

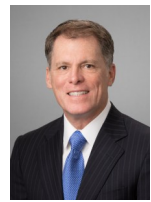
Weekly E&P Update

February 11, 2025

Vol. 6

Horseshoe Wells in the Permian: Drilling Faster, But Can they Compete?

By Steve Hendrickson
President of Ralph E. Davis Associates



Horseshoe wells (cleverly called, “paperclip wells” by some) in the Permian Basin continue to evolve. When I first wrote about them last May, they were still somewhat of an experimental concept—used selectively where lease constraints or geologic challenges made traditional straight-line laterals unfeasible. Early indications suggested they could reduce surface footprint and drilling costs, but questions remained about long-term performance relative to conventional wells.

Advances in Drilling Efficiency

One of the biggest shifts since my last article has been the continued refinement of drilling techniques, leading to faster execution times. Initially, concerns about well tortuosity and directional control made some operators hesitant to adopt horseshoe laterals widely. However, recent industry reports highlight improvements:

- **Matador Resources** drilled a horseshoe well in Loving County that reached total depth 20% faster than its previous best two-mile lateral by optimizing its bottom hole assembly (BHA) design and using rotary steerable systems to improve directional control. The company also incorporated real-time downhole data analysis to make continuous adjustments, minimizing unnecessary sliding and improving overall drilling efficiency.
- **New torque-and-drag modeling** has helped optimize well path curvature, allowing for smoother completions. These models predict the forces acting on the drill string more accurately, reducing friction and enabling operators to make more precise directional adjustments.
- **Operators are now refining completion strategies**, with some choosing not to fracture the U-turn section, avoiding unnecessary cost and stress concentrations in that portion of the well. This approach preserves completion integrity and prevents potential interference between the two lateral sections.

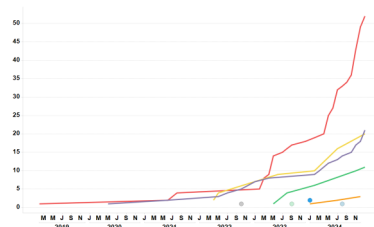
Performance Compared to Straight Wells

Early horseshoe wells showed mixed results compared to their straight-lateral counterparts. My previous article in May of last year noted that production per foot of lateral length lagged slightly behind nearby straight wells, at least in the short term. However, more recent data paints a more nuanced picture:

- **Matador’s horseshoe wells have achieved IPs of 2,477 and 2,166 BOE/d**, both in line with traditional two-mile laterals.
- **Shell’s initial well design saved 25% on rig time and 20% on total cost**, a trend that appears to be continuing with new deployments.

Updated Review: Delaware Basin Wells

The graph below shows the cumulative number of horseshoe wells spud by basin according to the UDriller.com website. As in my previous article, I will focus on the wells drilled in the Delaware Basin, which account for about half of the wells drilled so far.



CLICK TO ENLARGE
(Source: UDriller.com, RED Analysis)

Many of these wells were spud in late 2024, however, and do not yet have sufficient production data to gauge their performance accurately. Additionally, they have been placed in different landing zones, and many zones have not seen enough activity to provide a statistically meaningful sample.

For my updated analysis, I looked at wells in the Wolfcamp A formation, where 12 completions have sufficient production data. For comparison purposes, I selected offsetting wells in the same formation drilled since 2018 and spaced at three to four wells per section (as the horseshoe wells are).

Currently, the horseshoe wells in my review are still underperforming straight lateral direct offsets in the same formation on a cumulative oil per foot basis, in some cases significantly; these results do not yet reflect the most recently drilled wells, however. And while the IPs of some of the new wells are compelling, there still isn't enough data to conclude they will perform as well as the straight laterals over time.

Nevertheless, the technology enables wells to be drilled faster and at lower cost than two shorter laterals and in locations where longer straight laterals are not feasible. I expect they will continue to be selectively deployed, but in the Delaware Basin at least, it seems they will also contribute to the declining recovery per foot I discussed last week.

Sources -

1. "Shale Outlook: E&Ps Making More U-Turn Laterals, Problem-Free" – Hart Energy, January 9, 2025.
2. "New Permian Math: Vital Energy and 42 Horseshoe Wells" – Hart Energy, May 9, 2024.
3. "Successful Planning and Implementation of First South Texas U-Turn Lateral" – SPE Technical Paper 208801-MS, March 1, 2022.
4. "Why Shell Drilled a 'Horseshoe' Well in the Permian Basin" – Journal of Petroleum Technology, February 10, 2020.
5. "Horseshoe Wells: A New Strategy for Small Tracts" – Weekly E&P Update, May 21, 2024.
6. UDriller.com

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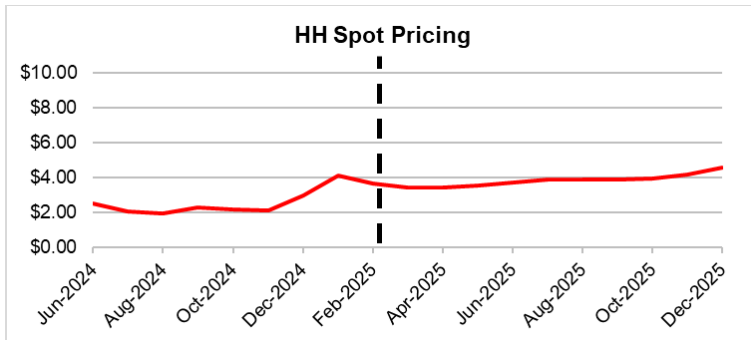
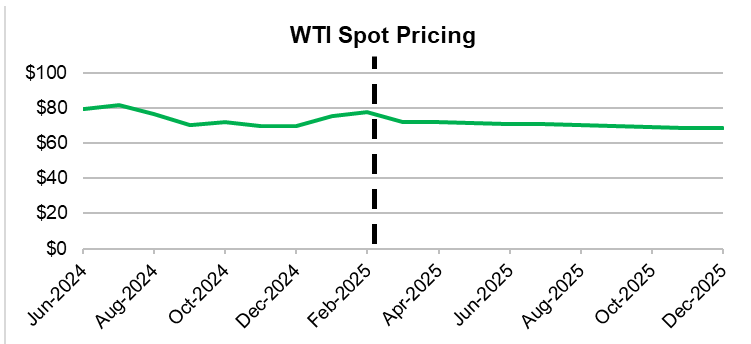
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NYMEX FUTURE PRICING



