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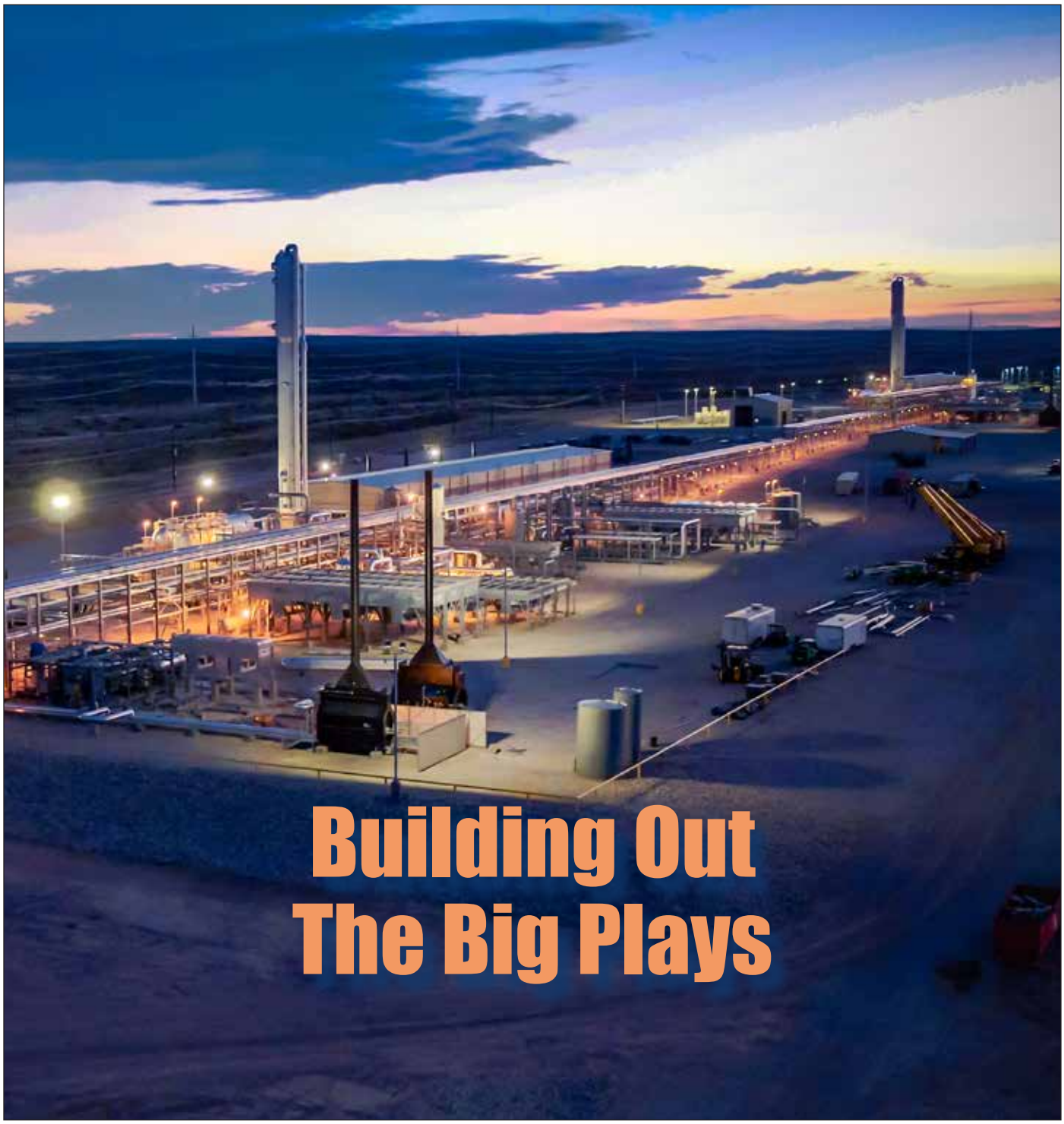

# Building Out The Big Plays

A supplement to Oil and Gas Investor

DECEMBER 2019

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*A supplement to*

Oil and Gas Investor

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# CONTENTS



**On the cover:** The rapidly expanding Delaware Basin has seen multiple new gas processing plants come on stream, including this unit recently completed by Jasper Ventures. *Source: Jasper Ventures*

# Question the ordinary
# *Imagine the extraordinary*
# Create the enduring

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# Black Swans

**By Paul Hart**, Midstream Editor-At-Large

Hard to believe, but in a few weeks—right after menorah candles are snuffed out and Christmas trees go back in the attic—we start a new decade. That's hard to believe.

Things have changed immensely for the industry, and for me, in the last 10 years. What lies ahead for the midstream? You'll read several prognostications from industry observers in this issue as we do a whip-around of the major shale plays and their particular midstream challenges.

Some analysts have shinier crystal balls than others, but I find a lot of people who get paid a lot of money get things wrong, despite crunching immense piles of data, incredibly complex computer models, and all that sort of thing.

It's the same thing as TV weather people, who never remind you what yesterday's forecast was. The one exception to that rule I recall came years ago when the weather guy on a Tulsa, Okla., station observed Oklahoma was getting "lots of partly cloudy today." His weather segment followed a news story with reporters on location, standing on city streets, knee deep in flood water.

I try to read a lot of analyst reports, and one of my favorites to peruse is Wells Fargo Securities' excellent *Midstream Monthly Outlook*. A recent issue gave the following sector forecasts out through 2025:

- A potential global economic slowdown, the U.S.-China trade fight, and overall geo-political instability could keep crude and gas prices range bound, muting the near-term outlook for increasing exports;
- "Given this backdrop, we expect U.S. crude, natural gas, and NGL production growth to moderate. While increased volumes and higher cash flows for midstream companies positioned in growth basins should still materialize, the overall growth trajectory is likely more muted;"
- Widening high-yield credit spreads and rising counterparty E&P risk to midstream players, mostly focused on small caps, tempers the near term;
- Several basins will likely be tight (supply vs. takeaway) for up to three years, "requiring continued infrastructure spending. Disciplined growth capital spending should support long-term DCF [distributable cash flow]/unit growth;"
- Low-cost U.S. hydrocarbons drive long-term export growth; MLP restructuring within the sector may attract institutions back; and
- "Further de-leveraging of balance sheets, continued improvements in corporate governance, and improved ROIC [return on invested capital] should attract outside capital."

Another point Wells Fargo makes that's worth noting: "A difficult environment to build pipelines or drill new wells (regulatory, public opposition)." The environmentalist movement has a religious fervor and isn't necessarily swayed by facts or reason. Think of those people last summer, dangling from Houston's Fred Hartman Bridge to shut down the Houston Ship Channel.

**We tend to think of black swans as negative … but they can be positive events too. The stupendous development of the shale plays in the past decade, which turned the U.S. from energy importer to exporter, is a case in point. Who, honestly, saw that coming in 2009?**

These projections all sound pretty good, pretty logical. What analysts and forecasters dread—and what will happen eventually—is a feared "black swan event," which the dictionary defines as "an unpredictable or unforeseen event, typically one with extreme consequences."

We tend to think of black swans as a negative—the 1973 oil embargo, for example—but they can be positive events too. The stupendous development of the shale plays in the past decade, which turned the U.S. from energy importer to exporter, is a case in point. Who, honestly, saw that coming in 2009?

"This has been an incredible gift to the United States economy, consumers and to the petrochemical industry, and we're still in the beginning stages," author and energy observer Robert Bryce told our Jeff Share in an interview featured in this issue. Will it be the gift that keeps on giving?

The winners, the midstream companies that will still be here and thriving in 2029, are the ones that will keep their binoculars up and their powder dry. The forecasts are valuable; executives need to read and heed them.

But this business is not a walk in the park. A black swan may cross your path. ■

*Paul Hart can be reached at **pdhart@hartenergy.com** or **713-260-6427**.*

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# Getting It Moving

## The Permian Basin continues to dominate, but the Marcellus-Utica and the Gulf Coast are ramping up as well.

*By Terrance Harris*

The third quarter was another high-producing three months, which saw companies making moves and deals to get more product—crude oil and natural gas—to market. The trend has rolled on into the fourth quarter.

In some cases, there were strategic partnerships, expansion and construction all taking place with a common goal. Here's a quick review of selected midstream projects, by the major plays:

### Permian Basin

The name of the game in the Permian Basin remains increasing the flow of product to market. To do so effectively, there is more construction coming online now and in the future.

One of the biggest projects, set to begin operation in early 2021, is the Wink to Webster Pipeline project. The pipeline, which will have 1 million barrels per day (MMbbl/d) of takeaway capacity from the Permian Basin, will see Wink to Webster Pipeline LLC affiliates MPLX LP, Delek US Holdings LP and Rattler Midstream LP joining ExxonMobil Corp., Plains All American Pipeline LP and Lotus Midstream LLC as partners.

Kinder Morgan Inc. is also moving forward with its South Texas pipeline connection that will transport crude from Phillips 66's 900,000 barrels per day (Mbbl/d) Gray Oak pipeline in the Permian Basin to delivery points on the Houston Ship Channel.

Kinder Morgan expects service to begin by the end of 2019 and carry 100 Mbbl/d.

Epic Midstream Holdings Inc. began shipping crude on its 400 Mbbl/d pipeline from the Permian Basin to the U.S. Gulf Coast during the third quarter, which had the positive impact producers wanted: Midland crude prices climbed higher.

### Rockies

A Noble Midstream Partners LP and Greenfield Midstream LLC collaboration is making progress and is on schedule to have a new liquids-focused system in operation for producers in early 2020.

Their Black Diamond Gathering LLC joint venture will provide crude oil gathering and storage services to producers in the Denver-Julesburg (D-J) Basin.

As part of the strategic relationship, Black Diamond and Noble Energy Inc. made commitments during Saddlehorn Pipeline's recent open season. Black Diamond's investment option expires in April 2020. The Saddlehorn Pipeline is jointly owned by affiliates of Magellan Midstream Partners LP, Plains All American Pipeline LP and Western Midstream Partners LP, and it is currently capable of transporting about 190 Mbbl/d of crude oil and condensate from the D-J and Powder River basins to storage facilities at the Cushing, Okla., facilities owned by Magellan and Plains All American. With the recent successful open season, the Saddlehorn Pipeline will be expanded by 100 Mbbl/d, to a new total capacity of 290 Mbbl/d.

To the north, an Energy Transfer LP executive said in September the firm received sufficient producer interest during a third-quarter open season to move ahead with an expansion of its Bakken Pipeline System. The project would nearly double capacity to 1.1 MMbbl/d. The Dallas-based firm did not provide a construction schedule.

### Gulf Coast

Freeport LNG isn't allowing a glut of natural gas supply to slow its business plan. In fact, the company has gone full steam ahead by shipping its first commissioned cargo of LNG from its Quintana Island location in Freeport, Texas. About 150,000 cubic meters of the super-chilled fuel was loaded on board the Bahamas-flagged *LNG Jurojin* and shipped from the Freeport LNG terminal in September. Ship tracking found that the tanker stopped in Jebel Ali, United Arab Emirates.

The start-up of Freeport LNG is expected to add to a supply glut that has been weighing on spot LNG prices in Asia. Industry observers speculate weak LNG prices could delay work on additional liquefaction capacity as the new year begins.

"The start-up of Freeport LNG contributes to even more supply growth at a time when the market is already oversupplied," FGE LNG analyst Edmund Siau said in a *Reuters* report.

Baker Hughes is at the helm of Calcasieu Pass LNG project construction and was granted a final notice to proceed (FNTP) in the third quarter by Venture Global. The project, which is expected to begin in the second half of 2020, will add 10 million tonnes per annum (mtpa) to domestic LNG capacity.

Under the contract, Baker Hughes will provide an LNG liquefaction train

with 18 modularized compression trains across nine blocks. The modularized system is said to offer a "plug-and-play" approach that allows for faster installation and lower construction and operational costs.

Meanwhile, Enterprise Products Partners LP has established plans to expand and extend its Acadian natural gas system, which will deliver volumes of natural gas from the Haynesville Shale to the LNG market in South Louisiana. This project, which is set to begin service in mid-2021, will feature construction of about 80 miles of pipeline around Cheneyville, La., to third-party interconnects near Gillis, La., and will include multiple pipelines that will serve LNG export facilities in Louisiana and Texas.

### Marcellus-Utica

Noteworthy—but far afield from other midstream projects—Kinder Morgan

**Selected Recent Midstream Construction Projects**

| Operator/Developer | Project | Location | Added Capacity | Play | Status/Completion |
|---|---|---|---|---|---|
| PERMIAN BASIN | | | | | |
| Wink to Webster Pipeline LLC/ MPLX LP/ Delek US Holdings LP | Crude Oil Pipeline Project | Texas | 1 MMbbl/d | Permian | Early 2021 expected completion |
| Kinder Morgan Inc. | South Texas Pipeline | West Texas | 100,000 bbl/d | Permian | End of 2019 |
| Epic Y-Grade Holdings | Ethane and Ethylene Pipeline | Corpus Christi, Texas | N/A | Permian | Q3 2020 |
| Longhorn Midstream Holdings LLC | Crude Oil Gathering System | Eddy County, N.M. | N/A | Delaware | Open season closed in August |
| Salt Creek Midstream Crude | Oil Gathering and Transportation System | Eddy County, N.M. | N/A | Delaware | Open season closed in August |
| Epic Midstream Holdings Inc. | Shipping Crude Oil | Midland, Texas | 400,000 bbl/d | Permian | Began Aug. 15 |
| GULF COAST | | | | | |
| Baker Hughes for Venture Global LNG | Calcasieu Pass | Cameron Parish, La. | 10 mtpa | N/A | Expected to begin second half of 2020 |
| Freeport LNG/ Westbourne Capital | NGL Train 4 Project | Quintana Island, Texas | 5 mtpa | N/A | N/A |
| Enterprise Products Partners LP | Acadian Natural Gas System | Cheneyville, La. | 3 Bcf/d | Haynesville | Beginning service mid-2021 |
| LyondellBasell/Enterprise Products Partners LP | Propane dehydration Plant | Mont Belvieu, Texas | 35,000 bbl/d | N/A | First half of 2023 |
| EVX Midstream Partners LLC | Water Gathering System | South Texas | N/A | Eagle Ford | First phase completed in September |
| MARCELLUS-UTICA | | | | | |
| Enterprise Products Partners LP | ATEX Ethane Pipeline | Pennsylvania, West Virginia, Ohio and Texas | 45,000 bbl/d | Marcellus/Utica | To enter service in 2022 |
| Williams Cos. Inc. | Natural Gas Pipelines | Pennsylvania | N/A | N/A | Expected to enter service in 2021 |
| MIDCONTINENT | | | | | |
| Blue Mountain Midstream | New Systems and Services | Central Oklahoma | N/A | Cushing, Okla., terminal | Fourth-quarter 2019 |
| ROCKIES | | | | | |
| Energy Transfer LP | Bakken Pipeline System expansion | Patoka, Ill., terminal | 530 Mbbl/d | Bakken | Sufficient producer interest to proceed |
| Noble Midstream Partners LP/ Greenfield Midstream LLC | Crude oil gathering and storage services | Colorado | 100 MMbbl/d | D-J Basin | Early 2020 |

*Source: Hart Energy*

announced early in the fourth quarter the commercial start-up of the first train at its Elba Island, Ga., LNG operation, outside Savannah. Trains 2 and 3 were expected to start up in the fourth quarter. The plant will have 10 trains when completed with a capacity of 2.5 mtpa.

It's the nation's second Atlantic-facing LNG plant, in addition to Dominion's Cove Point, Md., plant on Chesapeake Bay and will provide another, badly needed market for natural gas coming out of the Appalachian Basin, which faces continuing constraints on pipeline capacity.

It has taken longer than expected, but it appears Williams Cos. Inc.'s Constitution Pipeline from Pennsylvania to New York could start moving again. A breakthrough came when the Federal Energy Regulatory Commission (FERC) voted that New York State took too long to deny a water permit. There still is a chance of a permit reversal in the courts, and other permit issues loom. But the project could enter into service in 2021, if all goes well.

FERC ordered that the New York State Department of Environmental Conservation (NYSDEC) waive the water quality certification required under the federal Clean Water Act for the New York portion of the pipe. FERC approved construction of Constitution in December 2014, but the project has been at a standstill since 2016 due to permitting questions.

Enterprise Products Partners announced it will proceed with an expansion of its Appalachia-to-Texas (ATEX) ethane line following a successful open season. The system could be expanded by as much as 45 Mbbl/d to 190 Mbbl/d in 2022.

The 1,200-mile ATEX pipeline transports ethane from the Marcellus and Utica in Pennsylvania, West Virginia and Ohio to the NGL storage and trading hub at Mont Belvieu, Texas, which features pipeline access to multiple petrochemical plants along the Gulf Coast.

Enterprise could add up to 50 Mbbl/d of incremental capacity through a combination of pipeline looping and modifications to already existing infrastructure. The expansion could be in service by 2022.

Gas producers in Pennsylvania, Ohio and West Virginia need all they help they can get from new pipeline capacity. Appalachia, much like the Permian, has continuing "basis" problems, or the price difference in what producers realize there vs. gas produced in other basins.

And new capacity doesn't always have the desired effect.

The Rockies Express Pipeline, or REX Pipeline, was designed to improve Rockies gas prices by selling to the Northeast—until the vast reserves of gas from the Marcellus and Utica emerged. And, with that rapidly growing glut of gas in Appalachia, traditional long-haul pipelines serving Northeast markets ended up being reversed. ■

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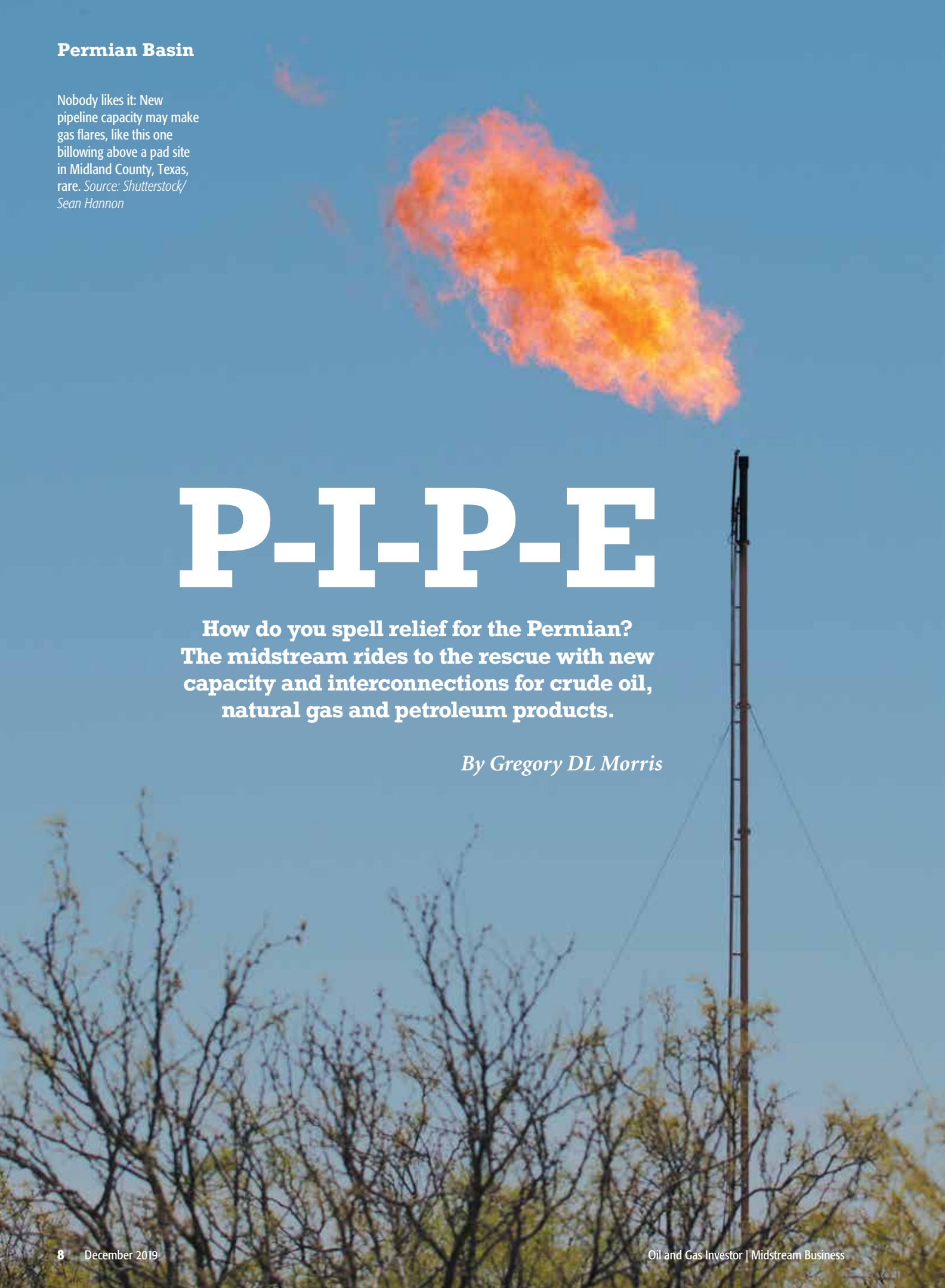
***Chris Sheehan*** *contributed to this report.*
***Terrance Harris*** *can be reached at* ***tharris@hartenergy.com*** *or* ***713-260-6477.***



Nobody likes it: New pipeline capacity may make gas flares, like this one billowing above a pad site in Midland County, Texas, rare. *Source: Shutterstock/ Sean Hannon*

# P-I-P-E

**How do you spell relief for the Permian? The midstream rides to the rescue with new capacity and interconnections for crude oil, natural gas and petroleum products.**

*By Gregory DL Morris*

As the fourth quarter began, Kinder Morgan launched full commercial service along its joint-venture Gulf Coast Express (GCX) gas pipeline ahead of schedule. The line runs from the Permian Basin's Waha gas pipeline to the Agua Dulce hub near the Texas Gulf Coast. Fully subscribed under long-term contracts, GCX provides 2 billion cubic feet per day (Bcf/d) of incremental gas capacity, which will help relieve existing Permian gas takeaway constraints and reduce flaring.

"We had more than 3,000 contractors deployed at times and more than 6 million contractor hours worked, all without a major safety incident during the construction phases of the project," said Sital Mody, Kinder's president of natural gas midstream. Kinder Morgan owns a 34% interest in GCX and is the operator of the pipeline. Other equity holders include Altus Midstream, DCP Midstream and an affiliate of Targa Resources.

Gulf Coast Express is the first of the three Permian pipelines planned by Kinder Morgan. The Permian Highway Pipeline will add another 2 Bcf/d of capacity by the end of next year. And still to come is the Permian Pass, which has yet to reach final investment decision. The decision will be contingent on demand from producers, but Kinder management has indicated that the project is moving along.

### Production progress

The Permian's August gas production of 14.7 Bcf/d is nearly twice that of production just three years ago. Natural gas prices at Waha have traded at an average discount of $1.81/MMBtu to the industry-standard Henry Hub in Louisiana this year and even fell into negative territory, signaling a need for additional takeaway capacity, according to energy infrastructure analyst firm Alerian.

Crude production in the Permian has more than quadrupled since 2011, and the basin is now, on its own, the fifth-largest producer of crude in the world, according to a recent report from Alerian. Total Permian crude production was over 4.3 million barrels per day (MMbbl/d) in August, a nearly 20% increase from just a year ago, and production growth is expected to continue.

Before recent pipeline additions, estimated Permian takeaway capacity was roughly 3.6 MMbbl/d.

"The Permian has long faced a lack of takeaway capacity due to its rapid growth, but new long-haul pipelines are finally coming online to provide an outlet for crude production," wrote Bryce Bingham, Alerian research analyst. "While these capacity additions helped ease the Permian bottleneck, additional takeaway capacity was, and still is, required to meet rapid production growth."

Two major Permian pipeline projects began service in August, helping to ease the basin's takeaway constraints and providing further sources of stable cash flows for midstream companies. Crude oil shipments began just days apart on Plains All-American's 670,000 bbl/day (Mbbl/d) Cactus II line and on Epic Midstream's Y-grade (mixed NGL) pipe.

Together they added more than a million barrels a day from the Permian to the Gulf Coast. Another 2 MMbbl/d planned to be added by 2022. (See adjoining chart.)

### Everyone in the pool

Technically, the Epic Y-grade line has only been temporarily converted to crude service. It will revert to NGL in January after Epic puts into service a dedicated 600 Mbbl/d line. That is scheduled to take place just a little after Enbridge and Phillips 66 Partners put into service the 900 Mbbl/d Gray Oak Pipeline.

At the other end of the line, NuStar Energy loaded the first shipment of Permian crude for export from its Corpus Christi, Texas, terminal in the third quarter. NuStar had only recently completed a project connecting a pipeline in South Texas to Cactus II.

U.S. crude exports have surged to a monthly record of greater than 3 MMbbl/d.

NuStar also said it was nearing completion of connections between its South Texas Pipeline System to two other long-haul pipelines that would also move barrels from the Permian to South Texas. The company said it was in discussions with both Epic and Phillips 66 Partners regarding connections to those lines.

Phillips 66 ranks No. 15 on this publication's Midstream 50 of the sector's largest publicly held firms.

The beat goes on with the Wink to Webster Pipeline, a group effort that is slated to add a further million barrels a day of transportation in 2021. The partners in that line read like a Who's Who of upstream, midstream and downstream: ExxonMobil, Plains All American, MPLX, Delek, Lotus Midstream and Rattler Midstream.

"Not only does additional infrastructure coming online benefit midstream companies, it has supported crude prices at Midland," wrote Bingham. "Crude spreads widened significantly last year as a result of inadequate pipeline capacity and rapidly growing production but have since narrowed significantly."

Crude at Midland was trading at a $0.35/bbl premium to West Texas Intermediate at the Cushing, Okla., pipeline and trading hub at the end of the third quarter.

"That is a dramatic shift from a nearly $18/bbl discount in August 2018," noted Bingham. "Houston-to-Midland differentials have also narrowed to $3.45/bbl after blowing out to nearly $24/bbl last summer."

In April, EagleClaw Midstream, a portfolio company of Blackstone Energy Partners and I Squared Capital, made the final investment decision on its proposed Delaware Link pipeline to transport residue natural gas from the Permian's Delaware Basin to Waha, with access to further downstream takeaway connections. I Squared Capital is an independent global infrastructure investment manager focusing on energy, utilities, telecommunications and transport in the Americas, Europe and Asia. The firm has offices around the world.

Delaware Link is expected to be anchored by residue volumes from EagleClaw's processing facilities, as well as third-party customers. The approximately 1.2 Bcf/d, 40 mile, 30-inch diameter pipeline will originate at EagleClaw's three existing natural gas processing complexes in Reeves County, Texas—East Toyah, Pecos and


Pecos Bend. Even as the decision was made to proceed, Blackstone noted the level of producer inquiry and is already considering increasing the pipeline's diameter and capacity.

