Artificial lift management simplified

The novel use of pump motor speed enables robust remote monitoring and management of artificially lifted wells.

Jennifer Presley, Senior Editor, Production

The continual innovation of artificial lift technologies has transformed marginal wells into reliable and profitable producers. Technology companies bring to the market their own specially designed solutions guaranteed to bring more uptime and dollars to the operator's bottom line. Like many of the remote well monitoring systems available, the Smart Pumper unit seeks to optimize production of artificially lifted wells while keeping costs low. However, to accomplish this, the Smart Pumper takes an approach different from the rest.

Looking for an affordable solution

Developed by Houston-based Direct Drivehead Inc., the Smart Pumper is billed as a universal platform capable of controlling any pumping device using electric and/or hydraulic motors from 5 hp to 1,000 hp. According to Greg Boyles, CEO of Direct Drivehead, the patent-pending pump motor speed control is based on actual fluid level in real time to the specific target the user wants to reach and maintain. The Smart Pumper serves as a master controller and monitoring device for electric submersible pumps, progressing cavity pumps, pumpjacks, and other pump devices including their facilities.

The system was initially developed by Boyles for use in heavy oil wells in Trinidad.

"As a producer of marginal wells, I found that in the past there was not an affordable automation solution for marginal wells," he said. "There were products available that one could piece together in an *ad hoc* manner to monitor pumping systems, but you'd find in the end that the cost could not be justified and remote pump control based on actual fluid level was not available."

To meet his need for a cost-effective and reliable solution, Boyles went to the drawing board.

"We built a computer and automated our wells in a way that nobody else was offering. In fact, in our patent search we were surprised to find that the concept of pump motor speed control based on real-time fluid level to a specific target, which in my view is the most

critical way to operate a well that has to be pumped, had not been addressed."

Smart Pumper specifications

Smart Pumper is a "plug-and-play" programmable logic controller that requires no step-ladder programing; however, optimization engineers can add to the many software drivers that already exist to make using it as user-friendly and easy to set up as possible, according to Boyles. Running on a 24-volt DC power supply, the system can control any type of variable frequency drive (VFD) and any form of artificial lift. The built-in two-way global communication uses cellular, radio, and satellite technology to bring well data and control to a desktop within seconds of turning it on.

"The system doesn't require communication or SCADA support groups. We tried to build this like your laptop," Boyles said. "When you install a new printer on your laptop, the print drivers automatically begin loading, so you can use the printer without needing to call a computer specialist to help set it up. Your IT team will find it's simple to use, but if you don't have an IT department for this application, you'll find you don't need one.

"In the case of oilfield communication, we have to be really flexible because you don't necessarily have the same cellular provider in all the places of the world," he said. "So we included communication drivers for all of the networks that support Smart Pumper such as Rogers Commu-
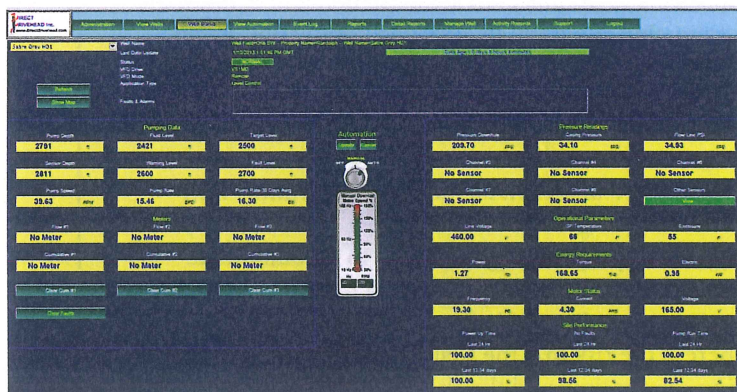
Data collected by the Smart Pumper are displayed on the well status page that operators can access through their dedicated website, where they can monitor and control wells remotely through a private secure network. (Images courtesy of Direct Drivehead Inc.)

A Smart Pumper automation system for a 70-hp saltwater disposal facility was installed in the Eagle Ford shale. The Smart Pumper intuitively determines injection rate to match tank inflow from multiple wells for continuous precision pumping while maintaining the specific preset tank level.

nication in Canada; Sprint, Verizon, and AT&T in North America; and in South America, Digicel and Tellus."

The system also supports European bandwidth, so any country's network will work with it. "You can switch the Smart Pumper from a North American/US network band to a European band with the push of a button, and it reprograms itself for you. So from a communication standpoint, it's very flexible and can be switched over to a radio frequency where there's no cellular coverage," he said.

The unit is programmed locally using the LCD display and keypad or remotely through the Web. Equipped with eight analog channels, the system supports all A-D sensors such as those for pressure, temperature, vibration, water quality, and gas monitoring. The system contains eight digital inputs for exotic sensors and four pulse counters for metering. It can convert four channels from digital to analog input. Boyles said the various VFDs the system manages are controlled and monitored through 485 Modbus, and hydraulic systems are controlled through voltage signals to a proportional valve.

Within a few seconds of installation the operator can begin to control and monitor its well and make adjustments from the Web-based interface from authorized laptops, tablets, or smart phones. According to Boyles, the data are collected every 10 minutes by the Smart Pumper server located in Dallas.

"We provide the server interface at no charge during piloting and ultimately load the Smart Pumper software onto the user's server for privacy and security reasons as required," he said.

With more than 35 customizable reports available to choose from, the Smart Pumper provides the flexibility needed to optimize production and reduce lifting cost. The data collection format is in Microsoft SQL with reports downloadable in table, Excel, and graph formats.

"With just a few flat-screen TVs on the wall and a couple of desktops, you can create an impressive control room environment where engineers can set operational parameters, control, and study the wells being managed by the Smart Pumper for very little money. With this, we quickly summarize the status of multiple wells from multiple leases to identify where we need to focus our effort each day," Boyles said.

Field successes

The system has been deployed and has experienced success in a variety of regions and climates. For example, the system was first field tested in the tropical forests of Trinidad and the desert plains of West Texas. Trinidad's Parryland field was selected because it consists of an extremely difficult-to-produce heavy oil reservoir with sanding and other dynamic reservoir conditions that can change inflow rapidly. The Orla South field located in the high desert plains of West Texas was selected because of its remote location and the drastic temperature swings in the summer and winter.

In each location, according to the company, the Smart Pumper matched pump output speed with wellbore inflow over time to achieve and maintain the fluid level selected until the pumps wore out from long-term normal use. The automation eliminated human error, which typically occurs due to efforts to optimize production without sufficient data; the 35-plus data logged input proved to be invaluable.

Planned enhancements

According to Boyles, expanding the capabilities of the Smart Pumper system is made easier because the manufacturer and programmers are all in Texas. Software development, assembly, and testing are conducted at the Direct Drivehead facility in Houston. "Today, Smart Pumper controls more than eight different VFD lines, from ABB, Baldor, and Allen-Bradley to Santerno," he said. "This quarter we are adding three more: KEB, Fuji, and the WEG VFD. Because the hardware and firmware development team are here with us, responding to customer needs and wants is a pretty quick thing for us to do." E&P