Weatherford®

LOWIS™
Life-of-Well Information Software

Enabling better decision making
for artificial-lift optimization

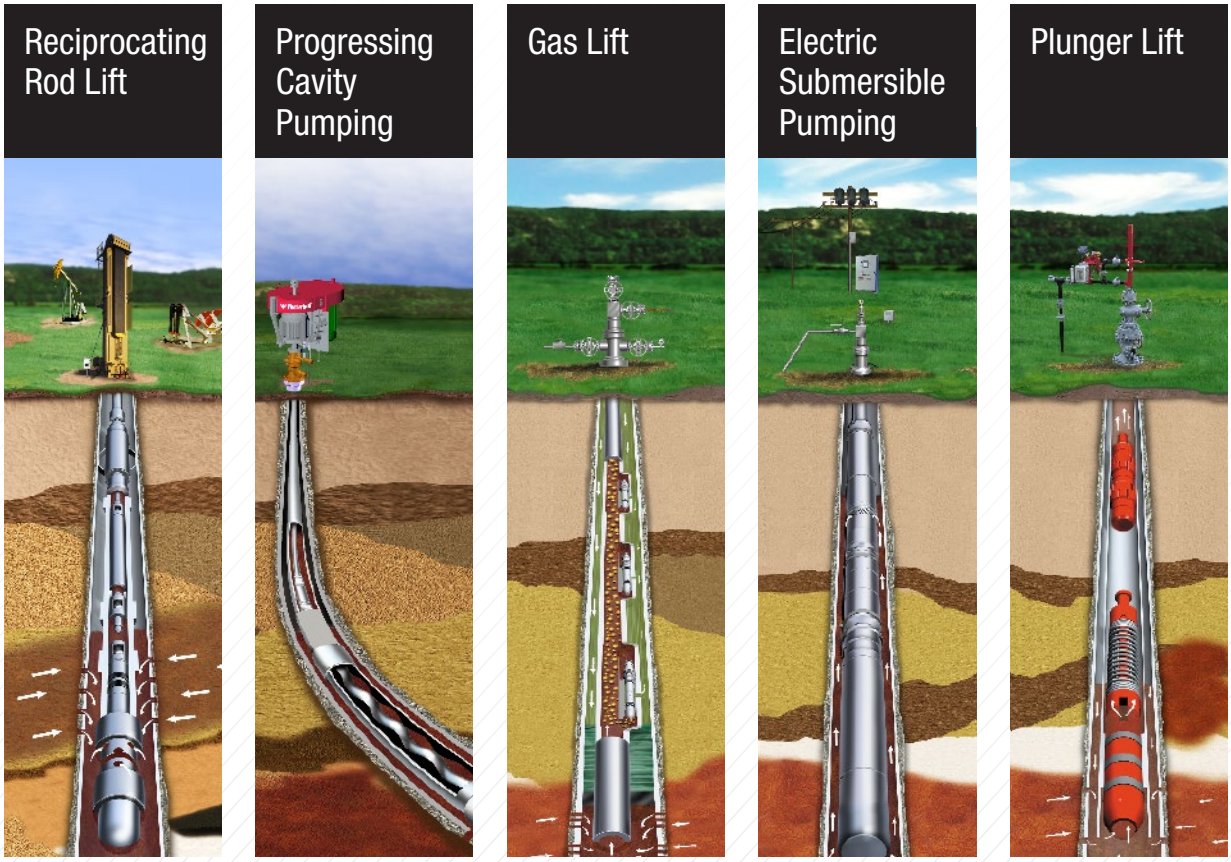
Get More from Your Wells

Optimizing production is no longer an option—it's a necessity. But unleashing the potential of your artificially lifted wells involves more than proven equipment; it requires a systematic approach that combines a comprehensive package of control and analysis with innovative field-management solutions. Weatherford, the only oilfield services company to offer extensive solutions for all forms of artificial lift, brings global expertise and an unparalleled depth of products to suit any production need.

Operators decide how best to make each well reach its potential. Our LOWIS™ life-of-well information software helps make those decisions faster, easier and more effective. Deployed enterprise-wide, the *LOWIS* application becomes your eyes and ears on every well, be it low-production onshore or high-volume offshore. A complete optimization tool for wells, the software includes remote monitoring and control, analysis and service management capabilities.

