EXPANSION ENERGY

You Know the Drill... Or Do You? Introducing Non-Hydraulic Fracturing

By Paul Adair

Hydraulic fracturing has opened up the Bakken to previously undesirable oil and gas reserves. It has helped create an energy boom for the region and delivered unprecedented growth for communities. Fracking has brought an economic windfall, not just for North Dakota but for the entire country.

On the flip side, hydraulic fracturing is also expensive, uses copious amounts of water, injects chemicals into underground formations and demands the treatment/disposal of tremendous volumes of wastewater, requiring a heavy reliance on trucks to deliver water and wastewater.

However, the drawbacks of hydraulic fracturing open the doors for innovative companies such as Expansion Energy, LLC, which is striving to eliminate the use of water and chemical additives in the fracturing process, while lowering costs, maintaining or increasing well productivity and enabling other tangible production benefits with their patented VRGE™ (pronounced "VeRGE") dry-fracking technology.

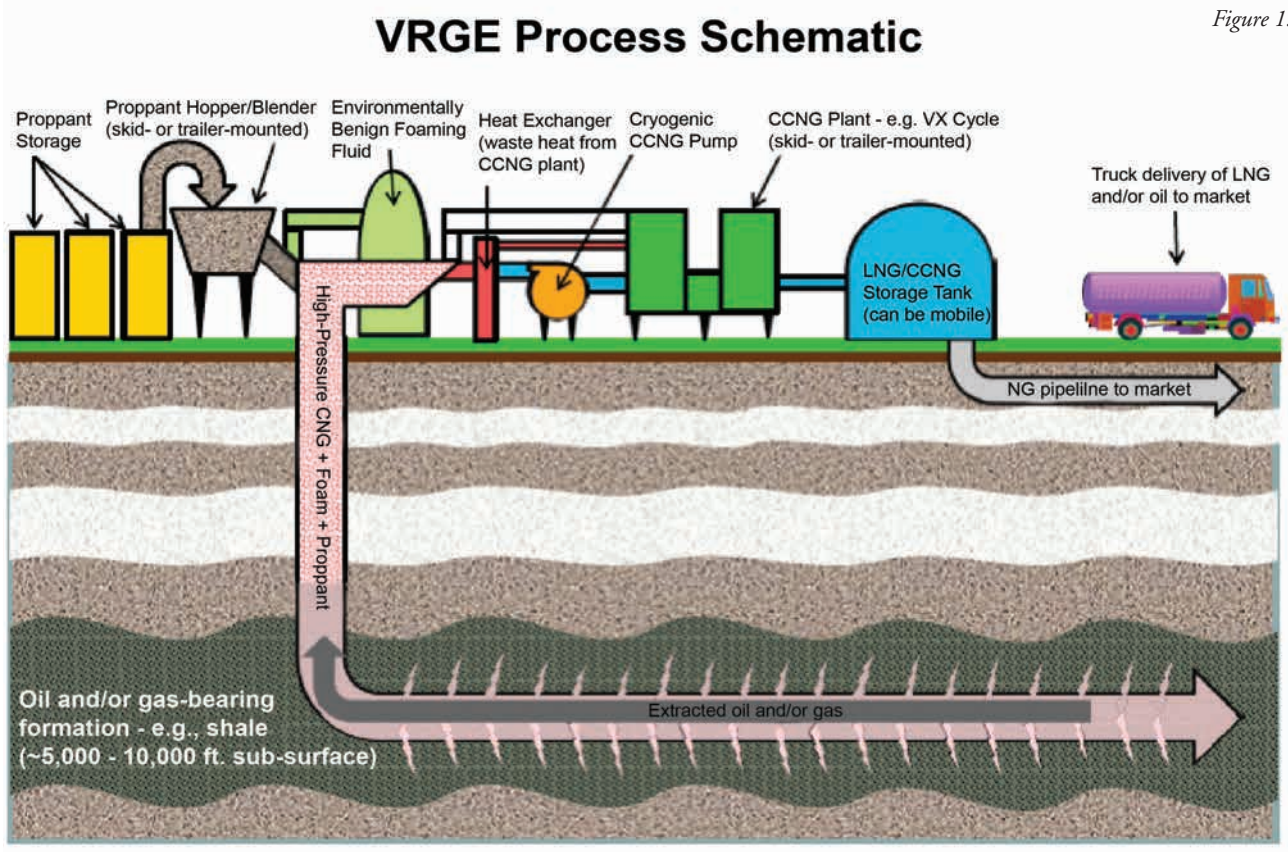

Figure 1.

