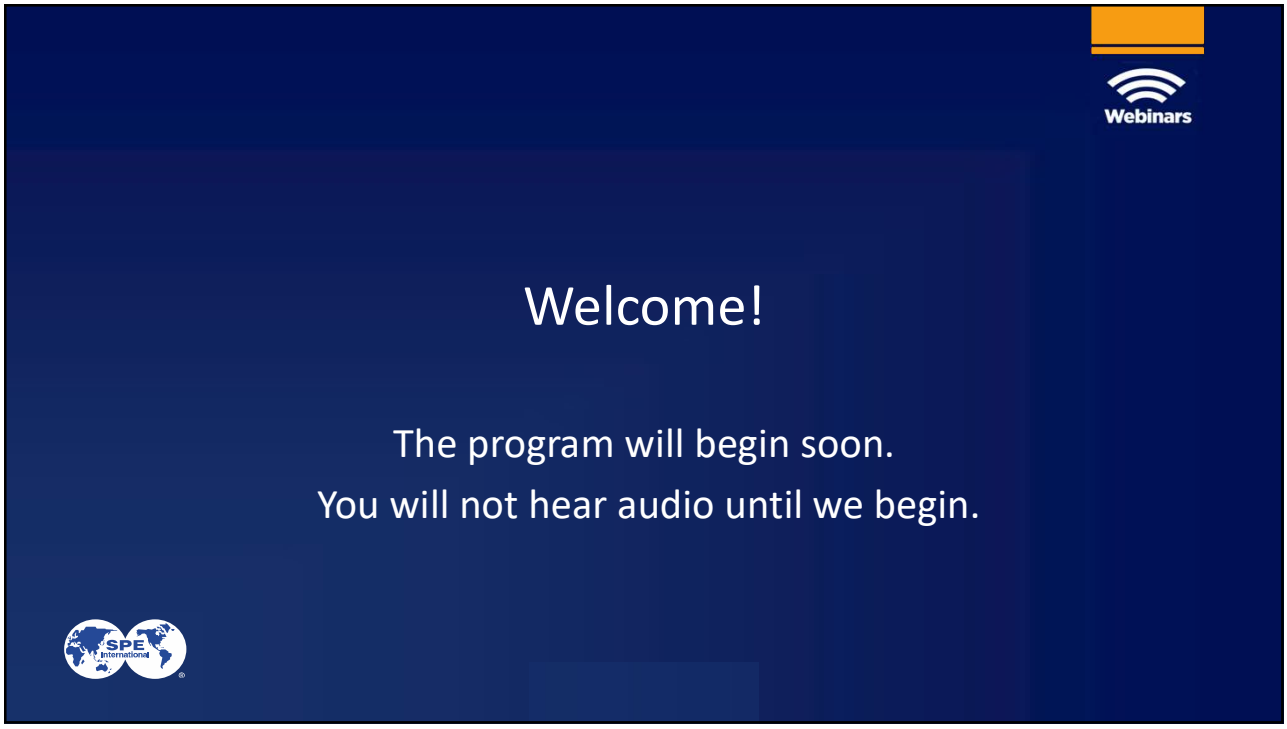
Webinars
Welcome!
The program will begin soon.
You will not hear audio until we begin.
SPE International

