



Weekly E&P Update

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The Search for White Hydrogen

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Hydrogen shows great promise as a low-carbon fuel source, and we've discussed some of its aspects in previous columns ("[The Many Shades of Hydrogen](#)", "[Blue Hydrogen Blues](#)", [Underground Hydrogen Storage Parts 1 and 2](#)" and "[Ammonia as a Green \(or Blue\) Fuel?](#)"). Although the combustion of hydrogen generates only water vapor as a by-product, manufacturing hydrogen is an energy-intensive process, and the generation of the energy needed often involves the combustion of low-cost carbon-based fuels or high-cost renewable sources.

Now, the search is on for so-called "white" (or "gold") hydrogen that is found in naturally occurring deposits. Few of these have been identified, and I've yet to find any reference to them in the [OnePetro](#) database of oil and gas technical papers. The US Geologic Survey has undertaken [a research effort](#) to understand the processes that control the formation and accumulation of underground hydrogen resources. Using the [petroleum system model](#) as a framework, the USGS work will address source, migration, reservoir, and trapping conditions needed to create an underground hydrogen reservoir.

The process of oil and gas formation vastly differs from that of hydrogen. Oil and gas formed through a process called "petrogenesis," through which complex organic material that was deposited underwater was eventually buried under increasing amounts of sediment until temperatures and pressures reached a point (and stayed there long enough) for them to break down into simpler hydrocarbons. Hydrogen, however, is formed under multiple different chemical pathways, but not all of them lead to the generation of large quantities.

Two methods that are believed to be precursors to the accumulation of large hydrogen volumes are "serpentinization", where water reacts with certain iron-rich minerals, and "radiolysis" in which the particles from naturally occurring radioactive decay slowly split water molecules into hydrogen and oxygen. The latter process is believed to be extremely slow.

There are loss mechanisms, however, that could consume hydrogen formed by these processes. For instance, petrogenesis will consume available hydrogen and incorporate it into the hydrocarbons formed, which explains why hydrogen is rarely found in oil and gas. There are underground microbes that feed on hydrogen, and because the hydrogen molecule is so tiny, it passes readily through many types of rocks, as wells as faults and fissures.

Now that interest in the hydrogen economy is growing; geologists are reviewing old records and other indications of potential hydrogen accumulations that were overlooked. There are too many details to cover in our column, but we may be experiencing the start of the next great exploration boom.

Sources and additional reading:

[Hidden Hydrogen: Does Earth hold vast stores of a renewable, carbon-free fuel?](#)

[A Preliminary Model of Global Subsurface Natural Hydrogen Resource Potential](#)

[They went hunting for fossil fuels. What they found could help save the world](#)

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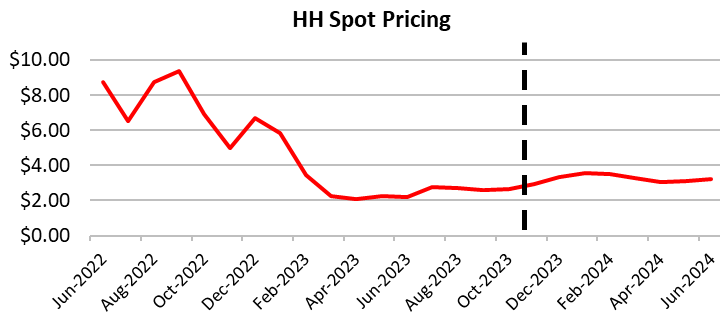
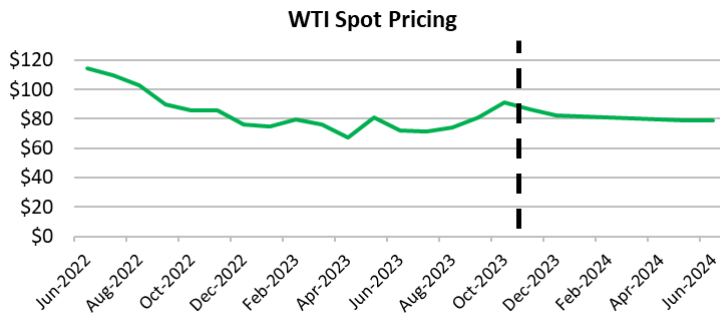
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NYMEX FUTURE PRICING



