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The NGLs Interview: Eric Smith, associate director of the Energy Institute at the A.B. Freeman School of Business, Tulane University

Since the oil price rout of 2014, US E&P companies have remained under immense pressure to cut costs and maximise profits. However, despite these challenges, natural gas liquids (NGLs) such as ethane and propane and their value-added derivatives have emerged as a consistently profitable segment for the upstream industry, even for firms primarily focused on producing dry gas rather than crude oil.

Gas Matters speaks to Eric Smith, industry veteran and former head of Saipem's US subsidiary, now associate director of the A.B. Freeman School of Business' Energy Institute at Tulane University in Louisiana, to ask him about how record levels of NGL production in the US are creating troublesome bottlenecks in parts of the country, while also spurring big investments that add value to the supply from the Marcellus shale.

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The US is producing record levels of NGLs. have US gas producers been able to profit from producing them?

Companies drilled for wet gas and were enthusiastic about associated gas and NGLs in the Eagle Ford and Permian Basin plays in Texas and the central southern US. That's also why they stopped drilling in the Haynesville and Barnett basins in the southeast – they were almost all dry gas.

Producers found an arbitrage opportunity after separating raw gas into methane and NGLs. Methane, referred to as 'residual gas' at the processing plant, is more commonly referred to as 'pipeline quality' gas once moisture, CO2, sulfur compounds and other impurities have been removed. NGLs comprise gases which are not pipeline gases - everything from ethane to condensates – and are called 'Y-grade'. We can take the Y-grade mixture, separate the components and sell the liquids at prices higher than their value. If we can't make a profit because the added revenue is not sufficient to offset the added segregation cost, we leave the hardest to remove component (ethane) in the natural gas stream, known as 'rejection'.

What percentage of US NGLs are coming out of the gas-rich Appalachia region?

The majority of NGLs are produced in Texas. Around 10% comes from Appalachia, but much of that supply ends up going into the Appalachia-to-

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south to north, but flow in the line was reversed in order to flow south in the early years of this decade, once the Marcellus and Utica shales began producing wet gas.

Unlike the Gulf Coast, there are currently no NGL steam cracker units in the Marcellus and Utica shales. Steam crackers are used to produce olefins from NGLs and from refinery-sourced naphtha. Shell is building a cracker in Pennsylvania, but until it is available, around 2022, the nearest functioning unit is in Sarnia, Ontario. That unit can receive some supply by pipeline from the Marcellus and Utica regions. Obviously, the Ineos ethane liquefaction train, near the coast at Marcus Hook, also serves as an outlet for some of the NGL material.

Looking at the US NGLs grid, nearly all roads lead to Texas. Why is that?

The US has a large pipeline system to move natural gas -- 300,000-odd miles of it -- but we also have a substantial pipeline system built specifically to move Y-grade liquids to a major facility near Mont Belvieu, Texas. That site is analogous to Henry Hub for US natural gas and Cushing Oklahoma for crude oil.

Mt. Belvieu became a popular hub for NGLs largely because it sits on top of multiple underground salt caverns, which Enterprise Products (EPD) uses to store NGLs to smooth out irregularities in flows to the 31 steam cracker units located along the Gulf Coast.

Enterprise Products controls the hub and operates the biggest shipping terminal for ethane and LPGs, which includes all of the other compounds in the Y-grade stream: propane, butane, condensate and so on. All those products are shipped around the world by a large fleet of foreign-flagged LPG and liquid ethane tankers.

There are no US companies with LNG or LPG tankers, so we depend on the rest of the world to ship them for us. That’s one reason that UK/Yamal LNG supplied Boston on two occasions this past month. We had surplus gas and LNG on the Gulf Coast, but no way to move it north. The gas pipelines were chock-a-block full and we had no ships. Russia and the UK came to the rescue. You would expect Boston to complain about supply from Russia, but they also like being warm, so not a peep.

E&P firms in the Marcellus and Utica desperately want more pipeline capacity to East Coast cities like New York City and Boston. Is there also a lack of Y-grade capacity along that same route?

Yes. Currently, there is only one NGL pipeline, called Mariner East, connecting the Marcellus shale to Marcus Hook near the coast of Pennsylvania. That site has an ethane liquefaction train and eight dedicated ships making deliveries. A parallel Mariner East 2 line has been proposed, but has come under attack from people who don't like any pipelines. There are numerous natural gas and NGL pipelines in the Marcellus and Utica shales, but transit states, like New York and Connecticut, don't want to hear about new pipelines, even while they're building new CCGTs and shutting down their remaining nuclear power plants.

New England states, like Vermont, New Hampshire and Massachusetts - don't mind running on oil, coal or expensive LNG during the winter because they prefer that to building gas pipelines that they believe will only be used a few weeks a year. Politically, New England has always been a deeply 'blue' region with deep antipathy towards pipelines. Not so on the Gulf Coast where we recognise their economic value and build new pipelines all the time.

How have gas-focused E&P companies been able to market NGLs?

Independent E&P operators in the Eagle Ford or Bakken shales want to produce oil, but when associated gas and NGLs come up as part of the bargain, they need to monetise those as well. That's not the case in the Marcellus and West Virginia, which produce mostly gas, little oil and some NGLs.

