Case Study: Smart production operations

Orellana Province, Ecuador, South America, Onshore

Smart production operations in a remote field in Ecuador

Summary

This project took place on a remote well pad, in a brownfield in the Amazonian region of Ecuador. Smart production operations (SPO) have been implemented as a comprehensive automated solution in the field, to improve operational performance and efficiency.

Objective

This project deployed digital solutions as a game changer for operational efficiency and production optimization in a challenging location. This well pad was chosen due to its remote location (a three hour round trip from base), a low mean time between failures (MTBF) for ESPs, high production losses from flow assurance events, lack of early identification and response for debottlenecking. It was further hindered by a lack of well tests and its reliance on manual operations. Access was also frequently interrupted by local strikes, delaying responses to corrective actions.

At the outset of the project six key performance objectives were identified, to increase oil production, reduce production losses, increase crew and people efficiency, reduce the well failure index, reduce CO_2 emissions, and increase chemical treatment efficiency and reliability.

Solution

Significantly upgrading the digital maturity and operations of the well pad required an integrated solution, combining multiple IIoT components and digital solutions.

The cloud native Delfi™ digital platform, enabled a digital solution architecture to be built, with seamless integration between data sources of all types. This made it possible to gather and transmit the necessary data at the right points in the production process, with computing power installed at the edge to connect and sync with automation and control workflows.

Advanced operational workflows were digitized using smart production surveillance solutions. These included the use of virtual flow meters calibrated with a Vx Spectra™ surface multiphase flowmeter to estimate each well's production rate and monitor water injection in real time.

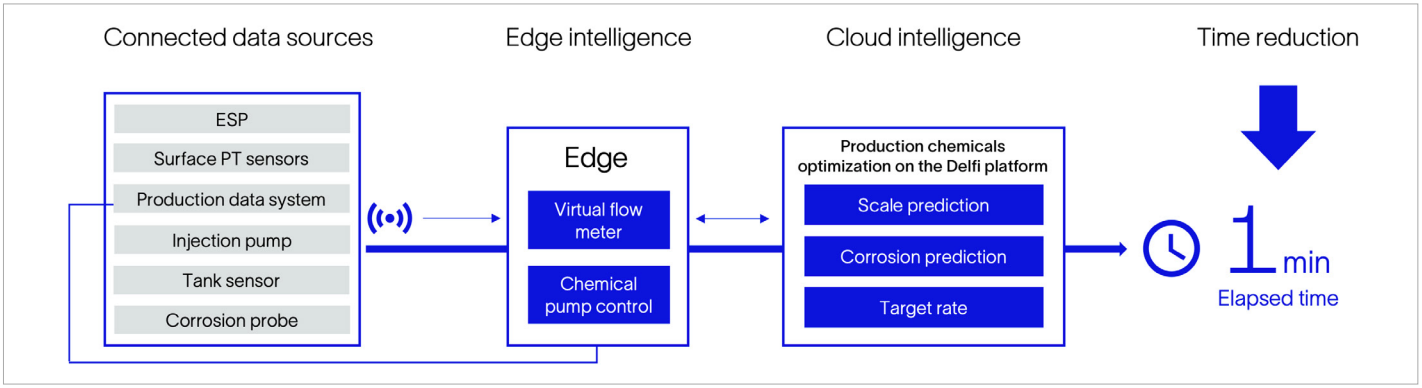
Smart alarms were used to facilitate the monitoring, analysis, and generation of self-optimization recommendations, for ESP performance, chemical efficiency, and scale and corrosion prediction models.

For chemical injection, the integration of surface and ESP data enabled implementation of scale and corrosion risk assessment, to ensure the correct chemical dosage was continuously and autonomously delivered to each well.

The advanced workflow and smart alarms, implemented for the waterflooding optimization system, enable autonomous adjustments of the water flow rate. This is done by continuously monitoring and evaluating water injection from source to sand face, and seamlessly modifying VSD frequency to automatically control the water injection system.

Advanced visual analytics, powered by AI and machine learning were utilized to improve HSE and sustainability performance. Security cameras, using AI computer vision and regenerative AI processes, were used to detect human presence in permitted or unpermitted areas (green or red zones) and the correct use of personal protective equipment (PPE), to ensure adherence to HSE guidelines and prevent accidents.

