Intelligent Control for Wastewater Treatment using an AI Digital Twin

Fiware4Water case study Amsterdam

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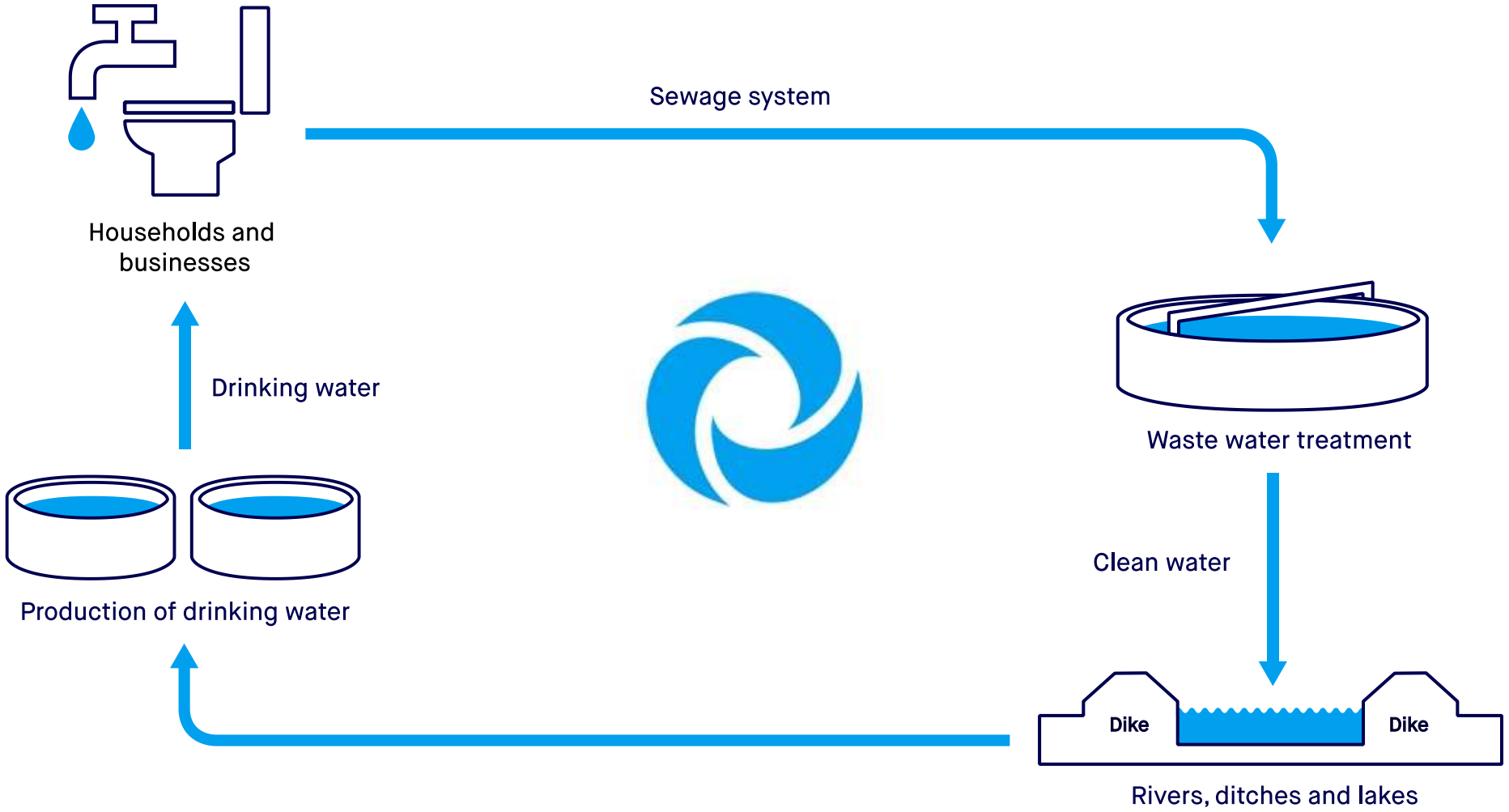
Waternet water cycle utility Amsterdam



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Our service area

- 18 municpalities
- Ca 1,3 million inhabitants
- In Amsterdam all water tasks

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Main objective

Link the water sector to FIWARE, an open and license free smart solution platform:

- by showing the potential of its interoperable and standardized interfaces
- by demonstrating a series of complementary and exemplary paradigms (4 Demo Cases)
- by promoting an EU and global wide network of users (SMEs Challenges)

www.fiware4water.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 821036.

