HUB TECH IA

Deliverable report 39

AI and IAGEN Application Use Case

Environmental Management in the Minimization of Resource Use for Water and Energy Optimization in Hydraulic Fracturing in Vaca Muerta, Neuquén, Argentina, via IAGEN

Executive Summary – Application of IAGEN in Resource Optimization in Hydraulic Fracturing in Vaca Muerta.

This executive summary presents a strategic application of artificial intelligence generative (IAGEN) in the energy sector, specifically in environmental management aimed at minimizing the use of water and energy in fracturing operations hydraulics. This is a significant opportunity to promote sustainability operational in Vaca Muerta, one of the main reserves of non-renewable hydrocarbons conventional in the world.

Use case classification

The report classifies this IAGEN application based on four criteria:

1. By main resource: water and energy.
2. By activity: energy efficiency and sustainability.
3. By technology: generative AI models, machine learning, artificial vision, intelligent agents, big data.
4. By strategic impact: sustainability and reduction of environmental impact.

1. Opportunities for using AI and IAGEN in the sector

The main application opportunities of IAGEN include: simulation of extraction scenarios, logistics route optimization and strategies predictive maintenance, improved emissions management, and optimization of use and Water recycling. Its ability to learn from multiple data sources allows integrated and dynamic management of critical resources in the process hydraulic fracturing.

2. Expected benefits

The incorporation of these technologies allows:

- Improve efficiency in the use of water and energy.
- Reduce the environmental impact of operations.
- Prevent failures and reduce downtime through maintenance predictive.
- Optimize transport logistics and emissions management. Increase productivity with more informed, real-time decisions.

3. Application of AI

AI is implemented through IoT sensors, predictive models and systems continuous monitoring. Integration of real-time operational data allows for fine-tuning dynamically the operating parameters, achieving process optimization key factors such as fluid injection, energy consumption and water recycling.

4. Proposed AI Agent

The report presents a structured intelligent agent-driven workflow in five phases:

- Sensor Agents: capture real-time data on water consumption, energy and operating conditions.
- Analytical Agents: process this data with machine learning to predict consumption and future needs.

- Autonomous Agents: automatically adjust parameters such as pressure or temperature to maximize efficiency.
- Executive Agents: implement operational decisions on the ground in real time.
- Evaluating Agents: analyze the results, provide feedback to the models and optimize future processes.

This agentic system allows end-to-end automation of environmental management of the fracturing, integrating with existing systems and scaling as needed operational. Its main benefit lies in its adaptability and autonomy operational and contribution to sustainability.

5. Conclusion

The integration of IAGEN and intelligent agents in Vaca Muerta constitutes a high-impact innovation for the energy sector. It allows us to move towards a proactive, data-driven resource management that simultaneously improves the Economic efficiency and environmental performance. Overcoming adoption challenges will require initial investment, strengthening of local capacities and regulatory frameworks adequate, but the projected benefits more than justify their implementation as part of a sustainable energy strategy for Argentina.