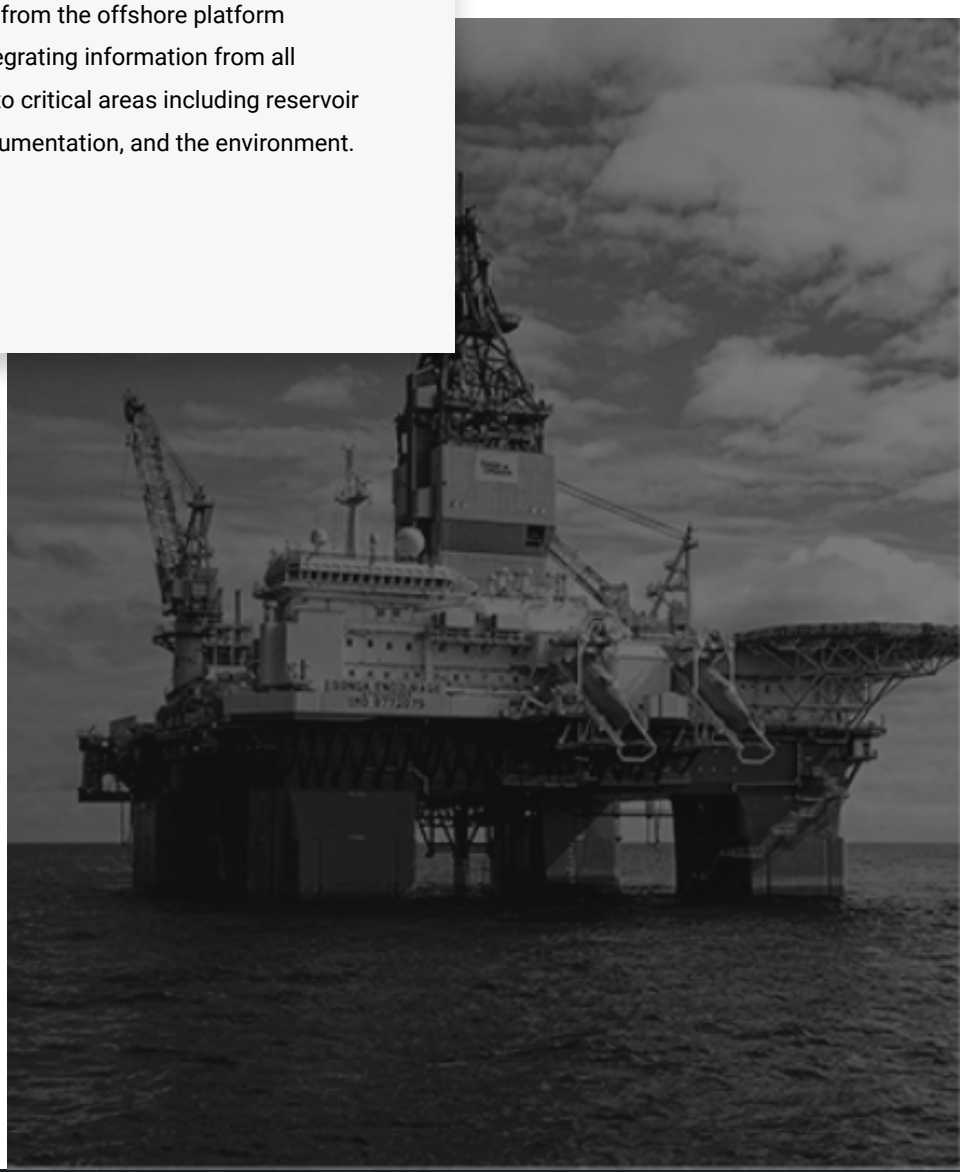
CONSTRAINT MANAGEMENT

# Linking the Topsides and Reservoir to Identify Constraints and Bottlenecks that Affect Costs and Production

This whitepaper was originally published by Datagration in August, 2021 prior to the company's acquisition by Weatherford.

Within multiple complex systems on offshore oil and gas platforms, equipment failure, unplanned downtime or non-productive time can negatively impact production. Currently, operators utilize equipment-centric predictive maintenance timetables based on common failure modes to avoid periods of unscheduled downtime.  A successful offshore asset management program widens the scope beyond operations, root cause analysis and preventive maintenance to include people, the environment and safety factors.

Constraint management is a holistic process that links facility topside data with reservoir data to identify operational problems or bottlenecks before they negatively impact production and revenue. Successful offshore asset management requires collaboration between multiple teams and disciplines, from the offshore platform to the onshore office. Data silos can be avoided by integrating information from all domains in a digital environment, giving users insight to critical areas including reservoir production, operations, maintenance, mechanics, instrumentation, and the environment.