FIWARE 4 WATER

Demo Case #1 • Greece

Athens • Water Supply System
real time operational managment

Demo Case #2 • France

Cannes • Improving the Water
Supply System

Demo Case #3 • Netherlands

Amsterdam • Intelligent control
for wastewater treatment

Demo Case #4 • United Kingdom

Great Torrington • Smart Meters
and Customers

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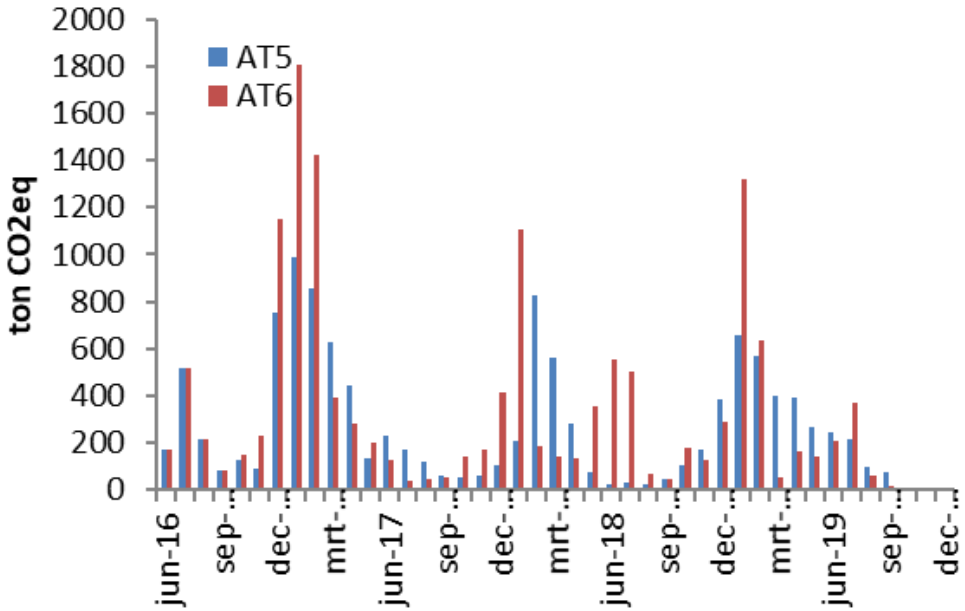
Wastewater treatment plant Amsterdam West

Nitrous oxide (N_2O) gas emissions

Real-time measurement in off-gas aeration tanks (ATs) of WWTP Amsterdam West starting 2016:

15 – 28 kton/year CO2-eq



Full-scale research lane

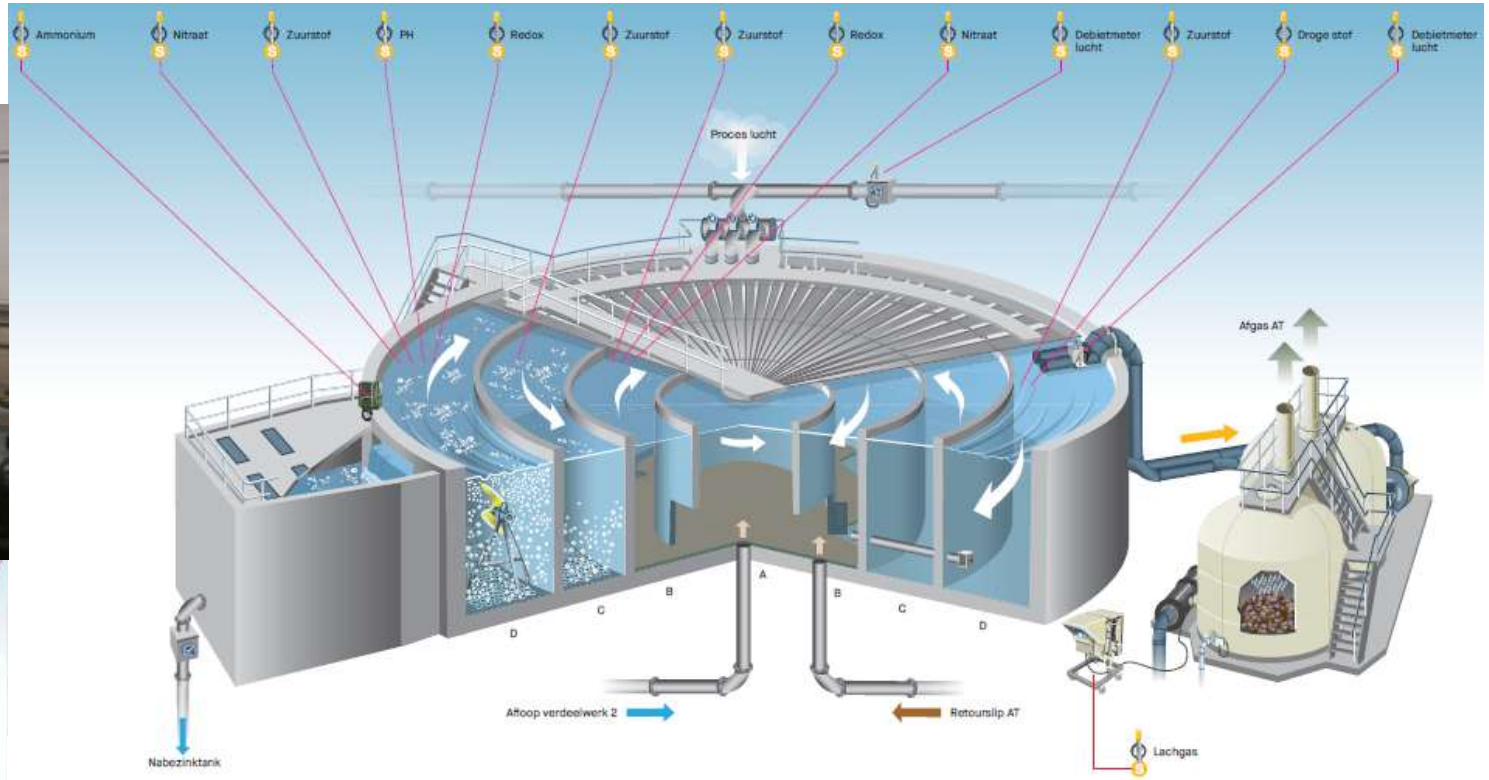
Objective: Reduction of nitrous oxide emission and electricity use aeration

