

# SCADA - is not enough!

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In 2016, Shale Tec LLC published an article on LinkedIn titled “SCADA – Do I Need It?” The below is an update – again, focused on plunger lift applications for oil and gas wells.

SCADA is an abbreviation for “Supervisory Control and Data Acquisition”. In essence, it’s the ability to view well site data and make changes to certain settings from a remote location. Some use the term telemetry, remote surveillance and even automation when referring to SCADA.

Plunger lift is an artificial lift type used to remove water from gas wells and oil from gaseous oil wells. For capable wells, plunger lift is one of the most economical artificial lift types known. Installation, maintenance and operational costs are exceptionally low when compared to other artificial lift types. As discussed in the prior article, when plunger lift is complimented by SCADA, significant benefits exist.

## **Yet, is it enough?**

To realize the benefits of SCADA implementations on plunger lifted wells, three basic elements are imperative. Without these elements, the benefits of SCADA are limited.

First, the data collected at the well site must be recorded at a frequency that allows operators to define trends and spot abnormalities. Note that the rate at which a controller samples data to determine when a set point is reached can be significantly different than the frequency at which the data is recorded in the controller. For plunger lift, the data recorded is typically casing pressure, tubing pressure, line pressure and flow rate. Events such as motor valve open / close and plunger arrival at the surface are also recorded. If the time interval for collecting data is set too long, trends for pressure build rates and flow rates may not be identifiable. Precision well tuning is not possible.



Additionally, if data is collected at extended time intervals, abnormalities such as leaking motor or dump valves, surface restrictions, worn out plungers, etc. might not be visible in the recorded data. Conversely, if the time interval is set too short, massive amounts of data collected can be difficult to transmit to the remote server and manage once received.

A good starting point is to record data at the well site at 1 minute intervals, then transmit that data back to the remote server before operators begin their shift, and maybe once or twice during their shift. Suspect wells requiring additional diagnosis can be continuously polled for short time periods as needed. Generally, data recorded at 1 minute intervals exhibits sufficient resolution to optimize and troubleshoot most plunger lifted wells.

Secondly, the data collected should be presented in a manner that promotes good decisions. Prior to SCADA, operators drove to well sites and viewed the plunger rise velocity on the last 5-10 plunger cycles. Based on this limited data, operators adjusted open or close times to optimize plunger rise velocity.

When data from SCADA systems are presented in a concise format, operators observe how controller settings affect production from cycle to cycle. Viewing controller settings, plunger fall time vs total close time, liquid load, lift pressure required vs actual, plunger rise velocity and gas produced on every cycle provides invaluable insight to optimize controller settings.

We know wells produce more when operated at a low flowing bottom hole pressure. For plunger lift, that means lifting a small amount of liquid on each plunger cycle, using a small amount of casing pressure - and making as many plunger cycles a day necessary to remove the available liquid from the well. Properly designed SCADA screens should lead operators toward controller settings that drive the well to the lowest flowing bottom hole pressure practical.



If all possible data and combinations of data gathered by SCADA systems are displayed on an HMI (human to machine interface) screen – it's very difficult to zero in on what data is important and what data is just a distraction. SCADA screens can be designed with too much or too little data - both are equally limiting. Each SCADA screen and data point presented should convey specific, actionable information promoting good decisions by well optimizers.

Designing effective SCADA HMI screens is not a simple task. It requires a deep understanding of the work required. Pascal Dennis, in his book *"Getting the Right Things Done"* states *"A problem is an abnormality, a deviation from a standard. If we can define 'what should be happening' and 'what's actually happening' – then we have problem consciousness. We're in the game. If not, we're lost."*

A good starting point to achieve "problem consciousness" is to create "standardized work" for well operators. "Standardized work" is a term broadly discussed in lean manufacturing literature. A way for us to begin to create "standardized work" is to define a work flow for operators. What is the best process for an operator to optimize a well – from the point he/she arrives at work in the morning, reviews well performance, prioritizes activities for the day and implements corrective action. Once consensus is achieved for an operator work flow, SCADA HMI screens can be created to support that process. The work flow should be followed by all and only modified once a better process is identified, tested and proven.