MONDAY'S MARKET CLOSE

NYMEX WTI CRUDE OIL FUTURES as of February 10, 2025 Close (\$/bbl)

Period	Current	WoW Change	Last Week	1 Yr Ago
2025	\$70.54	\$0.35	\$70.19	\$71.28
2026	\$66.91	\$0.85	\$66.06	\$67.87
2027	\$65.02	\$0.68	\$64.34	\$65.82
2028	\$63.94	\$0.49	\$63.45	\$64.82
2029	\$63.20	\$0.34	\$62.86	\$64.59

NYMEX HH NATURAL GAS FUTURES as of February 10, 2025 Close (\$/MMBtu)

Period	Current	WoW Change	Last Week	1 Yr Ago
2025	\$3.85	\$0.10	\$3.75	\$3.43
2026	\$4.05	\$0.08	\$3.97	\$3.76
2027	\$3.85	\$0.06	\$3.79	\$3.74
2028	\$3.65	\$0.00	\$3.65	\$3.71
2029	\$3.54	(\$0.01)	\$3.55	\$3.68

INDUSTRY METRICS—QUICK SNAPSHOT

	Current	Last Week	WoW Change	%Change
Crude Oil Near-Month Price (\$/bbl)	\$71.00	\$74.14	(\$3.14)	(4%)
Natural Gas Near-Month Price (\$/MMBtu)	\$3.41	\$3.23	\$0.18	5%
Weekly Upstream-Deal Transaction Value (\$MM)	\$1,202.75	\$5,859.74	(\$4,656.99)	(79%)
Weekly Number of Upstream-Deal Transactions	2	4	(2)	(50%)
Current Total US Rig Count	586	582	4	1%
US Field Crude Oil Production (MMbbl/day)	13.5	13.2	0.2	2%
US Field Dry Natural Gas Production (Bcf/day)	112.3	110.4	2	2%
Commercial Crude Oil Stocks-Excluding SPR (MMbbl)	424	415	9	2%
Natural Gas Stocks-Working Gas Underground Storage (Bcf)	2,397	2,571	(174)	(7%)
All Basin Drilled But Uncompleted Wells (DUC-Last Quarter)	5,238	5,238	0	-

*Source—Energy Information Administration (EIA), Bloomberg LP

*Source—Baker Hughes North America Rotary Rig Count & Enverus M&A Database

COMMODITY FUTURES - MONDAY'S MARKET CLOSE

	Current	1-Month Change	3-Month Change	6-Month Change	Year Ago Change
WTI					
Prompt	\$72.32	-6.50 [-8.25%]	+4.28 [6.29%]	-7.74 [-9.67%]	-4.60 [-5.98%]
Bal25	\$70.54	-2.99 [-4.06%]	+2.50 [3.68%]	-7.56 [-9.68%]	-5.08 [-6.72%]
Cal26	\$66.91	-0.95 [-1.40%]	-0.27 [-0.41%]	-6.73 [-9.13%]	-4.36 [-6.12%]
Cal27	\$65.02	-0.51 [-0.78%]	-0.54 [-0.83%]	-4.96 [-7.08%]	-2.85 [-4.20%]
Cal28	\$63.94	-0.27 [-0.41%]	-0.52 [-0.80%]	-3.54 [-5.25%]	-1.88 [-2.86%]
Cal29	\$63.20	-0.13 [-0.20%]	-0.66 [-1.04%]	-2.65 [-4.03%]	-1.61 [-2.49%]
Brent					
Prompt	\$75.87	-5.14 [-6.34%]	+4.04 [5.62%]	-6.43 [-7.81%]	-6.13 [-7.48%]
Bal25	\$74.05	-2.79 [-3.63%]	+2.91 [4.09%]	-7.41 [-9.09%]	-6.12 [-7.63%]
Cal26	\$70.75	-1.21 [-1.68%]	+0.99 [1.42%]	-7.48 [-9.57%]	-5.40 [-7.09%]
Cal27	\$69.12	-0.71 [-1.02%]	+0.12 [0.17%]	-5.74 [-7.67%]	-4.09 [-5.59%]
Cal28	\$68.39	-0.38 [-0.55%]	-0.27 [-0.39%]	-4.27 [-5.88%]	-3.05 [-4.26%]
Cal29	\$67.95	-0.15 [-0.22%]	-0.52 [-0.76%]	-3.29 [-4.62%]	-2.63 [-3.72%]
Henry Hub					
Prompt	\$3.44	-0.49 [-12.46%]	+0.52 [17.95%]	+1.26 [57.33%]	+1.68 [94.80%]
Bal25	\$3.85	+0.07 [1.95%]	+0.93 [31.97%]	+1.19 [44.60%]	+1.52 [64.90%]
Cal26	\$4.05	+0.11 [2.68%]	+0.91 [28.98%]	+0.69 [20.45%]	+0.62 [17.95%]
Cal27	\$3.85	+0.06 [1.59%]	+0.24 [6.66%]	+0.24 [6.51%]	+0.09 [2.47%]
Cal28	\$3.65	-0.05 [-1.30%]	-0.02 [-0.61%]	+0.03 [0.94%]	-0.09 [-2.49%]
Cal29	\$3.54	-0.02 [-0.65%]	-0.06 [-1.61%]	-0.01 [-0.32%]	-0.17 [-4.58%]
Heating Oil					
Prompt	\$2.45	+0.00 [0.19%]	+0.15 [7.52%]	-0.34 [-13.86%]	-0.26 [-11.11%]
Bal25	\$2.34	-0.01 [-0.25%]	+0.23 [11.54%]	-0.08 [-3.59%]	-0.21 [-8.81%]
Cal26	\$2.25	-0.01 [-0.72%]	0.00 [-0.24%]	-0.19 [-8.57%]	-0.14 [-6.31%]
Cal27	\$2.21	0.00 [-0.22%]	+0.03 [1.66%]	-0.14 [-6.42%]	-0.08 [-3.82%]
Cal28	\$2.18	0.00 [-0.09%]	+0.04 [2.07%]	-0.10 [-4.67%]	-0.04 [-2.09%]
RBOB					
Prompt	\$2.10	-0.08 [-3.25%]	+0.25 [11.53%]	+0.04 [1.85%]	-0.47 [-16.05%]
Bal25	\$2.18	-0.07 [-2.74%]	+0.14 [6.29%]	-0.09 [-3.83%]	-0.35 [-13.05%]
Cal26	\$2.01	-0.03 [-1.16%]	+0.05 [2.09%]	-0.16 [-6.45%]	-0.20 [-7.97%]
Cal27	\$1.98	-0.01 [-0.36%]	-0.01 [-0.44%]	-0.15 [-6.26%]	-0.14 [-5.93%]
Cal28	\$1.98	0.00 [-0.06%]	-0.01 [-0.32%]	-0.11 [-4.94%]	-0.11 [-5.00%]

