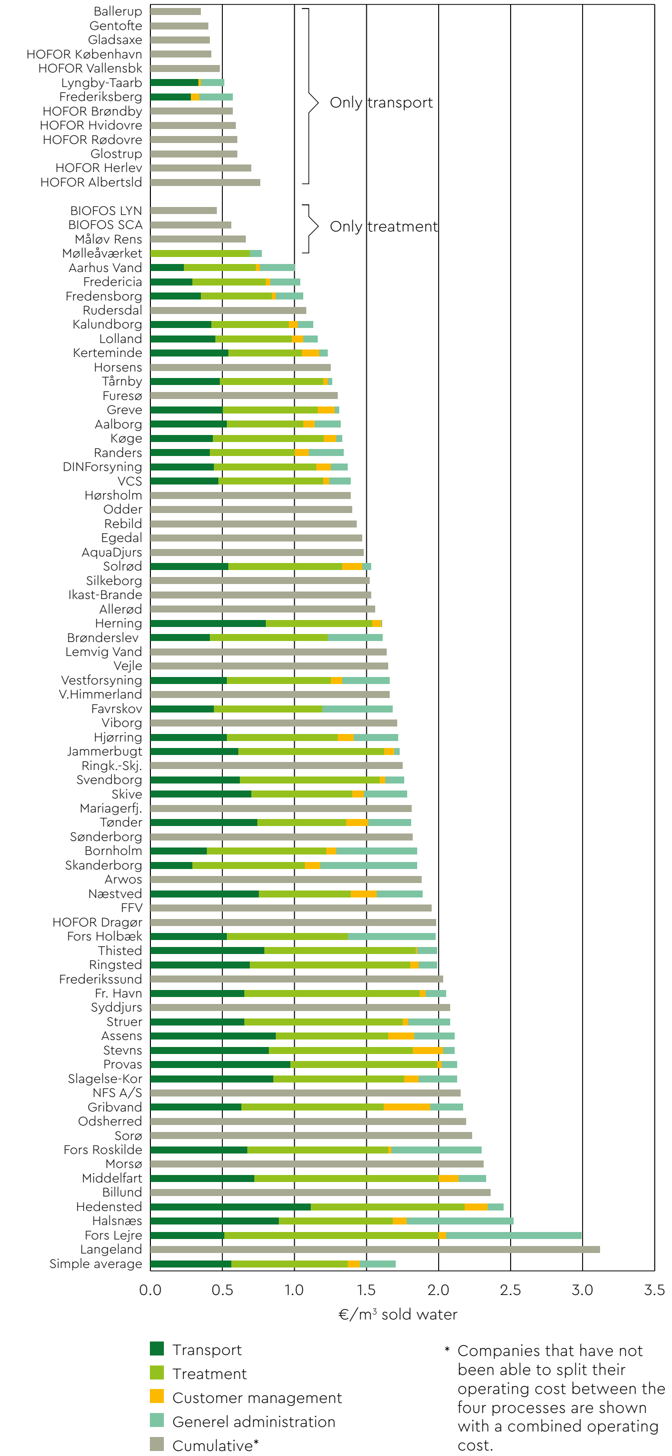


2010–2019: Implemented investments (66–87 companies – Investments and renovations)
2020–2021: Planned investments (87 companies – Investments and renovations)

Large variations in actual operating costs

It costs an average of € 1.46 to transport and treat 1 m³ of water sold. The variation between individual companies' expenses per m³ is relatively large and reflects the very different framework conditions under which the companies operate. These may, for example, include topographical differences, differences in population density, and the relationship between residential areas and large industries. The processing and disposal of sludge also affects operating costs.

ACTUAL OPERATING COSTS, 2019



The wastewater companies' **net- and gross energy**

The aim is for the Danish water sector to be energy-neutral or, even better, energy-positive, which means that the water sector delivers more energy for the benefit of society than it purchases.

Currently the wastewater companies use a lot of electricity for the pumping stations that pump water through the sewers and down to the treatment plants. At the treatment plants, the items that consume the most power are the aeration tanks, but internal pump operation and sludge treatment also use a lot of electricity. On the other hand, the treatment plants have great potential for producing energy in the form of electricity and heat for use in the district heating network. This can come from biogas or heat pumps on the treated water at the outflow from the treatment plants.

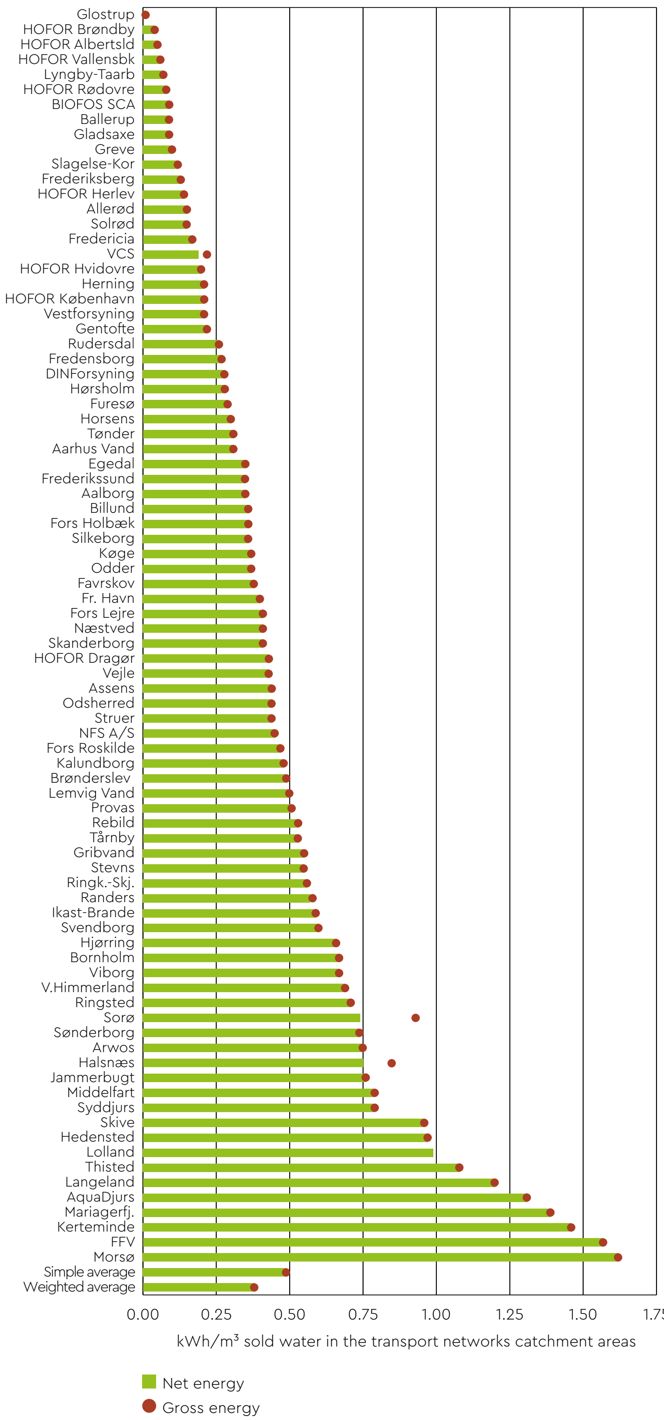
Energy consumption in the wastewater companies

The consumption of energy by wastewater companies is divided into that used in the transport network and that used at wastewater treatment plants. The reason for this is to produce appropriate comparable key figures such as kWh/m³ of water sold in the catchment area of the sewer system and the sewage treatment plant. This is necessary, as there is often a considerable difference between the two calculations of water sold, due to imports and exports across municipality boundaries. Particularly in Copenhagen, wastewater is collected in a few large wastewater treatment plants, where the wastewater is supplied from several companies that only operate sewer systems.

The graphs show the companies' net and gross energy consumption on the transport network, which is stated collectively for all the company's wastewater treatment plants. In the transport network, the net and gross energy ratio remains the same for the vast majority of companies, as very few of them have a very low energy production associated with their transport network. However, there is a distinct difference between net and gross energy consumption for treatment plants, as those over a certain size have the potential to produce energy, most often by means of biogas plants that generate electricity and heat. Some companies carry out sludge incineration, which provides large amounts of heat. The latest trend in energy production is the use of heat pumps, which draw large amounts of heat out of lukewarm wastewater, which can be a stable and continuous source of heat all year round. Some companies have chosen not to include energy production internally within the plant, but instead cooperate with, for example, a biogas plant (external energy production). Other companies do not have the means for biogas energy production, usually because sludge quantities are insufficient. These companies often have identical net and gross energy consumption.

The average weighted gross energy consumption per m³ of water sold to consumers is 1.92 kWh, split between 0.38 kWh/m³ for the transport network and 1.54 kWh/m³ for treatment.

NET- AND GROSS ENERGY FOR TRANSPORTATION, 2019



The key figures for net and gross energy consumption expressed as kWh per m³ of water sold reflect the amount of energy needed when a customer has purchased one m³ of water and discharged it into the sewer.

YOU CAN READ MORE ABOUT THE ENERGY CALCULATION METHOD ON PAGE 15.

The average weighted net energy consumption per m^3 of water sold to consumers is 0.50 kWh/m^3, split between 0.38 kWh/m^3 for transport and 0.12 kWh/m^3 for treatment. The companies purchase, on average, electricity equivalent to 1.50 kWh/m^3 of water sold to customers, split between 0.37 kWh for transport to the treatment plant and 1.13 kWh for treatment. If the sold electricity produced by the companies themselves is deducted, the net electricity consumption is, on average, 1.28 kWh/m^3. The 40 wastewater companies with their own electricity production produce electricity equivalent to about 28% of their own consumption.

The road to energy-positive wastewater companies

The wastewater companies' transport networks cannot easily produce energy, so net and gross energy will therefore be more or less the same. Below is a summary of energy purchases and production for the 85 wastewater companies that participate in DANVA's reports:

Transport	Purchased energy kWh	Self-produced energy used internally kWh	Sold energy kWh
Electricity	96 307,598	315,364	100,078
Heat	2,892,193	197,400	0
Total	99,199,791	512,764	100,078

The net self-supply ratio, which is defined as the percentage of energy sold in relation to energy purchased, is 0.1%.

