SEVEN

Chapter 7 | Infrastructure Takeaway

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BIGGER, FASTER: MIDSTREAM RAMPS UP

By Frank Nieto,
Contributing Editor

The surge of Permian Basin output has sparked a flurry of new midstream projects to replace legacy assets and foster exports.

America loves a comeback story, whether it's Rocky, Tiger Woods at the 2019 Masters, or Elvis in 1968. America also loves money-makers. Combine the two, and you wind up with the Permian Basin.

It's been 100 years since the Permian's first commercial well was brought online. This well sparked a nearly 50-year run of prosperity. However, the basin began to experience production declines in the 1970s, until the advent of better hydraulic fracturing techniques in shales helped the region's operators find their fastball again.

This led oil and gas production out of the Permian to surge to the point where it took on a whole second life far larger than the first. Between 2011 and today, oil production quadrupled and is now more than 4 million bbl/d. Gas output has also

Vaquero Midstream's Caymus natural gas processing facility in the southern Delaware Basin includes two processing plants with a total current capacity of 400MMcf/d. *Photo courtesy Vaquero Midstream LLC*

surged and could reach 15 Bcf/d by 2023, according to IHS Markit.

Unlike other booming shale plays, the Permian also has the advantage of existing infrastructure that has helped kickstart the region's ability to get production to market.

Yet this legacy infrastructure was quickly outmatched by production, which resulted in crude oil bottlenecks and negative natural gas prices in the region. "The problem was it bounced back so much that it just overwhelmed existing infrastructure," Peter Fasullo, principal at En*Vantage Inc., said.

Unlike when similar situations occurred in other shales, there wasn't the economic discretion to back off gas production to improve prices, since all the gas being produced in the Permian was associated gas from rapidly rising crude production.

According to Fasullo, the biggest challenge associated with the Permian Basin has involved developing end markets rather than midstream infrastructure. "Once there was this realization that new natural gas infrastructure was needed, gas pipelines were built across the Rio Grande to export volumes to Mexico. The problem is that Mexico hasn't really executed on its plans to convert to gas-fired power generation from petroleum-derived fuels. Their economy also hasn't grown as fast, and the only reason why we're exporting gas to Mexico really now is because Mexico's gas production is in steep decline," he said.

Pipelines for moving crude, liquids and gas are the infrastructure components most needed in the Permian, and their buildout is underway. "There's been a lot of money spent on infrastructure in the last several years to try to catch up with production, and I think that by the first part of 2020, for the most part we'll be caught up," said Karl Pfluger, president of Oryx Midstream Services, Midland. Oryx, the largest private midstream company in the Delaware Basin with at least 1 million acres dedicated to its system, will have transportation capacity exceeding 900,000 bbl/d.

Catching up—for now

Midstream capacity additions are lumpy, always not enough or too much, too soon or too late, as pipeline companies chase after producers and their activity. At one time in 2019, seven proposals for new Permian pipelines were on the table. The ones that have been greenlighted so far are expected to transport an additional 4 MMbbl/d of oil to the Gulf Coast by year-end 2022. More than 2 MMbbl/d of this new capacity will go to Corpus Christi for export, according to Wood Mackenzie.

That's the good news. However, consulting firm East Daley Capital has said that by 2021, crude oil pipeline capacity out of the Permian could surpass the basin's production by more than 3 MM bbl/d, "creating perhaps the largest midstream overbuild the word has seen." This may be a temporary phenomenon.

Permian producers have no choice but to have flow assurance, said Peter Fasullo, principal, En*Vantage Inc.

Permian production will once again exceed infrastructure, according to Karl Pfluger, president, Oryx Midstream Services LLC.

According to Enverus, the pace of Permian production growth is at risk of slowing down considerably if commodity prices remain flat. In order to support an increase in prices, long-haul pipelines to markets are necessary. Despite this, it's likely that production will again exceed infrastructure in the region because of the sheer size of the Permian resource opportunity.