Installing additional sensors

Treatment optimisation with Artificial Intelligence

Additional on-line sensors

Research facility



Aeration tank

Off-gas

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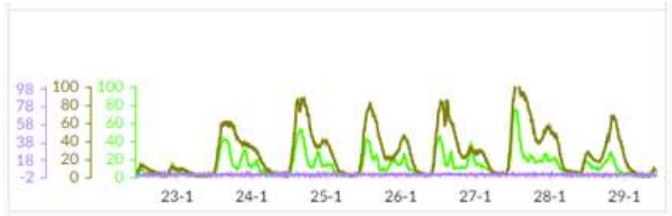
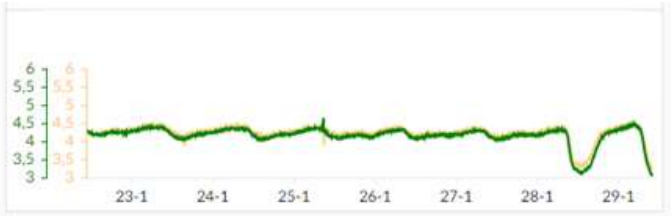
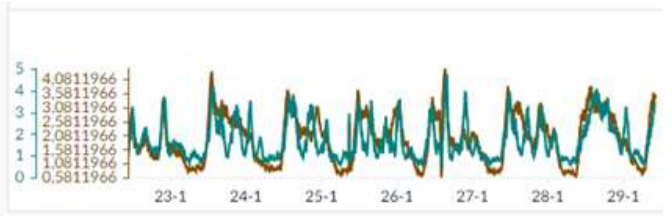
Data used in digital twin

- Setpoints e.g. oxygen setpoint in aeration tank
- Water flows e.g. influent, internal recirculation flows
- Water quality parameters e.g. oxygen, ammonia, nitrate, dry solids
- Air flows, incoming process air and off-gas flows
- Off-gas quality parameters e.g. N_2O
- Blower data e.g. energy use
- Air valves settings of the different compartments in the aeration tank







