How advanced aeration control contributes to Net Zero

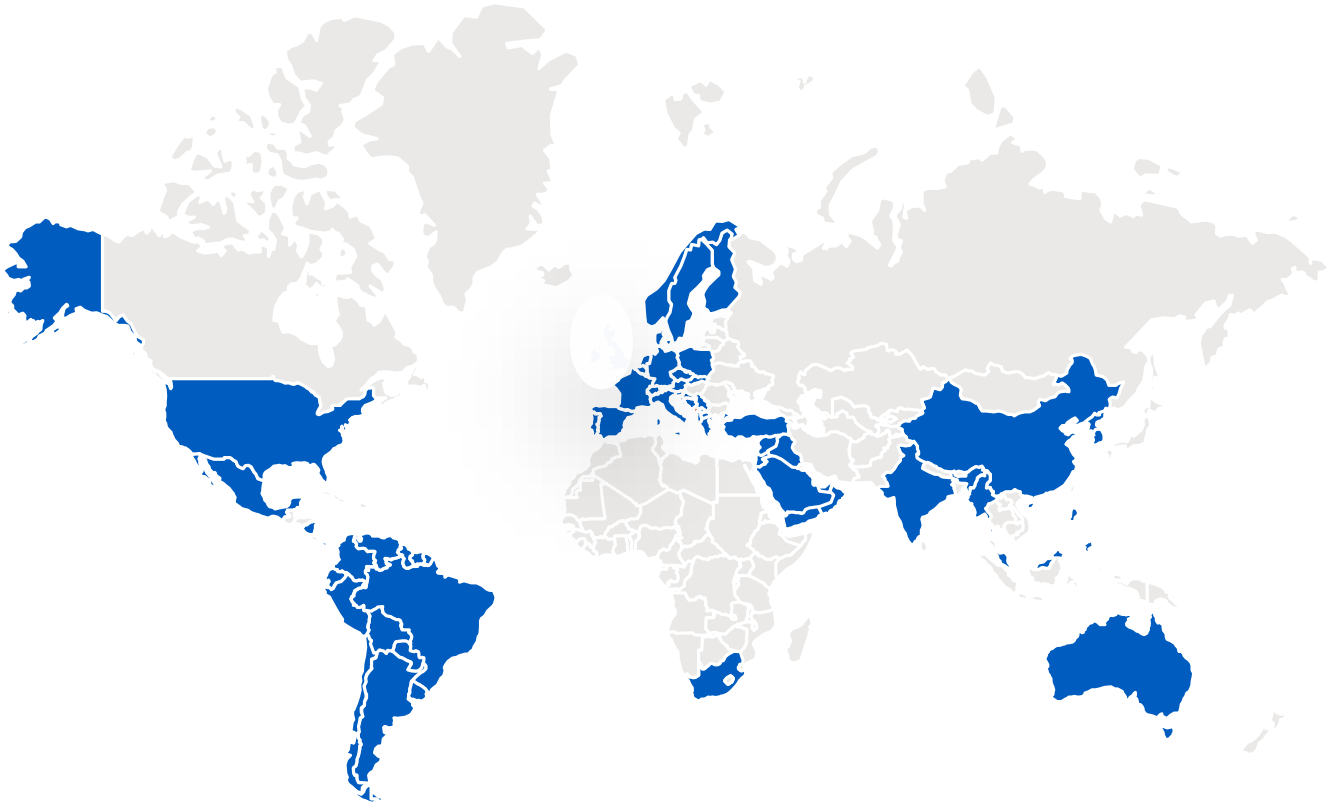
in many other ways than energy !

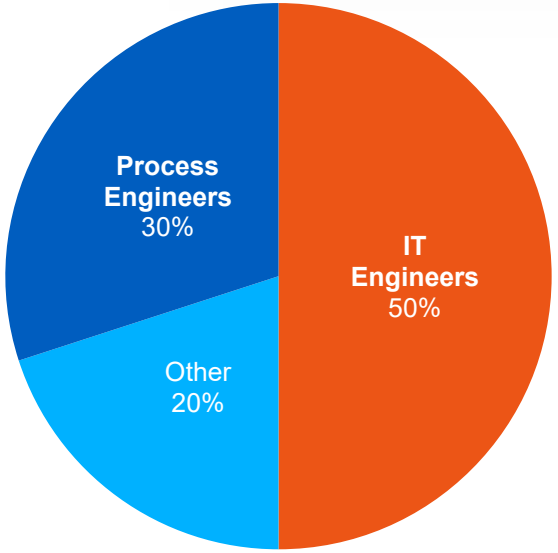
Empowering your assets and your teams.
Everywhere. Every second.

Createch 360°

1. Who we are
2. Background: CREA® platforms
3. Lleida WWTP description
4. Control modules implemented
5. KPIs
6. IDM module

They trust us





Team experience

- More than 150 references worldwide
- Municipal & industrial sites
- Company representation in over 20 countries