MONDAY'S MARKET CLOSE

NYMEX WTI CRUDE OIL FUTURES as of October 30, 2023 Close (\$/bbl)

Period	Current	WoW Change	Last Week	1 Yr Ago
2023	\$82.31	(\$3.18)	\$85.49	\$80.84
2024	\$78.69	(\$1.75)	\$80.44	\$73.80
2025	\$73.93	(\$0.82)	\$74.75	\$69.51
2026	\$70.49	(\$0.39)	\$70.88	\$66.37
2027	\$67.81	(\$0.09)	\$67.90	\$63.73

NYMEX HH NATURAL GAS FUTURES as of October 30, 2023 Close (\$/MMBtu)

Period	Current	WoW Change	Last Week	1 Yr Ago
2023	\$3.35	\$0.25	\$3.10	\$5.02
2024	\$3.43	\$0.03	\$3.40	\$4.57
2025	\$4.04	\$0.01	\$4.03	\$4.44
2026	\$4.08	(\$0.00)	\$4.08	\$4.39
2027	\$3.98	(\$0.04)	\$4.02	\$4.35

INDUSTRY METRICS—QUICK SNAPSHOT

	Current	Last Week	WoW Change	%Change
Crude Oil Near-Month Price (\$/bbl)	\$82.59	\$88.00	(\$5.41)	(6%)
Natural Gas Near-Month Price (\$/MMBtu)	\$3.33	\$2.91	\$0.43	15%
Weekly Upstream-Deal Transaction Value (\$MM)	\$60,000.00	\$6.00	\$59,994.00	>100%
Weekly Number of Upstream-Deal Transactions	2	4	(2)	(50%)
Current Total US Rig Count	625	624	1	0.2%
US Field Crude Oil Production (MMbbl/day)	13.2	13.2	0	-
US Field Dry Natural Gas Production (Bcf/day)	107.9	108.1	(0.2)	(0.2%)
Commercial Crude Oil Stocks-Excluding SPR (MMbbl)	421	420	1	0.3%
Natural Gas Stocks-Working Gas Underground Storage (Bcf)	3,700	3,626	74	2%
Total Drilled But Uncompleted Wells (DUC-Last Month)	4,681	4,681	0	-

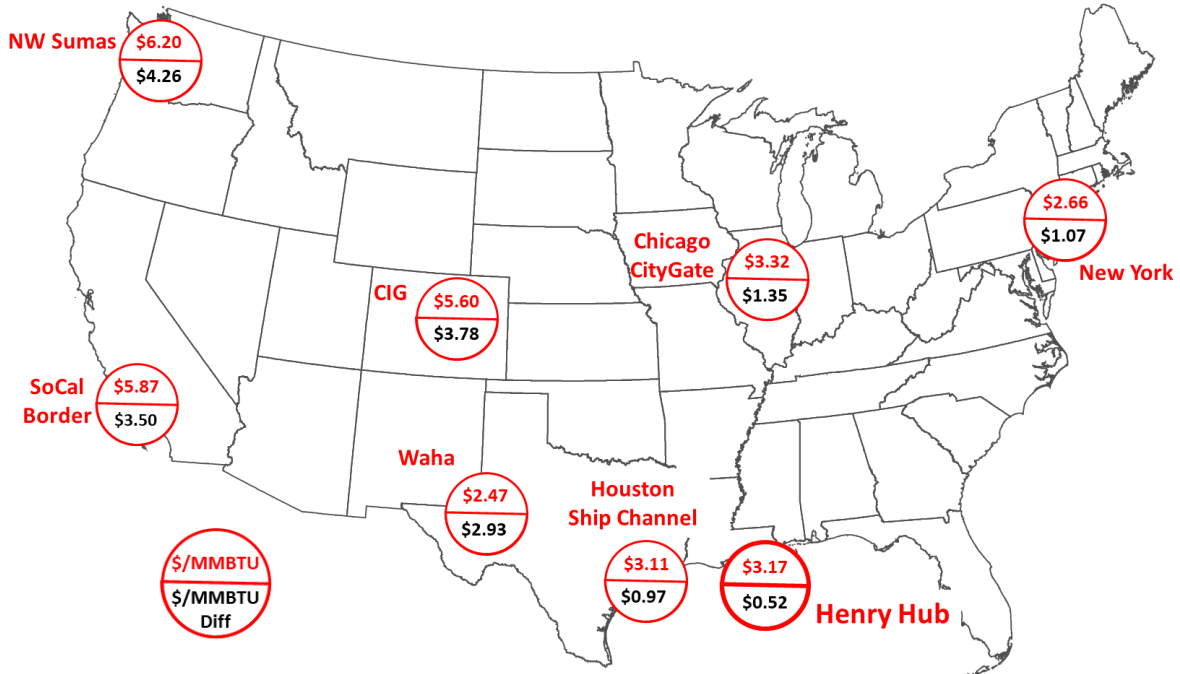
*Source—Energy Information Administration, United States (EIA)

