

**Kansen van procesautomatisering:**  
*De (on)mogelijkheden van data in de praktijk*



**Aquasuite®**

a product of Royal HaskoningDHV

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## Hoeveel kennis op de zuivering?

Hoeveel ervaring heb je met de afvalwaterzuivering?

*A: 0-5 jaar*



*B: 5-20 jaar*



*C: 20+ jaar*



## Welke uitdagingen?

De operationele kosten zijn in 2022 sterk gestegen, waar zit de meeste pijn?

A: Energie

B: Chemicaliën (nutriënten, ijzer, PE, actieve kool etc.)

C: Afvoer slib

D: Al het bovenstaande



Hoe ga je bovenstaande kosten te lijf?

A: Niet

B: Optimalisatieprojecten

C: Slim(mer) inkoopbeleid

D: Software en automatisering



## Beschikbare operationele data

Welke onlinemetingen zijn aanwezig op de zuivering?

A: pH/redox/O<sub>2</sub>

B: N/P

C: TOC (COD)

D: Slibniveau/MLSS

E: het grootste deel van de metingen zijn labmetingen



## Wat te doen met data: digitale volwassenheid

Wat is de mate van automatisering op de AWZI?

A: handmatig

B: SCADA/PLC

C: geavanceerde procesautomatisering (bijv. artificial intelligence)

Hoe verkrijg jij de benodigde inzichten in proces en kosten?

A: Excel / spreadsheets

B: SCADA historian + Excel (lab)

C: Ander softwarepakket

# Royal HaskoningDHV: Enhancing Society Together



141 years of consultancy and project management experience



Extensive track record on development of **water technology** like **Nereda**, Ephyra, Helea and Crystalactor



**300+ digital professionals** driving digital (twin) propositions forward



2009: Dogger Bank wind farm  
*Sustainable energy*



1968: Carrousel (BASF)  
*Clean industrial effluent*



2020: SEWR (United Utilities)  
*Preventing combined sewer overflows*



**Independently owned** engineering & consultancy organization



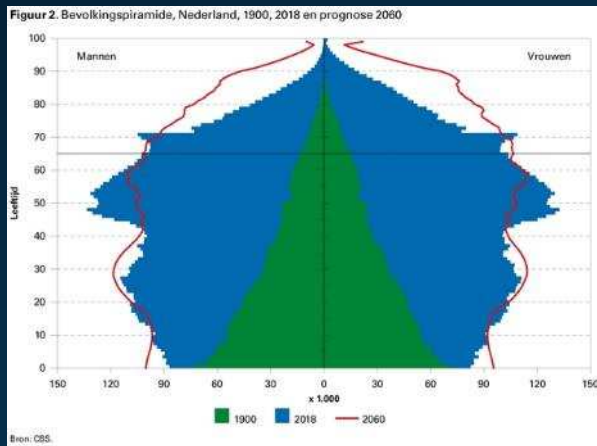
**1000+ water professionals** including (waste)water treatment, process & engineering water experts



Global workforce of **6,000** in more than 140 countries

Royal HaskoningDHV Digital

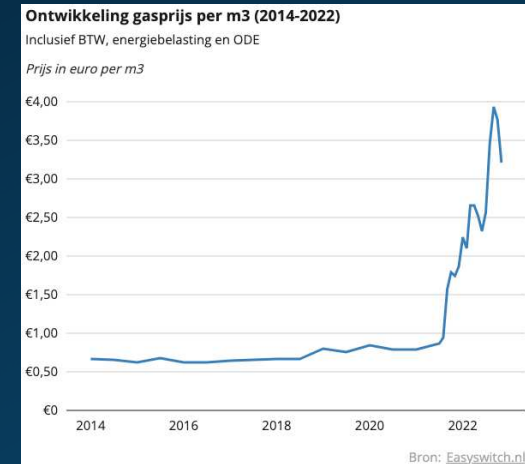
# Digital Twins: means to an end: modern threats to operations



Shortage of expert workforce to operate aging or increasingly complex machines and processes