The system not only delivers real-time information on each well, it also provides detailed well analyses, well optimization plans and intelligent alarms for production problems. Each morning, operators can efficiently dispatch crews based on the *LOWIS* application's prioritized reports of production issues or predicted equipment failures.

Enhancing Artificial-Lift Performance



An Integrated Approach to Artificial-Lift Optimization

LOWIS software is an enterprise-wide approach to well management. By reducing lifting costs, improving efficiencies and minimizing the financial risk of new technologies, this innovative software can help improve the bottom line for any oil and gas production operation.

Reduce lifting costs

The *LOWIS* application provides real-time monitoring and alarming capabilities coupled with integrated analytical and reporting tools. Using the application's unique workflow interface, you can quickly identify, prioritize, plan and service underperforming wells to reduce downtime and associated production losses.

Adopt best practices to improve efficiencies

Valuable well data once locked in spreadsheet files on individual desktops can now be instantly accessed across multiple production disciplines using *LOWIS* software. The system provides a unique combination of surveillance, analysis and well-service management in a single interface that allows users to standardize their production workflow. With quick access to complete well histories, you can design and implement best practices for failure management using the system's score card tools.

Minimize financial risk

Well economics are dynamic and need constant monitoring to identify the intersection between production value, OPEX and CAPEX. The *LOWIS* software provides these capabilities in the form of customized reports and alarms, enabling users to make operational decisions based on real-time economic data.

LOWIS Benefits at a Glance

- Improves remote well monitoring and control capabilities through full supervisory control and data acquisition (SCADA)
- Offers an easy-to-use interface to view and interact with data from multiple sources
- Provides an integrated set of surveillance, analysis and well-service management tools
- Enables prioritization opportunities from field and well surveillance
- Open to several methods of wellhead telemetry
- Supports all well types and processes
- Enables seamless trending

Texas, USA

14,000 ROD-PUMP WELLS
REDUCED FAILURE RATE & PRODUCTION LOSSES

1 MILLION DAMAGING STROKES PER DAY AND 50,000 CYCLES PER DAY ELIMINATED

Analysis Workbench

Artificial-lift analysis workbench (AWB) applications provide a means for faster diagnosis and remediation of production problems in reciprocating rod lift (RRL), electrical submersible pump (ESP), gas lift and progressing cavity pump (PCP) operations. With these tools, you can use real-time information to analyze and optimize wells, focusing on probable performance problems before they lead to degraded well performance or failure.

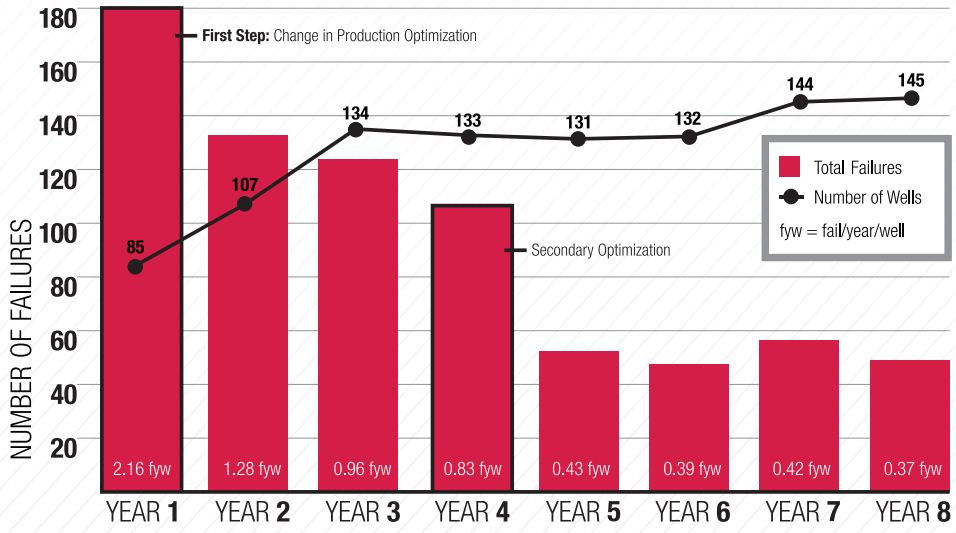
These AWB modules, specifically developed for each lift type, are based on detailed engineering models and lift-performance variables. Real-time data is converted into intelligent alarms to inform you of what's happening, why it's happening and what actions might need to be taken to maintain maximum production efficiency.