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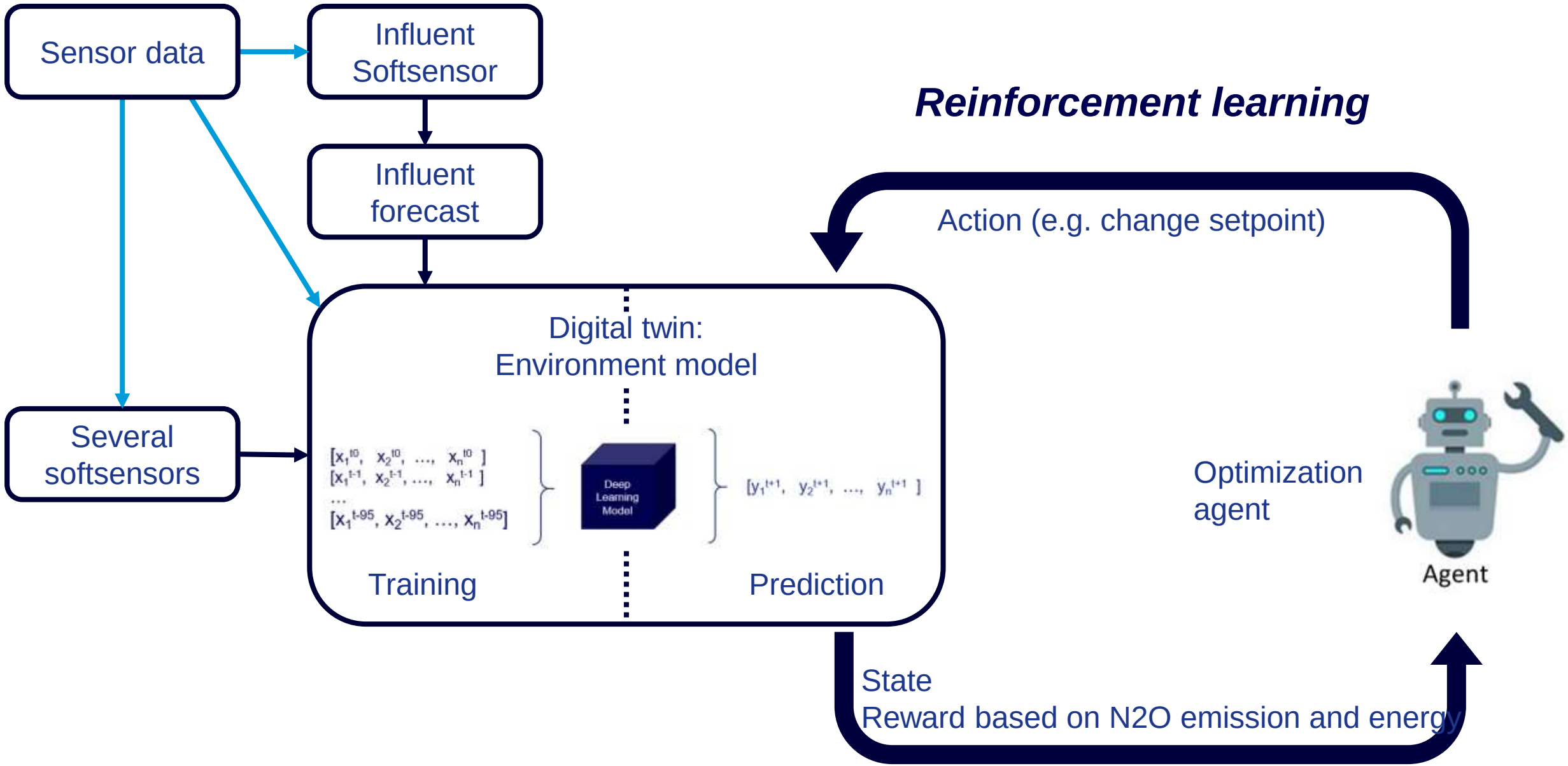
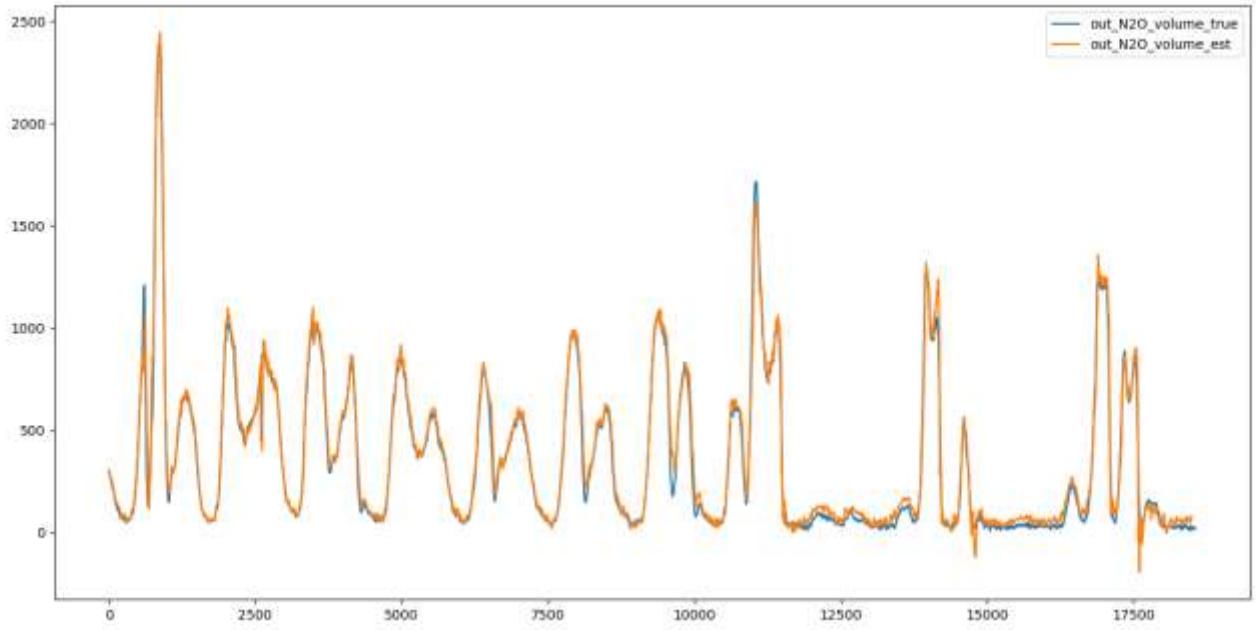
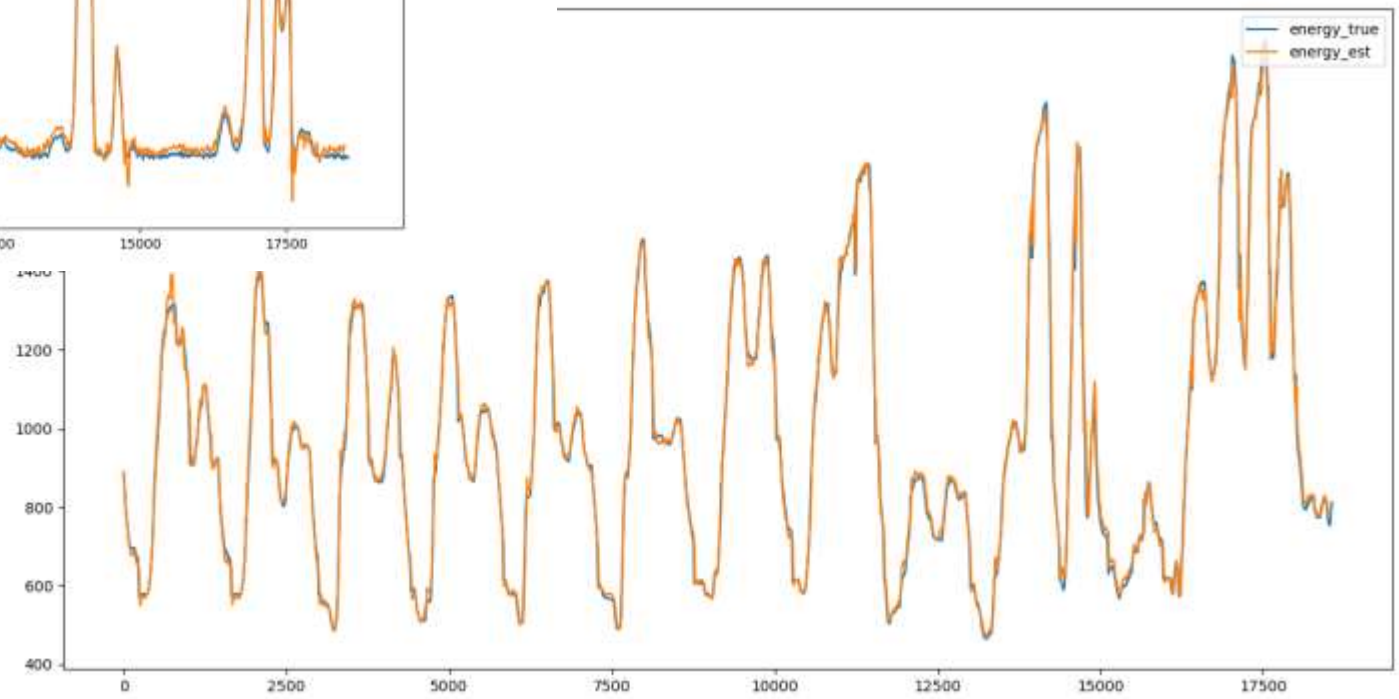
WWTP Amsterdam West AI setup



