

Strength of Permian Basin gas market persists



The energy industry is again focusing North American investments in the hydrocarbon-rich Permian basin of west Texas and southeast New Mexico. Upstream and midstream interest in the region is rising, as producers recover from the crude oil price debacle in 2020 and as global demand for natural gas continues to grow.

Permian natural gas production can reach many US markets and compete in delivered markets as diverse as the Gulf Coast, California and the upper Midwest.

The Mexican energy industry likewise has its sights on Permian gas, if and when contract terms can be resolved and pipeline projects can be completed. And worldwide, gas purchasers have their eyes fixed on the basin to learn if the US can fulfill what is seen as a promise to deliver more shale gas to the world via LNG tankers.

The Permian's future development may not be smooth, since the region is prone to price volatility. Mexico's enthusiasm for gas imports fluctuates as the governing Morena party's energy policies shift, and global LNG markets can at times be flooded with supply.

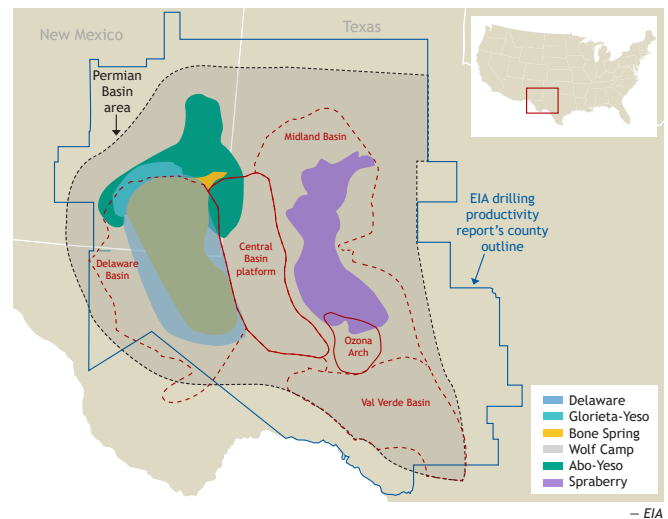
But despite all the uncertainties, what is clear is that the Permian has yet to reach its full potential.

Permian interest marks new era in shale development

Focus on the Permian comes as intense hydrocarbon extraction from shale formations in North America has entered its second decade. Shale gas and oil output have exceeded expectations, enabling the US to claim energy independence on a net basis.

The Permian extends hundreds of square miles in west Texas and eastern New Mexico. It features the Midland basin on the east

Permian basin geologic formations

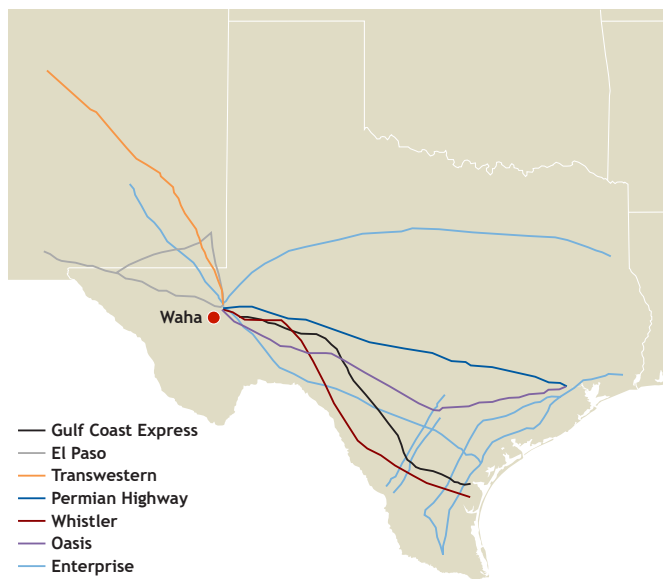


side of the region, with stacked pay zones at various depths such as the Spraberry and Wolfcamp trends, and the Delaware basin on the western side with the Bone Spring trend.

Crude oil production from the Permian basin has nearly quadrupled over the last decade to 4.7mn b/d, according to the US Energy Information Administration (EIA), along with large volumes of associated natural gas. The focus for Permian producers has primarily been to maximize output of crude, producing associated gas as a byproduct. As crude prices rise, associated gas prices often decline, making Permian supplies more competitive.

West Texas light crude prices for delivery at Midland began to fall in January 2020, hit bottom on 20 April 2020 at -\$25.53/bl and rebounded to \$74.45/bl on 1 July 2021. Global crude markets generally move in sync.

