



# VCS Denmark

– a sustainable water and wastewater utility based on practical water knowledge



VCS Denmark



## SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD



## Index

Executive Director's statement	3
VCS Denmark – a brief introduction	4
Projects all over the world	4
Training programmes conducted by experienced operators and specialists	5
Paving the way for new ways of thinking about wastewater	6
Passing on best practice	7
Taking the lead in developing innovative solutions	8
Intelligent drinking water systems – better quality and lower costs	9
Groundwater in Dhaka	10
Sharing and generating knowledge	10
Would you like more information?	11

The Executive Director's statement:  
**Part of a larger  
world**



VCS Denmark has a long history as an innovative water and wastewater company. We do, after all, date back to 1853, where we were founded as the first public water utility in Denmark. Being innovative today, demands an active and involved approach to the world around us. Continued learning, development and innovation happen all around us, both nationally and internationally. Engaging in international co-operation is part of our DNA – just as we naturally engage in co-operation with the largest utilities, innovation-driven projects and research institutions in Denmark.

There are multiple benefits in seeking international inspiration: We actively contribute to solving global challenges, we create an inspiring workplace for our employees; and we are able to continuously improve efficiency, to the benefit of our local customers. Working on development projects and as consultants for water companies abroad expands both our awareness of global challenges and strengthens our expertise and knowhow.

At VCS Denmark we see ourselves as a part of a larger world. As a publicly owned utility, we believe that we have a particular obligation to share our know-how since issues such as resource scarcity, climate adaptation and mitigation of climate changes all constitute global challenges. We are actively supporting the Sustainable Development Goals (SDGs) set out by the United Nations, as well as the United Nations' Global Compact principles.

The title of this magazine is "VCS Denmark – a sustainable water and wastewater utility based on practical water knowledge", because this is exactly what we are. We aim at turning know-how and new research into practical solutions, so that we may continue to develop and improve. This magazine serves as an introduction to the ways that we work towards these goals.

A handwritten signature in blue ink, appearing to read 'Mads Leth', with a long horizontal flourish extending to the right.

August 2018  
Mads Leth, CEO at VCS Denmark

## VCS Denmark – a brief introduction

VCS Denmark - VandCenter Syd - is one of the largest water and wastewater utilities in Denmark, and our history as an enterprise dates back more than 160 years. We are known as a frontrunner within the sector.

Our main operational activities include catchment, treatment and distribution of potable water and transport, treatment and disposal of wastewater – and in recent years our activities have increasingly incorporated climate adaptation as well. We contribute to the protection and improvement of the aquatic environment and the development of green urban living.

We share our knowledge and know-how with Danish and international partners. Our vision is to become a role model – locally, nationally and internationally. We wish to generate maximum value for our customers and, preferably, to exceed their expectations. Our actions are shaped by our core values: *Responsibility; commitment; innovation; professionalism; loyalty and humour.*

We are a limited company owned by the municipalities of Odense and Nordfyn. This means that we

have a special position where we are able to enter agreements and operate both on private company terms and as a publicly owned utility.



Odense Waterworks 1853.

# Projects all over the world

The combination of our comprehensive knowledge and practical experience enables VCS Denmark to assist other water and wastewater utilities in finding solutions to their various challenges.

VCS Denmark is an internationally acknowledged company, in addition to being a local water and wastewater utility, and the two aspects of our activities complement each other. We have first-hand experience with the challenges of delivering high-quality water and services to our customers, while ensuring both that we act sustainably and improve continu-

ously. Furthermore, we are able to turn our experiences and know-how into valuable knowledge for other water and wastewater utilities with similar challenges.

Our experiences and know-how open doors and enable us to participate in projects that take us all over the world – often in collaboration with international consultancy companies and contractors. We have worked in e.g. Bangladesh, Grenada, India, Indonesia, Latvia, Lithuania, Malaysia, Myanmar, Russia, South Africa, Sri Lanka, Sweden, Turkey, Vietnam, Zambia, Ukraine and USA.



## Co-operation with private companies

There are many reasons for our international involvement. We get inspiration when working on projects abroad, and we make an effort to send both technical experts and operators abroad. Both bring home something of value to us – whether it be ideas generated from seeing other ways of doing things or simply bringing back new experience. Our international activities are a valuable factor in retaining our highly competent employees in the company.

In the coming years, VCS Denmark will actively participate in international activities supporting the Danish water sector's strategic "WaterVision". The vision is endorsed by the Danish government. The objectives of the WaterVision include development and export of Danish water technology and know-how.