Average savings
15-25%

Average payback
1-3 years

La Farfana
(Chile)
760.320 m^3/d

Barcelona
B. Llobregat
(Spain)
420.000 m^3/d

Samra
(Jordan)
364.800 m^3/d

Jebel Ali
(Dubai)
293.000 m^3/d

Lodz
(Poland)
215.000 m^3/d

Rouen
(France)
150.000 m^3/d

Brembate
(Italy)
53.600 m^3/d

Guangdong
(China)
75.000 m^3/d

Honghu
(China)
50.000 m^3/d

Agra I-II
(Portugal)
44.336 m^3/d

Capivari II
(Brazil)
25.056 m^3/d

Torres
(Spain, winery)
650 m^3/d

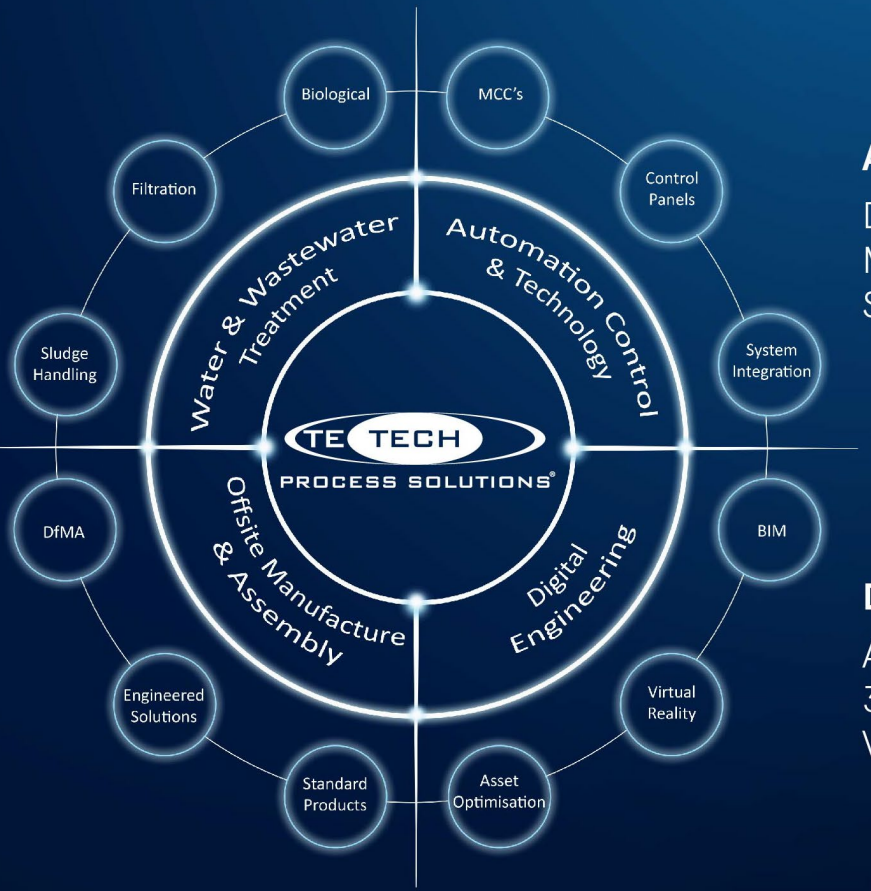
TE TECH
PROCESS SOLUTIONS

Water / Wastewater

Water Companies
Commercial / Developers
Oil & Gas
Energy
Defence
Marine

OMA

Fabrication
Manufacture
Assembly



ACT

Design
Manufacture
System Integration

Digital Engineering

Asset Optimisation / RTC
3D Design / BIM
VR / AR

Aqualia is :

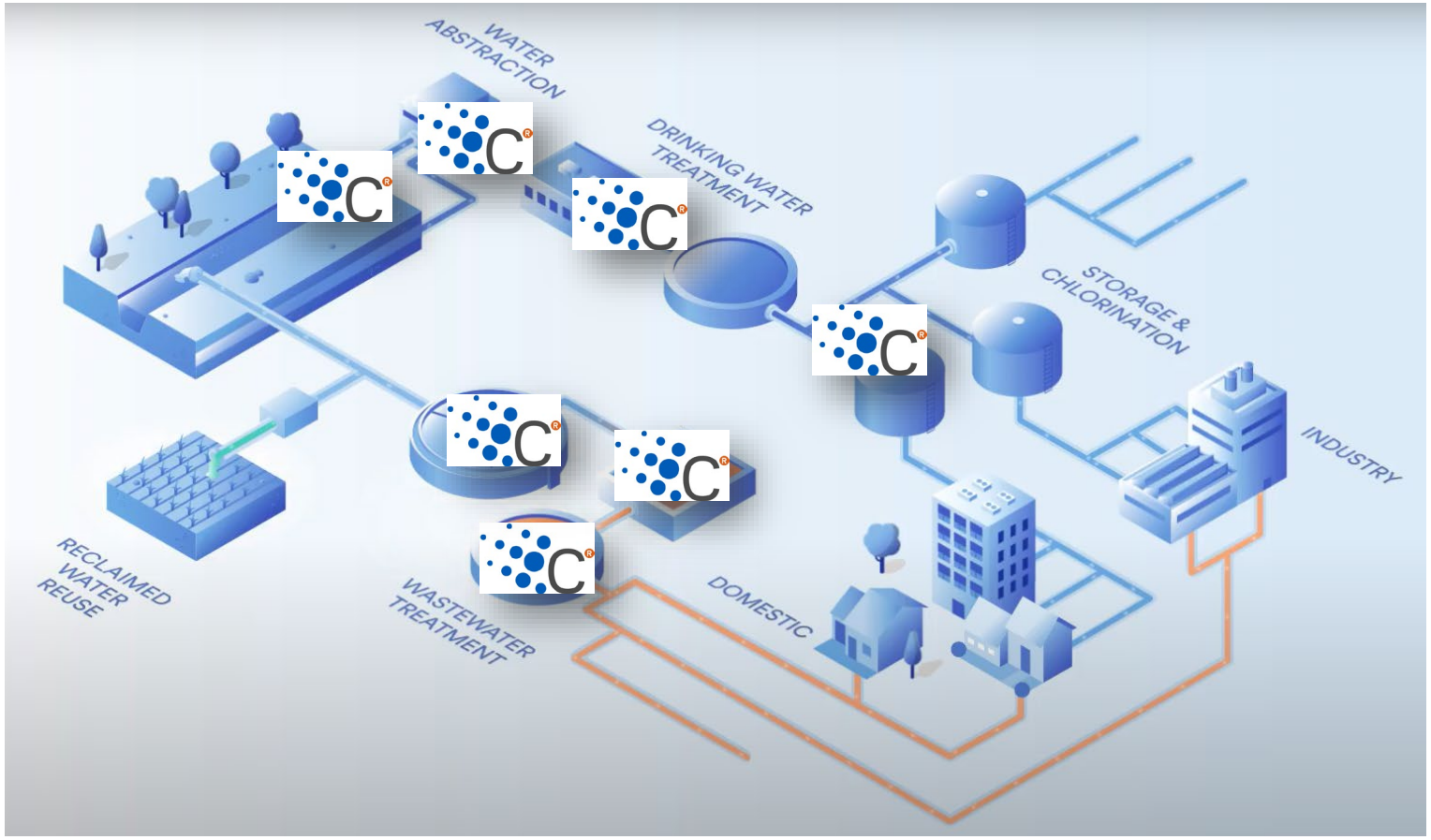
- the **4th largest water industry operator** player in Europe,
- the **9th worldwide** in terms of population served (GWI, March 2021)
- and covers the **whole urban water cycle**.

Aqualia serves circa 30 million people from 17 countries:

Algeria, Saudi Arabia, Columbia, Chile, Peru, Egypt, United Arab Emirates, Spain, France, Italy, Mexico, Oman, Portugal, Qatar, Czech Republic, Romania, Georgia.

Aqualia operates the **Lleida wastewater treatment plant**.