The total self-supply ratio, which is defined as the percentage of energy sold plus self-produced energy used internally in relation to purchased energy plus self-produced energy used internally, is 0.4%.

The companies will be energy-positive once they exceed 100%.

The wastewater companies' treatment plants have great potential for producing energy in the form of electricity, biogas and heat. It is also expected that the treatment plants will be able to produce enough energy to offset that consumed by the transport side and drinking water companies, so that the water industry as a whole can become energy-positive. Below is a summary of energy purchases and production for the 74 wastewater companies with treatment plants that participate in DANVA's reports:

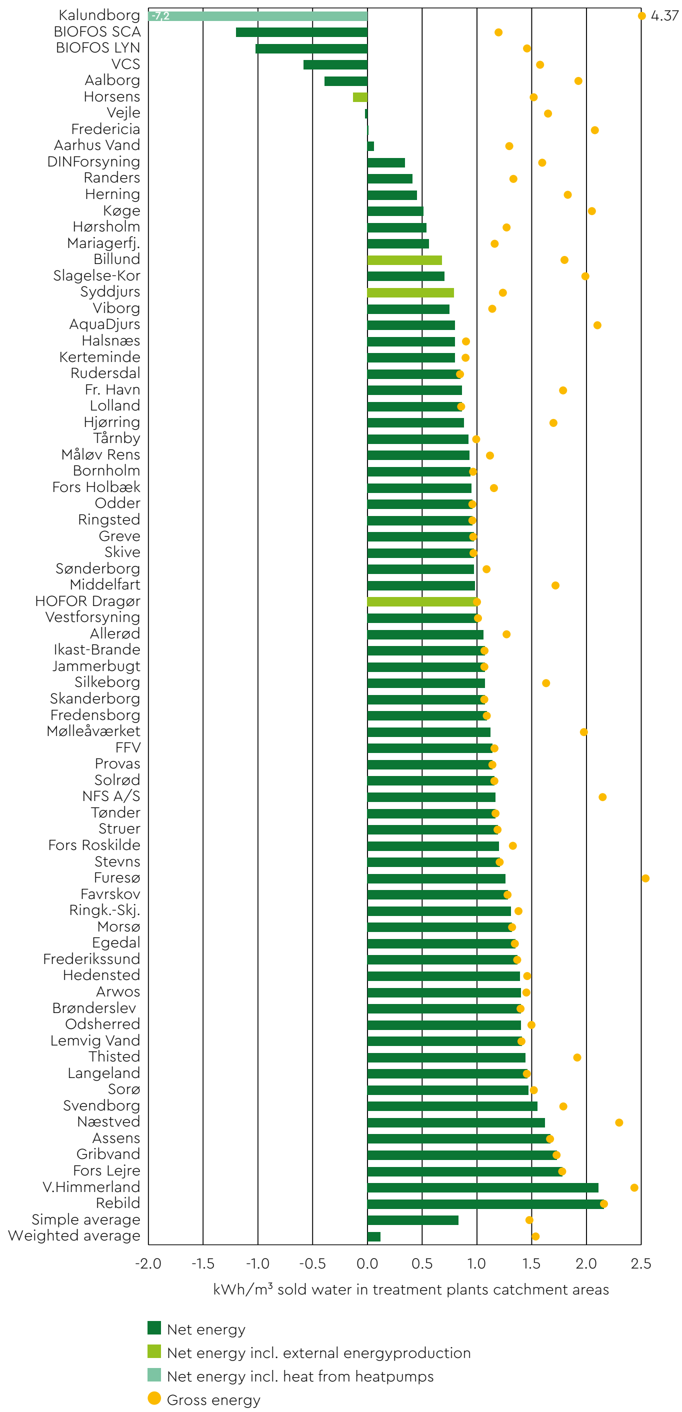
Treatment	Purchased energy kWh	Self-produced energy used internally kWh	Sold energy kWh
Electricity	290,486,911	2,783,314	58,560,587
Heat	28,281,106	76,776,167	216,856,934
Biomass	260,352		10,685,395
Total	319,028,369	79,559,481	286,102,916

The net self-supply ratio, which is defined as the percentage of energy sold in relation to energy purchased, is 89.7%.

The total self-supply ratio, which is defined as the percentage of energy sold plus self-produced energy used internally in relation to purchased energy plus self-produced energy used internally, is 91.7%.

The companies will be energy-positive once they exceed 100%. ■

NET- AND GROSS ENERGY FOR TREATMENT, 2019



Discharges of wastewater

Over the summer of 2020, there has been a big debate in Denmark on discharges from overflows and treatment plants that enter the aquatic environment. The sewer network is designed to conduct the wastewater from consumers to the treatment plant. This cleans the wastewater before it is discharged into the aquatic environment.

Discharges occur when treated wastewater is returned to the aquatic environment, separated rainwater is discharged, and when major downpours occur, potentially via overflow structures (safety valves). If a heavy downpour results in there no longer being enough room for all the water in the sewer, the overflow is meant to ensure that the water is discharged into the recipient instead of backing up into residents' basements via e.g. floor drains. If the water volume that flows down to a treatment plant becomes greater than the latter is designed for, the treatment plant can create a relief/bypass and send the water around the plant's aeration tanks. This is done to prevent large amounts of biological sludge being washed through the treatment plant's final sedimentation tanks and out into the aquatic environment.

There are six general types of discharge where nutrients are discharged into the natural environment:

- Discharge of treated wastewater from the treatment plants
- Outflows of rainwater
- Overflow of diluted wastewater from combined wastewater/rainwater systems
- Emergency overflow from pumping stations
- Relief/bypass arrangements upstream of treatment plants
- Planned short-term discharges

Discharge of treated wastewater from the treatment plants

Approximately 600–800 million m^3 of wastewater flow into the country's 700 treatment plants during the course of a year. Here, approximately 90% of the nitrogen and phosphorus are removed before the water is returned to the natural environment.

Taxes and the wastewater companies' own ambitions to minimise pollution of the aquatic environment have resulted in Danish treatment plants generally treating wastewater far better than the discharge requirements set by the authorities. Overall, the treatment plants discharge less than half of the phosphorus and less than 70% of the nitrogen they are permitted to release.

Outflows of rainwater

In sewer systems where wastewater is kept separate from rainwater, the latter is conducted from roofs, farmyards and roads into its own sewer pipe and discharged into the aquatic environment. Usually, there are requirements to establish a rainwater reservoir, the purpose of which is to regulate and treat the rainwater and thereby protect the recipient from serious adverse effects. Often, the rainwater reservoirs provide a recreational element to local communities.

Overflow of water containing wastewater from combined systems

During heavy downpours, water volumes can become too great to be managed in a combined sewer system. For this reason, several overflow structures (safety valves) have been designed that can discharge the water into the aquatic environment instead of allowing it to back up into residents' basements. Once the heavy rain starts, the "first flush" is set in motion, which is the water that contains the most wastewater, and flows down to the treatment plants. Subsequently, more and more of the combined sewer may be filled with rainwater, and if this cannot remain there, it will eventually be discharged via the overflow structures. Within an overflow, the water flows through a grating which holds back paper and other large solids. Overflow water is often described as mechanically treated diluted wastewater, and the mean concentration of nitrogen is a little less than 30% of the mean concentration of nitrogen in domestic wastewater. The phosphorus content of overflow water is around 15% of domestic wastewater.

Emergency overflow from pumping stations

Many pumping stations are built with an emergency overflow which allows the water to run off if the pump breaks down – a state of affairs which is however extremely rare.

RAIN-RELATED OUTFLOWS

These are termed RBU (regnbetingede udløb) in Danish environmental legislation. They cover two types of discharge: Discharge of rainwater from roofs, paved areas and roads from separate sewer systems, and overflows of water containing wastewater from combined sewer systems.

Relief/bypass arrangements upstream of treatment plants

Treatment plants are designed for a maximum water flow through the plant. This flow must not be exceeded, as otherwise there is a possibility of the active biological sludge being washed out of the aeration tanks, through the final sedimentation tanks, and out into the aquatic environment. To prevent this, treatment plants may have an overflow structure positioned just upstream of the plant or create a bypass e.g. after the mechanical filter and sand/grease trap within the aeration tanks. This water is often referred to as "relief of biologically untreated wastewater". The nutrient levels are lower than with normal wastewater, as it has been mixed with large quantities of rainwater.

Planned short-term discharges

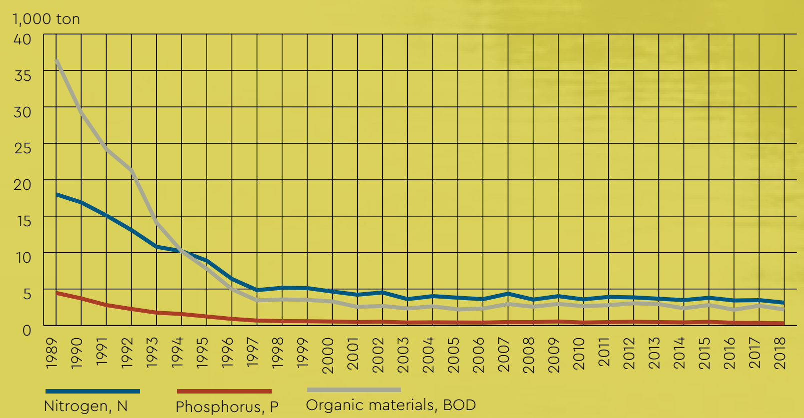
When conducting short-term renovations of central pipe pumping stations, wastewater companies can apply for a temporary permit to discharge wastewater directly into the aquatic environment, but only after initial mechanical treatment. As a rule, this solution is chosen as a final option in the event there are no other immediate solutions. Such discharges often have very little effect in terms of overall nutrient pollution of the aquatic environment, as they are often of very short duration.

