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Integrated Real-Time Analytical Workflows for EOR Surveillance, Management & Optimization

Presenter:

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Integrated Real-Time Analytical Workflows for EOR Surveillance, Management & Optimization

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Schlumberger

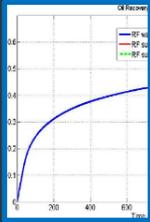
Content

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- EOR and WF Business Processes
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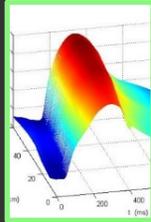
Business Drivers

1. Oil Rim Management:
 - a) Maximize Reserves
 - b) Balance Production Offtake and Injection
2. Injection Sweep Efficiency:
 - a) Understand Reservoir Connectivity and Injector/Production Vertical Conformance
 - b) Maximize Utilization Efficiency of Available Gas for Injection
3. Water Injection Quality and Monitoring
 - a) Water quality (PC, Diss. O₂, Fe, Cl)
 - b) Facilities reliability and uptime
4. Sufficient Gas Supply:
 - a) Integrated Production System Modelling
 - b) Gas Supply

A Need of Decision Support System



Is the current recovery factor as per plan?



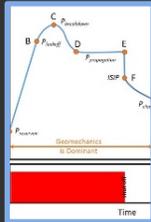
How is the reservoir pressure developing?



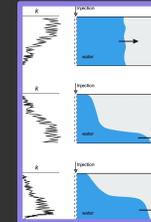
Do we have enough quality water & gas for injection?



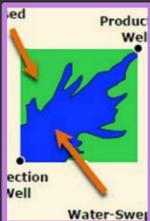
How are the gas compressors performing?



Is my injection pressure less than fracture pressure?



How is injection flood fronts developing?



How much oil has been displaced from swept zones?

WAG cycle

Water and Gas Injection uptime and injected volume per WAG cycle.

E_A
 E_I

What are areal and vertical sweep efficiency?

EOR IO Business Process



Structured, integrated & multidisciplinary approach to optimize the Asset value.

Physical Asset

Smart wells & facilities

Acquire data

Data: Realtime Monitoring, EBS, IO, FPC & etc.

Execution: Optimization & Remedial

Control systems (AAR)