Process intelligence & control



Process intelligence & control

For all – example for WW aeration

Quality requirements	Process configuration	Aeration equipment	Instrument brand	Goals
Nutrient removal	Plug - flow	Blower/Turboblower	S::can	Compliance
Carbon removal	Carrousel	Aeration brushes	Hach	Process stability
Spot, Average, other	Concentric	Turbines	Endress+Hauser	Treatment perf.
	Circular	Liquid oxygen	Other	Savings
	SBR	Submerged		
	MBR			

BESPOKE CONTROL: including plant manager knowledge, site constraints & equipment requirements

BESPOKE CONFIGURATION: to suit needs and client requirements

Process intelligence

With additional benefits

PROCESS INTELLIGENCE
DSS dashboards, auto reporting with data analytics and KPIs. Self-customized.

REAL-TIME DATA MONITORING
Online monitoring, equipment performance, energy KPI, weather, ...

BEST VALUE DESIGN PRINCIPLE
Customized solutions to reach your goal: savings, treatment, emissions...

SECURE
Locally-based control (on your site), with manual & auto fall-back.

INTELLIGENT CONTROL LOGIC
PID, fuzzy logic, models, AI, rules, pattern recognition and ML.

HOLISTIC MANAGEMENT
Key process control modules on a single platform enabling synergies.

EMPOWERED OPERATIONS
Self-customized alarms. Editable settings. No black box: your site, your strategy.

ROBUST AND FUTURE-PROOF
Self-adaptive setpoints, signal analysis, able to adjust to future changes.

Architecture

flexible

secure

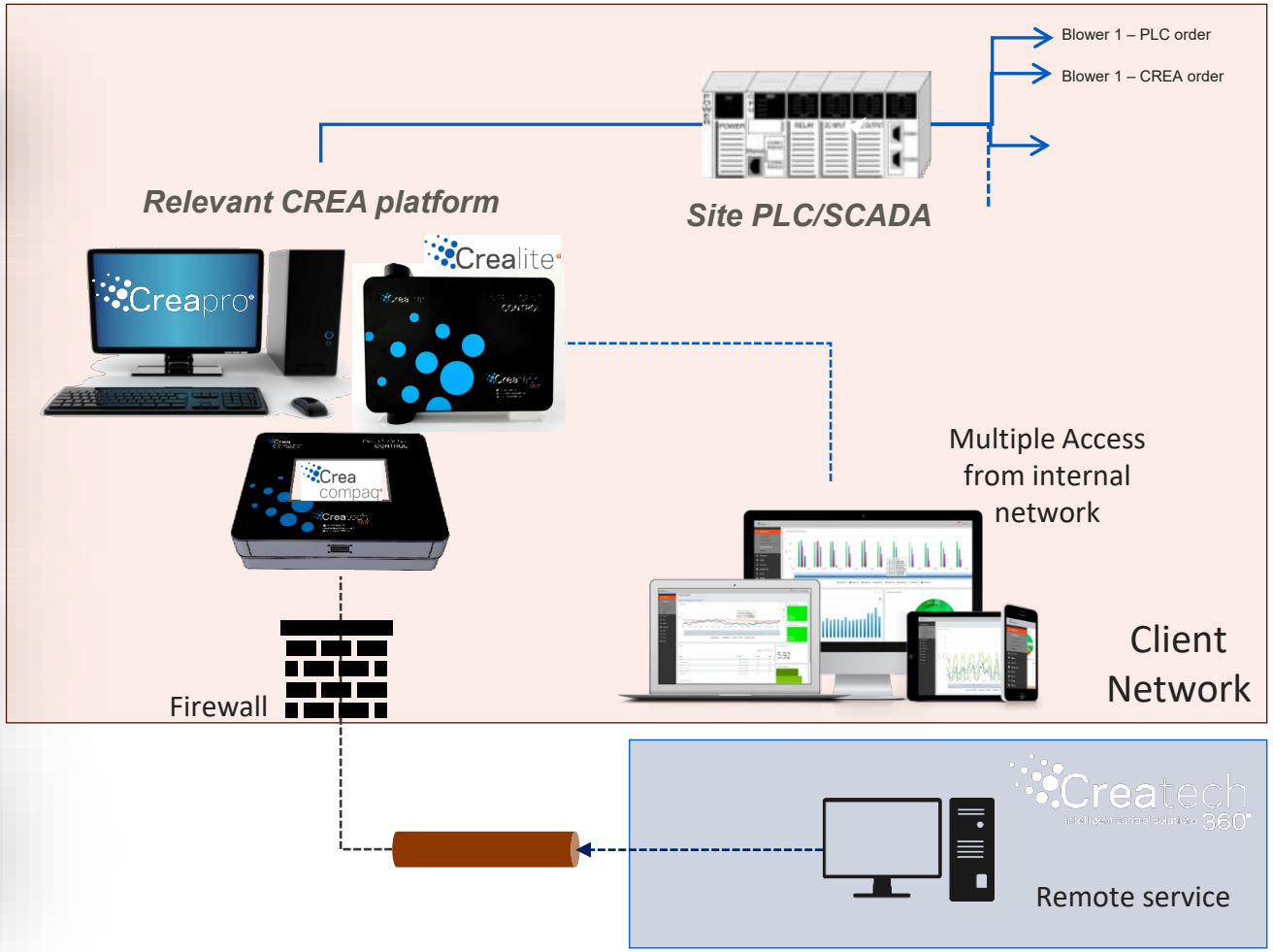
Local data and local control

Pre-existing control remains in place

Several fall-back procedures (auto/manual)