DANVA is of the opinion that it should not in future be possible to obtain a permit for direct discharge of untreated wastewater and that the law ought to be changed in this regard. ■

Discharges **from treatment plants**

Initiated by Action Plan for the Aquatic Environment I in 1987, a major upgrade and conversion of wastewater treatment plants in Denmark was launched to improve the treatment of nitrogen and phosphorus prior to discharge into lakes and fjords. This led to a sharp increase in wastewater tariffs in the late 1980s, equivalent to a doubling between 1985 and 1990, as wastewater companies had to spend a lot of money on the development of wastewater treatment facilities. The result was clearly shown in the reduction of nutrients discharged from treatment plants over the following 10 years. From 1989 to 1998, organic matter was reduced by 90%, nitrogen by 71% and phosphorus by 87%. For many years now, discharges have been at a reasonably low and constant level. ■

OUTLET OF NUTRIENTS FROM WASTEWATER TREATMENT PLANTS, 1989 - 2018



Source: Point sources 2018, Ministry of Enviroment and Food.

POINT SOURCE REPORT

The Danish Environmental Protection Agency is responsible for determining discharges by wastewater companies into the aquatic environment. Each year a report is prepared, called "Punktkilder" (Point Sources), which provides an assessment of the discharge of nutrients from the treatment plants, rainwater and overflows from the companies' sewers. The report can be found on the website of the Danish Environmental Protection Agency.

The companies' **sewer network**

Historically, the first few kilometres of sewer network were built with only one line, where wastewater and rainwater flowed through the same pipe. Later, the design changed to separate sewer systems, which has been the preferred design over the last 20 to 30 years for all new housing and building developments. At the same time, many companies have switched to separate sewer systems when renovating their sewer network. The main aim has been to keep rainwater separate from wastewater, thus ensuring room for the wastewater in sewers and treatment plants and thereby avoiding overflows of diluted wastewater into the aquatic environment. The rainwater is carried away through its own pipe into the aquatic environment. Another option is to ask residents to manage the rainwater on their own land. In Danish reference works, this solution is called LAR (lokal afledning af regnvand).

The tendency is that most wastewater companies opt for separate sewer systems in new building developments and renovations, whereas in older densely populated areas like town or city centres this can be very difficult and costly. The solution here will often be to upgrade the existing sewer pipes and build large wastewater ponds that can collect and retain the water that contains wastewater until there is room again at the treatment plant.

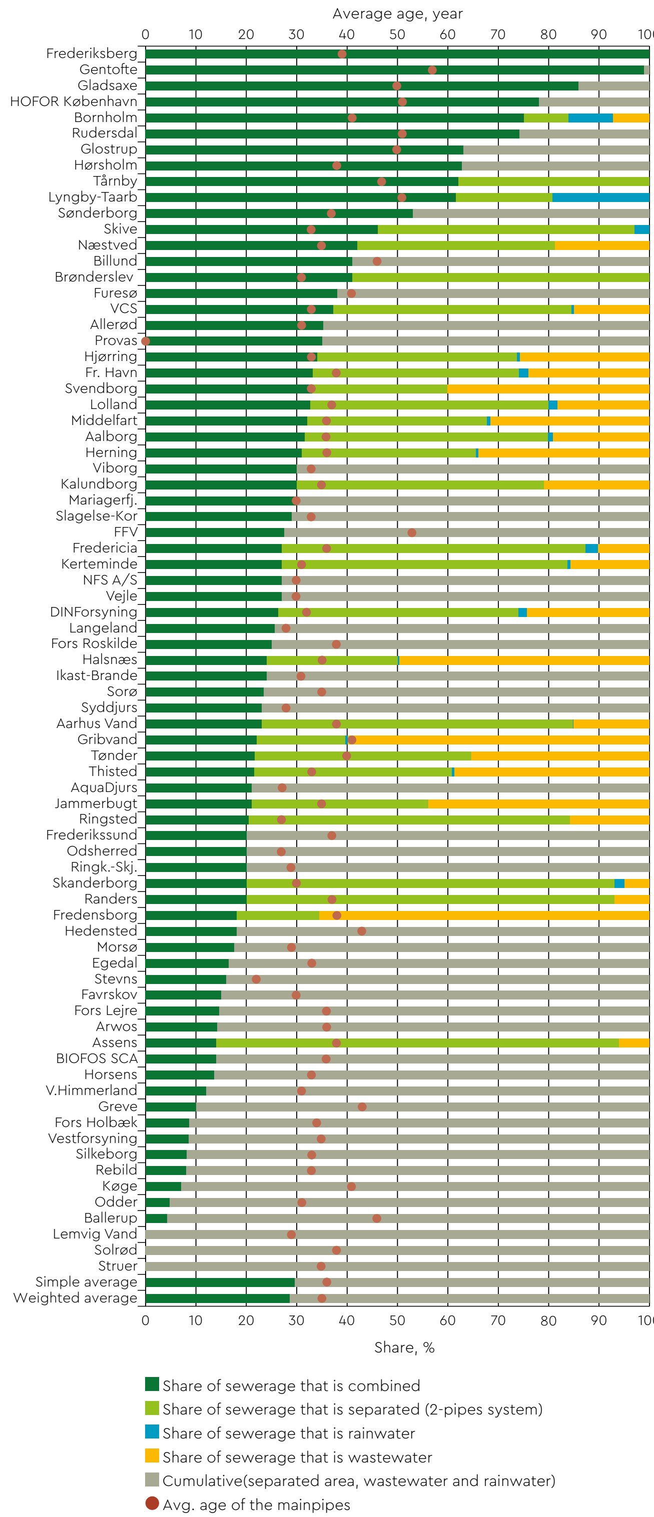
Greater focus on overflows

Nowadays there is a greater focus on discharges from overflows, not least from agriculture and on the part of other stakeholders. This is why both authorities and water companies have over recent years initiated extensive work in gaining an overview and more knowledge. Major work was started on ensuring the quality of the data that is reported to the Danish Environmental Protection Agency's database, PULS. The result is a new and improved database, PULS2, with new functionalities and an improved engine, which is considerably more user-friendly. PULS2 was launched in February 2020. It is anticipated that there will be requirements for the direct measurement of water volumes at the large overflow works, with the aim being to obtain better data with less associated uncertainty. ■

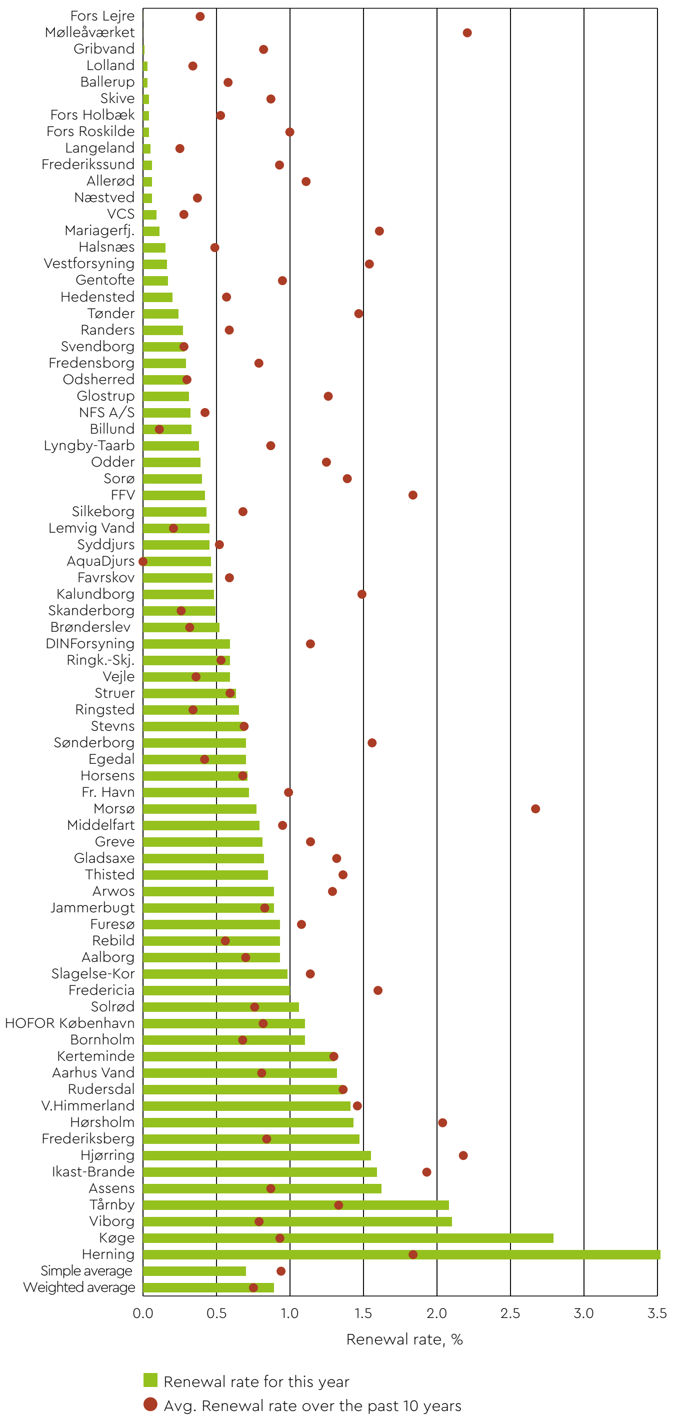
Breakdown between combined and **separate sewer systems**

There is a very substantial difference in the extent of separate sewer systems among the benchmarked wastewater companies. Some companies have almost exclusively combined wastewater sewer systems, while others have generally divided up wastewater and rainwater into separate sewer systems. Certain companies have a target of 100% separate sewer systems, whereas others are keeping to combined systems in e.g. older districts where separate sewer systems would be a colossal investment and cause great inconvenience to residents. ■

AREA ALLOCATION BETWEEN COMBINED AND SEPARATE SEWERAGE, 2019



RATE OF RENEWAL OF SEWER PIPES, 2019



The transport network's rate of renewal

The rate of renewal of the sewer network shows how much of the pipe network (as a percentage) was replaced last year, compared with the average per year for the past 10 years. Benchmarking in recent years has shown that more and more companies have a rate of renewal above 1%, which is fully in line with the major investments in sewer networks of recent years. Factors such as materials used, pipe dimensions, leaks and failures, geological conditions, surface load and age, have a bearing on when the sewer network should be renewed. Another significant factor is that large infrastructure and construction projects often require the wastewater companies to move their sewer pipes even if they have not reached the end of their useful life. ■

PHOTO: COLOURBOX.DK / ANIMAFLORA PICS STOCK

Shallow groundwater in towns and cities costs society a lot of money

Extraneous water is present, to varying degrees, among the various wastewater companies. Conditions such as the origin of the sewer network, groundwater level, soil conditions, rainfall and the state of the sewer network are parameters which affect the amount of extraneous water directed to the treatment plants. Extraneous water includes, among other things:

- Seeping groundwater in areas where the sewer pipes are below the groundwater level.
- Faulty connections in rainwater pipes and road drainage into wastewater systems.
- Drainage water connected to wastewater systems.
- Previous drainage pipes and piped streams which have eventually become sewer systems over time without the streams being disconnected.