Selected Permian gas pipelines



While US crude oil and natural gas production fell as prices crashed in the early months of the pandemic, propane demand remained high. China and India accounted for a larger portion of global LPG demand for the residential and petrochemical sectors early in the first quarter, and demand remained elevated as those countries began reopening in the summer.

Demand for natural gas liquids has rebounded with crude prices, since the products are substitutes in many global markets. US propane production is expected to grow in 2021 as crude and natural gas output begins to recover from Covid-19-related shut-ins, while overseas demand remains strong.

The rebound in worldwide crude oil prices has encouraged drilling again in the Permian. And that means growth in associated gas production continues.

Assuming adequate gas pipeline capacity, this inexpensive associated gas can displace supply from other hubs, including Opal, Wyoming, and the Henry Hub.

The Permian's massive Waha hub is not a single place but a region describing an extensive network of gas pipelines run by interstate and intrastate operators. The Waha area has four market centers with a total of 38 direct interconnections to a number of interstate and intrastate pipelines.

Gas from Waha can move west toward California, north to the Great Lakes and east into Texas and has reduced the overall price of gas in US markets.

Gas buyers at the many interconnected intrastate and interstate pipelines in the area of west Texas and southeast New Mexico benefit from cheap supply. The Waha hub typically trades below

the US benchmark, the Henry Hub in Louisiana, and in recent years has traded at negative values in the daily market, meaning that sellers have to pay the buyer to take the gas. This is possible because the market value of the crude oil far outweighs the cost of getting all the hydrocarbons from the ground.

Permian basin production is connected to processing and fractionation plants and extensive gathering systems in the region. Infrastructure to handle the associated gas was added in the first full decade of the shale boom and continues to do so. As energy demand both inside and outside of the US rises, gas production in the Permian will rise along with that of crude oil and natural gas liquids.

Some signals point to the growth of the upstream business. Pioneer Natural Resources, the largest producer in the region, said it would increase drilling through the middle of 2021. ExxonMobil planned to run seven to 10 drilling rigs and to increase production to about 400,000 boe/d, according to a March presentation. Permian output could climb as high as 700,000 boe/d by 2025 if crude remains in the \$60/bl range.

Permian natural gas production averaged 16.8 Bcf/d in December 2019, according to the EIA. Production slightly dipped during the course of 2020, driven down by a collapse in crude prices, but rose this year, averaging 17.2 Bcf/d in April.

Permian basin gas production was expected to be up by 10pc in August from a year prior with the same number of rigs, according to an estimate by the US EIA in its drilling productivity report, a time series that is highly subject to revision but is relied upon for general market direction.

Production is expected to continue to rise as rig counts return from lows last year. The Permian basin rig count peaked in March 2020 at 418 rigs ahead of the crude price collapse, according to Baker Hughes. The count bottomed out at 123 in September 2020, down by 70pc from its peak. The number of rigs in service slowly began to climb and was 245 in August.

Producers also are moving away from the environmentally unfriendly practice of flaring. Flaring is the burning of natural gas related to crude oil production, usually when gas pipeline infrastructure is insufficient. Rather than releasing gas into the atmosphere, it is visibly burned. Companies like BP have pledged to eliminate the practice altogether before the end of the decade.

In Texas, flared gas accounted for 0.65pc of gas produced in May, down from 2.29pc in June 2019, Texas Railroad Commission production data show. Overall flaring in the Permian Basin decreased to 270mn cf/d in the first quarter of 2021, the lowest since 2017, according to estimates by consulting firm Rystad Energy. That amount is 64pc below estimated Permian flaring in the third quarter of 2019, before the Covid-19 pandemic reached the US at large.

Gas processing key to basin's growth

For the Permian to reach its potential as a production powerhouse, wellhead activity had to be coupled with gas processing capacity. A handful of gathering and processing companies dominate the NGL business in the US, and most are active in the Permian. One of those companies, Targa, is relocating the 200mn cf/d Longhorn natural gas processing plant from north Texas to the Midland basin and renaming it the Heim plant in the fourth quarter of 2021. Targa expects its 2021 field gathering and gas processing volumes to rise between 5pc and 10pc in the Permian basin. Enlink Midstream said it is increasing natural gas processing by 29pc in the Permian in the third quarter of 2021 to take advantage of higher prices and drilling activity in the Midland basin, adjacent to the Permian.

