Ambyint

Production Optimization at Scale

Part 1: Plunger Lift Automation - A Diamond in the Haystack

Brian Arnst, Ambyint
Ferdinand Hingerl, Ambyint
David Crosby, Shale Tec LLC

2500 Summer Street, SUite 1100, Houston TX 77007
1440 Aviation Park NE #119, Calgary, AB T2E 7E2
+1 800 205 1311 | www.ambyint.com

A new reality for E&P companies set in during the past month with natural gas prices hovering around $1.70/Mcf. Some companies hedged production at higher prices for a limited time but after that, all are at the mercy of market pricing. Drilling capital has been slashed and production from many existing gas wells is declining by at least 7% per year.

As these wells age, they are more likely to experience issues that negatively affect production. Dedicated production teams work to spot these issues – yet the repetitive process of individually scanning hundreds of wells a day, day after day, is not efficient. Leading indicators of future problems and opportunities for improvement are easily overlooked. Also, due to the number of wells and repetitiveness of the process, operators struggle to remain vigilant each day, day after day. Reducing headcount would lower costs, but put the teams even further behind in optimizing production.

And yet, optimization remains imperative to success. Numerous recent success stories document significant lifting cost ($/mcf) improvements when basic plunger lift principles are applied to a defined number of wells by knowledgeable people. If those successes are true for a controlled number of wells, it seems logical the same results would be possible for an entire field. Operators are asking, “How can my team find the production diamonds in the haystack while reducing operating cost? How can we dramatically slash lifting costs?”

If this scenario rings true for your organization, there is a way for you to find those diamonds. It starts with truly understanding the root cause of optimization, and letting people do what people do best and machines do what machines do best.

A Day in the Life

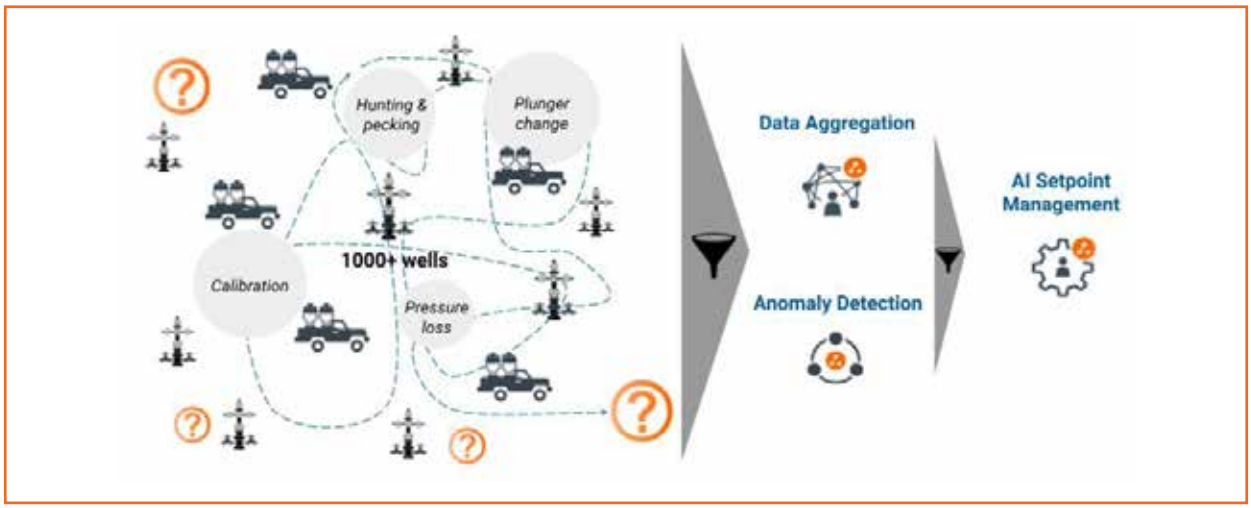
Production teams have been thrust into the spotlight during the past month. With fewer (or no) new wells coming online, every barrel, every Mcf, every hour of downtime matters more than ever to the company’s bottom line. Every engineer, technician, and lease operator must look after increasingly more wells at the same time that the benefits of optimizing production are more important than ever. Well optimization has now become a top priority – but production engineers’ toolbox has not seen an upgrade in decades.