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

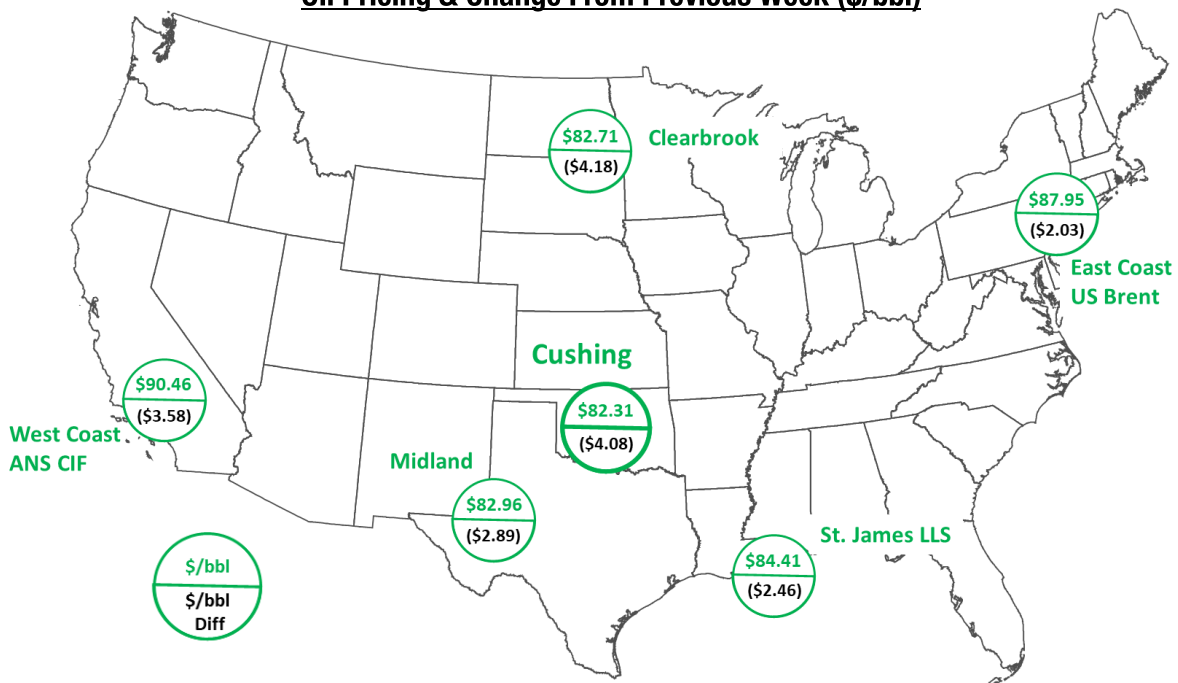


US COMMODITY PRICES CONTINUED

Natural Gas Pricing & Change From Previous Week (\$/MMBTu)



Oil Pricing & Change From Previous Week (\$/bbl)



*Source—Bloomberg LP



SELECTED INDUSTRY HEADLINES

Mega Mergers Spark New Debate Over Oil Demand Controversy

Around the time when Exxon announced the acquisition of Pioneer Natural Resources, the International Energy Agency published its much-awaited World Energy Outlook.

