Aquadvanced® Plant
Driving Energy Efficiency and Operational Control at Elancourt WWTP

How AI-powered aeration optimisation reduced energy consumption by 15% while maintaining full regulatory compliance

15%
REDUCTION IN TOTAL ENERGY CONSUMPTION ACHIEVED

18%
SAVINGS IN ELECTRICITY COSTS

> **Aquadvanced® is a real operational partner that helps us make the right decisions at the right time. It gives us the ability to react smartly – optimising energy use without ever losing control of the process.**
>
> **Ronald Linas**, Operations Manager, Elancourt WWTP

Context & Operational Challenge

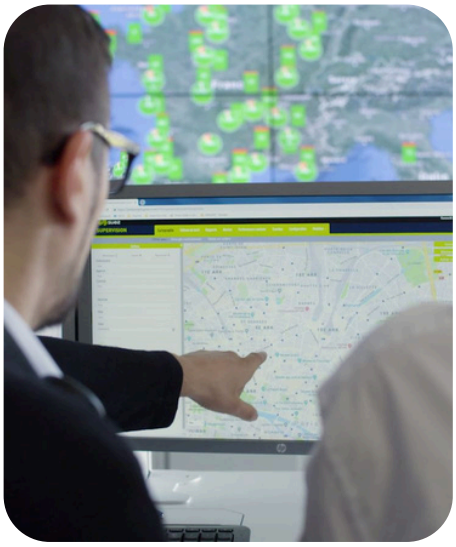
The Elancourt Wastewater Treatment Plant (WWTP), operated by SEVESC serves a population of approximately 40,000 in the Île-de-France region. The facility discharges treated effluent into a sensitive, environmentally protected water body, placing it under strict regulatory oversight, including increasingly demanding DERU discharge permit requirements.

The plant operates on a conventional activated sludge process with intermittent aeration; a configuration representative of nearly 80% of wastewater treatment plants in France. While proven and reliable, this process is inherently energy-intensive: aeration alone accounts for 40% to 60% of total electricity consumption, making it the single largest operational cost at the plant.

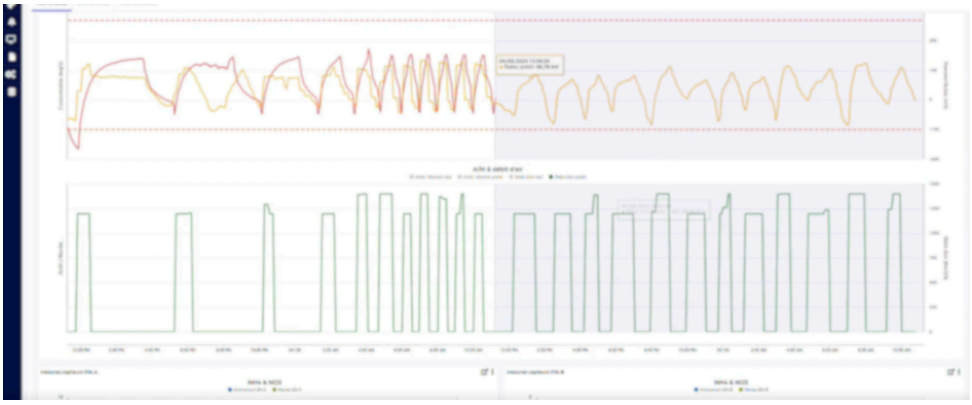
Against a backdrop of rising electricity prices and tightening environmental regulations, SEVESC faced a pressing dual challenge:

- *Reduce energy consumption from aeration without increasing operational risk or compromising treatment performance*
- *Optimise chemical reagent usage while maintaining full compliance with discharge standards for ammonium (NH_4), total Kjeldahl nitrogen (TKN), and sludge quality.*

Traditional plant management relied on conservative, manual aeration practices; a common response to process uncertainty that could lead to over-aeration and unnecessary energy expenditure. The operations team needed a smarter, data-driven approach capable of adapting to real-time process variations and fluctuating energy tariffs, while maintaining full regulatory compliance and operational reliability.



Measurable energy and cost savings at Elancourt WWTP, with full regulatory compliance



Solution Implemented

To tackle these challenges, SEVESC partnered with SUEZ Digital Solutions to deploy the Optim-Aeration Module of Aquadvanced® Plant: a real-time supervision and optimisation platform for water and wastewater treatment facilities.

At its core, Aquadvanced® Plant enables operators to achieve precise, proactive, and secure management of their plants: reducing energy costs and reagent consumption while guaranteeing regulatory compliance and effluent water quality.

At Elancourt, the Optim-Aeration module was deployed, delivering two integrated levels of operational intelligence:

- ***Real-time supervision****: a dynamic, cartographic multi-site dashboard providing an at-a-glance view of plant performance: water quality, energy and reagent consumption, sludge activation dynamics, equipment health and availability, and regulatory compliance. An intuitive colour-coded interface simplifies operational monitoring and accelerates decision-making*
- ***Automated process control****: AI-powered optimisation modules that automatically adjust key operational parameters every 15 minutes, combining artificial intelligence, constrained mathematical models, and SUEZ's deep process expertise to deliver continuous, adaptive optimisation.*

A key design principle of Aquadvanced® Plant is its ability to work with existing plant infrastructure. No additional physical sensors were required at Elancourt: the solution integrates directly with existing instrumentation, SCADA systems, and laboratory data, reducing deployment complexity and eliminating additional investment in sensor hardware and maintenance.

The solution was fully integrated and operational in under two weeks, including offline testing, with no disruption to ongoing treatment operations.

A structured, collaborative approach bringing together plant operators, process engineers and digital experts, supported by predefined fallback protocols and automatic Safe Mode activation in the event of data or communication disruptions, ensured a smooth transition and fostered operator confidence from day one.