As an example, if an operator is responsible for a field of plunger lift gas wells, his/her morning routine (workflow) might look something like this:

1. Arrive at work. Log into SCADA system.
2. Look at a well summary screen to determine for the past 12 hours:
  - a. Which wells, if any, indicate unsafe operating conditions
  - b. Which wells, if any, indicate wells that shut-in over night
  - c. Which wells, if any, are producing less than the production target
  - d. Which wells, if any, are missing plunger runs



- e. Which wells, if any, have slow or fast plunger runs
  - f. Which wells, if any, display malfunctioning equipment
  - g. Which chemical tanks, if any, are low and need refiling
  - h. Which water or oil tanks, if any, are nearing full
  - i. Which wells, if any, have maintenance due
  - j. Which well sites require a weekly inspection
3. Once wells requiring intervention are identified, operators may establish priorities based on:
- a. Wells operating in an unsafe condition
  - b. Wells that shut-in overnight
  - c. Wells producing below the production target
  - d. Wells exhibiting leading indicators of future problems

As a work flow is developed (which will require multiple iterations and input from lease operators, foremen, superintendents and engineers) “waste” should be avoided. Lean manufacturing literature defines waste as anything that does not add customer value. All 8 forms of waste defined in lean manufacturing literature may not directly apply to operating gas wells – yet these four should be considered – DEFECTS (reprocessing, inspections or correcting work), WAITING (processing delays, downtime, bottlenecks, no parts), MOTION (human movement that are not necessary), SKILLS (underutilizing talents, skills or knowledge).

Finally, operator behavior must align with the defined work flow. Training alone is not enough. The training must translate to learning, learning to behavior, behavior to habit. Steven Covey in “The 8<sup>th</sup> Habit” defines a habit as the intersection of Knowledge, Attitude and Skill. If any are missing, the desired behavior will not be sustained.

Consideration should also be given to skill levels and pay scales as operators gain expertise in optimizing plunger lift wells. At an entry level, operators should have a basic understanding of well safety, controller operation, abnormality detection and basic well optimization. A level two operator would have advanced troubleshooting skills using tools such as Echometer, and be able to handle a greater number of wells. A level 3 operator would have the expertise to train and oversee others.



If the above discussion is appealing to your organization and different than current practice, accept the fact that change is often resisted - except, of course, in the case of air conditioners, color TVs, cell phones, flavored ice cream, etc.

Pascal Dennis, in “Getting the Right Things Done” advises that **improvement occurs when there is a compelling need for change - and to change culture, change management behavior**. He also states that roadmaps and metrics keep us moving along the desired path. Key metrics for plunger lift may include % of wells producing on the natural decline curve, total well production time vs total available time, operator time per well, contract labor costs, overtime costs, lease operator costs, % of maintenance tasks performed on time, etc.

Finally, it’s interesting to ask - **What’s beyond SCADA?** Many are now familiar with the buzz words “*data analytics*”. Some have observed this methodology applied to plunger lifted wells by firms such as Kelvin Inc., eLynx Technologies and Ambyint. Effective application of techniques associated with advanced machine learning, artificial intelligence and data analytics to plunger lift requires an in-depth knowledge of plunger lift. Ultimately, our core objective is to maximize production while cycling the plunger at a velocity that does not damage equipment. Using these tools to solely control plunger rise velocity will often undershoot this objective.

While not overly familiar with some of the companies actively working in this field, I am familiar with the efforts of Ambyint. Their approach focuses on a creating a scalable system that provides operators a concise list of wells exhibiting known abnormalities so that the root cause can be corrected before production is lost. Next, Ambyint is blending plunger lift physics with machine learning to autonomously optimize oil and gas wells. This is an intriguing approach that offers significant upside to the plunger lift industry! If you are interested in more information regarding Ambyint and plunger lift, please contact Brian Arnst ([brian.arnst@ambyint.com](mailto:brian.arnst@ambyint.com)).



And, if your team could benefit from a deeper understanding of plunger lift, contact Shale Tec LLC ([info@Shaletec.com](mailto:info@Shaletec.com)) to schedule a 1-day plunger lift class for lease operators, a 2-Day comprehensive plunger lift course, a 1-day workshop – or to discuss how Shale Tec LLC could help your team improve production and reduce costs on plunger lifted capable wells.

Remember –

*“Problems are nuggets to be mined, and not garbage to be buried.”*

Pascal Dennis

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