Real-time critical information for each well in your portfolio is communicated via the AWB dashboard, email or text message. These updates allow you to efficiently manage your assets from anywhere in the world.

Advantages

- Optimizes well productivity and equipment reliability through sensitivity analysis
- Predicts and diagnoses potential causes of failure
- Identifies optimization opportunities and creates a daily cost-benefit analysis
- Reduces downtime and failures, which improves mean time between failures
- Predicts the impact of changes to operating parameters
- Enables proactive asset management

Measurable Optimization Improvements



An operator in the Permian Basin recorded a significant reduction in well failures.

Analysis Workbench

Reciprocating Rod Lift

When optimizing RRL systems with wellsite automation, operational monitoring is vital—incorporating advanced analytic engines to model lift-system and well-inflow performance dramatically improves production and reduces operational costs.

Asset operators are challenged to integrate operational monitoring and analysis to yield optimized wells. Offering a comprehensive set of tools and utilities, the AWB for RRL systems delivers a seamless solution.

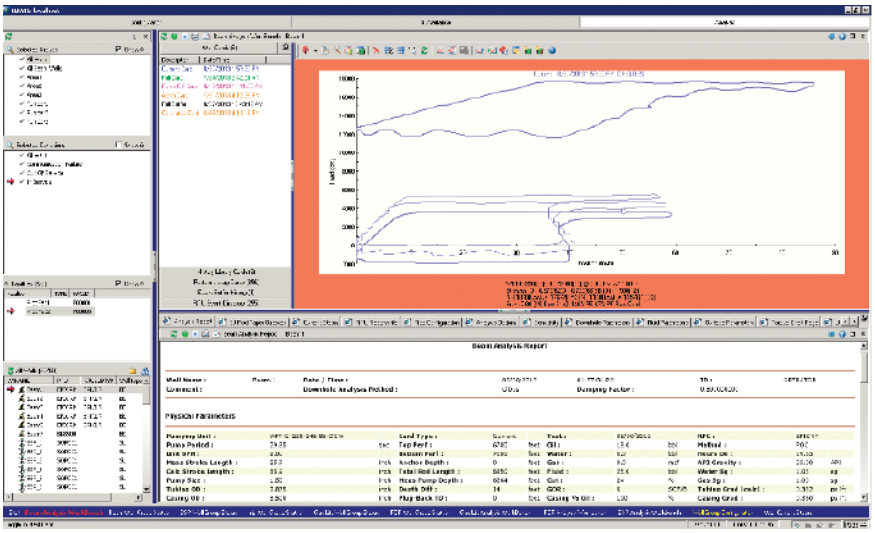
Well analysts can evaluate the entire RRL system, reviewing surface and subsurface performance compared to predictive models. Through the integration of real-time surveillance with predictive model data, asset operators can identify changes to operational conditions and diagnose problems that affect operations.

Functions

- Dynamometer card analysis includes multiple methods for generating the downhole pump card
- Quick-look and full-detail analysis reports of surface and subsurface equipment
- Trended analysis and surveillance data
- Intelligent alarms based on measured conditions versus predictive models and trended data analysis

Advantages

- Allows customization of individual field conditions for operational analysis and diagnostics
- Includes fully open and customizable catalogs and reference data
- Offers multi-point rod-stress analysis and automatically calculates the damping factor and pump fillage for each card using a modified Everitt-Jennings algorithm for wave equations



The AWB for RRL allows users to analyze dynamometer cards and review the detailed analysis report.