In 2018, the Danish Environmental Protection Agency estimated the total volume of extraneous water at 150–200 million m^3 of water annually. The amount of extraneous water (and therefore also discharges of nutrients from treatment plants) is expected to increase due to the influence of climate change on increased rainfall. The wastewater companies are therefore working on sealing leaks in their sewer systems to reduce the energy needed to pump and treat extraneous water.

Rising groundwater levels are currently giving rise to problems in several areas in the form of damp basements, waterlogging of residential areas, reduced security of supply, etc. These problems lead to unnecessary costs for both private and public landowners as well as wastewater companies. In the future, even more landowners will experience problems with groundwater penetration in houses, as the old sewer systems acted as drains and reduced groundwater levels. This means that, with improved sealing of the sewers, thought needs to be given to management of groundwater. The wastewater companies often have the tools to address the challenges of rising groundwater in cooperation with municipalities, but current legislation does not allow municipalities and wastewater companies to manage the groundwater.

DANVA is implementing a project in conjunction with Local Government Denmark (KL) on socioeconomic calculations for various solution models aimed at managing groundwater. The aim of the project is to have legislation enacted pertaining to the planning and management of groundwater in a way that creates the greatest value for residents, companies and municipalities.

Interim results from DANVA's and KL's project indicate that management of groundwater will be in the interest of society, as management costs less than repairing damage. ■

Considerable variation **in load**

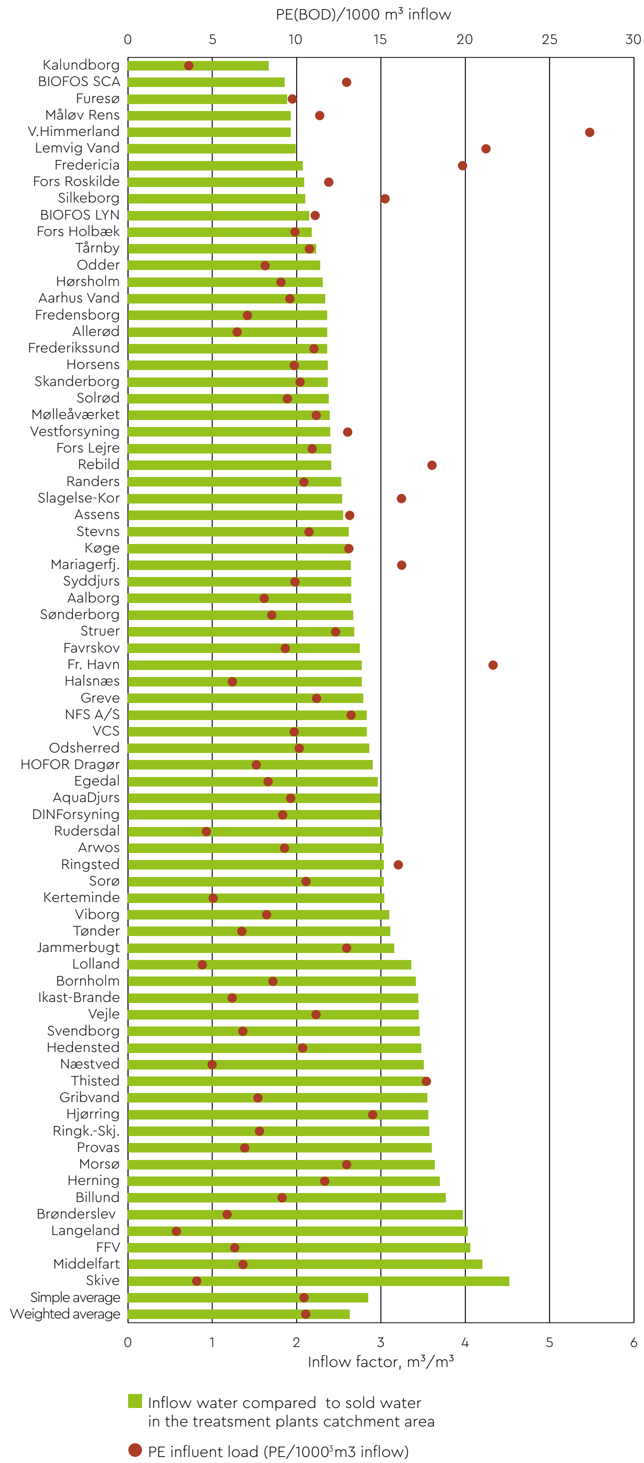
The volume of extraneous water at a treatment plant, together with the rainwater that flows into combined sewer systems, is compared with the quantity of drinking water sold in the treatment plant's catchment area. The graph shows that incoming volumes to treatment plants vary and that the inflow factor is between 1.7 and 4.5 — corresponding to 170–450% of the volume of water purchased and discharged by customers into the sewer.

Loads at the treatment plants

There is a very large variation in the organic matter content of the wastewater piped to treatment plants. Companies such as slaughterhouses or breweries emit large quantities of organic matter, and wastewater treatment plants having this kind of industry within their catchment areas have "thick" wastewater. If the treatment plant mainly receives wastewater from residential areas, it is defined as "thin".

Wastewater loads are calculated in population equivalents, called PE. One person equivalent is defined as the amount one adult contributes in the way of organic biodegradable material, nitrogen and phosphorus per day. 1 PE corresponds to 60 g of BI5/day, 12 g N/day and 2.7 g P/day. ■

INFLOW FACTOR AND INFLUENT LOAD TO THE TREATMENT PLANTS, 2019



WASTEWATER INDICATES CORONAVIRUS earlier than tests

It takes typically 9 to 13 days from the time a person is infected with the coronavirus to their testing positive. Conversely, it only takes one day from becoming infected to excreting the virus. Wastewater analyses therefore allow coronavirus to be traced and dealt with earlier.

DINES THORNBERG, BIOFOS

It can take up to a week from a person becoming infected with the coronavirus to the first symptoms appearing. It will then often be a number of days before they are tested and yet another day before the test result is ready. This means that typically a person has the coronavirus for 9 to 13 days before they test positive and the health authorities become aware of the infection and can take action. Furthermore, some people have few or no symptoms and can therefore infect others without themselves realising that they are infected.

Wastewater, on the other hand, can provide information about the virus some time before the symptoms appear, thereby giving health authorities the opportunity to react faster. The earlier they take action, the greater the opportunities of slowing an outbreak and thereby minimising the consequences and costs.

In actual fact, wastewater analysis can allow authorities to act a whole week earlier. This is because it only takes one day from becoming infected to excreting the virus in faeces.

Furthermore, a wastewater analysis has the advantage that a large population group can be tested at once at the location in question so that each individual can be swabbed.

"Wastewater is a fantastic sampling tool which can give a snapshot of what is happening in a city, including its state of health", says Dines Thornberg, Development Manager at BIOFOS.

Measuring the world's health

Over the last five years, BIOFOS has submitted wastewater analyses to the National Food Institute, Technical University of Denmark (DTU), which heads up a major international project on monitoring disease via wastewater. The purpose of the research project is to investigate how wastewater analyses can be used to monitor infectious diseases and resistant bacteria. As part of the project, researchers from the Netherlands, Italy, the USA and New Zealand have investigated the state of health in more than 250 cities in 103 countries.

"Bacterial resistance to antibiotics is a growing problem, and researchers have looked at the number of resistant bacteria in the wastewater. Doctors throughout the world can use the results to find out how effective antibiotics may be expected to be", explains Dines Thornberg.

In the light of the coronavirus, DTU also uses frozen wastewater samples from the previous year to analyse when the first traces of COVID-19 appeared in Denmark.

Test can show infections and indicate action

Eurofins Denmark has been focusing on coronavirus and has developed a wastewater test that can show the presence of COVID-19. In wastewater samples from a treatment plant with a throughput of 1.5 million litres of water from 3,500 people, Eurofins was able to show the presence of coronavirus from probably just a single infected person.

"In Copenhagen, the volumes of wastewater are so great that many infected individuals are needed before it becomes evident in wastewater samples. But a single district can be measured like this, and if the infection is shown to be present, source tracing can be carried out with the aid of pumping stations distributed through the system. This allows the disease outbreak to be more accurately contained, leading to subsequent individual swab tests", Thornberg says. HOFOR and BIOFOS intend to continue working on this.

Hospitals and care homes can also use the wastewater test, as can businesses wanting to ensure that they can take action on the disease as early as possible.

The test is stated as a Ct value and, by plotting the measurement results on a graph, the test can be used to measure the outbreak's scope and monitor whether the restrictions that are introduced are effective.

Lack of interest

Nonetheless, it has been swab tests carried out on humans that have attracted the attention of the health authorities.

"We have been in dialogue with the health authorities about the potential benefits of wastewater analysis in relation to the coronavirus, but there has not been much interest. This may be due to the fact that it is mainly medical experts who make the decisions and they have more knowledge and experience of human tests", says Thornberg, adding that the number of personal tests at the moment is so great that wastewater analyses would not provide any new information.

Together with Hillerød Spildevand and Aarhus Vand, et al, BIOFOS has decided to push for the development and make wastewater tests a larger and more natural part of health monitoring.

