

CASE STUDY

Decarbonization at Scale: Operationalizing Real-Time Methane Remediation



Introduction:

A Fortune 500 oilfield services provider partnered with Zemoso Labs to tackle a critical gap: how to operationalize methane emissions monitoring at scale so emissions data could drive continuous, governed, real-time decisions during oil and gas production. Traditional inspections and legacy systems created delays, fragmented visibility, and inconsistent workflows, slowing remediation and increasing regulatory exposure. Together, we built a platform so emissions signals could reliably become alerts, priorities, actions, and audit-ready reports at enterprise scale.

Industry challenge:

While the energy sector faces increasing pressure to reach net zero, untracked Methane emission continues to be a threat to that ambition. Methane, being invisible to the naked eye, is notoriously difficult to track. Legacy detection methods often fall short in complex environments like off shore rigs, mountainous terrains, and areas with dense vegetation

However, the primary hurdle isn't just detection; it's operationalization. Traditional inspections rely on manual, fragmented workflows that create significant data silos. When detection is slow and data architecture is brittle, organizations cannot convert signals into rapid remediation, leading to increased regulatory exposure and stalled decarbonization goals.

Zemoso's partnership challenge

A Fortune 500 oilfield services leader partnered with Zemoso to bridge the gap. While the client possessed an existing system for monitoring oil leaks, it was not engineered for the high-velocity, high-volume demands of methane remediation.

The ask was to build a high-scale, role-based platform capable of processing continuous IoT data streams, orchestrate workflows, and prioritize incidents intelligently for users.

Impact created

The platform delivers measurable emission reductions and accelerates progress toward 2050 net-zero goals by converting emissions monitoring into a continuous operational workflow. Teams can detect leaks earlier, prioritize what matters, and act faster without delays.

How did we do this?

We co-created an emissions monitoring platform for both ground sensors and aerial drones to turn raw signals and images into actionable decisions. This involved continuous ingestion of IoT and drone data, and converting readings into PPM (Parts Per Million) and geospatial views. By replacing periodic checks with always-on monitoring, the client can detect methane and other emissions earlier, prioritize what needs attention, and respond faster.

- **Drone and Sensor to Cloud Pipeline:** Drones capture images and videos of methane leaks, while ground sensors across facilities continuously collect methane and other harmful emissions every four seconds. All of this data is ingested into the platform and analyzed in real time to surface alerts and insights.
- **Composable Services:** A distributed services layer ensured ingestion, analysis, and reporting ran independently, keeping the system reliable even under heavy load.
- **AI-Powered Detection:** Deep learning models scanned drone feeds, flagging anomalies in near real time and reducing detection lag from hours to minutes.
- **Geospatial Precision:** A digital map layer turned raw detections into actionable insights, pinpointing leak locations directly on field assets.
- **Operator Experience:** From field engineers to compliance managers, role-based dashboards delivered the right data with right details, whether it was live alerts or regulatory reports.

Complex Engineering Highlights

Behind the scenes, several engineering breakthroughs made this possible:

- **High-Frequency Time-Series Analytics:** Machine learning models analyze sensor readings captured every four seconds for time-series prediction and anomaly detection, turning raw signals into early warnings instead of static reports.
- **Geospatial Rendering:** Integration with a GIS layer (Cesium) shows anomalies directly on site maps, helping teams see exactly where abnormal readings originate in the field.
- **Fault-Tolerant Services:** With a microservices architecture, failures in one module never brought down the system critical functions like alerting stayed live.
- **Event-Driven Data Flow:** A messaging layer separates fast sensor data collection from later processing and dashboards, so even big spikes in sensor data don't slow down alerts or screens.

How did Zemoso deliver excellence

Zemoso helped the client move beyond "methane detection" to operational decarbonization. The platform addresses a common net-zero failure point: emissions data gets captured, but it doesn't translate into consistent action across teams and sites. By unifying aerial and ground monitoring in a single decision-grade system, teams can detect leaks earlier, prioritize response, execute remediation, and generate audit-ready reports at enterprise scale.