

Waterless Fracking - a New Way to Frack Using Lpg Gel

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Extended Abstract

The hydraulic fracturing industry is a fast-growing sector but traditional extraction technologies based on the use of water and harmful chemicals are being increasingly questioned. Canada-based Gasfrac Energy has developed an innovative closed stimulation method, utilizing gelled LPG or propane based gel that is as natural to a well as soil is to the earth. It's dissolves into the formation hydrocarbons improving performance without using water.

The material used to frack a well using LPG technology has low viscosity and low surface tension, compared with the surface tension of water. The result is that the initial well yield is greater with LPG technology, and total yields can be as much as 30 % higher than if the well were hydraulically fractured. After the pressure and heat turn the gel into a vapor, it moves up to the surface, where it can be collected and sold down the line, since LPG is electrically neutral and lacks much friction, it doesn't dissolve any salts, heavy metals or radioactive compounds - compared to water, in which these things return to the surface and make a typically toxic mixture even more so.

The main advantage of the gelled propane is that once the gel is broken the propane flashes and mixes with the gas, Since the propane becomes part of the reservoir flow, the generated fracture is completely cleaned up, whereas in a water-based fracture stimulation, some of the water remains trapped in the fracture. In addition a water-based fracture has an efficiency of around 20 percent, while propane has 100 percent efficiency.

The technology isn't yet fully proven. Still the firm has fracked over 1,300 wells in Canada and the US. The method was originally designed to improve the performance of low-pressure wells and has impressed those within the environmental area.

One leading alternative that is gaining traction with some companies is fracking with liquefied petroleumgas (LPG). This technology was developed in Calgary, Alberta by GASFRAC Energy Services. GASFRAC has developed an innovative closed stimulation process and injection method, utilizing gelled LPG rather than conventional fracking fluids.

The LPG used in the closed GASFRAC system is primarily propane then butane or pentane – or mixtures of those gases, a naturally occurring hydrocarbon that is non-damaging to the formation. The LPG stimulation process has very significant benefits for both operator and environment, as eliminating water from the extraction process has significant environmental implications, as it removes the need for disposing of potentially hazardous wastewater and makes for a safer working environment

LPG fracturing is one of those rare technology breakthroughs in the oil and gas industry that can deliver both economic and environmental benefits for producers.

As much as 80% of the water that's used in conventional methods stays in the reservoir and most of the water that does flow back has to be disposed of safely.

Using LPG allows operators to use hydrocarbons already being produced to extract more hydrocarbons while also eliminating the need for biocides required in conventional fracturing.

When gelled with our proprietary chemicals, LPG provides a consistent viscosity, does not require the costly use of CO₂ or N₂, nor does it require any special cool down or venting of equipment. LPG—an abundant by-product of the natural gas industry—is stored at ambient temperature.

Using LPG also reduces the need to flare production to clean up the traditional fracturing fluids, reducing CO₂ emissions. Because propane liquid is half the specific gravity of water, there is reduced trucking to the site and no trucking to transport post stimulation – which can reduce truck traffic by up to 90% as shown in figure-1.

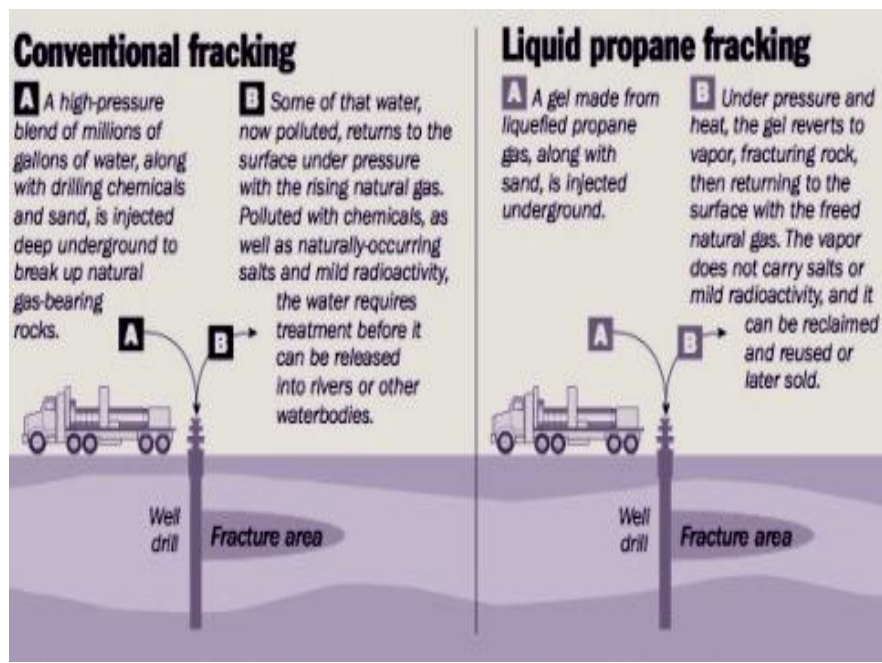


Figure-1: Comparing of conventional and liquid propane fracking.

LPG fracking uses this propane gel in place of water to both fracture the rock formation and deliver proppant. As in standard hydraulic fracking, the propane gel, or LPG, is mixed with proppant and pumped down the wellbore, seeping into the formation until such high pressures are reached that the rock fractures.

The LPG fluid system uses up to a 100% gelled LPG for the pad and flush stages. The sand slurry stages use about 90% LPG with the remaining being a volatile hydrocarbon based fluid. All the chemicals and proppant are added to the base fluid at the blender. Proppant at the blender is maintained at the maximum concentration throughout the treatment and this minimizes the volume of the resulting slurry. This fluid system provides an ideal solution for water sensitive formations provided one can recover majority of the introduced oil.