# Training programmes conducted by experienced operators and specialists

Whether you are an NGO wanting to improve access to clean water - or a company aiming at working more efficiently - VCS Denmark can assist you.

VCS Denmark offers a wide range of training programmes within water and wastewater management – tailored to the specific interests of each individual client.

As a company, we have had more than 160 years of operational existence, which means that we possess comprehensive practical experience in relation to water and wastewater management. We work with both research institutions and consultancy companies in Denmark and abroad and continuously seek new knowledge to improve our operations. We believe that our practical experience provides our customers with access to highly serviceable insight and know-how. We turn our experience into an asset for our customers.

## Different methods

Over the years, we have held training programmes for many international clients.

We provide content for professional discussion and offer workshops, theoretical theme-based programmes, seminars and lectures, as well as hands-on practical programmes for operating staff. We conduct training programmes at our customers' facilities, and we also offer workshops and company visits for the purpose of introducing methods, technologies and processes at our own operating facilities in Denmark.

We are ready to accommodate customer wishes as regards the venue for a given programme. On page 11 is a list of some of the topics that have been included in previous training programmes.

## Practical know-how presented by operators

Our programme instructors include both our technical experts and operators. This means that you get hands-on experience,

e.g. from solving practical challenges in relation to wells, pipes and facility optimization.

The possibility of working abroad is part of what makes VCS Denmark an attractive workplace. Through our international outreach activities we harvest experience from all over the world, and knowledge sharing is an integral part of our company culture.

In addition to learning from the experiences of others, we focus on continued updating and upgrading of our employees' knowledge and skills. This is one more reason that we are good at finding the solutions that you need to meet your water and wastewater challenges.



# Paving the way for new ways of thinking about wastewater

Ejby Mølle WRRF.

Wastewater treatment as resource generating – rather than a resource consuming process. This is the philosophy at Ejby Mølle, the largest Water Ressource Recovery Facility (WRRF) at VCS Denmark.

As regards energy production, we are far ahead in turning this philosophy into reality. In 2015, we reached an important landmark: *Production of energy exceeded 150 % of the energy consumption* at the plant.

## Focusing on resources

Back in 2011, VCS Denmark decided to become energy neutral by 2014. Ejby Mølle WRRF already had a biogas-plant producing electricity and heating, but we wanted to go further.

Our approach to achieving this was to start by identifying resources in the wastewater. The more carbon that goes into the digester, the higher the production of biogas. During the wastewater treatment process, sludge is separated from water and is pumped into the digester. Apart from producing more energy, this also means, that less space is required for the biological processes in the activated sludge plant.

We also introduced a process of deammonification of reject water. After biogas

has been produced, sludge from the process is dewatered. The reject water has a high concentration of ammonia. This water is treated in a separate process, before entering the activated sludge plant. The result of this is that the removal of ammonia now requires less carbon and aeration.

## Improve what you have

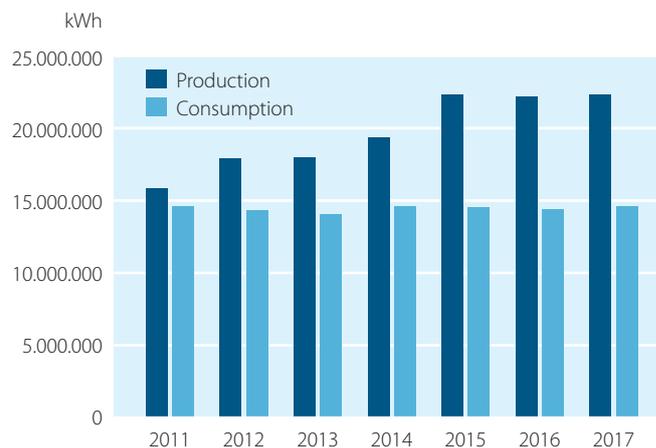
We work continuously on adjusting our processes; e.g. increasing the dry content in our digesters to expand digester capacity. Another focus point is to reduce emissions of nitrous oxide, while maintaining a high energy production. Using hydro cyclones, we improve sludge properties – creating a better mix of flocs and gra-

nules - so that the sludge can be handled more efficiently. We also continuously work on having the right kind of bacteria, in the right amounts, at the WRRF. Knowledge about our bacteria is gained through DNA sequencing, which is carried out in collaboration with universities. From 2018, we will be working as a demonstration and testing facility for the MABR-technology (membrane aerated biofilm reactor).

Ejby Mølle WRRF is not a new plant, and its physical location provides many restrictions. Yet, the investments required to facilitate the projects mentioned have been minor. Results have been generated by a changing of the mindset and making the most of the resources already at hand.