Validation results for N_2O emissions and blower energy use





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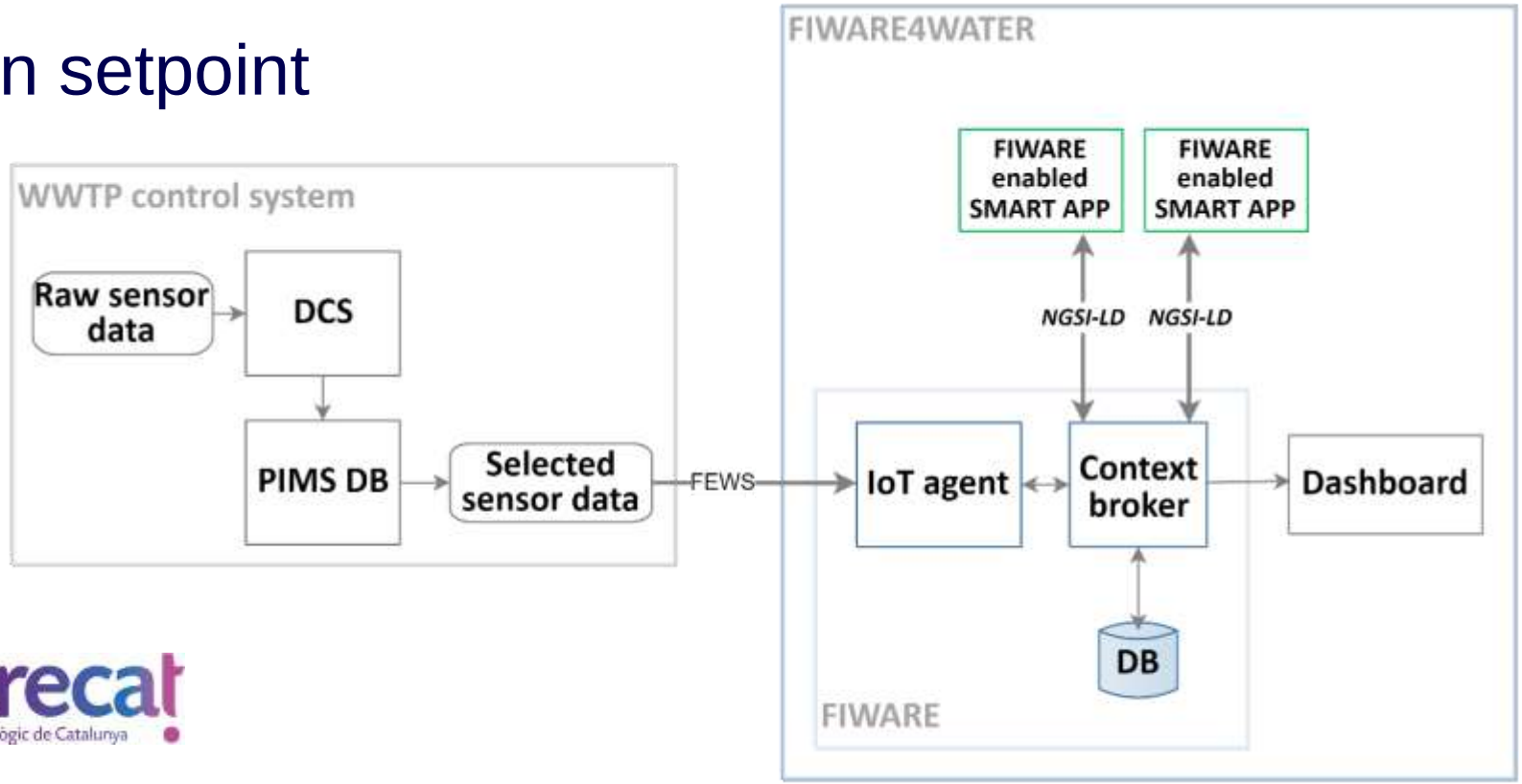
AI models