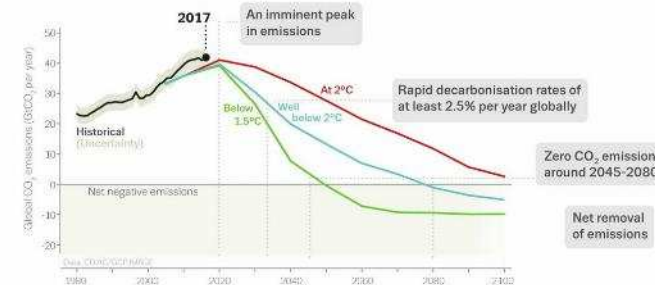
More stringent legislation, fines & big sustainability ambitions

High OPEX costs due to soaring energy prices, increasing ETS prices, costs of polymer and metalsalts



## Decarbonisation to meet the Paris Agreement

Future projected global CO<sub>2</sub> emissions that meet the Paris Agreement temperature goals have these characteristics...



# What is a Digital Twin?

*Problem solving 4.0*

*A dynamic, virtual copy of real-world assets and processes. Providing actionable insights and advanced process control by clever use of (existing) data*

But how to go from “just” data to insights?

*Aquasuite Digital Twin: our domain experts' and their virtual twin looking over water processes, 24/7*