China

200 ESP WELLS
12 MONTHS AFTER INSTALLATION

AVERAGE 30 PERCENT INCREASE IN PRODUCTION IN 56 WELLS

Fostering Collaborat

Asset Managers

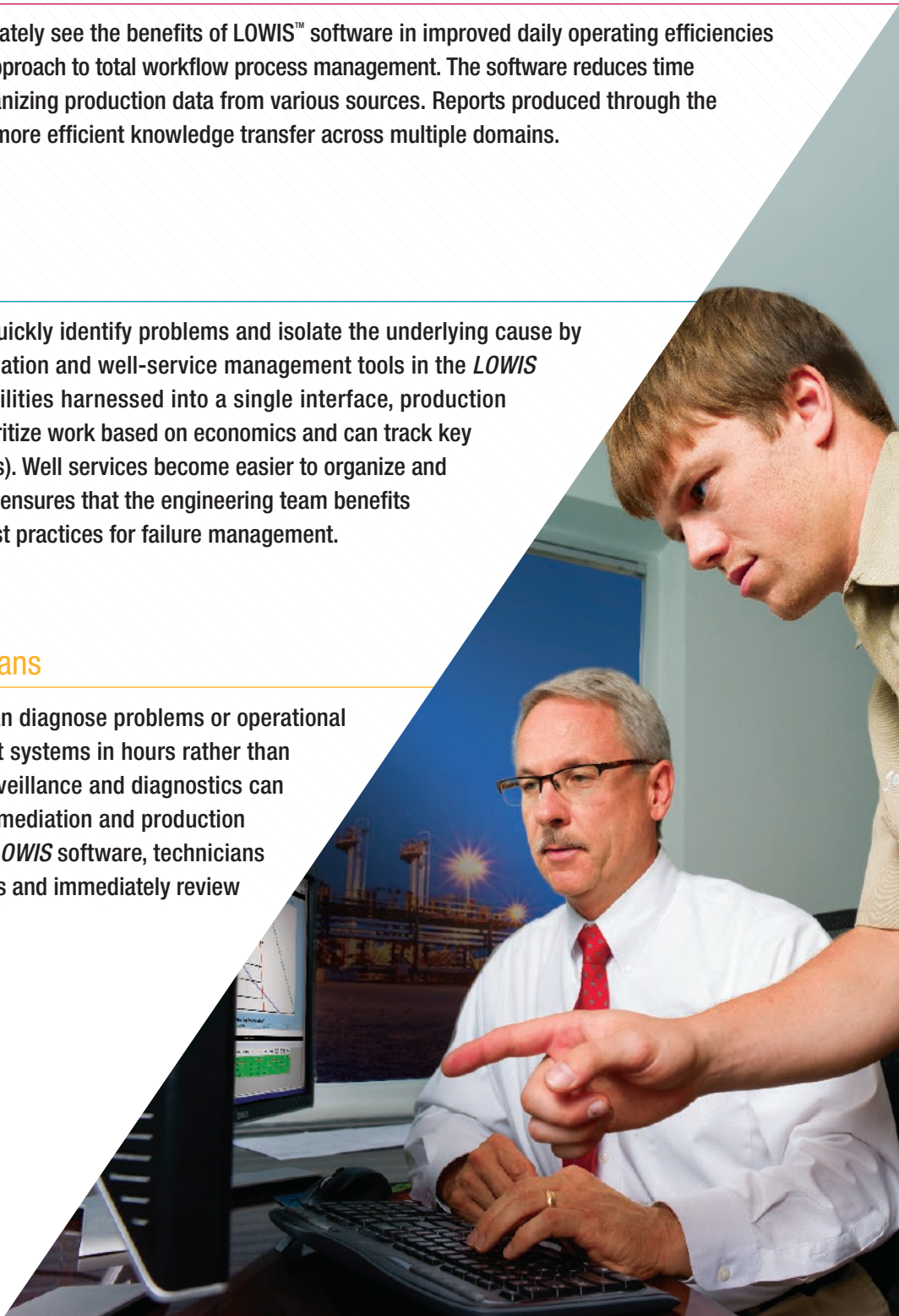
Asset managers will immediately see the benefits of LOWIS™ software in improved daily operating efficiencies and having a standardized approach to total workflow process management. The software reduces time spent searching for and organizing production data from various sources. Reports produced through the application facilitate faster, more efficient knowledge transfer across multiple domains.

Production Engineers

Production engineers can quickly identify problems and isolate the underlying cause by using the right-time optimization and well-service management tools in the *LOWIS* software. With these capabilities harnessed into a single interface, production engineers can plan and prioritize work based on economics and can track key performance indicators (KPIs). Well services become easier to organize and prioritize, and score carding ensures that the engineering team benefits from the development of best practices for failure management.

