A Collaborative Solution for Integrated Water Management and Quality Surveillance in Production and Injection Operations - Ecopetrol Case

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...Water in E&P...in figures
E&P Industry produces about **300+ million** barrels of water per day

Global average water cut is ~**80%**
Challenges of Water Management
WATER-RELATED RISKS FOR E&P COMPANIES*

- ENVIRONMENT
- REGULATORY
- SOCIAL
- REPUTATION
- RESOURCE

* SPE 168474
CHALLENGES AND KEY COMPONENTS OF WATER MANAGEMENT

- Water quality
- Treatment costs
- Volumetric balance
- Capacity of facilities
- Environmental
- EOR efficiency
- Financial impact
- Uncertainty of produced water
Business Intelligence applied to Water Management
METHODOLOGY FOR BUSINESS INTELLIGENCE

<table>
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<th>Business questions</th>
<th>Processes and data flow</th>
<th>Data integration</th>
<th>Dynamic visualization</th>
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<td>• What do we need to answer or improve?</td>
<td>• What data do we need and where is it located considering the appropriate process?</td>
<td>• Create a data model which allows the analysis of the entire process and make efficient decisions</td>
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Ecopetrol Case
UNIFIED ACCESS POINT FOR
DECISION MAKING
IS THE WATER A CRITICAL BUSINESS ISSUE?

- WCUT >90%
- ~6.5M BPD
- ~5.5M BPD
- ~1M

PRODUCTION

INJECTION (DISPOSAL – EOR)

Surveillance

EOR planning

Water quality

Source: Management and Sustainability Report - 2018
CHALLENGES
BUSINESS QUESTIONS

What is the current status of Ecopetrol water quality?

Does the water quality in Ecopetrol comply with the parameters established by the NACE standard?

How many wells are being monitored for production/injection water?

What are the possible operational problems derived from water quality?

How do the most representative physicochemical indexes of water quality evolve over time?

What are the main uses of water in Ecopetrol?

What assets are about to present difficulties of water availability for your injection projects?

What concessions must be renewed urgently?

What concessions capture more water?

What is the injection and production volume of the Ecopetrol fields?
CHALLENGES

BUSINESS QUESTIONS

WATER QUALITY ANALYSIS

DYNAMIC SURVEILLANCE FOR WATER PRODUCTION AND INJECTION

VOLUMETRIC PLANNING FOR EOR PROJECT
ECOPETROL
DATA REQUIREMENTS

- **Volumetric analysis of historical data**
- **Water quality analysis and trends**
- **Water uptake control and effective planning**
- **Anticipated viability EOR projects (including WF)**
- **Historical water production and injection**
- **Future volumes for water uptake permissions**
- **Injection and production forecast by EOR technology**
- **Water quality parameters**
INTEGRATING BUSINESS AREAS

- OIL
- GAS
- WATER
- LPG
- TDS
- TSS
- PH
- GREASE

VOLUMETRIC DATA
ENVIROMENTAL
GEOGRAPHICAL DATA
WATER QUALITY
RESERVOIR
OTHERS
ARCHITECTURE FOR
BUSINESS INTELLIGENCE

E.T.L. → Datamart → Metrics

Integration Tool

Business Intelligence Tool

Visualization and workflow automation

Engineers and Managers
WHAT’S NEXT?

ADVANCED WORKFLOWS

Business Process Management
- Roles and responsibilities
- Data flow optimization
- Data governance definition

DATA-DRIVEN DECISION MAKING

ASSET

Engineering Tools in cloud

Data quality rules

DecisionSpace Data Quality Software

Algorithms for water quality trends and predictions.

Water quality alarms based on predictions.

Current visual environment
Thank You

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