+ Co-creation with clients and knowledge institutes







Industrial wastewater  
treatment: PURE Industry

Drinking water  
supply: OPIR

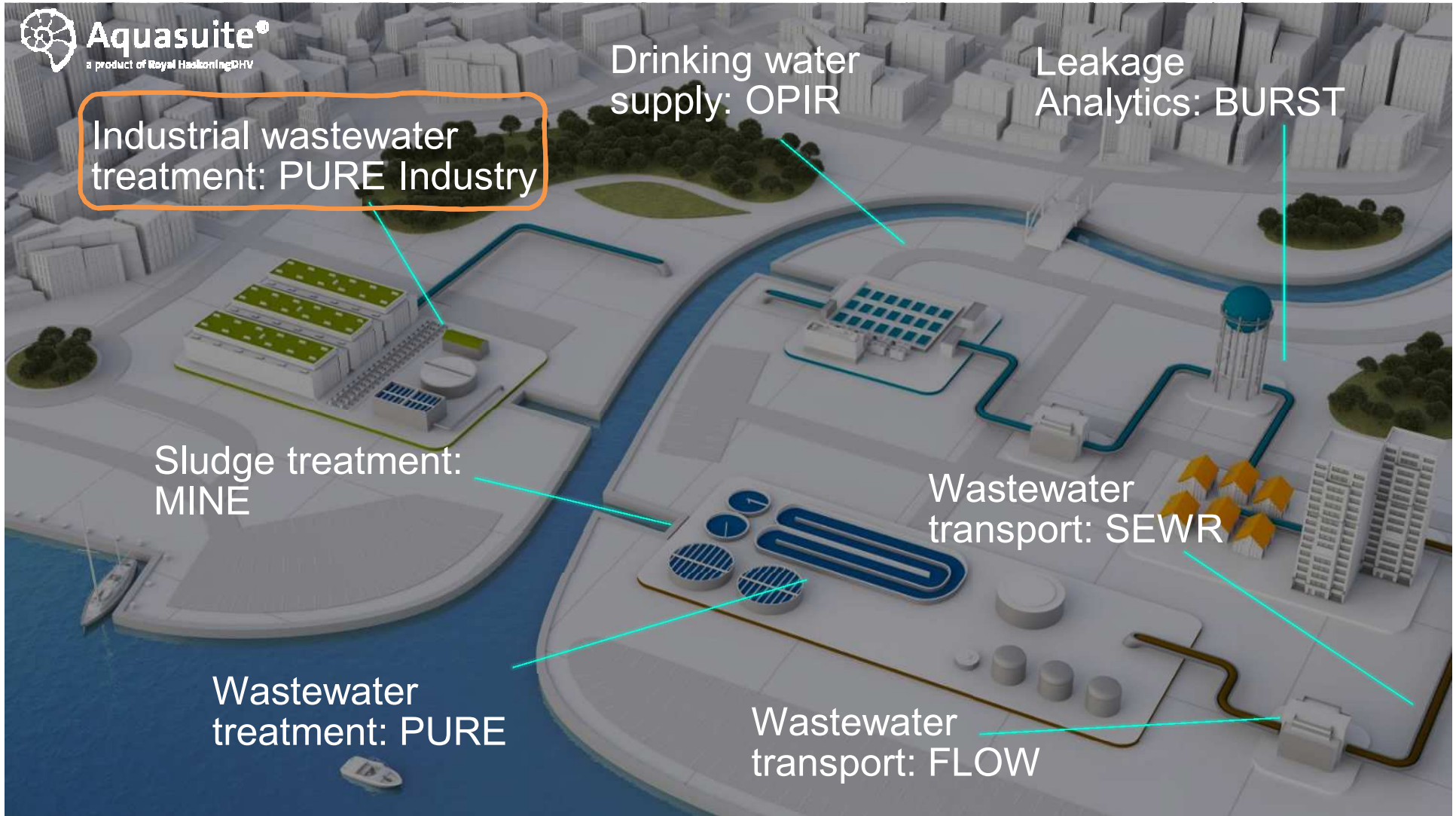
Leakage  
Analytics: BURST

Sludge treatment:  
MINE

Wastewater  
transport: SEWR

Wastewater  
treatment: PURE

Wastewater  
transport: FLOW



# Aquasuite Digital Twin: fit for purpose

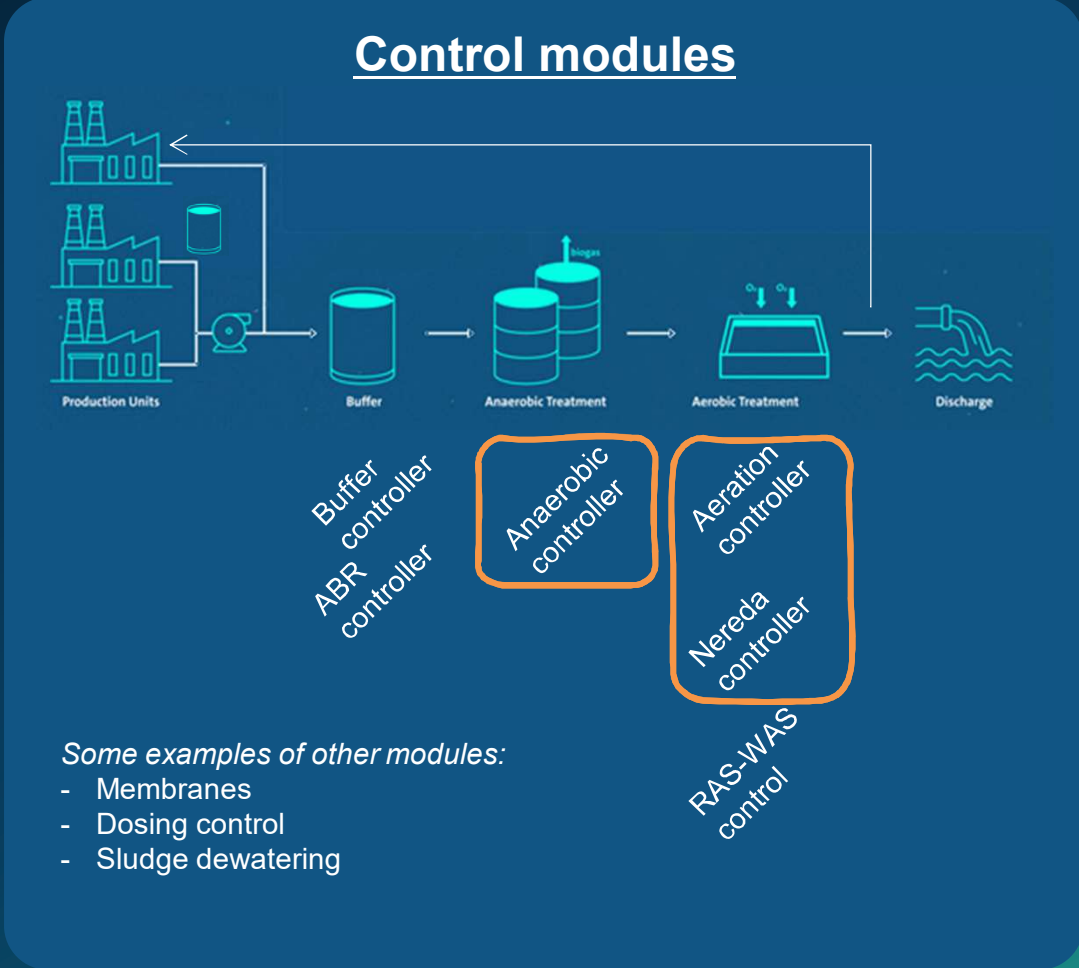


# Holistic by design

A unique, modular approach for the whole treatment.

