How We Built an Automated Recommender with Real-Time Data Using PI AF

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California Resources Corporation (CRC)

130+ M
BOEPD

137
Operating fields

2.2 M
Largest privately-held mineral acreage

0.34 IIR – Best in class among industry peers
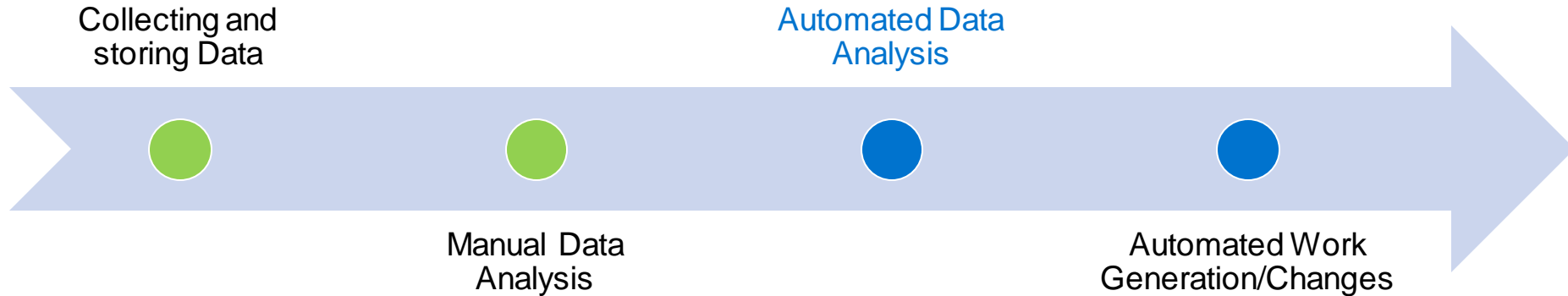

Dedicated to sustainable & safe energy production

Energy for California by Californians

CALIFORNIA
RESOURCES CORPORATION

CRC's Digital Journey

Collecting and storing Data

Manual Data Analysis

Automated Data Analysis

Automated Work Generation/Changes

Business Challenge

Market pressure forces CRC to continually find innovative ways to reduce cost and increase process efficiency

Engineers spending majority of their time looking for information instead of analyzing

Massive amount of data, of varying quality, in different systems and models that don't communicate with each other
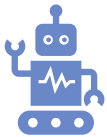
Tedious and non-standardized manual processes

Smart Operations Initiative

"Codification of organizational intelligence"

Can we leverage existing systems to reduce time and money while also improving performance?

Build tools to combine data across systems and improve analysis

Replace manual processes with more effective automated systems

Make decisions and actions transparent with KPIs and reports

# Project Use Case: Maintenance of Water Injection Wells

How do you determine when to service 1000s of wells that are running 24/7 with different operating requirements?