VRGE™ PROCESS STEPS

1. Natural gas is supplied from a nearby well(s) or from the targeted underground formation itself.
2. Natural gas is converted to CCNG by an on-site cryogenic plant.
3. The CCNG is pumped to high pressure with a cryogenic pump(s).
4. CCNG is then warmed and expanded by waste heat from the CCNG plant to make high-pressure CNG.
5. The high-pressure CNG is then blended with a proprietary, safe/benign, proppant-carrying foam.
6. The "energized" warm, high-pressure CNG+foam+proppant blend is sent down-hole to the well bore.
7. The high-pressure CNG+foam creates, extends and holds open fissures in the underground formation, and also carries proppants into those fissures.
8. Pressure is then reduced, leaving proppants to hold open the fissures, thus liberating oil and/or gas.

The process is repeated for each "stage" of fracking to be completed per well.

Founded in 2007, Expansion Energy is a developer and licensor of breakthrough technologies designed to solve key challenges in the energy and industrial sectors. The work of this New York-based company focuses on improving the production, transport, storage, processing and conversion of energy and related natural resources.

"Our mantra of 'relentless innovation' and a focus solely on breakthrough technologies with substantial commercial value has brought us to where we are today," says Jeremy Dockter, native of Bismarck, ND and co-founder and managing director of Expansion Energy, LCC. "Along the way, we have formed strategic relationships and licensing arrangements with some of the global energy industry's largest companies."

Expansion Energy's patented VRGE™ non-hydraulic fracturing technology virtually eliminates the use of water from the fracturing process. VRGE™ is able to take the place of hydraulic fracturing, using natural gas from nearby wells or from the shale formation itself as the fracturing medium instead of water.

By using very deep refrigeration and energy-efficient compression of natural gas to create the fracturing medium, VRGE™ relies on one or many mobile cryogenic natural gas plants (such as "VX™ Cycle" LNG plants manufactured by Dresser-Rand using Expansion Energy's LNG technology) placed at the well site. The cryogenic plant and cryogenic pumps then produce high-pressure compressed natural gas, which fractures the formations and delivers proppants via a benign, proprietary foam to hold open the fissures.

VRGE™ uses a dense, cryogenic (below -150° F) non-liquid fluid phase of natural gas that Expansion Energy refers to as Metacritical™, produced by the on-site cryogenic plant. Metacritical natural gas is above its critical pressure and below its critical temperature, and is synonymous with what Expansion Energy calls cold compressed natural gas (CCNG™). The CCNG produced on-site is nearly as dense as a liquid and can be pumped like a liquid with little energy, while requiring far less energy to produce than the full-liquid form of natural gas (LNG).

Although VRGE™ is intended to be a substitute for the hydraulic fracturing process, Expansion Energy acknowledges this technology builds on the history of success hydraulic fracturing has delivered to the

Bakken, and elsewhere, in the oil and gas industry. Even so, there are numerous differences between the two processes.

"One of the main differences is that VRGE™ uses virtually no water," says Dockter. "The use of water is the root cause of many of the public and regulatory concerns associated with hydraulic fracturing. By eliminating the use of water, we can solve many of these concerns."

A typical well created through hydraulic fracturing will use upwards of five million gallons of water and will require hundreds of truck trips to deliver. This entails expenses for the water itself and for water deliveries, increasing road traffic volumes, creating road wear and increasing road safety concerns. On top of this, the used frack water needs to be disposed of or treated, resulting in still more expense and a fresh round of truck trips. By using VRGE™ technology, companies can eliminate many costs associated with water consumption, water transportation and water treatment.

"At the regional costs level, VRGE™ reduces the need for new or upgraded wastewater treatment plants and new disposal wells," says Dockter. "Furthermore, reducing water truck trips translates into less frequent need for road repairs and expansions, saving money for state, county and local governments."

Hydraulic fracturing also uses many chemicals and fluid additives to counter the negative effects of water on oil and gas production, such as the swelling of shale formations, issues surrounding fluid viscosity and the surface tension of water. Some of these chemicals are considered by environmentalists, regulators and policymakers to be potentially harmful to the water supply. By nearly eliminating the use of water in fracturing, VRGE™ avoids the need for these chemicals and fluid additives.

The VRGE™ technology will also shrink the footprint of fracking, reducing the amount of capital equipment, capital expenditures and operating expenses required. A smaller footprint will also result in smaller well pads, lessening construction costs and surface disturbances.

As an economic bonus, should the cryogenic plant that creates the CCNG for the VRGE™ frack-job be left at the well site instead of moving it to frack new wells, it could further increase revenues for the well owner by creating or extracting value-added products from the natural gas, namely LNG and NGLs such as propane and butane—on a fully automated basis. These fuels can then be sold to nearby markets for many applications, from fueling drilling rigs and trucks to heating residential and commercial developments.

Additionally, almost all of the natural gas used in a VRGE™-fracturing job will eventually resurface, allowing it be sold to markets so even natural gas costs can be recovered.