Analysts and Technicians

Analysts and technicians can diagnose problems or operational inefficiencies in artificial-lift systems in hours rather than days. The time saved in surveillance and diagnostics can be redirected to problem remediation and production optimization. By using the *LOWIS* software, technicians can adjust controller settings and immediately review the results of the changes.



ive Decision Making

Lease Operators

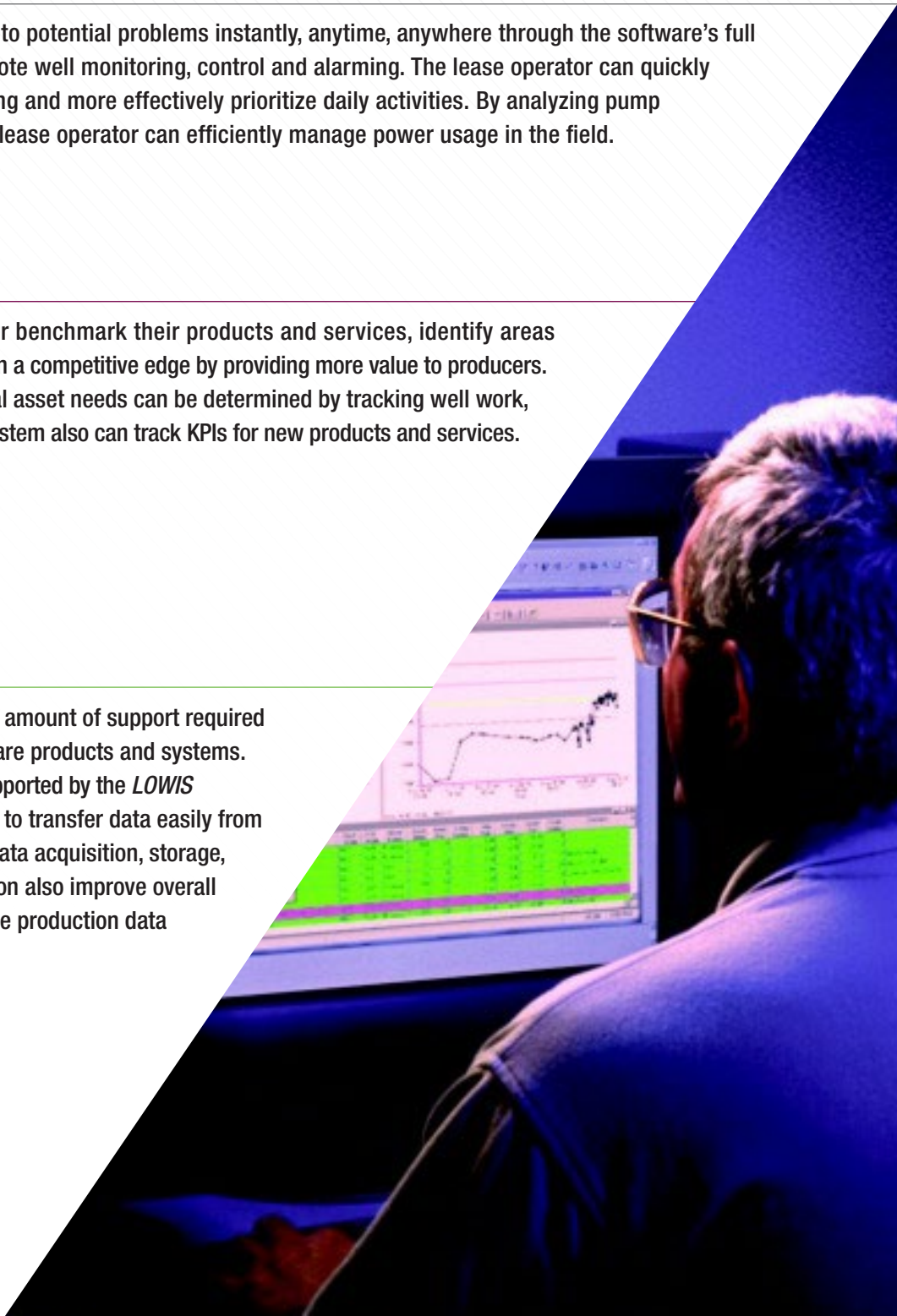
Lease operators are alerted to potential problems instantly, anytime, anywhere through the software's full SCADA functionality for remote well monitoring, control and alarming. The lease operator can quickly review all wells each morning and more effectively prioritize daily activities. By analyzing pump efficiency and run time, the lease operator can efficiently manage power usage in the field.