Planned interconnections include direct access to the Permian Highway Pipeline, a planned 2.1 Bcf/d gas line from Waha to the Gulf Coast and other markets. Permian Highway is a joint venture of Kinder Morgan, EagleClaw, Apache and another undisclosed anchor shipper. It is expected to be in service in the second half of 2020.

EagleClaw claims primacy as "the largest natural gas gatherer and processor in the southern Delaware Basin." EagleClaw is a partner with Targa on the Grand Prix Pipeline Project and with Kinder Morgan on the Permian Highway Pipeline Project. EagleClaw has long-term dedications for gas, crude and water midstream services in place over half a million acres from more than 25 successful and active producers in the Delaware Basin.

"We should be adding 21 Bcf/d of natural gas lines. We're only adding six, so this flaring issue is not going away with these three new pipelines."

– **Scott Sheffield**, *president and CEO, Pioneer Natural Resources Co.*

**Flare for the dramatic**

The Gulf Coast Express announcement by Kinder Morgan was as notable for what it mentioned as what it did not.

Kinder Morgan is one of the big dogs of midstream—ranked No. 3 on the Midstream 50—and its push to get gas transportation into service signals that the sector is serious about getting all Permian molecules to market, not just oil.

It is also notable that Mody stressed the importance of the new pipe as part of the effort to reduce gas flaring. It would have been easy to stick with banalities about export opportunities, especially given the number of liquefied natural gas (LNG) terminals being built and expanded along the Gulf Coast. Indeed, Kinder Morgan is leading one itself.

The Federal Energy Regulatory Commission (FERC) approved Kinder Morgan's request to start commercial operations at Train 1 of the company's Elba Island LNG complex in Georgia as the fourth quarter began. FERC approved the request to "commence service for liquefaction and export activities." Elba Island won't directly impact the Permian, of course, but is another example of the boom in U.S. LNG exports.

The facility experienced start-up problems that led to periodic delays since late last year as it tweaked the setup of its 10 trains. In total, they will produce around 3 million tonnes per year when up and running. The U.S. had exported 26 million tonnes of LNG through September, exceeding its 2018 total of 22 million tonnes with the fourth quarter to go.

That puts the U.S. into a tie with Malaysia for third place among global LNG exporters—quite a change from zero LNG exports less than a decade ago.

Centurion Pipeline's terminal outside Midland, Texas, serves the Midland Basin. *Source: Centurion Pipeline LP*

**The blight**

Flaring of associated gas has been the blight on the escutcheon of the Permian success story for years. In recent months, the pressure to address that has been increased as some upstream leaders have spoken publicly about it. The pivot point on the issue may have been a recent decision by the Texas Railroad Commission.

Ironically, the commission ruled 2-1 that a producer could flare and did not have to put associated gas into a nearby gathering system. Still, the split decision was made on narrow grounds in favor of a struggling producer and against a large national midstream operator.

Arguments in the case clearly showed regulators' patience is running out for flagrant flaring. Though natural gas pipelines providing additional takeaway capacity are welcomed, low natural gas prices, pipeline takeaway commitments and other economic factors remain an issue when it comes to flaring of gas, according to Scott Sheffield, Pioneer Natural Resources president and CEO.

"That's the biggest issue we have to solve with the producers and with the pipeline companies," Sheffield said during a recent Permian-focused event hosted by the Center for Strategic & International Studies. "And the states probably need to do a better job of putting more pressure on both groups of people, in my opinion, to solve that problem. We should be adding 21 Bcf/d of natural gas lines. We're only adding six, so this flaring issue is not going away with these three new pipelines."

Chevron has had a no-flaring company policy since 2008, according to another panelist, Stephen Green, president of Chevron North America E&P.

"That doesn't mean you won't ever see a Chevron facility that has a flare. We do have to use them for safety and operational issues," Green said. "But we don't bring on production with flaring as a routine part of the operations."

Both Green and Sheffield acknowledged economic challenges surrounding the flaring issue and how it impacts operators in different ways.

"But as an industry this is an issue that we have to come to grips with and figure out how to address for the long term," Green said.

**Produced water**

One of the ironies of prodigious Permian production is that it generates both fire and water at the same time: too much associated gas that ends up going up in smoke, as well as vast seas of produced water.

As producers, midstream operators and regulators struggle to reduce flaring, there is a broad effort to expand and integrate water-gathering systems.

At present most are focused on disposal wells, but there is progress on reuse and recycling. Both of the Permian's cities, Midland and Odessa, have struck deals to treat produced water as a way of tying the resources of the region to its population centers.

NGL Energy (NGLEP) closed an equity deal to acquire Hillstone Environmental Partners, a water midstream company, from Golden Gate Capital for about $600 million at the end of the third quarter. Hillstone operates water-pipeline and -disposal infrastructure to producers in the Delaware, with a core operational focus in the stateline area of southern Eddy and Lea counties, N.M., and northern Loving County, Texas. NGLEP acquired another water midstream firm, Mesquite, in July.

Hillstone has a fully interconnected, produced-water pipeline transportation and disposal system. It comprises 19 saltwater disposal wells with total permitted disposal capacity of 580 Mbbl/day. The newly built network of produced-water lines has a transportation capacity of about 680 Mbbl/day. NGLEP owns and operates a vertically integrated energy business with four primary businesses: crude logistics, water and liquids, as well as refined products and renewables.

Hillstone also has an additional 22 permits to develop another 660 Mbbl/day of disposal capacity. NGLEP expects to integrate the Hillstone system into its existing Delaware Basin operations. All of the water on Hillstone's Northern Delaware Basin system is delivered via multiple pipes. Hillstone also has an aggregate of more than 110,000 acres contracted under long-term dedications with priority disposal rights or minimum volume commitments.

"This transaction is highly complementary to our Delaware Basin operations," said Mike Krimbill, CEO of NGLEP. "It not only adds a redundant, interconnected produced-water pipeline system with significant permitted disposal capacity that fits perfectly within our existing footprint, but importantly, it also supports our ongoing strategy of increasing our cash flow predictability."

Doug White, the firm's executive vice president of water, added, "The integration of the Mesquite assets is fully underway and providing immediate benefit. The certainty of off-take and reliability of our integrated system of large-diameter pipelines will provide approximately 2.7 million barrels per day of operational disposal capacity in the Delaware Basin, including the addition of Hillstone. The Hillstone assets include long-term contracts with investment-grade producers. The contracts have an average remaining term of greater than 10 years, minimum volume commitments and first-call priority volume commitments that minimize impacts of timing related to recycle and reuse activities."

### Down Mexico way

NuStar is not only active in moving crude out of the Permian but in creating new markets for the basin's vast production, too. It also is building 600 Mbbl additional tankage at its Corpus Christi terminal. That will take total storage to 3.9 MMbbl completed by the end of the year.

NuStar also recently began moving refined fuels through its expanded Valley Pipeline System in South Texas after another expansion. That line runs from Corpus Christi to the Rio Grande Valley and across the frontier into parts of northern Mexico.

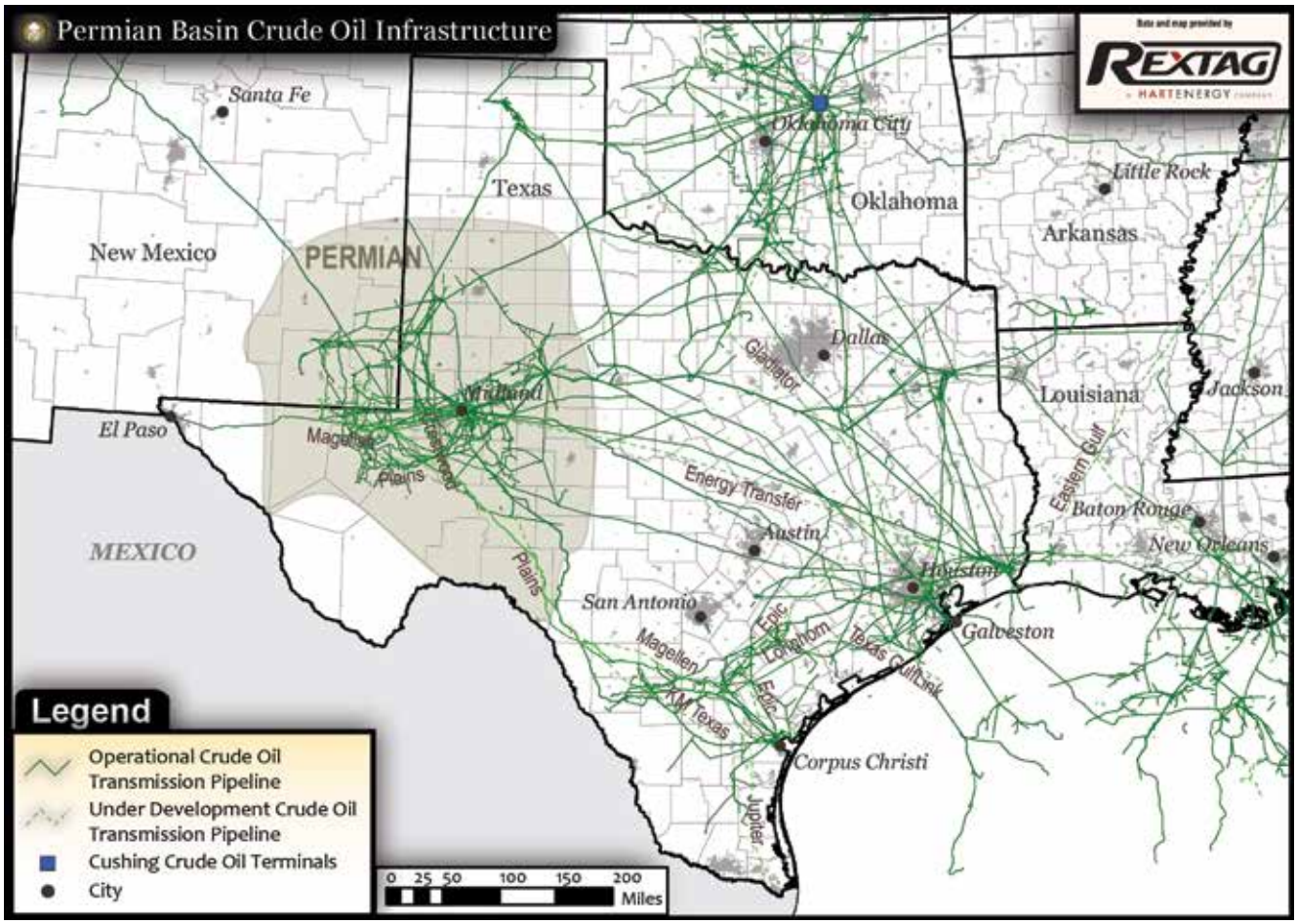
NuStar began moving diesel in particular into Mexico by reactivating its 11-mile, 8-inch refined fuels pipeline from its Laredo, Texas, terminal, crossing the short hop under the Rio Grande (Rio Bravo) to its Nuevo Laredo terminal in Mexico. That is all part of an initiative with Valero to move fuels from Valero's refineries in Corpus Christi and Three Rivers, Texas.

NuStar ranks No. 24 on the Midstream 50.

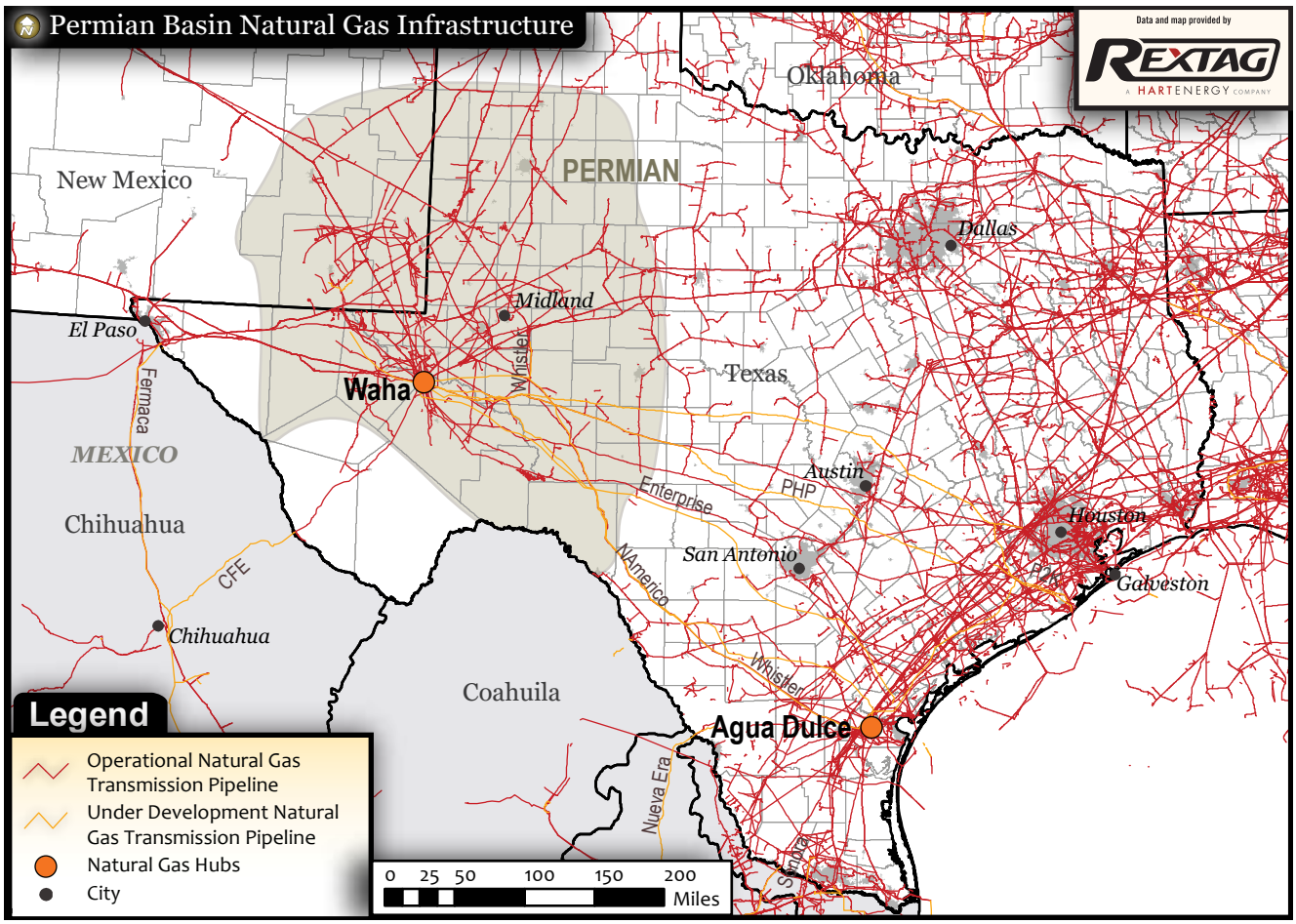
Under the sweeping reforms to nearly a century of state control of the petroleum industry in Mexico, many segments of the country have opened to foreign investment. The retail sector has seen the fastest and most extensive participation. In contrast, pipelines and refining have seen little investment.

"Refineries in Texas and California have been targeting northern Mexico for fuels by rail," said Luis F. Delgado, director of Mexico business development at Delek US, speaking at the Petrochemical and Refining Summit in New Orleans.

"Barges are not considered viable because there are no real navigable rivers, and pipelines are subject to sabotage and theft. The government recently turned off the pipelines to discourage the rampant illegal tapping, but the distribution system only has a two-day supply," Delgado told *Midstream Business*.



Natural gas must be processed before it goes in the pipe. Jasper Ventures serves as contractor on this new 200 million-cubic-feet-per-day plant going in to serve Delaware Basin producers in Loving County, Texas. *Source: Jasper Ventures*



The Cushing, Okla., pipeline terminal and trading hub has been the traditional target for Permian Basin crude sales. That's changing as new markets—particularly on the Texas Gulf Coast—develop. But wherever the oil goes, Cushing's West Texas Intermediate price benchmark remains an industry standard. *Source: SemGroup Corp.*

Until 2014, the six aging refineries operated by state energy company Petroleos Mexicanos (Pemex) were able to produce about half the fuels and other refined products that the country needed. At that point, inefficiency and years of deferred maintenance caught up with Pemex. Today, Mexico imports 70% of its fuels because the refineries are operating at an aggregate 40% of nameplate capacity.

That might seem like an opportunity for North American midstream operators, but they have been reluctant to invest.

In contrast, there are now more than two dozen companies with retail stations in Mexico in direct competition with Pemex at the fuel pump, according to Delgado. They have more than 1,700 stations and represent about 15% of the market. That penetration only took four years.

Mexican president Andrés Manuel López Obrador, universally known by his acronym, AMLO, opposed the petroleum reform laws, but they took effect before he assumed office. His main initiative has been to push a plan for a greenfield refinery, estimated to cost US$8 billion, in Paraíso, Tabasco.

As reported in October by the *Financial Times*, the planned refinery, beside the Dos Bocas port, is much more than just a prestige project. It is a powerful symbol of the new economy López Obrador wants to build: state-directed, centrally driven, reliant on national production and free of foreign influence.

However, "many businesspeople, former senior government officials, ex-Pemex executives and investors believe the rescue strategy for the oil company is deeply flawed," the newspaper reported. "The likely outcome of the plan, they say, will be missed targets and wasted resources. That could lead to downgrades of both the company's and Mexico's sovereign debt and risk further economic stagnation."

Pemex is Mexico's biggest company by revenue and Latin America's second largest, according to the story. But it is also a record-breaker for the wrong reasons: Its $104 billion of loans makes it the world's most indebted oil company, while its workforce of 125,000 is more than double that of Petrobras, its Brazilian state-controlled rival, whose revenues are 10% higher.

"A lot of that labor force is more of a burden than an asset," said Valérie Marcel, an expert on national oil companies at Chatham House in London. "The lack of investment in skills is a big issue."

Mexico also provides an important gas market for the Permian—although growth has not come as quickly as many expected. Platts noted recently that gas exports across the border had ticked up to just less than 6 Bcf/d.

## The longer view

The current relief over new transportation capacity is very much a short term view, said John Coleman, Wood Mackenzie's principal analyst of North American crude.

"There will be excess capacity. But looking beyond the next five years, we expect growth to continue, driving the need for either one new [line] from the Permian to the Gulf Coast or expansion, probably across multiple systems."

Coleman noted that between now and then, the Permian Basin is likely to see a moderate overbuilding in the early 2020s as the current wave of pipeline investments is completed.

Crude capacity from the Permian to the U.S. Gulf Coast is likely to tighten as production growth expands well into the 2030s, and Coleman suggested that if new pipe is not added in the Permian by the mid-2030s, takeaway will become a major concern again. Without more investment, the Permian-to-Gulf Coast pipelines could surpass 92% of capacity.

That eventuality would all but force pipeline expansions or greenfield capacity, he added.

Wood Mackenzie forecasts production in the Permian to peak at around 7.1 MMbbl/d by the late 2020s or early 2030s. Although, the firm's outlook differs with predictions from another analyst with the Bank of America Merrill Lynch, who predicts that production will triple to 9 MMbbl/d in the next three years and sees the current substantial infrastructure investment to raise concern of overbuilding. ■

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***Gregory DL Morris** is a freelance writer based in Chapel Hill, N.C., specializing in energy and petrochemical topics.*

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## 2019 HIGHLIGHTS

**Moda Midstream is the Gulf Coast's Largest Crude Oil Exporter**

**Q4 2019: Blue Racer Midstream exceeds 1 Bcfd in processed volumes**

**Lotus Midstream Partners with ExxonMobil and Plains All American to build 650-Mile Wink to Webster Pipeline**

**Cogent Midstream's Big Lake II Processing Plant and Residue Gas Pipeline Come into Service in Midland Basin**

**Aspen Midstream Commissions its Austin Chalk System**

**Cardinal Midstream Commissions Iron Horse Processing Plant in STACK/ SCOOP/Merge Play**

**EFM is Investing in New Teams from EFM Fund IV, a $3.25 Billion Fund**

**Rangeland Midstream Canada Begins Construction of Marten Hills Pipeline System**

**EFM makes $400 Million Equity Commitment to Ironwood Midstream**

**GREENFIELD MIDSTREAM AND NOBLE MIDSTREAM SIGNIFICANTLY EXPAND THEIR BLACK DIAMOND GATHERING JV**

**Stakeholder Midstream acquires San Andres Assets from Targa, Commissions Campo Viejo Processing Facility**

**EFM Has Closed on Six Acquisitions Totaling $3.6B over the Last Three Years**

**Nuevo Midstream Dos Acquires Republic Midstream**

**Tall Oak Midstream III commissions Panther Creek processing plant in Arkoma STACK**

**Zach Kayem named to Hart Energy's Forty under 40, 2018–19**

**CANDOR MIDSTREAM'S SCOOP-TO-NORTH-TEXAS RICH GAS GATHERING PIPELINE SYSTEM COMES INTO SERVICE**

**EnCap Flatrock Midstream Promotes Sam Pitts to Managing Partner**

**Evolution Midstream Brings Jewell Processing Plant into Service in PRB**

**EFM makes $300 Million Equity Commitment to Clear Creek Midstream**

It don't come easy: Appalachia's hills and valleys, like the ones Marathon Pipe Line faced along this project's right-of-way, are but one barrier to full midstream development to support Marcellus and Utica producers.
*Source: Marathon Pipe Line*

# Good News/Bad News

## The big Appalachian plays could be global game changers for natural gas.

*By Paul Hart*

Big reserves—and getting bigger: That's the good news about the Marcellus and Utica plays. By some analysts' estimates, the Marcellus now ranks as the largest natural gas field in the world, ahead of the gigantic South Pars Field that laps over into Iran and Qatar from beneath the Persian Gulf.

And the smaller Utica hardly would rate as little brother anywhere else, except given its nearness to the sprawling Marcellus.

The Potential Gas Committee and the American Gas Association (AGA) released the committee's biennial update on U.S. gas reserves late in the third quarter, which estimated the nation's gas resource base at 3,374 trillion cubic feet (Tcf) at yearend 2018.

"This is the highest resource evaluation in the committee's 54-year history, exceeding the 2016 assessment by about 20%—the largest two-year increase in the report's history," the AGA noted.

Drill down in the study and the really impressive number that jumps out is that the report's Atlantic area—read that Marcellus and Utica—jumped 25% to 1,311 Tcf in two years. The report's Midcontinent, which includes the Permian Basin, Oklahoma's Scoop/Stack plays and the landmark Hugoton Basin in Kansas and Oklahoma, recorded a higher percentage increase, but the Atlantic region started off 2 ½ times as big—and got bigger.

### The good

The "Atlantic area dominates with 39% of total U.S. gas resources," the committee noted as it announced the study. Not bad for a region that the industry considered a worked over has-been a little more than a decade ago.

Statistics show Pennsylvania passed Louisiana as the nation's second-largest gas producer, behind Texas, six years ago. Some industry observers say it's not far-fetched to project Pennsylvania will be the nation's top gas-producing state—ahead of Texas—in a few years.

The Pennsylvania Department of Environmental Protection reported the commonwealth's gas production increased 8.9% from 2016 to 2018, while Texas' gas output notched

upward 0.3%. According to the U.S. Energy Information Administration, Pennsylvania produced more than 18 billion cubic feet per day (Bcf/d) last year, while Texas produced 22 Bcf/d.

Already when taken together, Ohio, Pennsylvania and West Virginia collectively flow more gas than Texas.

Simmons Energy projected in a third-quarter report that Appalachia's October production would hit a new record, 32.8 Bcf/d. That's up a healthy 7% from the year-ago month and an increase of 200 MMcf/d from September.

### The bad

Now for the bad news: How to get that stupendous resource out of the ground and to market? What could Appalachia produce with adequate midstream infrastructure in place to move that gas to the numerous large and nearby markets? You can be sure that will be the primary question on the minds of attendees at Hart Energy's annual Marcellus Utica Midstream conference in Pittsburgh, scheduled to occur about the time this publication lands in subscribers' mail boxes.

And what markets they are: New York, Toronto, Detroit, Chicago, Boston and Baltimore/Washington all lie an easy day's drive away. Dominion Energy's big Cove Point liquefaction plant on Chesapeake Bay offers easy access to worldwide LNG markets.

The big plays also enjoy direct access to substantial—and growing—petrochemical operations. But even though Pennsylvania gave birth to the oil (and gas) industry as we know it, current residents tend to view the business as a newcomer.

Many fear it.

As one gas producer told *Midstream Business* about his acreage in Pennsylvania, move in bulldozers, scrape off a hillside and set up a coal mine headframe and area residents don't say a word. But move in bulldozers, scrape off a hillside and set up a drilling rig "and every phone at the county courthouse starts ringing." Things have improved in recent years as the plays have matured, but many in the region still regard oil and gas as an outlier, producers and midstream operators say.

That means there's about as much midstream action currently in courtrooms and legislatures as there is in the field.

Pennsylvania, in particular, struggles with how to regulate the booming industry.

### Rule of capture

In September, the commonwealth's Supreme Court heard oral arguments in a "rule of capture" case that could profoundly impact hydraulic fracturing in the Marcellus and beyond.

At issue in Briggs vs. Southwestern Energy Production Co. is a well fracture that crossed a property line, releasing gas that moved back across the line to be captured at a wellbore in Susquehanna County. The plaintiffs in the case, the Briggs family, maintain that because Southwestern Energy's fracture extended to the subsurface of their property and allowed the extraction of gas on their property, the company trespassed and the gas extraction was unlawful.

In its defense, Southwestern asserted that it never entered or drilled on the plaintiffs' property and that the rule of capture—developed from English common law and affirmed by Pennsylvania courts in cases dating to 1889—made the extraction legal.

"The industry in this case takes the position that when you're hydraulically fracturing rock, you don't really know where the fractures are going to go," Harry Weiss, practice leader of the Philadelphia-based Ballard Spahr law firm's environment and natural resources group, told *Midstream Business*. "As such, because it's too difficult to ascertain, the rule of capture should apply so any of the neighbor's gas you might happen to pull … would be yours—you captured it and you would not owe the neighbor any compensation."

A trial court granted Southwestern's motion for summary judgement, agreeing that the rule of capture precluded the request for punitive damages. Then the case went to the Pennsylvania Superior court on appeal, which overturned the trial court and determined that "hydraulic fracturing is distinguishable from conventional methods of oil and gas extraction" and the common law rule of capture did not apply.

In its decision, the court determined that gas in a shale formation is non-migratory by nature, unlike water in aquifers or conventional, porous oil and gas producing zones. It could only have moved from the Briggs property to the adjoining property leased by Southwestern by the application of an external force—hydraulic fracturing. The court also rejected Southwestern's

**Marcellus/Utica Rig Count**


*Source: Baker Hughes*

"First, we expect to streamline our capital expenditures, focusing on the most attractive returns."

– **Gary Heminger**, *chairman and CEO, MPLX LP*

contention that the difficulty in determining the occurrence of a subsurface trespass and the value of the gas meant that damages cannot be paid.