Control modules are available for physical/chemical, aerobic and anaerobic treatment processes.

Analytics dashboards packed with domain knowledge.



Some examples of other modules:

- Membranes
- Dosing control
- Sludge dewatering

## En nu de praktijk!

1. Anaerobic controller: soft-sensoren
2. Aerobic: machine learning
3. Analytics



# Crash course: Anaerobic controller

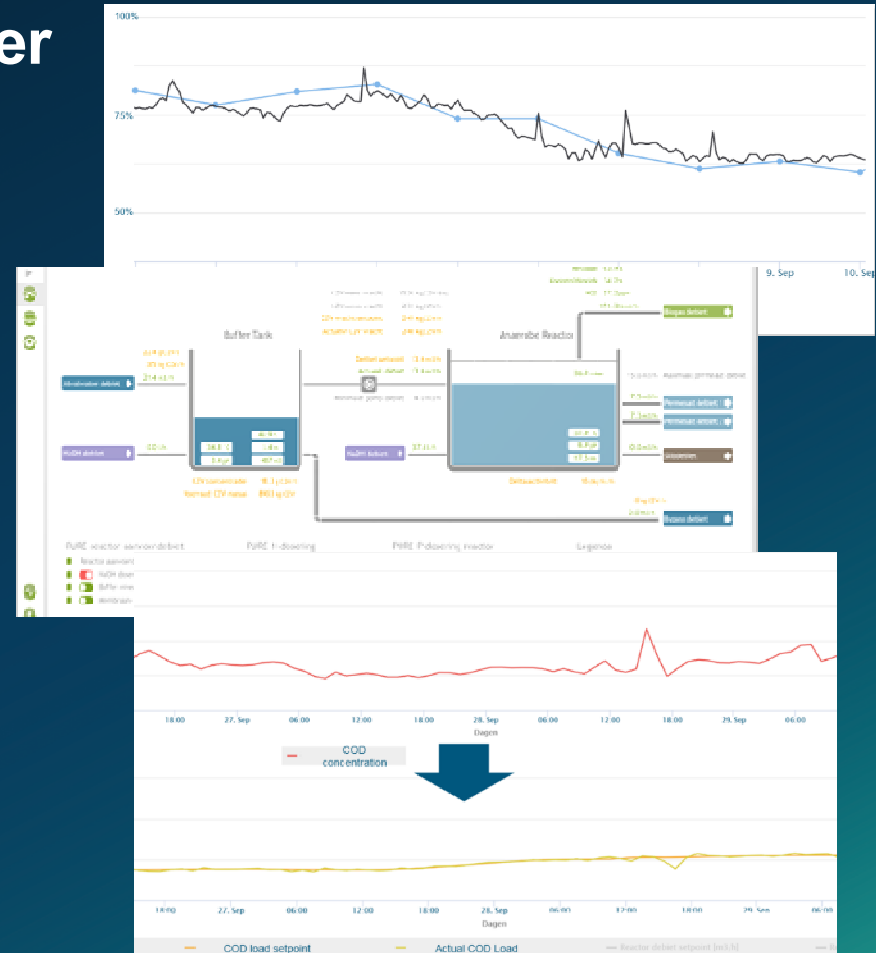
Anaerobic treatment process is good way for biogas recovery. However, it's sensitive by nature and performance greatly impacted by fluctuating loads easily leading to sludge washout.

## How it works:

1. Softsensor determines wastewater composition
2. Treatment capacity determined in real time based on several process indicators.
3. Safe and optimal influent setpoint provided to the equipment
4. Various safety measures built in in case of upsets

## Benefits:

- Optimal use of data: no capex investment needed
- Robust operations despite strong fluctuations
- Higher biogas production & relieve on aerobic stage
- Payback times in months possible