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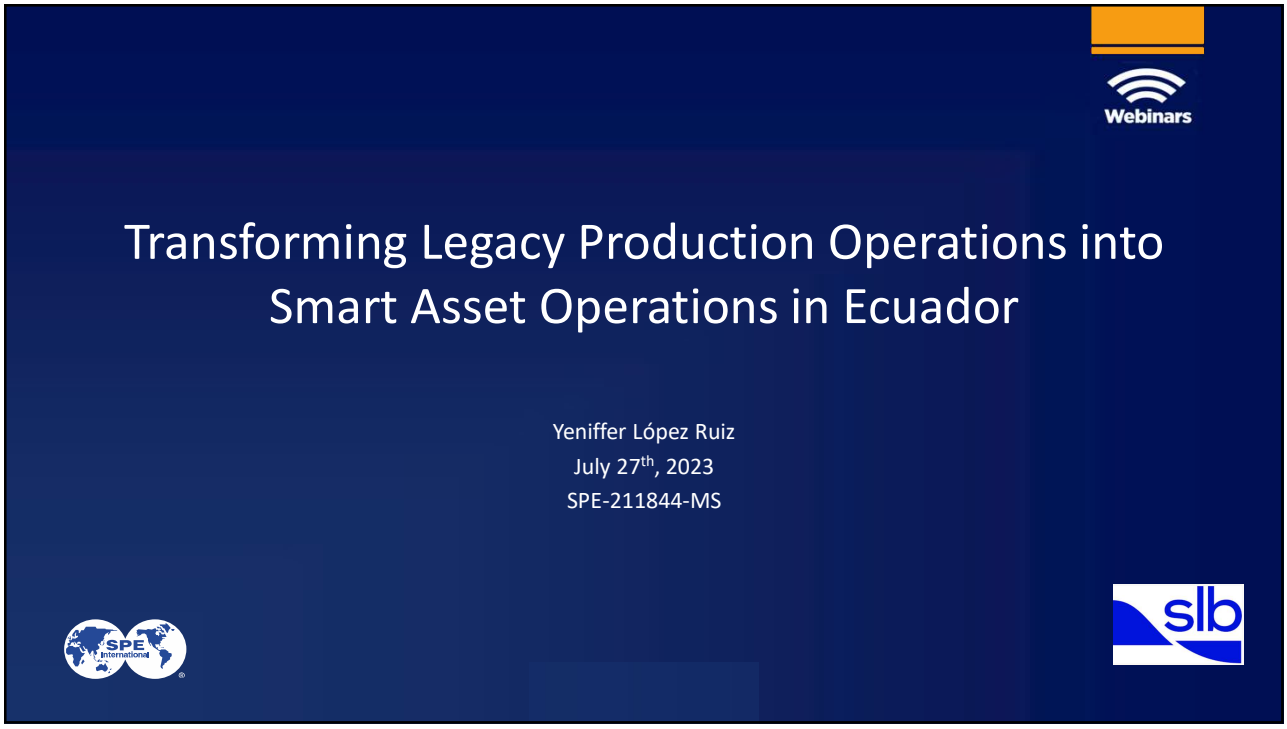
Webinars
Transforming Legacy Production Operations into Smart Asset Operations in Ecuador
Yeniffer López Ruiz
July 27th, 2023
SPE-211844-MS
SPE International
slb

2

3

Problem Definition in Ecuadorian O&G Industry

Internet of Things and Edge Computing Definitions

Internet of Things

The definition of IoT according to Deloitte España is the grouping and interconnection of devices and objects through a network (even if it is private or public), where all of them could be visible and interactive. These objects and devices could be anything from sensors and mechanical devices to everyday objects such as the refrigerator, footwear, or clothing. Anything that can be imagined could be connected to the internet and intervene without the need for human intervention. The goal is therefore a machine-to-machine interaction, or what is known as an M2M interaction (machine to machine) or M2M devices.

Edge Computing

According to the definition of "Red Hat", Edge Computing is a type of computing that occurs at the user's physical location, at or near the data source, which generates lower latency and higher bandwidth availability. It is important to understand that in a Cloud Computing model, services and computing resources are usually concentrated in large data centers, which are accessed by end users at the "extreme“ or "edge" of a network. This model generates economic benefits and provides a more efficient resource exchange capacity. However, new experiences for end users, such as the "Internet of Things (IoT)“, require computing power to be closer to where the physical device or data source is, that is, in the "end“ or "Edge" of the network. By bringing it closer to those locations, users can access faster and more reliable services that offer a better experience. Moreover, companies not only process data better and support applications that respond quickly to specific events, but also use technologies such as Artificial Intelligence (AI) / Machine Learning (ML) analysis to identify trends and offer better products and services

4

Problem Definition in Ecuadorian O&G Industry

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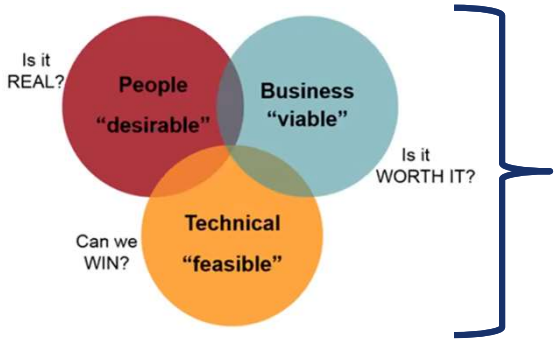
Internet of Things and Edge Computing Definitions

