HUB TECH IA

AI and IAGEN Application Use Case

Operations and Maintenance for Diagnosis and Fault Detection, Delays or Inefficiency in Vaca Muerta, Neuquén

Executive Summary – Application of IAGEN in Operations and Maintenance for Diagnosis and Detection of Faults, Delays, or Inefficiencies in Vaca Muerta.

This executive summary presents a strategic application of Artificial Intelligence Generative (IAGEN) in the energy sector, specifically in operations and Maintenance for diagnosis and detection of faults, delays or inefficiencies in Vaca Dead. This is a concrete opportunity to optimize production, improve the safety and reduce operating costs in one of the main oil reserves and unconventional gas in the world.

Use case classification

The report classifies this IAGEN application according to the following axes:

1. By main resource: Oil and gas (of equal importance).
2. By activity: Optimization of production processes.
3. By technology used: Generative AI models (GPT-4, PaLM 2, LLaMA 3), machine learning algorithms, computer vision, and processing of natural language.
4. By strategic impact: Optimization of production and infrastructure.

1. Opportunities for using AI and IAGEN in the sector

Specific opportunities identified include: equipment failure prediction

Critical, remote monitoring using drones and sensors, fracture optimization hydraulics and operating practices (draw-down, use of proppants), fracture characterization, feasibility analysis of recovery technologies and emission reduction. These solutions are aimed at solving challenges key operations such as complex logistics, extreme weather, infrastructure limited and shortage of qualified personnel.

2. Expected benefits

The implementation of IAGEN allows:

- Automated and accurate fault diagnosis.
- Significant reduction in downtime and delays.
- Automation in the generation of corrective orders.
- Improved operational safety.
- Optimization of maintenance and logistics. • Greater overall efficiency in the use of technical and human resources.

3. Application of AI

The proposed approach integrates IAGEN into existing operating systems using field sensors, specialized APIs, and real-time analytics (edge computing).
Generative models continuously analyze critical variables such as pressure, vibration and temperature, generating automated diagnostics and reports with specific recommendations, which allow for immediate or planned corrective actions to be taken.

4. Proposed artificial intelligence agent

The report proposes the development and implementation of an intelligent agent based on generative models such as GPT-4, PaLM 2 and LLaMA 3, designed to operate in real time within a four-stage agentic flow: (1) automatic data capture from sensors installed in critical equipment, (2) automatic analysis using IAGEN models that detect anomalies, (3) automatic generation of diagnoses

with detailed reports and practical recommendations, and (4) issuing corrective orders to ERP systems and maintenance technicians. This agent is integrated into SCADA and PLC systems through APIs, with support for edge computing technologies for on-site analysis.

Its main function is to anticipate technical failures and detect operational inefficiencies before that impact production, automating the entire process from detection to corrective action. Its implementation allows to reduce dependence on the manual diagnosis, improves response speed, and ensures continuity operational with minimal human intervention, representing a scalable and applicable to multiple Vaca Muerta teams and infrastructures.

5. Conclusion

The application of IAGEN in operations and maintenance represents a disruptive transformation for the hydrocarbon industry in Vaca Muerta. It allows move from a reactive logic to a proactive one, based on real-time data analysis real. This technological transition drives safer, more efficient and sustainable, with strategic benefits for the country's energy production.