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New Waterless Fracking Method Avoids Pollution Problems, But Drillers Slow to Embrace It

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By Anthony Brino, InsideClimate News and Brian Nearing, Albany Times-Union

Little-noticed drilling technique uses propane gel, not water, to release natural gas. Higher cost, lack of data and industry habit stand in the way.

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ALBANY, N.Y.—In the debate over hydraulic fracturing for natural gas, two facts are beyond dispute: Huge amounts of water are used to break up gas-bearing rock deep underground and huge amounts of polluted water are returned to the surface after the process is complete.

Tainted with chemicals, salts and even mild radioactivity, such water, when mishandled, has damaged the environment and threatened drinking water, helping fuel a heated debate in New York and other states over whether gas drilling is worth its risk to clean drinking water, rivers and streams.

Now, an emerging technology developed in Canada and just making its way to the U.S. does away with the need for water. Instead, it relies on a thick gel made from propane, a widely-available gas used by anyone who has fired up a backyard barbecue grill.

Called liquefied propane gas (LPG) fracturing, or simply "gas fracking," the waterless method was developed by a small energy company, [GasFrac](#) [2], based in Calgary, Alberta.

Still awaiting a patent in the U.S., the technique has been used about 1,000 times since 2008, mainly in gas wells in the Canadian provinces of Alberta, British Columbia and New Brunswick and a smaller handful of test wells in states that include Texas, Pennsylvania, Colorado, Oklahoma and New Mexico, said GasFrac Chief Technology Officer Robert Lestz.

Like water, propane gel is pumped into deep shale formations a mile or more underground, creating immense pressure that cracks rocks to free trapped natural gas bubbles. Like water, the gel also carries small particles of sand or man-made material—known as proppant—that are forced into cracks to hold them open so the gas can flow out.

Unlike water, the gel does a kind of disappearing act underground. It reverts to vapor due to pressure and heat, then returns to the surface—along with the natural gas—for collection, possible reuse and ultimate resale.

And also unlike water, propane does not carry back to the surface drilling chemicals, ancient seabed salts and underground radioactivity.

"We leave the nasties in the ground, where they belong," said Lestz.

David Burnett, a professor of petroleum engineering at Texas A&M University, one of the nation's premier petroleum engineering schools, said fracking with propane makes sense.

"From a reservoir engineering perspective, there is no reason this would not be effective," said Burnett, who runs the

[Environmentally Friendly Drilling Systems Program](#) [3], a project of the university and the Houston Advanced Research Center, a not-for-profit academic and business consortium. Supported by some of the nation's largest energy companies, as well as by the New York State Energy Research and Development Authority, the drilling program seeks new technologies that develop gas and oil in a safe and environmentally friendly manner.

Burnett said using gas instead of water can serve two ends—protecting the environment and reducing costs to the drilling industry of handling and disposing of tainted water.

But he said propane fracturing is "not a game changer," at least not yet.

"This is a very conservative industry," Burnett said. "Engineers want to see what someone else did first, and they want the data." Most companies that have tried the GasFrac technique have not published data publicly, he said, possibly out of fear of tipping off potential competitors to its benefits.

A search of public research reports on file with the [Society of Petroleum Engineers](#) [4] found only two case studies for wells that used propane fracturing—one in 2011 and one in 2009. "You are going to need more than one or two wells to prove this to the industry," Burnett said. And because gas fracturing is a proprietary method owned by a still small company with limited ability to supply and service many new users, "if more people want to use the technology, the cost will probably go up. So GasFrac is kind of caught in a Catch-22."

Propane Fracking Struggles To Be Accepted

Propane fracturing is still in its infancy, and only time will tell whether the technique will make inroads in a global drilling industry that began using water-based fracturing in the late 1940s and since has invested vast amounts in that technology. Hydrofracking for natural gas is now used in more than a dozen states, Canada and around the world.

"The infrastructure is already there for water, people have already put millions into it," Lestz said. "Sometimes the good is the enemy of the great."

Aside from being better environmentally, Lestz said propane fracturing also can be more efficient, because it allows more gas to flow from wells than water-based fracturing. All the propane leaves the fractured rocks, unlike water, part of which remains behind and can be absorbed into rock to partially block the pathways for gas to escape.

Also, the propane method uses only about one quarter of the number of truck trips that water-based fracturing employs, so the impact on local roads, the noise and dust annoyance to neighbors, and the trucking costs for drillers are reduced, he said.

However, propane costs more initially to use, even though it can be resold once recovered. It is also explosive, and requires special equipment to be handled properly and reduce risk.

In January, there was a flash fire at an LPG gas well being drilled in Alberta by [Husky Energy](#) [5], one of Canada's largest energy companies and one of the first to embrace LPG drilling. Three workers suffered burns, although no injuries were life threatening.