Old Process: Engineers manually review each well

Data Sources
• Excels

Analytics
• Engineers

Notification
• Calls and emails

Reporting
• None
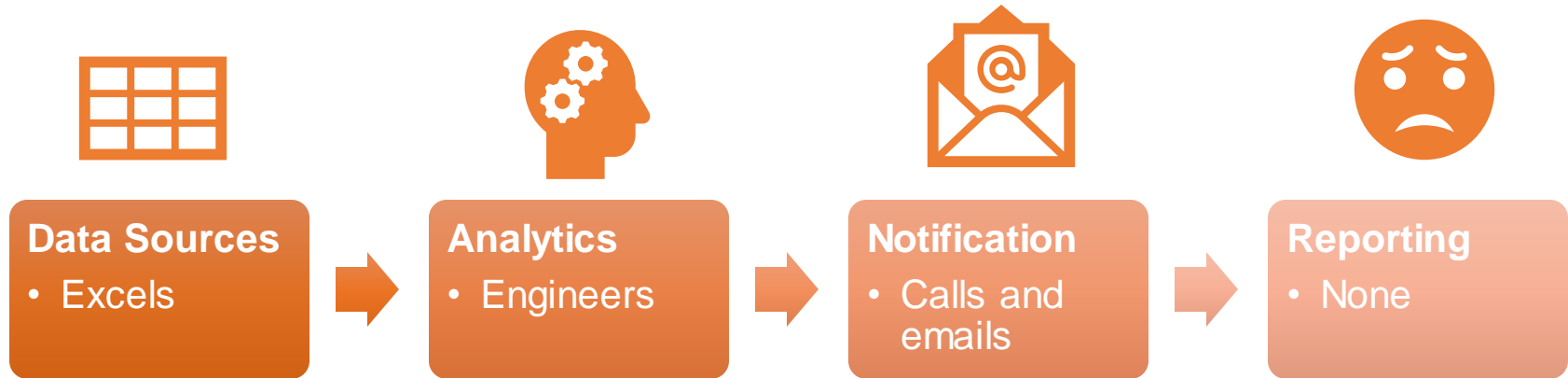
Components Used

New Process: Standardize and automated the collection of data, the monitoring and analysis of candidates for maintenance and creation of a ranked recommendation list.
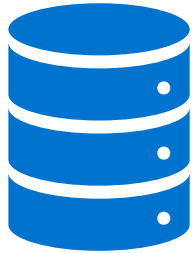
Data Sources	**Analytics**	Notification	**Reporting**
• PI Data Archive	• PI AF	• PI Notification	• PI Vision
• SQL Server			• Tibco Spotfire
• Static Files			

