

MORTEN REBSDORF

SENIOR PROJECT MANAGER AT AARHUS VAND

“Digitalisation and technological innovation play an immense role in helping WWTPs reduce their GHG emissions”



Aarhus Vand is a Danish water utility company internationally known for its innovative technologies and services. It has a clear goal: to become the leading water utility in its country and also one of the leading water utilities in the world.

 OLIVIA TEMPEST

Aarhus Vand is tackling challenges that are common for many utilities worldwide: a growing population and the uncertainty of climate change. To address these issues, the company is building a new and bigger wastewater treatment plant - the world's most resource-efficient WWTP – Aarhus ReWater. Aarhus Vand, in this way, is on its way to becoming energy self-sufficient and a net energy producer. Morten Rebsdorf, Senior Project Manager at Aarhus Vand, is tasked with planning and designing this avant-garde project and is an expert in

Greenhouse Gas (GHG) mitigation and protocol. We spoke to him about managing emissions at wastewater treatment plants and what is in store for the wastewater treatment industry.

Can you tell us briefly about your career path and your current work at Aarhus Vand?

I have a background as a chemical engineer from the Technical University of Denmark in 1998, and now I am employed as a senior project manager in Aarhus Vand for the last four years. Prior to my current position, I worked in a private consultancy for utilities and industry for approximately 13 years. Before that, I worked in the utility sector and in industrial R&D. The main focus in my current position is the strategic and operational focus of Greenhouse Gas (GHG) Mitigation, GHG Protocol, and how the Corpora-

tive Sustainability Reporting Directive (CSRD) will affect the GHG accounting for Aarhus Vand. Furthermore, my position covers specialist tasks related to the planning and design of Aarhus ReWater and various development projects on nitrous oxide, for example.

Climate change has increased the interest to determine the carbon footprints of wastewater treatment plants. How can wastewater treatment plants accurately estimate their GHG emissions?

It's a question with a lot of layers. A simplified answer could be like this: In my opinion, you should start with determining your system border, what is in, what is out – and for the chunks considered outside your border - why are they outside? Then determine the “large” chunks in the following order: 1. measure, 2. estimate and 3. guesstimate.

Nitrous oxide (N₂O) is a potent greenhouse gas, and its emission from wastewater treatment plants can vary substantially. How can wastewater treatment plants reduce this type of emission?

“The main focus is the strategic and operational focus of GHG mitigation, GHG Protocol, and how the CSRD will affect the GHG accounting”



Yes – Nitrous oxide (N_2O) is a major part of many WWTP's scope first emissions. You need to have a sound knowledge of your “biological machine”, and which control handles/options you have, furthermore, you will have to invest in sensors and the attached maintenance and calibration.

Monitoring N_2O is possible with sensors placed in the water phase and off-gas measurement. This implies skilled staff for maintenance and calibration, and skilled staff to interpret the results, implementing changes in the control of the plant, knowing that you have implemented a loop of measuring, calculating, assessing, improving controls and so forth.

At Aarhus Vand, we have been dealing with monitoring in both water and gas-phase for some years and recently spent many resources on a joint applied research project to get a sound knowledge base for understanding the formation, emission, control and possible mitigation of the N_2O emission.

The Danish Government implemented a new law in 2020 to reduce the



Close collaboration with other utilities, universities and technology providers is crucial to gain and develop the required knowledge



national CO_2 emissions by 70% in 2030. This climate plan includes goals to reduce N_2O emissions from wastewater treatment plants by 50% and to implement a limit for emissions from WWTPs larger than 30,000 person equivalents (PE), no later than 2025. How is Aarhus Vand working to achieve this ambitious goal?

The described project under question 4, is one of our tasks directly related to the reduction goals. Close collaboration with

other utilities, universities and technology providers is crucial to gain and develop the required knowledge, but we have

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not yet “cracked the nut”, though we have good indications of what to do and not to do. Data crunching in the following months will hopefully give us some directions and solutions, but of course also new puzzles.

"Aarhus Water is certified according to standards for environment and climate, working environment, drinking water safety and sustainability"

We are also looking into where to implement new N₂O sensors in our treatment plants.

Coverage of the biological tanks will enable the possibility of a central treatment for the vented air – and as a vision – developing a sort of molecular sieve, wherein the off-gas can be “filtered” into separate streams of pure CO₂, N₂O and O₂ for reuse. Finally, that a holistic approach is taken in projects having a direct or indirect impact on GHG emissions.

What advice would you give countries that are looking to reduce GHG emissions from wastewater treatment plants?

Wow – it’s a big question, and my answer might reflect the context in Denmark, where the green transition of electricity production indeed has reduced our GHG footprint over the years. Energy self-sufficiency via biogas production is also a way to reduce the GHG footprint, if the purchased energy for treatment processes is fossil-based.

At the end of 2022, the European Council gave green light to the corporate sustainability reporting directive (CSRD). What does this mean for the EU’s water sector?



In my opinion, it will serve as a much-needed regulatory framework, which will enable standardisation of how to calculate, report and communicate sustainability.

How is Aarhus Vand working on its sustainability report?

Aarhus Water is certified according to relevant standards for Environment and Climate, Working Environment, Drinking water safety and sustainability in the form of UN Global Goals. Now we are putting quite some effort into understanding and planning how to operationalise the CSRD into our reporting.

What role do digitalisation and technological innovation play in helping wastewater treatment plants reduce their GHG emissions?

An immense role. For example, in sensor development, wire-less communication, numerical modelling, data-driven models, digital twins, and more. But there is one factor of paramount importance, at least in my opinion, and this is the ability of utilities to recruit and maintain well-educated staff, thus enabling a critical mass for understanding how to adapt and develop sustainable solutions to complex problems for the citizens.

How do you think wastewater treatment plants will look in 20 years?

I would imagine that we will see larger regional differences in how the treated wastewater is reused, depending on the demand for water. Plants will be covered in increasing numbers, and there might be developed plants based on physical and chemical treatment instead of biological treatment – minimizing CH₄, CO₂, and N₂O-emission from the biological conversion, yet you have to consider such a profound shift in technology on a sound holistic assessment based on, for example, LCA.