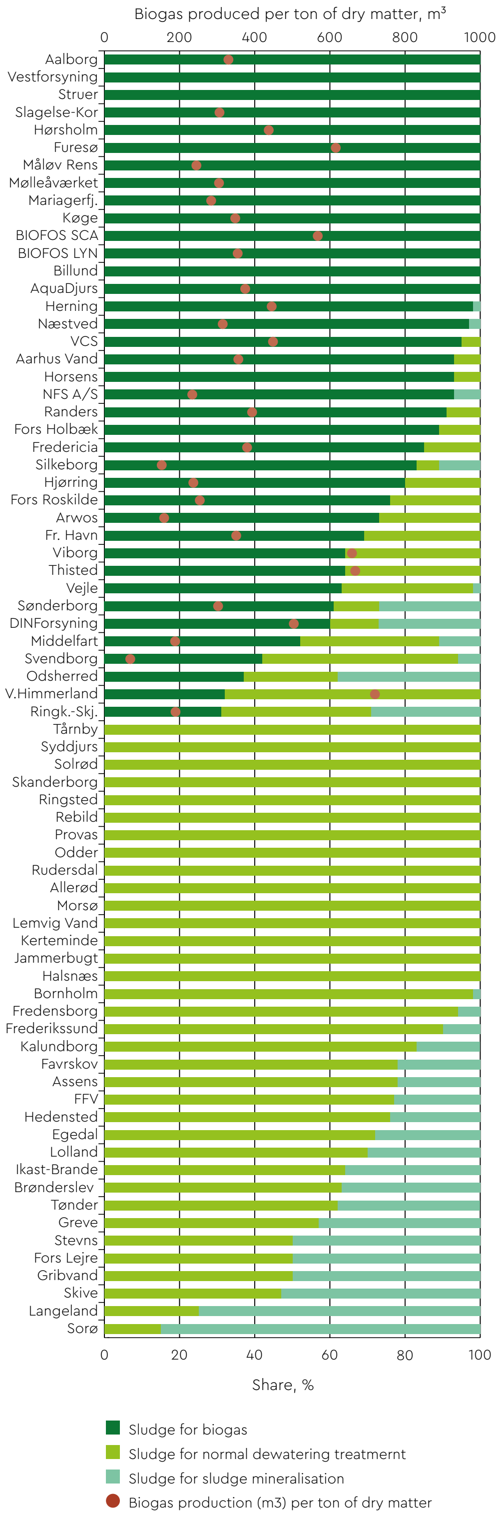
"We see potential in greater cooperation between the National Food Institute, Technical University of Denmark, Eurofins, the health authorities and the wastewater companies. For instance, we would be very glad to discuss with the experts how we can provide them with water samples that are most useful to them", says Dines Thornberg.

The hope is that wastewater monitoring can be used to a greater extent to safeguard the general community and that standard measurement would focus on more indicators than is currently the case.

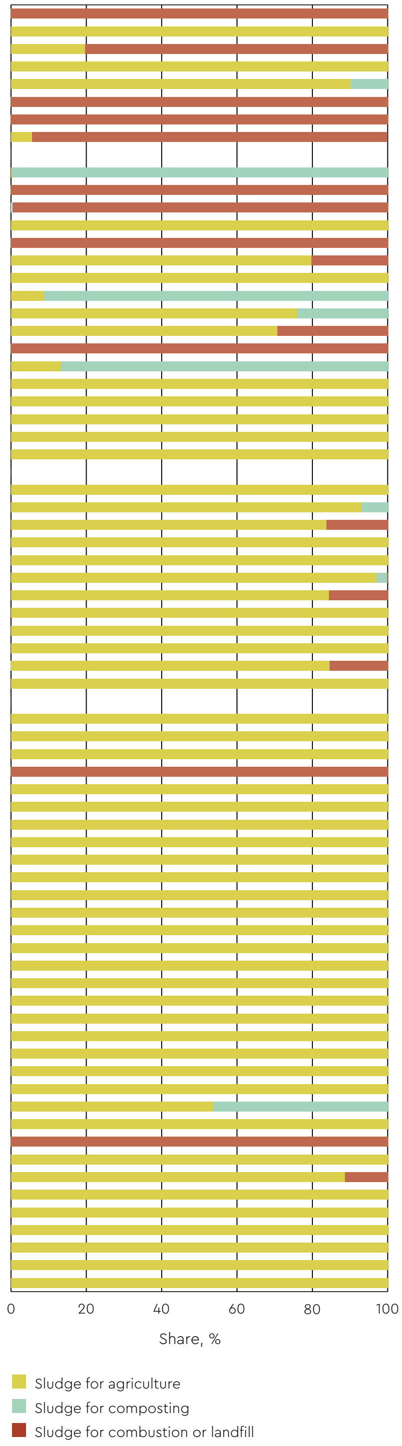
"But, that requires resources of course, and so we are now considering whether we should look for funding or other means to carry on working with the potential we see", says the development manager. ■

Sources: Dines Thornberg – BIOFOS, food.dtu.dk, Eurofins (webinar on Wastewater Test – Coronavirus)

SLUDGE TREATMENT, 2019



SLUDGE DISPOSAL, 2019



The wastewater companies' **sludge treatment**

After wastewater has been treated, the wastewater company is left with the biological sludge, which is a surplus product from the treatment. Sludge treatment at treatment plants represents about 29% on average of the operating costs of internal sludge treatment and disposal, which is the removal of the sludge. For wastewater companies without biogas plants, the average is around 24% of operating costs, and for companies with biogas plants, it is 32% of operating costs.

Internal sludge treatment

The production of surplus sludge extracted from biological aeration tanks by the companies is divided into three groups defined under the regulation:

- Sludge that only undergoes ordinary dewatering before disposal (normal treatment).
- Sludge used for biogas production and which is subsequently dewatered before disposal.
- Sludge run directly onto sludge mineralisation beds where it is slowly degraded. The sludge beds are usually emptied every 10 years.

It is up to each wastewater company to decide which type of processing it chooses. It is often larger plants with large quantities of surplus sludge that are able to build a biogas plant and thereby gain extra energy from the sludge while making the final product more stable and easier to dispose of. There is a relatively large difference in how much biogas the various companies can extract from their excess sludge. Among other things, this is due to differences in the composition of the sludge, for example the proportion of organic matter, and whether the companies add anything other than sewage sludge to their biogas plants, such as industrial waste. The costs encountered by wastewater companies for processing sludge in their treatment plants represent approximately 15% of the total operating costs of the plants.

Over recent years, new sludge treatment options have appeared, such as pyrolysis (thermal decomposition) which reduces unwanted substances in the sludge, but retains the nutrients, so that the end product can still be used as fertiliser. Another option in the future is to break down the sludge using HTL technology into different oil fractions, one of which would be jet fuel, useable in the aviation industry.

Sludge disposal

As a rule, dewatered sludge is disposed of according to one of three categories:

- Sewage sludge that can be spread on farmland.
- Sewage sludge requiring further treated, e.g. by composting before recycling (class B sludge). The reason for this is usually excessive levels of pesticides, which can be reduced by e.g. composting.
- Sewage sludge deposited in landfill or incinerated (class C sludge). This may be due, for example, to excessive heavy metals in the sludge.

It is the wastewater company itself that determines the method of disposal based on analyses of the sludge and the company's own sludge management strategy. The wastewater companies subject to the Danish Water Sector Reform Act together remove sludge amounting to approximately 140,000 tonnes of dry matter, and the expenditure on disposal of sludge accounts for about 14% on average of the wastewater companies' total operating costs at treatment plants. ■

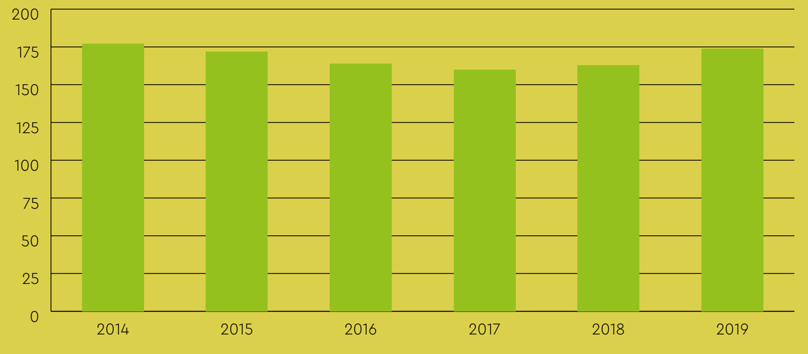
PHOTO: COLOURBOX

Rising prices for sludge disposal on farmland

Over the last few years, focus has been placed on the price of disposing of sludge on agricultural land. The costs mainly consist of those attributable to transport and payments to the recipient. DANVA Benchmarking has previously undertaken an analysis of factors that influence the price. In 2017, new rules were introduced regarding the amount of sludge, based on phosphorus content, that can be applied to farmland, which means that a larger area is needed to dispose of the same amount of sludge. This, in combination with other tightening of land-use rules, has led to an increase of over 9% from 2017 to 2019 based on the prices of 22 wastewater companies. Sludge disposal agreements are usually multi-year agreements and it can thus be expected that the average price will increase over the next few years. ■

AVERAGE PRICES FOR DISPOSAL OF SLUDGE FOR AGRICULTURE

€ PER TON OF DRY MATTER



Simple average based on 11 companies partcipating for the last 7 years.