Recommender Data Flow
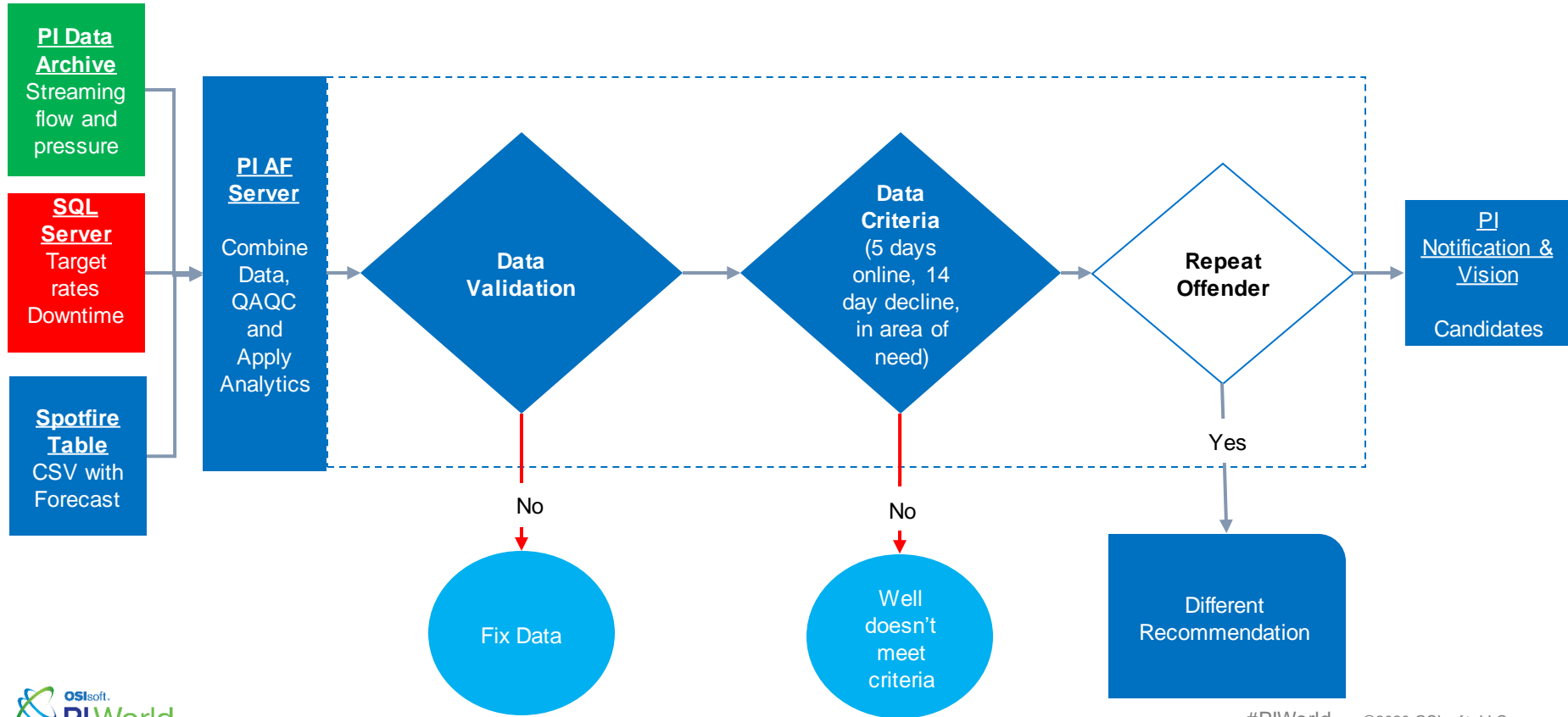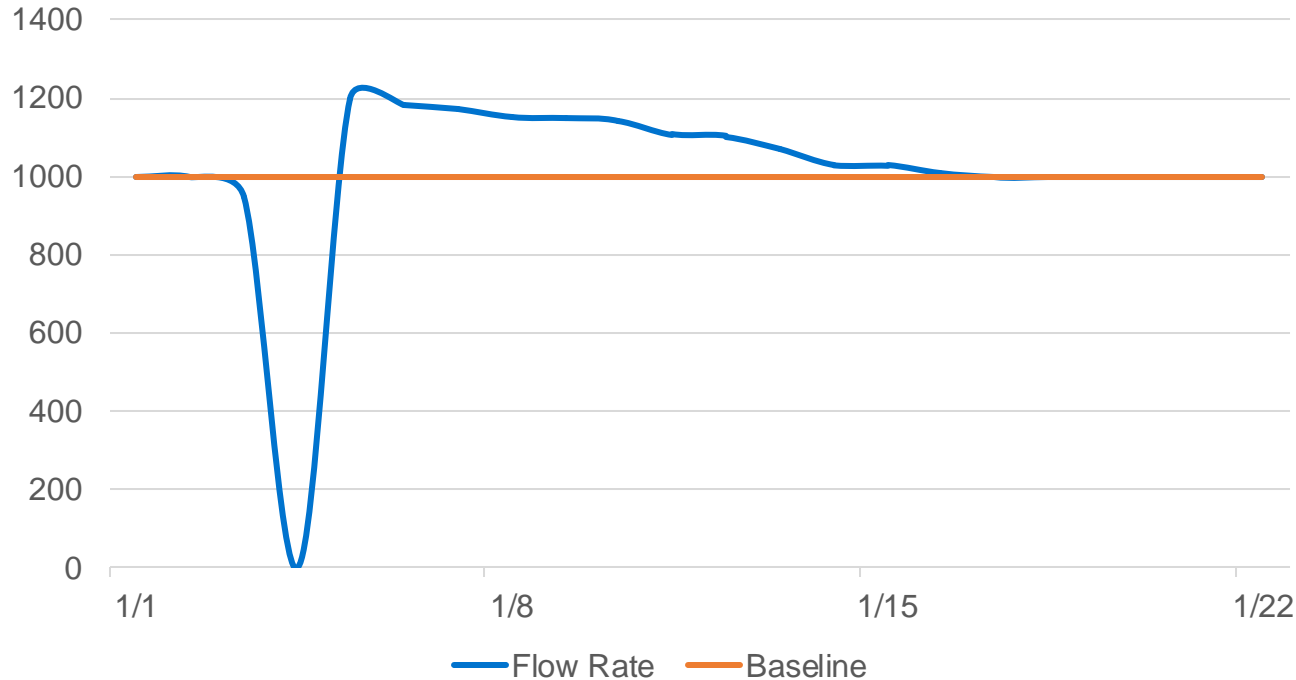
PI Data Archive — Streaming flow and pressure

SQL Server — Target rates Downtime

Spotfire Table — CSV with Forecast

PI AF Server — Combine Data, QAQC and Apply Analytics

Data Validation

Data Criteria (5 days online, 14 day decline, in area of need)