Lestz said an undetected propane leak was to blame, and the company subsequently added more monitoring equipment to reduce the risks. Wells now have 20 propane sensors, up from three, as well as an infrared video monitor that allows gas leaks to be seen by well crews.

A spokesman for the Alberta Department of Occupational Health and Safety said the mishap is still being investigated.

A spokesman from Husky declined questions, saying the company did not want to get "dragged into" any debate about gas drilling.

However, in September, Husky gave GasFrac a vote of confidence with a new three-year contract that carries a two-year renewal option. And a month before that, GasFrac obtained \$100 million in funding from HSBC Bank Canada, Bank of Montreal and Alberta Treasury Branches to help it grow. Lestz said the company expects to be able to expand its equipment "fleet" from two in 2010 to a dozen by 2012.

Weighing Expense Over Advantages

An industry executive said propane's expense does make it a tough sell.

"Propane is always going to be more expensive than water," said Roger Willis, president of Universal Well Services, a Pennsylvania company that provides drilling equipment to the industry. "But propane fracturing will probably be

useful in some situations. ... The economics of doing it would be fairly complicated. You have to weigh the cost and recovery of propane versus the transport and treatment of the water."

The New York Oil & Gas Association, a lobbying group, referred a reporter to Willis after being asked for the group's stance on propane fracking.

New York is anticipating allowing "produced" water to be taken by municipal sewer treatment plants that have been retrofitted and approved by the state to properly handle drilling contaminants. However, no plants New York currently have that approval.

How to safely transport and dispose of millions of gallons of produced wastewater is one of the issues being wrestled with as the New York Department of Environmental Conservation considers opening up the state to hydrofracking.

The state expects between 1,600 and 2,500 gas wells a year eventually could be hydrofracked in the gas-rich Marcellus Shale, an underground formation that runs from the western Catskills, and through the Finger Lakes and Southern Tier almost to Buffalo, and runs south through Pennsylvania and West Virginia.

An average well can use up to 7.8 million gallons of water; about a fifth of it returns to the surface and requires disposal. So billions of gallons of well water would have to be trucked in and trucked out for disposal elsewhere.

Propane fracturing is emerging just as New York tries to avoid repeating water disposal problems seen in Pennsylvania, where drilling wastewater taken to regular sewage treatment plants ended up fouling rivers in the western part of the state—including the Allegheny River, source of some of Pittsburgh's drinking water.

This spring, Pennsylvania officials found that high levels of bromides in treated drilling wastewater were being altered by the chlorine-based sewage treatment into a carcinogen. The state asked drilling companies to voluntarily stop taking drilling wastewater to more than dozen treatment plants.

New York's DEC Weighs In

New York's Department of Environmental Conservation [6] devoted a few paragraphs to propane fracking in its 1,500-page Draft Generic Environmental Impact Statement report on natural gas drilling in September. It tersely declared that the technology was "not mature enough" to support drilling in New York.

As well as costing more than water, the LPG technology is proprietary to GasFrac, and so has limited availability, the DEC said.

But the agency also seemed to recognize the technology's potential, adding: "While it is not known if or when LPG hydraulic fracturing will be proposed in New York, having ... infrastructure in place may be an important factor in realizing the advantages of this technology."

New York would appear to have a ready source of propane for fracking, as a major propane pipeline runs from Pennsylvania through the heart of the Marcellus Shale area in the Southern Tier. The Teppco pipeline goes through Watkins Glen, Oneonta and Selkirk before continuing into New England.

"This technology will be 'mature' in our view when we have a proposal or an application to review," DEC spokeswoman Charsleissa King said. "At this point we do not have anything before us. We have met with GasFrac to get a general understanding of the technology."

Lestz admits his company does not have nearly enough equipment to take its method mainstream. He said it envisions forming "strategic alliances" with larger, unidentified drilling companies to make its process more available.

"New York is very important. No companies there have put their cards on the table, so it is still virgin territory," said Lestz, who has traveled twice to New York to tout propane fracking.

Drilling Companies Say Results Are Promising

Two independent gas drilling companies that have run LPG wells—one outside of Moncton, New Brunswick, a few hours north of the Maine border, and another in Maverick County, Texas, close to Rio Grande River and Mexico—said they found the technique to be promising.

Calgary-based Jadela Oil drilled a well in Texas using GasFrac equipment in August. Company president Greg Lee said initial results showed gas flowing, and the well is now "shut-in" to allow pressure to build so gas can be collected.

"My gut feeling is that this is the way to go," said Lee. He said LPG can make gas wells more productive by eliminating potential blockage by water left behind and absorbed into fractured rock, which can close off some pathways for trapped gas to rise.

Lee says that while propane must be handled with care, the drilling industry should also pay more attention to the risks associated with hydraulic fracturing.

Burnett, from the environmentally-friendly drilling program at Texas A&M, said his group has been trying, so far unsuccessfully, to get Jadela's data on its propane gas well. "This in the kind of technology that our group is trying to locate, to document and then make that information available to the industry."