Customer defines authorized remote access

Flexible architecture: CREA product and communication protocol adapted to site

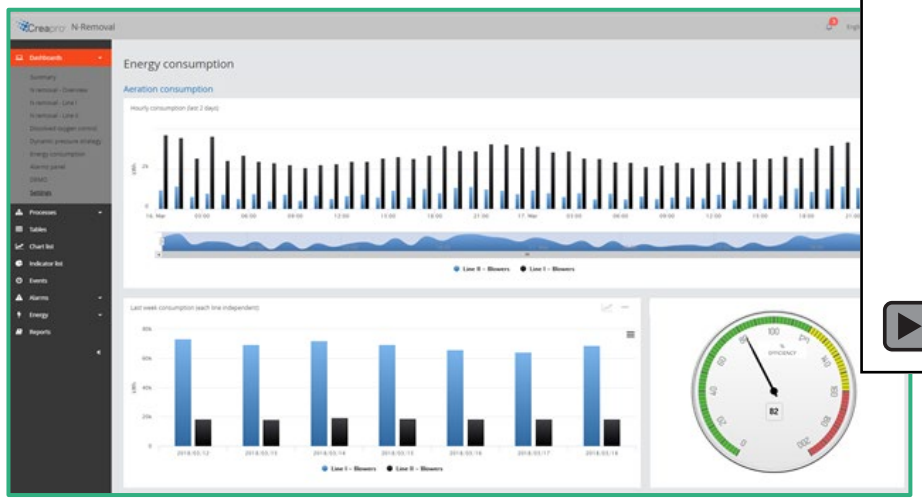


Build you own dashboard

smart monitoring

process intelligence

empowered operations

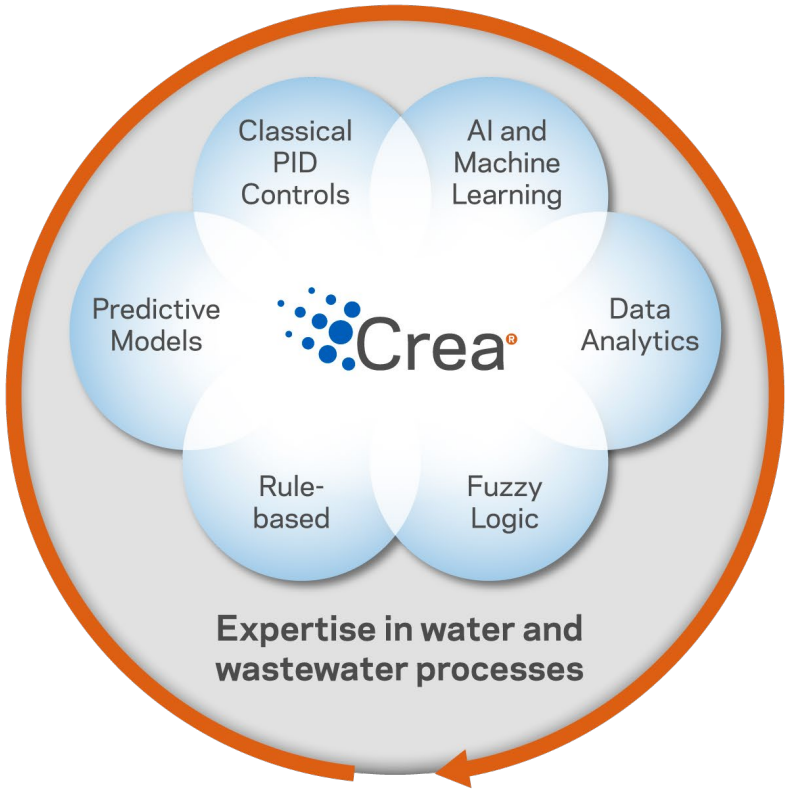


Fit-for-purpose tools

Serving straightforward goals

robust & future-proof

intelligent control logic



Intelligent logic tools selected case-by-case to optimize processes:

- ✓ Compliance with quality consents
- ✓ Minimum operational costs (energy, reagents, etc.)
- ✓ Evolutive and self-adaptive

best-value design

holistic

Pumping only when valuable

INTERNAL RECIRCULATION

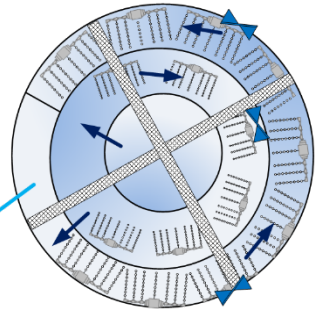
EXTERNAL RECIRCULATION

Dynamic chemicals dosing: only when valuable

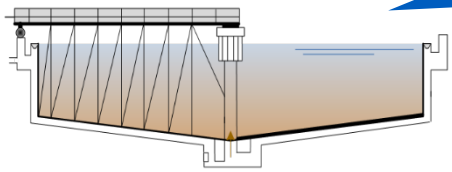
Tariff management to be $-efficient beyond kW-efficient

Incl. Site / user constraints and requirements

INCOMING LOAD



Optimising sludge age and MLSS

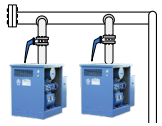


SETTLING/MBR

Weather forecast / stormwater management to balance incoming flows in real time

BIOLOGICAL PROCESS

Defining real-time air demand (dynamic DO)



AIR PRODUCTION

AIR DISTRIBUTION

Synergies within

Using efficient advanced logic tools

Protecting equiment (eg. manufacturer recommendations)

Minimal and efficient use of the production system as a whole and each equipment

Efficient at lowest pressure (dynamic P)

Overview

Flow: 87.500 m^3/day

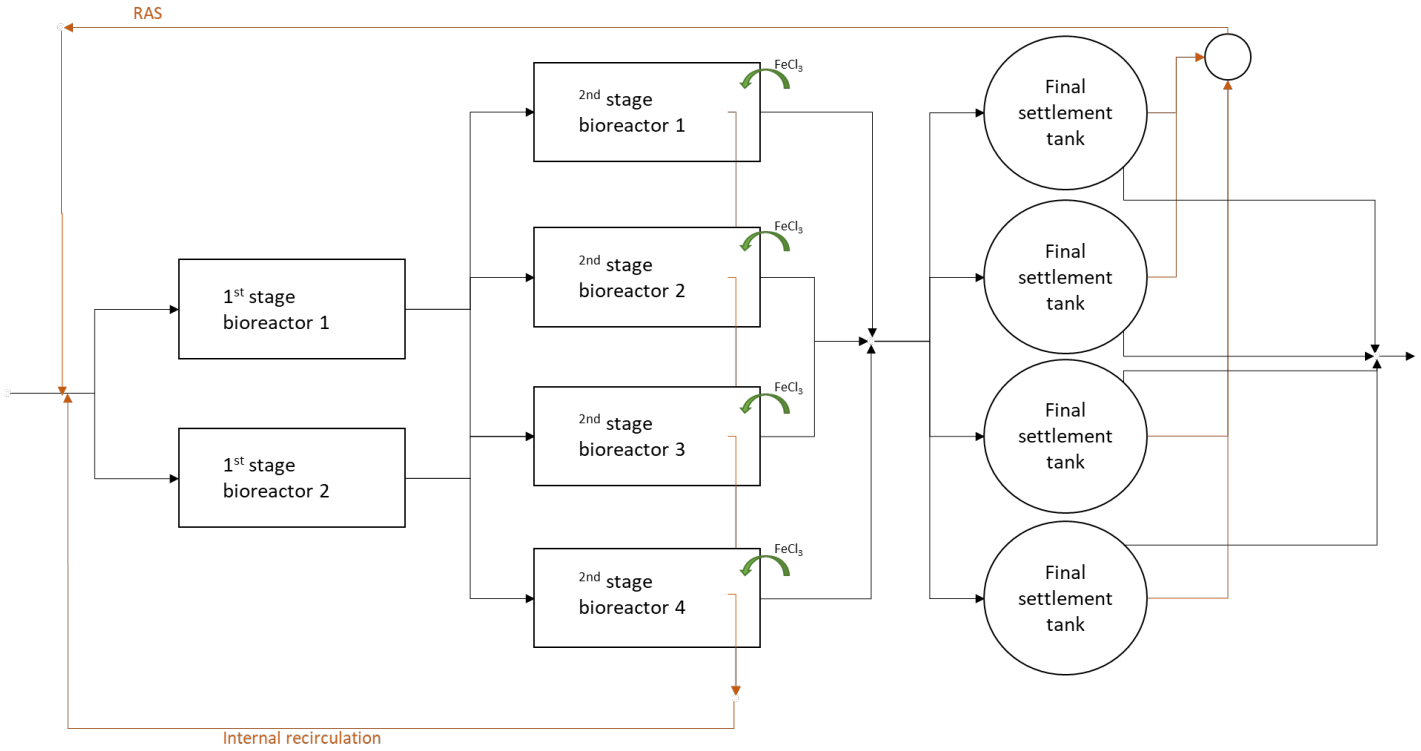
Biological reactor: 2x 1st stage + 4x 2nd stage