### Net energy balance

The production and consumption of energy at Ejby Mølle WRRF measured in kWh, 2011-2017.





# Passing on best practice

Training at the laboratory was one element in the program, that also involved on-site training in managing water and wastewater facilities.

As a subcontractor to a large improvement project, VCS Denmark has conducted training programmes for employees at Kafubu Water and Sewage in Zambia. Main focus: How to operate new facilities and utilise new equipment.

From 2016 to 2018, VCS Denmark worked as a subcontractor on the *Kafubu Sustainable Water and Sanitation Improvement Project*. The project improved local water and wastewater management by renovating and building new facilities, as well as introducing new equipment and software.

Employees at VCS Denmark instructed and taught local employees in the operation and maintenance of mechanical equipment, SCADA and various other efficiency-enhancing technologies and processes.

VCS Denmark was the planner and primary contributor of training programmes, but other Danish water companies also conducted a number of the courses. The objective of the teaching was to pass on best practice – thereby supporting safe and efficient implementation of new routines. In total, 400 training days were planned and carried out at the local water company in Zambia.

## Practice and theory

The staff from VCS Denmark conducted both practical training and theoretical teaching. The main focus was on successfully managing the water facilities and wastewater facilities after the significant technological boost generated by the project. The introduction of two new sewer vacuum units also required on-site training.

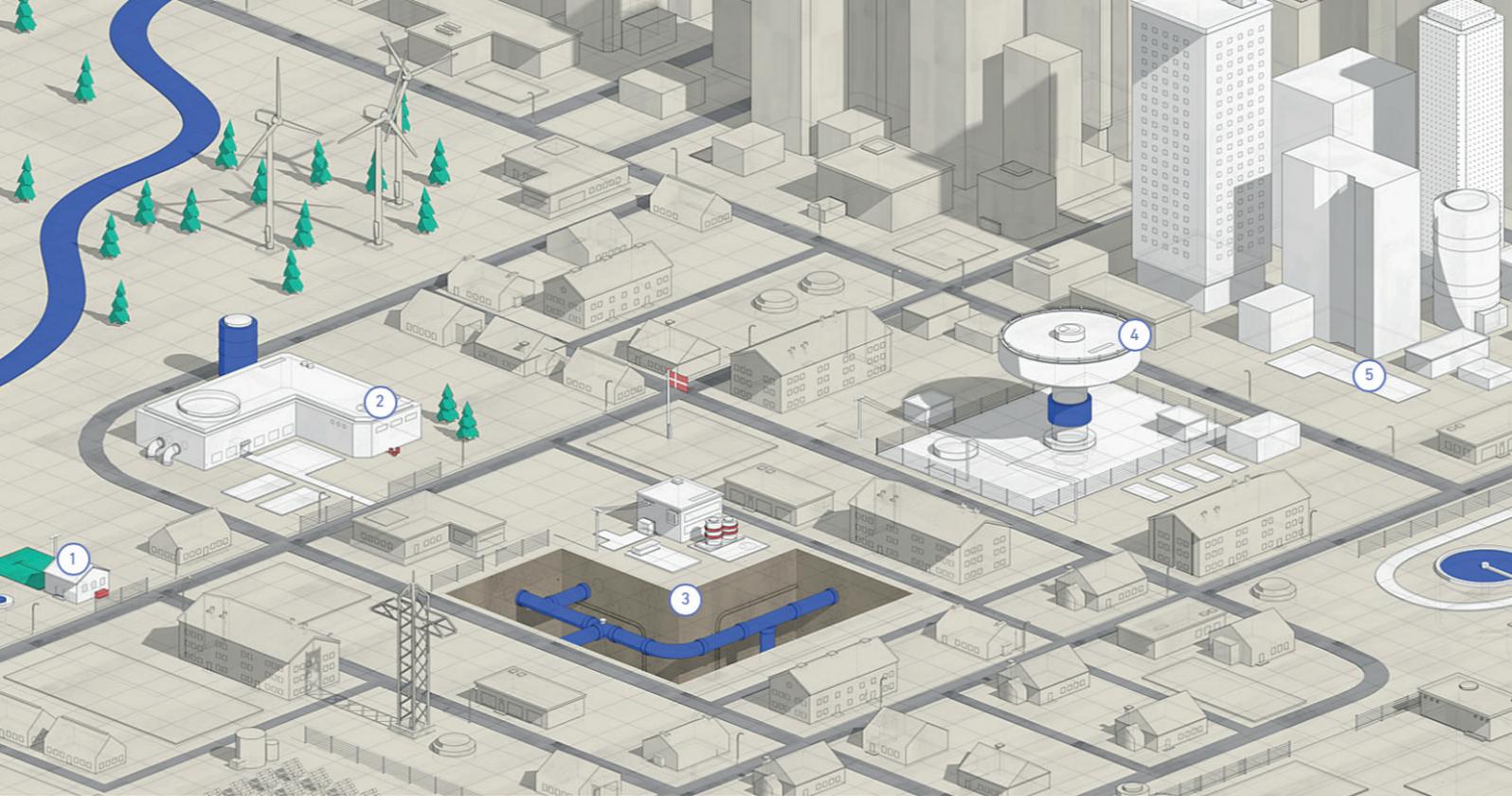
There were also employees who provided training at the laboratory. Themes included

