IBM asset analytics for rotational equipment in oil and gas

Empower production engineers with the insight to improve productivity and gain operational control

Highlights

- Optimise well-production yield and lower production cost

- Gain situational awareness and control over production operations

- Predict critical equipment failures and significant performance deviations and respond with plan, repair, replace and overhaul tasks

- Boost decision support with dashboards and collaboration tools tailored for oil and gas teams

- Monitor operations across the enterprise, from pumps to oil fields.

Major advances in production technology have made it possible to tap resources that were previously considered inaccessible. For example, with the advent of directed and horizontal drilling techniques, a single well pad can now be home to many well bores and reach a vast expanse of underground resources.

The older model of prospecting and commissioning each oil well involved significant investment in anticipation of a substantial return. The newer fracturing technologies rely on a large distribution of wells and multiple bores within each to produce an overall return on investment. In this new scenario, the focus of operational engineers is to maintain productivity and other performance objectives for a system of wells and bores within design and operational ranges.

As with traditional oil wells, the equipment involved in well extraction are highly instrumented. Operational engineers must now continuously monitor a range of performance indicators on all critical extraction equipment to understand when and where productivity and other performance objectives are deviating from the designed ranges. The magnitude of the task often carries the risk of not being able to identify timely corrective actions, or worse, missing indicators of critical failure.

The IBM® Asset Analytics for Rotational Equipment solution analyses massive volumes of data in real time to help predict asset failure, production quality, production yield and other issues relating to health and safety. By using historical equipment behaviour data from a wide range of sources, such as performance, failure and maintenance logs, the solution enables the creation of predictive models for electric submersible pumps (ESPs, Figure 1). These models are critical assets that provide oil and gas lift. Real-time data from ESPs, in addition to production yield data, are constantly analysed against these models to continuously generate insights about performance and potential failure. This task is too large and complex to be performed manually by even the most experienced production engineers.
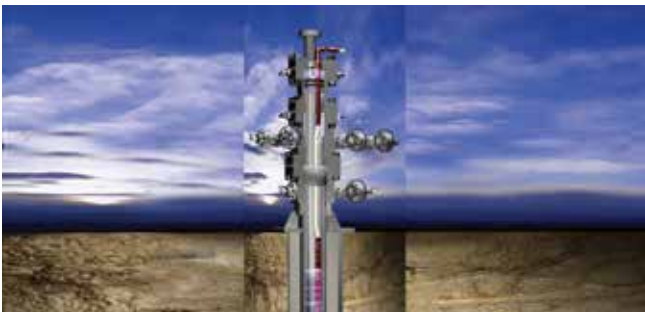

Figure 1: Electric submersible pump

The IBM solution brings significant business benefit to production operations by providing insight to increase productivity and lower the maintenance cost of ESPs. Further, it significantly lowers the risk of catastrophic equipment failure and health or environmental noncompliance. It is ideally suited for the 'big data' challenge of handling the daunting task of monitoring and managing production across thousands of wells.

Gaining situational awareness of the production operation

Operation engineers are constantly seeking insight into the yield and efficiency of oil production across the entire field of wells and into how their most valuable assets used in the extraction process are performing. Such insights are integral for early identification of critical failure and associated losses in addition to prioritisation of maintenance schedules and resources.

Asset analytics and predictive maintenance helps operation engineers observe production-related data that includes oil extraction rate, gas/oil ratio and water cut percentage. It also enables the identification of the mode of operation of every ESP by using models that use critical monitored parameters, such as pressure, amperage and temperature. When ESPs are found to be already in or trending toward failure mode, the ESPs in question and their risk profiles are displayed both on geospatial maps and in tabular views. A system-level key performance indicator (KPI) is the total number of ESPs at risk of failure across the entire field, categorised into high, medium and low risk profiles. Another system-level KPI offered is the production yield that is aggregated across entire fields.

The ability to observe oil production-related data for a well along with ESP modal shift history is highly valuable for operations engineers and analysts to determine tactical and strategic corrective actions. It can ensure uninterrupted and optimal production yields. Availability of prior maintenance history of ESPs is also useful in deciding the recommended action between tune, repair, rehab and replace for underperforming or failing ESPs.

Finding patterns in the data

The IBM Asset Analytics for Rotational Equipment solution analyses ESP operational data (Figure 2) to develop statistical models that help identify current operational mode, predict failure probability and rank failure risks. This method is based on associated impacts on production efficiency and other factors, such as health and environmental impact.

Figure 2: ESP operations dashboard

The solution takes several ESP data sets that include historian, maintenance logs, production performance and technical specifications as input to generate the operational models of ESPs, which capture normal versus at-risk-of-failure modes of operation. These models also incorporate change-point analysis to recognize the transition of an ESP to a new mode. Further, the models can also be used to predict if and when an ESP is likely to transition to a failure mode in the future and associate a probability of this happening.

Supporting multiple operational roles

The solution includes dashboards (Figure 3) that are designed to deliver operational insight in support of executive and analyst roles that are specific to the industry.

Dashboards include:

- A summary of ESP data from multiple fields and the multiple wells within
- Field oil production data
- Aggregated information of ESPs at risk, categorised into high, medium and low
- ESPs represented in geospatial maps and in detailed tables that show the current mode and risk of failure.

The analyst dashboard offers the ability to drill down into the performance of a specific well and associated ESPs. Historical performance of an ESP can be understood through graphs that present variation of pressure, amperage temperature and operation mode. Maintenance history can also be observed across all ESPs that are being monitored.

Converting insights to action

Recommendations can be generated based on pre-designed business rules to fine-tune ESP performance. For ESPs that have been identified as at risk for failure, higher priority maintenance work orders can be automatically triggered that carry specific recommendations for field technicians.

These recommendations can also be sent to an enterprise asset management (EAM) application, such as SAP Plant Maintenance or IBM Maximo Asset Management. The EAM uses the integration capability of the underlying IBM Predictive Maintenance and Quality product to interface with these systems.

Figure 3: ESP performance on the operations dashboard

Asset analytics for improved productivity

The IBM Asset Analytics for Rotational Equipment solution enables producers to use the power of asset analytical models and predictive analytics, providing decision support to executive and operational roles. The insights that are offered can help improve productivity, minimise asset down time, minimise the risk of asset breakdown and costly emergency repair, avoid unnecessary maintenance, and improve the quality of production processes.

Why IBM?

IBM has established a comprehensive portfolio of analytics solutions. It deploys 9,000 business analytics consultants and 400 researchers and has acquired more than 30 companies since 2005 to build targeted expertise in analytics. IBM secures hundreds of patents a year in big data and analytics, and converts this deep intellectual capital into breakthrough capabilities, including cognitive systems, such as IBM Watson. The company has established a global network of nine analytics solutions centres and has more than 27,000 IBM Business Partners.

For more information

To learn more about the IBM asset analytics solution for rotational equipment in oil and gas solutions, contact your IBM representative or IBM Business Partner, or visit: ibm.com/analytics/us/en/industry/chemicals-and-petroleum/asset-analytics.html.

Additionally, IBM Global Financing can help you acquire the IT solutions that your business needs in immensely cost-effective and strategic ways. We'll partner with credit-qualified clients to customise an IT financing solution to suit your business goals, enable effective cash management and improve your total cost of ownership. IBM Global Financing is your smartest choice to fund critical IT investments and propel your business forward. For more information, visit: ibm.com/financing.

ASS12345-GBEN-00