As wellhead activity and gas processing volumes rise along with prices, gas pipeline capacity has been added in fits and starts. Much of the gas production will continue to rise and fall with crude prices. Gas pipelines are backed by long-term transportation contracts, but some of the capacity holders for new pipelines in Texas quickly started doing daily spot business on the new infrastructure.

The Permian basin is far from being overpiped, where takeaway capacity continually exceeds demand. Kinder Morgan's Gulf Coast Express entered service in 2019, and its Permian Highway pipeline started flowing gas the next year. Those lines filled up quickly, and market participants began to generate daily spot trading activity on them. Locations on Texas intrastate pipelines are more likely to trade daily than monthly in the bid week market. Planned well before the pandemic, a number of midstream companies have completed new pipelines and expansions in the past two years (see table).

Pipeline project	Owner	Completion date	Capacity mn cfd
El Paso North Delaware Basin expansion	Kinder Morgan	February 2020	320
El Paso South mainline expansion	Kinder Morgan	July 2020	320
Sendero Carlsbad Gateway	Sendero Midstream	May 2020	400
Permian Highway	Kinder Morgan	January 2020	2,100
Agua Blanca expansion	Whitewater, MPLX	January 2021	1,800
Whistler pipeline	WhiteWater, MPLX, Stonepeak, West Texas Gas	July 2021	2,000
NGPL Lockridge extension	Kinder Morgan	September 2020	483
Double E pipeline	Summit Midstream	End of 2021	1,300
El Paso Permian North expansion	Kinder Morgan	Unknown	173

Kinder Morgan said in mid-2021 that an additional natural gas pipeline out of the Permian basin could be needed within the next few years. In July 2021, El Paso asked federal regulators to double capacity on a segment of pipeline in Edgar County, Texas, to meet customer demand. The Permian North Expansion would add 176mn cf/d on a 20-inch pipeline segment.

As US exports of gas rise, and if crude prices remain fairly stable, prices at the Waha hub are also likely to increase, narrowing to those of the Henry Hub.

Natural gas prices strengthened dramatically in the Permian this year as well as in the rest of North America. Growth in gas-focused shale plays suffers during gas price weakness, but the crude-focused Permian basin seems less affected. Even with Waha prices going negative, large amounts of gas were produced in the region.

Permian basin prices were stable in much of 2018, but Waha dipped to less than 50¢/mmBtu in the low demand Thanksgiving holiday weekend that year, a precursor of things to come in 2019.

The Waha index, generally representative of Texas intrastate flows, settled at a negative number 38 times in 2019. Interstate pipeline indexes followed but cleared the market at negative values slightly less often. El Paso Permian basin prices hit -\$6.0905/mmBtu on 9 April.

Negative pricing was only one-third as frequent the next year, but equally memorable when crude oil prompt month futures settled below zero for the May 2020 contract. El Paso Permian daily gas went to -\$5.29/mmBtu on 20 April 2020.

Markets rebounded in 2021, and spot natural gas values are twice those of a year ago. Widespread cold weather in February briefly placed Waha gas at a premium to the Henry Hub for seven trading days, but the volatility was unprecedented.

Prices started at -3.5¢/mmBtu to the Henry Hub on 8 February, rose to \$191.98/mmBtu over the Henry Hub a week later and returned to 14¢/mmBtu under the hub on 24 February.

Forward values have picked up in the past 10 months in the region, making the gas-rich Permian more attractive. Calendar 2022 for Waha, along with El Paso and Transwestern in the Permian basin, is up by one-third since 23 October, the last time when daily spot prices were negative.

Mexico key driver for Permian exports

Along with the continued growth of gas consumption in the US, Mexico's growing access to Permian gas supplies is an important market factor. Growth in the region contributed to a nearly 10pc increase in U.S. pipeline exports to Mexico in the 12 months that ended in March, according to the EIA. US marketer Texican Energy said recently that gas exports to Mexico were up to 7 Bcf/d in August.

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Mexico is a major trading partner with the US, consumes more energy than it produces and has a manufacturing-focused economy.

Two dozen export locations between the two countries have been in place for decades, often fairly underutilized. The extensive Kinder Morgan intrastate network and many other intra- and interstate pipelines reach the border. The KM Mexico pipeline is in now in its second decade of service from the border to Monterrey.