*Source—Bloomberg LP

SELECTED INDUSTRY HEADLINES

Supercharging Fracs: Experts Say Combining Technologies Is the Path to Optimization

While hydraulic fracturing technology has advanced by leaps and bounds from the first operation in 1947, opportunities exist for improvement and optimization.

US Permian Oil Output Growth to Slow in 2025 Despite Trump's Plan, Executives Say

Growth in oil output from the U.S. Permian basin, the country's top oilfield, is expected to slow by at least 25% this year despite President Donald Trump's vow to maximize production, energy executives forecast on Thursday.

JP Morgan Says Global Oil Demand 'Surged' to Over 101MM Bpd in January

In January, global oil demand surged to 101.5 million barrels per day, analysts at J.P. Morgan said in a research note sent to Rigzone by the JPM Commodities Research team this week.

Wright Taps Fossil Fuel Officials for DOE Gigs (LOGIN REQUIRED)

The newly confirmed Energy secretary is assembling a team that includes a consultant to oil and gas companies and a former adviser with the Texas Oil and Gas Association.

Oil, Gas Drillers See Increased Activity

The total number of active drilling rigs for oil and gas in the United States rose this week, according to new data that Baker Hughes published on Friday, after a 6-rig increase in the week prior.

A New Oil Cycle Begins And Sanctions, Shale, and OPEC Set the Stage

President Trump's push to cut Iran's oil exports to zero has fueled bullish sentiment in oil markets.

Oil Prices Advance Despite Concern Over More US Tariffs

Oil prices rebounded on Monday despite lingering fears over a potential global trade war after U.S. President Donald Trump's latest tariff plans, this time targeting steel and aluminum.

'Durable' LNG, Not AI, to Drive US NatGas Demand (LOGIN REQUIRED)

About three-quarters of future U.S. gas demand growth will be fueled by LNG exports, while data centers' needs will be more muted, according to Expand Energy CFO Mohit Singh.

Natural Gas Futures Climb as Sustained Cold Seen Trimming Inventories (LOGIN REQUIRED)

Natural gas futures continued to creep upward Tuesday morning, with wintry weather expected to further whittle natural gas inventories that already sit below the five-year average.

States Jockey For Carbon Storage Authority From Trump EPA

President Donald Trump signed multiple executive orders to help boost U.S. fossil fuels, but they don't mention one industry that aims to grow alongside oil, gas and electricity: carbon capture and storage.

Efforts to Put Carbon Dioxide Underground Face Less Support in Trump's Second Term

Putting carbon dioxide from power plants and industrial facilities underground where it won't contribute to global warming could see less federal support and enthusiasm under President Donald Trump.

Element3 Produces Lithium Carbonate from Permian Oil, Gas Wastewater

Element3 says it produced the battery-grade lithium carbonate using a Double Eagle Energy Holding subsidiary's wastewater in the Midland Basin.

SELECTED RECENT TRANSACTIONS

Bayswater E&P to Sell DJ Basin Assets for \$603 Million

Bayswater Exploration and Production, a Denver-based oil and natural gas development company, has entered into an agreement to sell assets in the Denver Julesburg Basin to Prairie Operating Company in a cash and stock transaction valued at approximately \$603 million.

ConocoPhillips Sells \$600 Million in Noncore Permian Basin Assets

Following its \$22.5 billion deal to buy Marathon Oil, ConocoPhillips is targeting \$2 billion in asset sales—a goal a company executive said would largely be achieved this year.

Viper Buys \$330 Million Midland Interests in Shadow of \$4.5 Billion Dropdown

Viper Energy has entered into a definitive purchase agreement to buy mineral and royalty interests from Morita Ranches Minerals LLC in a cash-and-equity deal valued at about \$330 million.

Elk Range Acquires Permian, Eagle Ford Minerals and Royalties

Elk Range Royalties LP is acquiring Newton Financial Corp., Concord Oil Co. and Mission Oil Co., which together own mineral and royalty interests across the Permian Basin and Eagle Ford Shale, Dallas-based Elk said Jan. 29.

Diversified to Acquire Maverick, Enter Permian Basin in \$1.3 Billion Deal

Diversified Energy will acquire EIG's Maverick Natural Resources, adding acreage that offsets Diversified's core Western Anadarko position and Permian Basin assets in the northern Delaware.

Amplify Energy to Merge With Juniper Capital's Upstream Rocky Mountain Companies

Amplify Energy has entered into a definitive merger agreement with privately held Juniper Capital to combine with certain Juniper portfolio companies which own substantial oil-weighted producing assets and significant leasehold interests in the DJ and Powder River Basins.

W&T Offshore Secures Settlement and Strategic Asset Sale

The company is making strategic moves by selling a non-core interest in Garden Banks Blocks 385 and 386 for \$12.3 million.