# Use case: Paper and pulp

## Fact & figures:

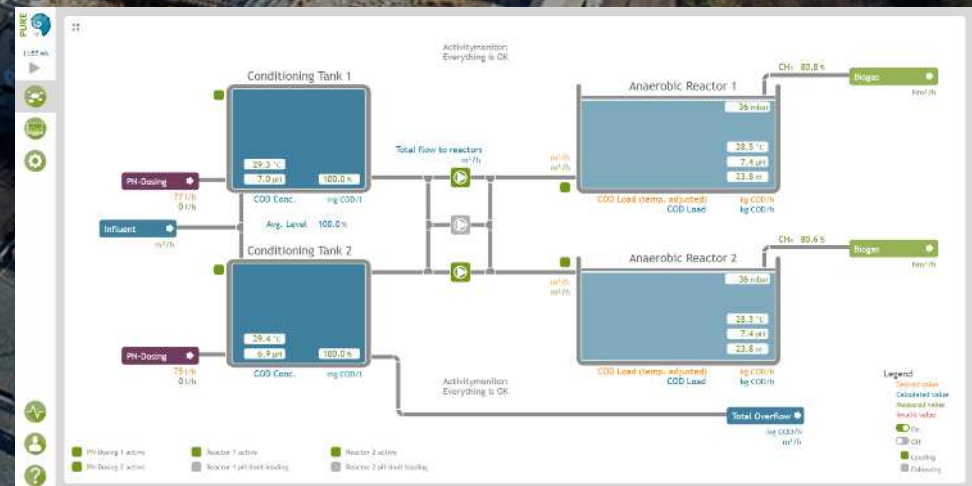
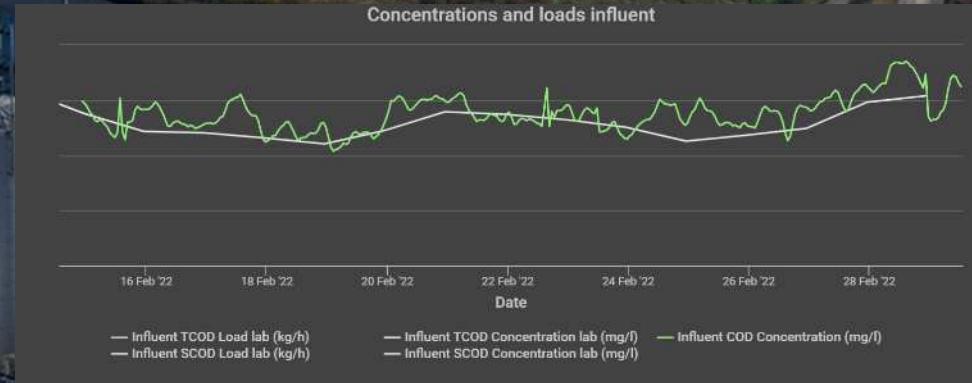
- Recycled paper mill
- Two IC's, >30t COD/day each
- Large aerobic lagoons as post treatment

## Drivers:

- Strong fluctuations influent
- High OPEX:
  - Washout
  - Suboptimal biogas production
  - Energy and sludge

## Modules implemented:

- Buffer control
- Anaerobic control
- Dosing control

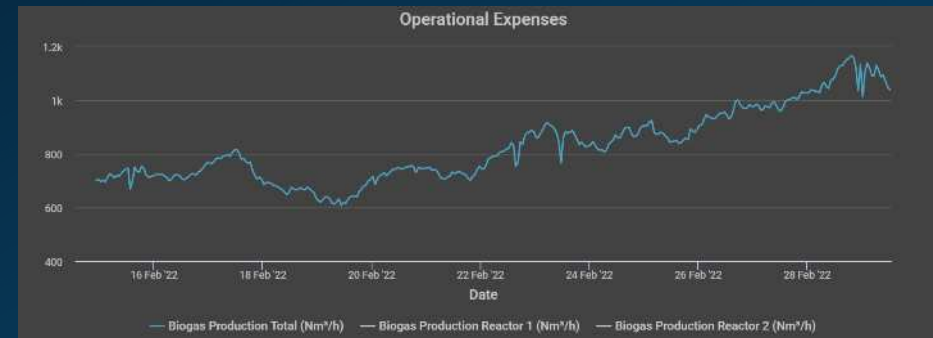


# Results

- In a few weeks up to design capacity, despite strong influent fluctuations
- From sludge washout to growth
- Decrease of sludge production and energy consumption aerobic stage
- Payback time < 1 month, no CAPEX (except controller)