Aeration system:
- 6x turbocompressors
- Regulation valves

Operating company: Aqualia – Aigües de Lleida

Challenges:
- To **reduce the energy consumption** (aeration, internal and external pumping, SRT) and chemicals (Ferric chloride) costs whilst ensuring the **effluent quality**
- To monitor, optimize and stabilize treatment performance, **incl. new stringent limits**

Process



$BOD_5 < 25\ mgO_2/L$

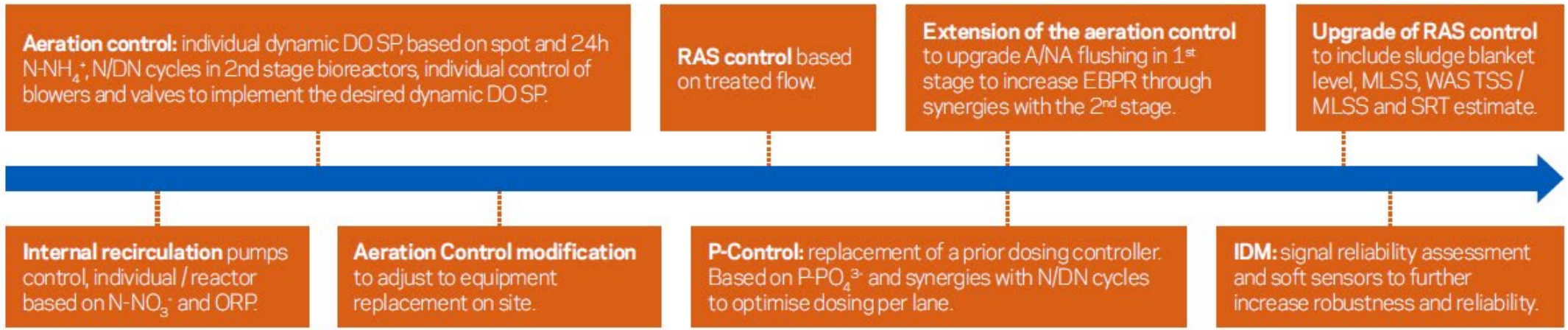
$COD < 125\ mgO_2/L$

$TSS < 35\ mg/L$

~~TN < 15 mgN/L~~ TN < 10 mgN/L

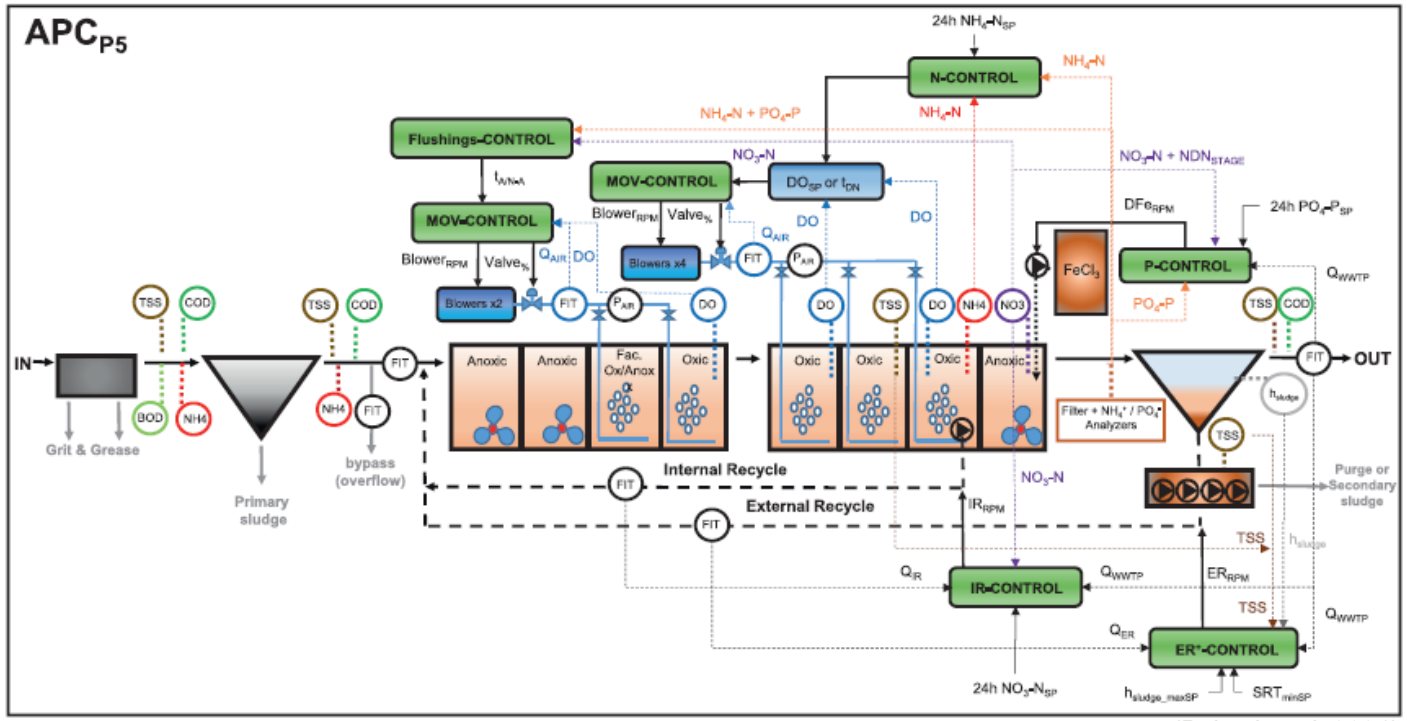
$TP < 1\ mgN/L$

Timeline



- ✓ **Water bodies quality**
- ✓ **Operational carbon footprint reduction**
- ✓ **Embedded carbon footprint reduction**
- ✓ **Monetary savings**