quality assurance, health, safety and handling of chemicals. VCS Denmark also contributed with knowledge about improving the methods for analyzing wastewater.

Other areas of teaching included: Registering, digging of trenches, fitting of water pipes, selecting materials and taking care of the working environment. All teaching was adapted to the local conditions and equipment available.

CEO of VCS Denmark, Mr. Mads Leth (to the right), visited the project in Zambia to see the progress made, and present diplomas to the participating employees of Kafubu Water and Sewage.





# Taking the lead in developing innovative solutions



The website [www.futurewatercity.com](http://www.futurewatercity.com) presents Danish state-of-the-art solutions and technologies.

The Future Water project has been one of the most comprehensive research and development projects of its kind in Danish water sector history. The project brought together expertise from a wide range of stakeholders for the purpose of solving a number of specified future challenges in relation to the water industry.

Funding was provided by The Danish Water Technology Foundation and The Danish Ministry of the Environment. Being a water sector frontrunner, it was natural for VCS Denmark to take the lead in the project. The project generated a number of advanced tools for water management and control that are available for demonstration in several water utilities in Denmark.

In continuation of the project, VCS Denmark initiated a website for the water sector that presents Danish state-of-the-art solutions and technologies, see more on: [www.futurewatercity.com](http://www.futurewatercity.com).

## Holistic approach

Danish corporate strategies typically adopt a holistic approach and include co-operation between stakeholders. In the Future Water project, consultancy companies, technology providers and academic institutions collaborated with water utilities, which ensured useful hands-on innovative solutions as well as facilities for full scale testing.

Due to the participation of a number of private enterprises, some of the products and technologies are available on the commercial market.

## The products

The Future Water project was established with focus on energy optimization, cost reduction, sustainability and improved water quality. Some of the generated solutions are listed below:

- Intelligent on-line wellfield management system ("UGraph Water Abstraction").

- Intelligent real-time analysis of water quality data ("Water Manager").
- GIS-based pipe rehabilitation planning tool ("WaterRehab").
- Applied Smart-Grid Tool for water production management ("WISE" software).
- Drinking Water Softening using pellet reactor for calcium carbonate removal.

Our participation in the Future Water project has developed our knowledge and know-how even further – ensuring that we remain a professional partner for utilities, industries and universities in Denmark and abroad.

Production and distribution of water:

# Intelligent drinking water systems – better quality and lower costs

VCS Denmark has a history of continuously striving to improve production technologies. This includes the process of abstraction, treatment and distribution of water.

In recent years, the introduction of intelligent systems has spread gradually, concurrently with the development of VCS Denmark's comprehensive experience with automation. The intelligent systems control the SCADA-system which in turn controls physical equipment. The result is a highly optimized workflow that is reliable, unmanned and energy cost efficient.

## Wells

VCS Denmark uses intelligent systems to control the contribution of each well in relation to the abstraction of water in a given wellfield. Water quality from different wells differs, as do production costs and environmental impact. Hydraulic and hydrogeological interaction between wells is a highly complex matter, and the best combination of abstraction can be determined by using advanced genetic algorithms.

Using intelligent control systems provides an efficient tool for identifying the most optimal solution at any given time – and

the result is optimized and balanced production that takes all relevant parameters into account.

## Pressure control

VCS Denmark applies advanced, locally developed software to set and adjust pipe pressure.

Our relatively large water distribution system receives water both from several water treatment plants and from a number of booster stations. Our system used to operate on flow compensating pressure control, based on a single pressure point. We use a network simulation program (AQUIS) to do online calculations based on real-time measuring of flow and pressure in the various sections of the water distribution system. The calculations are used to ensure the most optimal control settings for each of the many pumps in the system.