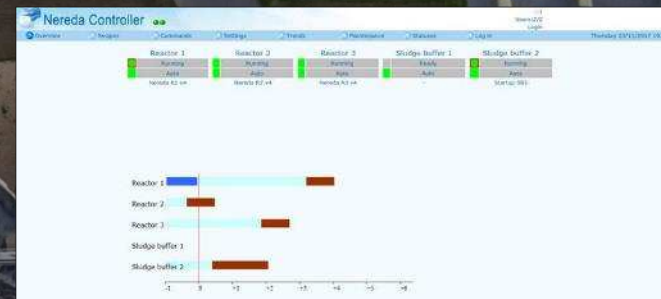
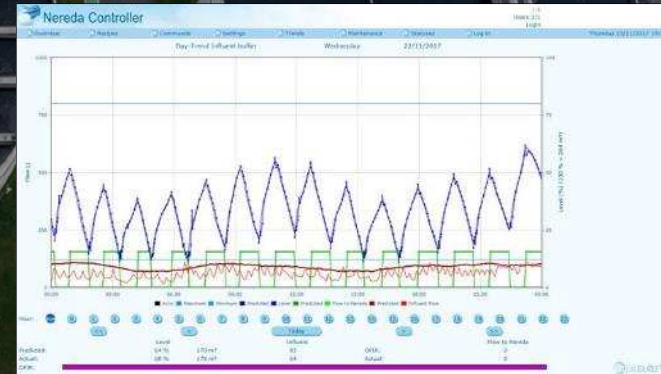
## Next steps:

- TSS remediation
- Aeration control

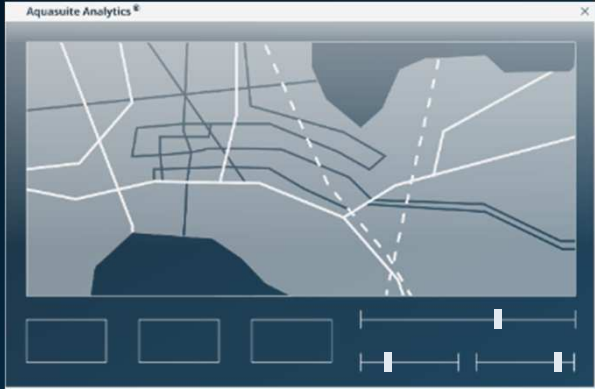


# Nereda controller

- Controller identifies trends and optimises performance
- Automated alerts sent by controller of operational issues
- Nereda® controller and infrastructure actively monitored by RHDHV for communication or service errors





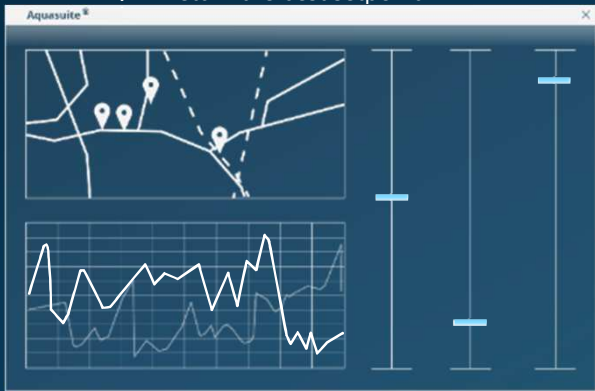


**Measure**

Interface with local system

**Control**

Return the best setpoint



**How to control aeration?**

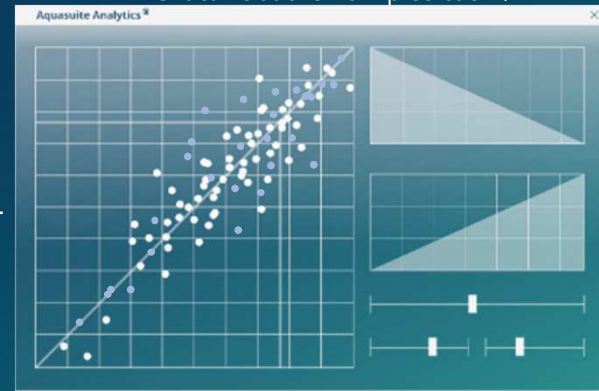
Examples from Nereda and other conventional systems