Disconnected and reactive

Connected devices becoming the standard

5

Methodology and Data

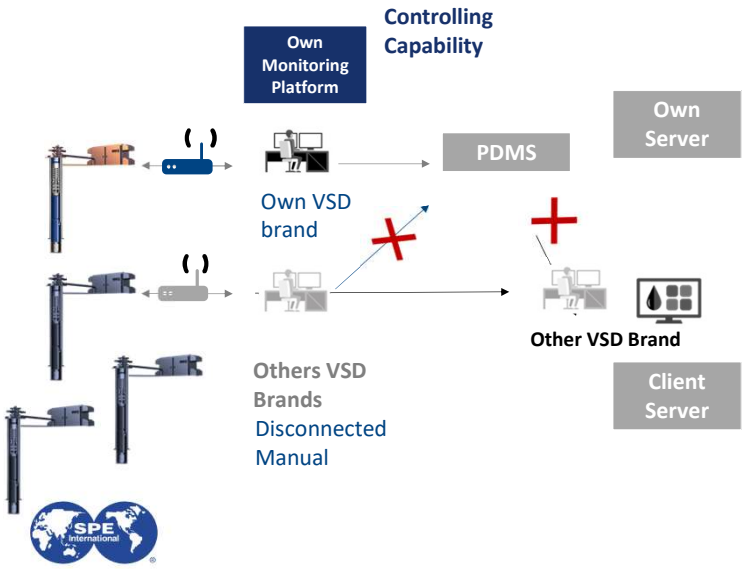


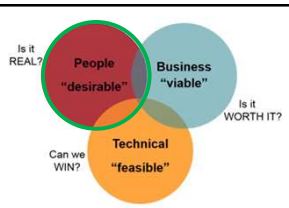
Design Thinking

RWW Methodology for product and service innovation, based on MIT Sloan School of Management

6

Methodology and Data



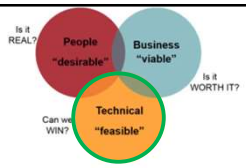


Webinars

Challenges

- Non-standard data sets
- Multiple ESP vendors
- High # of wellsite visits
- Standard alarms for many wells
- Compliance issue
- High Undesired ESP Trips (slow response)
- Oil Production Losses
- Low MTBF

Methodology and Data



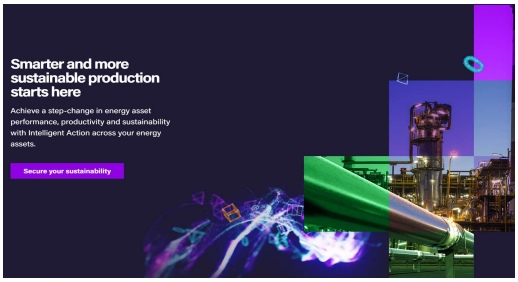
Webinars

Edge and IoT Business

- Startup created and incubated by SLB
- Think big, prototype small, and scale fast
- IIoT platform—edge computing with ML/AI

Partner Company

- Join Venture created mixing Process automation + Petro-Technical expertise
- 1,000+ experts serving customers globally



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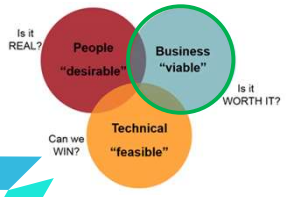
Methodology and Data



Webinars

1 Total oil production

2 Oil Production Losses

3 Crew Productivity

4 Total Well Cost

5 Chemical Treatment Efficiency

6 Carbon Footprint

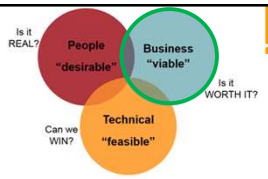
7 Equipment Run Life

8 ROI

Client General KPO's

9

Methodology and Data



Specific KPI's for ESP Surveillance Workflow (Compelling Event)

1. Time Response for Alerts
2. Number of Remote Operations
3. Travel Reduction
4. People Efficiency
5. Carbon Footprint
6. Early Detection

1. **Baseline Definition**
2. **Periodic Reviews (Weekly Check Points)**
   S Curves Calculation
   Main Deviations
   Why are We Deviated?
   Action Plan
3. **Tangible Improvement Measurenment**

10

Worldwide Biggest Field Implementation
Disconnected, multiple vendors, reactive workflows

Webinars

Challenge
Mixed equipment and Opex concerns

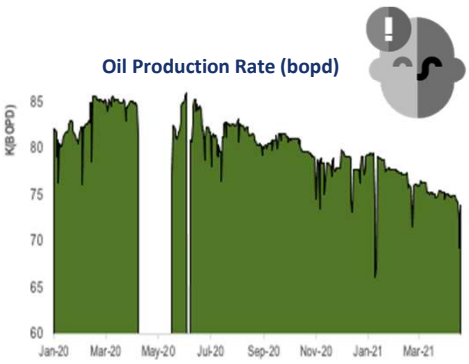
400+ Assets
(ESP, Meters, SRP etc…)