The LPG gel properties are shown in table-1.

Table-1: Specific properties of LPG Gel.

Water	Liquid Petroleum Gas
Viscosity = .66 cps (@105F)	Viscosity = 0.08 cps (@105F)
Specific Gravity = 1.02	Specific Gravity = 0.51
Surface Tension = 72 dynes/cm	Surface Tension = 7.6 dynes/cm
Potentially Damaging – Reactive with Formation Clays/Salts	Non Damaging – Inert with the Formation Clays/Salts

all of which when added together can create more effective fracture lengths, enabling higher initial and long term production of the well.

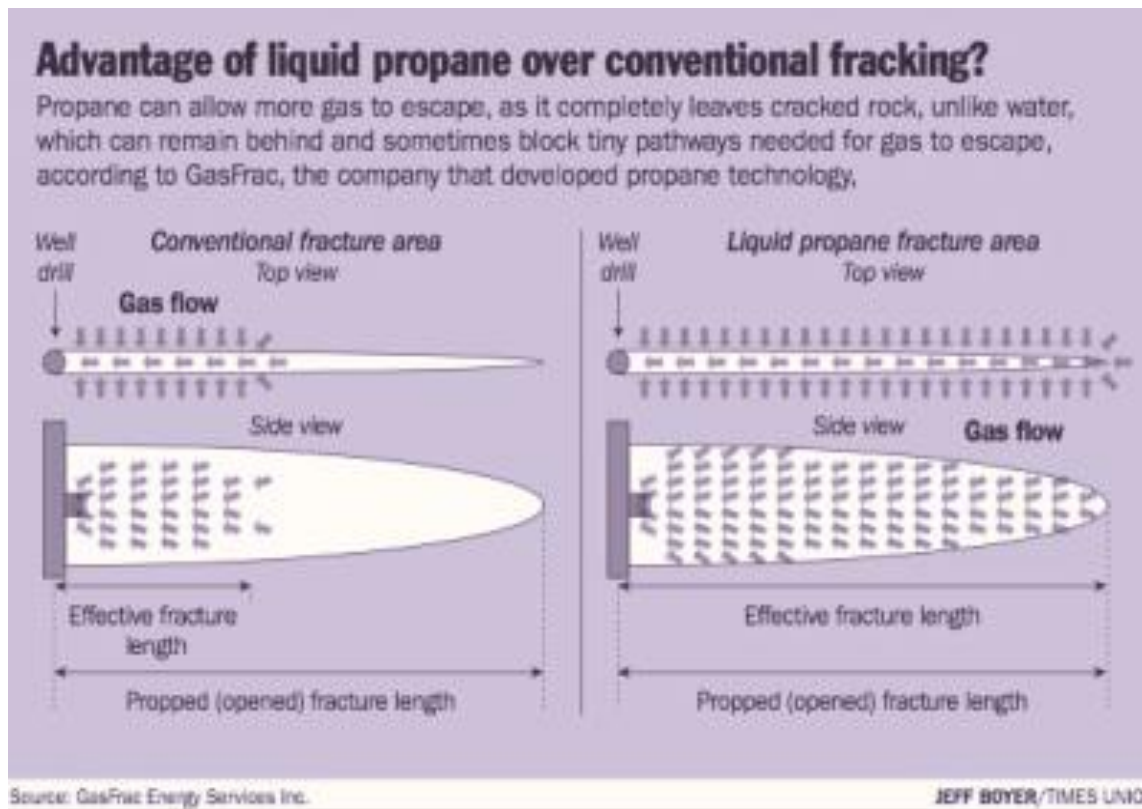
The key components of the safe and efficient application of LPG stimulation are:

Storage tanks -Utilizing a boost pump and nitrogen pressurization, a series of LPG storage tanks store and feed the LPG to the specialized sand blender. A pressurized nitrogen blanket is applied to all LPG storage tanks to ensure safety.

Sand blender - This proprietary blender is a pressurized system in which proppant is preloaded, purged and pressurized with the nitrogen. A controller uses a pressurized auger system to meter the proppant into the gelled LPG, creating a gelled LPG sand laden slurry to stimulate the reservoir.

Stimulation - Specialized high pressure pumping units inject the gelled slurry into the wellbore at the required surface pressures.

One perceived drawback of fracking by propane-based LPG is that initially it can cost 20-40 percent more than water fracking. Unlike hydraulic fracking, propane gas fracking requires specialized equipment to perform all operations under the pressure and low temperatures



needed to keep propane in a liquid state. As propane is also a volatile and flammable material, a barrage of monitoring devices and safety equipment is necessary to minimize operating risks.

In the environmental sense, there are two major concerns associated with water use in fracking - the massive volume of water used and the disposal of potentially polluted produced water. LPG fracking is environmentally attractive in that it efficiently addresses both issues. This technology increases the production of oil and gas ultimate recoverable reserves by 20% to 30%. In this technology, the process doesn't require any water, thus literally saving billions of gallons of potable water (an average well frac requires anywhere from 3 million to 12 million gallons of potable water per well).

It eliminates waste water, which is a highly toxic by-product of water fracking and a major source of pollution; the pumped propane/butane on the other hand returns to the surface as gas and could be captured and recycled by the operator. Since much less LPG is required for a frac and no waste water is produced, the trucking footprint of bringing water on site and trucking waste water out is significantly reduced. It significantly reduces the need for flaring (thus reducing CO₂ emissions).