Decision makers & action takers

Acquire data, data processing & management

Activity & decision management

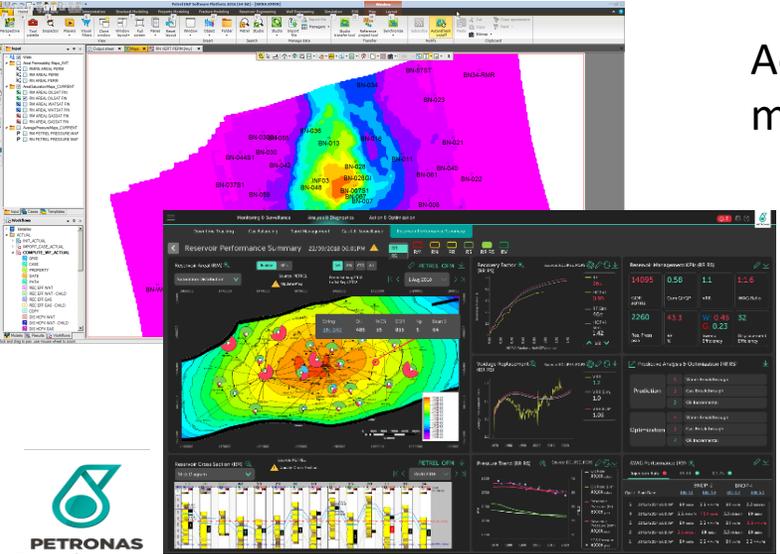
Analysis & Visualisation

Performance Diagnostics

Analysis tools, interpretation & integration

Generate & evaluate options

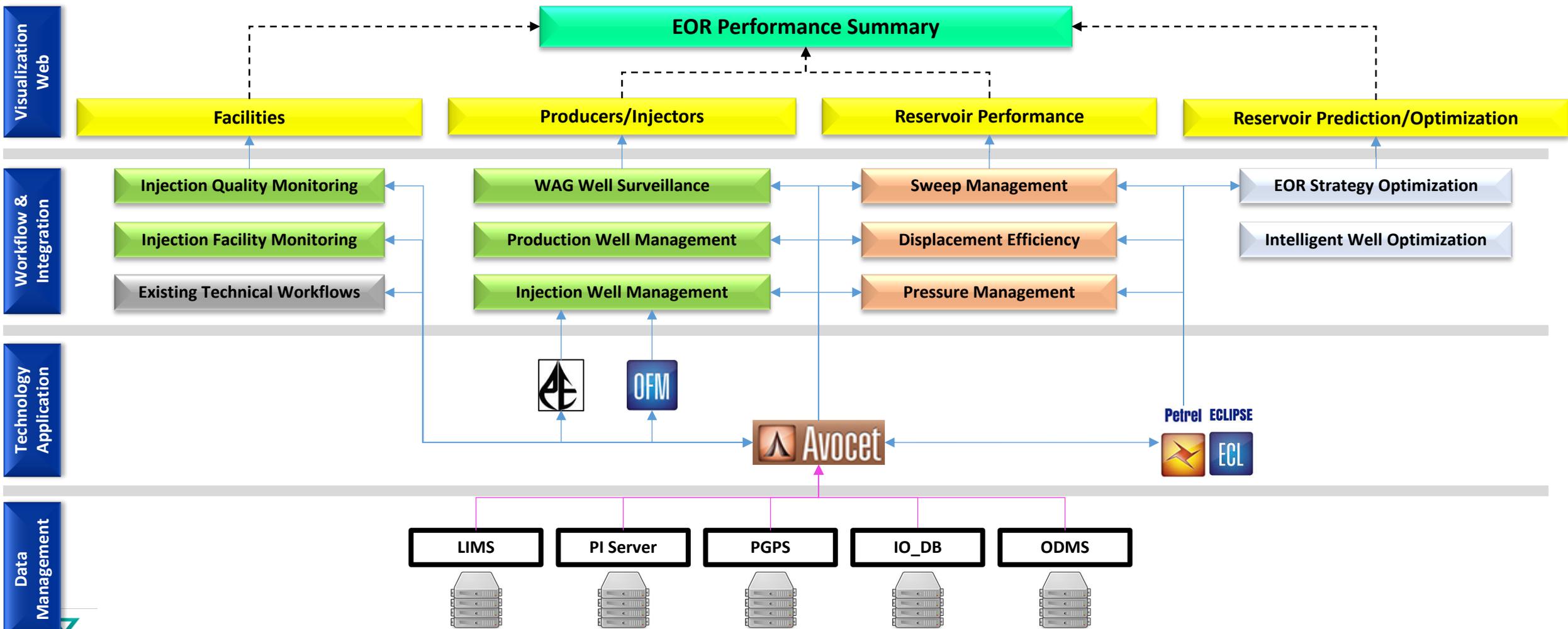
Plans & Optimization Decision



Solution Groups

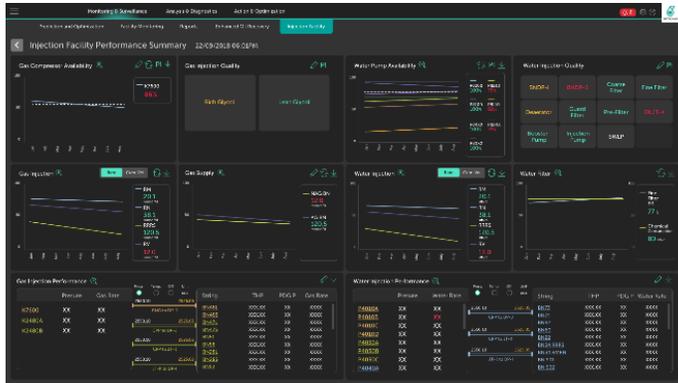
EOR SURVEILLANCE		EOR MANAGEMENT & OPTIMIZATION	
Facility Integrity Monitoring	<ul style="list-style-type: none"> - Monitor injection fluid quality - Injection fluid circuit pipeline monitoring - Injection fluid circuit pumps and compressors monitoring - Well Integrity Analysis - Uptime 	Fluid Contact Management	<ul style="list-style-type: none"> - Fluid movement monitoring and quantification - Changes in GOR, WCUT; PLT, Gas fingerprinting, Water Chemistry & tracer - EOR agent utilization efficiency
EOR Well Surveillance	<ul style="list-style-type: none"> - Zone Production/Injection Status - Zone Rate/Pressure Estimation (ICV, PLT, ILT, IO, non-IO) - Intelligent well ICV sensor health - Artificial lifting - (Also links to existing Well WFs) 	Displacement Management	<ul style="list-style-type: none"> - RST analysis; SWTT, NMR, pulsed neutron capture logs, - Observation wells
WAG Surveillance Activity Tracking	<ul style="list-style-type: none"> - Track planned WAG surveillance activities and compliance KPIs (e.g. PLT, RST, Tracer, Well Tests) - Compliance summary report (incl RMP) 	Pressure Management	<ul style="list-style-type: none"> - FGS, SGS analysis, VRR monitoring & balancing - Zonal PEOR estimation
Production Well Management	<ul style="list-style-type: none"> - Detect Productivity (Pseudo PI, etc.), - Diagnostics – Well operating envelope, Chan water & gas diagnostics, sanding 	Intelligent Well Optimization	<ul style="list-style-type: none"> - Optimize injection distribution from each zone
Injection Well Management	<ul style="list-style-type: none"> - Detect Injectivity, pseudo-injectivity index - Diagnose Hall plot, Well operating envelope 	Optimize EOR Strategy	<ul style="list-style-type: none"> - Quarterly to annual review of EOR performance; update strategy - Align strategy with current facility constraints - Evaluate sensitivities/uncertainties - Update model-based forecast and long-term planning