5,000+ Field Visit/Quarter

~72,000 km Driven/Quarter

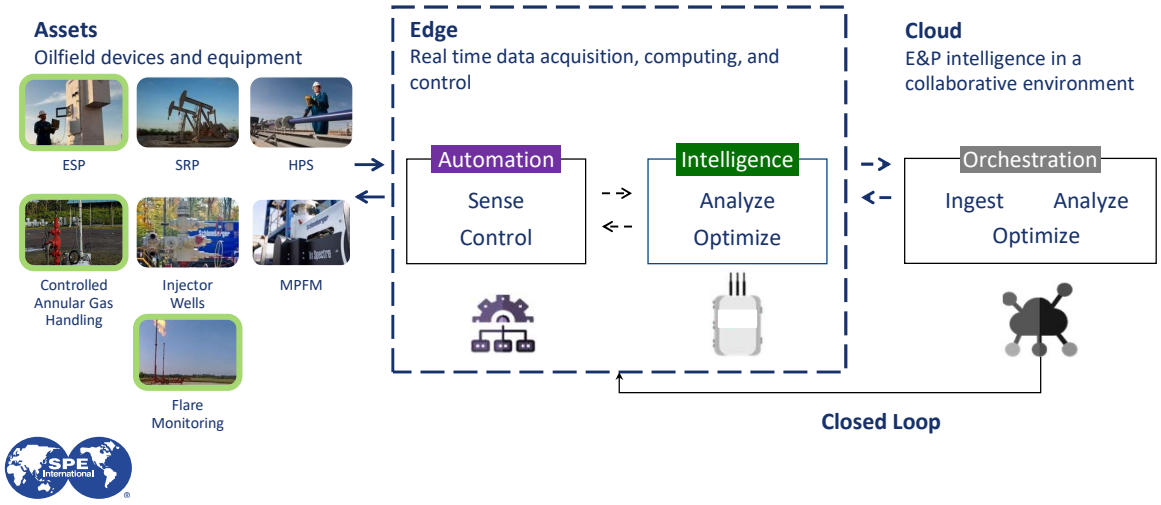
Vendors
Lack of integration

Operator
Declining production and increasing costs



Manage production decline (29%)

Solution was "Intelligent Asset Concept"
Connected, multiple vendors, proactive workflows

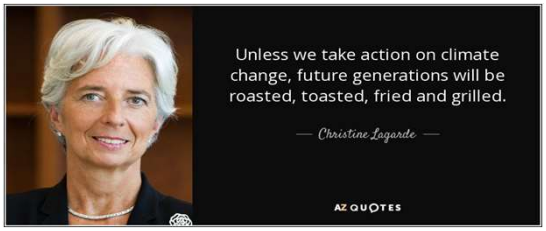


12

How we connect the Production Operations to Carbon Footprint Estimation?

13

Message from a Leader



It also brings about the melting of glaciers ridding off organisms like bears their habitats, causing flooding, changes in the pattern of precipitation and a host of others.

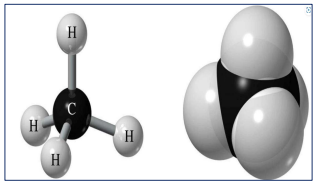
Global warming is the beginning of a rather sad story. Not only does it warm the earth, but it also puts coral reefs in danger as the ocean warms, scientist fear that coral reefs will not be able to adapt quickly enough to the resulting changing conditions, and bleaching incidents and diseases will increase.

14

Five Keys for Decarbonizing the Energy System Today

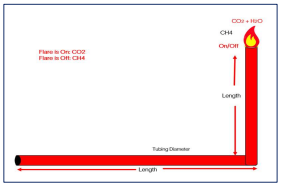
Webinars

1



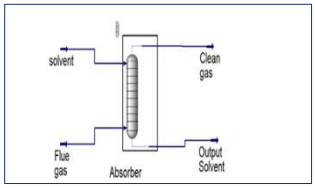
Methane Emissions

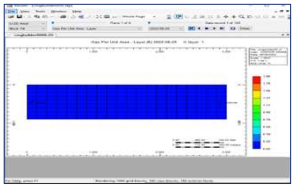
2



Flaring Emissions

3





Carbon Capture, Utilization and Storage

4

Cement

5

International Cooperation

https://www.linkedin.com/pulse/five-focus-areas-decarbonizing-energy-system-today-beumelburg%3FtrackingId=GB5dyXP8STGpOH3c8wipgQ%253D%253D/?trackingId=GB5dyXP8STGpOH3c8wipgQ%3D%3D

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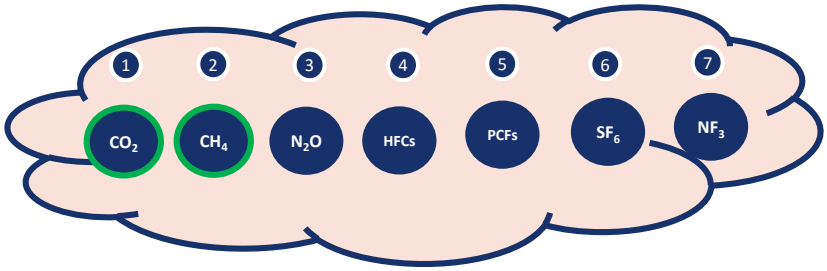
Methodology and Data – GHG Protocol

