

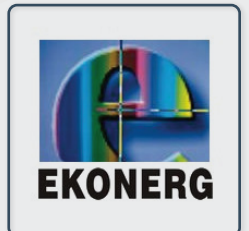
Zadar Port: A Hybrid Reference + Sensor Air Quality Network on the Adriatic Coast



INTRODUCTION

The Port of Zadar, one of Croatia's most economically significant Adriatic gateways, deployed a hybrid air-quality monitoring network that combines its two reference stations with five Oizom Polludrone sensor stations, all unified on the data visualization platform, Envizom. Through third-party data integration, the reference stations were brought into Envizom alongside the sensors, giving the port a single screen for every data source across the entire port area.

The result is a monitoring architecture rarely seen in real-world deployments: reference instruments and sensor nodes, visualised together, with sensors calibrated against reference stations, generating defensible, research-grade air quality data across one of the Adriatic's busiest maritime gateways.



05 Polludrone Stations
Deployed

02 Reference Stations
Integrated

24/7 Real-time Data
To Envizom

WHY ZADAR PORT

Zadar is one of six Croatian ports classified as being of special international economic importance, and it ranks among the three most-visited cruise destinations in the country. The port handles roughly 2.5 million passengers a year, making it one of the busiest points on the entire Adriatic coast.

Zadar is a tourism, transport, and trade hub, with activity spiking sharply in summer, when ferry, cruise, cargo movement, and road traffic around the port peak.

The port is also embedded within urban infrastructure; hence emissions generated at the waterfront directly reach the people living and working around the port. For a site of this economic significance within a densely populated coastal city, understanding air quality is a prerequisite for responsible operation.

THE CHALLENGE

The Port of Zadar lacked an air quality monitoring network to assess pollution levels during the peak tourist season. With multiple emission zones across the port, a single monitoring point could not capture air-quality variation. Fishing areas, cruise berths, industrial zones, and ferry terminals each have distinct activity patterns and emission profiles, so monitoring multiple locations is needed to capture a complete picture of port-wide air quality.

The port needed answers to questions that a basic monitoring setup could not resolve:

- Actual pollution levels and exposures in each functional zone of the port, rather than a single site-wide average.
- How reliable the sensor readings are, and where unusual values might warrant investigation.
- How data quality from sensor-based monitoring compares against reference-grade instruments, side by side.
- How maritime and road traffic affect air quality during the summer peak; a question now being formalized in a scientific research paper by the University of Zadar's Maritime Department as well.

Operating in Europe also entails a stricter calendar of environmental inspections and regulatory checkpoints throughout the year, raising the bar for data defensibility. Answering these questions required more deliberately placed data points and a way to trust each of them.

THE SOLUTION: A HYBRID REFERENCE + SENSOR NETWORK

The Zadar Port Authority adopted a hybrid model along with Ekoner & Oizom, installing two reference stations and five Polludrone Smart sensor stations at the same time.

One sensor is co-located with a reference station as the control sensor, and the other four are strategically placed across the port, each capturing a distinct emission profile. The sensor locations were selected based on Ekoner's air quality study, which identified the parts of the port most affected by emissions from ships at berth.

STATION	LOCATION	WHAT IT CAPTURES
1	Fisheries area	Emissions tied to fishing operations and adjacent activity
2	Ferry terminal area	High-frequency ferry and vehicle traffic emissions
3	Cruise berth	Emissions where cruise ships dock and idle
4	Industrial site	Cargo handling and industrial-source pollution
5	Co-located with a reference station	Direct sensor-vs-reference comparison for calibration and data-quality validation

THE FIFTH DEVICE PLACEMENT

One Polludrone is co-located with a reference station, enabling both systems to collect data from the same location and allowing their measurements to be evaluated alongside the reference data. The insights from this co-location support sensor calibration and data alignment across the other four Polludrone units deployed throughout the port.

This approach combines the established reference infrastructure with distributed sensor monitoring, extending high-resolution environmental visibility across multiple areas of the port.

CATEGORY	PARAMETERS MEASURED
Particulate Matter	PM ₁ (very fine), PM _{2.5} (fine respirable), PM ₁₀ (inhalable), and PM ₁₀₀
Gases	SO ₂ (sulfur dioxide), NO (nitrogen oxide), and NO ₂ (nitrogen dioxide)
Meteorology	Atmospheric pressure, temperature, relative humidity, wind speed, wind direction



INSTALLATION DETAILS
 5 Units of Polludrone Smart

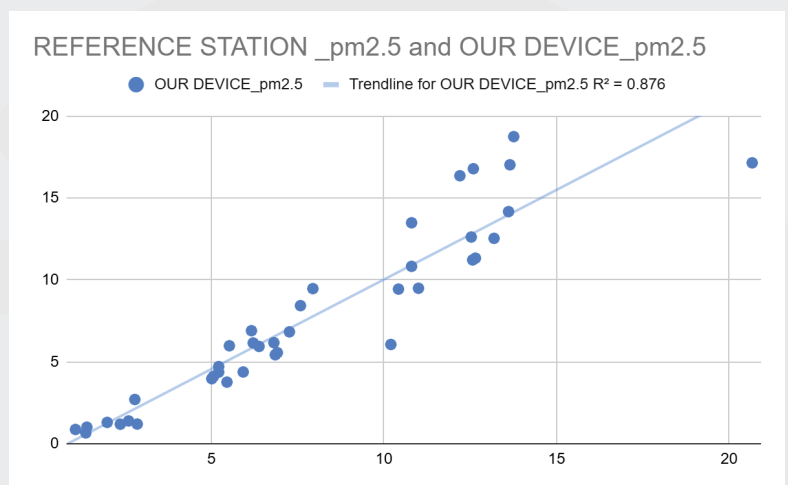
WHY OIZOM

Oizom was chosen for a combination of reasons that mattered specifically to a research-grade, regulation-aware port deployment:

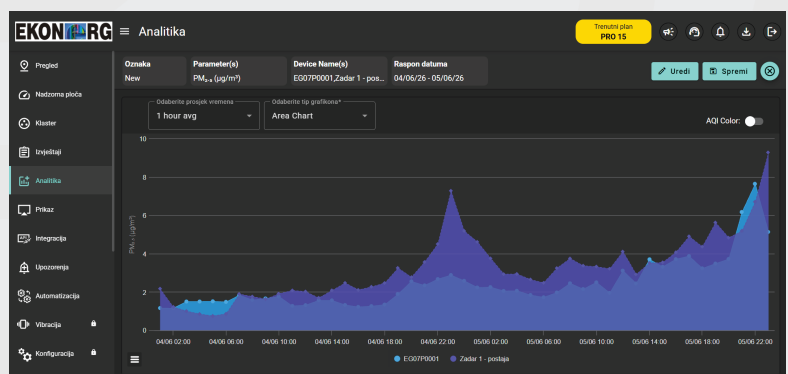
- **Reference-aligned accuracy:** Polludrone data is evaluated alongside on-site reference station measurements through continuous co-location.
- **True third-party integration:** Third-party equipment integration through Envizom, bringing reference-station data into a single platform for unified environmental visibility.
- **Customer support:** Direct, hands-on support, including AI-assisted data correction; a major deciding factor.

THE DEPLOYMENT: POLLUDRONE SMART+ENVIZOM

Polludrone is Oizom's continuous ambient air quality monitoring system, engineered to deliver reliable, high-resolution data closely aligned with reference measurements. It uses Oizom's patented **e-breathing sampling technology**, which mimics human breathing to ensure the air reaching each sensor is consistent and improves measurement reliability in challenging environments such as a working port. The system is designed for continuous operation, capturing changes in pollution levels as activities and conditions across the port evolve.



Because the port's interest is **deep pollution analysis and research**, the five Polludrone Smart units were configured around a specific set of parameters chosen for this study rather than a generic default. The selection was designed to support detailed source analysis and the academic research underway, while also keeping the regulatory landscape and the port's operational environment in view.



RESULTS

The hybrid network has given the port a denser, more trustworthy picture of air quality than reference stations alone could provide.

Zone-level pollution visibility

- Distinct emission profiles for the fisheries area, ferry terminal, cruise berth, and industrial site, rather than a single site-wide average.
- Real exposure data for the functional zones where people actually work.

Validated, calibrated data quality

- Continuous sensor-vs-reference comparison through the co-located station.
- AI-assisted calibration insights from the co-located node applied across the network to improve measurement consistency.

A single, unified data foundation

- Reference-grade and sensor-based data on one Envizom dashboard, comparable in real time.
- No manual reconciliation between separate systems or vendors.

Regulatory and research readiness

- Reference-grade data suitable for official air quality assessment, with the sensor network showing how pollution varies across the port.
- A trustworthy foundation for the academic research into how maritime and road traffic shape port air quality during the summer peak.

THE HIGHLIGHT: ONE PLATFORM FOR EVERYTHING INCLUDING THE REFERENCE STATIONS

The single most important outcome of this project is integration.

Envizom, Oizom's cloud-based environmental monitoring platform, doesn't just visualize the five Polludrone sensors. Because Envizom supports **third-party data integration via REST APIs**, the port's **reference stations were also connected to Envizom**. Every data source in the port- reference-grade and sensor-based alike- now lives on a single dashboard, comparable in real time, exportable in the same reports, and analyzed with the same tools.

For a port running calibration studies, data-quality assessments, and academic research simultaneously, having reference and sensor data under one roof is transformative.

Envizom adds the analytical layer the project depends on: customizable dashboards, smart threshold alerts by SMS/email/push, automated daily/weekly/monthly compliance reports, heatmaps, historical views, and AI-powered analytics, with AES-encrypted security and flexible cloud or on-premises deployment.

IMPACT

By adopting a hybrid system, reference-plus-sensor architecture unified on the data visualization platform, Envizom, the Port of Zadar has built a monitoring system that is research-grade. The solution strengthens the port's ability to understand emissions at the zone level, supports data-driven environmental decisions, and lays the groundwork for academic research into the relationship between port traffic and air quality, all while protecting the public health of the surrounding coastal city.

It also creates a consistent data framework across different monitoring points, making it easier to compare conditions across operational zones and identify changes over time. This provides the port with a stronger evidence base for environmental planning, operational improvements, and future research initiatives.

Oizom specializes in real-time environmental monitoring solutions designed to help organizations measure, manage, and improve environmental performance. Our comprehensive portfolio includes air quality, weather, noise, and emission monitoring systems, powered by advanced sensor technology and cloud-based analytics. Trusted across industries, governments, and smart city initiatives, Oizom's solutions enable continuous monitoring, regulatory compliance, and actionable environmental intelligence.

TO EXPLORE A HYBRID REFERENCE-PLUS-SENSOR NETWORK FOR YOUR OWN SITE,
GET IN TOUCH WITH THE OIZOM TEAM.