Service Providers

Service providers can better benchmark their products and services, identify areas for improvement and maintain a competitive edge by providing more value to producers. Opportunities to fill additional asset needs can be determined by tracking well work, services and products; the system also can track KPIs for new products and services.

IT Specialists

IT specialists can reduce the amount of support required to administer multiple software products and systems. Communication protocols supported by the *LOWIS* application help IT personnel to transfer data easily from one application to another. Data acquisition, storage, consolidation and visualization also improve overall data integrity and simplify the production data management process.



Analysis Workbench

Electric Submersible Pumps

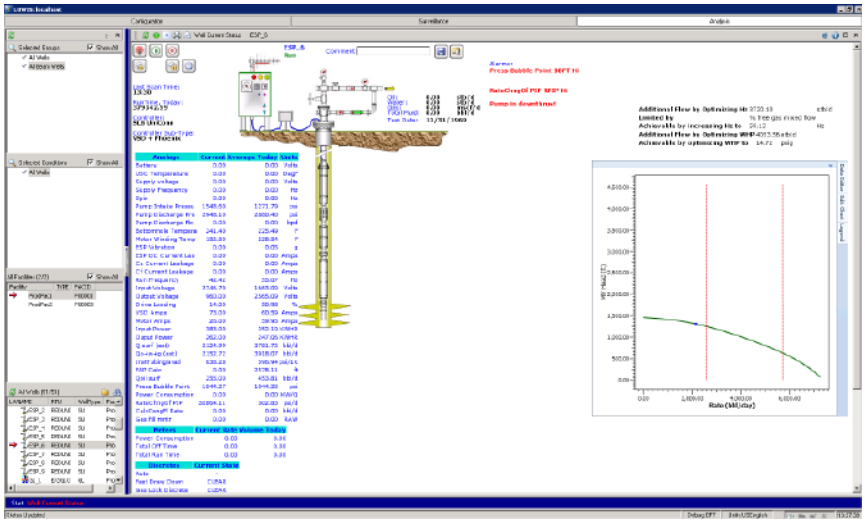
ESPs are complex and costly tools often placed in dynamic well environments, creating a crucial challenge to keep both the well and pump operating efficiently. An optimized ESP well not only steadies production in a changing well, but also maximizes the life of the pump itself. For optimal performance, it's essential to monitor and analyze ESP wells, including performance variables such as pump intake and discharge pressures, the gas-to-oil ratio and water cut.

The AWB for ESP combines monitoring with a detailed nodal-analysis model to provide a comprehensive range of capabilities, including well-model tuning, calculating flowing bottomhole pressure, measuring the amount of gas entering the ESP and determining an optimal operating point. This data is presented graphically to provide a wealth of information on ESP performance.

The application's intelligent alarms alert users to gas lock, recirculation issues, broken shafts and ESP wear. These alarms enable asset operators to manage an ESP well proactively, increasing operational efficiency and extending the life of the well and pump.

Functions

- Surveillance of flow rate, pump intake pressure (PIP), pump discharge pressure (PDP), amperage, vibration and associated simple alarms
- Detailed analysis, including pump wear, incorrect sizing, depletion, skin, water-cut changes and emulsion
- Numerous built-in intelligent alarms, including fast drawdown, gas lock, high-temperature shutdown warning, overload and underload shutdown warning, pump intake plug, high and low casing choke differential pressure, reverse rotation and broken shaft



The AWB for ESP enables users to determine pump performance in real time.

Advantages

- Performs nodal-analysis-based calculations
- Generates simultaneous analyses of inflow, outflow and pump performance curves
- Identifies and determines causes of underperformance

Analysis Workbench

Gas-Lift Wells

Gas-lifted wells often need more frequent optimization analysis due to changing well conditions. Until now, the integration of real-time operational information with model-based diagnostics meant maintaining and accessing multiple systems, which created a labor-intensive manual workflow.