Webinars

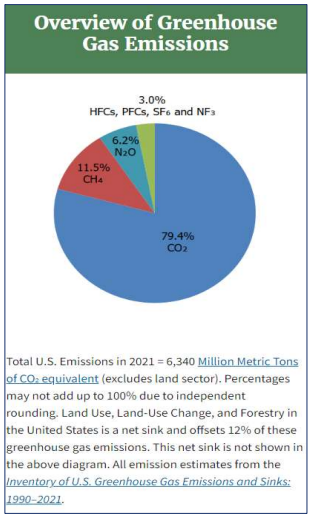
1. Carbon Dioxide (CO_2)
2. Methane (CH_4)
3. Nitrous Oxide (N_2O)
4. Hydrofluorucarbons (HFCs)
5. Perfluorocarbons (PCFs)
6. Sulphur Haxafluoride (SF_6)
7. Nitrogen Trifluoride (NF_3)



Metric Tonnes of CO_2 equivalent

16

Greenhouse Gas Emissions in USA Today (Statistics)



https://www.epa.gov/ghgemissions/overview-greenhouse-gases

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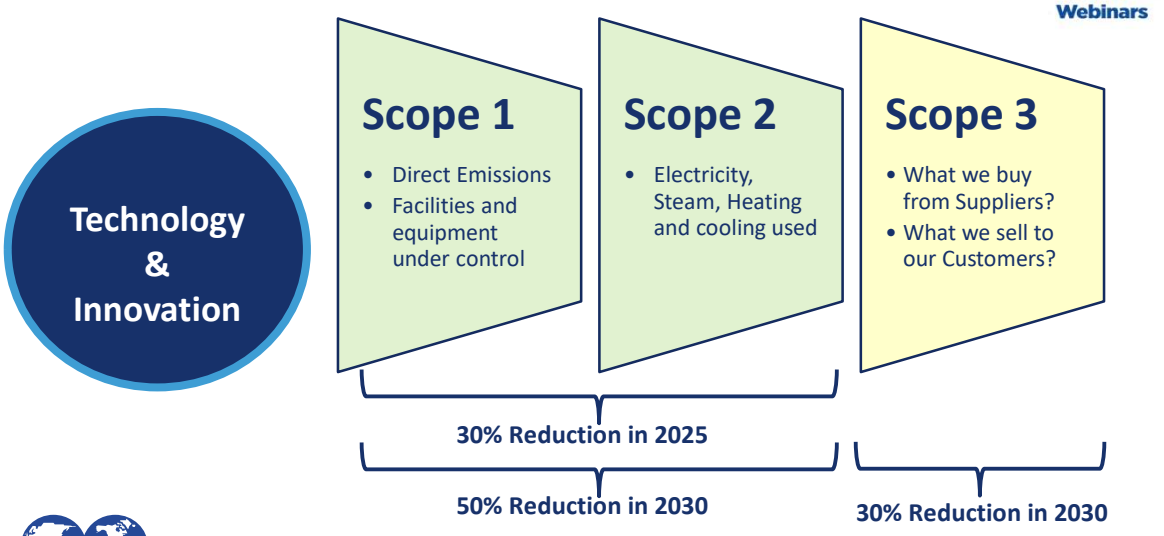
Methodology and Data – GHG Protocol

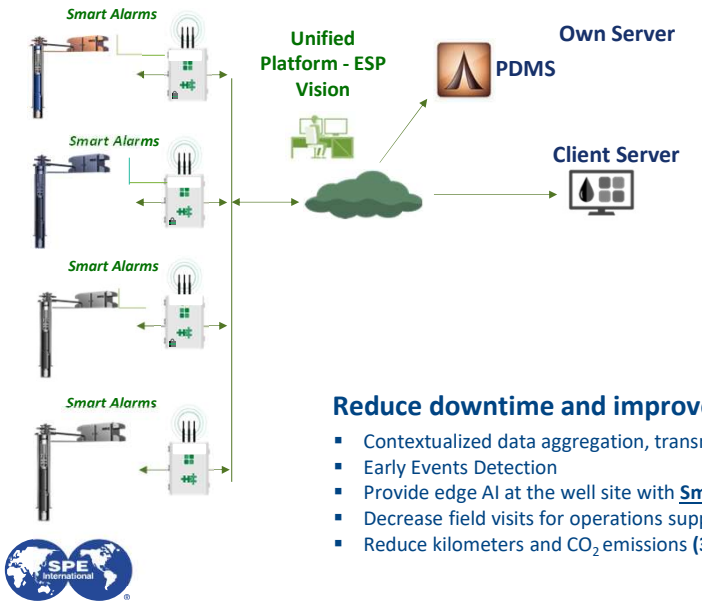


18

Real Field Cases Implementations

19

Smart ESP Remote Operations (Case 1)



