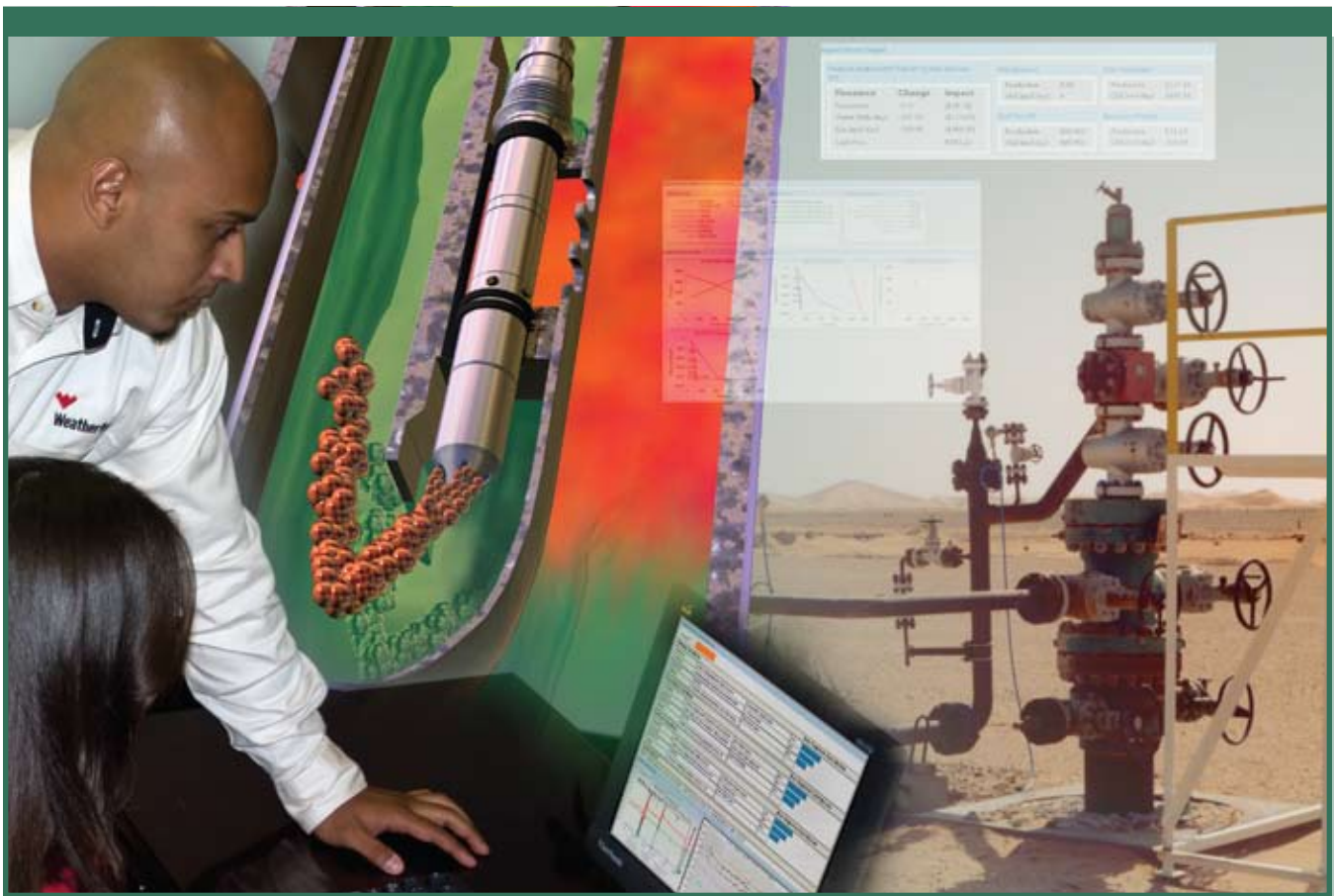




**Weatherford**<sup>®</sup>

# WellSavvy<sup>™</sup> Artificial Lift Real-Time Diagnostic Software



Diagnose downhole conditions using the latest well test data in conjunction with real-time well data and a knowledge base of skilled gas lift experts.

# WellSavvy Artificial Lift Real-Time Diagnostic Software

## Applications

- Analysis of large number of wells without human intervention
- Provides choices with probable accuracy when data is unreliable or inaccurate
- Real-time gas-lift performance diagnosis
- Well optimization candidates identified in seconds from any number of wells with management by exception technique

## Benefits

- Reduces daily workload to free engineers for optimization activities
- Completely automated continuous diagnosis of gas-lifted wells
- Handles large amounts of data
- Knowledge base expands through machine learning process for the most accurate detection of the root cause of underperformance
- Associative memory enables the system to become “smarter” or “get used” to a particular field operating condition and its specifics
- Constantly provides recommended remedial actions
- Automatic economic impact analysis
- Management-by-exception status display

Technology in the oil and gas industry has been growing at an exponential rate for decades. Recent trends have job-specific computer programs replacing manual calculations and spreadsheets for analysis. However, with the proliferation of real-time data monitoring systems, large amounts of data can be overwhelming to use. As real-time data monitoring expands in detail and purpose, operators find the need to properly store, organize, and analyze large amounts of data in an effective way.

