Deliverable report 53

AI and IAGEN Application Use Case

Treatment and recycling of fracking water in Vaca Muerta

Executive Summary – Application of AI and IAGEN for the treatment and recycling of fracturing water in Vaca Muerta

This executive summary presents a strategic application of artificial intelligence (AI) and generative artificial intelligence (IAGEN) in the industrial water treatment sector, specifically in the management of flowback or return water from the Hydraulic fracturing in the Vaca Muerta formation. This technology represents a key opportunity to promote water sustainability and improve efficiency. operational and reduce the environmental impact in one of the main basins conventional in the world.

Use case classification

The report classifies this AI application according to four axes:

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

1. Opportunities for using AI and IAGEN in the sector

AI is applied throughout the flowback treatment cycle, from prediction in real time of its quality up to the dynamic optimization of the parameters of the process. Opportunities such as predictive maintenance, automatic chemical dosage adjustment, machine vision monitoring, and traceability are highlighted. automated and early detection of anomalies. IAGEN, in particular, enables the creation of intelligent agents that coordinate complex tasks in environments changing operations, reducing direct human intervention.

2. Expected benefits

AI integration enables improved treatment efficiency, reduction in the use of fresh water and chemical inputs, lower generation of waste and a safer operation by reducing personnel exposure to risk conditions. In addition, it improves traceability, speeds up delivery times decision and optimizes the reuse of treated water, strengthening the social license and regulatory compliance.

3. Application of AI

AI is applied through predictive models that anticipate water quality and adjust processes in real time, platforms that integrate sensor data, SCADA and laboratories, algorithms that optimize treatment sequences and vision computerized system that monitors the visual conditions of the water. All of this transforms a traditional, fragmented and reactive management into an automated operation, proactive and data-driven.

4. Proposed AI Agent

The report proposes an agentic workflow composed of four agents interconnected, each with specific roles:

- Data Integration and Preprocessing Agent, which normalizes and validates the information from sensors, databases and laboratories.

- Flowback Quality Predictive Agent, which anticipates the composition of the water and assesses risks in real time using multivariate models and networks neuronal.
- Treatment Control and Optimization Agent, responsible for adjusting automatically operating parameters such as dosing, filtration and equipment cleaning.
- Artificial Vision and Security Agent, which detects anomalous conditions visual and triggers autonomic responses.

These agents allow for holistic, dynamic and continuous control of the management of the Fracking water, surpassing traditional methods through intelligence distributed. Its main benefit lies in the comprehensive automation of the process, with greater efficiency, traceability and adaptability, even in scenarios of high complexity.

5. Conclusion

The adoption of AI and IAGEN for fracking water treatment in Vaca Muerta transforms an environmental problem into a strategic opportunity. Its implementation facilitates circular management of water resources, promotes reduction of waste and optimizes operations with lower costs and greater safety. This technology represents a key step towards a more sustainable energy industry, prepared to meet growing environmental demands and consolidate its competitiveness in the medium and long term.