



## **Deliverable report 51**

### **AI and IAGEN Application Use Case**

#### **Environmental Risk Assessment in Water Management in Vaca Dead, Neuquén**

##### **Executive Summary – Application of AI and IAGEN for Risk Assessment Water Environment in Vaca Muerta**

This executive summary presents a strategic application of artificial intelligence (AI) and generative artificial intelligence (IAGEN) in the energy sector, specifically in the assessment of environmental risks associated with water management in the Vaca Muerta formation, Neuquén. This is a key opportunity for move towards a more sustainable, efficient and transparent industry in one of the the world's main reserves of unconventional hydrocarbons.

##### **Use case classification**

The report classifies this AI application based on the following axes:

1. By main resource: water + energy.
2. By activity: energy efficiency and sustainability.
3. By technology used: generative AI, machine learning, natural language processing, computer vision, intelligent agents and data integration platforms.
4. By strategic impact: sustainability and reduction of environmental impact.

##### **1. Opportunities for using AI and IAGEN in the sector**

AI allows to transform water management in Vaca Muerta, going from a reactive approach to a preventive one. Specific opportunities include: analysis Geospatial with satellite images, anomaly detection in IoT sensors, prediction of environmental risks such as leaks or micro-earthquakes, and optimization from water reuse. These technologies make environmental monitoring possible continuous, anticipated and more precise.

## 2. Expected benefits

The implementation of AI in this context brings multiple benefits:

- Improves early detection of incidents and reduces response times.
- Facilitates automated regulatory compliance.
- Optimizes the use of water resources and reduces operating costs.
- Strengthens strategic decision-making with reliable data.
- Increases transparency and trust among authorities and communities.

## 3. Application of AI

AI is applied through an ecosystem of sensors, algorithms and dashboards integrated. Predictive models and time series analysis allow for the evaluation in real time the behavior of the water system, while platforms of Visualization provides key indicators such as the water compliance index. systems use neural networks, supervised learning, computer vision and language processing to integrate operational, climatic and geological data.

## 4. Proposed AI Agent

The report proposes the design of an intelligent agent powered by generative artificial intelligence (IAGEN), called "Environmental Guardian for Environmental Management" "Hydric", conceived as an autonomous system that integrates, analyzes and acts on critical environmental information in real time. This agent combines multiple AI technologies—such as predictive models, natural language processing, and generative simulations—to continuously monitor data from IoT sensors, satellite images, weather information and variables operational, in order to identify water risks such as leaks, seepage,

micro-earthquakes or episodes of incipient contamination.

In addition to its anticipation capabilities, the agent incorporates advanced functions simulation and automated reporting, allowing the generation of environmental impact scenarios in the event of hypothetical incidents and the drafting of regulatory reports with data traceability. Its smart dashboards offer clear visualization and immediate alerts for decision making, while its module of Community communication allows technical information to be translated into a language accessible, strengthening transparency and dialogue with the community. This approach not only improves regulatory responsiveness and compliance, but which also consolidates an organizational culture oriented towards prevention, sustainability and data-driven innovation.

## 5. Conclusion

The incorporation of AI and IAGEN into Vaca Muerta's water management represents a technological transformation that enables more robust environmental monitoring, proactive and sustainable. This strategy not only improves environmental protection, but contributes to the operational continuity and social legitimacy of the energy activities. Successful implementation requires leadership, training and an integrated vision that aligns technological innovation with environmental responsibility.