Kimbell Royalty Partners Acquires Midland Basin Assets for \$231 Million

Kimbell Royalty Partners, LP an owner of oil and gas mineral and royalty interests in approximately 17 million gross acres in 28 states, today announced that it has agreed to acquire mineral and royalty interests held by a private seller in a cash and unit transaction valued at approximately \$231 million.

Diversified Energy Company to Acquire Operated Properties of Summit Natural Resources LLC for \$45 Million

Diversified Energy Company PLC agreed to acquire operated natural gas properties and related facilities of Summit Natural Resources LLC for \$45 million on January 6, 2025.

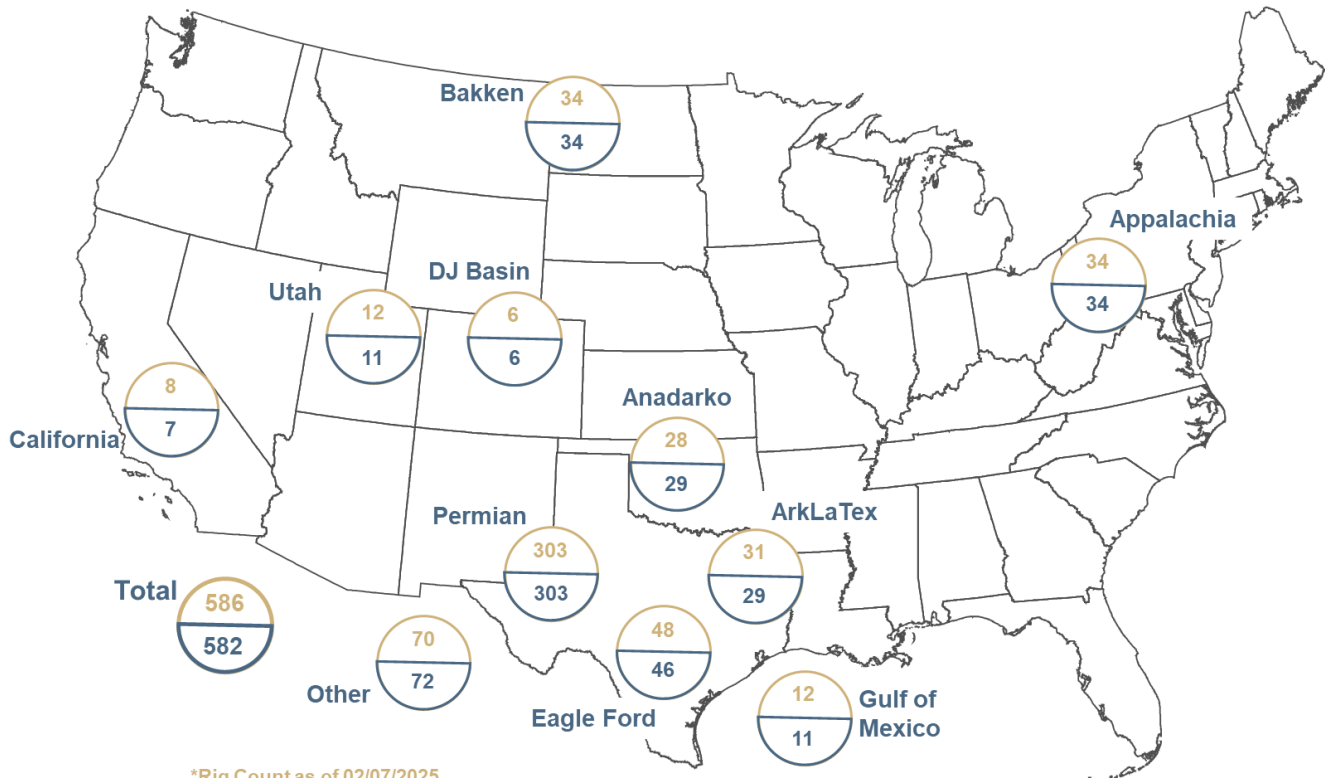
Vitesse Inks a \$222 Million Strategic Expansion Deal to Acquire Lucero Energy

Vitesse Energy, Inc. VTS recently announced an all-stock transaction deal to acquire Lucero Energy, an oil and gas producer operating on the North Dakota side of the Williston Basin.

China's CNOOC Sells US Assets to Britain's INEOS

China's CNOOC Ltd has sold its U.S. subsidiary, together with its upstream oil and gas assets in the Gulf of Mexico, to British chemicals group INEOS, according to a CNOOC statement issued on Saturday.