Along with its tangible environmental and economic advantages, VRGE™ also has the potential to increase oil and gas production for many wells. Oil-bearing and gas-bearing formations generally do not "like" the water used in hydraulic fracturing. Water causes swelling in shales and creates surface tension in the underground formation, restricting the flow of oil and gas. Again, VRGE™ avoids this drawback by virtually eliminating the use of water.

It has been shown by others in the oil and gas industry that gas-energized fracturing fluids increases a well's oil and gas production and results in a more gradual reduction of a well's production over time; in other words, a less steep decline curve. Although VRGE™ relies on using natural gas in place of CO_2 or nitrogen, the principle is similar.

Continued on page 68

Continued from page 67

The use of CO_2 or nitrogen-energized fracturing requires the costly importation of CO_2 or nitrogen (which must be purchased from the market) from a source other than at the well site, which can be very cost-prohibitive. VRGE™ technology, in contrast, uses the natural gas directly from the well site itself, avoiding the logistical complexity and expense of shipping other compressed or liquefied gases to the wells.

An additional benefit to using natural gas instead of CO_2 or nitrogen is that these gases must first be separated from the produced natural gas before it can be sold into the market. The natural gas used by VRGE™, of course, does not need to be separated and can be marketed directly with the produced gas.

As an added bonus, VRGE™ may help improve production by delivering a cold "thermal shock" to the shale formation. VRGE's™ cryogenic plant is capable of producing very cold fluids, which can be sent underground at temperatures of about -20° F, making it brittle or pre-conditioning the formation before actual fracturing occurs.

The introduction of a new technology such as VRGE™ to the oil and gas industry requires that certain hurdles be cleared. Fracturing is a highly scientific process that relies on time-tested practices to determine the right combination of fracturing factors. For VRGE™ to be widely accepted as a commercial practice and to optimize it for individual shale plays—such as in the Bakken—significant field demonstration and tweaking must be undertaken.

"The industry uses formulas that, while always undergoing continuous improvement, are derived primarily from the statistical databases which fracturing services companies have amassed and analyzed in recent years," says Dockter. "VRGE™ will need to piggyback on that knowledge and undergo experimentation in the field until enough VRGE™ data has been amassed to create formulas that are tailored specifically to the VRGE™ approach."

To date, VRGE™ technology has not been deployed within the Bakken. However, the oil and gas industry is showing an ever-increasing interest in using the VRGE™ technology to advance the effectiveness of the fracturing process.

"To that end, we are in discussions with several large producers and fracturing/completion service companies to embark upon a demonstration program in the coming months and we invite other companies in the industry to contact us to participate," says Dockter. "Expansion Energy almost always prefers to partner with existing companies in the industries we target, rather than trying to compete against them. This is also our plan for the commercialization of VRGE™; license the technology to key companies already in the industry, or to partner with them in other ways."

It is important to note that VRGE™ does not require any substantial changes to well development and production practices prior to or after fracturing.

"Drilling companies and producers can continue to operate almost exactly the same as they do today for wells that use the VRGE™ technology," says Dockter. "Only the companies involved in the actual fracturing/completion step of a well's lifecycle need to undertake some retooling and operational changes to get the full benefits of VRGE™."

The most important retooling is for fracturing/completion service companies to purchase or lease cryogenic (LNG/CCNG) plants that are part of the VRGE™ approach. However, any expenses incurred adopting VRGE™ would be offset by the reduction of costs currently related to hydraulic fracturing, such as avoiding the need for standard hydraulic fracturing compression

and pumping equipment, and the elimination of the costs for chemical additives, water use and in labor cost savings.

"Technological progress is a continuous process and we believe VRGE™ is a key next-step in the ongoing innovation of oil and gas production technologies," says Dockter. "VRGE™ can help the oil and gas production industry lower its costs and become more profitable, more resource-efficient and more sustainable, providing a win-win outcome for oil and gas producers and the regional stakeholders who host their operations, including landowners and the general public."

GET TO KNOW OUR EXPERTS

JEREMY DOCKTER

Jeremy Dockter is co-founder and managing director of Expansion Energy LLC. He has an MBA from Columbia University (New York, NY); and a BA from the University of Minnesota (Minneapolis, MN).

Dockter is the founder of four energy-related companies and has 15+ years' experience in the energy and natural resources industry with energy technology, energy and natural resources production/project development and energy finance. Specific areas of expertise include oil and gas exploration and production; natural gas pipelines, processing and storage; liquefied natural gas (LNG); power generation; waste-to-energy; refining; gasification; mining and minerals; fertilizer production; biomass-to-energy; industrial-waste-heat-to-power; and renewable fuels.

"Energy is one of the most important industries in the world," he says. "Tremendous opportunities exist for new, innovative ways to produce, convert and use energy. Being involved in the energy industry allows me to have a global impact while working at home in North Dakota."