- 3 “virtual” AI soft sensors for e.g. air and water flows per lane
- Real-time AI anomaly detection and correction
- AI influent prediction
- AI digital twin
- AI control model for oxygen setpoint

In the cloud with Fiware4Water, deployed with CI/CD pipelines



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KWR

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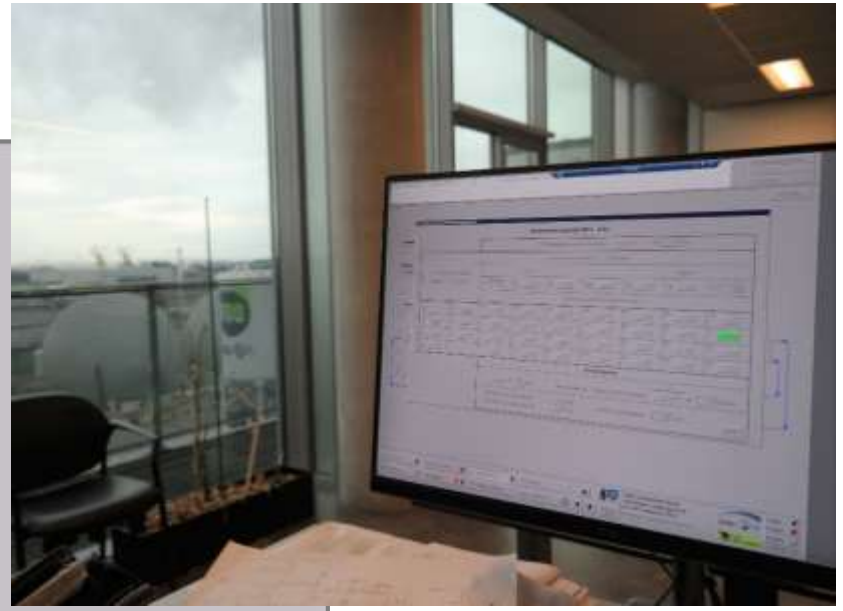
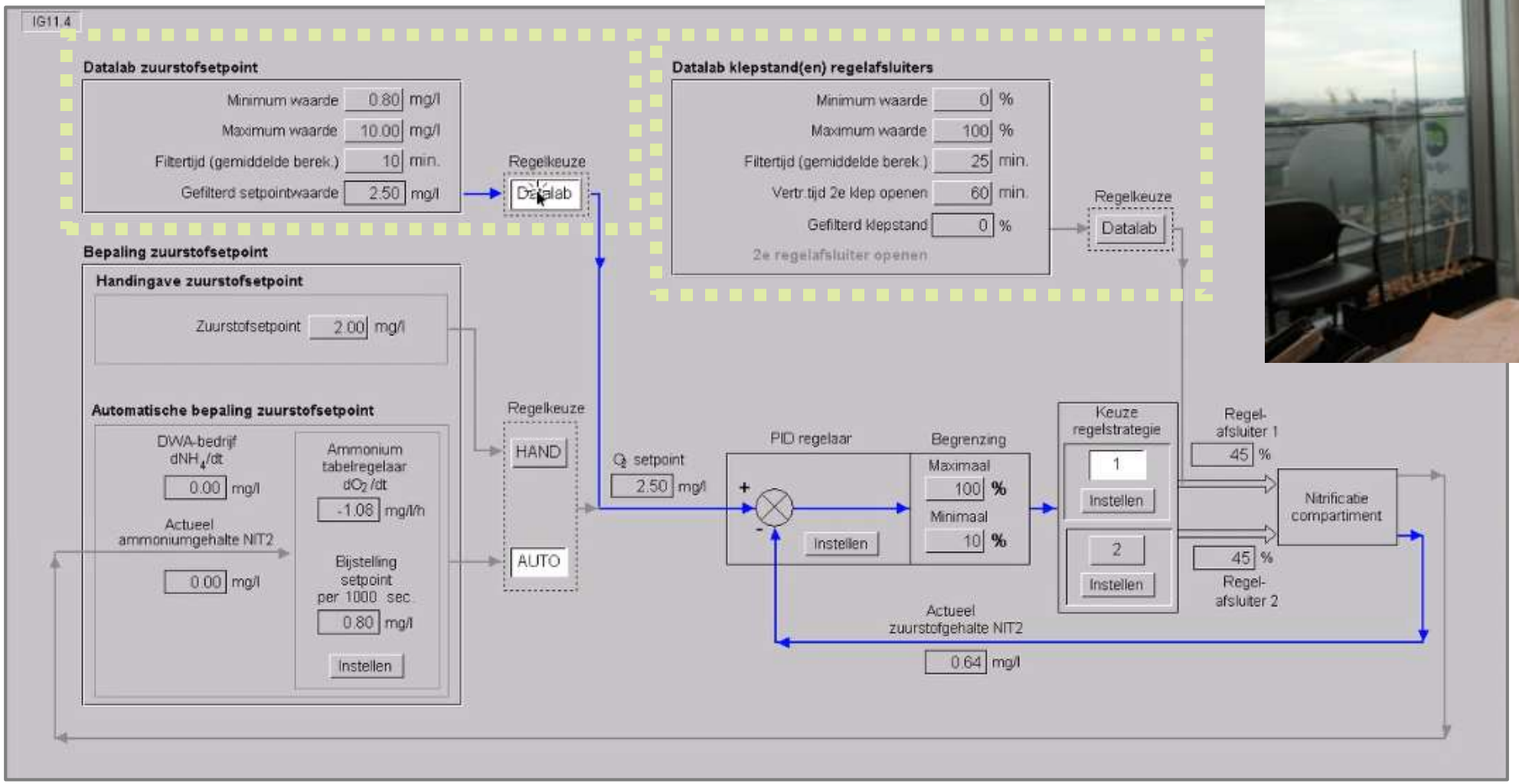
Centre Tecnològic de Catalunya