RIG ACTIVITY BY US REGION

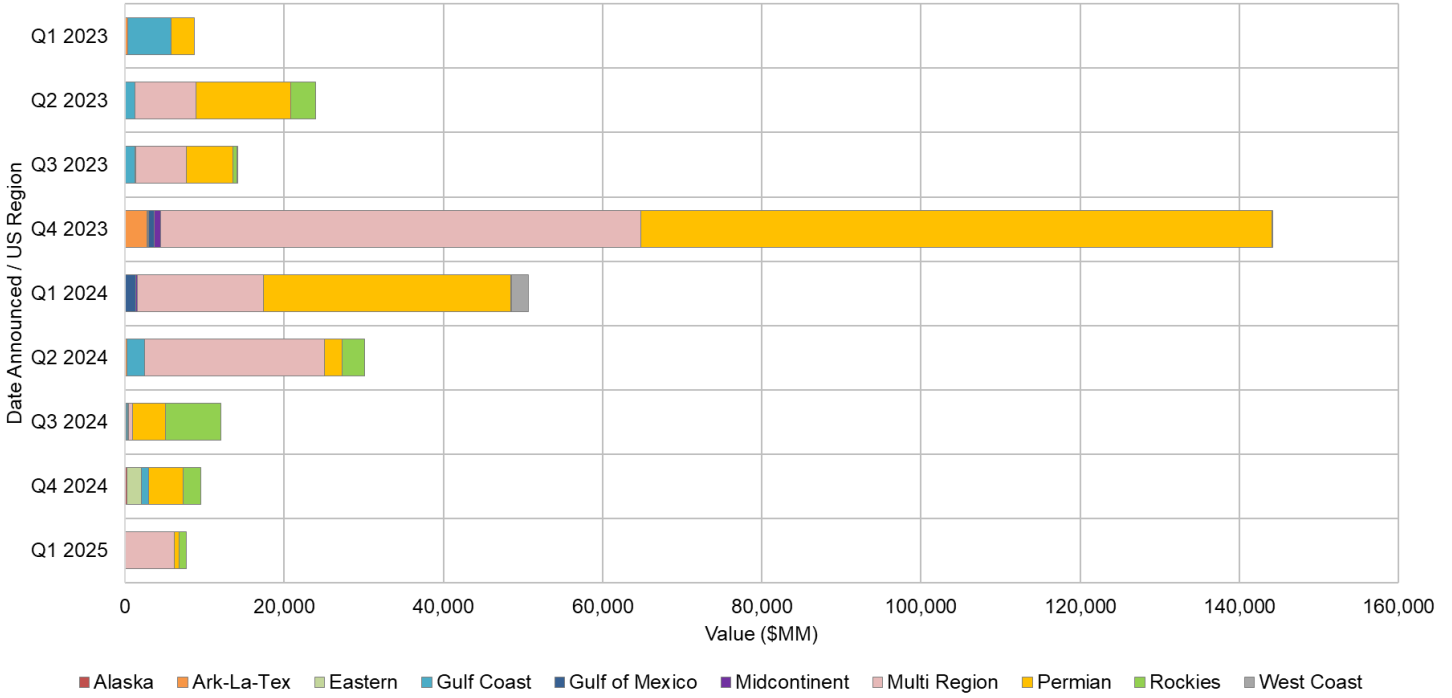


*Rig Count as of 02/07/2025
*Rig Count as of 01/31/2025

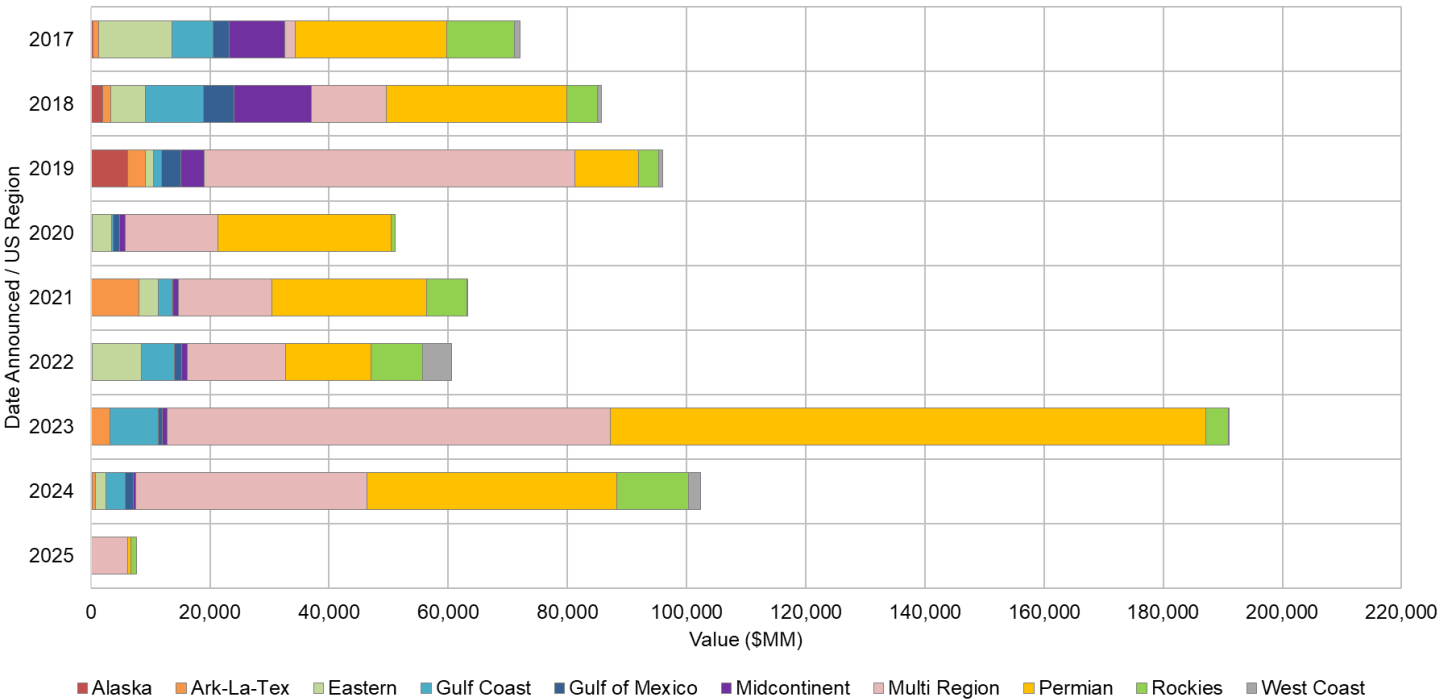
	Week Ending 02/07/2025			Week Ending 01/31/2025		Week Ending 02/09/2024
U.S. Rig Breakouts	Count	+/-	Count	+/-	Count	
Oil	480	1	479	(19)	499	
Gas	100	2	98	(21)	121	
Not Specified	6	1	5	3	3	
Directional	50	0	50	(1)	51	
Horizontal	523	4	519	(37)	560	
Vertical	13	0	13	1	12	
Land (Inc Others)	570	3	567	(32)	602	
Inland Waters	2	0	2	2	0	
Offshore	14	1	13	(7)	21	
US Total	586	4	582	(37)	623	

*Source—Baker Hughes North America Rotary Rig Count

DEAL VALUE BY US REGION (BY QUARTER)