The court likely will decide the case early next year. Meanwhile, the issue places a damper on some producers' drilling programs. An EnVantage report said the Appalachia plays had 517 drilled but uncompleted (DUC) wells in August. It's no surprise, then, that the region's rig count has been dropping.

### The ugly

A decision for the plaintiffs could create a blizzard of similar lawsuits in other states. That uncertainty ties into the nation's interest in renewables and reticence to develop any hydrocarbons, anywhere.

New York State has effectively blocked new pipelines that would serve its residents as well as New England markets. Some industry observers have come to refer to the Empire State's border with Pennsylvania and New Jersey as the "Wall of Cuomo," given the continuing, bitter opposition to oil and gas development of any kind by Gov. Mario Cuomo.

The state's opposition has blocked six gas transmission projects to date.

Opposition exists elsewhere. Work halted on the Atlantic Coast Pipeline, a 600-mile, 42-inch transmission line as the year began. Atlantic Coast, with a planned capacity of 1.5 Bcf/d, would extend from West Virginia to North Carolina. Environmentalists convinced the Fourth Circuit Court of Appeals to vacate a permit issued by the U.S. Fish and Wildlife Service, and now the issue seems headed to the U.S. Supreme Court.

Dominion Energy and its partners, Duke Energy, Piedmont Natural Gas and Southern Co. Gas, remain optimistic that work will resume sometime in mid-2020. But the delays will prove expensive. Dominion estimated costs will go up by some $1 billion to around $7.5 billion.

Similar legal setbacks have stymied the proposed PennEast Pipeline. A federal appeals court ruled late in the third quarter that the project does not have eminent domain power to seek condemnation of state-owned property in New Jersey. The legal wrangling continues, but industry observers point out that, if upheld, the ruling could throw up a significant development of all pipelines in the U.S.

The 120-mile, 36-inch pipeline would move 1 Bcf/d of gas from western Pennsylvania to New Jersey customers. UGI Energy Services, the midstream unit of local distribution company UGI Corp., leads the project.

### Ohio sausage

Next door, Ohio faces its own disagreements. The Clear Energy Alliance recently noted a bill in the Ohio legislature is a "Sausage-O-Rama" that would help solar, nuclear and coal—while it would do nothing to support the state's booming gas business. The alliance said "HB-6 is a mish-mash of energy legislation. ... These days it seems every government agency is worried about $CO_2$ emissions. So why would this subsidy sausage include coal, but not wind, and decrease future renewable mandates? Politics."

But as always, the midstream sector finds a way. New midstream infrastructure headed west and southwest has provided the best outlets for Marcellus and Utica production. A recent EnVantage market report noted the major gas transmission systems headed west—Rover, Nexus, REX—have had growing volumes in the last two years.

There are new assets entering service and new customers emerging—some in the region itself—even if the activity has been less than what's needed, given the scale of the resource.

The Williams Cos., ranked No. 6 on this publication's Midstream 50 of the sector's largest public players, has a significant role in Appalachia, given its ownership of the Transco gas transmission system.

Late in the third quarter, the firm placed its Rivervale South to Market project in service. The project expanded the existing Transco system to meet growing heating and power generation demand for consumers in the Northeast.

Rivervale South to Market project provides 190,000 dekatherms of firm gas service by uprating 10.3 miles of existing Transco line, adding less than a mile of new pipeline looping, and upgrading or modifying existing facilities, in New Jersey. Williams noted that's enough gas to serve 1 million homes.

"The demand for clean, reliable natural gas is at an all-time high, particularly in the northeastern markets where it has had a direct impact on significantly improving regional air quality," Alan Armstrong, president and CEO, said in announcing the start of service. "The Rivervale South to Market project will continue this progress in a manner that minimizes environmental impacts by enhancing and expanding our existing Transco pipeline infrastructure."

The Transco system includes approximately 10,000 miles of pipeline, extending nearly 1,800 miles between South Texas and New York City. The system provides the major gas transmission link to 12 southeastern and Atlantic Seaboard states, including major metropolitan areas in New York, New Jersey and Pennsylvania.

One of the region's biggest players, Marathon Petroleum, continues to add to its strong Appalachian infrastructure position through its MPLX subsidiary, which ranks No. 7 on the Midstream 50. It told investors in a September presentation that its investment in its Northeast gathering and processing operations will still represent some 20% of MPLX's estimated 2019 EBITDA, even as the firm works to meld in the midstream assets it acquired earlier this year in its acquisition of Andeavor Logistics, formerly Tesoro Logistics.

### Petrochemical prize

The big prize for the Appalachian energy industry will be Shell's world-class Pennsylvania Petrochemicals Complex, going up on the Ohio River in Beaver County, Pa., outside Pittsburgh. When completed, the $6 billion plant will produce 1.6 million tons per year of polyethylene, using abundant Marcellus/Utica ethane as feedstock.

Shell told Pittsburgh media during a recent press tour that work is on track for completion in 2021, adding that some 6,000 construction workers are at the plant now, and that the plant will create 600 permanent jobs when it goes on stream. All major components of the plant had been installed by the third quarter, a company spokesman said.

It will be the first big cracker built in the U.S. outside the Gulf Coast. Shell touts the location—with adjacent rail, river and Interstate highway access as ideal, centrally located between major U.S. and Canadian markets and close to seaports serving foreign markets.

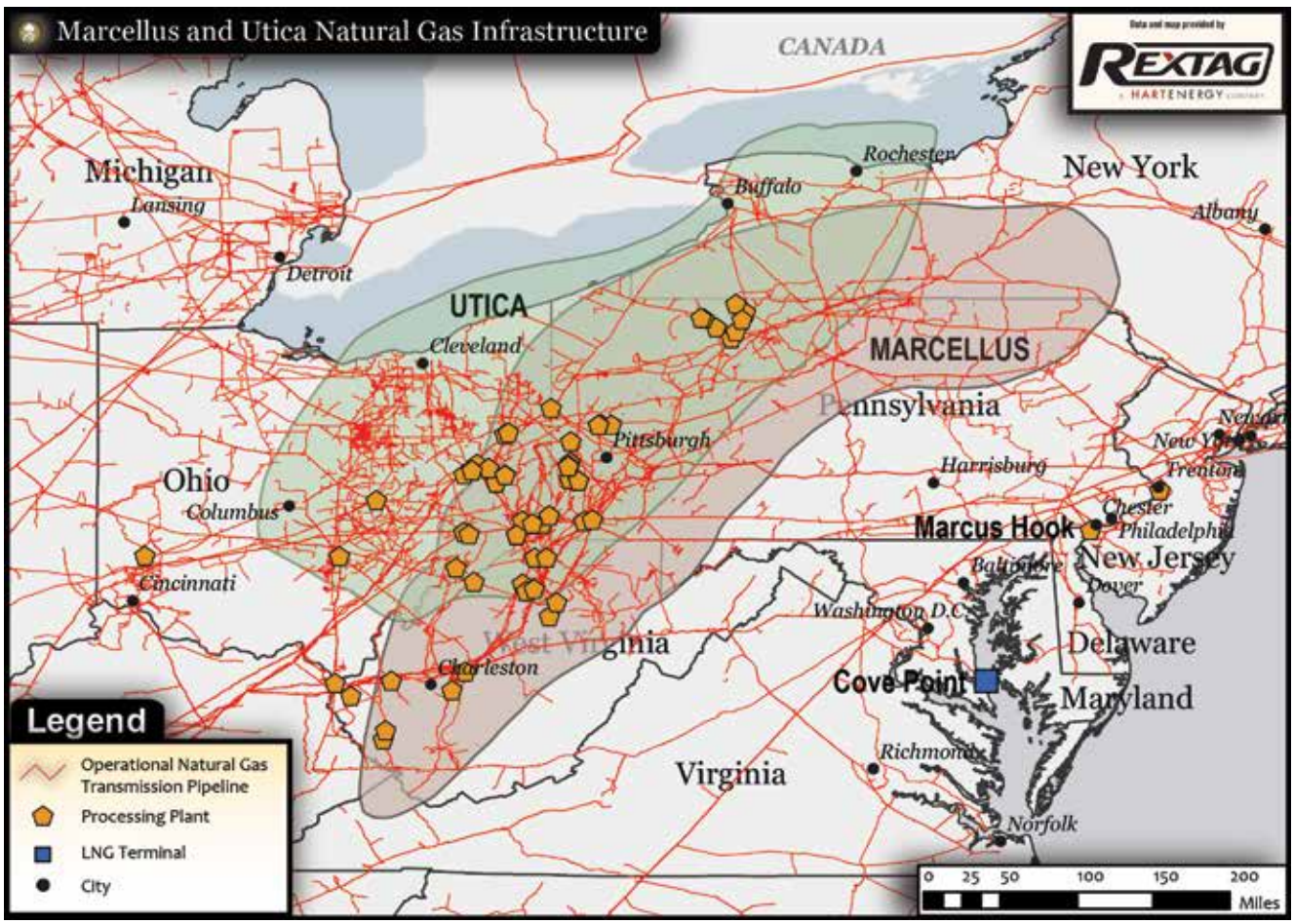
But the region's gas-fueled petrochemical industry seems to have taken two steps forward and one step back. Braskem SA announced in the third quarter it would drop a smaller polyethylene cracker proposed for Parkersburg, W. Va. A third cracker, proposed by PTT Global Chemical for a site in Belmont County, Ohio, remains a possibility, although the Thai-based firm has not announced a final investment decision.

### NGL plans

Gas produced from the big plays tends to the wet side, providing an abundance of ethane, along with propane, butane and natural gasoline, that could feed that developing petrochemical base. But in the meantime, what to do with it?

Enterprise Products Partners, No. 4 on the Midstream 50, announced in October sufficient shipper interest to move ahead with proposed 50,000 barrels per day (Mb/d) expansion of its ATEX ethane pipeline that moves NGL from the Appalachian Basin to the big gas liquids hub at Mont Belvieu, Texas, outside Houston.

The extra capacity Enterprise has proposed for the 1,200-mile line would



# Fueling Growth At Home And Around The World

*By David N. Taylor*

In recent weeks, Pennsylvania's Department of Community and Economic Development acted on an invitation from Australia's Northern Territory to visit and share our state's experience with the development and application of natural gas. I was honored to accompany the commonwealth's representatives on behalf of Pennsylvania's manufacturing sector, which relies on affordable, available and reliable energy and whose success depends on wise energy policy decisions from Harrisburg.

What we learned Down Under illuminates our energy management choices in Pennsylvania: Even as the Northern Territory is working on how best to develop the natural gas opportunity in the Beetaloo Basin, Australia in general has overcommitted to LNG exports, an unintended consequence of which has been to stifle Australia's manufacturers with high energy prices and shortages of domestic supply.

Back home, ***Forbes*** reports that 2019 is set to be the biggest year yet for the emerging U.S. natural gas export business, and America is expected to surpass Malaysia to become the world's third-largest LNG exporter.

In our region's Marcellus play, there is often debate about gas exports and whether we are at risk of exporting too much, at the expense of economic growth in Pennsylvania. Or, put another way, if too much of our gas leaves Pennsylvania, will we miss the opportunities to add value to the resource locally, which grows jobs, businesses, and strengthens communities?

Fortunately, the gas reserves in the Marcellus and Utica plays should allow us to optimize use in the Pennsylvania-Ohio-West Virginia region even as we continue to sell for export. And beyond development of the gas, the presence of such significant energy assets should position us as a prime location for the next generation of advanced manufacturing–including the design and production of advanced materials. This will help increase employment (and drive population growth), and reap what is estimated to be tens of billions in expanded GDP.

**NGLs**

In addition to the gas that powers and heats our businesses and homes, NGLs are produced here. NGLs are a key component for making plastics, resins, fuels and chemicals that are fundamental to countless products we rely on every day.

The "Forge the Future Phase 1" econometric study report showed that Pennsylvania's vast amounts of gas and NGLs are meeting relatively weak demand growth in-state, and limited, but growing, pipeline capacity to move it. As a result, Pennsylvania's voluminous gas supply is currently being sold at a steep discount, which makes it attractive for export. The report also found that because of our abundant supply, those exports are unlikely to raise prices here to a level that would impair our manufacturing cost competitiveness or hurt consumers.

Establishing export markets has spurred the production that is now coming online for greater domestic use. If we pivot now to the Forge the Future report's agenda for an energy-enabled economy, Pennsylvania can benefit–immensely–from both.

There are foundational elements to the pursuit of a new, automated and data-driven manufacturing era for Pennsylvania, supported by the significant energy reserves in our region. Let's:

- Benefit a broad base of Pennsylvanians with more jobs, better jobs and greater job stability. Work in gas development and downstream advanced manufacturing delivers family-sustaining wages that will return minimum-wage jobs to what they used to be: a place to start, learn and grow, not a destination.
- Ensure that there is enough gas demand growth–in-state and for export–to make gas production economical. Natural gas producers in many cases currently make little or no profit in the region–they are investing for the long run.
- Work together to apply existing technologies and develop new ones that bring our economic, environmental and health interests into alignment.

A range of efforts are underway to help Pennsylvania fulfill its potential. Pennsylvania joined Ohio and West Virginia again as a member of the Tri-State Shale Coalition to collaborate on strategic ways to build our energy- and manufacturing-driven economy. Pennsylvania Gov. Tom Wolf has also recently created the Governor's Office of Energy to lead and coordinate growth strategies and tactics across the Commonwealth. Additionally, Pennsylvania House Speaker Mike Turzai and other House Republicans rolled out a package of bills called Energize PA, which is intended to expand the manufacturing potential of the shale boom.

Plans for a regional storage and trading hub for natural gas and NGLs are advancing. The state's pipeline network–which provides a range of benefits compared to surface transport over highways and rail–is growing and our affordable energy is reaching more residents.

Based on Forge the Future data, successful development of downstream industries holds the potential for significant economic growth in Pennsylvania: a $60 billion increase in Pennsylvania GDP, the addition of more than 100,000 jobs and an increase in natural gas demand of 4-5 trillion cubic feet. Collectively, this could generate several billion dollars in additional tax revenue for the commonwealth and help us grow our way to sustained fiscal health, and a better quality of life. ■

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***David N. Taylor*** *is president and CEO of the Pennsylvania Manufacturers' Association.*

Midstream operators work to blend in with the wooded countryside typical of Appalachia. This station serves the Transco system's new Rivervale South to Market line that entered service earlier this year. *Source: The Williams Cos. Inc.*

come via a combination of pipeline looping, hydraulic improvements, and modifications to existing infrastructure. The expanded capabilities could be in service by 2022, Enterprise said.

Another big NGL expansion project, Energy Transfer's proposed Mariner East 2, linking western Pennsylvania and Marcus Hook, outside Philadelphia, is tied up in controversy. The original Mariner East line, completed in 2015, feeds liquefied ethane exports to European petrochemical plants.

Dallas-based Energy Transfer ranks No. 2 on the Midstream 50.

### Wall Street woes

All this doesn't help, given the investment community's current cold shoulder to all of the energy industry.

"U.S. energy markets are coming to the end of their latest infrastructure cycle just as the reality of tight capital markets is sinking in," Rusty Braziel, president, CEO and principal consultant for RBN Energy. He added, "…there is a chill in the air. … Easy access to capital is a thing of the past," in a recent report.

That reticence shows up in midstream capital planning, of course. Gary Heminger, chairman and CEO of MPLX LP, talked about his firm's plans in his second-quarter earnings call.

"First, we expect to streamline our capital expenditures, focusing on the most attractive returns," Heminger said. "Second, we are working with [parent Marathon Petroleum Corp.] MPC on a portfolio optimization initiative, which could include potential asset divestitures. Third, we plan to use the proceeds from any divestitures for general purposes such as investments and high-return projects, as well as debt reduction.

"We believe these initiatives will help MPLX continue to be one of the best-positioned midstream platforms in the industry for long-term value creation," he added.

MPLX ranks No. 7 on the Midstream 50. It has significant gathering, processing and transportation operations in the Marcellus and Utica. But it also recently acquired Andeavor Logistics (formerly Tesoro Logistics) with significant—and potentially easier to develop—operations in the Permian Basin and Bakken Shale. Capital likely will flow to those plays instead.

### Arabs and Appalachia

But things could be looking up for Appalachian infrastructure in the wake of the attacks on Saudi Arabian assets in September. Tom Gellrich, founder of Philadelphia-based Topline Analytics, said in a recent statement the attacks make assets in the politically stable U.S. much more attractive.

"The Saudi attacks, unanticipated with military precision, against highly defended targets adds an untenable risk premium to any Middle East investment," Gellrich said. "After decades of relatively stable and consistent strategies the Western petrochemical majors are changing at an unprecedented pace. … These attacks make the Appalachian Basin an even more viable region for the petrochemical industry" and the related midstream assets that support it.

Wells Fargo Securities noted the impact of the energy business in general, and the midstream in particular, in a recent special report that noted the state's mining, oil and gas sector enjoyed 18.4% growth, year over year, in first-half 2019.

An "abundance of natural gas supports a wide array of jobs in the state, many of which go beyond the exploration, extraction and refining industries, extending to other sectors, such as construction, manufacturing, engineering and other professional support services," Wells Fargo said.

"Increased natural gas production has brought with it the need for a more robust energy infrastructure and has led to a surge in heavy and civil engineering construction jobs over the past few years. The pace of employment growth, however, has eased a bit more recently. Pennsylvania still has thousands of miles of natural gas pipelines under construction, second only to Texas. The Mariner East 2 pipeline, which will carry natural gas liquids from western Pennsylvania to a processing and export facility near Philadelphia, has faced some delays recently but is a shining example of the ongoing energy infrastructure buildout." ■

***Paul Hart*** *can be reached at* ***pdhart@hartenergy.com*** *or* ***713-260-6427****.*

SPONSORED CONTENT

# WSP Mined Cavern Storage: We 'Rock' Hard Rock

With the burgeoning growth in the production of crude oil and natural gas liquids (NGLs), exports are on the rise. In fact, two big think tanks—RBN Energy ("Let It Flow - The Rise Of U.S. LNG Exports") and Stratas Advisors ("North American NGL Outlook 2020 – 2040")—each recently made the same bold statement: All new U.S. crude oil production would have to be exported!

Since then, industry leaders have echoed similar statements regarding natural gas/liquefied natural gas (LNG) space. The industry has been gearing up—the number of NGL treating, pipeline and export-oriented projects are growing dramatically. Development of this high-quality infrastructure isn't without the need for additional storage (crude, NGL, chemical derivatives), which can mitigate feedstock supply risk, improve pipeline flexibility and reduce ship loading cost.

Underground storage of crude oil and NGLs in salt caverns is common in the U.S. Some of you may recall that salt cavern storage was the subject of a WSP USA article in *Industry Voice*, "Underground Storage Goes Midstream," which appeared earlier this year. As Mother Nature would have it, not every region of the U.S. has underground salt storage potential. In areas where this is the reality, WSP geologists, geoscientists and engineers look to a suitable "salt substitute" to provide a viable and appropriate storage solution: Hard rock.

Many regions in the U.S. have underlying blankets of shale and limestone, which are very desirable for mined storage development. Over the past five decades, WSP has constructed more than 80 hard rock caverns in the U.S., storing either propane or butane. Many are already in use worldwide, and more are under construction for crude oil storage.

WSP USA has constructed more than 80 hard rock caverns in the U.S. to store propane or butane.
*Source: WSP USA*

## Proven Technology

The mines used for hydrocarbon storage are unique, and are situated roughly 600 feet below the surface. WSP uses proven geoscience technology to identify formations suitable for creating an underground storage mine.

"We've been very successful utilizing igneous, metamorphic, dolomite, limestone and shale formations, and not all of them are suitable," advised Ron Mart, a lead geologist at WSP. "Once a formation is identified, it is subjected to a rigorous technical evaluation program. Multiple test wells are drilled in order to retrieve rock core for lab analysis and in-situ testing."

WSP hard rock cavern engineer Frank Jurica agreed. "WSP pressure tests the rock in multiple locations as part of the cavern formation technical evaluation," he said.

Once the rock is proven and permits are approved for mine construction, WSP mobilizes the cavern engineering and construction

When a mined area is large enough to lower drilling and hauling machines into place, items are dismantled, lowered down the production shaft and assembled at mine depth. *Source: WSP USA*

teams to develop the mining plans needed to safely carry out the project.

"Our mine engineers carefully lay out the pillar and cut sections, showing the exact locations of the shafts; and then the work of drilling the shafts begins," Jurica said. "Mucking is the term used to describe the process of bringing the mined material to these drilled shafts during mining operations for removal," he added.

**Storage Cavern Construction**

Once the shafts are completed to mine depth and the casings are cemented in place, the next phase of development is to install the mining equipment, including the hoist and skip. When this equipment is ready for operation, the "real" mining begins.

"It's called break-out mining," Jurica said. "During break-out mining, the first mine excavations are designed to be big enough to receive the mining equipment."

Once the mined area is large enough to lower drilling and hauling machines into place, these items are dismantled, lowered down the production shaft piece-by-piece, and assembled at mine depth.

Eventually, there is enough excavated space, downhole equipment and mining personnel to get "production mining" underway. During this phase, most of the mine volume is created, safely and methodically. Mined cavern space created is surveyed utilizing state-of-the-art techniques to monitor throughout production mining. Once the target volume is achieved, the mine can be prepared for storage conversion.

"When we mined the butane cavern in Illinois, we created approximately 1.4 million barrels of volume for butane storage," Jurica said. "We had numerous industry and government representatives visit the mine while it was in the production phase, which was good."

Once the mine enters the storage conversion stage, visitors are no longer allowed downhole. At this point, storage infrastructure installation progresses with attention to detail and quality. The wellheads, pumps and cavern monitoring instrumentation are installed in preparation for final pressure testing and commissioning.

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For more information about WSP, visit our website at www.wsp.com. To learn more about the firm's hard rock mine projects, go to https://www.wsp.com/en-US/projects/butane-storage-cavern. ■

# Not Yet

## Will the Midcontinent be the Next Big Thing? Possibly, but it may be a while.

*By Paul Hart*

The rigs are still there, just not as many. Western Oklahoma's pool table-flat prairie sported multiple steel fingers poking into the sky's blue dome not long ago. When you stood in the dark at the right spot on some obscure, section-line road in the Scoop or Stack, lights twinkled on rigs in every direction.

To the east, where the Sooner State rolls into the Crosstimbers, then climbs into the Ouachitas—looking more Appalachia than the Great Plains—the tops of masts and crown blocks poked above the trees.

A recent ramble as fall began through the back country of Pittsburg County, Okla., near Hartshorne, found signs pointing down dirt roads to this-or-that pad—Arkoma Woodford wells. Oilfield trucks passed on the highway—but not many.

It's a current trend throughout the industry, so why should the Midcontinent be immune? Oklahomans don't embroil themselves in the litigious political drama common elsewhere,

Enable Midstream's Wetumka, Okla., complex serves Arkoma producers.
*Source: Enable Midstream Partners*

so blame weak prices, geology and an unfortunate nearness to the energy industry's current Mr. Big: the Permian.

**But when?**

A few years ago, many thought the Midcontinent's unconventional plays would combine to offer the industry's Next Big Thing to producers and the midstream—right behind the Permian.

Maybe they will, someday, but not yet.

"Autumn has brought a dual tailwind impacting midstream financial performance," James Wagstaff, senior vice president for oil and gas at PowerAdvocate, told *Midstream Business*. "Steel prices, which are a critical cost driver for a midstream operator, stabilized [in September] and we expect further declines in steel prices. Additionally, our analysis of top midstream operators in the Scoop/Stack shows overall spending in the market has declined by 10% over the first six months of 2019. Notably, operating expenditures have taken an increasingly large portion of total spending—a thread which is five years in the making. In 2014, Opex [operating expenditures] accounted for less than 20% of total midstream spending; today that number is more than 40%.

"The top midstream performers in the basin will be the ones who prioritize more efficient Opex spending," Wagstaff added of the Midcontinent.

Platts noted in a report as the fourth quarter began that Oklahoma's rig count had fallen to the lowest point in three years, a 44% decline from 105 rigs as 2019 began. The pinnacle came in second-quarter 2018 at 116 rigs making hole. Oklahoma went into November with 54 rigs running.

"This year, though, higher well costs, varying rock quality and increasingly unpredictable, often disappointing, rates of return have seen major acreage holders, such as Chesapeake, Cimarex, Devon, Marathon and others, move in droves to pause their drilling activity—particularly in the Stack of Kingfisher County (Okla.)," the report said.

"In September, half-cycle internal rates of return in the Stack were estimated at 17% and in the Scoop at less than 11%, data from S&P Global Platts Well Economics Analyzer shows.

"Of particular concern for many operators are the rock formations. Although many pilot wells drilled in Central Oklahoma at first appeared similar to those found in the Permian Basin, upon deeper exploration, those formations have been weighted more heavily toward gas. In the Stack, gas comprises about 42% of the production mix. In the Scoop, gas accounts for about 47% of the recoverable resources, Platts Analytics data shows."

The South Central Oklahoma Oil Province is nearly 50% gas? Things don't always go as planned.

Sorry, producers want crude.

**A midstream breather**

So where does that leave the Midcontinent midstream? Maybe a breather will help it catch up.

Wells Fargo Securities' Midstream Monthly Outlook for September headlined that "Anadarko Basin/ Scoop-Stack has sufficient takeaway" capacity into the foreseeable future. Anadarko crude line capacity could exceed production by as much as 69% by fourth-quarter 2025—if current trends continue. The outlook projected late 2025 Anadarko oil output at 703,000 barrels per day (Mbbl/d), up from somewhere around 600 Mbbl/d in the first half of this year.

Capacity in and out of the sprawling Cushing, Okla., crude terminal and trading hub also will be positive by then, the report said.

Things look a bit more snug for NGL. Capacity from western Oklahoma to the Conway, Kan., NGL hub should exceed production by 11% by late 2025, a little

Let's start at the very beginning: Jasper Ventures has basic ground work under way for a new 120 million cubic feet per day gas processing plant that will serve producers in Oklahoma's Stack play. *Source: Jasper Ventures*

better than the slim 7% excess capacity for gas processing, Wells Fargo projected.

Like all producing regions, there are shifts in and out of areas as crude oil, natural gas and NGL prices shift, along with other variables.

"I think the fundamental shift that we've seen in the Midcontinent is a shift back to the Scoop, after we originally saw a move out of the Scoop and into the Stack, and now we've seen a shift back to the Scoop," Tina Faraca, Enable Midstream's senior commercial executive, told *Midstream Business*. "There is a focus, obviously given where commodity prices are, on the oilier portion of the Scoop, and that's been the big change that we've seen within the Anadarko Basin. A lot of rigs on our footprint, and I think generally, have moved south."

"There is a focus, obviously given where commodity prices are, on the oilier portion of the Scoop, and that's been the big change that we've seen within the Anadarko Basin."