How the Solution Works

Aquadvanced® Plant operates as a continuously learning optimisation engine. It combines multiple data streams, machine learning algorithms, and constrained mathematical models to calculate and apply the most efficient aeration strategy in real-time: recalculated every 15 minutes for continuous responsiveness to process and energy conditions.

Virtual Sensors: the Foundation of Predictive Intelligence

At the heart of the solution are AI-powered virtual sensors; one of Aquadvanced® Plant's key differentiators. Rather than relying exclusively on physical probes, the platform uses a combination of artificial intelligence, mathematical modelling, and SUEZ's operational expertise to predict and simulate the real-time evolution of key process parameters: dissolved oxygen (O_2), ammonium (NH_4), nitrates (NO_3), and redox potential.

Virtual sensors deliver a dual benefit: improving measurement reliability through continuous cross-checking while reducing capital and maintenance costs by limiting the need for additional physical sensors.

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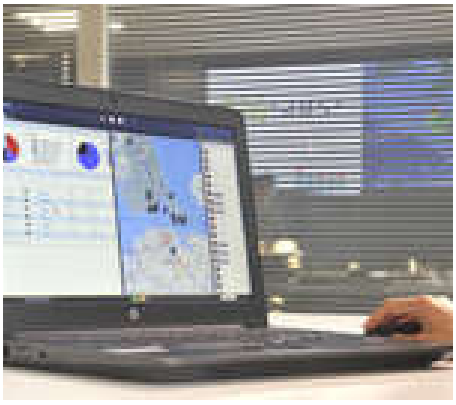

At Elancourt, the virtual ammonium sensor was central to the aeration optimisation strategy, enabling the system to predict biological treatment needs before they materialise.

Predictive Load Forecasting

Using machine learning models trained on plant operational data, Aquadvanced® Plant forecasts ammonium load evolution up to 24 hours in advance. This predictive horizon allows the plant to anticipate treatment demand and align aeration schedules proactively; rather than reacting after the fact. The system natively integrates weather forecast data and can incorporate additional external signals such as electricity price forecasts, green energy production schedules, or planned desludging operations, enabling intelligent energy arbitrage aligned with grid tariff periods.

Constrained Optimisation Engine

Forecast data feeds a constrained optimisation engine that recalculates the optimal operating plan every 15 minutes. It simultaneously balances multiple objectives: biological treatment performance and effluent quality, energy consumption and electricity cost, equipment wear and operational longevity, and regulatory compliance thresholds. Aeration blower operation; start/stop sequencing, airflow volumes, and timing, is modulated automatically, targeting 90% automated control coverage under normal operating conditions, while a Safe Mode fallback ensures continuous operation in any circumstance.

Intelligent Supervision & Alarm Management

Operators retain full visibility and control through real-time dashboards displaying plant KPIs, predicted parameter trends, and system status at both site and multi-site level. Intelligent alarm management and early drift detection help teams identify anomalies before they develop into process deviations or compliance risks. Rather than replacing operator expertise, Aquadvanced® Plant enhances it, providing the data, foresight, and decision-support tools needed to manage treatment processes with greater confidence and efficiency.

Operational Benefits & Results

Over the first six months of operation at Elancourt WWTP, Aquadvanced® Plant delivered measurable, sustained performance improvements across energy efficiency, cost reduction, regulatory compliance, and operational resilience.

Energy & Cost Performance

- *15% reduction in total energy consumption from aeration: the plant's dominant operational cost driver*
- *18% savings in electricity costs, with optimised scheduling during off-peak tariff periods*
- *Estimated annual financial savings of approximately €7,500*
- *Approximately 12 tonnes of CO_2 emissions avoided per year.*

Process & Compliance Performance

- *Full regulatory compliance maintained throughout, with zero permit exceedances for NH_4, TKN, or sludge quality*
- *Enhanced sludge settling performance, improving progressively as aeration cycles became more precise*
- *System availability of 97%, with rapid recovery from communication or equipment issues, validated through stress testing.*

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Operational & Cultural Impact

- *Operator-led efficiency gains extended beyond the original scope: insights from the platform led teams to identify and correct over-aeration tendencies on adjacent treatment lines, generating additional savings not initially targeted*
- *A measurable shift toward data-driven process management, with operators gaining confidence in automated control and actively engaging with predictive capabilities*
- *Reduced reliance on conservative manual practices while addressing a key industry challenge: the gradual loss of experienced operational expertise and the growing need for digital tools that capture and embed institutional knowledge into everyday plant management.*

The Elancourt deployment demonstrates that Aquadvanced® Plant delivers real, lasting operational value; even at conventional mid-sized wastewater treatment facilities. With a modular architecture scalable from 10,000 population equivalents, a deployment timeline of under two weeks, no requirement for additional physical sensors, and a low total cost of entry (installation from €1,000 with an annual subscription of approximately €6,000 for a 40,000 PE plant), the solution offers a fast, low-disruption path to significant OPEX reduction and sustainable, long-term treatment performance.

About the Client

SEVESC operates the Elancourt wastewater treatment plant in the Île-de-France region, providing wastewater services for approximately 40,000 residents in a environmentally sensitive area.

About SUEZ

Faced with growing environmental challenges, SUEZ has been delivering essential services that protect and improve our quality of life for more than 160 years. SUEZ provides its customers with innovative and resilient solutions for water and waste services. With 40,000 employees across 40 countries, the Group works with customers to create value over the full lifecycle of their assets and services, and to drive their low carbon transition. In 2025, SUEZ provided drinking water for 67 million people worldwide and sanitation services for 36 million people. The Group generated 8.7 TWh of energy from waste and wastewater. In 2025, SUEZ generated revenues of 9.5 billion euros.