Webinars

Reduce downtime and improve people efficiency

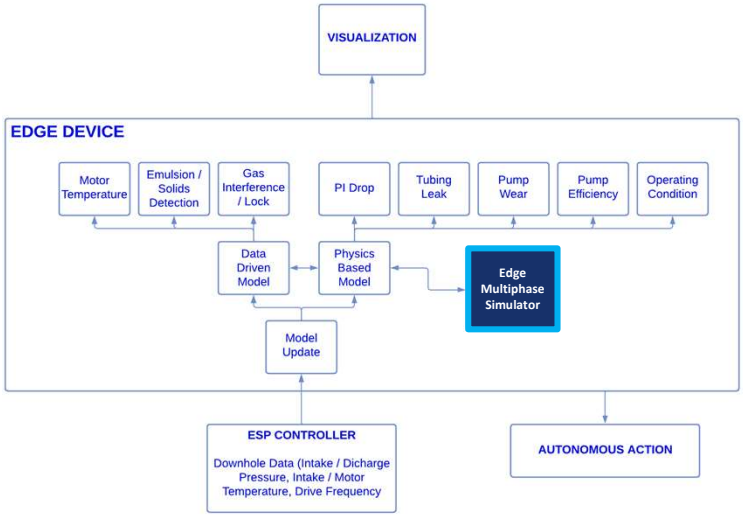
- Contextualized data aggregation, transmission, and visualization for multiple vendors
- Early Events Detection
- Provide edge AI at the well site with **Smart Alarms** (SPE-209958-MS)
- Decrease field visits for operations support (550 visits/Quarter)
- Reduce kilometers and CO_2 emissions **(3.5CO_2 ton CO2e)**

20

Smart Alarms (SPE-209958-MS)

Webinars

- ✓ Real-time detection of abnormal operation conditions
- ✓ Leverages physics-based and machine-learning models
- ✓ Reduces detection and validation by 99%



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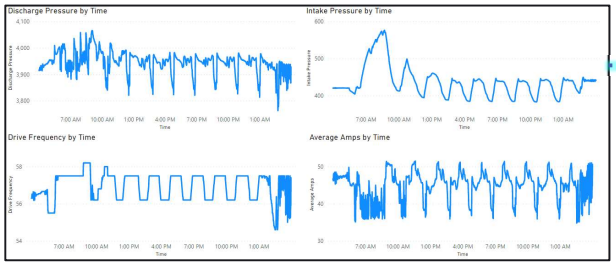
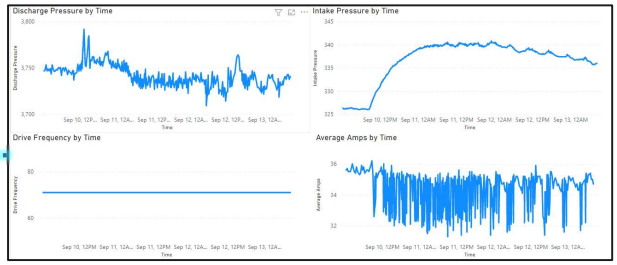
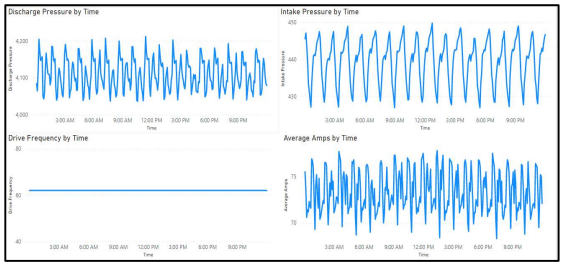
Smart Alarms (SPE-209958-MS)



GLK Alarm - Type 1



GLK Alarm - Type 2



Suspicious Alarm: Emulsion Potential

22

22

Smart ESP Remote Operations Results

Webinars

	Baseline	YTD 2023	Jun 2023 Results
Remote Operations Center	180 per month	1,476 cumulative	325 per month
Travel Reduction	Km per month (Associated to Production Operations) 128,830	Total Saved Km cumulative: 53,124 Km	11,930 Km (4.4↓ %Km per month)
People efficiency	12 hours shift (2 per day)	6 saved man-hours (Remote Center Personnel) 3.7 saved man-hours (Production Operators)	↑25 % for Remote Center Engineers ↑ 15 % for Production Operators
CO_2 Emissions	25-ton CO_2 e	12.4-ton CO_2e decreased	↓14 % (3.5 t CO_2 e, comparing with Carbon Emissions Baseline)
Early Event detection	74 events/month 532 undesired trips	1,072 events 591 undesired trips	176 Notification alerts 77 undesired trips 86% increase ESP uptime