DRINKING WATER COMPANIES THAT PARTICIPATED IN BENCHMARKING AND STATISTICS 2020 (DATA FOR 2019)

	BASICDATA					
	Inhabitants in the supply area	Total quantity of water sold (FS definition)	Boreholes (water catchments-area)	Waterworks	Hardness of extracted water	Distribution network (supply pipes)
Company	persons	m³/year	number	number	dH	km
Arwos Vand A/S	16,624	1,191,225	13	3	11.5	260
Assens Vandværk A/S	8,400	577,269	10	2	16.0	136
Billund Drikkevand A/S	7,306	728,631	7	1	8.1	158
Bornholms Vand A/S	20,000	1,293,085	28	4	15.0	758
Brønderslev Vand A/S	15,500	881,638	12	3	10.8	338
DIN Forsyning Vand A/S	118,800	8,588,527	74	10	7.4	1.474
Energi Viborg Vand A/S	54,020	2,404,016	12	4		563
FFV Vand A/S	9,244	567,142	6	2	18.0	215
Fors Vand Holbæk A/S	46,301	2,245,204	14	2	15.5	222
Fors Vand Lejre A/S	6,094	229,284	3	1	21.3	87
Fors Vand Roskilde A/S	72,652	3,147,611	12	3	20.3	359
Fredensborg Vand A/S	40,415	1,699,969	11	2	14.0	280
Frederiksberg Vand A/S	104,305	5,048,509	5	1	29.0	169
Frederikshavn Vand A/S	54,000	4,432,000	96	5	8.0	1.228
Give Vandværk A.m.b.a	5,000	287,617	5	1	7.2	80
Glostrup Vand A/S	23,128	1,321,236	13	2	24.0	100
Grindsted Vandværk A.m.b.a.	12,000	1,174,092	11	2	6.6	260
Halsnæs Vand A/S	10,900	602,426	11	2	18.0	169
Herning Vand A/S	44,370	3,116,775	22	3	8.5	728
Hjørring Vandselskab A/S	40,000	3,139,623	43	5	14.0	888
HOFOR Vand Albertslund A/S		1,224,846		1		101
HOFOR Vand Brøndby A/S		1,812,933		1		166
HOFOR Vand Dragør A/S		653,438		2		88
HOFOR Vand Herlev A/S		1,459,981		0		119
HOFOR Vand Hvidovre A/S		3,108,784		1		210
HOFOR Vand København A/S	633,021	51,161,569	468	7	20.0	1.172
HOFOR Vand Rødovre A/S		1,778,853		2		123
HOFOR Vand Vallensbæk A/S		451,472		0		50
Horsens Vand A/S	57,443	4,064,939	24	4	14.0	491
Hurup Vandværk A.m.b.a.	4,326	417,885	10	3	15.0	108
Ikast Vandforsyning A.m.b.A	16,000	868,745	9	2	8.5	212
Ishøj Vand A/S	20,800	1,060,488	0	0	21.0	103
Kalundborg Vandforsyning A/S	16,500	2,989,736	45	4	15.0	352
Kerteminde Forsyning – Vand A/S	17,000	903,161	9	2	24.0	239
Køge Vand A/S	33,519	1,538,910	14	2	21.0	267
Langeland Vand ApS	9,196	732,164	25	4		379
Lemvig Vand A/S	20,000	1,838,486	17	5	7.0	781
Lolland Vand A/S	24,731	1,596,729	29	4	19.0	903

PROCES BENCHMARKING (MAIN KEY FIGURES)						TARIFFS 2020 (level 1)		
Actual operating costs for production, distribution, customer management and general administration in relation to the sold volume of water flow	Operating costs of production of water produced at own waterworks	Operating costs related to distribution compared to sold water in own supply area	Operating costs on customer by water meter	Operating costs on general administration in relation to sold water	Implemented investments and renova-tions	Fixed annual price, incl. VAT	Variable water price, incl. VAT and other taxes	Costs for a consumption of 100 m³ /year
€/m³ sold	€/produced m³	€/m³ sold	€/watermeters	€/m³ sold	€/m³ sold	€	€/m³	€/year
0,55					0,78	188,25	1,74	361,88
0,91	0,41	0,22	12,76	0,19	5,54	86,01	2,63	348,66
0,31					0,71	101,24	1,85	285,84
1,30	0,25	0,43	12,90	0,51	1,14	167,17	2,21	388,05
0,64					0,77	103,75	2,23	326,64
0,57	0,24	0,11	22,69	0,11	0,60	132,86	1,95	328,18
0,65					0,84	113,79	1,87	300,67
1,12					0,73	117,14	2,44	361,04
0,49	0,13	0,14	5,25	0,21	0,17	83,67	1,85	268,81
1,39					0,27	83,67	2,52	335,48
0,78	0,19	0,23	7,64	0,32	0,23	83,67	2,44	327,31
0,41	0,17	0,10	5,29	0,17	0,28	34,00	2,34	268,41
0,68	0,24	0,19	95,92	0,28	1,08	49,53	3,15	364,66
0,84	0,30	0,30	18,33	0,10	0,75	175,70	2,41	416,80
1,21					0,56	92,54	1,90	282,76
0,64					1,86	37,85	3,08	345,75
0,64	0,18	0,11	59,33	0,10	0,39	100,08	1,92	292,19
1,13	0,32	0,44	1,73	0,35	2,42	131,19	2,68	398,93
0,64	0,25	0,30	9,70	0,01	0,66	104,93	1,63	267,72
0,73	0,30	0,19	8,56	0,16	0,68	183,40	2,05	388,89
0,67					1,09	13,39	3,07	320,75
0,94					1,07	16,73	3,74	391,03
0,65					1,32	59,06	3,12	370,70
0,54					1,55	0,00	3,50	350,07
0,51					0,95	0,00	3,11	311,24
0,52					0,81	64,26	2,44	308,43
0,77					1,05	0,00	3,34	334,40
0,49					0,34	16,73	3,37	354,08
0,53					0,55	128,85	1,74	302,48
0,93					1,30	108,77	1,90	299,13
0,78					0,88	83,67	1,99	282,33
0,42					0,63	0,00	3,09	308,70
0,42	0,41	0,10	21,35	0,10	0,33	0,00	3,14	314,06
1,08	0,40	0,55	22,06	0,09	1,17	104,42	2,49	353,41
0,76	0,35	0,17	12,89	0,09	0,86	28,41	3,66	394,81
1,05					1,32	133,20	2,01	333,73
0,48					2,78	121,77	2,21	342,65
0,85	0,24	0,39	6,12	0,14	1,00	126,17	3,24	449,73

DRINKING WATER COMPANIES THAT PARTICIPATED IN BENCHMARKING AND STATISTICS 2020 (DATA FOR 2019) (DATA FOR 2018)

	BASICDATA					
	Inhabitants in the supply area	Total quantity of water sold (FS definition)	Boreholes (water catchments-area)	Waterworks	Hardness of extracted water	Distribution network (supply pipes)
Company	persons	m^3/year	number	number	dH	km
Lyngby-Taarbæk Vand A/S	56,214	2,781,930	7	2	16.2	212
Mariagerfjord Vand a/s	15,000	1,438,882	10	3	8.9	349
Midtfyns Vandforsyning A.m.b.a.	16,000	1,752,202	13	5	17.0	439
Morsø Vand A/S	9,375	540,367	9	2	13.0	119
NFS A/S	18,706	1,143,540	21	2	18.3	173
NK-Forsyning A/S	45,000	2,104,410	16	2	16.0	621
Novafos Vand Ballerup A/S	48,602	3,073,113	10	4	18.0	263
Novafos Vand Egedal A/S	16,500	597,973	9	1	20.0	156
Novafos Vand Frederikssund A/S	27,000	1,275,637	22	5	16.0	323
Novafos Vand Gentofte A/S	74,830	3,609,839	22	1	18.0	301
Novafos Vand Gladsaxe A/S	69,262	3,218,595	9	2	18.0	225
Novafos Vand Hørsholm A/S	24,864	1,191,683		0		135
Novafos Vand Rudersdal A/S	34,037	1,598,945	13	3	19.0	204
Novafos Vand Sjælsø A/S	0	6,696,587	43	1	16.0	32
Odder Vandværk a.m.b.a.	11,989	887,685	8	2	15.0	210
Odsherred Vand A/S	5,200	354,554	16	4	17.0	195
Provas	25,645	1,568,412	16	3	10.8	409
Ringkøbing – Skjern Vand A/S	36,520	3,490,338	28	5	7.9	1,227
Ringsted Vand A/S	27,125	1,668,116	13	4	17.0	382
Silkeborg Vand A/S	59,100	2,560,160	11	3	4.0	586
SK Vand A/S	69,900	3,487,054	48	4	18.0	720
Skanderborg Forsyning A/S	20,072	1,054,283	23	6	12.3	212
Skive Vand A/S	34,500	2,405,025	28	9	10.0	713
Sorø Vand A/S	10,000	501,033	8	1	19.0	251
Struer Forsyning Vand A/S	13,970	920,311	9	2	6.3	249
Svendborg Vand A/S	38,610	1,930,306	27	6	20.0	460
Sønderborg Vandforsyning A/S	41,500	2,093,869	21	6	15.0	367
Thisted Vand A/S	32,535	3,117,911	34	8	13.0	878
TREFOR Vand A/S	147,000	11,076,868	69	10	13.0	1,446
Tønder Vand A/S	24,287	1,570,503	12	4	11.3	552
TÅRNBYFORSYNING Vand A/S	42,989	2,710,271	10	1	19.0	190
VandCenter Syd as	175,181	9,160,655	48	6	16.4	1,059
Verdo Vand A/S	50,000	2,402,276	21	5	12.5	379
Vestforsyning Vand A/S	48,163	3,507,364	26	5	11.5	1,106
Vesthimmerlands Vand A/S	350	48,612	5	5	7.0	48
Aalborg Vand A/S	123,000	6,837,292	57	13	13.0	718
Aarhus Vand A/S	349,873	13,780,365	85	8	16.0	1,494

PROCES BENCHMARKING (MAIN KEY FIGURES)						TARIFFS 2020 (level 1)		
Actual operating costs for production, distribution, customer management and general administration in relation to the sold volume of water flow	Operating costs of production of water produced at own waterworks	Operating costs related to distribution compared to sold water in own supply area	Operating costs on customer by water meter	Operating costs on general administration in relation to sold water	Implemented investments and renova-tions	Costs for a consumption of 100 m³ /year	Variable water price, incl. VAT and other taxes	Costs for a consumption of 100 m³ /year
€/m³ sold	€/produced m³	€/m³ sold	€/watermeters	€/m³ sold	€/m³ sold	€	€/m³	€/year
0,58	0,31	0,27	9,61	0,15	0,68	0,00	3,32	332,13
0,45					0,39	89,91	1,76	266,22
0,52					0,48	107,10	1,82	289,02
0,63					0,65	99,20	1,87	285,94
0,69					0,51	83,67	2,10	293,17
0,80	0,17	0,20	18,58	0,28	1,31	118,14	2,32	350,01
0,59					1,31	0,00	3,09	308,57
0,85					1,21	0,00	3,80	379,52
0,90					0,84	113,79	2,68	381,53
0,64					1,06	0,00	2,68	268,41
0,62					1,05	0,00	3,17	317,27
0,47					1,05	0,00	3,34	334,00
0,83					0,66	0,00	2,99	299,20
0,24					0,48			
0,88					1,19	97,05	2,28	325,03
1,43					0,73	190,76	1,94	384,34
0,92	0,16	0,63	3,38	0,09	6,16	123,55	2,24	347,78
0,45					0,66	185,24	1,96	381,49
0,50	0,19	0,21	17,40	0,03	1,10	24,84	2,67	291,37
0,77					0,81	105,42	1,73	278,92
0,84	0,22	0,27	7,14	0,29	0,99	173,86	2,17	391,13
0,92	0,47	0,14	6,29	0,24	0,85	98,73	2,07	305,82
0,49	0,17	0,14	7,97	0,12	1,44	100,40	2,17	317,54
0,86					0,73	77,14	2,64	341,53
0,66	0,18	0,19	8,75	0,23	0,52	90,03	1,82	272,09
0,86	0,29	0,36	5,77	0,17	1,29	113,79	2,57	371,08
0,63					0,59	74,30	2,21	295,72
0,37	0,11	0,20	2,65	0,05	0,55	104,25	2,20	324,20
0,75	0,18	0,15	39,77	0,23	0,68	167,34	2,30	397,72
0,67	0,16	0,28	16,15	0,15	0,58	140,16	2,47	387,15
0,38	0,32	0,20	17,72	0,06	0,79	35,64	2,33	268,57
0,57	0,23	0,26	2,46	0,07	0,49	80,32	2,40	320,75
0,81	0,11	0,22	6,72	0,45	1,48	92,87	1,81	273,46
0,66	0,19	0,22	17,40	0,15	0,36	125,50	2,04	329,92
1,01					1,09	123,83	2,10	334,14
0,79	0,20	0,29	6,52	0,25	1,48	167,34	1,95	362,65
0,74	0,20	0,30	10,75	0,17	1,47	92,03	2,46	337,95