Flare monitoring cameras were also employed to quantify the amount of produced gas that is flared in the field. They were used to analyze real-time flare imaging, with this data being used to train machine learning models, and accurately predict the total amount of gas flared, using periodic flare images.



Autonomous production chemicals optimization on the Delfi™ digital platform

Results

The SPO project implemented in this field has shown remarkable results against all six of the benchmarking performance objectives. The solutions implemented have resulted in improved production, with a 1.5% average increase and production losses reduced by 48%. People efficiency also increased by 60%, due to the reduction in time taken to perform activities remotely from the monitoring center compared with when they were previously performed manually on location.

After eight months of implementation, current trends show the well failure index will be reduced by as much as 25% and three rigless interventions have been avoided saving upwards of USD 30 thousand.

The chemical treatment system has shown even greater improvement with a 99% increase in reliability.

The project also achieved a significant improvement in carbon footprint with a 57% reduction in CO_2 emissions, which translates to a reduction of 1.5 tons of CO_2 emissions per month. This was due to a reduction in the number of field visits, made possible by digitally enabled remote and autonomous operations.

Products used

- Avocet production operations software platform
- AgoraGateway™ ruggedized edge computing device
- AgoraVision™ real-time data visualization interface
- Vx Spectra surface multiphase flowmeter
- Production chemicals optimization on the Delfi™ digital platform
- Production operations solution on the Delfi platform
- Operations data foundation

References

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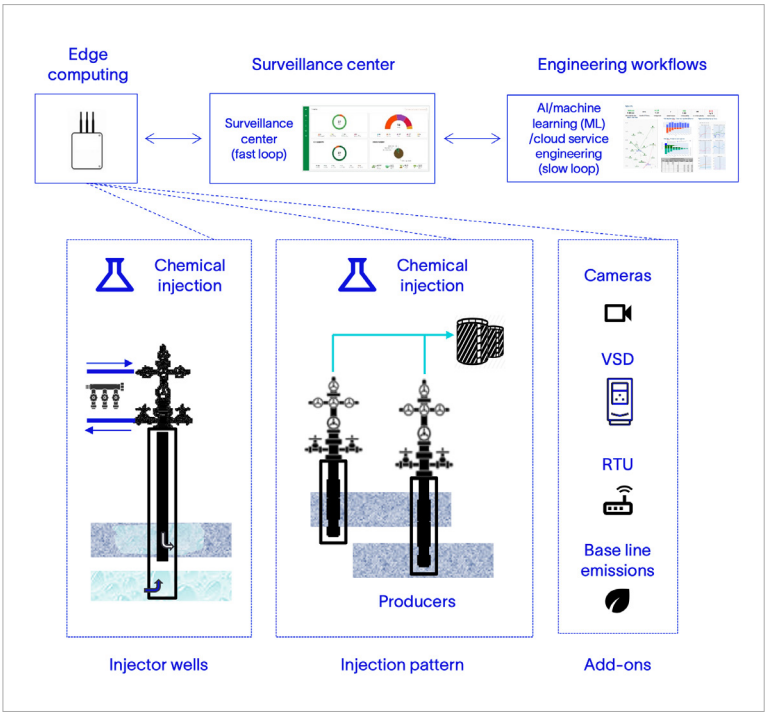
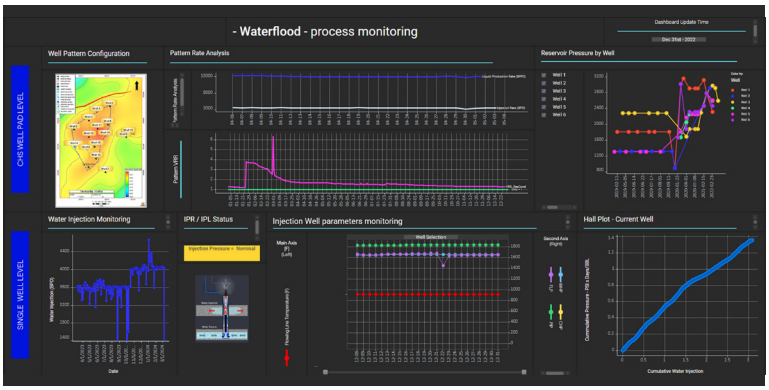


Smart production operations solution



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