Current state



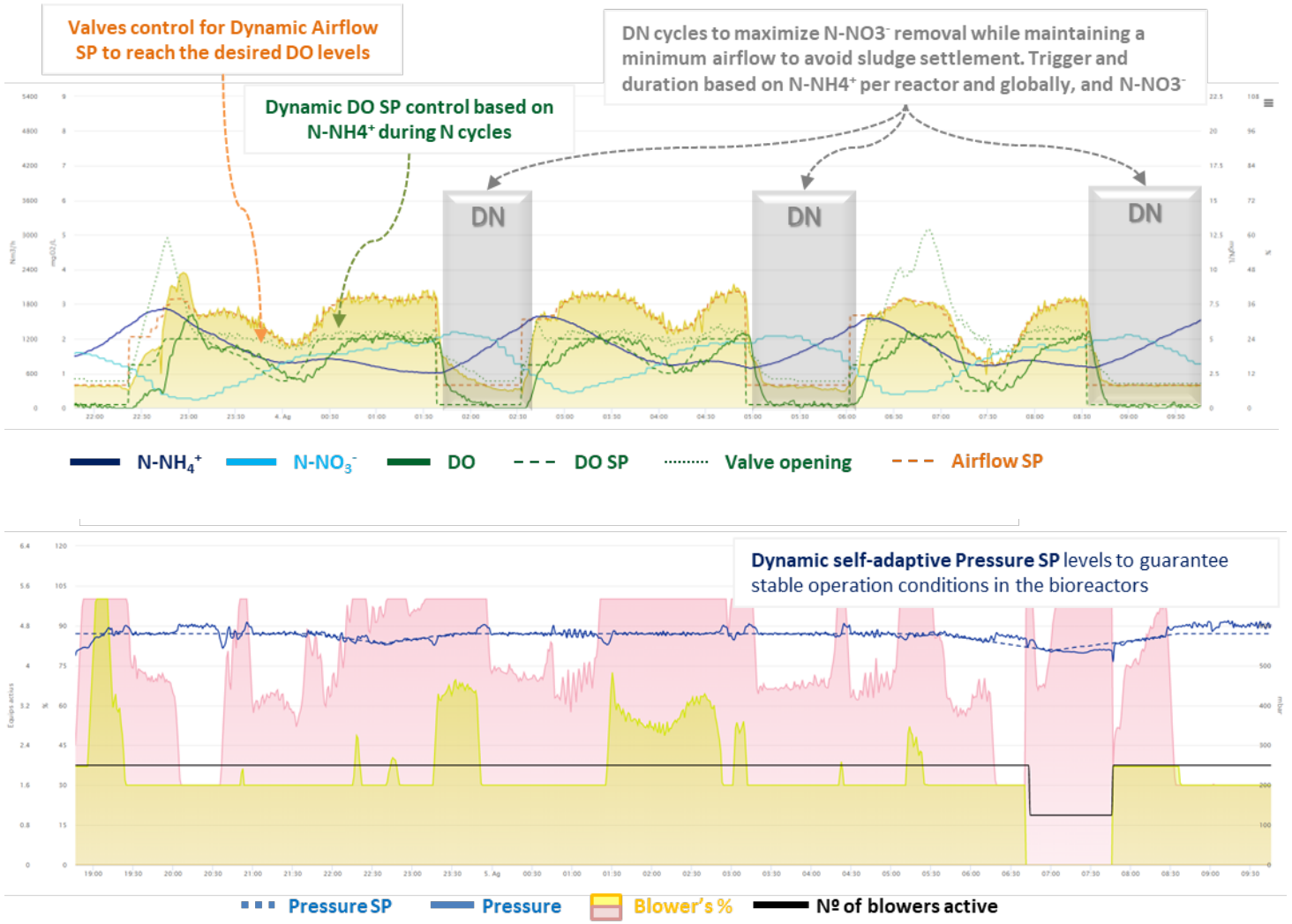
(Palatsi et al. 2021)

How does it work?

This module **controls blowers and valves.**

Process philosophy:

- ✓ A/NA cycles in 1st stage to boost EBPR
- ✓ N/DN cycles in 2nd stage for efficient TN removal
- ✓ Dynamic DO control
- ✓ Dynamic P control
- ✓ Power tariff strategy (24h consent limits)