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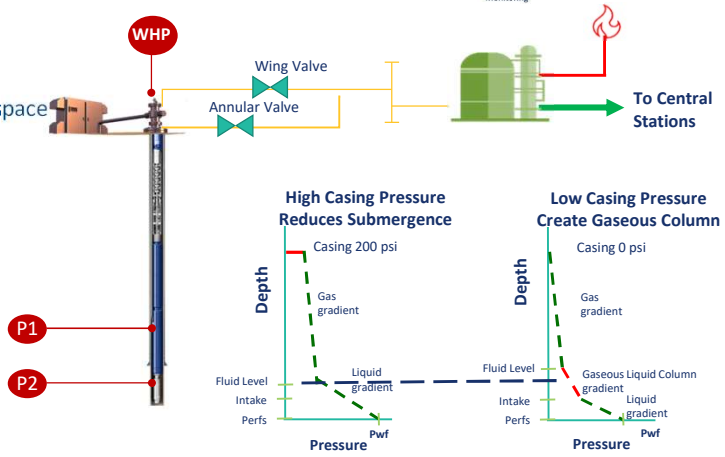
Automated Gas Handling (Luna Project)
(Case 2). SPE-209339-MS

Webinars

Challenges

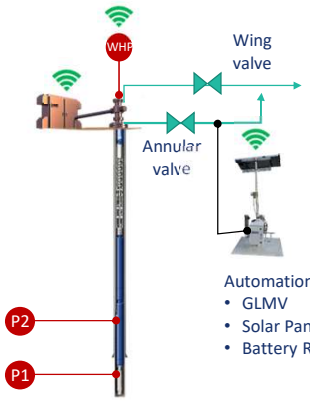
- Remote locations and manual interventions
- High workover costs
- Gas accumulation in annular space



Automated Gas Handling

Webinars

ESP and Skid



Automation Skids
- GLMV
- Solar Panel
- Battery Rack

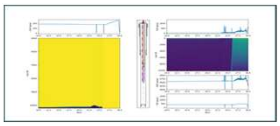
Intelligent Edge System

Reduce order model algorithm

ESP monitoring and skid control flow

Cloud Visualization

ESP surveillance and skid data and control

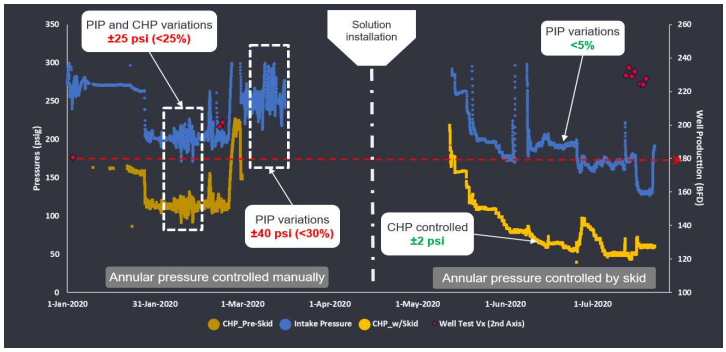


Dynamic well modelling and well behavior visualization

Closed loop

25

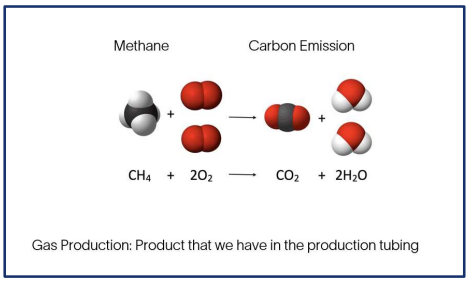
Automated Gas Handling – Field Implementation



Webinars

- Well Production Optimization of 30%
- Smother Operation of the ESP-PIP with variations lower than 5%
- Less cyclic loads (11% Electric Optimization)
- Adjustment of wells valves / equipment (98% reduction)
- Personnel trips to well pad (97% reduction)
- Carbon Footprint Decrease

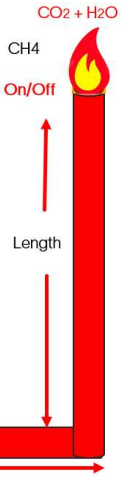
Case 3. Flare Monitoring – Field Implementation
(Video Intelligence Products)



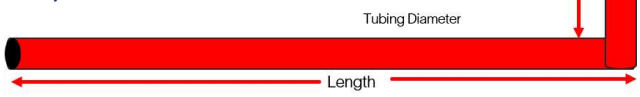
Gas Production: Product that we have in the production tubing