**Analyze or predict**

What is coming in

**Learn**

Critical relations from prediction



# Crash course: Aeration control

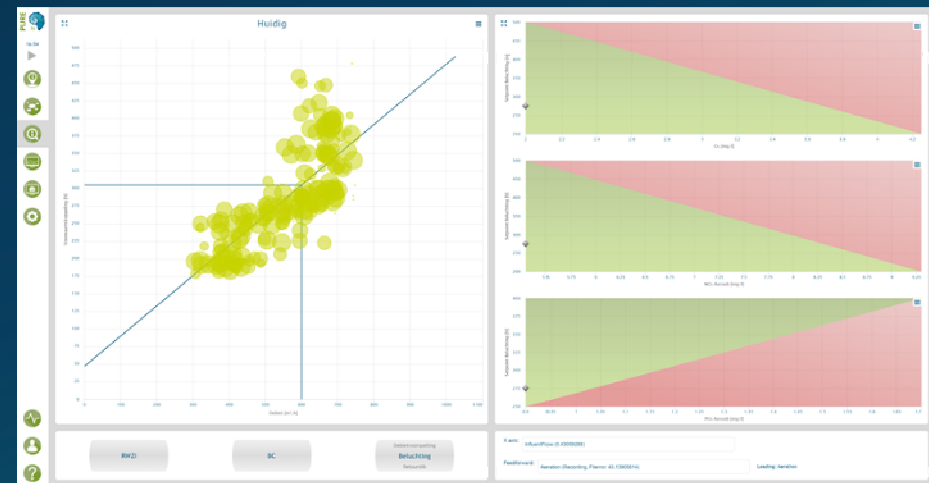
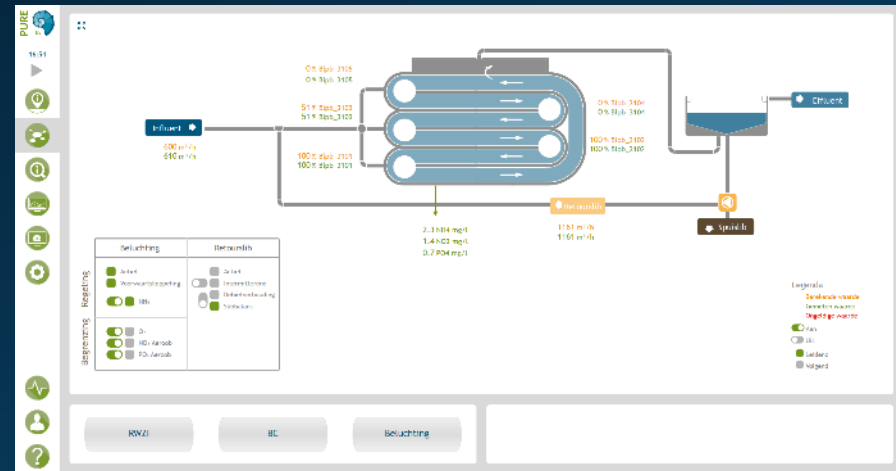
The self-learning aeration module developed for the municipal market (e.g. Carcon) adapted for industry

## Features:

- Feed and settling
- RAS + WAS flow
- N-recirculation
- Chemical dosing

## Benefits:

- Lower energy costs – up to 20%
- Reduced chemical costs – up to 15%
- Mitigate (N<sub>2</sub>O) emissions