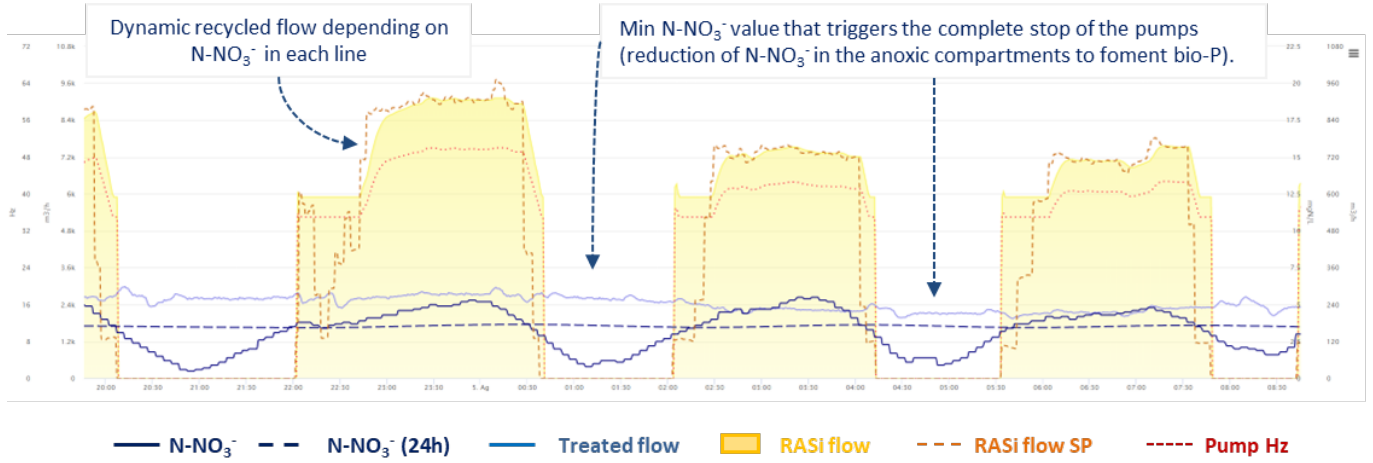


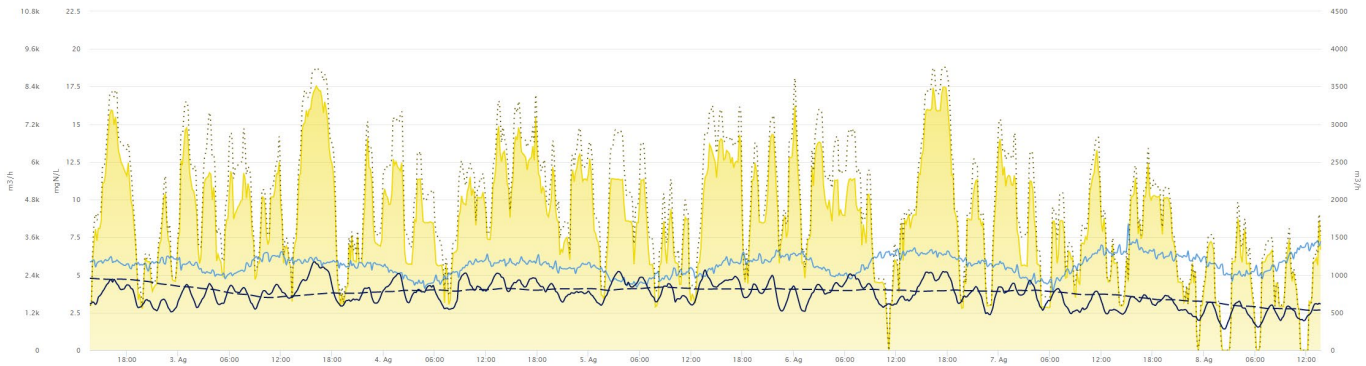
How does it work?

This module **controls mixed liquor pumps.**

Process philosophy:

- ✓ Dynamic pumping depending on denitrification requirements
- ✓ Individual per lane



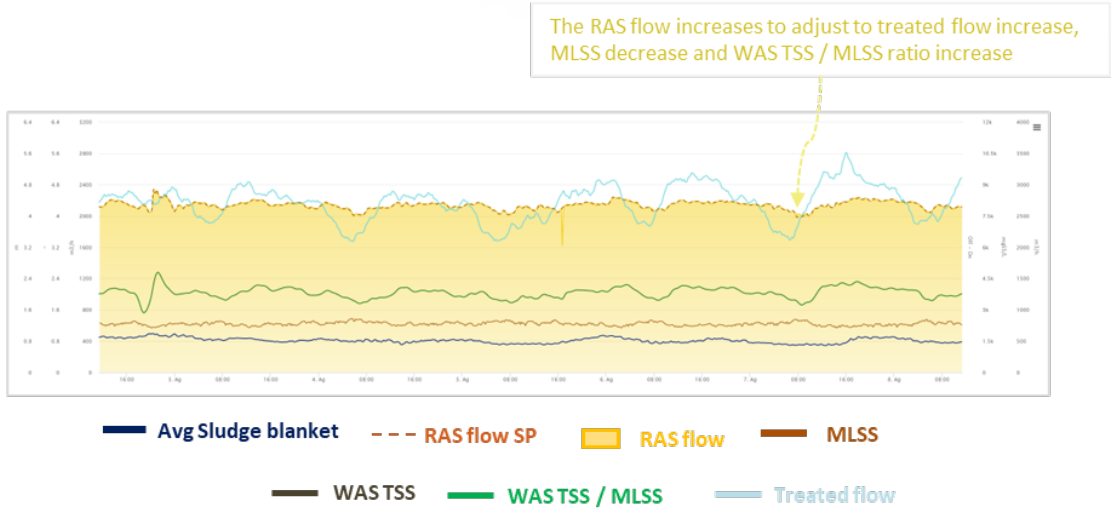


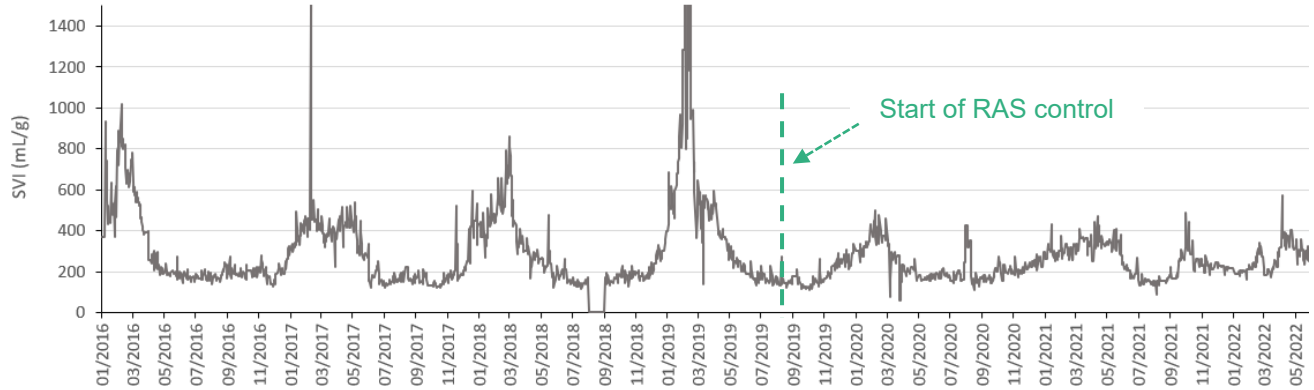
How does it work?

This module **controls blowers and valves.**

Process philosophy:

- ✓ Control of blanket in the final settlement
- ✓ Control of settling properties
- ✓ User defined SRT to control WAS