The startup of the NetMexico pipeline in 2016, which can flow 2.1 Bcf/d from the Agua Dulce area to the border, drastically increased exports. It connects with the Los Ramones Phase II pipeline, which serves the states of Tamaulipas and Nuevo Leon.

Pipeline companies continue to add capacity. Kinder Morgan's El Paso Natural Gas completed its 320mn cf/d Sierrita Pima expansion in early 2020, boosting capacity on the export pipeline from Tucson, Arizona, to the Mexican state of Sonora. Carso Energy's 0.5 Bcf/d Samalayuca-Sásabe pipeline began commercial flows in January, running from the Permian to Chihuahua and Sonora states.

Other midstream builds take supply deep into central Mexico. The last leg of Fermaca's Wahalajara natural gas pipeline system to export US production as far south as Guadalajara state to Mexico entered service in October 2020. Gas Natural del Noroeste, a subsidiary of US utility Black Hills, launched its 535mn cf/d Zapotlanejo branch line in October 2020, connecting the Cenagas state-operated pipeline system with the Wahalajara system.

Not only can gas go directly south or west into Mexico, but the east-bound intrastate lines from the Permian can deliver into a variety of pipelines that move supply to the south. Enbridge's Valley Crossing pipeline came on line in the middle of 2019 at

Brownsville, Texas, to deliver into a subsea line that runs south to Tampico in Tamaulipas state.

Mexican gas imports are expected to continue to grow, albeit at an uneven pace. The US-Mexico-Canada free trade agreement replaced the North American Free Trade Agreement in 2020. But a new strain of nationalism led by Mexican president Andres Manuel Lopez Obrador has removed certainty in energy planning efforts in both countries.

The pandemic has slowed indigenous consulting processes across Mexico for several natural gas pipeline projects. In the Mexican interior, IEnova's Guaymas-El Oro and TC 866mn cf/d Energy's Tuxpan-Tula gas pipelines are years behind schedule amid protracted consultation processes.

LNG offers new potential for Permian gas

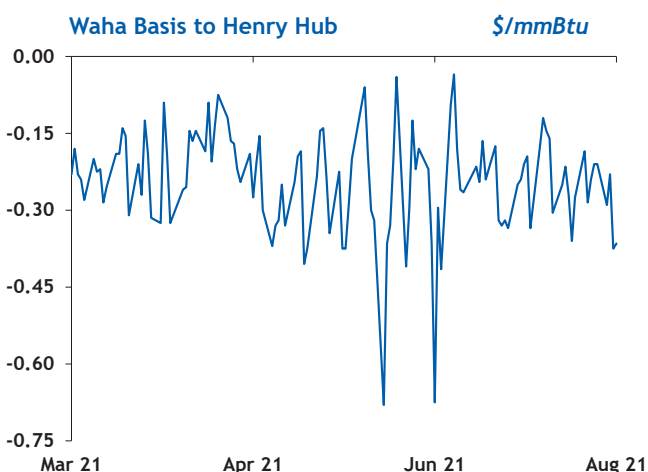
LNG exports from the Texas Gulf Coast also are likely to support Permian gas demand.

Today, LNG exports make up about 10pc of the US gas market, according to Texican, for a typical daily output that can approach 10 Bcf (283mn m3). Four of the six liquefaction facilities are on the Gulf of Mexico, namely Cheniere Energy's Sabine Pass and Corpus Christi plants, Sempra's Cameron facility in Louisiana and the Freeport plant in Quintana Island, Texas. Their output comprises nearly 90pc of the US LNG production most days, and their owners intend to expand them.

Cheniere plans to expand at Corpus Christi, and Freeport expects to make a decision on a fourth liquefaction train next summer. The US Federal Energy Regulatory Commission (FERC) has approved nine other liquefaction plans on the gulf coast, but none are under construction.

Three of those projects are in Texas. A US federal appeals court said in August that FERC's analysis on climate change and environmental justice issues for the Rio Grande LNG and Texas LNG export projects were "deficient" and must be redone. The two projects are to be located near Brownsville. Sempra will may take a final investment decision in the Port Arthur project in 2022.

Market participants and infrastructure developers lack certainty about investment decisions of international companies and the regulatory regime in Mexico. But the cyclical nature of the worldwide energy commodity business normally creates a profusion of projects, usually more than demand justifies. Projects that get built usually have sponsors that are able to sign up offtakers and shippers, negotiate with vendors and customers as conditions change and have deep pockets to absorb swings in materials prices and borrowing costs.



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