EOR Processes & Architecture

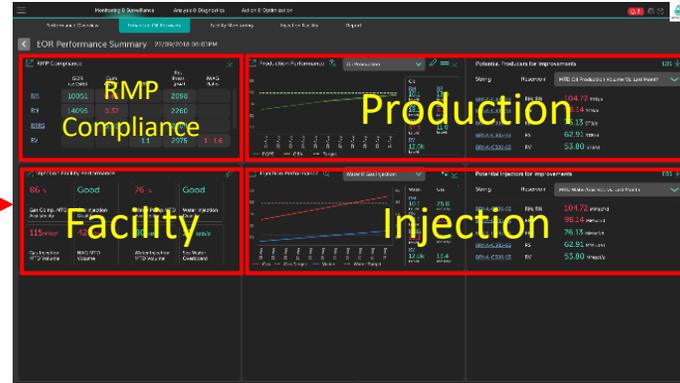


Solution Components

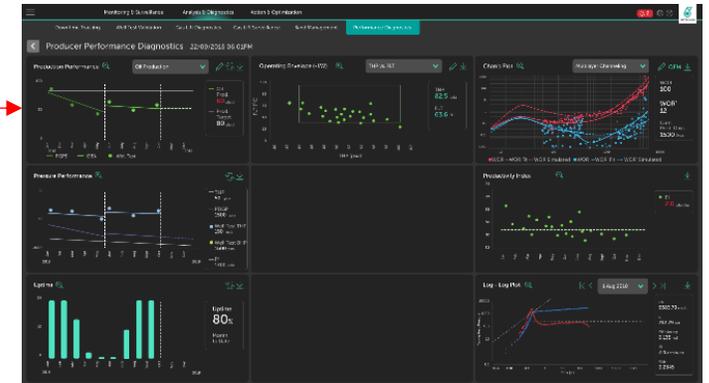
Injection Facility Performance Summary



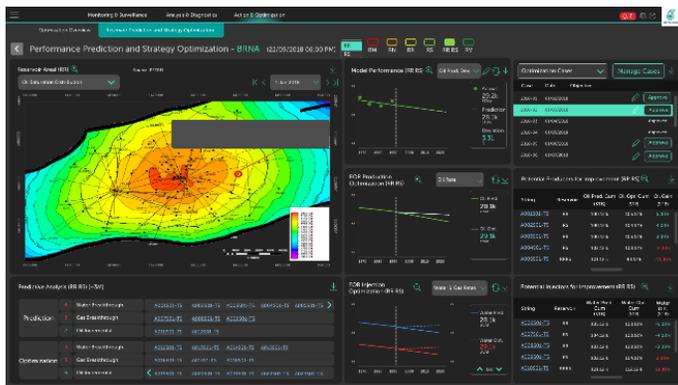
EOR Performance Summary



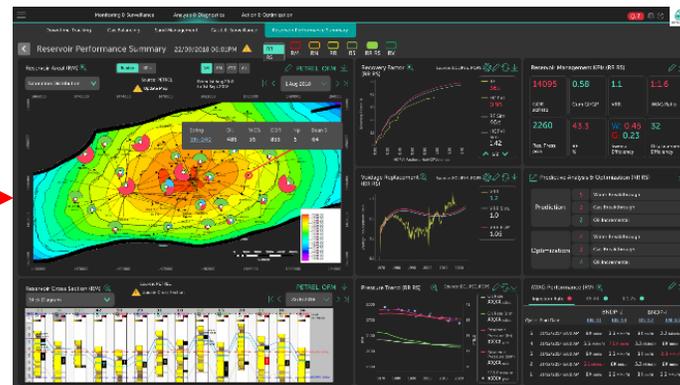
Producer Performance Diagnostics



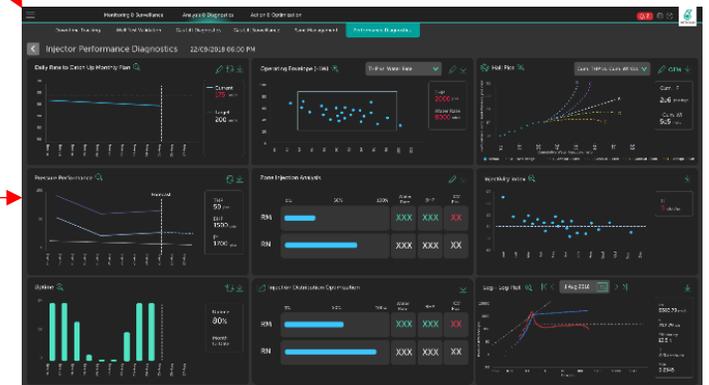
Reservoir Prediction and Strategy Optimization



Reservoir Performance Summary



Injector Performance Diagnostics

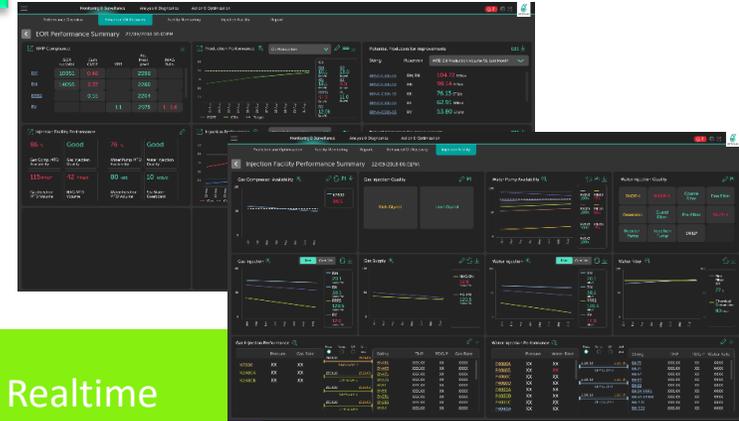


EOR IO Business Process



Structured, integrated & multidisciplinary approach to optimize the Asset value.