– **Tina Faraca**, *senior commercial executive, Enable Midstream*

Oklahoma City-based Enable is one of the region's biggest midstream players and the largest gas processor in the Scoop and Stack. It ranks No. 17 on this publication's Midstream 50 list of the sector's largest publicly held players.

It's a matter of favoring oil and reducing gas, but even when producers are "going for oil and not gas, there's still obviously associated gas," Faraca added.

### The rest of the story

And like other plays, the rig count doesn't tell the whole story, thanks to technology, efficiency gains and concerns about maintaining cash flow.

But sometimes technology takes two steps forward and one step back, and

"The debottlenecking of current infrastructure constraints in the Permian has started. … This can put other regions under pressure especially if weak demand puts a dent on commodity prices and drilling economics … the Midcontinent and Eagle Ford would be the regions to watch."

– **Sunil Sibal**, *senior energy infrastructure and MLP analyst, Seaport Global Securities*

that's certainly the case in the Stack.

More wells drilled per section, combined with more proppant, doesn't necessarily equal greater productivity. At least that was the case for an operator targeting the Mississippian in a normal-pressured window of the Stack in Kingfisher County, Okla.

"The operator increased [its] well spacing from six to eight wells per section. At the same time, [it] increased proppant intensity about 40%," said Sarp Ozkan, a senior oil and gas market analyst and manager of upstream and crude market efforts for Enverus, formerly Drillinginfo, in a third-quarter webinar.

"However, that resulted in about a 30% loss in productivity. … An aggressive development plan of increasing frac intensity and downspacing at the same time can greatly impact productivity to the negative side."

The case study focused on the first six months of oil production, using the firm's spacing dataset, which has spacing metrics on neighbor, parent, child and co-completed wells along with well density, estimated ultimate recovery, production and completion data related to spacing among other data.

Sorting out what works best takes time, and midstream operators will have to wait while producers sort out the productivity gains—and the not-so-productive gains.

"We're seeing the rig count going down on our system in the basin, but producers are using increased efficiencies to maintain a similar well count, the well count is staying similar," Faraca explained. "That has a lot to do with producers being mindful of living within cash flow, being very efficient. Our producers have said basically they're into section-line drilling right now.

### Down the line

"They're just moving down section lines. Some of ours have quoted this a 20% to 40% efficiency range that they're gaining from their current drilling techniques."

Enable enjoys a system that can handle shifts in drilling, Faraca noted. The firm's "super header" can move production to processing as gas plant flows top out or drop off.

"We have a rich-gas header that stretches from [western Oklahoma's] Granite Wash all the way down into the Scoop so we can utilize our plants there. Our plant in the Granite Wash is full, processing a significant amount of gas, a lot of that is just the way we shift gas around on the super header.

"So, regardless of where the activity is, we can move it on the header to make sure we're maintaining very high efficiency in our plants. It's a really nice setup and, again, allows us to be efficient with our construction of our new plants to make sure we're not overbuilding, and that we can capture the movement," she added.

### ONEOK's plans

Tulsa, Okla.-based ONEOK Inc. is another big midstream player in the Midcontinent, ranking No. 10 on the Midstream 50. It has approximately 1.2 billion cubic feet per day (Bcf/d) of capacity in the region, with some 300,000 dedicated acres in the Stack and Scoop.

Those Wells Fargo numbers indicate that if there's a capacity constraint looming in the region, it will be for NGL—and ONEOK's responding. It plans to put its Arbuckle II Pipeline in service during the first quarter of next year. The 530-mile, 24- and 30-inch line will have an initial capacity of 400 Mbbl/d, expandable to 1 MMbbl/d.

ONEOK recently told investors that 375 Mbbl/d of initial capacity is under contract. ONEOK projects long-term Scoop/Stack production growth, it added.

MPLX LP, No. 7 on the Midstream 50, has committed to enlarging its Midcontinent footprint.

In the Stack, it's enlarging its Omega gas processing plant in Custer County, Okla., to 120 million cubic feet per day (MMcf/d), along with rich-gas and crude gathering and logistics facilities. It started the Omega I plant in 2018 at 75 MMcf/d. Omega II, originally scheduled to go on

Big and getting bigger: The Cushing, Okla., terminal lies next door to the Midcontinent's Scoop and Stack plays, with pipeline connections to multiple markets. SemGroup is one of the Cushing hub operators adding to its assets, shown here, at the complex. *Source: SemGroup Corp.*

stream late this year, is now scheduled to start up in first-quarter 2020.

"Some of the hardest-hit systems, from a rig count perspective, include Enable, DCP and EnLink," Melissa Saurborn, senior commodity fundamentals analyst for East Daley Capital, told *Midstream Business*. "ONEOK has also realized a decrease in rigs on their system; however, the larger impact for them is the volume of NGLs produced in the basin, as they are connected to the majority of the plants in the region. The drop in rigs and lower production outlook comes as ONEOK looks to bring the Arbuckle II pipeline online."

### Cushing Connect

Holly Energy Partners LP and Plains All American Pipeline, Nos. 33 and 8, respectively, on the Midstream 50, announced in October the formation of a 50/50 joint venture, Cushing Connect Pipeline & Terminal LLC, to build a 160 Mbbl/d, common-carrier crude line that will connect the Cushing complex to the big HollyFrontier Corp. refining operation in Tulsa. The JV also will own and operate 1.5 MMbbls. of storage at Cushing.

The partners plan to have the Cushing terminal start up in second-quarter 2020, with the pipeline to enter service in first-quarter 2021.

In southeastern Oklahoma, MPLX and partner Targa Resources started up two plants, Hickory Hills, located in Hughes County, Okla., and Tupelo, in Coal County, Okla. as 2019 began, to serve Arkoma Woodford producers. The two plants have a combined capacity of 270 MMcf/d.

Another addition to NGL midstream capacity will come with expansion of the Southern Hills Pipeline, scheduled for fourth-quarter 2020. The project will enlarge the line, which serves northwestern and Central Oklahoma, to 230 Mbbl/d.

Southern Hills partners are Enbridge Inc., Phillips 66 Co. and DCP Midstream partners. The line entered service in 2013. DCP has some 2 Bcf/d of gathering and processing capacity in the Midcontinent.

### Next door

No play operates in a vacuum, of course, and the Midcontinent has a problem from being awfully close to the booming Permian. Midcontinent production wants to flow to the same markets at Permian output.

"The debottlenecking of current infrastructure constraints in the Permian has started and should facilitate continued production growth in the basin," Sunil Sibal, senior energy infrastructure and MLP analyst at Seaport Global Securities, wrote in a recently published analysis. "This can put other regions under pressure especially if weak demand puts a dent on commodity prices and drilling economics … the Midcontinent and Eagle Ford would be the regions to watch."

"We continue to see the region as growing," Enable's Faraca said. "It's very productive. It has got the benefit of commodity price shifts, and when we see a shift in gas prices going up, we have some gassier areas. But right now, obviously there's a crude focus. We think that is going to be the focus for a while.

### Gulf Run

"We continue to work closely with the producers to get them to the best markets. We want to make sure the producers we have in the Anadarko have the ability to get to the water, which is becoming one of the premier markets," she added, mentioning Enable's Gulf Run gas pipeline.

Gulf Run line will connect to Enable's existing Haynesville operations, which connect to its Midcontinent system. It will serve the Golden Pass LNG plant on the Gulf Coast with a projected 2022 start-up.

"We do that with all commodities. We also have condensate, crude and NGL. We want to make sure that we have a focus that our producers get to the best markets, they get the best net back, which obviously gives them more cash flow, allowing for more drilling." ■

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***Velda Addison*** *contributed to this article.*
***Paul Hart*** *can be reached at* ***pdhart@hartenergy.com*** *or* ***713-260-6427****.*

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# The Interview

# Leadership

## The GPA Midstream Association gains a new president and CEO.

*By Paul Hart*

*The midstream sector's leading trade group sails into 2020 with a new hand on the helm. Industry veteran Joel Moxley became president and CEO in the third quarter, assuming the post from Mark Sutton, who worked for GPA Midstream for 37 years and led it for 25 years—more than one-fourth of the historic organization's existence—prior to his retirement.*

*Moxley brings impressive credentials with him.*

*"Joel is a seasoned and trusted leader and is uniquely qualified to drive strategic prioritization for GPA Midstream in our ever-changing industry," said Bill Ward, senior vice president of commercial activity at Superior Pipeline and current GPA Midstream chairman. "With more than 30 years of industry experience and a long history of leadership roles within the association, Joel can step right into action."*

**Joel Moxley, president and CEO of GPA Midstream**

*Moxley's career has included a number of midstream executive roles. Prior to his appointment, he served as chief commercial officer for Southcross Energy Partners/Southcross Holdings, responsible for the company's gas gathering, gas treating, gas processing, NGL fractionation, and gas and NGL marketing assets. Earlier, Moxley served Crestwood Equity Partners as senior vice president, operations services, and served as chief operating officer for Crestwood Midstream Partners.*

*Earlier executive roles focused on commercial activities within Crosstex Energy, Enterprise Products Partners, El Paso Corp. and PG&E Corp.*

*He served as GPA Midstream's chairman from 2013-2015. Under his leadership, the association opened a Washington, D.C., office to increase its involvement in federal legislative and regulatory issues. More recently, he led a strategic review of the association that resulted in a number of key changes within the organization. GPA Midstream awarded Moxley a Citation for Service Award in 2018.*

*Moxley took time following a recent GPA Midstream board meeting to visit with* Midstream Business *and share his vision for the association's future.*

**MIDSTREAM You're taking the reins of the association as it nears its centennial. Does GPA Midstream have any special plans to mark the upcoming anniversary?**

**MOXLEY** Yes, the centennial will be 2021, so 2020 will be kind of a lead-up year. We'll start things at our convention in New Orleans this coming April. This is a very noteworthy occasion, for a trade association to hang around for a hundred years is quite remarkable. Our 2021 convention will be in San Antonio.

**MIDSTREAM What would you regard as the current top priorities for the association and the sector that it serves?**

**MOXLEY** As you can imagine, there are a lot of things that we talk about in our board meetings, and we're certainly in a challenging environment for all companies that are in the carbon-based energy businesses. We know we can be a part of the solution.

Our members provide a lot of services to hydrocarbon producers—natural gas, specifically—in a safe and reliable manner. We're certainly getting a lot of pressure from a lot of groups that object when we try to build new pipelines or construct new facilities. We want to show that we're good citizens, good neighbors and responsible companies that are here to do this needed and necessary work.

We need to get this message out and show the positive aspects of the midstream industry. We're going to work that message in the political realm, in the regulatory world, and hopefully right down to the grassroots level. Our chapter officers met mid-year in The Woodlands, Texas, and we talked about getting out and being responsible representatives of our industry in their neighborhoods and their communities.

**MIDSTREAM The natural gas business, overall, is in the middle of a significant restructuring right now. On the supply side, the major shale plays emerged in the last decade. At the same time, new markets for gas and NGL have emerged on the demand side. Big picture, how are those trends changing the association's mission?**

**MOXLEY** You know, I think GPA Midstream is here to serve our members and help where we can to support the industry's expansion. We're going to keep our major focus on three points. First, the organization started way back in 1921 as a technical-type organization that developed product standards. We'll continue to do that. We have some tremendous technical committees that share industry learnings. I've sat in on meetings where the committee members were sharing best practices for employee safety, operational improvements to further reduce the environmental impact of our facilities, and how to build and operate things in different operating parameters. I think that's still a strength of the organization as we grow—as the industry grows—and also, frankly, as our workforce turns over.

**"We've just got to keep doing what we do. You know, there are certainly new circumstances. The basic processes that we use are, I'd say, fairly mature."**

Second is education. We have a lot of folks who came in the industry in the '70s and '80s who are retiring now. Mark is just one of them. They have a lot of institutional knowledge that they're taking with them. But the good thing about GPA Midstream is, we still have a lot of that body of knowledge in our archives, and people can rely on those technical standards and papers to solve current issues. We still have that base. We still provide education and have increased our schools and training, especially in the last five years.

Again, as our workforce expands with more and more facilities, we're bringing in, by definition, new people to the industry. We have to provide educational opportunities for them, and we're doing that. We're doing that at the national level, and our chapters around the country are doing the same thing within their local organizations, providing educational opportunity. In the future, I would like to grow our online presence to make our knowledge accessible to our members no matter where they are.

Third, our newest initiative is to be a good advocate for the industry—the midstream industry—in legislative and regulatory affairs. Until a few years ago, we didn't have an office in Washington. We do now. We have two people up there, and they're very active in trying to be the voice of the midstream in the capital and in several key states. For example, there are all kinds of things going on with the Environmental Protection Agency (EPA) and the Pipeline and Hazardous Materials Safety Administration (PHMSA) that impact the midstream business. We're very active in working with those two agencies and others to make sure that our member companies' needs are represented.

**MIDSTREAM GPA Midstream has made government relations a significant enhancement to its efforts. With an election year coming up, how will you get involved in the process?**

**MOXLEY** We're not going to pick and choose individual candidates, other than try to educate our members and member companies on what's going on at the federal level. It's interesting, really, that things tend to slow down in Washington when you get into an election year. Neither side, neither party, wants to push to get a lot of things out that might be controversial. However, a lot of groundwork is done in election years, then, once you see which direction things will go after an election, you might see a change—or no change at all. It depends on who wins.

We started a separate political action committee a few years ago and have some funds available to make selected contributions to candidates who are in a position help the midstream business, that are involved in some of the Congressional committees and agencies where we're active. We are trying to be more active from that perspective.

**MIDSTREAM Going back to your first point: technical standards. How is that mission changing?**

Moxley leads a recent meeting of GPA Midstream's board of directors. *All photos, GPA Midstream*

**MOXLEY** I think it continues to evolve because there are more and more things that change with technology. You come up with more learning, and you share it. For example, we're still doing basic research on thermodynamic properties, which you'd think we would have figured all of it out by now. But no, there always seems to be another twist. There are several new research projects that have been suggested, which will start next year.

You know, it just keeps coming. The sector has built a tremendous amount of infrastructure in the last 10-plus years with the shale era, once we started in the mid-2000s with the Barnett Shale. We've built a lot of plants and a lot of pipelines—and again, just as new people got involved in the midstream.

It's all new to them to some extent. There are things that the guys who started their careers in the '80s know, and now you're starting to see the folks that have less than five years' experience in our industry. What we do is always new to somebody.

We've just got to keep doing what we do. You know, there are certainly new circumstances. The basic processes that we use are, I'd say, fairly mature. Cryo-plants have been around since the late 1960s. We certainly have seen evolution in them, but there hasn't been much revolutionary change. There certainly have been changes in their controls and all the peripheral things, though, like the treating of natural gas or gas liquids for $CO_2$. There are always tweaks to be made.

This is not unlike the upstream E&P industry, we're always tweaking things to make them better, to make them run more reliably and safely. We're always learning from that standpoint.

That's a good thing about a trade association, those learning opportunities are shared because, ultimately, what we all want to do is to be good operators and operate safely and responsibly. A lot of things get shared from that standpoint. Take safety programs: We put a lot of effort and a lot of thought into best practices for safety and how we can educate those around the industry.

**MIDSTREAM Of course, setting technical standards relates to the widely used Engineering Data Book, published by GPSA, your supplier affiliate. You've had a major project to update the book and put it online. Could you give an update on that effort?**

**MOXLEY** Yes, the cloud-based data book is now live, and building out the features will be an ongoing process over the next few years. All of the text is there now in the web version, and we're continuing to complete the other details as we move from paper. If you look through the data book information, there are a lot of charts and graphs, and it's our goal, over time, to make those interactive, so that you can press your mouse at a given point and actually get the X-axis and the Y-axis numbers, rather than trying to eyeball it like you would from a chart in a book. That's an ongoing work.

This is a significant change that we hope our members, both at GPA Midstream and GPSA, benefit from. It's now part of their membership privileges. Before, you had to buy the book or get a CD/DVD. Now, we've changed the data book subscription model to be included as a part of membership. That started with the data book going online last summer. It became a part of our membership dues for GPSA beginning last July. For GPA Midstream members, it becomes a part of the membership starting next month, in January. And it goes beyond just offering the data book; all GPA Midstream standards, technical bulletins and presentations are also in the cloud and free to both organizations' members.

**MIDSTREAM You discussed the association's emphasis on educational programs. Could you follow up on that? With the big crew change under way, which you mentioned, and all of the things that are going on in the sector right now, do you see foresee any particular changes or expansion in your educational efforts?**

**MOXLEY** We're still doing the week-long introductory course to the data book, which is mainly focused on engineers and technical staff. We're also doing the Introduction to Midstream course that we have been doing at preselected locations. Now, it has evolved to where we go onsite upon request of member companies to train their nontechnical workers.

I'd like to point out too that our chapters around the country have ongoing educational programs, almost every time they meet. The chapters meet, on average, around four or five times a year. That's something that I feel like we certainly want to encourage.

We recently expanded what used to be only technical committee meetings in the fall of each year into our first-ever, two-day technical conference this past October in Oklahoma City. We added

technical presentations and networking functions alongside the usual committee meetings, again to add value to our members. Attendance exceeded our expectations, which tells us we're doing the right thing.

I don't know that we have a target yet of what else to grow in education. We certainly encourage operational courses, like the compression program we support at Oklahoma State University-Okmulgee. We've supported some others around the country, too. We're still very much in support of education and broad education overall, not just technical, but operational staff, too.

**MIDSTREAM Networking is a plus for any trade group. What is the association doing to enhance its members' ability to meet and work together on common issues?**

**MOXLEY** I think that's probably one of our strengths. Our board meetings provide key networking for advocacy, technical matters, safety and so on. Then, of course, there is our annual convention—that's a massive networking opportunity. We continue to evolve the convention program to create more opportunities for folks to meet and share ideas, for customers and clients to get together.

And like I mentioned earlier, networking within the chapters is incredibly strong, from luncheons and golf and sporting clays to their regional meetings. Some of them have very active young professional groups attached to them, too.

**MIDSTREAM A significant share of the association's membership is based overseas. How does the midstream sector abroad differ from what we see in the U.S. and Canada?**

**MOXLEY** The overseas companies that are involved in GPA Midstream, for the most part, are there for access to our technical standards, our research and our papers. They also find great value in the safety programs.

Traditionally, the U.S. and Canadian midstream is structured very differently than what we find elsewhere. In the U.S. and Canada, we have focused midstream firms, a lot of publicly traded midstream companies as well as private equity-backed midstream companies. Whereas around the world, our membership is more traditional, split between upstream and downstream. They come to GPA Midstream with a technical focus and come from large, state-owned companies, as well as the supplier and engineering organizations that support them.

It's a different audience. Their focus is, I would say, right now, more on the traditional aspects of our association, what we do from a technical and safety standpoint, whereas the U.S. membership has that—plus the interest in what we're doing from the advocacy standpoint and in education. ■

***Paul Hart** can be reached at **pdhart@hartenergy.com** or **713-260-6427**.*

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**Ben Rich**
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Black Diamond's Milton Terminal serves Denver-Julesburg producers in Weld County, Colo., and connects to the Saddlehorn Pipeline. *Source: Black Diamond Gathering*

# The Rockies Waiting Game

## Political and legal questions threaten development of the sprawling region's multiple plays.

*By Jeffrey Share*

It's been quite a while since we've heard much discussion about infrastructure development coming out of the Rockies. Operators have preferred to send their cash, equipment and workforce to the prolific Permian Basin, which continues to pump out record amounts of crude.

As a result, the Southwest region has also been the focus of the bulk of pipeline activity as the midstream sector struggles to keep up with producers seeking to move supplies to Gulf Coast and East Texas refineries.

This is not to say that the Rocky Mountain region is devoid of action. As you'll discover, activity is slowly starting to pick up. Let's just say that it has had to wait its turn.

### Bakken happenings

The Bakken—usually lumped into the loose "Rockies" region, although scant mountains poke above the western North Dakota prairie—remains the hub of most midstream action.

Attention is focused on two heavily publicized projects: Energy Transfer Partners' expansion of the Dakota Access Pipeline (DAPL) and TC Energy's Keystone XL project. The firms rank Nos. 2 and 5, respectively, on this publication's Midstream 50 of the sector's largest publicly held companies.

The DAPL expansion nearly doubles pipeline capacity from over 570,000 barrels per day (Mbbl/d) to 1.1 million barrels per day. The expansion will not require new pipelines but includes enhancing the existing line with two 6,000-horsepower mainline pumps and a 300,000 barrel-capacity tank, as well as adding three new midpoint pumping stations in North Dakota, South Dakota and Illinois.

The expansion is slated for completion in late 2020.

Keystone XL passed one hurdle with a court victory in Nebraska. However, a U.S. District Court judge in Montana is expected to decide late this year whether he will again block the 1,184-mile pipeline as he did in 2018, upholding arguments from environmentalists, or allow President Trump's permit for the line to cross the border with Canada. Native American tribes are also fighting the approval.

Bruce Bullock, executive director of the Maguire Energy Institute at Southern Methodist University's Cox Business School, is doubtful of Keystone XL's short-term prospects.

"If I were to say right now, probably not," he told *Midstream Business*. "Just based upon the balance in the crude markets, it looks like we're headed back to a surplus again in 2020. I don't know whether we're going to need that crude in the East or in the U.S. Prices are forecast to go down, not up. That makes the type of crude coming out of the Canadian oil sands less economic.

"I believe Canadian companies have a longer horizon in terms of their view on these types of projects than some U.S. companies might. Therefore, they may see something in five to 10 years that they like and decide to proceed."

Meanwhile, Enbridge, the sector's largest firm, may add services for producers and shippers in the Bakken through further linkage between its North Dakota System and the Bakken Pipeline System in which it has an equity interest. Current system capacity out of the North Dakota Bakken is 360 Mbbl/d.

Still in limbo is ONEOK Inc.'s proposed 900-mile, 20-inch Elk Creek Pipeline, which would transport up to 240 Mbbl/d of unfractionated NGL from eastern Montana to its existing Midcontinent facilities in Bushton, Kan. The $1.4 billion project was intended to be completed by the end of this year but is delayed because of regulatory issues.

In a unique development in North Dakota, an industry-led consortium, the iPipe (Intelligent Pipeline Integrity Program) has been created to detect and prevent leaks in the state's 27,000 miles of gathering lines by helping to commercialize new technologies.

Genscape lists other Bakken projects:

**Liberty (Phillips 66/Bridger)**—A 350 Mbbl/d line from the Bakken and other Rockies production areas to the Cushing, Okla., crude terminal and trading hub. Initial service is expected to commence in first-quarter 2021. Houston-based Phillips 66 will lead project construction and operate the $1.6 billion, 1,350-mile pipeline.

"The Liberty Pipeline is an important undertaking on the part of our company to ensure that oil from Wyoming, the Rockies and the Bakken can get to markets in the U.S. and around the world," said Hank True, president of Bridger Pipeline. From Cushing, shippers can access multiple Gulf Coast facilities, including Corpus Christi, Ingleside and Houston in Texas.

Phillips 66 ranks No. 15 on the Midstream 50.

**Portal Line (Enbridge)**—Some 145 Mbbl/d will be idled to optimize mainline operations out of Canada. Reduced Bakken deliveries started in the third quarter, and the line will fully be idled in first-quarter 2020.

From Canada into the Rockies:

**Express Pipeline (Enbridge)**—From Canada into the Rockies, a 50 Mbbl/d expansion with use of drag-reducing agents and pump station expansions. The in-service date is expected to be first-quarter 2020.

In gas infrastructure:

**LS 22-Billings Expansion**—A 22.5 million cubic feet per day (MMcf/d) project in Montana, owned by WBI Energy (MDU Resources). Work had been planned for October, but it got a later-than-expected start.

It will replace 10-inch pipe with a larger diameter and increase operating pressure to allow more gas to move.

**Bakken Missouri River Crossing**—A 180 MMcf/d line in North Dakota, owned/announced by Kinder Morgan. Work is to start in January, but it has been unclear if the project has made it past announcements.

### Colorado chronicle

Recent news has involved mergers and acquisitions, some planned expansions, and in the key state of Colorado, the focus is on Bill 181, which was signed into law last April and gives local governments increased regulatory authority over oil and gas development.

Industry officials warn that 181 threatens future investment and could ultimately kill drilling activity. The Colorado Fiscal Institute disputes this, pointing out that 181 does not ban any drilling techniques, including fracking. In addition, the study suggests that the likelihood is low of a local government, like Weld County, where 80% of current oil and gas extraction occurs in the Denver-Julesburg (D-J) Basin, banning development.

*Midstream Business* interviewed several consultants about Rockies' development, and the general agreement suggests patience.

### Political peril

Nathan Scott, principal, Continuum Advisory Group in Denver, acknowledges that the biggest challenge in Colorado is political, following earlier setbacks or governmental actions that resulted in a lighter version of the initiatives sought by fossil-fuel opponents. The bill was intended to be focused more on the environment, less on industry, he said.

"The writers would say they balanced it; the industry would say they shifted to anti-oil and gas. The effect is yet to be determined. How that's going to play out, how regulation changes moving forward, is still an open question. My takeaway at this point is the uncertainty around it, particularly with significant investment, because building infrastructure to move oil and gas out of the state requires a long-term play with long-term projections," Scott told *Midstream Business*.

"The Colorado situation, I would say, is iffy for the upstream people," agreed SMU's Bullock. "The ability to build additional infrastructure, to get product out there and to market, is probably going to be challenged in the coming months and years. From a gas and oil standpoint, it won't be until later this year or early next year we'll get relief in a lot of product coming out of the Permian. I think you will ultimately get some things built out of the Rockies, but it's going to be more resistance up there than in other areas."

Blame political and environ-

ONEOK's expansion of its Demicks Lake complex in McKenzie County, N.D., will add 400 million cubic feet per day of gas processing capacity in the Bakken. *Source: Hart Energy*

mental resistance, he said, echoing Scott's commentary.

"The voters, in fact, rejected something that was on the ballot that would have virtually shut down the industry in Colorado; so, to a great extent, they're going about it legislatively and through regulations to make it much more difficult. And generally, these environmental groups, whatever they're not able to stop on the upstream end, they tend to turn on the midstream end to keep pipelines from being built. That's probably where they'll turn their attention to next," Bullock said.

Scott said the need for oil vs. natural gas pipelines is "fairly balanced at this point."

**Market driven**

"The market drives it; there's more money in oil as gas prices have continued to stay low. In most states in the West, flaring of gas is not okay, particularly over the long term, and is gaining ire from regulators along with attention from environmentally concerned groups. Fracking and the nature of how we're extracting oil in most fields in the Rocky Mountains produces a lot of gas that you have to be able to take off, so the need there is for both.

"I'm not sure of percent-of-capacity for long-haul natural gas vs. oil. There are still projects on the drawing board continuing to move oil. At a local level, if you've got wells, at least, from a gathering line perspective and getting into compression facilities, there's still a need for [pipelines] because you can't burn it off or store it onsite," Scott said.

**The price conundrum**

The economics of production and moving gas out also present one of the biggest challenges that the Rocky Mountain region faces.

