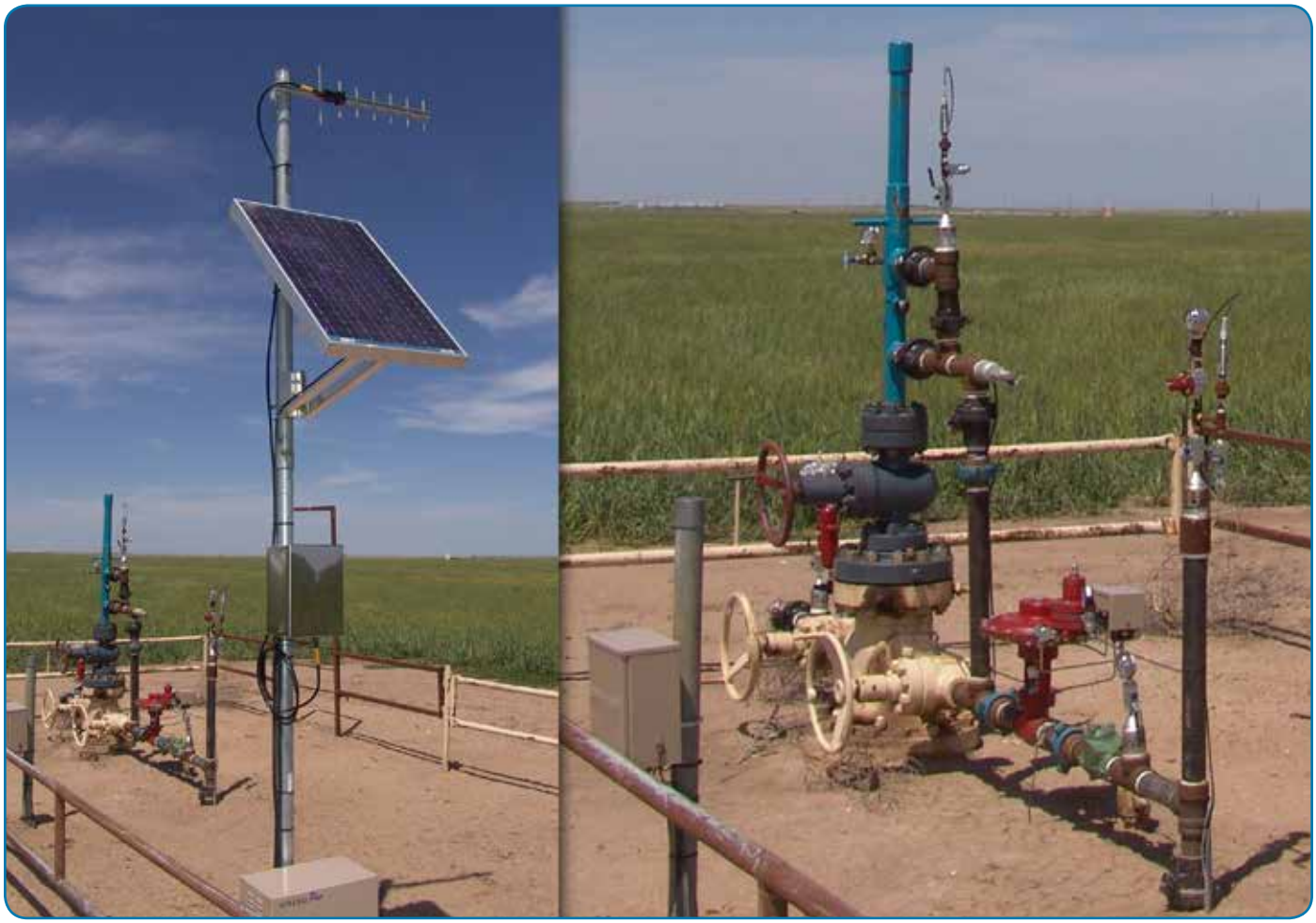
Solar-Powered Diaphragm Pumps Enhance Oilfield Profitability

New diaphragm pump technology provides enhanced chemical-injection solutions that have been designed to optimize North American shale-well and oil-sands production

By Tom O'Donnell



Harsh environmental conditions, water or sand in the well bore and corroded piping are just some of the challenges faced by North American oil and natural gas producers. Arming their wellheads with Solar D™ Chemical Injection Pumps from Neptune™ will help protect critical pumping components from damage and corrosion that could lead to their failure and costly downtime and maintenance.