Current industry production software and tools are generally legacy technology developed in the 1990s or earlier. This aging and increasingly limited resource requires manual and time-consuming workflows – none more so than plunger lift where optimization means finding a distinct set of setpoints across dozens of categories to maximize production. That alone would be difficult enough but seemingly insurmountable when considering volatile horizontal wells that require daily attention and tweaks by technicians and engineers responsible for hundreds of wells.

At the same time, the tools available to production teams include SCADA screens, production accounting programs, and a series of spreadsheets. While these methods are effective at collecting data, the task of making optimization decisions remains a time-consuming, manual process. A user must combine data from all of these sources, using bits and pieces from each to drive an optimization decision. This heuristic methodology relies almost exclusively on the analyses and decisions of smart, well-trained people and their practical experience.

Traditional software and tools simply do not provide the ability to perform all the diagnostic and optimization tasks needed to keep wells producing near the natural decline curve while controlling operational costs. Ultimately, optimization suffers, and many items simply fall through the cracks. As a result, more than 80% of wells are operating inefficiently, according to our internal analysis of empirical data from thousands of onshore wells.

Resolving these difficult circumstances requires more than pushing raw data to the user; instead the goal must be to provide engineers with insights they can readily understand and apply. This solution uses the machine to do what it does best – all the processing and calculations – and do it all the time. When the machine reaches a determination, that information is provided to engineers and optimizers so they can quickly make a well-informed, strategic decision, allowing humans to focus on what we do best – critical problem solving.



Machine data algorithms help solve operations challenges through anomaly detection and building to setpoint management

Needle in the Haystack: Opportunities in Production

In supporting optimization measures, the engineer's challenge starts with sifting through mountains of data and attempting to identify and describe production anomalies. This needle-in-the-haystack approach becomes increasingly difficult as more wells and data from the field are added: while the haystack gets bigger, the needle looks the same, and the diamonds become harder to find.

Machine data algorithms search the haystack to find the needle and present it for engineering review. Eliminating the inherent problems of manual data searches allows engineers to focus on optimizing production instead of sifting through the haystack.

Using today's tools, an in-depth search of every well in the field to detect "needles" and "diamonds" simply is not possible.

Much of the industry's technology efforts focus on achieving significant advances in drilling and completing the well. Increasingly, that emphasis is shifting to production operations, as E&P companies seek new efficiencies and revenue over the life of the asset.

In contrast to drilling and completion operations, production optimization is a long-term undertaking that involves many processes and teams over the life of the well and field. The solution for this complex challenge demands operational efficiency.

More than SCADA

Today's SCADA systems gather and present data to an operator. The operator is responsible for sorting through the data (often hundreds of wells per person) to find the needle, or even a diamond, in the haystack. This process is repetitious, time-consuming, and prone to missed opportunities. The current tools cannot provide the level of support needed to make sense of increasingly large volumes of data.

A well – established mental model of what 'good' performance looks like is required by the operator to assimilate the data, reach conclusions, and make decisions – and do it in a reasonable amount of time. As personnel, well ownership, and a multitude of other variables occur over the well's life, it is an unreasonable expectation for individuals to develop and retain intimate knowledge of each well over a period of many years.

The human decision-making process, based on traditional data, is not scalable. More wells and more data limit the ability of an operator to ascertain rational decisions for ALL wells, ALL the time. As a field's population of plunger-lift wells increases through mergers, acquisitions, drilling, or conversions, the scale of operation can increase dramatically. The growing number of wells strains resources and makes it nearly impossible to continue staffing the field with experienced operators capable of effectively overseeing several hundred wells per day. E&P companies are faced with the arduous tasks of locating, hiring, training, motivating, and retaining junior operators. The actual costs and production lost associated with this approach is rarely tracked, yet exorbitantly high. A paradigm shift is required to provide limited personnel the ability to optimize an increasingly large number of wells. Analyzing large data sets from an increasing number of wells is a task well suited for computers, and not well suited at all for people.