"The value of the hydrocarbons is discounted in the Rockies region; the problem is there's an even greater discount elsewhere," Greg Haas, director, integrated oil and gas, at Hart Energy's Stratas Advisors, told *Midstream Business*. "Recently there were deep discounts, and even negative prices, in the Waha gas basin of West Texas. That was the result of much more associated gas than anyone anticipated. Coming with this very strong growth in crude output, the gas came online before anybody anticipated the need for new pipelines.

"That created an overhang of natural gas in the Waha region which then drove prices negative. We recently saw one significant pipeline startup from the Waha area, and that has brought it [prices] back into positive territory. But it's around a dollar and change. Henry Hub is $2.40 [per MMBtu] or so today. The price of Colorado or Wyoming gas is about $1.90 or so. How can you get past this wall of West Texas gas economically coming all the way from the Rockies if you're heading toward the Gulf Coast?

"That's the real question," he continued. "If you're going west to California, you don't have a lot of options, so that can pay if demand is there. If you're going east, you have to overcome the wall of gas coming out of Appalachia in the Marcellus/Utica. If you're trying to go south, you've got that wall of gas in the Permian. All of that is really pressuring the cost of moving and producing gas in the Rocky Mountain region."


Expansions at Black Diamond's Lucerne Terminal, outside Greeley, Colo., and at its nearby Milton Terminal, will provide 540,000 barrels of storage by the end of first-quarter 2020. *Source: Black Diamond Gathering*

**Niobrara-D-J**

The Niobrara-Denver-Julesburg Basin is a crude oil and liquids-rich gas play located in northeastern Colorado and southeastern Wyoming. The Niobrara is also located in several other areas of the Rocky Mountains, including the Powder River Basin in Wyoming and in parts of northwest Colorado.

The Niobrara production area in the Rockies is a complicated place to determine crude oil supply and demand balances, analyst John Zanner wrote for RBN Energy. It's at the crossroads of a number of supply areas, with volumes coming in from Canada and the Bakken, as well as locally from the Powder River and D-J basins.

"In terms of destinations, there are well-established local markets, or you can send the molecules to Salt Lake City, or southeast to the Cushing hub and beyond. The Niobrara is one of the few growth areas we look at where there is substantial pipeline capacity for inflows and outflows, with the option to service multiple markets. Now, there are a couple of new pipeline projects ramping up in the Rockies, and given the region's interconnectivity, it's a good bet that the status quo in the Niobrara is in for some big changes," he said.

Edward C. Kelly, vice president, Americas Gas & Power Consulting, IHS Markit, told *Midstream Business*, "We see one oil pipeline moving forward out of the Niobrara, but new natural gas pipelines leaving the Rockies await the resumption of net production growth in the region."

**Uinta Basin**

The Uinta Basin in northeastern Utah contains huge reserves of unusual, waxy crude oil with many characteristics that refiners desire: medium-to-high API gravity and very low sulfur, acid and metal content. The combination of long horizontal wells and hydraulic fracturing offers producers access to the basin's product at a remarkably low cost per barrel. However, as consultant Housley Carr wrote for RBN Energy, the crude is difficult to transport, posing a major economic and logistical challenge: cost-effective transport to distant markets.

"Refineries in nearby Salt Lake City have been making good use of the waxy oil for decades, but there are limits to how much they can process, so Uinta Basin producers, midstreamers and investors have been working on ways to move large volumes to faraway places like the Gulf and West coasts. They may finally be making real progress," Carr wrote about the prospects for taking the often-overlooked Utah play to the next level.

Though the fast-growing Denver, Boulder and Salt Lake City metro areas provide a substantial market for Rockies gas, new problems arise as pipelines begin to encroach into more densely populated regions, creating local opposition.

However, the plan has long been to ship that gas to the West Coast. Currently the major route for Rockies gas is via Kinder Morgan's 680-mile, 1.5 billion cubic feet per day (Bcf/d) Ruby Pipeline, extending from Wyoming to Oregon. For crude, producers want more routes to the Cushing hub and to West Texas, from where it can easily be shipped to the Gulf Coast.

**Noble Midstream**

Noble Midstream Partners LP, a leading developer in the Rockies, is partnering with Greenfield Midstream LLC in a joint venture, Black Diamond Gathering LLC, which provides crude oil gathering and storage services to producers in the Denver-Julesburg Basin. Black Diamond has a strategic relationship with Saddlehorn Pipeline Co., owned by

Magellan Midstream Partners LP, Plains All American Pipeline LP and Western Midstream Partners LP.

Saddlehorn is capable of transporting 190 Mbbl/d of crude oil and condensate from the D-J and Powder River basins to storage facilities in Cushing, owned by Magellan and Plains. After a successful open season, Saddlehorn will be expanded by 100 Mbbl/d to 290 Mbbl/d. The higher capacity should be available in late 2020 with additional incremental pumping and storage.

Black Diamond has secured a 15-year oil gathering dedication from Verdad Resources, encompassing 85,000 acres and over 750 potential drilling locations in the D-J Basin in southern Weld County. The total acreage dedicated to the Black Diamond system is now 243,000 acres.

Noble Midstream operates Black Diamond, which includes a large-scale integrated crude oil gathering system in the D-J, consisting of 240 miles of pipeline in operation, 300 Mbbl/d delivery capacity and 390 Mbbl/d crude oil storage capacity. The system is connected to every major takeaway pipeline in the D-J Basin, including White Cliffs Pipeline, Saddlehorn Pipeline, Grand Mesa Pipeline and Pony Express Pipeline.

### DCP Midstream

DCP Midstream has been among the nation's top gas processors and NGL producers for over a decade. Following the price downturn several years ago, the company has focused on a "relaunch" dubbed DCP 2.0. Investing in fee-based growth projects has resulted in a 65% increase in fee-based gross margins so far this year.

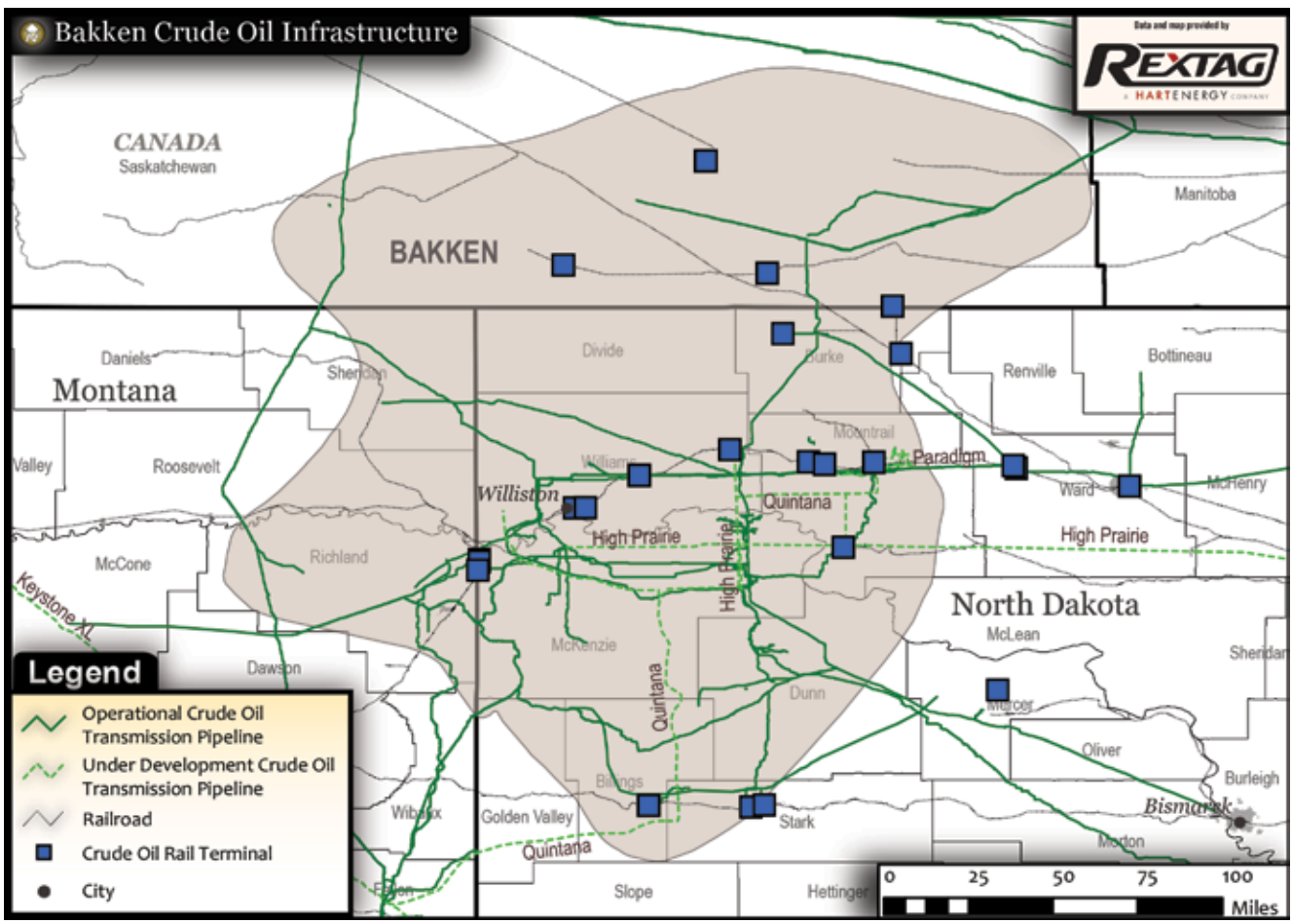
The DCP 2.0 strategy uses technology to drive optimization and improve efficiencies throughout its portfolio of assets. The D-J Basin has been a standout play this year with a double-digit, year-over-year volume growth in the second quarter. This region is poised for even more growth following a long-term agreement with Western Midstream Partners to provide up to 225 million cubic feet per day (MMcf/d) of incremental processing capacity by mid-2020, said company officials.

DCP had partnered with SemGroup Corp. on the project, but in September, SemGroup was purchased by Energy Transfer in a $5 billion deal that establishes Dallas-based Energy Transfer as a major shale oil and NGL player in the Rockies with its first infrastructure in the D-J Basin.

By adding SemGroup's export terminal on the Houston Ship Channel, this could lead to a significant export market for D-J producers, according to published reports.

### Tallgrass Energy Partners

Sept. 18 was a significant day for Tallgrass Energy LP as the Federal Energy Regulatory Commission authorized certificates for its Cheyenne Connector and REX Cheyenne Hub Enhancement projects. The Cheyenne Connector Project involves construction of a 70-mile, large-diameter interstate natural gas pipeline



Black Diamond's Milton Terminal in the Denver-Julesburg Basin: Colorado's cloudy political climate casts a shadow over the future of the Centennial State's robust energy business. *Source: Black Diamond Gathering*

to transport natural gas from processing plants in the D-J Basin in Weld County to the Rockies Express Pipeline (REX) Cheyenne Hub just south of the Colorado-Wyoming border.

This would provide access to interconnected pipelines and local distribution systems at the REX Cheyenne Hub as well as interconnected systems downstream of REX that reach end users in West Coast markets, Midwest markets such as Chicago and Detroit, the Gulf Coast and Southeast. Tallgrass said the Cheyenne Connector has an estimated initial design capacity of 600 Mcf/d with potential for expansion. Precedent agreements for a combined 600 Mcf/d have already been signed by affiliates of DCP Midstream and Occidental.

The 1 Bcf/d enhancement of the REX Cheyenne Hub in Weld County includes modifications to accommodate multiple natural gas pipelines with various operating pressures in providing customers increased diversity in terms of market access. It is expected to be in-service during first-quarter 2020.

**Black Hills Corp.**

Rapid City, S.D.-based Black Hills Corp. has announced plans to expand its energy business with the expenditure of up to $2.5 billion over the next five years, including over $1.6 billion for natural gas utilities in the process of being consolidated in Colorado, Nebraska and Wyoming, according to Linn Evans, CEO.

Among the main components of the program is a natural gas transmission pipeline planned for central Wyoming, he said. Black Hills Gas Distribution LLC is constructing the 35-mile, 12-inch Natural Bridge Pipeline at a cost of $54.2 million. It will run from Douglas to Casper, Wyo. The company has 57,000 customers in central Wyoming. Black Hills has also won approval to combine two Colorado gas distribution utilities into Black Hills Colorado Gas Inc.

**Waiting on the Permian**

Bullock believes many developers are waiting for pipeline activity to finish up in the Permian before they move up into the Rockies.

"I think that's part of it," he said. "They will certainly get more relief which should come by first quarter of 2020. That's reason to look elsewhere. I think there's more political risk in the Rocky Mountain region that has a chilling effect."

And could the national election factor into this for operators and their investors, who may be holding back on their investment, just in case?

"It's a two-edged sword on projects that are possibly going to require significant capital past 2020. Any approvals past 2020, they probably are holding back on. On the other hand, things that they can get done through the remainder of 2019 and in 2020 in terms of decisions on capital deployed, I think they're probably speeding those up," Bullock said. Another factor slowing investment is shareholder pressure on public companies.

"Shareholders have spoken loudly that they want these public companies to return money either through dividends, buybacks or other mechanisms. For the most part through the growth stages since 2012 a good portion of the companies have not done that. They're having to reduce their capital budgets on top of these lower prices. This is definitely having a chilling effect on investment," he said. ■

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***Jeffrey Share** is a Houston-based Hart Energy contributing editor specializing in midstream energy topics.*


Work moves ahead on Aspen Midstream's Giddings Field gathering system. *Source: Aspen Midstream LLC*

# Mixed Signals

## Improved export-focused infrastructure can boost fortunes of the Eagle Ford and Haynesville.

*By Travis E. Poling*

The long-term outlook for natural gas is mostly bright, but two shale plays in Texas and Louisiana have two very different tales to tell when it comes to investing in infrastructure to support a possible upturn while commodity prices remain low.

In the Eagle Ford of South Texas, there is excess capacity in the system, but Gulf Coast projects at Corpus Christi, Texas, primarily designed to handle Permian Basin oil production, will also carry Eagle Ford volumes.

The Haynesville in the Ark-La-Tex Basin of East Texas and western Louisiana, however, is weathering the low prices with more expansions of gathering systems, transportation pipelines and processing facilities to handle future production as 100 drilling rigs work the land.

### Eagle Ford tiers

The take on the Eagle Ford from analysts at Wells Fargo Securities is that the play has excess capacity for crude at least through 2025. What's more, breakeven prices by efficiency are in tiers there, with $61 a barrel (bbl) in Eagle Ford West, $50/bbl in the central segment, and about $39/bbl in Eagle Ford East.

"The potential for a global economic slowdown, the U.S.-China trade war and geopolitical instability could keep oil and natural gas prices rangebound, muting the near-term outlook for U.S. hydrocarbon export growth," Wells Fargo analysts predicted in a recent report. "Given this backdrop, we expect U.S. crude, natural gas and NGL production growth to moderate. While increased volumes and higher cash flows for midstream companies positioned in growth basins should still materialize, the overall growth trajectory is more muted."

Analysts at investment banking company Stifel Financial said that even

Freeport LNG loaded its first shipment from Train 1 of its Freeport, Texas, plant aboard the Bahamas-flagged *LNG Jurojin* late in the third quarter. The plant provides a new market for both Eagle Ford and Haynesville gas producers. *Source: Hart Energy*

though natural gas prices have been well below past years' $3 per million Btu (MMBtu), gas rigs operating in the combined Marcellus and Haynesville shales have been steady at 100 or more in 2019.

The Eagle Ford had only nine natural gas rigs throughout the year and 58 oil rigs, Stifel reported. By comparison, more than 440 oil rigs operate in the Permian.

"Volumes aren't growing. They're pulling their reins in because of the commodity price," said Joel Moxley, a longtime midstream executive, who recently joined the GPA Midstream Association as president and CEO. "Midstream's health relies on upstream's health." (See interview with Moxley in this issue.)

Moxley said flat volumes in the Eagle Ford mean things have been slowing down for midstream, and any new infrastructure projects that might have been planned are on hold. What's more, operators are taking Eagle Ford revenue and pumping it into the Permian and other hot areas.

### A different story

"The Haynesville is very much a different story. Volumes are growing," Moxley said. Volumes from the Haynesville are at a new all-time high, surpassing a previous high from about five years ago that necessitated a buildup of midstream assets to get it to market, he said.

As of September, Haynesville natural gas production was 11 billion cubic feet per day (Bcf/d) and is forecast to hit 14 Bcf/d by 2025.

He said that Haynesville producers may be so active, even at $2.35/MMBtu and less, because the cost of drilling is lower than before, much of the infrastructure is already in place, and the play's mostly dry gas decreases processing costs. The Haynesville also is closer to markets than the Eagle Ford, which lowers costs even more, he said.

However, "The Eagle Ford is already connected to all this export capacity," so it is positioned to move significant volumes if strong natural gas prices make a return, he said. "Capacity usually comes on in large chunks, but demand takes some time to come up."

Forecasts from Enverus (formerly Drillinginfo) put Eagle Ford oil production up to 1.49 million barrels per day (MMbbl/d) in 2020, compared to 1.43 MMbbl/d in the third quarter of 2019. Natural gas production from the play is expected to dip in 2020 to 6.82 Bcf/d from 6.87 Bcf/d in the third quarter this year.

### Contracts ending

Many existing pipelines and processing facilities in the Eagle Ford (and Austin Chalk) and Haynesville are nearing the end of their dedication contracts with producers, which could mean a reduction in revenue off the assets, unless the gap between excess capacity

Workers assemble a tank, part of a 600,000-barrel expansion of NuStar's North Beach terminal at Corpus Christi, Texas. *Source: NuStar Energy LP*

and supply narrows, Moxley said. The legacy agreements, however, will have paid for the infrastructure by the time they expire, and midstream services could go cheaply to keep the pipeline full, he added.

Gas infrastructure projects in the Eagle Ford abounded in 2014 and 2015, with the latest projects completed in 2017, according to data compiled by Hart Energy's Stratas Advisors. Stratas noted just one processing project associated with the play in 2019: Aspen Midstream LLC's processing plant and gathering system in Giddings Field.

Dallas-based Aspen expects to complete the project by the end of the year, a company spokeswoman said. The plant, treating facility and 90-mile system of gas gathering 10- to 20-inch mainline in Giddings will take advantage of the stacked plays including the Austin Chalk and Eagle Ford across six counties. The cryogenic processing plant can handle up to 200 MMcf/d. A residue gas pipeline runs to the Katy, Texas, market hub.

"We believe our system's proximity to premium markets for both NGLs and natural gas takeaway will allow our producers to realize better netbacks and compete economically with other basins," Aspen CEO James Clarke said when the project was first announced. In all, the system has long-term dedications with several producers across a 150,000-acre area.

While many pipeline and processing projects focus on easing the bottleneck from an influx of Permian crude oil for export, they also are prepping for potential future volumes from the Eagle Ford.

Howard Energy Partners, a San Antonio company with 215 miles of lean-gas gathering line with a capacity of 1 Bcf/d in Webb County, Texas, has entered a joint venture with Juno, Fla.-based NextEra Energy Partners. NextEra has a 150-mile pipeline from LaSalle County, Texas, to the Aqua Dulce gas hub.

### Agua Dulce link

Combining its Eagle Ford assets means Howard's tie into NextEra's 30-inch and 16-inch transportation lines creates an option to expand capacity on the gathering system, said Howard Energy's chairman and CEO Mike Howard. The producers get a direct link to Agua Dulce and access to emerging markets in Mexico and the Texas Gulf Coast.

NextEra president Armando Pimentel said the venture gives the company organic growth in the Eagle Ford with a minimal capital investment by increasing the use of its Eagle Ford midstream system. The joint venture is based on future contracts committing to the use of both systems, so it doesn't have any influence on existing contracts and revenues.

**Workers lower 30-inch pipe in the ditch, part of Aspen Midstream's Giddings Field expansion in South Texas.** *Source Aspen Midstream LLC*

Another Eagle Ford project on the books is the first phase of a water gathering system from EVX Midstream Partners LLC. In September, the company announced it had completed more than 300 miles of large-diameter water gathering systems. EVX CEO Herb Chambers IV said the systems' rapid expansion has allowed the company to contract with most producers operating in the Eagle Ford.

NuStar Energy LP is building another 600 Mbbl of storage space, bringing capacity at its Corpus Christi terminal to 3.9 MMbbl when completed in December. It is accompanied by the completion of a connection from the Plains Cactus II pipeline to the NuStar terminal to facilitate Permian crude transportation.

Eagle Ford volumes, however, are still very much in the long-range planning for the San Antonio-based company, ranked No. 24 on this publication's Midstream 50 list of the sector's largest publicly held companies.

The continued growth of the company's South Texas crude system "is once again experiencing throughput at near the historically high levels we saw in the Eagle Ford's heyday in 2015," said Brad Barron, president and CEO, when the latest projects were announced in September. The export terminal is "handling the leading edge of the impending wave of Permian long-haul crude oil. And we expect continued growth for both Permian and Eagle Ford barrels going forward."

### Corpus Christi LNG

Also in Corpus Christi—with an eye to creating more export capacity—Cheniere Energy commissioned Train 2 at its liquefaction plant. Between Corpus Christi and its Sabine Pass location on the Louisiana Gulf Coast, Cheniere and Bechtel Oil, Gas and Chemicals Inc. had substantially completed a total of seven processing train units for LNG by the end of the third quarter. Deliveries will begin in May 2020 to several countries, including Spain, Indonesia, Australia and France.

This gives Cheniere another 600 MMcf/d of liquefaction capacity. All told, the top LNG producer and exporter will have a capacity of 45 million tonnes per year.


**The Battle Horse processing plant, with a capacity of 200 million cubic feet per day, will be the hub of Aspen Midstream's new South Texas system.** *Source: Aspen Midstream LLC*

Freeport LNG has launched an expansion at its export terminal in Brazoria County, Texas. A loan of more than $1 billion from Australian private equity firm Westbourne Capital will allow Freeport to build a fourth processing train while Trains 2 and 3 are still under construction. The first three units will have the capacity to produce as much as 15 million metric tons of LNG a year. Trains 2 and 3 are expected to come online in January and May of 2020. Train 4 would add another 5 million metric tons.

Enterprise Products Partners LP, ranked No. 4 on the Midstream 50, has about $6 billion in capital projects in the works. The partnership is gearing up to process another 35 Mbbl/d with a second propane dehydrogenation plant and as many as 1.65 billion pounds a year of polymer grade propylene (PGP) at the Mont Belvieu, Texas, NGL hub, according to the company.

The primary customer of the new plant is plastics, chemicals and refining giant LyondellBasell.

Enterprise also has a second isobutane dehydrogenation, or IBDH, plant in the works. The first plant has been in operation since 1993. An expansion of the refrigeration facilities at its terminal is also in the works, allowing Enterprise to load up to 5 Mbbl/hour of PGP, as well as to load PGP and LPG on the same large gas carrier.

To supply the growing LNG needs for markets in Louisiana, Enterprise is constructing an 80-mile pipeline from outside Cheneyville, La., to other company connections near Gillis, La. The additional capacity from the Gillis Lateral, when it opens in mid-2021, and additional horsepower at its Mansfield compressor station in DeSoto Parish, La., will increase the existing capacity of the Acadian Haynesville Extension by another 300 MMcf/d, to 2.1 Bcf/d.

"The expansion and extension of the Acadian system enhances our capability to link supply to some of the most attractive markets in the U.S.," said A.J. (Jim) Teague, CEO and general partner, in a statement. The company has a 357-mile gathering system in the Haynesville with a capacity of 1.3 Bcf/d and treatment of as much as 810 MMcf/d of gas.

### A Haynesville prop

Haynesville and other Ark-La-Texas Basin plays are propping up the bottom line for some midstream companies, with revenue making up for parts of the business that are drooping.

For example, Enable Midstream Partners management told shareholders in commentary on its second-quarter financial results that its gas processing and gathering revenue segment was down about 8.4% to $587 million, compared to the same quarter last year, because of lower revenues from NGL sales and lower than average gas sales prices.

Company officials said the decreases were partially offset by several factors, including increased natural gas revenues in the Ark-La-Tex and Anadarko basins from higher gas gathering revenue and greater volumes. Processing fee revenue from those basins also was up but tempered by lower prices. Enable ranks No. 17 on the Midstream 50.

### The tightrope

Midstream companies walk the tightrope, not just in the Haynesville and Eagle Ford, but in all of the natural gas producing regions because, while low commodity prices don't encourage shorter term gains from infrastructure projects, the long-term global outlook for natural gas demand is strong. Producers, midstream companies and financiers operating in Texas and Louisiana shale plays have their eyes on China.

In a recent report, energy market intelligence firm McKinsey & Co. said "gas is the only fossil fuel expected to continuously rise in demand through to 2035." Last year, China became the largest importer of gas and LNG, knocking Japan and South Korea from the top spots. McKinsey's analysis of the data found that gas demand will rise 0.9% a year globally, with Asian demand growing by 2.1% a year.

An increase in supply of about 22.4 trillion cubic feet (Tcf) by 2035 will largely come from the U.S. The U.S. is expected to provide an additional 11.6 Tcf, with Russia and the combined African countries supplying about 3.9 Tcf each, McKinsey forecasted.

