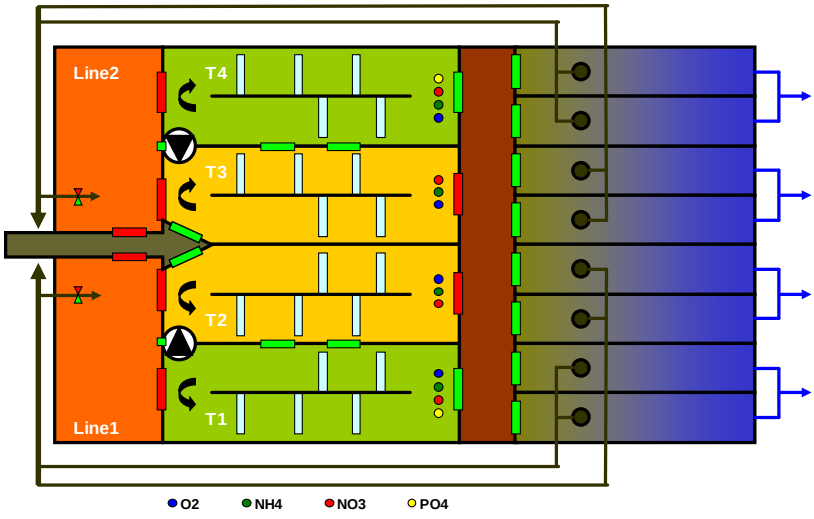
DHI CASE STORY

SUCCESSFUL WASTEWATER TREATMENT OPTIMISATION IN DENMARK

Increasing efficiency, saving money, reducing the environmental footprint

Aarhus, Denmark's second-largest city and principal port, faced a serious need to increase its wastewater treatment efficiency and capacity. Adding new machinery and tanks would have added significant burden to the city's finances. DHI was able to provide a fix that was both cost-efficient, providing annual savings of about EUR 701,000, and easily maintained by Aarhus Water's own staff.

Aarhus Water is a water supplier and storm- and wastewater service provider to Aarhus Municipality and its 310,000 residents. The water utility operates four larger and six smaller wastewater treatment plants (WWTPs) that, combined, receive approximately 35 million cubic metres of wastewater a year. Recently, they faced a pressing need to expand the capacity of its plants to contain the increasing volumes of wastewater.



Configuration of Egaa WWTP. Process tanks: hydrolysis (orange), denitrification (yellow), nitrification (green). Weirs: open (bright green) and closed (red). The image shows the simple and low-cost technique for dividing the return sludge between the inlet (shown) and the hydrolysis tanks.

SUSTAINABLY INCREASING EFFICIENCY WITHOUT MAJOR INVESTMENTS – A CHALLENGING TASK

Aarhus Water wanted to increase the efficiency and the capacities of their four larger WWTPs and at the same time reduce energy consumption and effluent values without any major investments in the treatment plants themselves.

SUMMARY

CLIENT

Aarhus Water

CHALLENGE

Need to increase efficiency and capacity of WWTPs without major investments

SOLUTION

Thorough understanding of the involved processes allows for their optimisation through using on-line sensors, data processing, process control and involvement of staff

VALUE

- Annual savings of EUR 701,000
- Reduced environmental and CO2 footprint
- More stable and robust WWTP
- Extended capacity
- Well-trained staff for sustainable optimisation

LOCATION / COUNTRY

Aarhus, Denmark

Moreover, the client aimed at a sustainable solution, which could in the future be maintained and configured by their own staff. Finally, Aarhus Water wanted to know exactly what they were up to – through estimates of expected results (yearly cost savings and return of investment period) before implementing any measures.

PROCESS OPTIMISATION IS THE KEY TO IMPROVED OPERATION

The solution to these requirements was to implement processes optimisation, thereby allowing the WWTP to operate to its maximum. To evaluate different process optimisation measures and to come up with a priority list of measures, DHI closely cooperated with Aarhus Water and created a prioritisation methodology that combined general process knowledge with local knowledge of daily operations at the specific treatment plants.

REAL-TIME MONITORING FOR MAXIMUM EFFICIENCY

Process optimisation was achieved by real-time monitoring of the processes and automatically fine-tuning the processes to operate efficiently during variable conditions. This solution did not command any major construction work, but only required the purchase of new sensors (ammonium-, nitrate-, phosphate sensors, sludge blanket meters, etc.). These sensors were be used for automated set point control with the Data Integration and Management System (DIMS), a DHI Solution Software. DIMS uses the existing SCADA/PLC (supervisory control and data acquisition/programmable logic controller) as a front end. Library functions within DIMS that can be configured according to the specific needs were used to implement software sensors and control algorithms.

Project implementation was actively supported by the staff at the four WWTPs, in order to increase staff competencies and allow for future maintenance and further development after formal project completion.

Close cooperation with the local staff is important to secure continuing optimisation effects.

ACHIEVING MORE WITH LESS

The value of the optimised system is apparent: Annual savings of EUR 701,000 are just one particularly striking aspect of the many benefits. The economic results shown in the table below have been evaluated to be better than originally estimated, and staff at Aarhus Water now perform configuration of DIMS themselves.

Thanks to the implementation of the process control, Aarhus Water was able to extend the WWTP capacity, save energy and chemicals - and reduce the associated costs - and decrease effluent values. The latter are now highly predictable according to given ammonium and phosphate set-points. This curbs the WWTP's CO_2 emissions and ultimately minimises the burden on the environment.

With just minor investment and the implementation of the process control, the WWTP has achieved increased process stability and has become more robust, enabling it to cope with variable conditions (e.g. inflow amount and composition, weather, etc.).

LONG-TERM SECURITY THROUGH SUSTAINABLE SOLUTIONS

The city of Aarhus depends on Aarhus Water for its everyday water consumption and to manage its wastewaters. Thanks to DHI, the people of the municipality can count on Aarhus Water to maintain their waters for many years to come.

Economic results		Marselis	Egaa	Viby	Aaby	Total
WWTP size	PE	200,000	120,000	83,000	84,000	487,000
Savings on energy and chemicals	EUR/year	73,000	31,000	40,000	132,000	276,000
Reduced effluent values – lower effluent tax	EUR/year	114,000	19,000	27,000	2,000	162,000
Increased capacity – depreciation 25 years	EUR/year	54,000	50,000	132,000	27,000	263,000
Total	**EUR/year**	**241,000**	**100,000**	**199,000**	**161,000**	**701,000**

Economic results of process optimisation at the four major WWTPs operated by Aarhus Water. Effluent tax in Denmark (2010/2011) is 1.48 EUR/kg BOD, 2.68 EUR/kg TN and 14.77 EUR/kg TP.

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