"There's always been a cycle where production outpaces infrastructure, but it's an efficient market and you've got a lot of midstream teams chasing opportunities by trying to get ahead of the production curve and build more infrastructure. Our expectation is that this field is way north of 4 million barrels a day of production and at some point production will again exceed the infrastructure. We just don't know when that will be," Pfluger said.

Infrastructure development is so important that for many projects, multiple partners are needed. Producers and midstream operators have joined to ensure systems are close to the wellhead. Some E&Ps are taking equity positions in pipeline projects.

One such project is EPIC Midstream LLC's 700-mile EPIC NGL Pipeline. It had the capacity to transport 400,000 bbl/d of crude oil out of the Delaware and Midland basins, but the company's 590,000 bbl/d EPIC Crude Pipeline came online in January 2020. One of the partners in EPIC is Ares Management LP, which is a publicly traded global alternative asset manager that invests in upstream and midstream projects.

Large publicly traded midstream companies are also a driving force behind many projects, including Plains All American LP's $1.1-billion, 575-mile Cactus II Pipeline that transports up to 670,000 bbl/d of crude out of the Permian. Both Cactus II and EPIC NGL pipelines began interim service in October 2019.

In addition, Energy Transfer LP and ExxonMobil's Permian Express IV pipeline expansion added 120,000 bbl/d of capacity to the system when it came online in the third quarter of 2019, and Phillips 66 Partners intended to bring its 900,00 bbl/d Gray Oak Pipeline online in late 2019.

"The Permian is such a big play that producers have to have flow assurance; they have to make sure

those hydrocarbons—whether crude, gas or liquids—flow. They have no choice," Fasullo said.

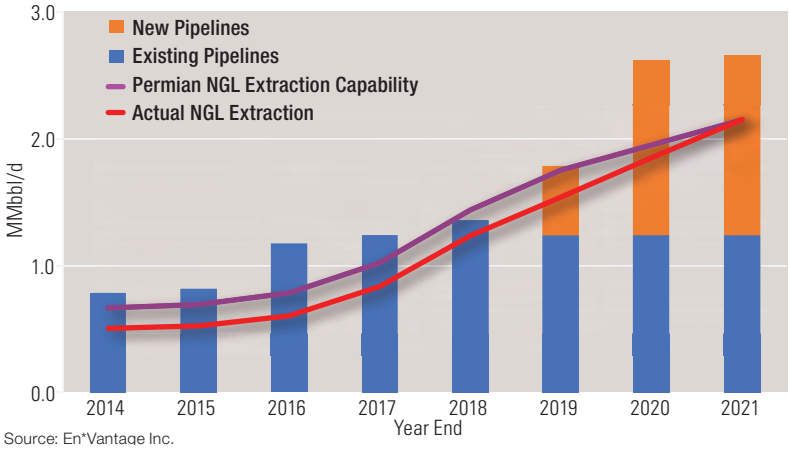
Transporting these huge volumes to the Gulf Coast for export overwhelmed the market and depressed prices in 2019. Fasullo believes that sustained price depression may result in majors becoming further involved in the midstream.

"Independent producers in the Permian are not well capitalized, and they are being pressured by investors to cut spending and focus on maximizing cash flows from volumes being produced. Larger major players like ExxonMobil and Chevron that have been in the Permian a long time will replace the independents as the future drivers of production growth. They have the staying power and the capital to continue to expand even with lower commodity prices," he said.

Fasullo noted that the interest these majors take in the midstream is not necessarily full ownership or operation of assets, but they are gaining interest in various projects and assets in the region, because of the large volumes they have at stake and the critical need for flow assurance.

An early Delaware Basin midstream player, Vaquero's operations, such as the Caymus facility shown here, are now well-established. *Photo courtesy Vaquero Midstream LLC*

PERMIAN NGL EXTRACTION VS NGL PIPELINE TAKEAWAY CAPACITY



Source: En*Vantage Inc.

"Permian producers have been anticipating the end of takeaway constraints and preparing to ramp up their production in the Midland and Delaware basins—assuming prices for the region's benchmark West Texas Intermediate (WTI) stay at reasonable levels, by working with midstream companies to develop new gathering lines, storage capacity and shuttle pipelines to transport increasing volumes of crude oil from the lease," RBN Energy said in a research note.