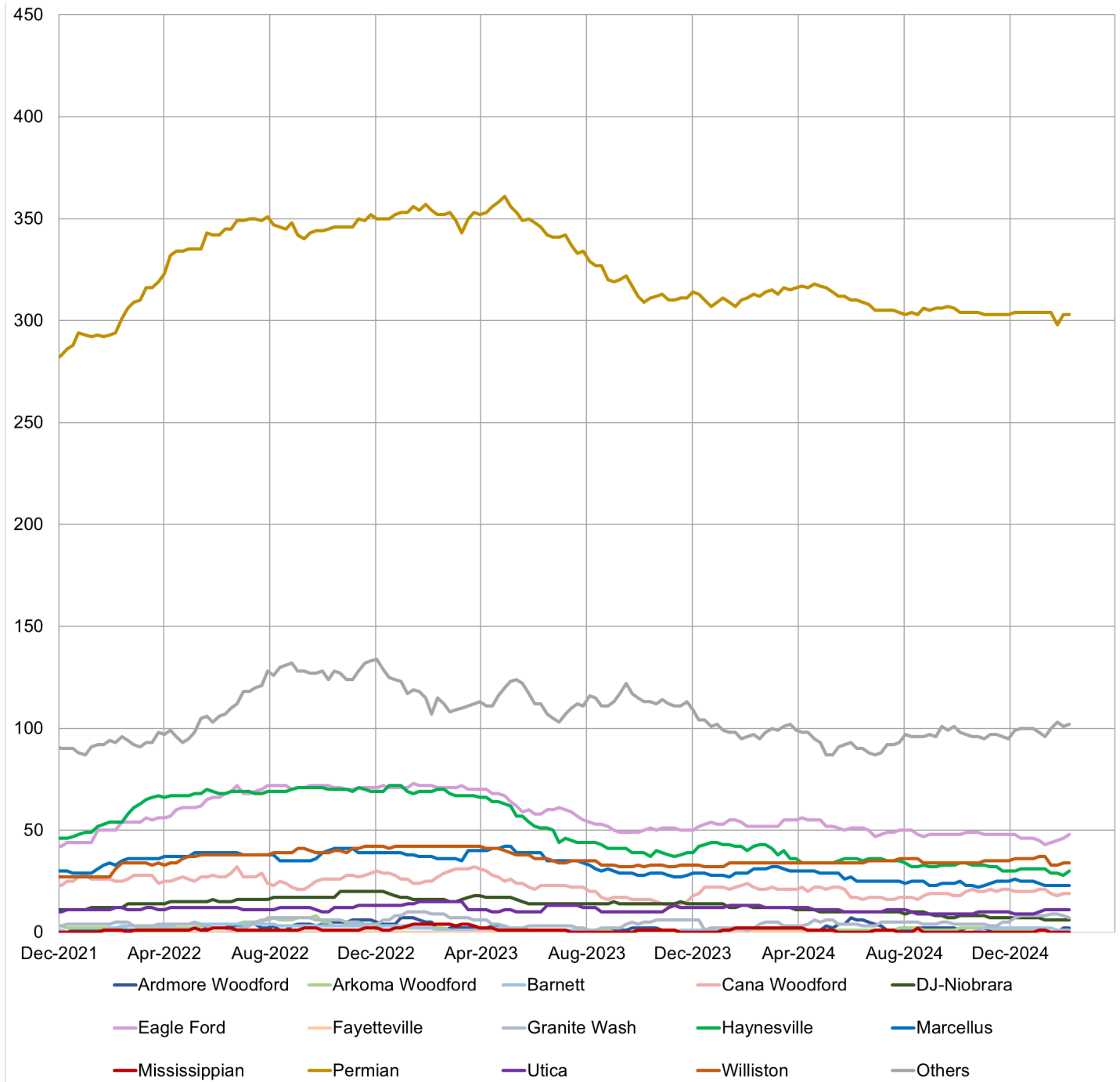


DEAL VALUE BY US REGION (BY YEAR)



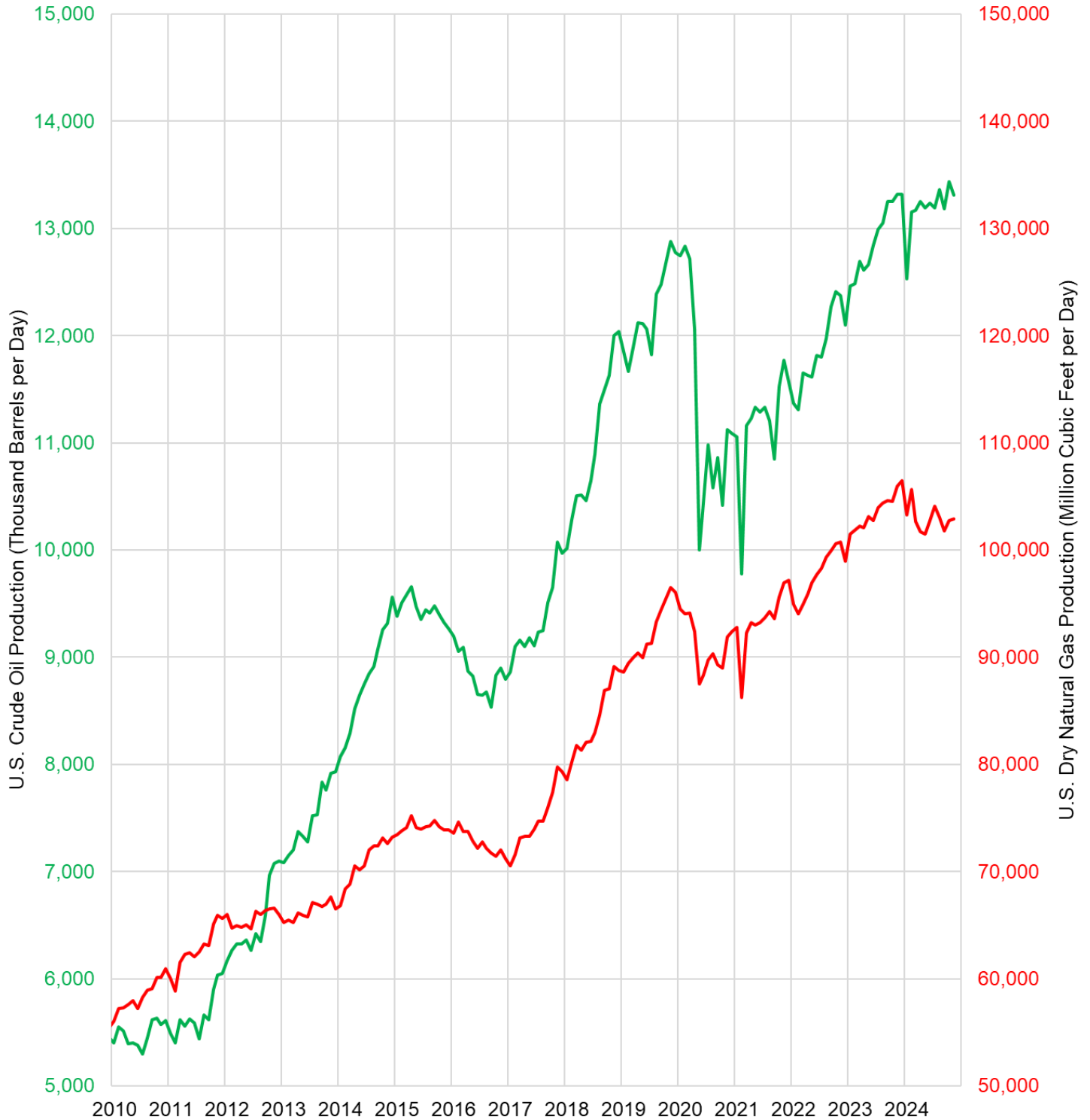
*Source—Enverus M&A Data- (Charts exclude terminated deals)