As each week and month passes, it is becoming increasingly more clear that North America is in the midst of a "golden age" of oil and natural gas production, which is being driven by record levels of recovery in United States shale plays and the Canadian oil-sands formations. The evidence is overwhelming: By 2020, the International Energy Agency has reported, the U.S. will surpass Saudi Arabia as the world's largest producer of crude oil, while natural gas is on course to overtake coal as the world's second-largest source of energy by 2025.

This historic—and growing—rate of North American production requires recovery systems that can deliver the operational capability and reliability that producers demand. Producers have benefited greatly from exploration and recovery techniques like horizontal drilling, hydraulic fracturing and surface mining that have become more fine-tuned and increasingly efficient when retrieving the buried treasures below, leading to the historic rise in production rates. Therefore, the myriad complementary systems that are found in the oilfield must keep pace with the advancements being made in drilling and recovery techniques.

This white paper will show how a new type of pump technology—solar-powered diaphragm metering—can

deliver the most accurate chemical-injection rates in the industry, which keep wells pumping and equipment operating, and can result in optimized production and reduced maintenance and personnel costs.

The Challenge

Unlocking shale formations and oil sands through horizontal drilling, hydraulic fracturing and mining initiates the oil and natural gas recovery process from producing zones deep beneath the surface; a process that often results in more than 20-plus years of production from a single well. During the production years, however, oil and gas operators face significant challenges to recovering these energy sources. Water and sand entering the well bore, corrosion of steel piping and harsh environmental conditions constantly work against the efforts of those striving to reclaim oil and gas.

Faced with these production-hampering challenges, a resourceful industry has discovered that introducing specific chemicals into the contained well bore can counteract many of the detrimental effects of the harsh operating environment. Corrosion inhibitors enhance the life of the steel tubing used to conduct the oil and gas stream from the underground reservoir to the surface. Surfactants break the surface tension of water that enters the well bore, effectively reducing the water column pressure on the oil and gas moving up the well bore. With reduced downward pressure exerted by the water column, more recoverable product is extracted from the formation. In cold-weather environments, methanol is often used to lower the freezing point of liquid moving through surface transportation piping.

Introducing production-enhancing chemicals into the well is most commonly accomplished with a pump at the surface. The pump's primary purpose is to consistently and accurately inject a user-selectable type and volume of chemicals into the well, without discharging harmful gases into the environment. Many may argue that the large number of variables in a well disqualify the need for injected chemical volumes to be consistent. However, astute operators know a consistent, repeatable volume of chemical injected into the well enables a predictable outcome—including the monthly usage, and thus cost, of the chemicals injected, the corrosion rate of down-hole

Neptune™ Solar D ™ Chemical Injection Pumps have proven to be an accurate, consistent, durable and reliable way to inject corrosion inhibitors into a well bore, while their being solar-powered reduces the need for on-site maintenance and costly trips to the well site by oilfield technicians.

steel tubing and, in some cases, even the volume of oil and gas produced.

Equipment reliability and remote monitoring capabilities are additional key requirements of chemical-injection pumps located at remote oil and gas well locations. Pumps requiring frequent maintenance create unpredictable down-hole outcomes resulting from a reduction in injected chemical volume. Additional costs are incurred as technicians are required to be deployed to diagnose and resolve pump problems.

To function at maximum efficiency, a chemical-injection system must employ a pump that consistently injects an accurate, user-selectable chemical volume into the well bore. The fear for operators is that the pump technology being used for this application falls short of that objective. Root causes can include inconsistent injection rates, seal failures, chemical leakage, gaseous discharge to the environment and increased maintenance requirements.

At present, the two most prevalent pump styles used to inject chemicals into a well bore are gas-powered (pneumatic) and solar-powered reciprocating piston pumps. Although low-cost and comparatively simple to operate, making gas-powered pumps popular among oil and gas producers, they are now in the process of being phased out due to a heightened focus by governmental regulating entities on the amount of volatile organic compounds (VOC) they are releasing to the atmosphere.