This infrastructure will connect to multiple West Texas hubs, including Orla, Wink, Crane and Midland. "By offering this optionality—and with it, the ability to access destination markets in Cushing, Corpus [Christi], Houston and elsewhere—midstreamers with well-thought-out gathering systems enable those they serve to secure the highest-possible prices for their crude," RBN said.

Big play Permian

Gary Conway, president and CEO of Vaquero Midstream LLC and proud Aggie, told Hart Energy that he was aware of the Permian because of high school football and the iconic pumpjacks in some highlights of Friday night games. "I grew up in East Texas, but I was definitely aware of Permian High and Midland Lee growing up."

The Permian has been a consistent part of Conway's professional life since then, starting with early career consulting in sour gas fields around Pyote, Wink, Coyanosa and Fort Stockton in West Texas. The Permian was always a place of interest as an area that kept rediscovering itself over and over again. Conway was a contributor in TEAK Midstream LLC. Though this company was largely focused on the Eagle Ford Shale, Conway said that he and his partners were looking at projects in other plays, including the Midland Basin.

After selling TEAK Midstream to Atlas Pipeline Partners LP in 2013, Conway and Bryant Patton,

Gary Conway, president and CEO of Vaquero Midstream LLC, has experienced the difficulties and successes of private midstream operations in the Permian.

Tanner Alexander
VP of Business Development
Brazos Midstream

"Formed in early 2015, Brazos Midstream made its entrance into the Permian, specifically the Delaware Basin, through the acquisition of a small gathering system in Ward and Reeves counties. Over time, we have built upon that initial footprint to become one of the largest privately held midstream companies in the region.

"After recapitalizing in 2018, we are well prepared for the next wave of midstream infrastructure that will be needed as technologies improve and production continues to increase. This type of growth will include the expansion of existing infrastructure and potentially M&A or some combination of both.

"The Permian Basin has proved to be a major contributor to our country's energy independence, and we see this continuing. We believe in the longevity of the play and are excited about the additional midstream opportunities that will come as producers continue to advance their drilling programs. Staying ahead of production demands and customers' needs is critical to any midstream company's success and we look forward to continuing to provide the best customer service in the industry."

one of his fellow partners at TEAK, teamed up to form Vaquero. They considered projects in the Midland, but realized they may have been a bit late to the party. Their story illustrates how private midstream players approach big Permian production growth.

"We realized it was going to be tough to build an asset that we had in mind in the Midland Basin. We were always looking to build a much larger scalable asset, but the Midland side was a bit crowded, so we went further west to the Delaware Basin. We felt we could get into the area and build something of size and scale in that area, which was sort of like the new West," Conway said.

When Vaquero entered the Delaware, drilling was just starting to ramp up. Future production was going to require plenty of additional infrastructure, especially takeaway capacity.

One of the ways Vaquero seeks to differentiate itself in the face of fierce competition from other midstream operators is to focus on service. "Those of us on the private side, we'll often face a bit of a struggle with some producers who favor public companies, because they're afraid the private equity-backed companies will sell at some point and they don't know who will then own the midstream asset. Fortunately, this wasn't as big of a deal when we started Vaquero," he said.

Oryx Midstream Services is expanding its 800 Mbbl crude oil storage capacity in Crane, Texas, by 360 Mbbl. *Photo courtesy Oryx Midstream Services LLC*

1989
The *Exxon Valdez* oil supertanker ran aground on Bligh Reef in Prince William Sound, Alaska, after almost 12 years of daily oil tanker passages through the area. The accident resulted in a massive oil spill.