# Constraint Management Value to the Business

Digital constraint management solutions in the PetroVisor platform are user-friendly and designed for engineers.  PetroVisor's Constraint Management solution uses predictive analytics to identify constraints or bottlenecks on offshore platforms or production facilities before they occur. The digital constraint management solution alerts users of underperforming or critical conditions before an event occurs which prompts engineers or operations teams to take proactive steps. This process enables a full understanding of the constraints before downtime occurs to support better decisions immediately.

An integrated constraint management solution can provide downtime reduction, minimize costs and maximize production. Using Artificial Intelligence (AI), Machine Learning (ML) and Physics-Based Modeling (PBM) algorithms, sensor data is analyzed across the entire offshore plant or facility ecosystem. The PetroVisor Constraint Management solution will identify conditions and predict adverse interactions between systems that may cause performance issues or events. With information from PetroVisor's predictive analytics, engineers can adjust equipment and processes to identify and address process safety issues.

Results are seen across the offshore project ecosystem, including equipment, maintenance, environment and safety enabling fleet management. Operators who use PetroVisor to debottleneck offshore facilities can expect a 5-15% process improvement, depending on facility conditions. A platform with a capacity of 130K BPD at $50/bbl oil can potentially save millions of dollars per year by using PetroVisor to eliminate bottlenecks. The PetroVisor Constraint Management solution brings value to offshore asset management by improving system reliability, optimizing facility efficiency and energy consumption, enhancing fleet management, capacity and performance.

## Using Predictive Analytics to Prevent Excessive Emissions

A client in the Gulf of Mexico used the constraint management solution to optimize power generation for an offshore plant. Optimal power generation was defined as running generators at maximum efficiency without exceeding the EPA's NOx emission standards regulations. The client used inputs from four separate and disparate monitoring systems on the platform: generator performance, temperature, pump performance and battery voltage. The inputs were modeled with AI, ML and PBM to predict NOx emission levels at specific generator output levels. Predicted NOx emissions correlated with actual NOx emissions. PetroVisor's predictive modeling of disparate data enabled the client to identify the maximum generator output that did not violate EPA regulations. As a result, the client increased the offshore plant's operational efficiency without adding labor.

## Gas Compression Process Improvements Reduce Maintenance Costs and Boost Production Returns

A PetroVisor user identified constraints within the gas compression system and process on an offshore facility. PetroVisor alerted engineers that the system was exceeding ideal operating envelopes and not running efficiently. Based on aggregated data from PetroVisor, the engineering and operations teams made 20 adjustments to the equipment's process and identified and addressed two process safety issues. As a result, 14 personnel trips were prevented. By identifying and addressing constraints, the client saved $690k on reactive maintenance and prevented $52 MM in production loss.

# Automating and Driving Accurate Diagnostics with AI, ML and PM

Predicting conditions can enable users to identify and understand where bottlenecks will occur within an offshore platform system. The PetroVisor Constraint Management solution achieves this by critical data from multiple sources using predictive analytics driven by AI, ML and PBM. Together these methods help identify correlations in data across the production systems and show the potential negative impacts from a single constraint. The solution can evaluate process equipment conditions against operating envelopes, KPIs and thresholds developed by Datagration's semantic language. Users can view topside and reservoir data in real-time or run scenario models to detect anomalies or constraints, such as potential equipment failures. Users can configure rules for alerts to specific combinations of data stream conditions. After receiving an alert to one or many conditions, engineers or operations personnel can intervene and address the constraint. Facility efficiency, energy consumption, equipment behavior across multiple installations and pending equipment failures are all combined with the constraint management solution.

# The PetroVisor Platform Delivers a Constraint Management Solution for Offshore Assets

PetroVisor's Constraint Management solution addresses the challenge of efficiently operating offshore platforms with multiple data streams and dispersed teams. The solution breaks down technology silos by integrating topside facility and reservoir data across the entire project ecosystem. PetroVisor's predictive analytics efficiently processes high volumes of data and identifies bottlenecks and adverse events before they occur. This solution goes beyond traditional root cause analysis and preventive maintenance by enabling engineers to run scenarios, identify constraints and debottleneck offshore platform operations without additional labor. PetroVisor Constraint Management users can avoid costly unplanned downtime, personnel trips and production loss. With PetroVisor's Constraint Management solution, operators can minimize costs and maximize production on offshore platforms.