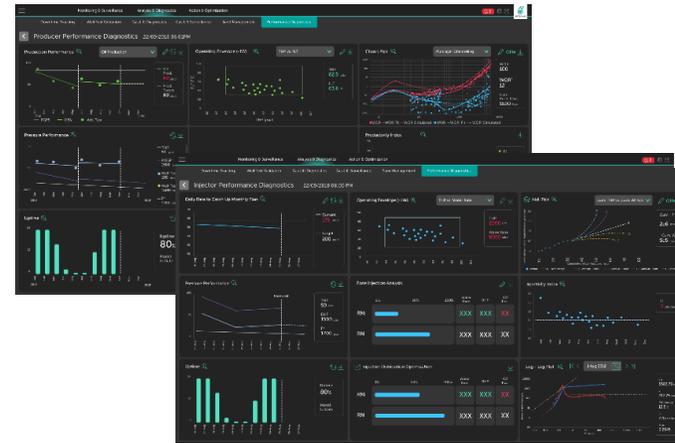
Physical Asset



Execution: Optimization & Remedial

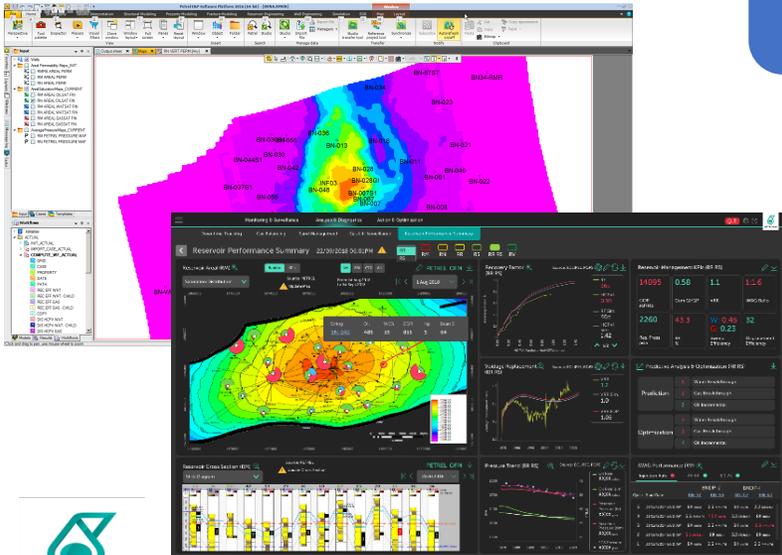
Data: Realtime Monitoring, EBS, IO, FPC & etc.