WASTEWATER COMPANIES THAT PARTICIPATED IN BENCHMARKING AND STATISTICS 2020 (DATA FOR 2019)

	BASIC DATA					
	Inhabitants in the catchment area	Sewer system (wastewater and rainwater)	Amount of water sold in catchment area (FS definition)	Treatment plant over 30 PE	Inflow volume to treatment plants	Total influent organic load
Company	persons	km	m³/year	Number	m³/year	PE, person equivalents
AquaDjurs A/S (Spildevand)	37,163	1,153	2,006,797	2	4,899,445	47,355
Arwos Spildevand A/S	53,000	1,554	2,520,874	7	7,631,711	70,944
Assens Spildevand A/S	35,015	1,363	1,752,301	8	4,460,069	58,905
Billund Spildevand A/S	22,361	465	1,603,522	5	6,048,033	55,595
BIOFOS Lynettefællesskabet A/S		0	43,831,073	2	94,359,000	1,049,067
BIOFOS Spildevandscenter Avedøre A/S		57	13,829,400	1	25,677,000	333,261
Bornholms Spildevand A/S	30,000	856	1,966,242	7	6,714,422	57,970
Brønderslev Spildevand A/S	28,373	614	1,352,268	3	5,368,796	31,684
DIN Forsyning Spildevand A/S	171,144	2,814	8,705,910	18	26,500,389	244,035
Energi Viborg Spildevand A/S	97,000	2,071	4,004,612	13	12,411,676	102,153
Favrskov Forsyning A/S	43,100	1,156	1,794,881	6	4,721,455	44,079
FFV Spildevand A/S	51,814	1,333	2,256,506	8	9,157,790	58,176
Fors Spildevand Holbæk A/S	62,190	1,256	3,092,579	7	6,754,562	67,289
Fors Spildevand Lejre A/S	25,040	613	1,070,957	8	2,580,808	28,266
Fors Spildevand Roskilde A/S	87,914	1,108	3,878,420	5	8,112,112	96,597
Fredensborg Spildevand A/S	41,000	641	1,731,882	3	3,173,302	22,530
Fredericia Spildevand og Energi A/S	51,400	1,044	5,217,243	1	10,820,364	214,858
Frederiksberg Kloak A/S	104,305	207	4,926,476			
Frederikshavn Spildevand A/S	55,068	1,104	3,747,815	9	13,638,156	295,591
Glostrup Spildevand A/S	23,129	207	1,326,349			
Greve Spildevand A/S	49,895	753	2,138,513	1	5,962,363	66,819
Gribvand Spildevand A/S	48,205	1,036	1,818,997	9	6,448,943	49,785
Halsnæs Spildevand A/S	29,138	615	1,319,284	2	3,891,023	24,187
Hedensted Spildevand A/S	33,550	976	1,758,438	5	6,116,101	63,530
Herning Vand A/S	45,035	1,241	3,999,763	14	14,793,369	172,587
Hjørring Vandselskab A/S	52,000	1,411	3,151,570	7	11,217,525	163,106
HOFOR Spildevand Albertslund A/S		608	1,215,194			
HOFOR Spildevand Brøndby A/S		345	1,800,750			
HOFOR Spildevand Dragør A/S		177	633,932	1	1,793,800	13,698
HOFOR Spildevand Herlev A/S		264	1,442,950			
HOFOR Spildevand Hvidovre A/S		488	3,023,371			
HOFOR Spildevand København A/S	633,000	1,347	30,769,037			
HOFOR Spildevand Rødovre A/S		272	1,735,221			
HOFOR Spildevand Vallensbæk A/S		176	623,679			
Horsens Vand A/S	90,966	1,644	4,965,867	3	11,780,745	116,556
Ikast-Brande Spildevand A/S	36,000	853	1,853,522	3	6,369,039	39,500
Jammerbugt Forsyning A/S	45,700	1,001	1,813,708	4	5,725,742	74,509
Kalundborg Spildevandsanlæg A/S	48,452	933	5,540,299	8	9,267,645	33,722

PROCES BENCHMARKING (MAIN KEY FIGURES)						TARIFFS 2020 (level 1)		
Actual operating costs for transport, treatment, customer management, and general administration compared to sold volume of water	Operating costs to sewer system related to the amount of water sold in the sewerage catchment area	Operating costs to treatment in relation to the amount of water sold in the treatment plant's catch-ment area	Operating costs to customer management by water meters	Operating costs to general administration in relation to the amount of water sold	Implemented investments and renovations	Fixed annual price, incl. VAT	Variable price incl. VAT and taxes	Costs for a consumption of 100 m^3 /year
€/m^3 sold	€/m^3 sold	€/m^3 sold	€/water meter	€/m^3 sold	€/m^3 sold	€	€/m^3	€/year
1,48					3,14	104,93	4,35	540,01
1,88					3,60	102,07	7,10	812,38
2,10	0,90	0,78	19,51	0,28	7,23	83,67	8,37	920,35
2,36					1,76	104,92	5,86	690,60
0,46					0,31	0,00		
0,56					0,19	0,00		
1,84	0,39	0,83	7,80	0,56	1,83	92,70	5,36	628,85
1,62	0,41	0,82		0,38	4,83	0,00	5,82	582,33
1,37	0,44	0,70	13,11	0,12	6,70	104,75	4,02	506,36
1,71					4,17	0,00	6,36	635,88
1,68	0,44	0,79	0,00	0,49	3,00	95,58	5,77	672,42
1,95					4,19	104,93	6,59	764,24
1,99	0,53	0,84	0,69	0,61	1,04	104,92	5,77	682,30
2,99	0,51	1,49	4,91	0,94	1,42	104,92	6,01	706,39
2,29	0,67	0,98	2,86	0,63	1,40	104,92	4,64	568,91
1,06	0,35	0,63	4,99	0,19	0,63	0,00	5,45	544,71
1,04	0,29	0,51	9,36	0,21	2,19	58,57	4,81	539,69
0,57	0,28		59,90	0,23	5,05	0,00	2,26	225,84
2,04	0,50	0,93	6,03	0,14	2,52	104,92	6,35	739,99
0,60					4,09	0,00	4,35	435,07
1,31	0,50	0,66	17,93	0,03	2,07	0,00	3,68	368,14
2,16	0,63	0,99	20,59	0,23	5,13	104,93	7,91	895,56
2,52	0,83	0,74	8,79	0,74	2,69	99,56	8,37	936,24
2,45	1,11	1,07	16,32	0,11	3,53	104,92	6,36	740,80
1,61	0,80	0,74	7,14	0,01	3,93	104,93	4,86	591,41
1,72	0,53	0,77	13,36	0,31	3,13	103,75	6,88	791,30
0,76					1,08	0,00	5,31	530,92
0,57					3,52	0,00	4,42	441,77
1,98					3,71	0,00	5,21	521,42
0,70					3,97	0,00	3,80	379,65
0,59					3,72	0,00	5,44	543,51
0,42					1,45	0,00	2,71	270,82
0,60					2,18	0,00	3,59	358,77
0,48					1,82	0,00	5,93	592,77
1,25					2,58	104,92	4,59	563,96
1,53					2,37	104,93	5,44	648,84
1,72	0,61	1,01	5,70	0,04	2,82	104,95	3,68	473,09
1,13	1,33	0,54	21,82	0,11	0,67	0,00	7,37	737,48

WASTEWATER COMPANIES THAT PARTICIPATED IN BENCHMARKING AND STATISTICS 2020 (DATA FOR 2019)