"We'll look back at this as a milestone year, when China became the world's biggest LNG importer and we saw the highest volume of liquefaction projects taking FID (final investment decision)," said Rahul Gupta, associate partner at McKinsey Energy Insights. "In many ways, that sets the tone through to 2035: Asian economies in the ascendancy—led by China—with growing energy demand; the U.S. continuing to rank highly for both supply and demand; but on the supply side, Europe and Asia's second-tier economies falling away. Overall though, this is a growth story for gas and LNG." ■

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***Travis E. Poling** is a freelance writer based in San Antonio.*

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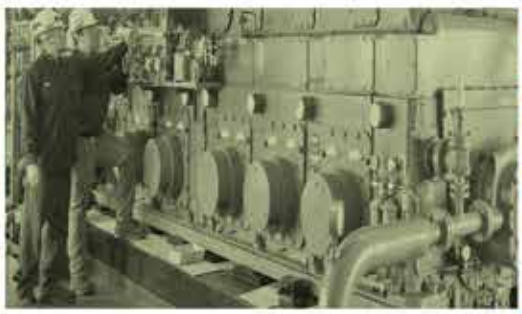


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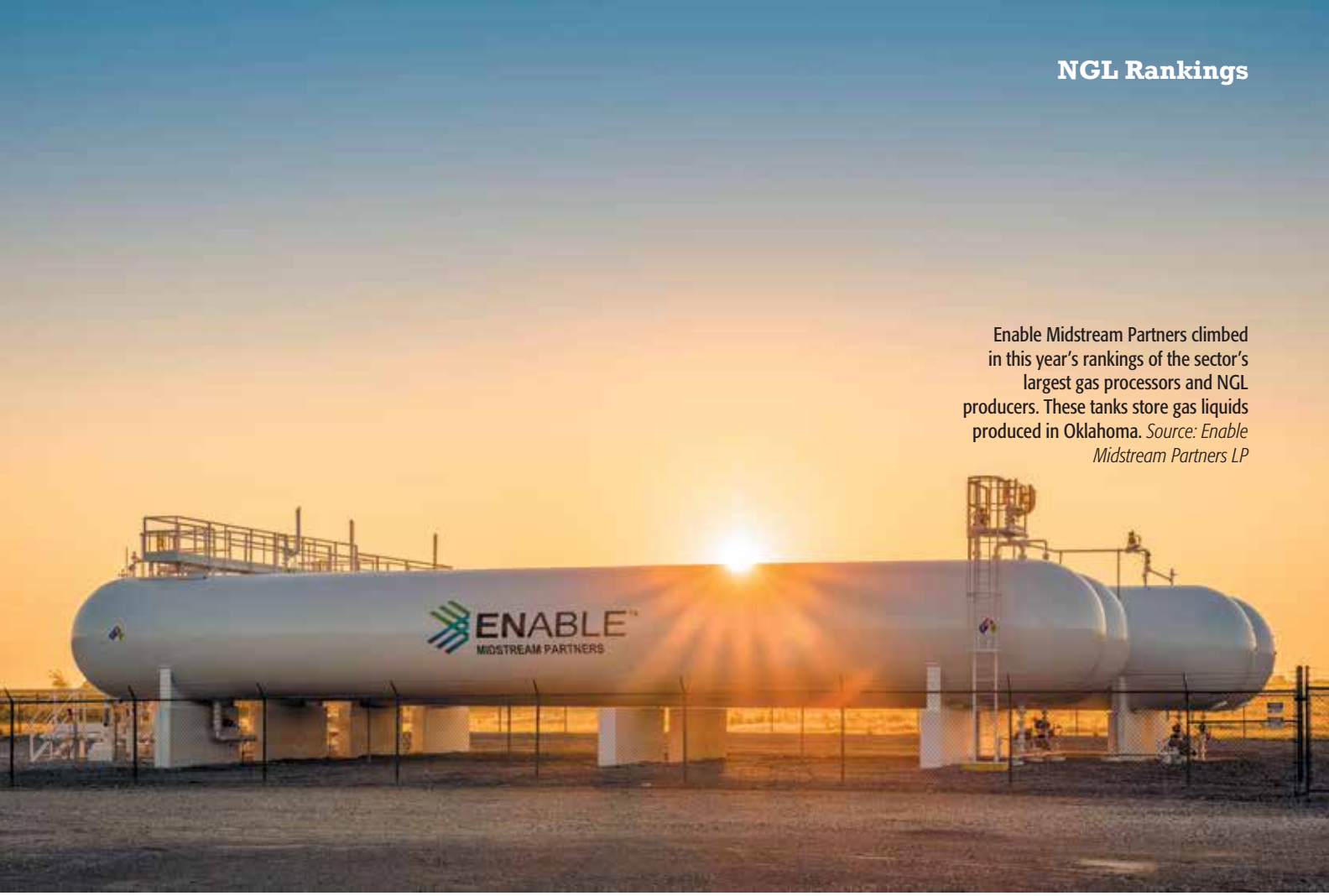


Enable Midstream Partners climbed in this year's rankings of the sector's largest gas processors and NGL producers. These tanks store gas liquids produced in Oklahoma. *Source: Enable Midstream Partners LP*

# Growth Of The Status Quo

**Despite substantial growth by the ranked companies, there wasn't much movement in our annual rankings, with the top spots retained by MPLX and Energy Transfer.**

*By Frank Nieto*

For the first time in three years, the top spots in *Midstream Business*' annual rankings of the top gas processors and NGL producers have remained the same. Energy Transfer Partners retained its spot as the top NGL producer while MPLX's gathering and processing segment (previously known as MarkWest Energy Partners) was once again the top gas processor in our rankings.

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### One-two punch

There was a great deal of volume growth from ranked companies, including those at the top of the lists. Energy Transfer's NGL production rose by 14% to 540,000 barrels per day (Mbbl/d) for 2018. Energy Transfer also reported large increases in the amount of gathered natural gas within its system, which were due to ramped-up production out of the Permian, Northeast, and North Texas.

In fact, it's likely that these increases pushed Energy Transfer into the top two in our natural gas processor rankings. However, the company did not supply processing figures. The

company earned a ranking in our top-10 processor rankings based on its gathering volumes and gas processing net capacity—but without specific figures we placed it tenth.

Energy Transfer's biggest splash this year was the $5 billion acquisition of Tulsa, Okla.-based SemGroup Corp. This deal increases the company's crude oil assets and enhances its NGL assets in the Denver-Julesburg and Anadarko basins, including several pipelines that will connect these regions to the Cushing, Okla., crude oil hub.

The Mariner East system is also a focal point for the continued growth of Energy Transfer, according to the company's CFO, Thomas Long. "Since resuming operations on Mariner East 1 in late April, the combined Mariner East pipeline system has moved approximately 230 Mbbl/d of NGLs through Marcus Hook [Pa.] and we expect that volume to continue to ramp up when Mariner East 2X comes online later this year," he said during the company's recent conference call to discuss second-quarter earnings.

Between pipeline, truck and rail, Energy Transfer is moving about 300 Mbbl/d of NGLs through Marcus Hook.

The company with the biggest year-over-year NGL production growth was Enable Midstream Partners, which rose 44% to 129.9 Mbbl/d to go along with record volumes of natural gas gathered and processed, as well as record amounts of crude and condensate gathered. These results were driven by continued producer activity and strong well results.

**Top processing spot**

"2018 was a transformational year for MPLX," Gary Heminger, the company's chair and CEO, said during a recent earnings call. "In the gathering and processing segment, we added 11 new plants, which expanded our processing capacity by nearly 1.5 Bcf/d [billion cubic feet per day] and our fractionation capacity by 100 Mbbl/d."

For the 2018 fiscal year, MPLX's gathering and processing segment reported a 15% increase in earnings to $1.4 billion. This was largely driven by record levels of natural gas volumes gathered, processed

## TOP NGL PRODUCERS

| Rank | Company | 2018 NGL Produced (bbl/d) | 2017 NGL Produced (bbl/d) | Percentage Change | 2017 Ranking |
|---|---|---|---|---|---|
| 1 | Energy Transfer | 540,000 | 472,000 | 14% | 1 |
| 2 | MPLX* | 459,000 | 394,000 | 16% | 3 |
| 3 | Enterprise Product Partners | 429,318 | 404,433 | 6% | 2 |
| 4 | Targa Resources | 415,700 | 333,200 | 25% | 5 |
| 5 | DCP Midstream Partners | 413,000 | 375,000 | 10% | 4 |
| 6 | EnLink Midstream Partners | 209,028 | 176,300 | 19% | 7 |
| 7 | ONEOK Partners | 198,000 | 187,000 | 6% | 6 |
| 8 | The Williams Cos. | 162,000 | 148,000 | 9% | 8 |
| 9 | Enable Midstream Partners | 129,980 | 90,110 | 44% | 10 |
| 10 | Kinder Morgan | 118,432 | 141,438 | -16% | 9 |

**Previously listed as MarkWest Energy Partners*

*Source: Hart Energy*

## TOP GAS PROCESSORS

| Rank | Company | 2018 Gas Processed (Bcf/d) | 2017 Gas Processed (Bcf/d) | Percentage Change | 2017 Ranking |
|---|---|---|---|---|---|
| 1 | MPLX* | 7.19 | 6.46 | 11% | 1 |
| 2 | Enterprise Product Partners | 5.64 | 5.16 | 9% | 2 |
| 3 | DCP Midstream Partners | 4.8 | 4.77 | 1% | 3 |
| 4 | Targa Resources | 3.94 | 3.47 | 14% | 4 |
| 5 | Western Gas Partners | 3.89 | 3.68 | 6% | 9 |
| 6 | The Williams Cos. | 3.03 | 3.05 | -1% | 5 |
| 7 | EnLink Midstream Partners | 2.8 | 2.45 | 14% | 6 |
| 8 | ONEOK Partners | 2.3 | 1.98 | 16% | 7 |
| 9 | Kinder Morgan | 0.97 | 1.35 | -28% | 8 |
| 10 | Energy Transfer** | N/A | N/A | N/A | Unranked |

**Previously listed as MarkWest Energy Partners*

***Company did not provide daily average*

*Source: Hart Energy*

and fractionated. The growth in processed volumes came out of the Marcellus Shale.

Heminger added that MPLX will focus on expanding its midstream assets through organic growth in order to further generate third-party revenue. MPLX anticipates adding about 800 million cubic feet per day (MMcf/d) of natural gas processing capacity and 100 Mbbl/d of fractionation capacity in 2019.

MPLX reported significant growth in processed volumes in the first-half of 2019, with a 15% increase to 7.8 Bcf/d in the second quarter, compared to the same time in 2018. Once again, the bulk of these volumes are due to growth in the Marcellus.

This Targa processing plant in Wise County, Texas, serves Barnett Shale producers. The firm has been a perennial top player in gas processing and NGL production. *Source: Hart Energy*

**ONEOK surges**

ONEOK Partners had the biggest increase on the gas processing side with a 16% year-over-year increase to 2.3 Bcf/d in 2018, due to greater producer activity in the Rockies and the Midcontinent.

"We continued to see strong producer activity and efficiency improvements across the Williston Basin and Powder River Basin, which is driving associated natural gas and NGL growth. NGL volume gathered on the Bakken Pipeline in 2018 increased 4% compared with 2017. Fourth-quarter NGL volumes gathered averaged 148,000 barrels per day, a 7% increase compared with the third-quarter 2018," Kevin Burdick, ONEOK's executive vice president and COO, told analysts in a recent earnings call.

These figures are expected to continue to increase, based on the number of capital growth projects in place for this year and next. ONEOK anticipates spending more than $4.4 billion in 2019 through the first quarter of 2020.

ONEOK anticipates a strong opening for several new assets in the Williston, which has more than 250 MMcf/d of natural gas currently being flared on its dedicated acreage in the region. Company officials expect the 200 MMcf/d Demicks Lake I natural gas processing plant to open full when it comes online in the fourth quarter. Another 200 MMcf/d plant, Demicks Lake II, is expected to be complete in the first quarter of 2020.

In the Rockies, well connections exceeded expectations in 2018 and are expected to be even higher during 2019.

ONEOK also reported increased activity out of its acreage in the Midcontinent for the 2018 calendar year. Natural gas processed through the company's plants rose by more than 18% from the previous year, following the connecting of 138 wells.

Processed volumes should further increase in 2019 as the company completed the expansion of its Canadian Valley natural gas processing plant in the Stack play. This plant increased ONEOK's processing capacity in Oklahoma about 1.1 Bcf/d.

"In our gathering and processing segment, we expect natural gas volumes processed to increase approximately 5% compared with 2018, primarily from growth in the Williston Basin. Additionally, with our Demicks Lake I plant coming online in the fourth quarter, we expect our 2019 exit rate for volumes processed in the Williston Basin to be approximately 20% higher than our current processed volume level," Burdick added.

**DCP down, up**

One note of significant import is DCP Midstream Partners reaching its lowest place in our rankings in over a decade. From 2007 to 2015, DCP held the top spot in both of our rankings. Despite experiencing a 10% increase to 413 Mbbl/d of NGL produced, the company fell to No. 5 in top NGL producer rankings. It retained the No. 3 spot in the gas processor rankings after processed volumes rose 1% to 4.8 Bcf/d.

Since the downturn in oil and gas prices, the company altered its business model to reduce its sensitivity to commodity prices. The DCP 2.0

strategy, now in its fourth year, is focused on using technology to drive optimization and improve efficiencies throughout DCP Midstream's portfolio of assets. These assets are located in some of the most prolific plays in the country, including the Permian Basin, Eagle Ford Shale, Scoop, and the D-J Basin. The D-J Basin in particular has been a standout play for the company this year as it experienced a double-digit year-over-year volume growth in the second quarter.

By the middle of 2020, the company anticipates having a total of nearly 1.7 Bcf/d of processing capacity in the D-J Basin. A large chunk of this new capacity results from the recently completed O'Connor 2 processing plant, which has a total capacity of 300 MMcf/d.

DCP officials also announced that the company is increasing NGL takeaway capacity on the Southern Hills Pipeline by 40 Mbbl/d, which will increase the system's total capacity by about 20% to 230 Mbbl/d by the end of 2020.

While the company is in transition, one thing that remains the same is its commitment to its highly concentrated super-system strategy that allows the company to maximize its assets. By providing customers with multiple options in a single region, DCP ensures highly reliable services with minimum down time, it says.

The super-system strategy also makes for higher reliability when it comes to financials and investments.

"Looking at our overall portfolio growth, the vast majority of our investments are focused on fee-based logistics assets and combined with our existing premier footprint we are well-positioned to achieve our long-term strategic goals while also solving for needed capacity additions in these top tier regions," said Wouter van Kempen, chairman, president and CEO.

### Pushing boundaries

For much of DCP's run at the top of our rankings, Enterprise Products Partners paced it for those top spots. However, Enterprise has remained remarkably consistent in its growth patterns. In fact, the only companies that have surpassed Enterprise in our rankings have been Energy Transfer and MPLX, which have both had unparalleled growth in their gas processing and NGL production operations.

What's impressive about Enterprise's figures is that the company has kept up with both of those companies while also changing its focus from a traditional midstream operator to, in many ways, being the segment's trailblazer.

Enterprise has been one of the leaders at changing the definition of what a midstream company is by embracing all forms of oil and gas transportation, not just pipelines. The company was also at the forefront of the push towards exporting U.S. crude, NGL and gas

It's hard to argue with the company's strategy as it continues to regularly shatter internal records. In the fourth quarter of 2018 alone, Enterprise reported it broke eight operational financial records. These included liquid pipeline, gas pipeline and propylene production volumes.

According to Jim Teague, CEO of Enterprise, a big part of the company's success with exports has been supply access for its terminals.

"Enterprise's supply position coupled with our Houston-area storage and distribution network offers unmatched connectivity and supply aggregation," he said during the company's fourth quarter 2018 earnings call earlier this year.

Enterprise is one of the frontrunners in providing midstream services to petrochemical companies.

"We continue to write the book on midstream services to the petrochemical industry, which is growing faster on the Gulf Coast than any place in the world," Teague added.

While the company has been helping to expand the definition of midstream services, Enterprise continues to invest heavily in traditional midstream assets. Nowhere is this more evident than in the Permian Basin, where Enterprise has committed more than $6 billion in capital growth projects.

These projects include gas processing and gathering systems, crude storage, as well as crude, liquids and gas takeaway. New projects include two new NGL fractionators at the big Mont Belvieu, Texas, NGL hub to handle production out of the Permian. Once these capital projects are completed in 2020, Enterprise will have more than 1.5 Bcf/d of gas processing capacity and more than 250 Mbbl/d of liquids production in the Permian.

### Targa quietly growing

One company that has been quietly moving up our annual rankings for years is Targa Resources, which posted a 25% gain in NGL production to 415.7 Mbbl/d and a 14% increase in gas processing to 3.94 Bcf/d in 2018.

"Targa is in a special unique position. [We have] a franchise Permian gathering and processing position and diversity from other strong gathering and processing positions," Joe Bob Perkins, Targa's CEO, said during its fourth-quarter 2018 earnings call.

He added that Targa is one of the only integrated midstream operators that can boast a combination of strong gathering and processing, NGL transportation, Mont Belvieu fractionation, NGL exports, and other premium downstream markets. Perkins stated that this combination puts the company on a path to achieve greater growth than its peers, along with rapid deleveraging and dividend coverage improvement.

### Outlook: more of the same

Inevitably, the top NGL producers and gas processor rankings will look much different in a decade, but it's hard to see large changes in the immediate future. Energy Transfer and MPLX have such sizable leads over the companies behind them in the rankings that it's unlikely either will be knocked out of the top spot in each category in the next year.

It is safe to say that we're likely to see the top processors and producers still on this list in some form or another, but the forecast gets murkier the further out you look with potential headwinds and tailwinds that could alter production and demand levels. Many companies are also in the midst of new strategy plans and developing assets in areas that are expected to experience production growth. ■

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***Frank Nieto** is a freelance writer based in Washington, D.C., with more than a decade of experience covering the energy industry.*

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# Can Oil & Gas Survive?

**Energy scholar Robert Bryce offers an unabashed view of the shale revolution, climate change and the future of energy. Spoiler alert: Don't expect oil and gas to disappear anytime soon.**

*By Jeffrey Share*

Energy scholar Robert Bryce offers an unabashed view of the industry that you don't often come across. You might disagree with him, but you can be reassured that his often provocative comments are well-thought-out.

And, it won't hurt his feelings if you disagree.

I've known Bryce since 2002, when he wrote "Pipe Dreams, Greed, Ego and the Death of Enron." A native of Tulsa, Okla., he has written several other energy books, including "Power Hungry, The Myths of 'Green' Energy and the Real Fuels of the Future" and a best-seller: "Smaller, Faster, Lighter, Denser, Cheaper."

His articles have frequently appeared in leading magazines and newspapers. He has also produced a new documentary called "Juice: How Electricity Explains the World" that had a Tulsa premiere earlier this year. He has been a featured speaker at Hart Energy conferences.

I visit with Bryce periodically to gain his perspective on the business, especially as energy remains a divisive issue in our nation. So, can today's oil and gas industry survive without dramatic change?

"They have survived a long time, and they're going to survive a lot longer. I don't mean to be flip, but this idea that the industry is going to go away and we will quit using oil and gas, I just don't see that happening," Bryce said.

### Who will dominate?

Who will be the players watch? Will activity continue to be driven by the major oil companies who have always seemed to control the industry?

Look beyond that, Bryce suggested.

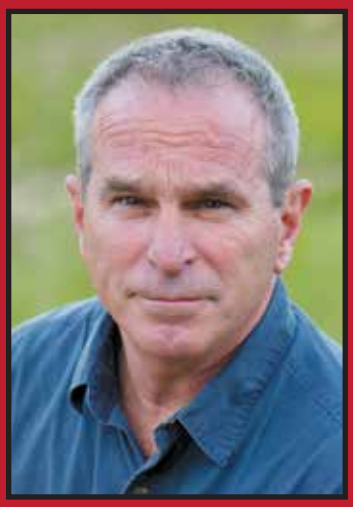
"The state-owned companies still have plenty of clout, whether it's Rosneft and Gazprom [Russia], NIOC [National Iranian Oil Co.], Saudi Aramco, or Statoil [now Norway's Equinor]," he said. "The publicly traded supermajors obviously are going to get a lot of attention. They are the big natural resource players, but they're not the only ones.

"Watching the supermajors going back to the Permian Basin is a fascinating development. Chevron bidding for Anadarko (only to be outbid by Occidental) was intriguing in that the independents are leading the way on some of these greenfield opportunities; true, the Permian is hardly a greenfield, but the independents continue to be the ones that discover and develop many of these resources. So, it's going to be a lot of what we've seen in the past: supermajors scooping up assets from smaller companies when it fits their needs," he said.

Bryce has written extensively on alternative energy sources and doesn't foresee any of them taking the place of petroleum products for years to come.

"In transportation, oil will dominate for many decades to come. If oil didn't exist, we would have to invent it. It's a nearly miraculous substance in terms of ease of handling at both atmospheric pressure and normal temperatures; it doesn't require super expensive tankage or containment systems.

"Natural gas, particularly, will have a long run. Look at the staggering growth in the LNG business just in the last few



"A year from now we'll have 10 Bcf/d [billion cubic feet per day] of LNG export capacity. We flipped from being a prospective LNG importer of 20 Bcf/d to a real exporter of 10 Bcf/d. This is a very, very big deal."

— Robert Bryce

years and the emergence of the United States as a major LNG exporter. These are important trends that are going to be sustained for many years to come and by that, I mean decades," Bryce continued, agreeing with the many experts who call natural gas the fuel of the 21st century.

"If we're serious about reducing emissions, natural gas and nuclear offer the best no-regrets pathways," he said. "The fact that now you have natural gas from the U.S. displacing diesel fuel for transportation in China and competing for market share with coal-fired electricity in Japan is a phenomenal development.

"Just a quick aside, in 2007 [then ExxonMobil Chairman] Lee Raymond said that the U.S. had to build the Arctic gas pipeline because there was no more gas to be found in the continental U.S. Fast forward to today and we've seen U.S. natural gas consumption nearly double just in the last decade. A year from now we'll have 10 Bcf/d [billion cubic feet per day] of LNG export capacity. We flipped from being a prospective LNG importer of 20 Bcf/d to a real exporter of 10 Bcf/d. This is a very, very big deal."

### The shale revolution

Bryce describes the shale revolution as "the single biggest and most important energy breakthrough probably in my lifetime, and, as my friend Mark Mills put it, this has been the single biggest addition to global energy supply in world history. We're just now coming to grips with it and what it's going to mean.

"This has been an incredible gift to the U.S. economy, consumers and to the petrochemical industry, and we're still in the beginning stages."

How so?

"We might be in the second or third inning. We're seeing the maturation of the shale business. Everyone is settling in for the long haul and turning this into a long-term manufacturing process. Chevron CEO Mike Wirth said that the shale game is a scale game. That's what we're seeing now in the Marcellus, Utica, Permian, Eagle Ford, Haynesville. It's all about scale now."

Then we come to the inevitable question of climate change and its impact on oil and gas. It's an issue the industry is trying to cope with, he says.

"We've already seen the industry try to respond and add its weight to the discussion. Many companies are advocating for carbon taxation because they see it as a chance to affect policy in a positive way. The big European oil and gas companies are clearly under tremendous pressure to toe the line and try to do something substantive on this issue. Let's be clear, it's going to be difficult for them," Bryce said.

Climate change is also looming as a leading issue in next year's presidential election.

"Nearly all the Democratic candidates are saying they love renewables. Climate change is a litmus test for the Democratic Party, where 80% to 90% of Democratic voters say this is their number-one issue. It's going to be a hot issue for a long time to come, but how much of that is going to be political posturing versus actual efforts to dramatically reduce fossil fuel emissions? Are they serious about wanting to cover the countryside with solar and wind projects and high-voltage transmission lines? That's a whole other set of questions," Bryce said.

He advises that wind and solar aren't quite the answers their advocates claim them to be.

"We're seeing already with solar, and particularly with wind, an increasing number of collisions with rural communities across the country over land use. This is not new. Land-use policy and energy policy are inextricable. Whether it's Keystone XL or Dakota Access pipeline, these land-use issues and conflicts over energy projects are multiplying all over the country, in fact, all over the world.

### Wind/solar opposition

"More and more communities are moving to reject or restrict wind projects. Only this year, San Bernardino County, Calif., the largest county by area in America, approved a ban on large-scale wind and solar projects. Two wind projects in New York State in recent months have been canceled because of local opposition. Dewitt County, Ill., just refused to grant permits for a big wind project.

"I call this the vacant-land myth; it's the idea that there is a whole lot of unused land out there in flyover country that is ready and waiting to be covered with renewable-energy stuff," Bryce says. "The truth is quite different."

Still, this represents a cultural challenge for the oil and gas industry.

"The hard truth is that here in America we have extreme scientific illiteracy. That illiteracy contributes to this delusion that we can run the world on renewables alone. The lack of scientific understanding and basic mathematics combined with this romantic notion about we're going to turn back the hands of time and going

to rely just on solar and wind, it's a very powerful set of beliefs. That set of beliefs holds a lot of currency among the general public. It's going to be a very difficult battle to fight, and it's almost a religious one."

**Energy's future**

What might the energy company of tomorrow look like?

"That's a broad question, but there are a couple of mega-trends underway that I think are inexorable. One of those is electrification," said Bryce, whose next book, "A Question of Power, Electricity and the Wealth of Nations," is scheduled to be released next year. "I testified recently before the Senate Energy and Natural Resources Committee and made a few points that are pretty much self-evident.

"Electricity is the world's most important and fastest growing form of energy. Second, $CO_2$ emissions from the electricity sector are greater than that of any other single sector. The latest IEA [International Energy Agency] data shows that electricity generation is growing at about 4% per year. That means it's doubling every 18 years or so. This is a big deal. How countries decide what fuels they choose to generate the electricity that's going to be needed over the next 20-30-40 years is going to have a big impact on reducing $CO_2$ emissions.

"But it's also going to be about the conversion of primary energy into secondary energy. Shell and some other companies are trying to get more into the power business. That's going to be one of the big trends we see, whether it's electricity for cars, data centers, or growing marijuana, all of which are potential growth areas. The energy companies of tomorrow are going to look much like the ones today, but definitely with a bigger interest in electrification," he said.

Note: A study by the Federal Reserve Bank of Dallas reports that the shale boom significantly impacted the nation's economic growth from 2010-15. The Fed estimated that the increase in light oil production by itself was likely responsible for raising economic output by 1% despite the oil and gas sector providing less than 1.5% of the nation's economy

Economic output overall increased by about 11% during that period. "The effect of the shale boom is significant, at about one-tenth of growth," the Fed reported.

As reported by the Fed, prior to the shale boom the U.S. imported twice as much oil as it produced. Today, the U.S. exports about 3 million barrels of crude daily. The result is that the petroleum trade imbalance has shrunk by $356 billion from 2005 to 2018. ■

*Jeffrey Share is a Houston-based Hart Energy contributing editor specializing in midstream energy topics.*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Pipelines represent the true convergence of information technology and operational technology, making cybersecurity critical to safe operation. *Graphics courtesy of Siemens*

# Keeping A System Safe

**Artificial intelligence and security analytics hold the keys to pipeline cybersecurity.**

*By Leo Simonovich*

The digital revolution is creating transformational business opportunities for midstream oil and gas companies that harness the power of the Internet of Things (IoT) and Big Data. However, to safely capitalize on the benefits afforded by connecting operational technology (OT) assets, pipeline operators must be prepared to operate in an environment where cyberattacks are all but inevitable.

While no industry today is safe from malicious cyber activity, pipelines represent an especially attractive target due to their interconnected and distributed nature, as well as the high-impact outcome that can arise from a successful attack.

In 2018, four American pipeline companies reported communications system interruptions after a cyberattack on a data network. While gas service was not interrupted, all four companies were forced to temporarily shut down communications with their customers.

For the owners and operators of the more than 2.7 million miles of pipelines across the nation, events like these highlight the vulnerabilities inherent in midstream infrastructure. While the impact in this incident was relatively minor, other utility and energy companies have not been so lucky. In fact, a number of cyberattacks have led to millions of dollars in losses and potentially devastating near-miss safety events due to such viruses and malware as WannaCry, Havex, BlackEnergy Trojan, etc.

### Cybersecurity challenges

Unlike most parts of the oil and gas value chain, pipelines represent the true convergence of information technology (IT) and OT, making cybersecurity critical to safe operation. However, the vast majority of midstream infrastructure in operation today was not designed with connectivity in mind. Digital capabilities have simply been bolted on top. This integration of the physical and digital worlds has made infrastructure more vulnerable to increasingly sophisticated cyberattacks.