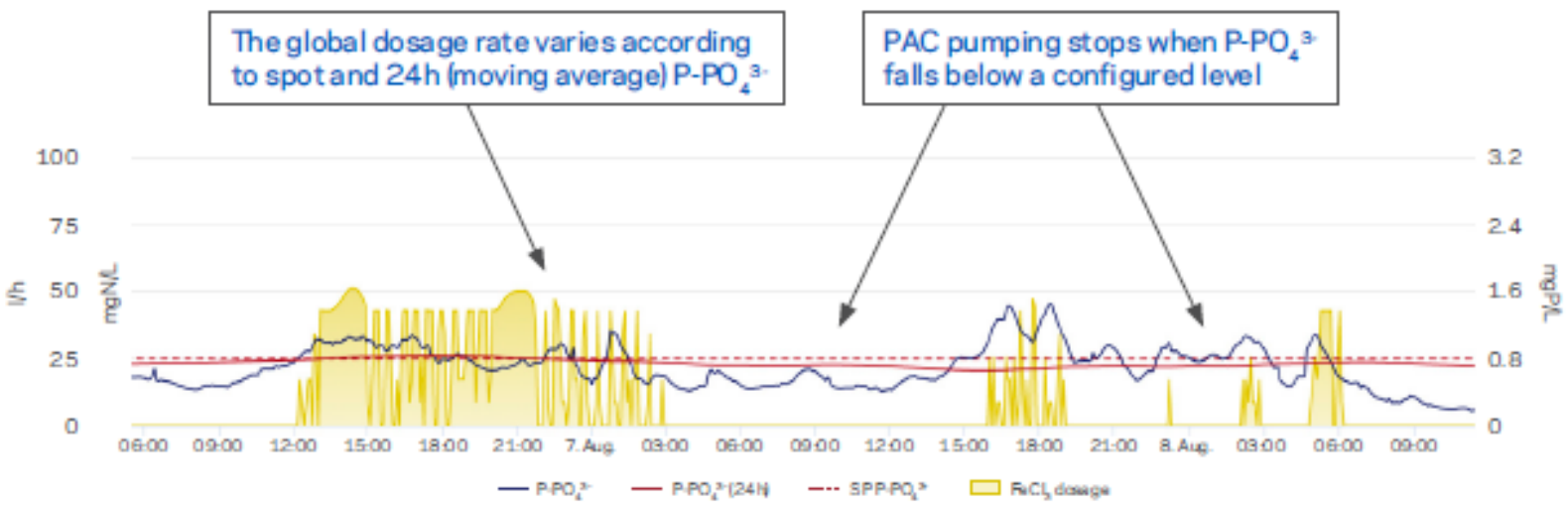


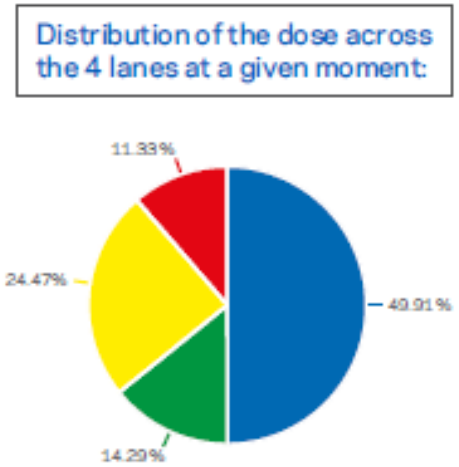


How does it work?

This module **controls the $FeCl_3$ dosing pumps**.

- ✓ dynamic dosage setpoints individually in each lane
- ✓ based on the bioreactor's effluent P-PO_4^{3-}
- ✓ synergies with aeration process / P-PO_4^{3-} release





Process, energy, quality, sustainability

Process

100 %
Quality compliance

25 %
Increased TN removal rate

9.2 %
Increased TP removal rate

Power

22 %
Reduction in kWh_A / kgN_{rem}

22 %
Reduction in kWh_{NuR} / kgN_{rem}

Blowers
IR pumps
RAS pumps

28 %
Reduction in m^3 $_{(IR)}$ / m^3

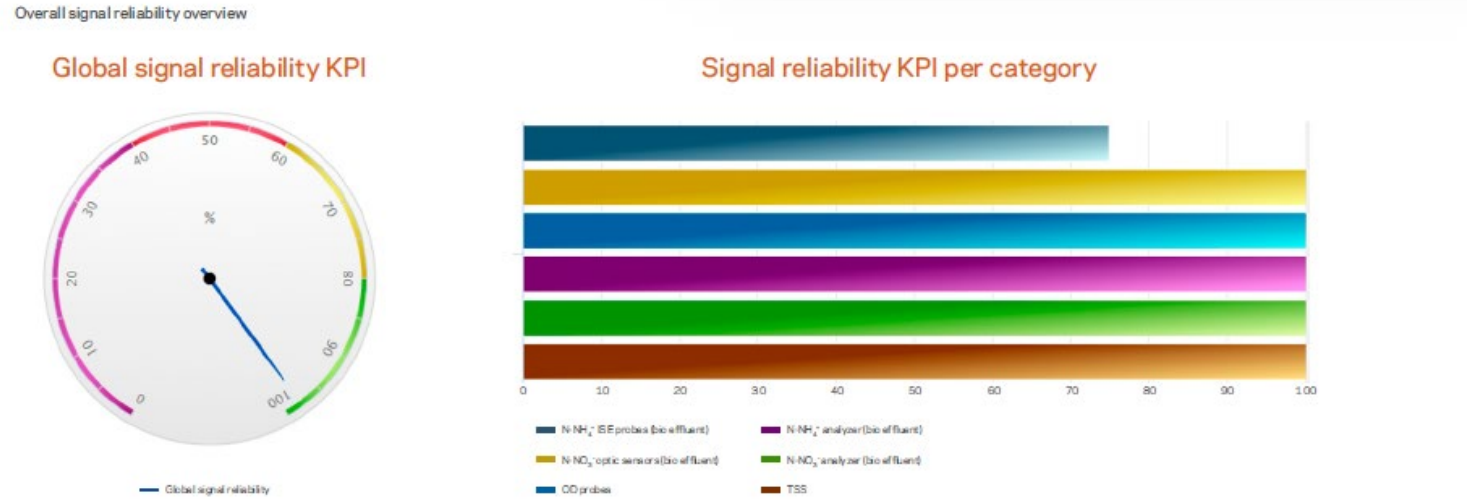
Chemicals

44 %
Increase in bio-P removal

20 %
Reduction in kgFe / $kgTP_{rem}$

How does it work?

- ✓ **Assesses in real-time the reliability and rates it**
- ✓ Builds and calibrates **soft sensors** of strategic signals using **Artificial Intelligence and machine Learning** & rates their reliability
- ✓ **When the reliability of signal falls below a minimum level**, the system deems it unreliable and uses in its place a replacement, sa. the **soft sensor**



IDM soft sensors:

Conclusions

- Enable **compliance** with new consent limits (TN), without revamping the existent WWTP
- Promote **EBPR**, despite the asset not being designed for this purpose
- Provide **power and chemical savings**, with the associated **environmental impact** benefits
- Provide **monetary savings**, over and beyond the commodities savings
- Enhance the **robustness and reliability** of the system, using data analytics, AI and ML
- Evolve and expand **step-by-step with customized solutions**, as per site requirements

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Createch intelligent control solutions 360°

TE TECH PROCESS SOLUTIONS®

aqualia