AI control implementation





Lessons learned for developing AI DT

- Installing & maintenance of sensors with high accuracy is time consuming
- Constantly checking data quality gives lots of new insight in the processes
- You need data scientists ánd machine learning engineers in DS teams
- In the current labor market, it is a challenge for water utilities to ensure a stable DS team for large projects
- We just started to explore the power of implementing AI

WRR

THE NETHERLANDS SCIENTIFIC COUNCIL FOR GOVERNMENT POLICY

November 2021

1. Make learning about AI and its application an explicit goal of governmental policy.

9. Bolster national competitiveness through a form of 'AI diplomacy' that is focused on international cooperation, specifically within the European Union.

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And we are also working on …

Digital twin installations

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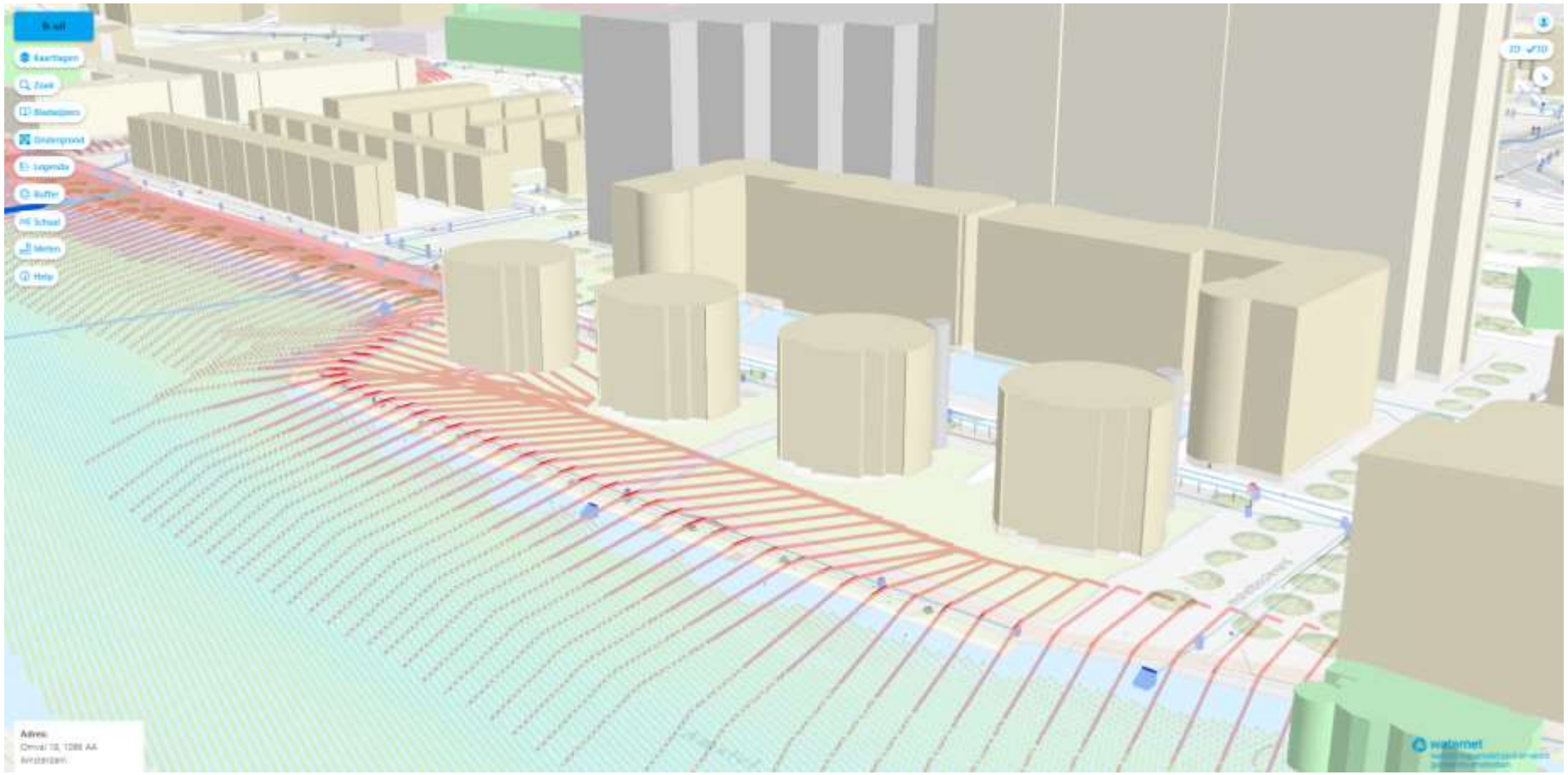
And we are also working on …