Today, the core challenge for protecting connected midstream assets, such as compressor stations, is visibility.

**Most companies are not aware of the threats that lie within their fleet, how vulnerable they are or what actions they should take to prevent attacks.**

Operators cannot protect what they cannot see. Most companies are not aware of the threats that lie within their fleet, how vulnerable they are or what actions they should take to prevent attacks. One salient example occurred in the power sector in December 2015, when a cyberattack in Ukraine caused 225,000 homes to lose power in the middle of winter. For the first few hours, the utility operator did not know a cyberattack was occurring. The operator simply thought the control system was malfunctioning.

Digitalization, and more specifically, the application of security analytics and artificial intelligence (AI), hold the key to protecting midstream infrastructure from cyber threats. However, the energy industry has historically been unable to apply these tools to identify malicious threats within distributed OT systems. This is particularly the case with pipelines, where assets are spread over millions of square miles of remote terrain.

In this environment, it has traditionally been very difficult and cost-prohibitive to apply and scale the necessary analytics and cybersecurity solutions across networks.

### Sprints and marathons

Overall, the challenge of identifying and defending against cyberattacks is both a sprint and a marathon. As we see more advanced threat scenarios, we also see advancements in the technologies needed to counter them, with data analytics and AI leading the way.

Armed with these tools, companies can "own their environment" by significantly improving detection when an operation system is being attacked and implementing effective measures to ensure safety and reduce overall risk.

Siemens recognized the growing need for a holistic cybersecurity solution that could address the unique challenges presented by distributed energy infrastructure. That is why we partnered with Chronicle, an Alphabet Inc. company, to apply the power of analytics and AI to secure pipeline networks. (Alphabet owns Google). Through a unified approach that will leverage Chronicle's Backstory platform and Siemens' strength in industrial cybersecurity, the combined offering gives energy customers unparalleled visibility across IT and OT so they can quickly detect and confidently act on threats.

This partnership between Siemens and Chronicle will help the industry securely and cost-effectively leverage the cloud to store and categorize data, while applying analytics, AI and machine learning to identify patterns, anomalies and cyber threats within OT systems.

Chronicle's Backstory, which is a global security telemetry platform for investigation and threat hunting, will be the backbone of Siemens' managed service for industrial cyber monitoring, in both hybrid and cloud environments.

Backstory is designed to collect, integrate and store petabytes of data. It can conduct forensic analysis and investigations of behavior so that security analysts can identify and understand unusual activity that might indicate an attack is, or even was, underway.

Through the integration of analytics from Backstory and Siemens-managed OT services, an analyst can trace activity from the OT network back to the IT network, identifying gaps and unpatched systems that represent pathways for an adversary to enter a network, establish control and lie dormant—waiting to take over and force a shutdown. This is achieved by enabling the following:

**Enhanced Visibility**—Visibility is grounded in developing a continuous situational awareness of what's happening in the physical and digital worlds. To do this, a pipeline operator must consume several different types of data—and in unfathomable volumes. Being able to store this amount of information, let alone study it for those key links that may identify a cyberattack, was once nearly impossible. But with Backstory, it is now a reality.

For instance, in the Ukraine example previously referenced, the way to identify an attack or system malfunction would have been to analyze control system data and then correlate it with network data—something that wasn't feasible because operators lacked visibility into all systems at once. But now, looking at the two systems, which were never designed to work together, we can understand that the system errors are the result of intentional malicious activity.

**Context**—The second key in thwarting a cyberattack is context. Even after detecting an attack, operators are still powerless to act because they cannot understand how the attack is impacting their systems or determine the attack's reach or intent. This is where context matters.

A better way to think of this is pattern identification—how quickly and how accurately can we examine normal asset

behavior versus abnormal behavior. By identifying patterns in Backstory, Siemens' security analysts can build an accurate picture of the environment so operators can act.

**Quick and Decisive Action**—With the insight provided by Backstory, Siemens' OT specialists can then work with customers to take quick and decisive action to stop the cyberattack and mitigate impacts on infrastructure. In most cases, this will not mean shutting down the system. Rather, it is about working with the customers to develop options that balance operational, safety and security constraints. The ultimate objective is to initiate a proportional and appropriate response and to use insights to continuously harden systems and protect them from future attacks.

This integrated solution and first-of-its-kind OT-managed service from Siemens and Chronicle is a significant advance in raising the OT cyber defenses for pipelines. It leverages all that digitalization has to offer to unlock the value of security data—providing cyber protection across the entire midstream operating environment.

### Industry-government collaboration

When it comes to cybersecurity in oil and gas, and particularly the midstream sector, the most important idea that companies must embrace going forward is that securing their environment is not something they can achieve on their own.

It will require collaboration between industry and government and a strengthening of trust in the digital world. To achieve this, Siemens initiated the world's first-ever joint charter for cybersecurity—called the "Charter of Trust."

The Charter of Trust points out 10 areas for action in cybersecurity where government and business must become equally active. It calls for establishing responsibility for cybersecurity at the highest levels of government and businesses and for introducing a dedicated ministry in government and a Chief Information Security Officer at companies.

It also calls for mandatory, independent certification for critical IoT applications. Above all, it aims to create an industrial environment in which cybersecurity is addressed proactively so that companies, including oil and gas operators, can realize the full potential of digital transformation.

The government must take a leadership role when it comes to the rules in cyberspace; however, private companies must take a risk-based approach to implement standards and share best practices in a trusted community.

### Air gapping

OT cyberattacks against the oil and gas industry have risen from 5% to 30% in just a few short years. They range from disrupting SCADA and industrial control systems, causing outages and safety issues, to ransomware attacks, where systems are held hostage with threats to disrupt and destroy operating systems.

With more than 2.7 million miles of oil, gas and chemical pipelines crisscrossing the U.S. alone, intrusions into control systems could do more than disrupt deliveries. As a result, the primary challenge midstream operators face is securing a complex and open ecosystem without impacting profitability.

Given that the likelihood of being attacked in today's environment is 100%, pipeline operators cannot wait any longer to address cybersecurity. Many mistakenly believe that the only way to protect their assets is to "air gap," an absence of a direct or indirect connection between a computer and the Internet for security reasons.

Air gapping, however, focuses on minimizing connectivity, which prevents companies from reaping all the benefits that digitalization has to offer. It also limits visibility into the operating environment, which makes it all but impossible to recognize abnormalities and react when a cyberattack does inevitably occur.

**In a recent survey conducted by Siemens and the Ponemon Institute of 377 oil and gas security professionals, 65% of respondents said that a negligent or careless insider was their top cybersecurity concern.**

### Inside threats

Air gapping also doesn't protect against inside threats, which often pose the greatest risk to critical operations.

In a recent survey conducted by Siemens and the Ponemon Institute of 377 oil and gas security professionals, 65% of respondents said that a negligent or careless insider was their top cybersecurity concern, while 15% said it was a malicious or criminal insider.

It is essential that midstream companies view cybersecurity not as a seatbelt or an airbag in the digital world, but rather as a crucial component to their success in the digital economy. Data and security analytics hold great promise in identifying and thwarting sophisticated machine speed attacks, which require immediate levels of response and pattern recognition.

This innovative OT-managed service from Siemens and Chronicle leverages analytics and AI to unlock the value of security data—providing cyber protection across the entire midstream operating environment. ■

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***Leo Simonovich** is vice president of industrial cybersecurity for Siemens.*

Source: Shutterstock/Somsak Nitimongkolchai

# Water

## There are multiple strategic considerations when buying or selling a produced-water business in Texas.

*By Archie Fallon*

Dealmaking is on the rise for businesses that gather, transport and dispose of water produced in hydrocarbon exploration and production activities. These businesses can trade at multiples similar to conventional midstream companies, implying that buyers expect these businesses to grow their earnings from long-term contracts having predictable, inflation-protected fees.

Given the evolving commercial and legal landscape for produced water businesses, a seller or buyer may face challenging issues during a transaction that conventional midstream businesses do not encounter, such as landowner issues, insurance for underground risks, and the status of material projects like saltwater disposal well (SWD) completions, among many others.

This article introduces key issues that a seller, in preparation for a sale, or a buyer, in connection with a due diligence process, should consider as potential value drivers.

### Ongoing capex

An active produced-water business continuously constructs major capital projects for customers, including gathering lines, trunklines, storage tanks, and, in some cases, SWDs. Factors that could impact the cost of a pipeline project include right-of-way acquisition costs, pipeline materials and labor supply.

A SWD project can be affected by the permitting timeline, the depth of the well, the quality of the drilling crew, and underground events. In the sale of a produced-water business, particularly where the purchase and sale agreement provides for an interim "stand-still" period between signing and closing to address certain conditions precedent like regulatory approvals, buyers and sellers must agree upon the amount of capital

necessary to deploy for those projects during that time period.

One solution for the parties to consider is creating a target capex amount for material projects during such period. As long as the target capex parameters are not exceeded during the interim period, the seller would be free to continue executing those projects during that period. The parties will have to determine the extent to which the purchase price credits the seller for value of those projects in process during the interim period.

Both buyers and sellers typically desire for an ownership change to not interrupt a capital project that straddles the closing, or else there could be miscommunication with third-party stakeholders like landowners or vendors. Accordingly, if there will be significant personnel changes in connection with the business, a buyer may incentivize the seller to complete the relevant project after the closing through a transition services arrangement.

Further, if the target business is entitled to monetary claims against insurance providers or contractors for a project that straddles the two ownership periods, then the parties might allocate the proceeds from such a claim based upon the relative periods of ownership.

### Acreage dedications

Many produced-water service contracts are structured as acreage dedications—the oil and gas operator dedicates all of the produced water from certain acreage or wells to the midstream company. However, those dedications are typically subject to any pre-existing agreement of the operator affecting water rights.

For example, an operator might agree in an oil and gas lease or surface use agreement (SUA) to drill and use SWD wells that are located on the tract of land where the wells are drilled. These arrangements could impact the rights of the midstream business to gather, transport and dispose of the produced water away from the relevant tract.

Further, an SUA may regulate other activities relevant to a midstream company, including:

- Payment for rights-of-way on the surface estate to connect water pipelines to the operator's facilities;
- Royalties to the landowner for use of the landowner's SWD; and
- The sharing of profit from any oil skimmed from produced water.

In Texas, overall, landowners have more legal rights in relation to produced water activities than a midstream company typically encounters, in part because produced water is technically the property of the surface estate owner under state law and is frequently governed by an SUA between the operator and landowner.

### Recycling rights

New technology is emerging that recycles produced water by extracting solids, metals, salt and other elements so that the water can be reused for drilling or other purposes and the relevant extracted components, such as salt, can be resold. Midstream businesses that have clear legal rights to recycle produced water are well-positioned to capitalize on the new technology.

The Texas Legislature recently passed a law to protect a downstream purchaser of produced water—as long as the produced water is sold for a "subsequent beneficial use," then the water's buyer takes legal title. Although the law did not define "beneficial use," such use is generally considered to include recycling of the water (rather than simply disposing of it in a SWD).

In many situations, the operator compensates the landowner for freshwater extracted by the operator from the surface estate, and so landowners may not view recycling as economically accretive. Accordingly, landowners may restrict water recycling activities in an SUA. Because the surface estate owner has, unless separately conveyed, legal title to water produced from the surface estate under the laws of Texas, the industry will continue to pay attention to how landowners and operators address the allocation of economic value in relation to water recycling activities.

### Insurance

Representation and warranty insurance has increased in popularity for midstream oil and gas transactions. The insurance product allows a buyer to rely upon an insurance policy, rather than the seller's balance sheet or escrowed proceeds, for substantially all of its recovery from breaches of the seller's representations and warranties. It is important for a buyer that anticipates using such a policy to budget time during its process for the preparation of a legal due diligence report that insurance underwriters will review and potentially have questions regarding.

A representation and warranty insurance policy may or may not

cover breaches of environmental representations and warranties, which are often addressed through separate insurance policies. In particular, there are special insurance policies that an operator of SWDs typically obtains, which are more in the nature of insurance policies that upstream oil and gas companies obtain.

These policies cover events like underground leaks of produced water or accidents involving disposal trucks at or near the SWD. Early in the deal process, a seller or buyer should consult with an insurance adviser about the scope of coverage, the policy limits and the existence of any claims.

### The value chain

Unlike with certain midstream businesses focused on one particular service—like transportation, gathering or storage—many produced-water businesses have assets and operate across the value chain. They may even have different means to provide a service; many companies have trucks available to transport produced water in lieu of a pipeline, particularly at the early stages of a well's lifecycle when more water is commonly produced.

**From a transactional perspective, the seller and buyer should clearly define which individuals and assets function in the different operational areas of the business.**

From a transactional perspective, the seller and buyer should clearly define which individuals and assets function in the different operational areas of the business. If the transaction is a business carve-out, such as a sale by an operator of its produced water assets, the parties will need to agree upon personnel and assets that are subject to the transaction, which may result in some gaps that the buyer has to fill through its own personnel or new hires.

This article introduces some key considerations for sellers and buyers prior to a strategic transaction involving a produced water business. Overall, the parties will need to bear in mind that a transaction involving a produced-water business has similarities to other midstream M&A transactions, but because of the unique nature of landowner relationships, operator relationships, insurance policies and environmental risks, and multi-faceted business operations (including SWD management), there are important distinguishing characteristics. ■

***Archie Fallon*** *is a partner with Willkie Farr & Gallagher LLP in Houston.*


Source: Shutterstock/William Potter

# Compliance-Efficiency-Protection

## Procurement integrity matters in the oil and gas industry.

*By Ellen Roberson and Jen Dunham*

The typical procurement lifecycle is highly complex, ever-changing, and often policy and process heavy. Within the transactional avalanche of purchase requisitions, invoices and payments lurk unseen risk and probable revenue loss.

Regardless of industry or company size, inefficiencies, waste and improper payments collectively cost organizations billions of dollars every year.

The nature of businesses in the oil and gas industry—the locations and equipment involved, the diverse suppliers and contractors they depend on, and the volumes of goods and services required for operations—puts them at greater risk of loss than those in other industries. Further, many of these companies abroad are state-owned, which leads to tighter oversight to avoid doing business with the wrong people and refrain from corrupt practices.

### Managing the system

Many oil and gas companies have deployed enterprise resource planning (ERP) systems to help manage contracts, suppliers, payments, forecasting and inventory. Despite the investment, organizational efficiencies and cost controls are rarely fully realized. In fact, industry experts estimate losses are 4% to 5% of annual revenues.

Coupling continuous surveillance and monitoring of all procurement and contracts data with ERP systems can go a long way in securing supply chain risk and reducing losses in the procure-to-pay cycle. Applying analytics to this problem area can identify abnormalities, improper payments and risky suppliers that could siphon profits and put a company's reputation at risk.

The industry's next generation also can't ignore the increasing shift to digital, and in oil and gas that means the digital oilfield. It's a concept that combines business process management with digital technologies to automate workflows that maximize productivity, reduce costs and minimize the overall risks associated with oil and gas operations.

So, what can an oil and gas company do to mitigate inherent risks and save millions annually? Exploring the following five best-practice areas to improve fraud, risk and compliance issues is a good starting point.

### What and where is your data?

The key business drivers of procurement optimization are cost and risk reduction—via standardization of processes and controls, profit growth through cost savings, and better management of existing inventories.

While these drivers may seem applicable to all industries, oil and gas procurement processes are decidedly different. The differences are reflected in the industry's unique tangible assets (pipelines, separators, rigs, wells, etc.) and operational spend. Consider, too, the industry's intangible assets (business practices, processes, organizational structure).

For an oil and gas company, procurement risks can occur at any stage—upstream, midstream or downstream.

The first step to properly managing the procurement lifecycle is the most critical and the most time-consuming: Determining what data you have, where the data comes from, what data is important and how you can start collecting the key data digitally if you aren't already.

As we consider the importance of new data sources, we also need to think about the innovation and modernization that comes with the data influx from the digital oilfield and its Internet of Things (IoT) connected devices. Data from IoT devices coupled with the process automation advances from AI and machine learning point to the invaluable nature of data and the improved competitiveness and sustainability it can lead to. However, the legacy systems and remote fields complicate data capture from these valuable production assets.

Data is at the core of any successful decision-making outcome. You'll need to aggregate data from different parts of the organization and its many systems in addition to incorporating third-party data to augment knowledge about suppliers, people, products and contracts.

Don't skip data cleansing, the standardization of data including name variations; use of common addresses, phone numbers or bank accounts; and business ownership monitoring. Although this step appears to be a no-brainer, it's common for data quality to be low in areas like master vendor lists.

**Generally, the bigger your organization, the easier it is for employees to commit fraud, waste or abuse without detection.**

Ensuring the data is high-quality, consistent and flows seamlessly among departments and processes without bottlenecks or gaps is foundational to your success and well worth the upfront investment.

### Continuous monitoring of procurement data

Studies show that most procurement fraud occurs due to weak controls and detection measures. When controls aren't strong—especially within large organizations—signs of fraudulent activity or circumvention of controls can get lost in many thousands of transactions.

Generally, the bigger your organization, the easier it is for employees to commit fraud, waste or abuse without detection.

Continuous monitoring of all procurement-related data is the foundation for an integrity-based approach that detects potential risk early, *before* payments go out the door. An integrity-based approach combines typical controls and processes with a "continuous monitoring" review cycle, so organizations can identify and act on issues as they occur. This approach maintains the integrity of the procurement process by avoiding mistakes or wrongdoing and helps to ensure the organization remains stable and solvent.

### AI and analytics efficiencies

Early detection uses analytical techniques such as clustering, segmentation, pattern recognition, associations and business rules to determine or predict the overall risk posed by each payment, invoice, supplier or purchase order.

Successful procurement integrity requires analytic solutions that deliver artificial intelligence (AI) through automation, natural language processing and machine learning, along with other advanced analytic capabilities. These solutions continuously analyze diverse data sets to deliver deep insights into contracting, billing and payment processes, effectively identifying overpayments and potential fraud while meeting internal procurement and compliance mandates.

With digital oilfields gaining momentum from the pervasive use of IoT devices and the data captured from them, oil and gas companies are achieving production gains from the improved reservoir understanding, remote monitoring of drilling, and supply chain optimization that come from the use of advanced technologies like AI.

Other key analytics capabilities to consider include:

- **Associative linking, or link analysis**, identifies relationships among entities based on static attributes in the data (such as phone numbers, addresses or bank accounts) or transactional attributes (such as business relationships and referrals).
- **Vendor/supplier scoring**, done by running various scenarios

against the data, identifies any networks in the data and provides a scored approach for looking at your vendors based on transaction volume and total purchases, entity level and relationships to employees and suppliers.

- **Network scoring** helps identify collusion in the procurement space—both with employees and with other vendors.
- **Fraud rules**, applied to make use of weighting, also deliver a scored approach with ranked alerts, suppliers and employees that help investigators know where to focus their efforts.
- **Drill-down functionality** enables you to identify and investigate the root causes of problems such as the need for more advanced controls, process changes or reporting standards that can improve the purchasing process while reducing risk.
- **Geo-mapping** makes it easy to understand exactly where you have risk based on locale or geopolitical issues.

Using a combination of these analytic methods results in a proactive approach to procurement integrity that shifts the focus from fraud detection to prevention—all while vastly reducing the potential for financial losses, reputational damage, operational disruption and legal action. This approach also improves the bottom line by eliminating traditional "pay-and-chase," a strategy that culminates in the recovery of funds in less than half of cases.

### Prioritize high-risk indicators, focus investigations

Oil and gas companies must focus on their product supply chains and the nonhydrocarbon supply chains that handle the parts, materials and services required to run the business. The nonhydrocarbon supply chain is critical to deliver the equipment and services required to find, extract, refine and finally market the oil and gas.

Procurement and supply chain strategies are at the forefront of critical issues plaguing oil and gas companies, especially with the current volatility in oil prices.

Analytics can point you to the highest indicators of risk. Aggregated, entity-level alerting reduces false positives and prioritizes the thousands of transactional-based alerts that analytics generate. This frees up business users to focus their time and resources on the most critical and high-value risk in the procurement cycle.

Integrating data from all financial and contractual systems into one environment with a unified workflow can help improve investigative capabilities and decision-making. Reporting provides information to key decision makers in the form of dashboards or portals, mobile reporting and risk insights across the procurement and financial groups.

**Some businesses are in a state of denial, neither believing they are targets nor taking steps to protect themselves from procurement fraud.**

These tools make the process of reviewing risk indicators more efficient for business users, auditors and investigators alike, as each function can quickly find weaknesses in their control systems and address them to prevent and detect risk more efficiently.

### Feedback loop and tracking success

Analytics-enabled modes of detection are faster than manual control checks. By employing continuous monitoring, risk is further reduced from the typical spot-check or annual random audits that often surface issues. This ongoing approach of reviewing all data ensures issues are uncovered quickly, saving considerably more costs in a shorter period of time.

The median duration of internal fraud is 16 months, but the length can vary considerably depending on its type, according to the Association of Certified Fraud Examiners.

Creating an adaptive learning system that continually improves its ability to detect anomalies and react rapidly to the emergence of new risk patterns is another important capability to consider. By automating much of the data management, alert generation and workflow, operations can be streamlined for efficiency and enable analysts to make decisions quickly.

By taking advantage of more digital data and streaming data monitoring, we can bring the decisioning process closer to real-time, combining streaming data with advanced data streams and enabling a continuous scoring of streaming data. The results of the decisions should be fed back into the continuous monitoring system so the data can be refined, and the analytical models retrained for accuracy. Thus, the detection methodology gets more intelligent over time—as do the results.

### The way forward

Most oil and gas organizations are aware of the danger posed by procurement fraud waste and abuse and are taking steps to tackle it. However, the true scale of the challenge is poorly understood. Some businesses are in a state of denial, neither believing they are targets nor taking steps to protect themselves from procurement fraud. This naivety is a potential windfall to the would-be fraudsters.

Digitizing and modernizing the supply chain process can reduce procurement costs for all purchases of goods and services by 20%, reduce supply chain process costs by 50%, and increase revenue by 10%.

Until organizations adopt an integrated, data-driven approach to the detection of fraud, waste and abuse, they will continue to lose untold millions to procurement fraud. Companies need solutions able to spot errors and fraud throughout the procurement cycle, from bid to contract execution.

What businesses don't see can still hurt them. ■

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***Ellen Roberson*** *is global marketing manager at SAS, and* ***Jen Dunham*** *is a solution specialist with SAS Security Intelligence-Global Practice.*

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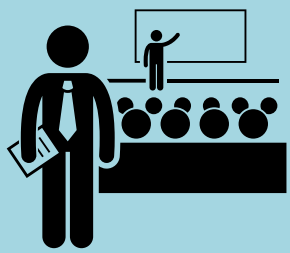

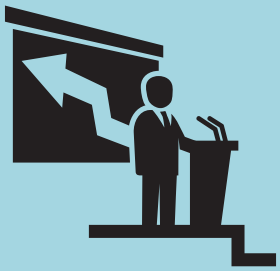

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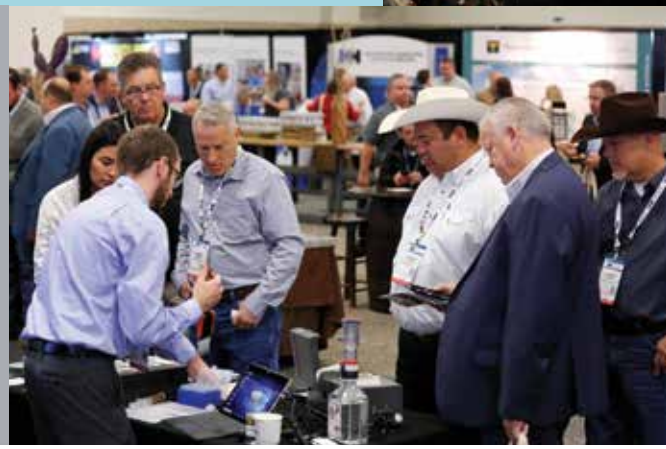

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# Predictive Maintenance

**Cmap software allows accurate prediction of centrifugal compressor performance in off-design conditions.**

*By Massimiliano Di Febo and Pasquale Paganini*

Centrifugal compressors are a vital component within processing plants. Compressors are widely used upstream, as well as in midstream plants, to accomplish critical missions for overall production goals.

Compressors are often one of the most important assets due to their impact on capital investment and on output loss caused by possible temporary machine unavailability—and related maintenance and repair costs.

From this perspective, it is evident why understanding if a compressor is running and working properly is crucial. The capability to detect early indicators of malfunctions, and to quickly identify and understand their causes and possible remedies, greatly contributes to plant efficiency, minimizing overall operational costs.

### Predictive maintenance

This is generally known as predictive maintenance. Today, the predictive approach is well represented across all the involved industries and applied to several kinds of machinery.

For many, or most, common centrifugal compressors, the predictive techniques commonly implemented are connected to the vibrational and structural dynamic aspects of the rotor's operational conditions.

This approach, being phenomenological—phenomena separate from normal operations—can be applied in the design stage from insight by the original

## CONFIGURED GASES

| Item | Gas Name | Symbol |
|---|---|---|
| 1 | Acetylene | $C_2H_2$ |
| 2 | Ammonia | $NH_3$ |
| 3 | Argon | Ar |
| 4 | Benzene | $C_6H_6$ |
| 5 | Iso-Butane | $C_4H_{10}$ |
| 6 | n-Butane | $C_4H_{10}$ |
| 7 | Iso-Butylene | $C_4H_8$ |
| 8 | Carbon Dioxide | $CO_2$ |
| 9 | Carbon Monoxide | CO |
| 10 | Chlorine | $Cl_2$ |
| 11 | n-Decane | $C_{10}H_{22}$ |
| 12 | Ethane | $C_2H_6$ |
| 13 | Ethyl Acohol | $C_2H_5OH$ |
| 14 | Ethylene | $C_2H_4$ |
| 15 | Helium | He |
| 16 | n-Heptane | $C_7H_{16}$ |
| 17 | n-Hexane | $C_6H_{14}$ |
| 18 | Hydrogen | $H_2$ |
| 19 | Hydrogen Chloride | HCL |
| 20 | Hydrogen Sulphide | $H_2S$ |
| 21 | Methane | $CH_4$ |
| 22 | Methyl Alcohol | $CH_3OH$ |
| 23 | Nitrogen | $N_2$ |
| 24 | n-Nonane | $C_9H_{20}$ |
| 25 | Iso-Pentane | $C_5H_{12}$ |
| 26 | n-Pentane | $C_5H_{12}$ |
| 27 | n-Octane | $C_8H_{18}$ |
| 28 | Oxygen | $O_2$ |
| 29 | Propane | $C_3H_8$ |
| 30 | Propylene | $C_3H_6$ |
| 31 | Sulphur Dioxide | $SO_2$ |
| 32 | Water Vapour | $H_20$ |
| 33 | 1-Butene | $C_4H_8$ |
| 34 | 2-Butene | $C_4H_8$ |
| 35 | 1.3 Butadiene | $C_4H_6$ |
| 36 | Ethyl chloride | $C_2H_5Cl$ |
| 37 | Methyl Chloride | $CH_3Cl$ |
| 38 | Pentylene | $C_5H_{10}$ |
| 39 | Propadiene (Allene) | $C_3H_4$ |
| 40 | Methyl Acetylene (Propyne) | $C_3H_4$ |
| 41 | Toluene | $C_7H_8$ |

*Source: IPC*

equipment manufacturers (OEMs) to rotor dynamics. But often, it assumes a more practical and empirical form on the operating floor, where, basically, the machine's vibrational parameters are measured and compared to acceptable limits and used merely for alarm triggering.