The AWB for gas-lift wells seamlessly integrates real-time information with analysis in a unified platform. Operators and engineers across your enterprise share the same information within a single system, eliminating the need to find and correlate data from disparate sources.

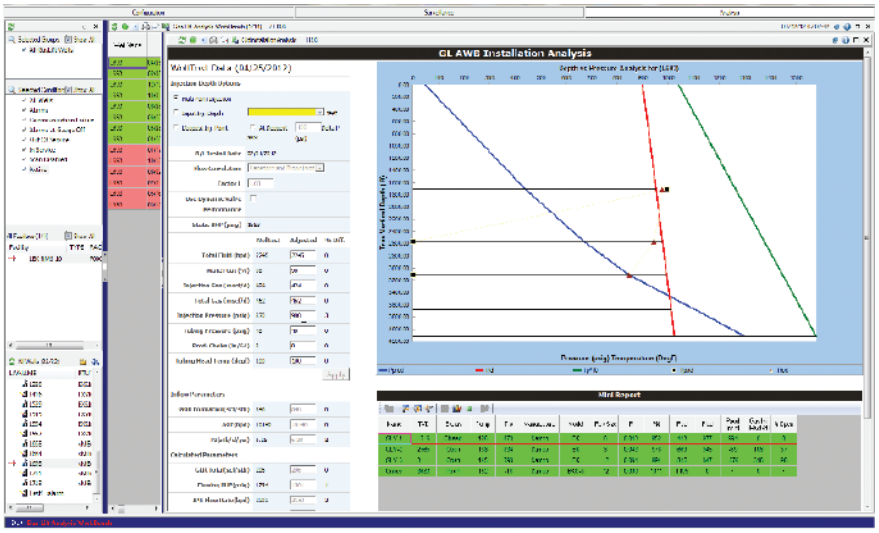
The application provides a platform for multiple disciplines to collaborate globally for well reviews, detailed analysis and optimization. The AWB for gas-lift wells also includes applications to identify shallow or multi-point injection tubing leaks and other inefficiencies to allow for informed engineering decisions.

Functions

- Single information source for operations monitoring, well engineering and optimization
- Displays both diagnostic and operational alarms in real time
- Advanced gas-lift valve modeling for more accurate performance

Advantages

- Continuous analyses accommodate changes to well characteristics, allowing producers to react to operational situations including declining production.
- Integrated intelligent alarms enable operators to prioritize workflows, ensuring timely servicing and a stable and reliable group of assets



The AWB for gas-lift wells enables users to perform well test analysis with valve diagnostics.

Wyoming, USA

330 ESP WELLS
MONITORED USING LOWIS SOFTWARE

INCREASED PRODUCTION
700 BBL/D

Analysis Workbench

Progressing Cavity Pumps

Real-time optimization of PCP wells is a collaborative effort among multiple disciplines, typically requiring the use of several data systems. The AWB for PCP wells is a platform to bring together your people and data into a single real-time environment.

The AWB enables analysis, optimization and improved production of PCP-operated wells by using real-time data integrated with engineering-model-based information. This integration platform allows for immediate identification and diagnosis of production problems, enabling well engineers to take quick corrective action in advance of a production-impacting event.

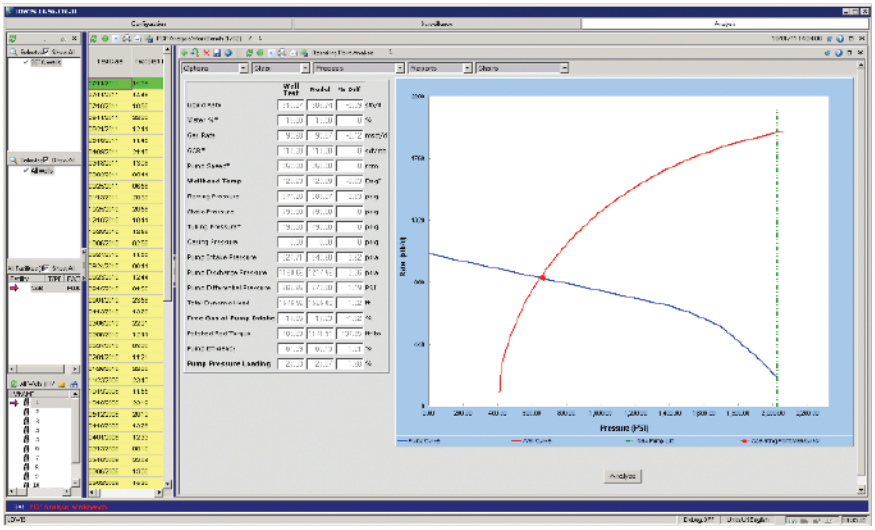
The AWB for PCP supports production in even the most difficult environments, including cold heavy oil production with sand, heavy oil and coalbed methane.