Plunger lift software developed by Ambyint presents field – level insights to operators in an actionable format. Searching for needles and diamonds in the haystack is no longer the role of the operator, as that task is efficiently accomplished by computers. With the computer providing real-time, meaningful insights to well performance, operators now can spend their time making critical decisions related to problem solving and production enhancements. Additionally, Ambyint's algorithms stabilize and then optimize production for many wells – allowing operators' more time to manage wells that may behave in nontypical fashion.

Starting with insights

Optimization demands a process that begins every morning by identifying and prioritizing the needles in the haystack. Out of all the data evaluated, what are my priorities? What needs attention first? Which wells do I spend time on that will have the biggest impact on production? Which wells display leading indicators of future problems?

This workflow puts all of the cognitive load and complexity on the end user, whereas Ambyint believes modern software should take on the complexity and provide the user with a simple, user-friendly workflow that starts with insights.

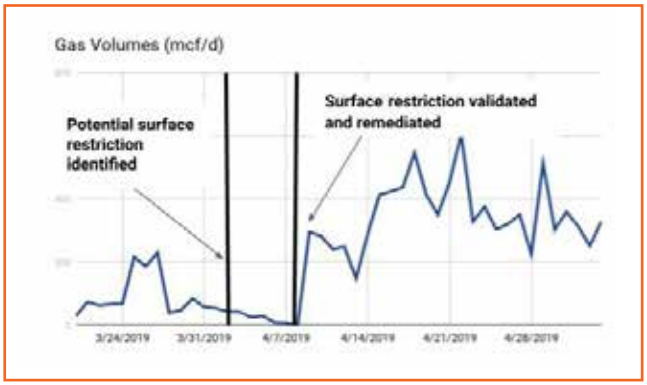
Cloud Computing

Cloud computing puts virtually unlimited computing capabilities at the operator's disposal. AI and machine learning are able to process a wide range of data points, so the human has to focus only on critical tasks.

With cloud computing, Ambyint technology automatically sorts and analyzes very large volumes of data in real time. Patterns and priorities are then applied based on the operator's specific criteria for the field. These criteria may be standard variables, such as production rates and pressure, or specific use cases tailored to the field and operator objectives, such as detecting paraffin problems.

Anomaly Detection

At Ambyint, our anomaly detection process relies on two basic sets of data – the physical data that is coming out of the well, and a contextual data set that considers how the operator conducts operations, available manpower resources, well locations, and many other details to prioritize and organize day-to-day well management.



A plunger lift optimization technology with cloud-based AI and analytics used anomaly detection hasten remediation of problems degrading production.

Anomaly detection starts with data about the well and completion design. Once these fundamentals are defined, Ambyint's algorithms continuously scan customer data, applying AI and a full physics engine to characterize the well's performance.

This first step identifies wells that have anomalies, which eliminates the daily search for needles in the haystack. The wells that need attention today are immediately presented on a single software screen. This detection is focused on the most common issues in plunger wells that can lead to bigger issues if not resolved. Equally critical, the software further identifies anomalies in terms of what can be automatically fixed (i.e., setpoints or remote changes), and where human intervention is required (e.g., a

mechanical surface issue or worn plunger that needs replacement).

Starting the day viewing an intuitive dashboard visually depicting well performance as well as anomaly detection for every well allows for the effective dispatch of work, proactive issue resolution, and more time to address additional critical operational tasks.

There are about 15 standard anomalies that are detected without need for customization. In addition to these global anomalies, customers can also label data to identify specific and unique anomalies, such as those that lead to hydrate formation. Using data collected from the field, we work with the operator to build a specific use case for their application.

Surfacing anomaly insights saves valuable time by revealing on one screen which wells need immediate attention.

These advances in anomaly detection describe a new opportunity for optimizing plunger lift operations that far exceeds the limited, needle-in-the haystack approach of legacy methods. Advanced software using AI and machine learning provides the ability to find the diamonds in the haystack. Operators are freed from anomaly searches and daily well tuning for typical wells, enabling more time to engage in profit-enhancing activities across the field during the life of each and every well. Part II of this series will examine how margins are improved at scale with AI-powered optimization achieved using

Ambyint production surveillance technology.
Brian Arnst is a product manager at Ambyint
Ferdinand Hingerl is the lead data scientist at Ambyint
Dave Cosby is founder of Shale Tec LLC