The real-time calculations ensure a relatively steady pressure throughout the water distribution system – and this, in turn, increases the service life of our pipes. The increased precision with which we are able to set or adjust the pumps in the system also makes it possible to reduce energy

costs – we use the energy required, no more, no less.

## Non-Revenue Water

The SCADA system is an integral factor in all our decisions regarding improvements – and it is a significant factor in the achievement of one of our most remarkable results: **An Infrastructure Leakage Index (ILI) of merely 0.75 (2017).**

Our results effectively challenged the pre-conception of what was deemed possible.

Other factors contributing to our low ILI are a high level of workmanship – e.g. we are leading in welding of PE-pipes. We also choose high quality materials. Furthermore, we have transformed our water distribution network into a branch architecture, from the more standard ring connection architecture. This makes it easy to detect the actual location of a given leakage. On average, onsite repairs commence within four hours from the time of detection of a leak, and this reduces water loss significantly.

We also benefit from using the branch architecture in terms of prevention. Implementing UV-treatment on key locations in our distribution network will limit spreading in case of pollution.

In general, we are focused on maintaining high levels of hygiene in all aspects of our work – from internal processes to external processes such as repairing water pipes without risking microbiological contamination. We regularly host hygiene courses for our colleagues at other Danish utilities.





## Groundwater in Dhaka

One of our international projects was located in Dhaka, where we participated in a project in 2015-2016. Dhaka is a metropolis with more than 15 million citizens. The water supply in the city is operated by DWASA and used to be entirely based on groundwater.

Today, however, water resources also include surface water. Still, about 740 wells provide around 85 % of the water. The ab-

straction of groundwater poses problems with resource depletion – every year the water table has dropped 2-3 meters.

In the future, groundwater will only contribute with about 30 % of the supply, as additional surface water plants are established, and groundwater will be abstracted from approximately 500 wells in a fully automated manner.

VCS Denmark and SWECO conducted an intensive study of the existing abstraction wells, and made recommendations for instrumentation, operation and training of staff. We provided our project partners with knowledge and know-how from operating our own wellfields, and offered input for the most cost efficient mode of operation, e.g. in relation to material lifetime and energy.

# Sharing and generating knowledge

For VCS Denmark, international involvement is of paramount importance. We strive to be a frontrunner and we apply ourselves in a broad range of research projects. We are experienced at cooperating with Danish and foreign universities and utilities as well as private companies. In such projects we typically provide facilities and knowhow.

We have co-operated with the American

Wastewater Utility, AlexRenew, since 2012, e.g. on implementation of Anammox Technology. We also have a close cooperation with PUB Singapore - one of the worlds' leading water utilities.

We contribute with papers and presentations at various conferences, and we are represented on the Research Advisory Council under the American Water Research Foundation (WRF). We participate in

The International Water Association (IWA) and collaborate in to the hosting of the World Water Congress and Exhibition 2020 in Copenhagen.

We are at the disposal of potential partners and customers that would like to visit our facilities, as we see international exchange as a great opportunity to be actively involved in the development of new solutions for the water sector.

# Services

The services offered by VCS Denmark include:

- NRW reduction
- Energy optimization
- Production and distribution of drinking water
- Containment and treatment of wastewater and storm water
- SCADA systems (water and wastewater)
- Capacity building
- Environmental management and quality control
- Financial management
- Welding of pipes
- Borehole inspection
- Pressure management
- GIS
- Network modelling
- Wellfield modelling

# Would you like more information?

Please contact VCS Denmark for further information about our services and projects, or if you would like to inquire about possibilities for project collaboration:

Director Henrik Werchmeister

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You can also find more information on our website: [www.vcsdenmark.com](http://www.vcsdenmark.com), or on [www.futurewatercity.com](http://www.futurewatercity.com).



At VCS Denmark we exchange knowledge and know-how with our partners and participate in projects all over the world. This map shows the geographic span of our international activities in 2018.

## VCS Denmark

VCS Denmark offers a wide range of consultancy services, innovative solutions and hands-on training programmes. Our specialty is turning advanced theory and technologies into practical water knowledge.

Among other things, this magazine introduces our results from energy reduction projects and explains why we are a global leader as regards reduction of Non-Revenue Water. It also provides the background for our dedication to act responsibly and to co-operate with others, both domestically and internationally.



## Certifications

- ISO 9001 – Quality Management
- ISO 14001 – Environmental Management
- ISO 22000 – Drinking Water Safety
- DS/OHSAS 18001 – Occupational Health and Safety Management

## VCS Denmark

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**VCS Denmark**  
PRACTICAL WATER KNOWLEDGE