Phillip Knoll, president of Nova Scotia-based Corridor Resources, said his company started drilling propane wells in 2009 in New Brunswick. Corridor Resources helped write a 2011 [case study](#) [7] that is available through the Society of Petroleum Engineers. It showed gas fracking can work.

"We had absolutely tremendous results that compared favorably with other techniques," like hydrofracking, said Knoll. "This technology is improving substantially."

His company also uses water-based hydrofracking.

Since 2008 30 LPG wells have been drilled in British Columbia, all by GasFrac, said Sandra Steilo, a spokeswoman for the Ministry of Energy and Mines. No accidents have been reported.

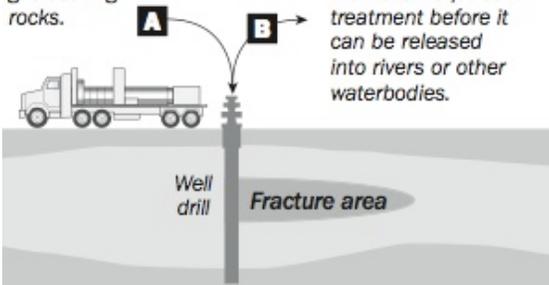
She offered an explanation for why the LPG method is not more widely used. "As far as we're aware, the technology has so far not proved cost-effective for gas wells," she said. "The technology works best when sufficient infrastructure is in place to allow the propane to be captured and re-used."

InsideClimate News produced this report in a partnership with the Albany (New York) Times-Union.

Conventional fracking

A A high-pressure blend of millions of gallons of water, along with drilling chemicals and sand, is injected deep underground to break up natural gas-bearing rocks.

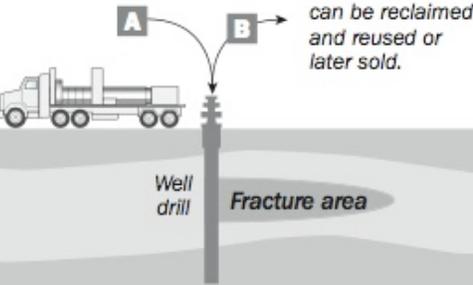
B Some of that water, now polluted, returns to the surface under pressure with the rising natural gas. Polluted with chemicals, as well as naturally-occurring salts and mild radioactivity, the water requires treatment before it can be released into rivers or other waterbodies.



Liquid propane fracking

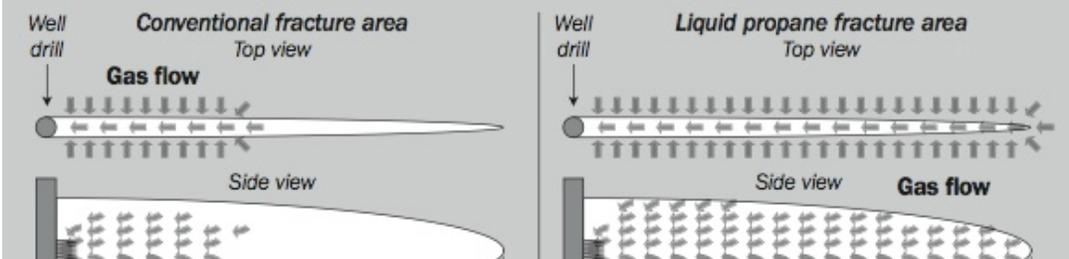
A A gel made from liquefied propane gas, along with sand, is injected underground.

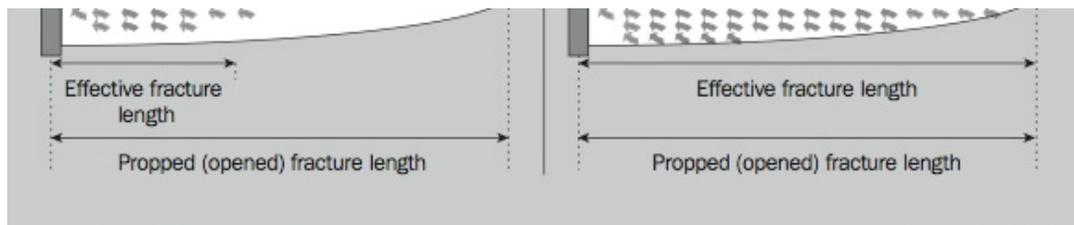
B Under pressure and heat, the gel reverts to vapor, fracturing rock, then returning to the surface with the freed natural gas. The vapor does not carry salts or mild radioactivity, and it can be reclaimed and reused or later sold.



Advantage of liquid propane over conventional fracking?

Propane can allow more gas to escape, as it completely leaves cracked rock, unlike water, which can remain behind and sometimes block tiny pathways needed for gas to escape, according to GasFrac, the company that developed propane technology,





Source: GasFrac Energy Services Inc.

JEFF BOYER/TIMES UNION

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