Digital twin installations and Geodata combined



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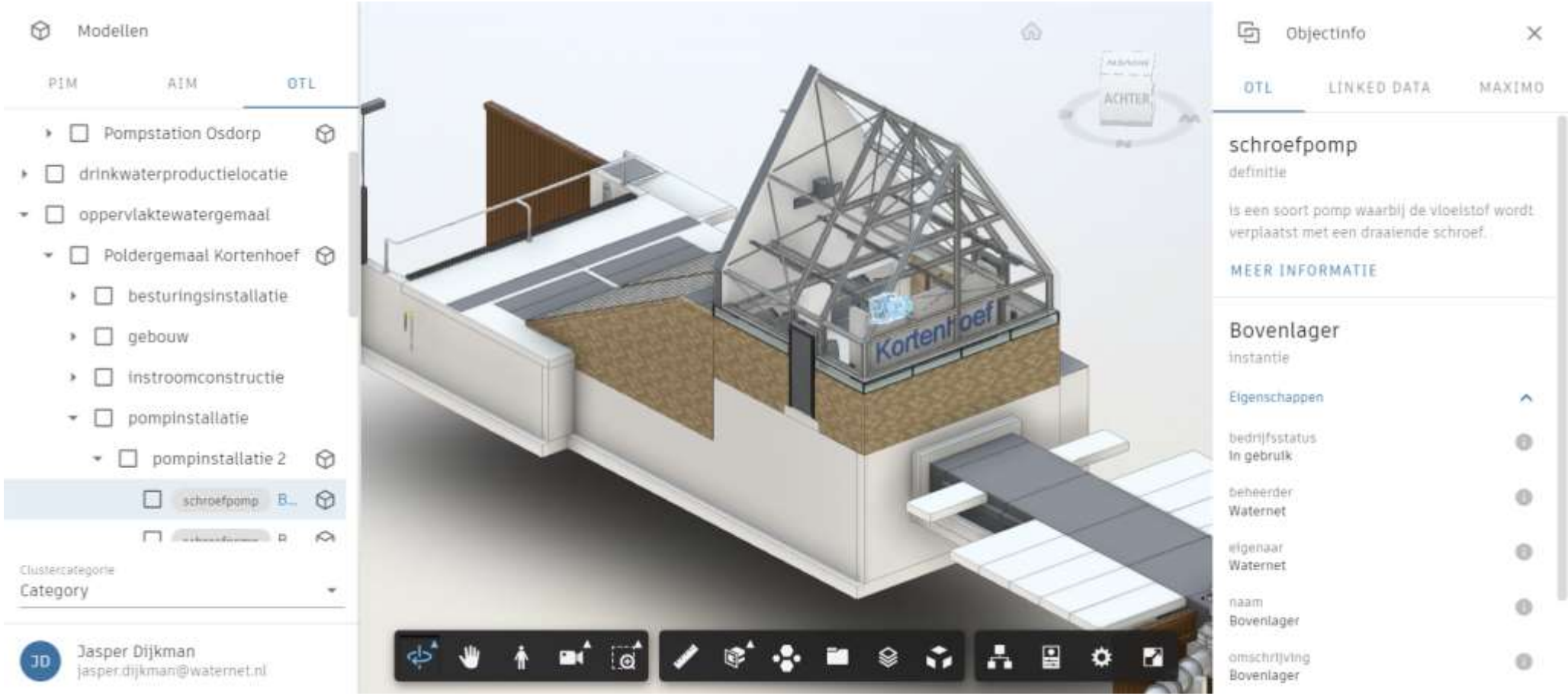
And we are also working on …

Asset documentation via Waternet object type library (OTL) – Linked Data



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And we are also working on …

ALL our underground infrastructure visible with AR in the field

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