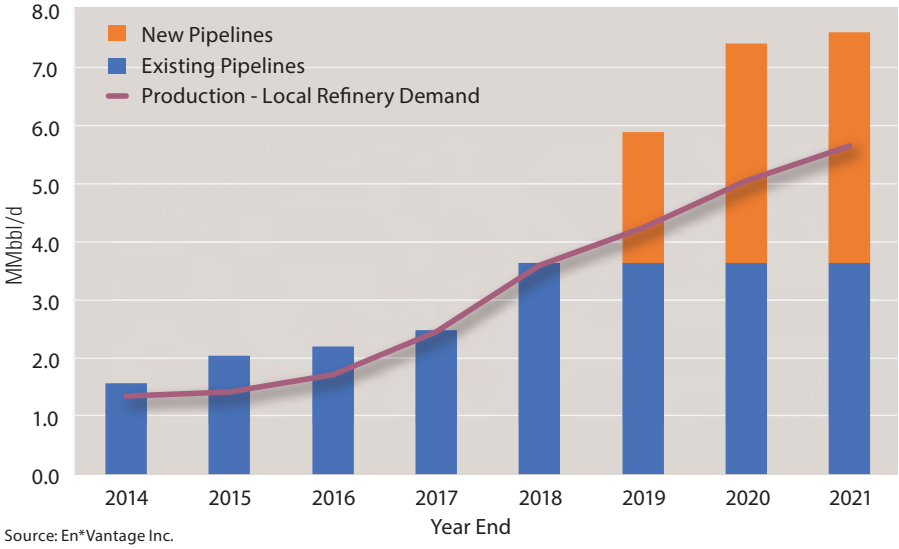
1990
The first natural gas futures traded on Nymex, with the delivery at Henry Hub.

1990
The Santa Rita No. 1 was taken out of service and plugged after 67 years of service.

Part of this confidence was due to the size of Vaquero's Caymus natural gas processing system in Pecos County. Two processing plants have total capacity of 400 million cubic feet per day (MMcf/d). The system was originally designed to provide up to 1 billion cubic feet per day (Bcf/d) rich gas header capacity to the cryogenic facility. Conway also noted that Vaquero was purposefully set up to look like a long-term, MLP-style company in order to make producers more comfortable.

Caymus was designed with optionality in mind, with six residue connections and four NGL connects. This allows producers to make their own downstream arrangements should they choose rather than thinking Vaquero is pushing them in a certain direction.

PERMIAN OIL SUPPLIES VS. PIPELINE TAKEAWAY CAPACITY



Source: En*Vantage Inc.

Vaquero decided to build its processing facility as close to the Waha gas hub as possible because that allowed for the flexibility of quickly connecting to multiple downstream infrastructure, interstates and intrastate pipelines on both residue gas and NGL products. Multiple access points ensure that producers can get the best price for their product or have a place to offload it if prices are not as strong.

The company has a third 200 MMcf/d plant in inventory that it is gearing up to construct once a final decision is made to move forward. "You don't build 400 MMcf/d right away. You build 200 MMcf/d [first] because it takes a while to grow it," Conway said.

To bring the third Caymus plant online, Conway said the company is reading the tea leaves. "We're watching our producers' growth rates and crude prices, even though we're dealing with associated gas. This is a crude oil basin. It's very important to them because they manage inside their cash flow just like we do, but we'll be ready when they are," he said.

The long-term goal for Caymus? It will be a 1 Bcf/d system with five 200-MMcf/d processing plants, although Conway said the company has room for more than five plants on the system's 309 acres. Though the Permian is a crude oil play, a massive amount of associated natural gas is coming out of the wellhead, and reliable service will be paramount for producers.

"Our solution was to go in with large assets because the gas needs processing, and it's very difficult in our mind, to be able to go in with smaller plants and pipelines," Conway said.

Legacy issues

One challenge midstream operators face in the Permian is the region's history. Some operators used legacy midstream assets at first for expediency, but that created issues because those assets weren't designed for the products or specifications inherent in today's surging oil and gas production.

"That legacy infrastructure served as a good bridge to new infrastructure, but the problem is that it was really built to service vertical activity, and it has been overwhelmed by horizontal production. We've had to basically recreate any infrastructure that did exist and then fill in the gaps for places that didn't have infrastructure," Pfluger explained.

Another issue has been the sheer volume of legacy infrastructure in place in the region, which can make it difficult to build new infrastructure. In Vaquero's case, Conway said the company crossed more than 100 pipelines in the first three miles of the Waha area with its 30-inch Lariat header pipeline.