Decision makers & action takers

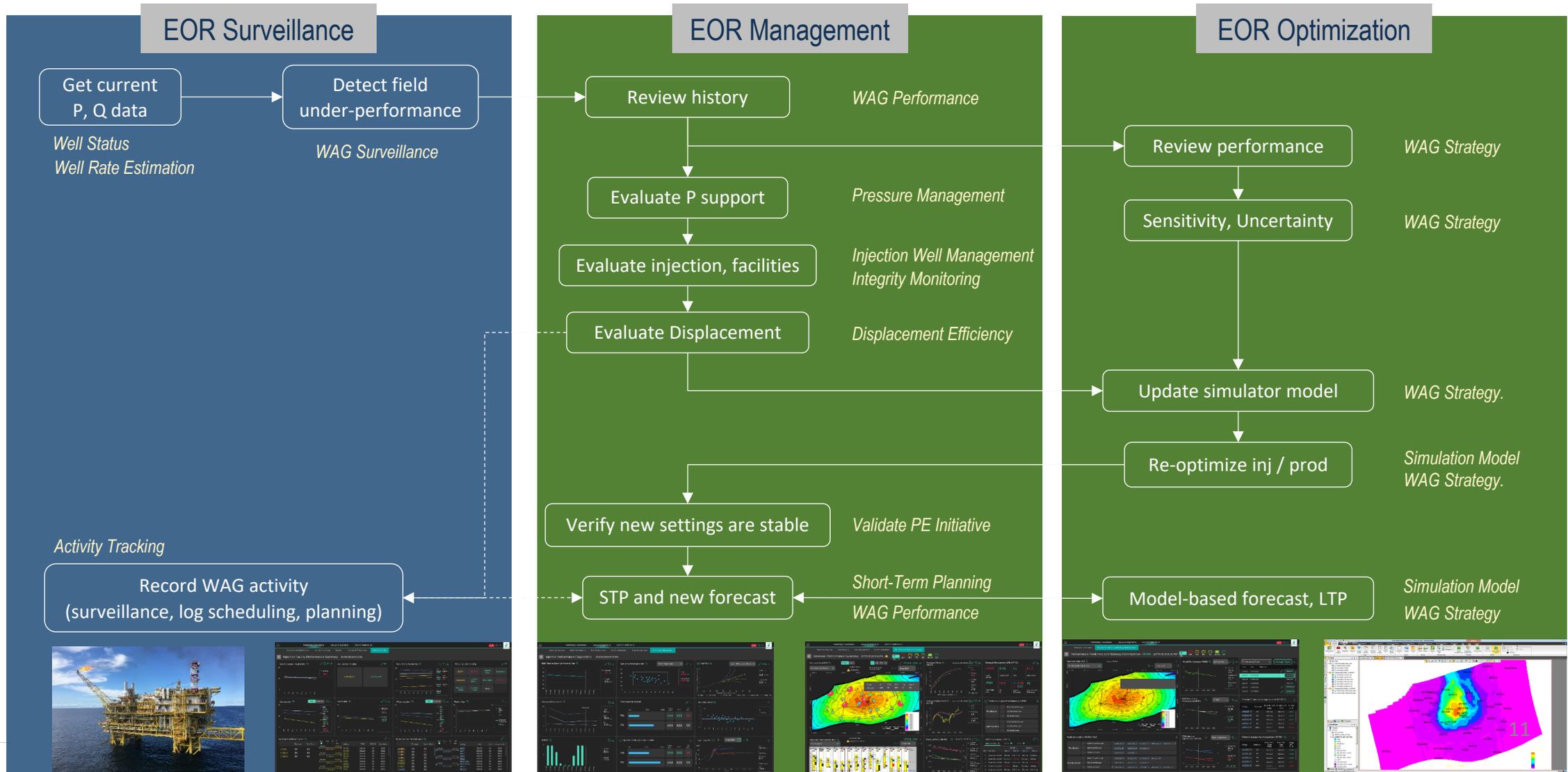


Plans & Optimization Decision

Performance Diagnostics



Business Process: WAG Strategy Under-Performance



Value Creation

- **Increase the production & recovery factor** through prudent monitoring & total asset optimization.
- Intelligent alarms & alerts to **reduce the unplanned deferment & downtime** for continuous asset awareness.
- **Increase the operational efficiency** through streamlined & automated workflow processes, allows **faster informed decisions** by highlighting possible related measurable or calculable KPIs as key information for issue analysis from one source supported with required visualization.
- Validated data acquisition & dissemination across the organization to create **a collaborative work environment** among multiple disciplines & locations, where opportunities for improvement can be analyzed & corrective actions can be undertaken.
- **Remote monitoring of the offshore facilities** from the Regional & Central Head Quarter which are thousands of kilometers apart.

Acknowledgements/Thank You/Question

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Thank you