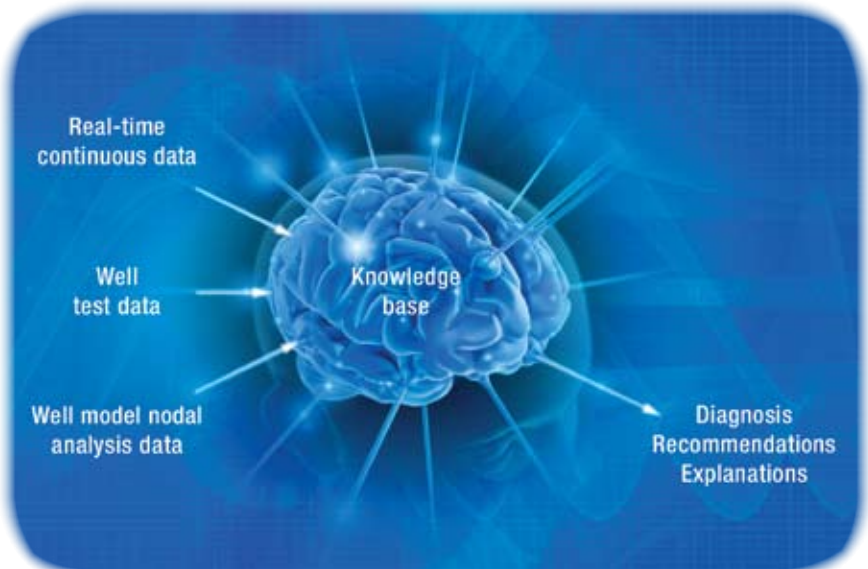
Merely adding more analysis programs does not provide what well engineers need to operate more effectively. They require an optimization tool to accelerate what they do best—performing a detailed analysis of wells in a reasonable time using all available data. That is where *WellSavvy* software is invaluable. It offers the ability to identify non-obvious trends in large amounts of data based on prior observations—much like a production optimization expert would do in real life. The result is hundreds or even thousands of wells analyzed accurately in seconds, even when data is incomplete or partially inaccurate.

## How Does It Work?

In the gas-lift domain, production data is used to carry out optimization at three levels:

- Well-by-well, detecting downhole problems
- Field-wide, calculations of optimum lift gas allocation to a group of gas-lifted wells
- Real-time, where the calculated optimum allocations are fed back into the control system for lift gas set points for each well

Of the three methods described above, well-by-well optimization generally provides the greatest benefit for the least amount of cost. *WellSavvy* software places most of its emphasis there using real-time and historical data to derive problem solving scenarios and their relative probable accuracy.



*WellSavvy* software is built on a principal of Digital Engineers, which perceive and act on environmental conditions. It is autonomous in its behavior in that extensive calculations and analysis can be done without human intervention. That means

that an entire field's wells can be analyzed overnight and ready for morning evaluations. The program partially depends on the scenarios occurring in the fields which means it can be trained for unique well conditions. It focuses on well-by-well optimization and performs the following tasks:

- Continuously monitors wells
- Diagnoses problems in the artificial lift system
- Recommends courses of actions to confirm or correct the problem
- Explains the recommendations with information consistent with a gas-lift expert's "mental model" for problem solving

The knowledge base incorporates various data and analyzes them in a very organized way. The result is a system that processes the data much like an engineer would. The difference is the *WellSavvy* application can do the analysis much faster.

## Why Use WellSavvy Software?

The *WellSavvy* program performs advanced analysis that normally takes hours or days in seconds. That means field engineers and operators are able to spend their time prioritizing well activity such as redesigns and repairs so that the most profitable actions are taken first. The software helps there too. Management-by-exception (MBX) allows the user to sort results by predefined parameters so the most urgent issues are immediately displayed at the top of the list or designated by specific color codes. The user configures the display by designating which ranges of results constitute alerts. Additionally, automatic economic impact analysis allows quick detection of optimization opportunities.

The key to the analysis system is a knowledge base that was developed by experienced artificial-lift engineers over several years. The wealth of knowledge is captured within the program and used more efficiently than the data could be used by an engineer. The gas-lift knowledge base has been constructed using a set of all possible conditions. For each condition, a number of key attributes is calculated and presented. Attributes can be obtained using values collected in real time from the wells or through the result of some calculation, such as system analysis. In general, this set of attributes represents an over-defined system; meaning that multiple diagnostic techniques are used to generate answers to the same question. By developing this knowledge base in an over-defined manner, it is possible to arrive at the correct answer even when data is incomplete or partially inaccurate.

Beyond rapid analysis, the knowledge base also contains an associative memory that enables the system to become "smarter" by accommodating characteristics of the particular field's specific operating conditions resulting in an increasing degree of accuracy as the tool is used. Based on the operating conditions and analysis, the software constantly provides recommended remedial actions.

## Using WellSavvy Software

*WellSavvy* software provides a consolidated screen to quickly see which wells require attention (Figure 1). Additional information is a mere click away. Second and third probable causes are easily available by clicking on the individual well (Figure 2). Drilling deeper reveals more details such as uplift potential; cash flow potential; percent deviation from the last well test; GOR; GLV type and well status, active or inactive (Figure 3), are all available for a more thorough evaluation.

The screenshot shows a software interface with a data table. The table has multiple columns, including well identifiers, status indicators, and various numerical and text-based diagnostic metrics. The rows are color-coded: a top section is red, indicating high priority or urgent issues; a middle section is yellow, indicating medium priority; and a bottom section is green, indicating low priority or optimal conditions. The interface includes a standard Windows-style menu bar at the top with options like File, Edit, View, and Help.

Figure 1—Management by exception identifies priority wells for urgent action.