RIG ACTIVITY BY US REGION



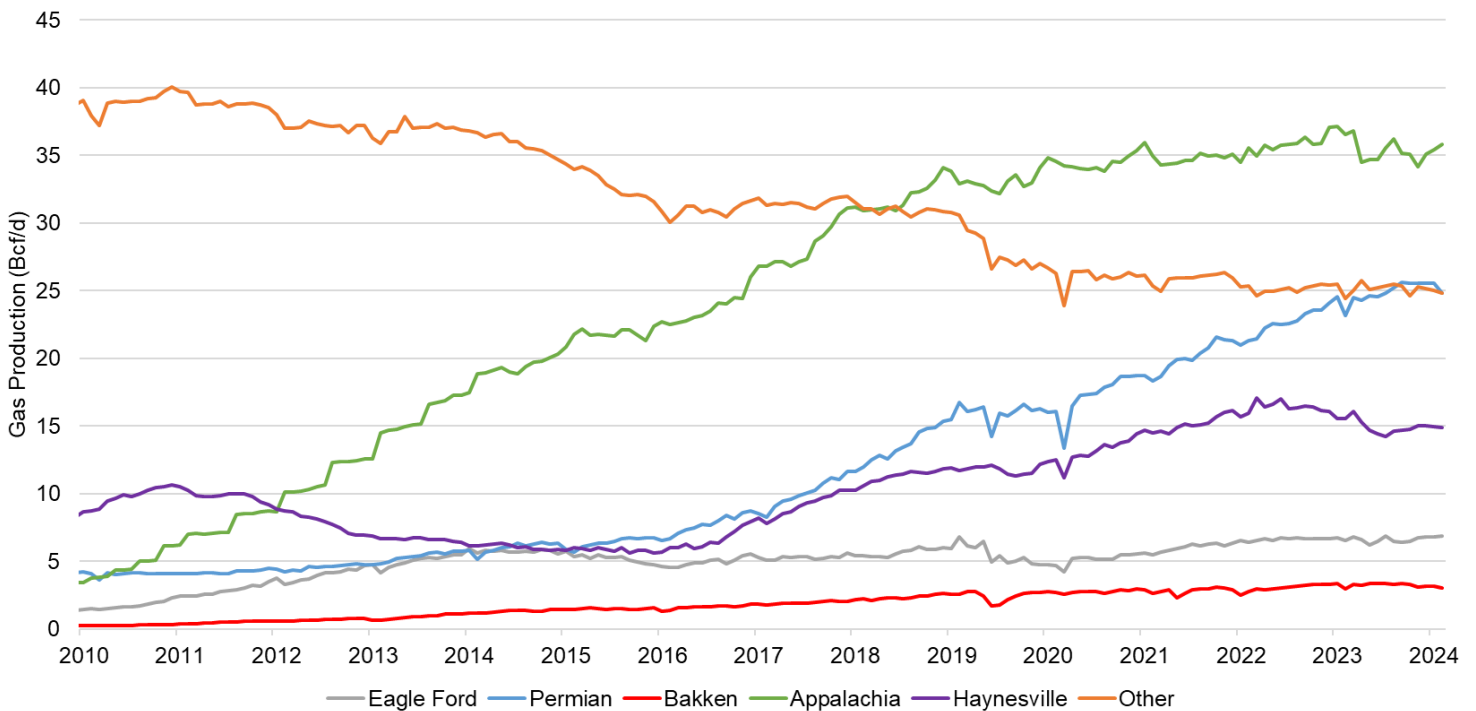
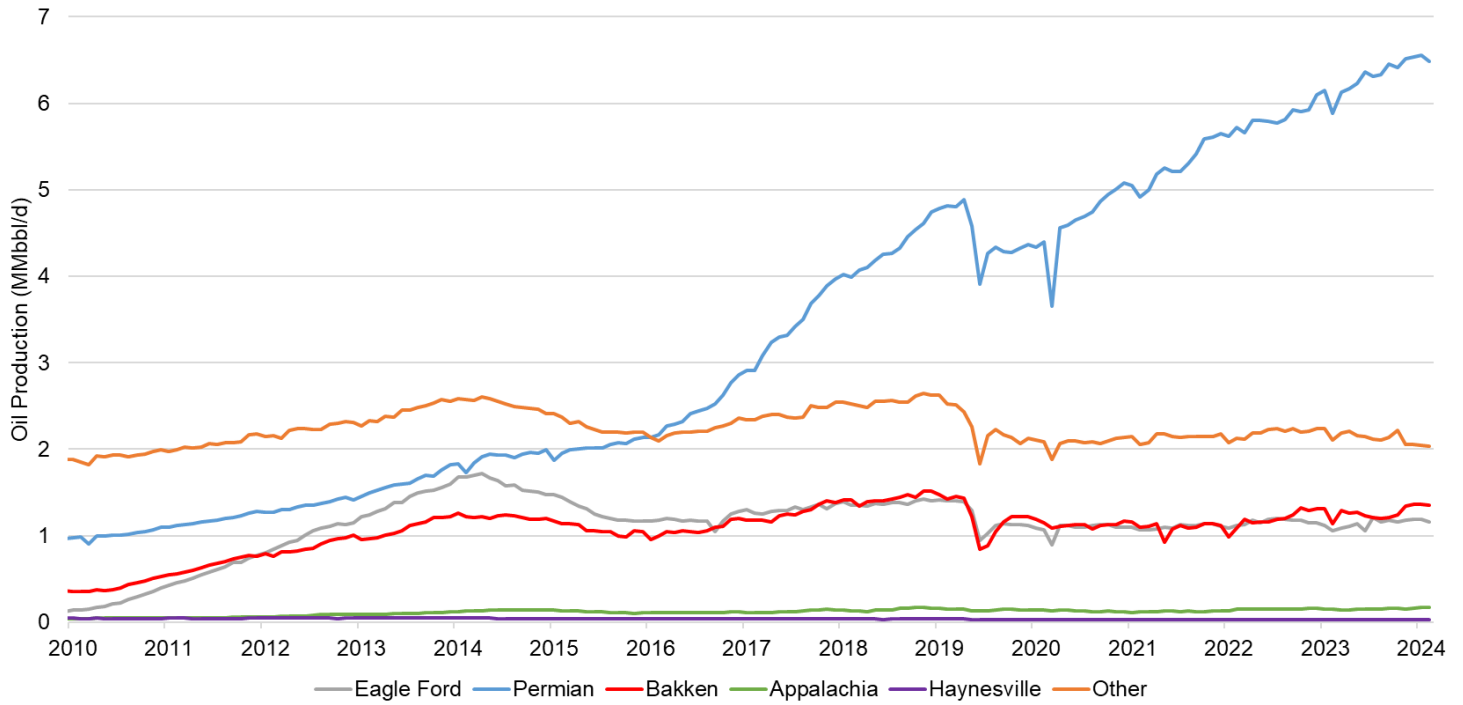
*Source—Baker Hughes North America Rotary Rig Count