	BASIC DATA					
	Inhabitants in the catchment area	Sewer system (wastewater and rainwater)	Amount of water sold in catchment area (FS definition)	Treatment plant over 30 PE	Inflow volume to treatment plants	Total influent organic load
Company	persons	km	m³/year	Number	m³/year	PE, person equivalents
Kerteminde Forsyning – Spildevand A/S	23,773	572	1,047,488	3	2,402,766	12,196
Køge Afløb A/S	56,300	936	2,500,659	4	6,582,676	86,409
Langeland Spildevand ApS	9,125	528	556,520	8	2,240,798	6,494
Lemvig Vand A/S	19,200	621	1,273,909	3	2,534,949	53,799
Lolland Spildevand A/S	19,545	1,182	2,972,930	39	6,554,679	28,987
Lyngby-Taarbæk Spildevand A/S	56,214	430	2,780,964			
Mariagerfjord Spildevand A/S	30,000	1,144	2,089,998	1	5,488,541	89,269
Middelfart Spildevand A/S	38,853	838	1,610,236	6	6,766,985	46,257
Morsø Spildevand A/S	15,980	637	848,163	3	3,085,737	40,149
Mølleåværket A/S	0	7	5,077,040	1	12,141,862	135,840
NFS A/S	36,320	682	1,543,047	4	5,210,071	69,056
NK-Forsyning A/S	72,000	1,433	3,031,874	8	10,655,960	53,165
Novafos Måløv Rens A/S		0	2,060,040	1	3,976,914	45,268
Novafos Spildevand Allerød A/S	25,056	369	1,181,700	3	2,783,479	17,974
Novafos Spildevand Ballerup A/S	48,353	462	2,687,585			
Novafos Spildevand Egedal A/S	41,788	704	1,532,811	3	3,297,684	27,443
Novafos Spildevand Frederikssund A/S	42,545	818	1,894,707	6	4,474,203	49,386
Novafos Spildevand Furesø A/S	40,712	438	1,719,084	1	1,662,624	16,279
Novafos Spildevand Gentofte A/S	74,956	498	3,616,575			
Novafos Spildevand Gladsaxe A/S	69,681	377	3,273,828			
Novafos Spildevand Hørsholm A/S	24,767	239	1,176,430	1	3,951,093	35,972
Novafos Spildevand Rudersdal A/S	55,939	561	2,707,734	3	4,783,460	22,368
Odder Spildevand A/S	8,059	508	912,555	2	2,079,192	17,007
Odsherred Spildevand A/S	26,150	803	1,179,710	9	3,378,277	34,406
Provas	50,894	1,266	2,410,922	11	8,679,907	60,348
Rebild Vand & Spildevand A/S	23,400	766	1,177,699	11	639,979	11,550
Ringkøbing – Skjern Spildevand A/S	41,000	1,451	2,600,341	16	9,284,434	72,728
Ringsted Spildevand A/S	29,554	704	1,844,642	3	5,595,286	89,849
Silkeborg Spildevand A/S	86,662	1,820	3,825,172	11	8,026,886	122,388
SK Spildevand A/S	62,500	1,375	3,228,185	21	8,190,512	132,870
Skanderborg Forsyning A/S	57,630	1,168	2,550,204	6	6,001,006	61,365
Skive Vand A/S	31,939	1,103	1,826,760	5	8,253,627	33,813
Solrød Spildevand A/S	23,000	363	914,303	1	2,179,795	20,670
Sorø Spildevand A/S	21,000	407	1,024,246	5	3,107,225	32,767
Stevns Spildevand A/S	19,217	533	808,150	4	2,119,495	22,817
Struer Forsyning Spildevand A/S	19,063	503	884,958	3	2,374,461	29,300
Svendborg Spildevand A/S	57,802	1,023	2,625,056	6	9,085,321	62,149
Syddjurs Spildevand A/S	35,400	1,022	1,565,064	9	3,352,009	33,323

PROCES BENCHMARKING (MAIN KEY FIGURES)						TARIFFS 2020 (level 1)		
Actual operating costs for transport, treatment, customer management, and general administration compared to sold volume of water	Operating costs to sewer system related to the amount of water sold in the sewerage catchment area	Operating costs to treatment in relation to the amount of water sold in the treatment plant's catch-ment area	Operating costs to customer management by water meters	Operating costs to general administration in relation to the amount of water sold	Implemented investments and renovations	Fixed annual price, incl. VAT	Variable price incl. VAT and taxes	Costs for a consumption of 100 m³ /year
€/m³ sold	€/m³ sold	€/m³ sold	€/water meter	€/m³ sold	€/m³ sold	€	€/m³	€/year
1,24	0,54	0,68	11,69	0,06	1,23	104,95	4,35	540,03
1,33	0,43	0,77	24,48	0,04	2,68	0,00	6,93	692,77
3,12					8,32	104,93	6,87	792,08
1,64					0,67	106,81	4,69	576,02
1,16	0,83	0,80	12,33	0,10	7,11	105,51	8,43	948,35
0,50	0,33		3,67	0,16	1,11	0,00	3,96	395,72
1,81					2,80	89,91	5,85	674,65
2,33	0,72	1,28	14,02	0,19	5,52	0,00	7,72	772,16
2,31					3,27	104,92	7,03	807,73
0,77		0,69	4.653,75	0,08	0,23			
2,15					1,86	83,67	6,28	711,24
1,89	0,75	0,64	18,62	0,32	5,49	104,21	7,40	843,83
0,66					1,99			
1,56					3,01	0,00	7,59	759,04
0,35					3,06	0,00	4,13	412,99
1,47					1,98	0,00	5,78	578,31
2,03					6,18	99,73	6,79	778,45
1,30					2,71	0,00	6,02	602,41
0,40					15,93	0,00	3,92	391,57
0,41					5,69	0,00	4,28	428,38
1,39					4,79	0,00	5,12	512,05
1,08					1,28	0,00	4,73	472,56
1,40					2,69	104,92	4,95	600,23
2,19					7,34	103,75	7,23	826,64
2,13	0,97	1,02	3,89	0,11	10,02	105,09	7,00	804,95
1,43					3,57	101,74	4,97	598,39
1,75					2,89	104,25	7,13	817,10
1,75	0,91	1,11	12,68	0,13	7,00	0,00	5,95	595,18
1,52					4,02	87,85	4,02	489,46
2,13	0,85	0,91	13,06	0,27	3,45	100,57	6,19	719,71
1,85	0,29	0,79	13,49	0,67	3,59	92,03	5,77	669,41
1,79	0,70	0,70	9,78	0,30	1,59	100,40	5,66	666,00
1,52	0,54	0,79	18,00	0,06	3,13	0,00	5,35	535,48
2,23					3,05	86,04	7,69	855,12
2,11	0,82	1,00	18,35	0,08	3,63	100,90	7,55	855,66
2,09	0,65	1,10	4,46	0,29	1,02	0,00	4,69	468,54
1,76	0,62	0,97	4,98	0,13	1,87	52,21	5,76	627,84
2,08					4,61	104,94	6,41	746,44

PHOTO: COLOURBOX.DK

WASTEWATER COMPANIES THAT PARTICIPATED IN BENCHMARKING AND STATISTICS 2020 (DATA FOR 2019)

	BASIC DATA					
	Inhabitants in the catchment area	Sewer system (wastewater and rainwater)	Amount of water sold in catchment area (FS definition)	Treatment plant over 30 PE	Inflow volume to treatment plants	Total influent organic load
Company	persons	km	m³/year	Number	m³/year	PE, person equivalents
Sønderborg Spildevandsforsyning A/S	74,561	1,510	3,202,137	5	8,540,855	73,046
Thisted Vand A/S	57,415	1,021	2,423,376	5	8,540,804	151,541
Tønder Spildevand A/S	29,357	882	2,009,750	17	6,245,677	42,291
TÅRNBYFORSYNING Spildevand A/S	43,063	266	2,228,239	1	4,969,340	53,528
VandCenter Syd as	234,368	2,646	11,112,655	8	31,418,218	310,853
Vandmiljø Randers	92,075	1,802	4,571,389	5	11,550,832	120,440
Vejle Spildevand A/S	101,748	2,185	5,186,413	9	17,870,786	199,423
Vestforsyning Spildevand A/S	52,000	1,279	3,511,216	6	8,415,300	109,999
Vesthimmerlands Vand A/S	29,631	1,024	2,003,290	3	3,867,392	106,086
Aalborg Kloak A/S	209,893	2,573	10,558,245	2	30,395,656	246,031
Aarhus Vand A/S	363,868	3,651	14,972,402	4	34,081,131	327,870

PROCES BENCHMARKING (MAIN KEY FIGURES)						TARIFFS 2020 (level 1)		
Actual operating costs for transport, treatment, customer management, and general administration compared to sold volume of water	Operating costs to sewer system related to the amount of water sold in the sewerage catchment area	Operating costs to treatment in relation to the amount of water sold in the treatment plant's catchment area	Operating costs to customer management by water meters	Operating costs to general administration in relation to the amount of water sold	Implemented investments and renovations	Fixed annual price, incl. VAT	Variable price incl. VAT and taxes	Costs for a consumption of 100 m³ /year
€/m³ sold	€/m³ sold	€/m³ sold	€/water meter	€/m³ sold	€/m³ sold	€	€/m³	€/year
1,82					4,10	0,00	6,31	630,92
2,00	1,02	1,05	1,89	0,14	1,40	104,93	5,19	624,08
1,81	0,74	0,62	14,84	0,30	1,42	82,60	6,16	698,39
1,27	0,48	0,72	7,26	0,03	1,93	0,00	3,65	365,46
1,38	0,47	0,73	5,64	0,15	2,52	100,40	4,94	594,11
1,35	0,46	0,59	13,87	0,24	2,63	97,73	4,76	574,04
1,65					3,75	107,02	5,35	642,50
1,66	0,53	0,72	13,26	0,33	2,09	104,28	4,92	596,12
1,66					3,01	100,07	6,39	739,42
1,32	0,53	0,49	15,23	0,18	3,63	104,92	3,86	490,86
0,99	0,23	0,51	4,95	0,24	1,93	83,67	3,75	458,90

DANVA

DANVA, Dansk Vand- og Spildevandsforening (the Danish Water and Wastewater Association), is a national industry and stakeholder organisation for Denmark's drinking water and wastewater companies. You can read more about us at www.danva.dk

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KEY FIGURES

- ½ litre of water costs less than 0.48 cent.
- The average consumption of water in Danish households is 101 litres per person per day.
- The actual operating expenses of the drinking water companies, on average, are € 0.63 per m^3 sold, and the investments implemented amount to € 0.91 per m^3 sold.
- The actual operating expenses of the wastewater companies, on average, are € 1.46 per m^3 sold, and the investments implemented amount to € 3.32 per m^3 sold.
- Electricity consumption (purchased electricity) for 1,000 litres of water pumped from the ground, delivered to the consumer and drawn from the tap, on average, amounts to 0.41 kWh. Transport, treatment and diversion to the recipient requires, on average, 1.50 kWh. Collectively, this results in purchased consumption of electricity of 1.91 kWh. If this quantity is offset by the electricity that the companies produce themselves, the net consumption of electricity amounts to 1.69 kWh per 1,000 litres.
- An average family of 2.15 people uses 79.29 m^3 of water annually, the net cost of which is 1.69 kWh/m^3 in electricity consumed by the drinking water company and the wastewater company. This means that a family's annual "greenhouse gas" emissions based on the amount of electricity used to cover its water consumption is equivalent to 9.1 kg of CO_2.