Repeat Offender

PI Notification & Vision — Candidates

No → Fix Data

No → Well doesn't meet criteria

Yes → Different Recommendation

Tracking Value: Automated KPI

Example Chart

Net gain/loss

per event

Tracking Value: Automated KPI

Example Chart

Net gain/loss

per event

Tracking Value: Automated KPI

Example Chart

Net = Green Area – Red Area

Net gain/loss per event

Flow Rate — Baseline
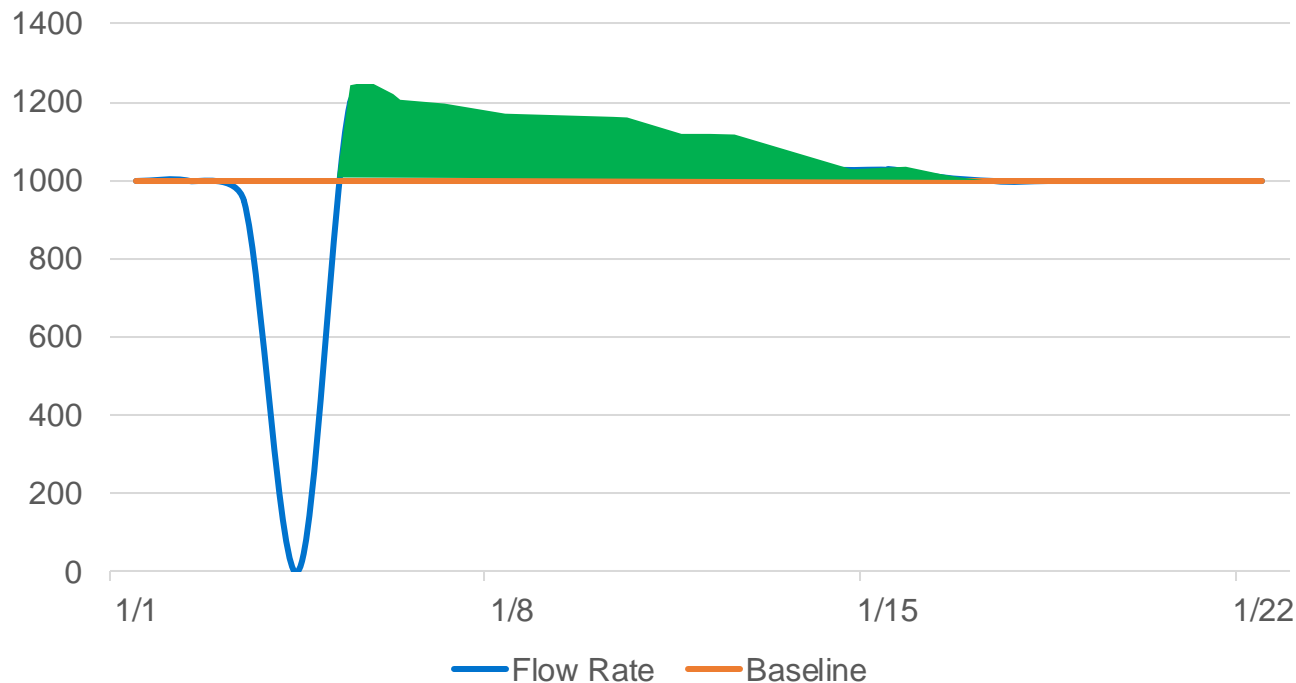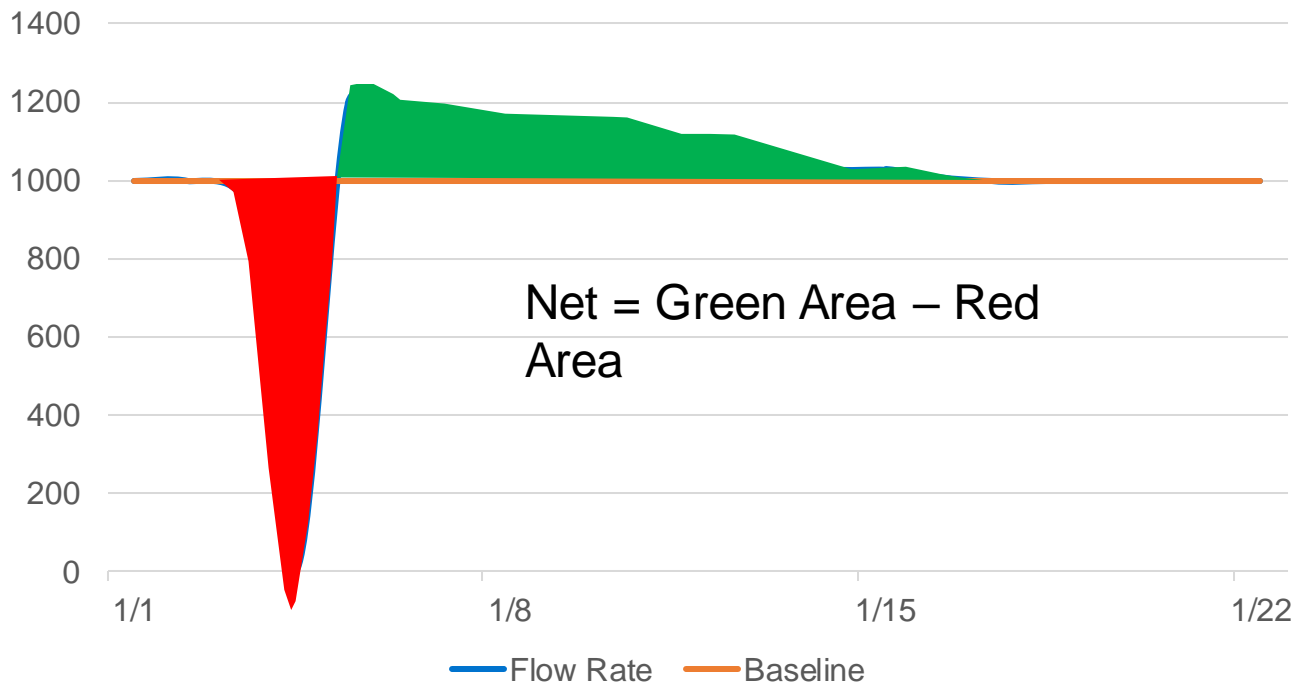
2019 Results