US DAILY CRUDE (MMbbl) & DRY NATURAL GAS PRODUCTION (MMcf)



*Source—Energy Information Administration (EIA)

HISTORICAL PRODUCTION OF SELECTED US SHALE REGIONS



*Source—Energy Information Administration (EIA)



UPCOMING EVENTS

February 2025

<u>KIPP Better Together Breakfast</u>	February 11	Tulsa, OK
<u>SPE GCS - A&D Symposium</u>	February 26	Houston, TX

March 2025

<u>U.S. Men's Clay Court Championship</u>	March 29 - April 6	Houston, TX
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April 2025

<u>Texas Bankruptcy Bench/Bar Conference</u>	April 2	Houston, TX
<u>Quorum Qnections 25</u>	April 22-24	Las Vegas, NV
<u>World Oilman's Poker Tournament</u>	April 23-25	Las Vegas, NV
<u>Hunger Free Golf Classic</u>	April 25	Houston, TX

*Denotes an Opportune Sponsored Event

ABOUT RALPH E. DAVIS ASSOCIATES


Ralph E. Davis Associates LLC (RED) is an industry-leading petroleum engineering and geosciences firm committed to satisfying the individual needs of clients. We accomplish this by holding ourselves to the highest standards of integrity and professionalism to deliver honest, direct and actionable insights to help clients achieve their strategic objectives. We distinguish ourselves by combining reservoir engineering, geoscience evaluation techniques and advanced data analytics with economic analyses to provide our clients with individual, customized solutions.

Banks, bondholders, private equity firms, financial institutions and law firms around the world trust in RED's diverse services and unrivaled upstream oil and gas expertise to deliver comprehensive solutions that help clients make informed decisions. We add value to every engagement by employing a team approach, leveraging Opportune LLP's experienced bench of experts in transactional due diligence, tax advisory, investment banking, restructuring and valuation.


We offer technical and economic analyses to deliver our clients a complete, independent, accurate and detailed assessment of the value of their assets. We apply a robust set of technical capabilities to assist our clients. Our capabilities include:

- Reservoir engineering and geosciences
- Economic forecasting and reporting
- Data analytics and geospatial analysis


KEY CONTACTS



Steve Hendrickson is the President of Ralph E. Davis Associates, an Opportune LLP company. Steve has over 35 years of professional leadership experience in the energy industry with a proven track record of adding value through acquisitions, development and operations. Steve is a licensed professional engineer in the state of Texas, and holds an M.S. in Finance from the University of Houston and a B.S. in Chemical Engineering from The University of Texas at Austin. He recently served as a board member of the Society of Petroleum Evaluation Engineers (SPEE) and is a registered FINRA representative.



John Beaird is Vice President of Ralph E. Davis Associates, an Opportune LLP company. John has 39 years of oil and gas management, reservoir engineering, and petroleum economics evaluation experience. Recent relevant experience includes the Permian, Western Gulf, Tx-La-Miss Salt, Mid-Continent, Denver-Julesburg, Wind River, Williston Basin, and Appalachian Basins. John is a registered Petroleum Engineer in the State of Texas and holds a B.S. in Petroleum Engineering from Louisiana Tech University. He is also an active member of the Society of Petroleum Evaluation Engineers (SPEE).



David Edwards is a Petroleum Engineer at Ralph E. Davis Associates, an Opportune LLP company. David has over four years of reserves engineering experience in conventional and unconventional reservoirs. Before RED, David was a Petroleum Engineer at a lower middle market A&D advisory firm where he handled the technical processes for marketed assets. He began his career with an operator in Dallas, where he contributed to its engineering, operations, and A&D teams. David holds an M.B.A. from The University of Texas Permian Basin and a B.S. in Petroleum Engineering from The University of Oklahoma.

