Pushing up the range of options

As operators seek to optimise production in a cost-cutting climate, oil services giant Schlumberger has responded by ramping up its artificial lift offerings, as Jennifer Pallanich reports.

Oil prices are down, rig counts are low, and operators are looking to keep cash flowing so they can pay down debt or fund further drilling.

“With the price of oil crashing and market dynamics the way they are, clients are seeking to improve financial performance,” says Kyel Hodenfield, president of artificial lift for North America at Schlumberger. “Some clients have stopped drilling completely, while most have pared their programme down quite a bit. Nearly all of them are focusing on optimising production from existing wells.”

Optimising production often relies on various methods of artificial lift. While Schlumberger has offered a family of electrical submersible pumps (ESPs) and gas lift, the company until recently did not offer low-volume pumping solutions.

Schlumberger went on its rod lift acquisition spree starting in mid-2013 to address the scope of challenges presented by unconventional wells. Within 18 months, it had purchased 16 smaller companies with good client lists and expertise in different geographic basins. The purchases included companies that manufacture, supply, distribute and install surface beam pumps, sucker rods and sucker rod pumps, as well as a progressing cavity pump company.

Hodenfield says Schlumberger has retained the management, expertise and local content of the acquired companies.

“Unconventional wells have proven to be a challenge across the board, from drilling to completing to fracturing,” he says. “The challenges for artificial lift are even more drastic.”

Production levels for unconventional oil and gas wells in North America can decline between 50% and 80% in the first year. The reservoirs pose a difficult flow environment because of the sand proppant used to hold fracture pathways open.

“Very few existing artificial lift systems can handle large volumes of solids, so the produced sand and subsequent erosion causes premature failure on an artificial lift system,” he says.

Most unconventional wellbores have four phases of production — gas, oil, water and sand. Sand, of course, can plug a wellbore and will erode equipment. Produced water can carry corrosive fluids with carbon dioxide and hydrogen sulfide, or deposit scale, while oil can leave paraffin or asphaltene deposits. Further challenges come from gas production, which make a pump less efficient and in extreme situations can cause gas locking.

Since most artificial lift systems were developed for vertical wells, the deviation of these wellbores can require special equipment or tooling. Undulations of horizontal wellbores can lead to slugging production. The change of flow rates and fluid types create a difficult challenge to artificial lift systems such as motor cooling and cyclic pressure changes.

“All of these wellbore conditions need to be addressed in a holistic way,” Hodenfield says. While each of these production challenges exist
Throughout the world, “nowhere do they exist in one wellbore at the same time and to the magnitude that you have in these unconventional wellbores”.

While ESPs are generally optimised for a specific flow range, the company’s newest addition to its ESP family handles an expanded range. Schlumberger has had the REDA Continuum ESPs in the field since the fourth quarter of 2014 and launched the new pump as an extended-life ESP solution for unconventional reservoirs in April.

According to Hodenfield, the Continuum ESP is flexible enough to handle varying production flow rates without requiring change-out of the pump, which is critical for unconventional situations where high decline rates are typical.

The company is offering three pumps — one that can operate at 200 bpd to 1350 bpd, one at 1000 bpd to 3200 bpd, the third at 3500 bpd to 7000 bpd. The ESP can accelerate production early in the well to improve cash flow and provide efficient artificial lift to maximise recovery time.

To extend the life of the ESP, certain components are made out of the high-performance alloy Inconel, zirconia, and tungsten carbide to guard against erosion from produced sand.

“The Continuum ESP is designed to pump the sand and proppant that becomes entrained in the fluids from the formation,” Hodenfield says. “We are running this in the Bakken and are experiencing an extended run life of up to three and a half times that of the previous generation pumps.”

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“Making Progress: Schlumberger’s KUDU progressing cavity pumps are engineered to handle oil, coalbed methane and dewatering applications.”

“Spotlight: Artificial Lift”
enhanced compression design to allow it to operate at low flow rates, and the minimum rate is determined by system constraints such as protector thrust bearing, motor cooling, and shaft brake horsepower limit.

Workovers to change out artificial lift systems can be costly, and the new system must be flexible enough to deal with production declines.

Hodenfield says it is important to understand each customer’s financial drivers.

“Some clients prefer higher initial cash flow and want to accelerate production, while another client may prefer a production model that drives ultimate recovery. Therefore, there are different approaches to artificial lift solutions depending on the company and how it creates the highest value for its stakeholders. The price of oil and the characteristics of the reservoir also have an influence on artificial lift selection. With the industry trend towards unconventional oil development and the challenges of artificial lift, many clients asked us about beam pumps and rod lift. To address the full scope of challenges over the production cycle, we were compelled to acquire these technologies,” Hodenfield says.

“As we move forward with our plans, we are working with our clients to offer transitional artificial lift. It starts with selecting the right artificial lift solution at the right time for each well, designing and engineering the various components together to ensure that we put an extended life artificial lift system in the well that can withstand the production challenges.”

Such solutions require collaboration between the service company and the operator, and would be based on many parameters, such as initial flow rates, decline rates, and volumes of gas and solids.

The Continuum ESP uses the LiftWatcher surveillance service to monitor production and the performance of the ESP in real time. Armed with such information, he says, it is possible to make calculated assessments to adjust the speed of the pump, adjust to changes in flow rate or gas volumes and determine whether chemical treatments are required to remove paraffin, asphaltene or scale deposits. Furthermore, the company says, the LiftWatcher service is used to determine when a changeover in artificial lift systems will be required or advised due to economics.

As production declines it is usually more efficient to run a rod lift system than it is to run...
an ESP. Some clients prefer to run an ESP until it fails, while others schedule a workover rig to minimise the time that a well is offline, Hodenfield says.

The production rate of the particular well and the rig availability are the driving factors. The benefit of scheduling a change-out, he says, is that pulling an ESP and replacing it with a rod pump system can be done in two days, if the rig is available.

Schlumberger has begun implementing new business models to help assure clients that the equipment is reliable. In some instances, the service company is taking on risk to guarantee life of the artificial lift system — in others, it is selling or leasing the system.

“For all artificial lift systems, we’re evaluating the installation process and equipment required as well as the rig time required,” Hodenfield says.

One focus is making surface equipment associated with artificial lift systems easier to move. Variable speed drives and controllers for ESPs, which are used to power, monitor and control the downhole equipment, are mounted on trailers rather than permanently installed. That way they can easily move from one site to another with minimal cost, the company says.

The company is developing and enhancing sensors for measurements at the downhole pump to detect slight changes to the condition of the downhole equipment or changes to the wellbore fluids. This data is used to automatically control the speed of the pump and increase reliability.

“We have the research and development team engaged and we are really putting the minds of Schlumberger on the production side of the business, applying material science, evaluating low-cost sensor and data transmission options from downhole, all the while brainstorming on new forms of artificial lift,” Hodenfield says.