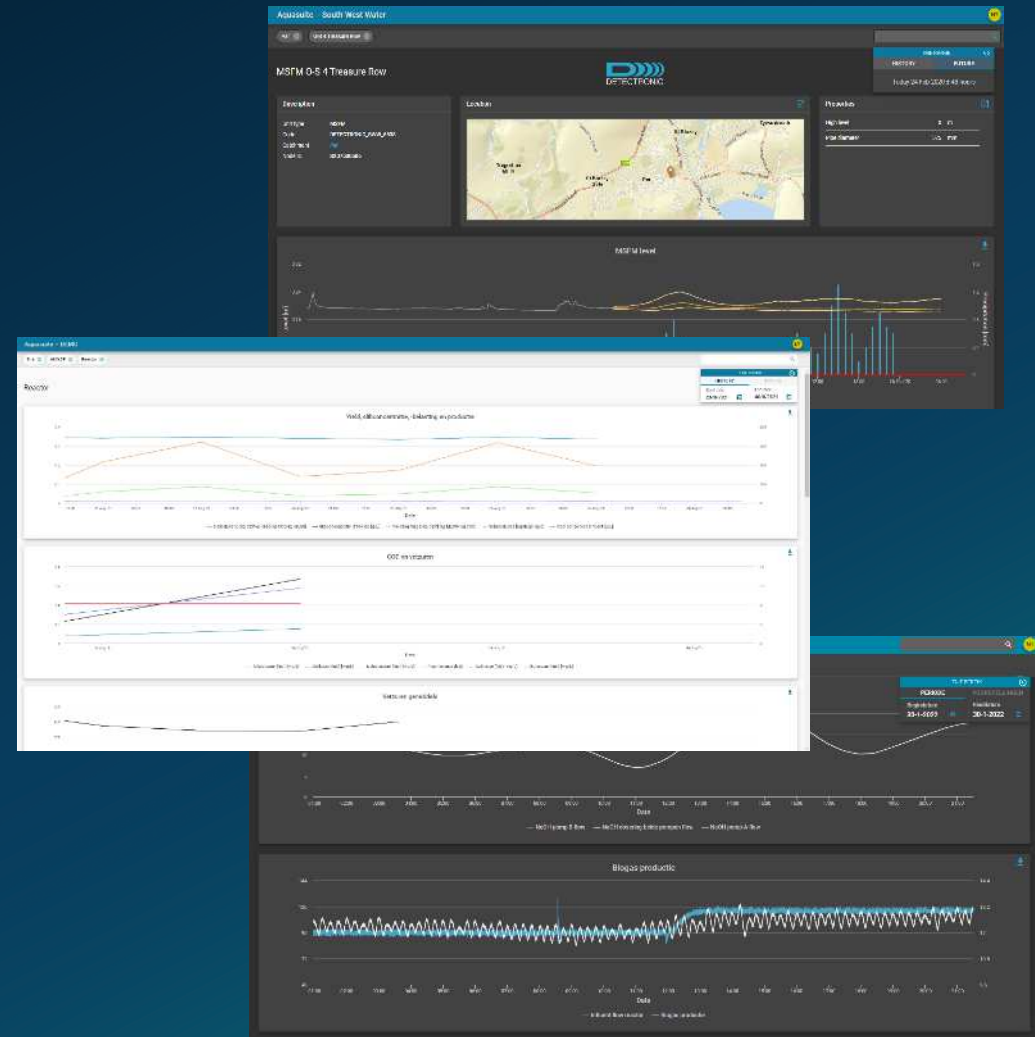


# The sweet spot of Control

	Manual O <sub>2</sub> setpoint	PLC control (Like PID)	Prediction + machine learning	Neural Network
Process stability				
Energy consumption				
Ease of implementation				
Prediction of effluent quality				
Learning time				
Retraining needed when process changes				

# Analytics

- Platform for providing actionable insights in process performance and costs
- More **value and insights** from existing measurements
- Domain knowledge is packed in specific pages help end-users and are available for 95% of the most occurring process steps.
  - DAFs, ABR, (an)aerobic treatments, settlers etc.
- Different tools used to turn data into value, e.g.:
  - Visualization & calculations of KPIs
  - Events & alarms functionality
  - Advanced data science, e.g. predictions for anomaly and drift detection
- Precious time saved
- Tool for operational support



## What have we seen?

### Benefits:

- Improved process effluent stability and be compliant (avoid penalties)
- Lower OPEX & CO<sub>2</sub> footprint
- 24/7 operational support for process operators – up to 90% less time spent
- Insightful dashboards and decision support tools, capturing knowledge and easier knowledge transfer
- Up and running in short(er) notice
- Hardware agnostic & no capex needed

### Challenges:

#### Technical:

- Availability of measurements
- Data quality: maintenance and calibration
- Standard modules vs one-off

#### Digital maturity of clients:

- Cybersecurity concerns
- Organizational readiness and acceptance (cold feet)
- PA not “written off” like other CAPEX and therefore not often replaced

## Belemmeringen om verder te gaan met de automatisering?

- A. Ik geloof er niet in
- B. Het is te duur
- C. Cybersecurity
- D. Ik heb de benodigde metingen niet
- E. Niets