22% ↑
# of Jobs
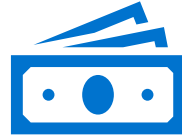
15,000 ↑
Bbls of oil

$1 M ↓
Wellwork Cost

- Built process framework for future projects
- Demonstrated potential of digital transformation

DEMO

Smart Operations

PI Vision - Smart Operations Dashboard
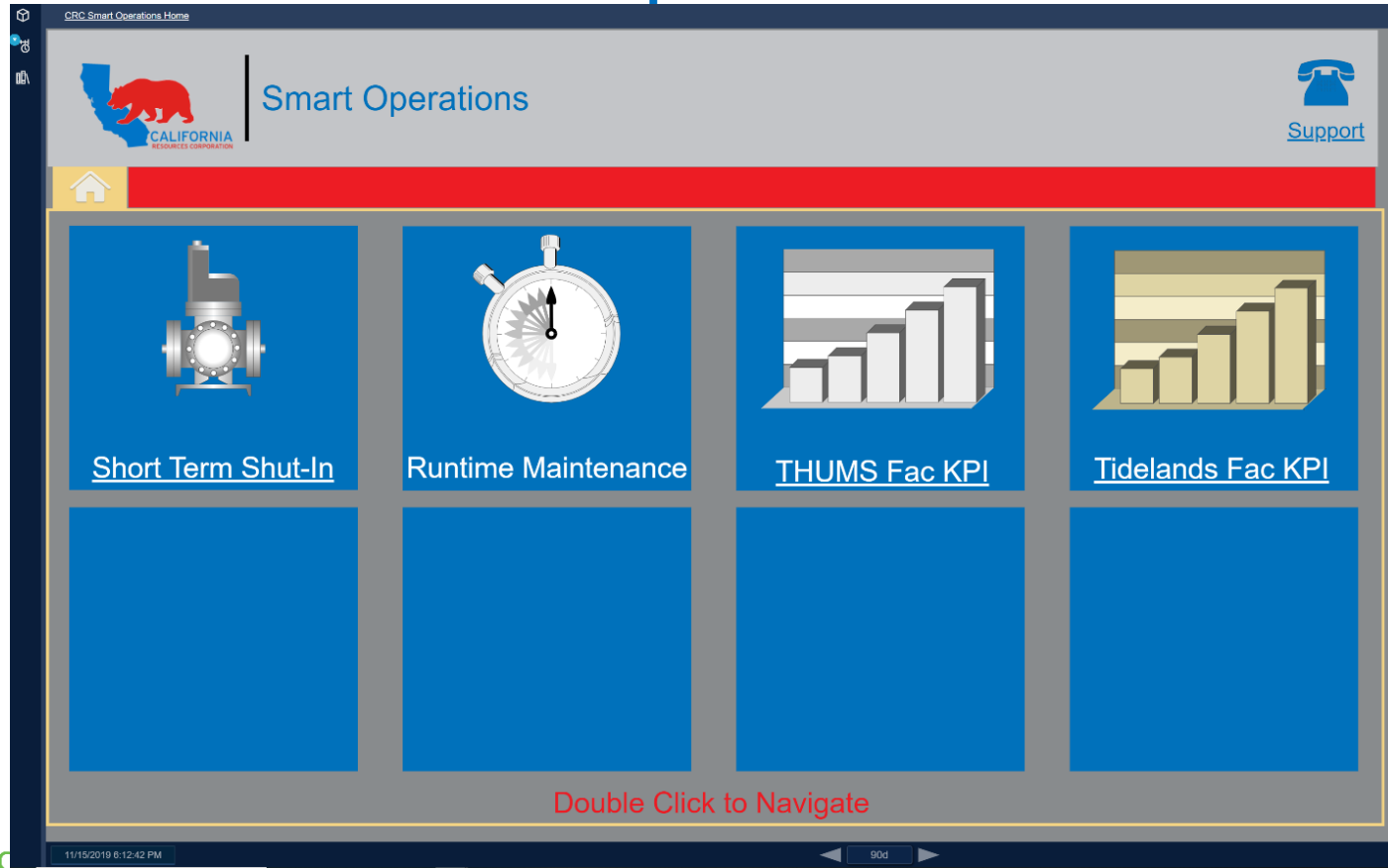
Well Maintenance Dashboard
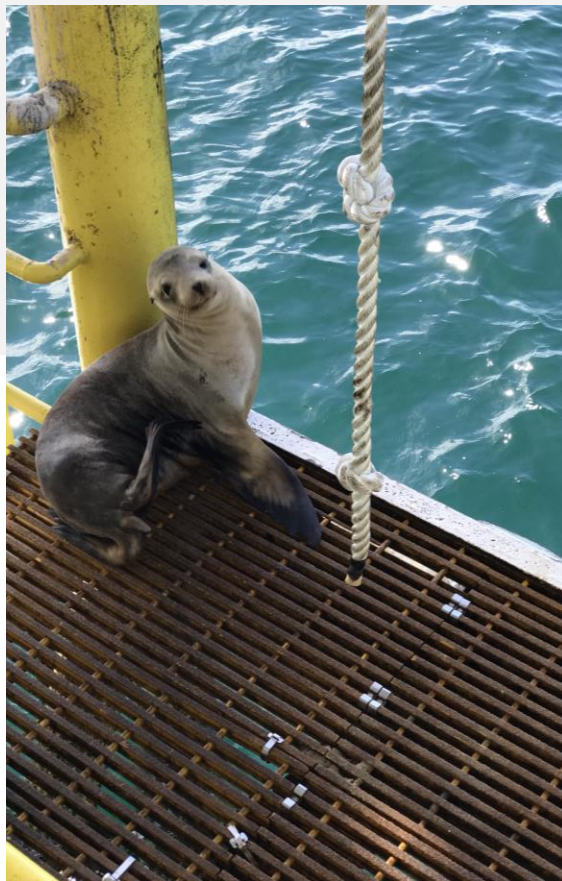
AF and Analytics

Spotfire Report

Next Phase

- Expand PI Asset Framework
- Condition based maintenance
- Drilling analytics
- Data quality validation
- Reservoir forecasting

Automated Recommender System

CHALLENGES

- Consume real-time data from 1000s of wells, each with different operating parameters to determine maintenance requirements

SOLUTION

- Combine different data sources into PI AF to analyze and auto-generate a recommendation list

- Regularly scheduled publishing of recommendation with PI Notifications

BENEFITS

- Reduced man hours needed to review wells

- Completed 22% more jobs than before

- Increased injection = Increased oil, save $1M on maintenance

" To find a successful use case, we focused on a pre-existing process but is manual, tedious, inconsistent and time consuming. From there, we automated and standardized the data collection, data validation, and analysis leveraging systems and technology we already had, to optimize the process, reduce the man hours and improve the results. "

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THANK YOU