Functions

- Batch-oriented, automated analysis to compare field-wide performance
- Nodal-analysis based modeling using pressure profile optimization with real-time production data

Advantages

- Enables management of a field-wide 24-hour production plan, identifying candidate wells that provide the greatest potential for increasing production based on well productivity and equipment limits
- Provides intelligent alarming based on analog pattern recognition to identify potential failures
- Supports comparative analysis monitoring of measured versus engineered operating conditions
- Identifies wells with the highest deviation between monitored performance and calculated performance



The AWB for PCP provides comparative monitoring of measured and engineered conditions.

WSM Well-Service Manager

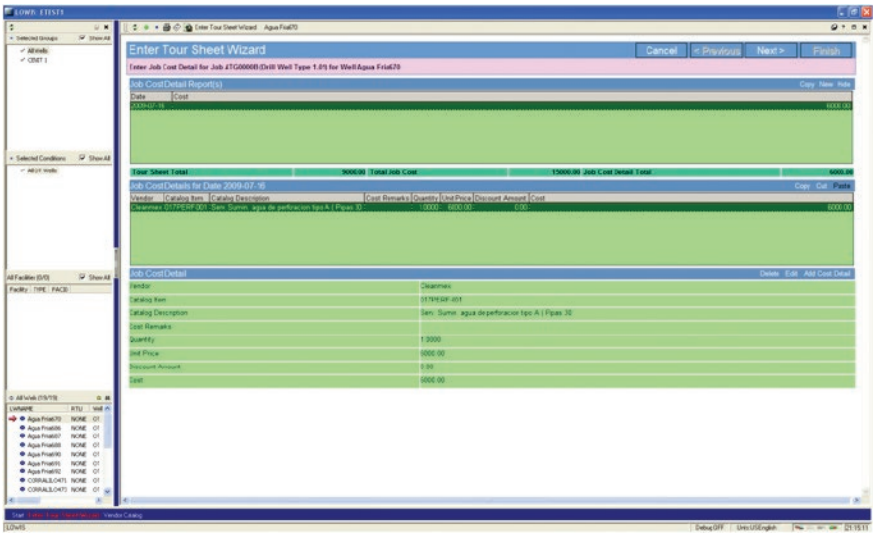
Servicing a well is costly in time, production and capital. The WSM (well-service manager) enables users to manage and optimize well services, including efficiently scheduling services, ensuring the thoroughness of jobs performed and reviewing the frequency of repairs throughout the life of the well.

The application delivers utilities for planning, scheduling and evaluation of all well services, ranging from surface project to more complex downhole remediation.

Intended for a wide range of personnel, including third-party rig crews, production planners and management, the WSM application creates a collaboration environment for all users. The module presents histories in comparative graphs, web reports and scorecards, providing a tool to analyze operational issues, understand cost drivers and determine best operating practices.

Scorecard analyses include:

- Annual costs for tubing and rod failures
- Number and cost of acid jobs completed with individual and annual detail
- Annual number and total associated costs of pump failure workovers
- Analysis of service company performance on any job, including detailed crew and supervisor information
- Number of workovers and costs trended over time



The WSM Enter Tour Sheet Wizard enforces company approved work flows to ensure accurate data entry.

Argentina

190 PCP WELLS ANALYZED
DURING THE FIRST 12 MONTHS OF USING LOWIS™ SOFTWARE

200 BBL/D
INCREASED PRODUCTION

70 PERCENT
REDUCED DOWNTIME

The Weatherford *LOWIS* life-of-well Information software can increase production and lower lifting costs in any type of asset. For more information about how it can work for you, contact us at **po-info@weatherford.com**; or call your authorized Weatherford representative.

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