As gas-powered pumps are phased out for this application, many producers are turning to solar-powered reciprocating piston pumps that feature a timer to control pump cycles. While these solar-powered pumps may be the new default technology for oilfield operators, they do have some operational characteristics that can be cause for concern in certain applications. Therefore, the savvy operator would be wise to consider a different pumping alternative.

The Solution

Oil and gas producers in need of a new and innovative solar chemical-injection system should consider a different type of pumping technology. Diaphragm metering pumps are highly durable and resistant to various chemicals. Featuring few moving parts and no dynamic seals, diaphragm metering pumps are more reliable and easier to maintain than gas-powered and reciprocating piston pumps. The diaphragm completely separates the chemical side from the hydraulic-fluid side. Regardless of the type of chemical to be injected, seal materials do not require changeout. On the hydraulic-fluid side, there are no O-rings in the pressurizing piston sleeve, which means less wear on the piston rod.

Diaphragm metering pumps feature stainless-steel components in contact with the injected chemical (such as the pump head and check valves), and a chemical-resistant PTFE-coated diaphragm. This robust design helps extend the life of the pump, while preventing chemical leaks and reducing the cost of maintenance.

One of the top monthly operational expenses incurred by many oil and gas producers is the cost of the chemical that is injected into the well bore. Frequently, chemical-injection pumps will be set at a higher dosing rate than prescribed for the well. This common practice is necessary to counteract any inherent or perceived pumping inefficiencies. Diaphragm metering pumps address this concern by consistently injecting user-selected chemical volumes into the well bore with extreme accuracy.

When speaking specifically about chemical-injection systems that utilize diaphragm metering pumping technology, Neptune™ Chemical Pump Company, North Wales, PA, USA, created the Solar D™ Chemical Injection Pump. Relying on the resources and expertise of one of the most trusted names in the energy and chemical-dosing industries, the Solar D pump solves many of the problems experienced with other chemical-injection systems, thereby optimizing oilfield productivity and profitability.

The Solar D™ pump is based on proven Neptune diaphragm metering pump technology that has been used in industrial chemical-dosing applications for many years. The diaphragm metering pump features a sealed brushless non-sparking DC motor paired with a plug-in timer for precise, accurate injection rates. It is powered by a 12-volt DC power supply that is most commonly a battery with solar panel.

Over the pressure range of 300 to 1,200 psi (21 to 83 bar), tests show that the Solar D pump has an excessively small deviation of injection rate within a 95% confidence interval. The result: the need to inject a greater volume of chemical than that prescribed for the well is greatly reduced – resulting in real savings for operators. At 1,200 psi, other solar chemical-injection pumps can vary their injection rate as much as 2.8% (more than four gallons a month per well, assuming five gallons is injected per day).

The Solar D™ Chemical Injection Pump meets the needs of oilfield production by consistently injecting accurate user-selectable chemical volumes, which results in predictable downhole benefits.

By comparison, the Solar D pump's injection rate varies only as much as 0.9% (less than 1.5 gallons per month per well). Its reliability means fewer technician trips to the well in conjunction with the additional chemical cost savings for operators.

Solar D™ diaphragm metering pump injection rates are easily adjustable from 0 to 45 gallons per day (0 to 170 L/day). The pump's timer allows users to cycle the pump for a pre-determined amount of time, both on and off. For example, on for one minute and off for five minutes.

Conclusion

In summary, the Solar D™ chemical injection system offers numerous benefits previously unavailable to shale oil and gas producers:

- Environmentally friendly, emitting no atmospheric gases
- Utilizes seal-less, low-maintenance diaphragm metering pump technology
- Consistently injects accurate user-selectable chemical volumes, enabling lower chemical consumption and corresponding costs, while enabling predictable down-hole benefits.

When considering all of these features and weighing the ownership costs associated with previous pumping alternatives, the new Solar D™ Solar-Powered Chemical Injection Pump from Neptune provides an efficient solution for overcoming the harsh realities of oil and natural gas production.

About the Author:

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