Flare is On: CO2
Flare is Off: CH4

Webinars



1. **Produced gas at the entrance (Affected by GOR from each well)**
2. **Gas Composition**
3. **Combustion Efficiency**



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Case 3. Flare Monitoring – Field Implementation
(Video Intelligence Products)

Webinars

Problem

- Flare Status (shut in / on)
- Monitor gas volume
- Ensure compliance with environmental regulation
- Reduce large spend on maintenance and compliance
- Reduce number of visits for see flare functioning

Challenge

SPE International

Case 3. Flare Monitoring – Field Implementation
(Video Intelligence Products)

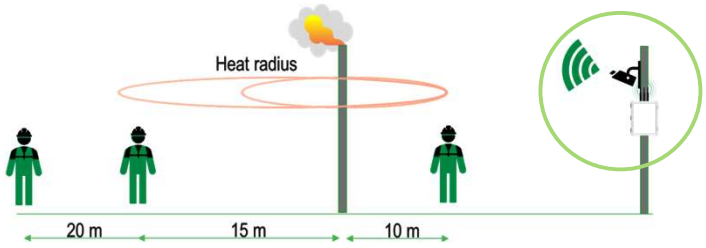
Solution

Solution

- Real time audio & video analysis of flare feeds
- Convolutional neural networks (CNN) for deep learning
- Flare Status (shut in / on)

Results

- Lower OPEX and maintenance cost
- Broad compliance monitoring
- Improved safety at the well-pad
- Carbon footprint reduction



Webinars

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Case 4. Rig Safety Red Zone – Field Implementation

(Video Intelligence Products)

Objective

- Reduce the number of incidents during rig operations

Solution

- Video Intelligence with AI models for PPE, red zone
- Real-time data algorithm to automatically enable the red zone
- Automated alerts

Tangible Benefits

- One estimated 50% reduction in red zone risks
- Deployed in Mature Fields located in Ecuador
- Developed in collaboration with the teams in Houston and India
- The system has already been successfully deployed on several rigs located in the Kingdom of Saudi Arabia and Iraq

Outcome

- Increase Personnel Safety and Exposure
- Visual/sound alerts in case of person at risk
- Email and web notifications
- Dashboard to understand remotely the HSE rules follow-up

Key Takeaways - Journey into Intelligent Asset Concept

Q4 2020 onward
New workflows (Vx, Flare Monitoring, SRP, HPS)
16 applications (3 Mature Fields)

Q2-Q3 2020
Full Smart ESP Surveillance

Q2-2020
LUNA Gas Handling

Q1-2020
Other VSD Brands Migration

Q4- 2019
Implementation Agreement
(10 Wells)

Webinars

ESP


SRP


HPS

Controlled Annular Gas Handling


Injector Wells


MPFM


Flare Monitoring

Operations Efficiency


Oil Production


Safety

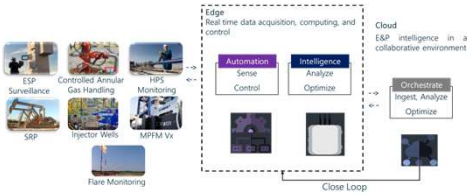

Sustainability


Field Travel Reduction

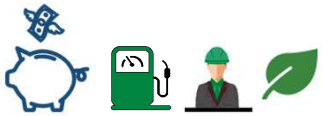
Conclusions

1. Edge technology + Action

2. Production Increase Safely



3. Automated intelligent solutions



4. Tangible Benefits

Leasons Learnt during the Ecuadorian Digital Journey

1. **SPE-211844-MS.** "Transforming Legacy Production Operations into Smart Asset Operations in Ecuador"
2. **SPE-211796-MS.** "A Digital Transformation Journey for a Mature using Production Technologies and Innovation Principles"
3. **SPE-211057-MS.** "Digital Solution for Water Handling System Surveillance to Enhance Operations and Avoid Production Losses in the Shushufindi Field"
4. **SPE-209339-MS.** "Well Production Optimization through Annulus Gas Management using Gas Handling System in Auca Field, Ecuador"
5. **SPE-209958-MS.** "Real-time Electrical Submersible Pump Smart Alarms Suite Enabled Through Data Analytics and Edge-based Virtual Flowmeter"
6. **SPE-207968-MS.** "Assess Digital Maturity to Set Digital Transformation Strategy in Oil and Gas"
7. **SPE-209339-MS.** "Well Production Optimization Through Annulus Gas Management using Gas Handling System in Auca Field, Ecuador"
8. **SPE-204513-MS.** "Digitalization creates the Big picture of Integrated ESP Optimization in Shushufindi Field"
9. **SPE-207732-MS.** "Autonomous Corrosion and Scale Management in Electric Submersible Pump Wells"

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Thank you…!

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Special Thanks to personnel working in the Monitoring Center located in Ecuador

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