What many don't realise is that, prior to NGL production exploding in the US, the global plastics industry primary depended on olefins derived from steam-cracking naphtha, which in turn, is a by-product of oil refining. Nowadays you don't need to be an accountant to see it's a lot more expensive to buy a barrel of oil, crack it to get naphtha, then crack the naphtha to get ethylene and propylene for making plastics. It's easier to simply take NGLs from the field and crack them once.

We've also developed newer technology called 'propane dehydrogenation' where instead of using a steam cracker - which is like firing a shotgun at a chicken, you get feathers everywhere - you put in a pound of propane and get 100% of the equivalent polypropylene plus some hydrogen. That's a more elegant solution. The US only has four or five of these plants. EPD is building a new plant to do the same thing with butane in order to produce butadiene used to make plastics and rubber as well as our old friend iso-butylene used to produce high octane alkylate fuel.

Because of those developments, the US is rapidly converting naphtha steam crackers to utilise NGLs. That may be bad for oil refineries, but it's good news for plastics producers. The British chemicals firm Ineos that rebuilt its crackers in Grangemouth, Scotland and is rebuilding those at Raffnes, in Norway, is converting their steam crackers from consuming naphtha, from oil refineries, they can run on NGLs from the Utica and Marcellus shale imported from Marcus Hook in the US.

Like natural gas, US NGLs production is forecast to rise until at least 2050. Does the US have cracker units to handle this supply?

We had a base of 31 crackers with at least half a dozen more coming online in the next five years. Some idled units have been restarted and we've 'goosed' older ones to increase their capacity. Domestic companies will continue to build new crackers and PDH units. We're not concerned about any shortage of capacity because anything the US doesn't crack and polymerise will be shipped as raw material to someone like Ineos that does have crackers and polymerisation in the international market.

Transit states, like New York and Connecticut, don't want to hear about new pipelines, even while they're building new CCGTs and shutting down their remaining nuclear power plants

Will US liquids ports have enough capacity to export the necessary volumes of NGLs?

Yes. Coincidentally, the US went from being a net importer of propane in 2008 to the world's largest exporter in 2017. That's a pretty dramatic swing. We've got pretty good shipping capacity for ethane, propane and butane. The adjacent terminal at Mont Belvieu has been expanded and can now simultaneously load two 200,000-barrel ships with cryogenic ethane. On the east coast, the Marcus Hook terminal in Pennsylvania already loads ethane and propane for Ineos for its plants in the UK and Norway. Marcus Hook is scheduled for expansion as soon as they get the domestic pipeline expansion named Mariner East 2 online.

Which ports are likely to see the most growth?

New petrochemical plants are coming on-stream, but US crackers and polymer plants will only absorb a portion of the ethane and propane. We

many people are missing is that when one feeds ethylene or propylene into a polymerisation unit in Louisiana or Texas, the result is a train hopper car full of plastic chips. That's fine for domestic consumption. The problem is, We can't export a hopper car of chips, but I can export an ISO [shipping] container or a standardised shipboard container of chips.

There are companies called "re-packagers" that unload those railcars and fill bags and other small containers. All these fit into standard containers. So US container ports are actually the ones that will see a bump-up in shipments. Outside of bulk liquids leaving Texas and Louisiana, the ports likely to see the greatest growth are the obvious container ports in places like Houston and New Orleans. However, Long Beach, California on the Pacific side and Savannah, Georgia and Charleston, South Carolina on the Atlantic seaboard are also seeing significant growth. That is because they are already large container ports, they have good rail service and they have a surplus of empty containers looking for a way home.

How are US NGLs priced? Are they indexed to crude oil?

The price of methane at Henry Hub sets a 'floor price' for ethane because if it's rejected, it stays in the natural gas stream. The US is producing enormous amounts of ethane that is rejected and its price correlates with pipeline natural gas.

The heavier molecules, propane, butane and other NGLs, all basically follow crude oil because, historically, naphtha supplies come from the FCCU units at oil refineries rather than from natural gas processing plants. When oil prices are low, the value of propane and butane tend to be low. When oil is high, the LPG prices trend higher. For example, butane follows US gasoline prices, which follow the British marker crude Brent, in part because the northeast US imports significant amounts of gasoline from the UK and Europe.

Some countries have built NGL-to-power projects in recent years. Is that trend likely to strengthen?

Generally not. In Ghana, where I did some work, their ultimate plan is to use associated gas from an offshore oil field to run a CCGT [the Bridge power project]. In the meantime, they need power, so they may use imported NGLs to start, then import LNG and re-gasify it offshore, before eventually using domestic natural gas from their own offshore fields.

Caribbean islands like St Thomas and St Croix have looked at using NGLs

the power plant could no longer burn waste gases from the refinery. The idea was to build some smaller combustion turbines of 25-50 MW that ran on propane - a commodity with ships readily available.

I've also heard about a proposal in Mexico to run a power plant on ethane. Gas-fired plants can burn just about anything, but getting ethane down to the middle of Mexico where they need electricity is problematic. It's easier to use natural gas. They're already building new natural gas pipelines from the US.

So in conclusion, you don't anticipate an NGL glut in the US over the next 20 years?

I don't think so. The moderator for the US will be how much it puts into the export market. That's true of LNG, as well as NGLs. We have capacity to produce both, and will continue to build new capacity to the extent that there's an international market for the products. However, I suspect that even 20 years from now, we'll still be exporting NGLs, as well as intermediates like olefins, and of course bulk plastics; just in different proportions.

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