"The challenge has been more on the right-of-way side of things, maintaining safe distances and depths," he said, adding that Vaquero and some other midstream operators have placed extra importance on being environmentally sound.

As the Permian boom really took off, the midstream lagged behind production to a great extent, but it has been catching up. "We as an industry almost always overbuild, though sometimes it's not been in the right place. I think we all try to build in the right places, but inherently producers are pushed to the edges of plays needing services," Conway said.

"Producers will go out into a geologic area and press the edge to see where the boundary is. Everybody first started out in relatively the same area and then started spreading out and we in the midstream will follow to serve the guys the furthest away," Conway said.

Vaquero has chosen to build laterals off its large rich gas header into these areas rather than build a

Finite labor resources, said Brett Wiggs, CEO of Oryx, lead to a very interactive construction process in the Permian.

Drew Ward
Partner & Chief Commercial
Pinnacle Midstream II LLC

"My first experience in the Permian was five to six years ago when I first met with Clayton Williams and he told me that Reeves County was going to be the center of the universe before anyone else recognized it. He was proven right when they sold to Noble Energy Inc.

"Pinnacle [Midstream] I was a success due to the risk that the management took on an unknown 'fringe' area in Culberson County that turned out to be some of the best acreage in the Delaware Basin.

"When starting Pinnacle [Midstream] II, it was impossible to not begin looking for opportunities within the Permian as it still has a lot of chapters to write in its development cycle.

"The Permian Basin is a national treasure in that it was thought to be depleted just a few years ago and has since gone through a revival. There isn't any other place on earth that has the proven stacked pay and other potential horizons that the Permian does.

"The Permian directly and indirectly influences every Texan whether they know it or not through revenue taxes, royalties to the UT Land system and the incredible amount of jobs that have been created through the development of the resource."

plant further away from takeaway, power and other needed infrastructure.

Despite its existing assets, the Permian has required significant investment in other areas outside of the typical midstream purview as production has grown in the past decade. Conway noted that the sudden development of the basin created a huge need for more electrical power, better highway infrastructure and lots of workers. On the worker front, this has required not only skilled industry workers, but also healthcare, educational, and service workers to help deal with the influx of industry personnel.

Brett Wiggs, CEO of Oryx Midstream Services, said that the finite resource pool for skilled workers in the region has translated into higher construction costs and longer lead times to execute projects.

A midstream project may seem like any other construction project on paper with lead times for funding, planning and development. During this phase, midstream operators work very closely with producers, similar to how real estate developers meet regularly with clients. However, operators and producers may actually meet more often once the facility or pipeline system is online.

"Developing a pipeline gathering system that meets producers' needs is a very interactive process, so regular interaction with the customer is extremely important," Wiggs said. We always have a minimum of biweekly meetings to update our process, communicate and coordinate with those producers. As we get closer to in-service, that often goes to kind of a weekly coordination meeting."

He added that this kind of project management extends to working with other operators, especially on the downstream side, to ensure that connecting projects remain on track throughout the value chain.

Rapid growth, more capacity

Private equity-backed midstream teams have found a nice foothold in the Permian since they're able to move quicker and are more focused than some companies that operate in multiple plays, according to Pfluger.

"Larger public companies can offer more services in-house that we use third parties for, but we believe that we're more nimble and able to act quicker than many of those companies. We're also 100% focused on one asset: our system in the Permian Basin," Pfluger said.

When Wiggs, Pfluger and their partners created Oryx Midstream, they wanted their system to stand out for safely being used 50 years in the future. This system is built of 100% steel with a larger diameter pipeline than required. It also features world class control systems such as SCADA, leak detection, continuous monitoring and a 24-hour operation and control center.

Oryx Midstream's pipeline system is also the only purpose-built, batchable system in the Permian. The company can transport crude at various API ranges and then segregate them at central terminals, then batch that through its regional transport line for delivery to different market centers.