Predictive strategies, based on the analysis of performance, are increasing their presence as a tool for diagnostic and evaluation of machine health status during operational time. For centrifugal pumps, for instance, the use of a machine model for the purpose of comparison of measured performance to design is relatively easy and straightforward.

For centrifugal compressors, the same process is more complex because of the dependency of compressor performance from the gas mix composition and operative inlet conditions (inlet pressure and inlet temperature). For centrifugal compressors, therefore, an approach based on performance assessment requires a more complex machine model that should embed and couple several calculation capabilities, from aeromechanics to thermodynamics.

### Inlet conditions

In fact, one of the main difficulties of analyzing centrifugal compressors' operating performance arises from the need to have, ready and available, the compressor performance map adjusted to actual inlet conditions. Usually, expected performances are described in terms of graphs of discharge pressures, discharge temperatures, polytropic heads, efficiencies and absorbed power, related to the design inlet gas conditions.

In general, inlet conditions in the field are different from specification conditions defined in the unit's data sheets. A somewhat diffused practice consists in trying to reduce the complexity of the problem, considering the compressor head as invariant with inlet gas conditions, and applying simplified machine formulas.

While this method holds for very low pressure ranges and constant gas mixes, it introduces considerable errors as soon as the pressures go up and gas mix variability is introduced.

In these situations, in order to assess compressor performance, it is necessary to adjust the design performance to operative conditions, taking into account the full complexity of the problem, and then compare that to measured values. This is essentially the approach indicated by the American Society of Mechanical Engineers (ASME) Performance Test Code 10 on Compressors and Exhausters (PTC10).

The main purpose of this article is to present a general method and calculation tool for the prediction of centrifugal compressor field performances in off-design conditions. All numerical evaluations executed with CMAP software reported here have been developed using the most-recent thermodynamic theories and machine aeromechanical models and in accordance with PTC10.

### Method description

To begin with, we can consider that, for a centrifugal compressor, performance is strictly linked to the inlet gas conditions. This consideration is valid both to design and off-design performance.

The starting point is the availability of a centrifugal compressor performance curve, the relevant gas mix composition and thermodynamic conditions (pressure and temperature). Having this input data available, the software will perform all complex calculations in a fully automated way and produce the expected compressor performances for inlet pressures, inlet temperatures and gas mix compositions, different for design/reference.

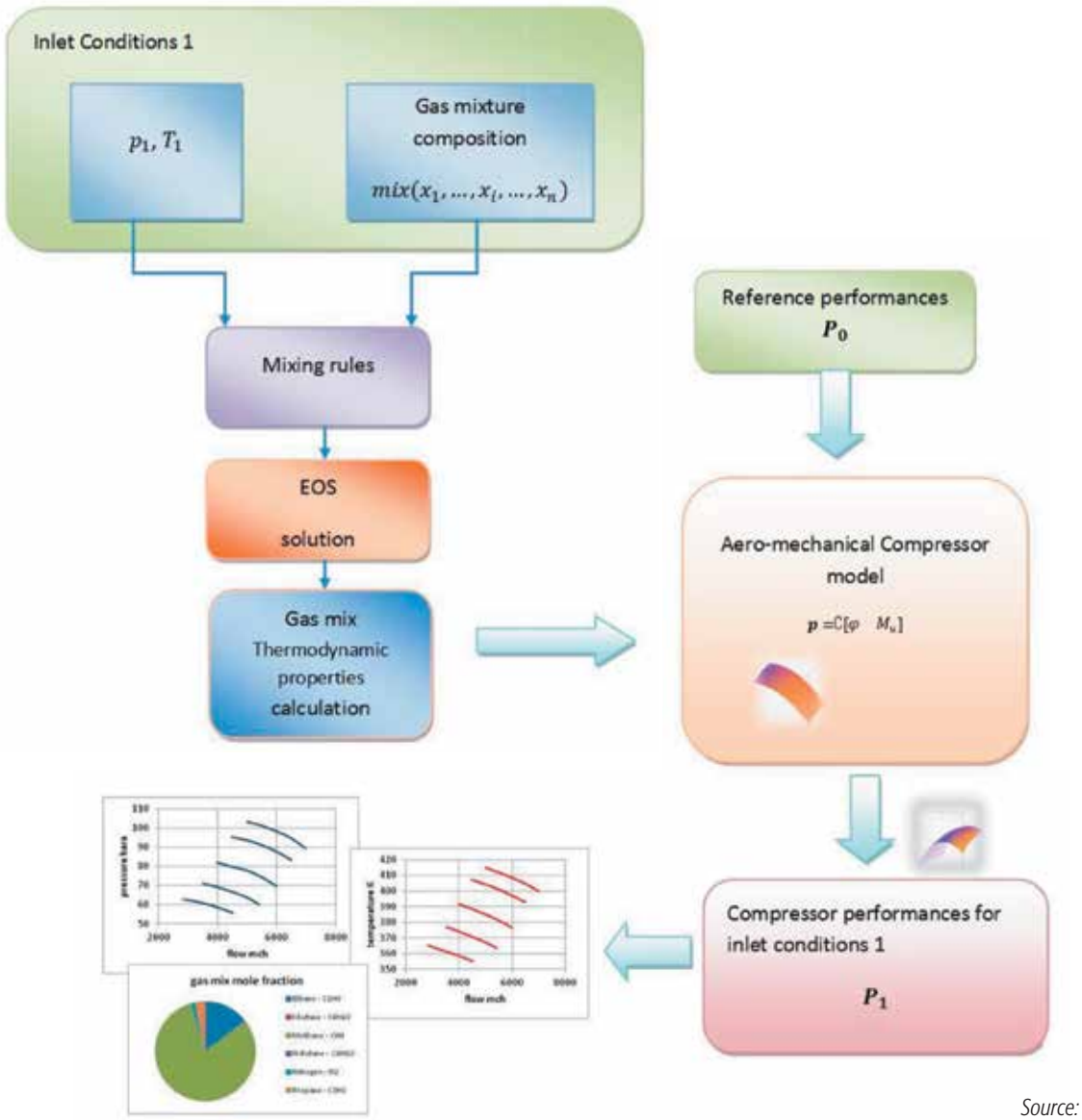
Calculation algorithms used are able to predict both machine behavior and thermodynamic real gas properties in off-design conditions. The nearby table shows the gases that can be configured into the calculation.

### Gas components

From a fluid dynamic point of view, a strict similarity of flow at each performance point is necessary. For this reason, the non-dimensional parameters head coefficient, flow coefficient and Mach number must be determined. The proposed method needs the following inputs:

**Reference/design compressor maps**—In general, these maps provided by the OEM give a reliable

## HOW CMAP WORKS




*Source: IPC*

indication of the machine's capability and are considered here as the starting point. It's clear that in case these input data should be affected by errors, these errors shall propagate in the outputs generated by this method. OEMs usually supply two different machine maps related to different moments of the compressor manufacturing process. "Expected" maps are usually issued in the commercial/design stage, as tested maps are issued at the end of the manufacturing process when the compressor is shop or field tested. In general both maps may be used as input for the method although "as tested" maps may be considered preferable.

**Reference input conditions**—Reference/design maps are linked to specific inlet conditions such as inlet pressure, inlet temperature and gas mix composition. This set of data shall be stated in order to proceed to off-design calculations.

**Off-design input conditions**—These are the conditions at the compressor inlet (pressure, temperature and gas mix composition) from which the new performance should be obtained. Off-design conditions may be some alternative inlet conditions to be considered in the compressor design stage, or may be the actual inlet condition in some specific time during compressor operation.

Starting with the above-described inputs, the method proceeds to calculate the compressor performances in off-design inlet conditions. Performance obtained as output from the described method is referenced below as off-design conditions, i.e., design performance adjusted to off-design operative conditions.

When reference is made to off-design performance in off-design operative conditions during operational time, this performance shall be indicated also as "actual" performance. Calculation of off-design performance requires the capability to extract the invariant information that describes the compressor behavior and to use this

information to rebuild the performance in new conditions.

These calculations are intimately coupled with the thermodynamics of gas compression and the thermodynamics of real gas mixtures, so that a variation in each component of the gas mixture is potentially able to manifest its effects, as well as a change of the inlet pressure and temperature. The connection among these different modeling areas allows the method to provide an accurate prediction of the compressor performance.

With reference to the field values, the nearby tables compare the pressures and temperatures as read from transducers to the value predicted by Cmap software.

The analysis indicated that Compressor 1 was running with operative performance aligned with design expectations. Compressor 2, differently, was running with performance not aligned with design expectations. This comparison gives compressor analysts important quantitative indications on the machines' health status and should drive the analysis towards an understanding of possible causes that may justify the observed difference.

**COMPRESSOR 1**

| Properties | Field value | Cmap predict value | Percentage error |
|---|---|---|---|
| Discharge pressure [bar a] | 98 | 97.6 | 0.40% |
| Discharge temperature [°C] | 122 | 123 | -0.80% |

*Source: IPC*

**COMPRESSOR 2**

| Properties | Field value | Cmap predict value | Percentage error |
|---|---|---|---|
| Discharge pressure [bar a] | 240.5 | 263.7 | -8.80% |
| Discharge temperature [°C] | 99 | 102 | -2.90% |

*Source: IPC*

The method does not require information about the internal parts of the machine, and in this sense it should not be considered as a design tool but more correctly as an analysis tool that starts just after the completion of the machine design stage.

### How Cmap works

Consider two case studies of performance prediction in off-design conditions that present the method applied, using the Cmap software tool. The compressors studied were running under off-design inlet conditions. The analysis developed with Cmap obtained the performances in these off-design conditions and a comparison to measured field values.

In these cases, the compressor performances map, in design conditions, was available for both. Cmap software allowed calculation, at the actual flow, of the values of expected pressure, temperature, head and efficiency in the actual (off-design) conditions, and then compared them to the measured ones

The analysis developed using Cmap also allows evaluations of the efficiency deviation—difference between the actual compressor efficiency and the expected efficiency in the actual operative conditions. Time trends of calculation results provided a useful analytical basis for compressor maintenance decisions.

The method has been profitably used to predict compressor performances and support planning of machinery maintenance activities

Cmap allows compressor performance predictions using different equations of state (EOS), depending on gas mix considered in the calculations. For hydrocarbon gas mixtures, the Lee-Kesler method of determining saturated vapor pressure, or Peng–Robinson equation of state, can be used.

For Freon R134a the Benedict-Webb-Rubin (MBWR) EOS should be selected to determine the thermodynamic properties of the operating fluid.

### Conclusions

Experience with real machinery showed that compressor performance predictions obtained with Cmap software are in alignment with OEM predictions and field measurement for machines in good conditions. Also, experience showed that in most cases the deviation of some parameters, such as efficiency, indicates some problems.

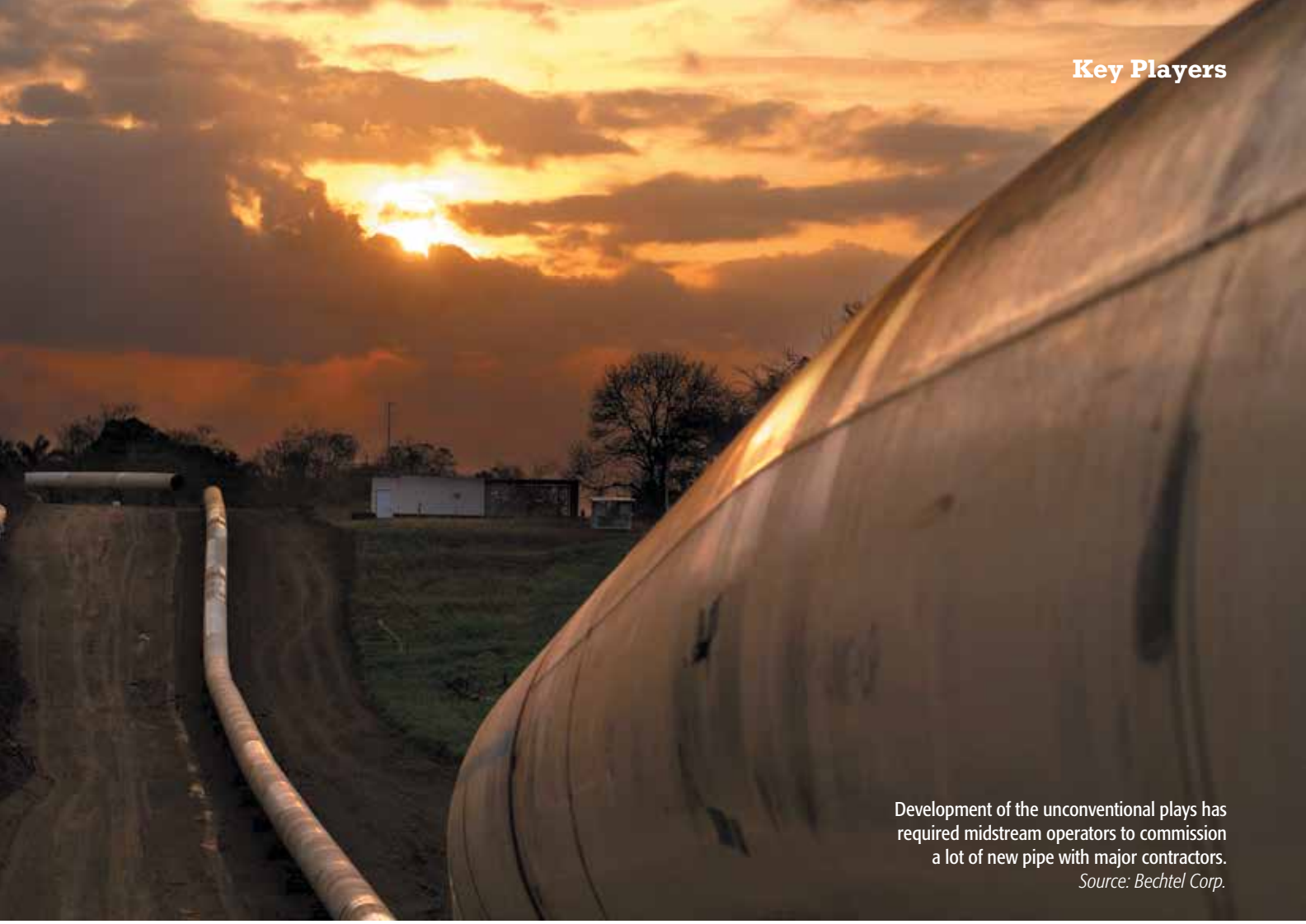
The proposed method may be used in a fully automated way, and it could provide substantial benefits, especially for those machines that work in high pressure ranges and under rapidly time-varying process conditions.

Automated application of CMap gives the possibility to provide a continuous monitoring of performance and therefore provides an automated surveillance and diagnostic. Also, compressor protection from surges can be automatically and continuously updated to actual inlet conditions, overcoming limitations of actual systems (see the IPC Surge Protection System).

Methods proposed and described here can allow operators to:

- Predict the performances of a centrifugal compressor in off-design conditions. The prediction of compressor performances is accurate even at high pressures, where the ideal gas theory commonly used introduces considerable errors;
- Predict the modification of surge points in actual operative conditions, with different inlet pressure and temperatures, different operative gas and to implement advanced protection from surge;
- Have useful indications on the health of the compressor (diagnostics), based on the capability to analyze the performances and efficiency of the machine in a simple and immediate way; and
- Support decisions and planning of predictive maintenance and activities. ■

***Massimiliano Di Febo*** *is an operations manager and* ***Pasquale Paganini*** *is a technical manager for IPC.*



Development of the unconventional plays has required midstream operators to commission a lot of new pipe with major contractors. *Source: Bechtel Corp.*

# The Buildout

**The expansion of the continent's pipeline grid depends on some of the world's most experienced contractors.**

*By Michelle Thompson*

North America is home to the largest oil and gas pipeline network in the world—and that impressive infrastructure didn't build itself. Every day, contractors across the U.S. and Canada are called upon to build safe, efficient and economical transportation systems.

Whether they're working for industry giants or smaller, independent firms, these contractors strive to deliver top-notch jobs with each project. Here are some selected players in North America's pipeline contracting business:

## Bechtel Corp.

- Reston, Va.
- bechtel.com

As a world leader in global engineering, construction and project management, Bechtel's projects span 160 countries and all seven continents. The company, which constructs pipelines for private and public customers, has built more than 50,000 miles of pipeline, which is enough to circle the world twice.

Bechtel specializes in cross-country pipes, and it was one of the major contractors responsible for the construction of TC Energy's sprawling Keystone Pipeline. It was also the management contractor of the Trans-Alaska Pipeline System (TAPS) that links North Slope fields to Valdez on Alaska's Pacific Coast.

On the international front, major projects have included a 330-mile gas pipeline in Algeria for a joint venture of BP plc and Sonatrach. Bechtel Corp. was founded in 1898 and continues to be a family-run business. Brendan Bechtel became CEO of the fifth-generation company in 2016.

## Fluor Corp.

- Irving, Texas
- fluor.com

From deserts to rainforests—and from the sunny tropics to the frigid Arctic—Fluor has worked everywhere.

The company is known throughout the industry for its ability to build logistically challenging pipelines across the world. It has worked in more than 100 countries on six continents. Fluor's 200,000-mile portfolio includes an assortment of projects big and small.

In 2013, Fluor and its partner Giprovostokneft were hired by the Caspian Pipeline Consortium to build the $3.2 billion CPC crude oil pipeline system, which stretches 1,056 miles from Tengiz, Kazakhstan, to a deepwater marine terminal on the Black Sea at Novorossiysk, Russia.

And in the 1970s, Fluor completed engineering, procurement and construction services for TAPS, which was then one of the world's largest pipelines. The 800-mile system was installed in Arctic environments, across mountain ranges and earthquake faults.

Fluor Constructors International is the primary union construction company within Fluor. It has a strong relationship with North America's Building Trades Unions and maintains a strong working relationship with the National Building and Construction Trades Department and its 14 unions.

## Gulf Interstate Engineering Co.

- Houston
- gie.com

As a world leader in pipeline design, award-winning Gulf Interstate has helped construct some of the most sophisticated pipelines in recent memory.

Notably, it was commissioned to provide front-end engineering for Kinder Morgan's Rockies Express Pipeline (REX), one of the largest pipeline systems ever built in North America. Gulf Interstate also helped design, specify, and requisition equipment and materials for construction of the 1,679-mile REX project.

More recently, the firm also worked on the 515-mile Sabal Trail Transmission LLC pipeline, a joint venture between Spectra Energy Corp., NextEra Energy Inc. and Duke Energy, that provides important gas service to Florida.

Additionally, the company assisted Reliance Industries Ltd. with the preliminary engineering and construction of its East-West Gas Pipeline, a multibillion-dollar pipeline running nearly 870 miles between India's east and west coasts.

Based in Houston, it has offices in Moscow; Calgary; Faridabad, India; and Peru. It employs about 1,400 people worldwide.

## Henkels & McCoy Inc.

- Bluebell, Pa.
- henkels.com

Henkels & McCoy Inc. needs little introduction for pipeline aficionados. After all, the company helped build TC Energy's original Keystone Pipeline, among other major projects.

During the first phase of the Keystone project, it constructed a 1,300-mile pipeline to transport crude oil from the Canadian oil sands through the U.S. Upper Plains.

Henkels was founded in 1923 as a tree trimming contractor but ultimately expanded to serve other industries. It completed its inaugural pipeline job in 1975, when it constructed a pipeline in the Bay of Fundy area of New Brunswick. It officially established its pipeline division in 1977.

The unionized company has since completed numerous other projects spanning thousands of miles. In 2003, it completed a 135-mile pipeline across Mexico's Baja California. It earlier completed 13.8 miles of "critical work" for the 2,333-mile Alliance Pipeline, which runs from British Columbia to Chicago.

## Ledcor Group

- Vancouver, British Columbia
- ledcor.com

Tough terrain is no match for Ledcor, a Canadian company that specializes in building mainline cross-country pipelines. It uses mechanized or manual welding methods to work across varied terrain, including muskeg, heavily forested and mountainous regions.

Ledcor offers a suite of services, including pipeline construction, integrity service, subcontractor management and labor resource management.

It has been awarded several Enbridge Inc. contracts, and it built two construction spreads recently for the Waupisoo Pipeline in Alberta. Challenges included one spread of 43 miles in congested parts of northeast Edmonton, Alberta. Another was building 58 miles of pipeline, during winter, near Fort McMurray, Alberta.

Ledcor also worked on TC Energy's Grand Rapids Pipeline. The project consisted of two parallel, 264-mile pipelines running from northwest of Fort McMurray to the Edmonton area.

All of the company's hourly employees are union members and covered by a variety of collective agreements.

## Mears Group Inc., USA

- Rosebush, Mich.
- mears.net

Mears Group Inc. hails itself as a one-stop-shop for pipeline construction—and for good reason. For the past 40 years, it has offered turnkey services to the energy industry.

Its services include pipeline fabrication, construction and demolition, engineering and design, route selection, permitting, environmental and more. With operations throughout the world, Mears also provides materials procurement services and project management.

## Michels Corp., USA

- Brownsville, Wis.
- michels.us

As a world-record breaker, Michels says its customized fabricated equipment is designed to build pipelines of all sizes and complexities, and its product has been put to the test through a series of significant projects.

One of the biggest pipeline projects in recent years was TC Energy's (formerly TransCanada Corp.) sprawling Keystone system that links Alberta to the Texas Gulf Coast. Its last link, Keystone XL, remains in legal limbo due to court challenges. *Source: TC Energy*

Michels built 371 miles of pipeline in Texas and Oklahoma for the Gulf Coast Express project.

The company more recently constructed 177 miles of pipeline in Michigan and Ohio for the Nexus Gas Transmission pipeline.

Throughout its 60-year history, Michels has built 10,000 miles of pipeline, reaching diameters of 42 inches. It set two notable records in 2015; one was a world-record breaking 12,459-foot horizontal drilling installation, and the other was a North American record for a 4,038-foot direct pipe installation. The company has both union and non-union employees.

## Primoris Services Corp.

- Dallas
- primoriscorp.com

Primoris Service Corp.'s pipeline portfolio runs below city streets, wetlands and cross-country. Founded as a pipeline construction company in 1960, Primoris has experience with oil and gas pipelines ranging in size from 4- to 42 inches in diameter. Although the company has since expanded to serve other markets, it remains active in the oil and gas industry.

In Virginia, Primoris Pipeline rerouted 5.8 miles of pipeline—and removed a dual pipeline— for Colonial Pipeline Co.'s Cobb Creek project in 2016. The company also recently constructed 84 miles of 24-inch pipe for Enterprise Products Partners LP in late 2017.

## Price Gregory International Inc. USA

- Houston
- pricegregory.com

With a 100-year history, Price Gregory International Inc. has built thousands of miles of pipeline throughout the world. The firm today focuses on providing pipeline construction services in the U.S. and Canada.

In the continental U.S., Price Gregory has the capacity to work on multiple projects at once. It can handle eight 30-inch mainline spreads of work, two small-diameter pipeline projects, and three oil and gas facility projects concurrently. That said, it places safety at the forefront of its work.

The firm traces its roots to inventor H.C. "Hal" Price, who perfected the electric arc welding of pipe joints during the Oklahoma oil boom following World War I, the basis of pipeline construction today. Price George was formed in 2008 through the merger of longstanding pipeline contracting firms H.C. Price and Gregory & Cook Construction. It was later bought by the publicly traded Quanta Services.

The company, which is unionized, is based in Houston with additional offices in Alaska and Canada.

## Shawcor Ltd.

- Toronto
- shawcor.com

Canada-based Shawcor Ltd. says it is a staunch believer in the power of collaboration. It works with operators, contractors and pipe mills to build and maintain infrastructure all over the world.

From consultation to installation, Shawcor provides end-to-end support for all aspects of pipeline construction. Then, it serves customers throughout the entirety of a pipeline's life cycle. It offers a range of technical solutions for pipeline management, including inspection, maintenance, repair and overhaul processes.

Meantime, Shawcor says it has become a leader in pipeline

One of Bechtel's more interesting assignments, if not the largest, was the 47-mile Cross Island Pipeline, laid for the National Gas Co. (NFG) of Trinidad and Tobago. *Source: Bechtel Corp.*

technology through its recently released iLine platform, which was designed to improve efficiency, reduce costs and eliminate risks. The solution allows pipeline operators to integrate tracking, asset management and more.

The company has contracts with various domestic and foreign unions.

## Strike LLC

- **The Woodlands, Texas**
- **strikeusa.com**

Wetlands and mountains are no match for Strike LLC, which has been installing pipeline in challenging terrain since 2003.

Strike's construction services include marsh and swamp installation, directional drilling, pipeline repair and rehabilitation and more. The company—which employs more than 6,600 people across the U.S.—provides project management services, hydrostatic testing and pipeline construction.

As an engineering, procurement and construction partner for a recent client, Strike led the construction of a gas gathering system in Loving and Ward counties in Texas' Delaware Basin. The project included 68 miles of low-pressure pipelines and 25 miles of header pipelines that connect to an existing gas processing plant.

Strike also constructed and installed about 140 miles of pipeline, including 70 miles crossing mountainous terrain and 30 miles of blasted right-of-way, to help increase capacity at a Memphis refinery.

Strike is a non-union pipeline contractor.

## U.S. Pipeline Inc.

- **Houston**
- **uspipeline.com**

With a 20-year track record of successful operations both in the U.S. and abroad, U.S. Pipeline Inc. (USPL) has worked for some of the biggest players in the industry.

Its pipeline portfolio spans more than 3,200 miles, and it includes work for TC Energy (formerly TransCanada), Energy Transfer Partners, Kinder Morgan Inc. and more.

Earlier this year, USPL was contracted by The Williams Cos. Inc. to replace about six miles of pipeline for the operator's North Seattle Lateral Upgrade project to the Northwest Pipeline gas system. In 2018, it helped TC Energy with installation, cleanup and connection for the Mountaineer Xpress project.

Although USPL works mostly on large-diameter pipe, its work has included construction and services of pipes of all sizes. It has also worked on numerous other energy-related projects, including storage and liquefied natural gas facilities. USPL is a union company. ■

***Michelle Thompson** is a freelance writer based in Orange County, Calif., and specializes in energy topics.*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1. US Energy Information Administration, Short Term Energy Outlook, September 12, 2018.