The rapid growth of the Permian is evident in the Oryx pipeline system being designed to transport about 200,000 bbl/d of crude. Company officials assumed that would be enough for about five years—but after 18 months, they had to expand due to high demand from producers. Oryx more than doubled the line's capacity to achieve an average transportation capacity of about 425,000 bbl/d. The company anticipates capacity to reach about 1 million bbl/d in the next few years.

In early October 2019, Oryx announced a $355-million joint acquisition with Rattler Midstream LP of Reliance Gathering LLC. This deal included more than 230 miles of crude gathering and regional transportation pipelines and about

According to a Rystad Energy analysis, gas flaring and venting in Texas and New Mexico reached an all-time high in third-quarter 2019, averaging more than 750 MMcf/d.

200,000 bbl of crude oil storage in Midland, Martin, Andrews and Ector counties. Oryx will operate this system.

"We're really excited about the acquisition and working with Rattler and their parent, Diamondback Energy. It's our first expansion to the Midland Basin; it gives us a good growth platform to expand the services that we have on the Delaware side of the Permian into the Midland Basin, and to capitalize on infrastructure that we already have in place relative to connections and deliverability," Wiggs said.

Bottlenecks abound

In some ways the biggest concern from a midstream perspective in the Permian is related to natural gas production. Producers have been focused on crude and liquids and more relaxed when it comes to developing new natural gas pipelines and LNG export terminals in certain hubs.

Since natural gas is a byproduct of crude production, producers haven't been as focused on this less economic commodity. The result is that midstream operators are following producers' focal points to develop crude and NGL infrastructure first.

"E&P companies have become so efficient that they've been able to produce at much higher rates, and it overruns the existing infrastructure. That's why you've seen so many bottlenecks occur," Fasullo said, noting there has been significant flaring of gas in the region. According to a Rystad Energy analysis, gas flaring and venting in Texas and New Mexico reached an all-time high in third-quarter 2019, averaging more than 750 MMcf/d.

The LPG export terminal area of choice for Permian production will be the Upper Texas Gulf Coast from Freeport to Nederland, Texas. While Corpus Christi is closer and has fewer potential bottlenecks than Mont Belvieu and the Houston Ship Channel, there is far less NGL storage and LPG export capacity in the greater Corpus Christi area.

"There's not enough NGL market down in Corpus to absorb that much liquid. Just isn't. If you go up the coast at Belvieu, you've got a huge market with much more optionality," Fasullo said.

Indeed, it's likely that once takeaway capacity meets production levels, the next challenge will be storage, along with market distribution to domestic and international customers.

Although producers have gotten extremely efficient at drilling and the midstream companies have been quick to develop new pipelines and natural gas processing plants, developing and constructing world-scale ethane crackers, refineries and export terminals takes longer. Many large integrated midstream players such as Enterprise Products Partners LP, Targa Resources and Energy Transfer Partners are meeting these challenges by expanding their downstream infrastructure, particularly their LPG export capacities.

Indeed, as of mid-year 2019, there were as many as eight offshore export terminal projects proposed, requiring billions of capital investment. Among other objectives, these projects recognize the need to better accommodate very large crude carriers (VLCCs), which, in order to be loaded efficiently, require either deeper channels or offshore terminals.

Admittedly, some projects have generated concern. Trafigura Trading LLC's proposed Corpus Christi offshore terminal has faced opposition from the Port of Corpus Christi, due to the terminal's purported environmental risks. Others, however, have received stamps of approval, such as the Phillips 66 subsidiary Bluewater Texas project, which would link to two pipelines and receive VLCCs to carry Permian crude.

Even so, the results from new links between the pipeline buildout and export terminals already show. According to the companies' August 2019 press release, Trafigura and Buckeye Partners LP's terminal at Corpus Christi received its first delivery of Permian crude oil from Plain's All American's Cactus II pipeline, ahead of the line's full operation, foreshadowing increased activity in the export hub.

This will be needed, given the quick rise of Permian crude production, which according to the U.S. Energy Information Administration has increased from about 849,000 bbl/d in 2007 to 4.2 million bbl/d at present.

That's a huge increase, and it's not likely to slow down anytime soon. It's likely the midstream buildout won't be slowing down anytime either.

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