Chevron-Hess Deal May Lift Bakken Oil Output, But No Return to Boom Days

Chevron's recently announced deal to buy Hess, one of the largest operators in the Bakken shale play in North Dakota, could raise oil output there marginally but analysts do not expect a return to its peak pre-pandemic boom days.

Biden Alaska Oil Plan Seen as Major Threat to Future Drilling

A century after the US set aside a broad swath of northwest Alaska to be used as an emergency oil supply, the Biden administration is pursuing changes that could make it impossible to harvest crude from new leases in the 23 million-acre site.

Oil Falls Over 1% as Concerns About Mideast Supply Ease

Oil slipped more than 1% recently as concern eased about the Israel-Hamas war affecting supply from the region and as investors adopted caution ahead of this week's U.S. Federal Reserve meeting and other indications of global economic health.

Oil Jumps Friday but Posts First Weekly Loss Since Conflict Began

Oil surged the most in two weeks after Israel's military said it was "expanding ground activity" in Gaza this evening, reviving concerns about the conflict spreading more broadly.

Growth Risks to Restrain Oil in 2024, But Mideast Risks Loom Large, Reuters Poll Shows

Slow global economic growth will keep crude prices anchored below \$90 a barrel this year and next, unless the Israel-Hamas conflict draws in more countries in the Middle East and exacerbates supply tightness.

Oil and Gas Markets Eye Escalation Risk as Gaza War Deepens (LOGIN CREDENTIALS REQUIRED)

Oil and gas markets are set for another volatile week of trading after Israel began its long-anticipated ground invasion of Gaza.

Surge in Worldwide LNG Projects to Ease Natural Gas Supply Concerns, IEA Says (LOGIN CREDENTIALS REQUIRED)

The International Energy Agency (IEA) is projecting that global demand for natural gas will start to dip by the end of this decade, but should remain strong and near a historic peak through 2050.

Natural Gas Prices Forecast: Volatility Spikes Amid Rollovers, Weather Uncertainty

Today's natural gas futures paint a volatile picture, influenced by contract rollovers, low trading volumes, and fluctuating weather forecasts.

Firm Claims Texas Well Holds Highest Lithium Concentrations in North America

Standard Lithium says the latest drilling project indicates an increasing trend of lithium concentrations in the Texas-portion of the Smackover formation.

How Solid-State Batteries Could Transform Transport (LOGIN CREDENTIALS REQUIRED)

Toyota appears close to a manufacturing breakthrough that could accelerate the transition to electric vehicles. But will the technology ever be commercially viable?

Plastic Waste Becomes Clean Hydrogen Goldmine

A study focused on turning waste plastics into high-value graphene just unlocked a new way of producing hydrogen that could transform the nascent industry and, on a grander scale, positively alter projected decarbonization pathways



SELECTED RECENT TRANSACTIONS

Chevron to Buy Hess Corp For \$53 Billion in All-Stock Deal

Chevron has agreed to buy Hess for \$53 billion in stock to gain a bigger U.S. oil footprint and a stake in rival Exxon Mobil's massive Guyana discoveries, the latest in a series of blockbuster U.S. oil combinations.

Trio Secures Option to Acquire Gas Prospect in Sacramento Basin

California-based Trio Petroleum Corp. has secured a four-month option with exclusivity to acquire a natural gas prospect in the Sacramento Basin, which has the potential to produce an estimated 40 billion cubic feet of gas.

Ellipsis U.S. Onshore Holdings Acquires Additional Assets Located in The Delaware Basin

Ellipsis U.S. Onshore Holdings LLC ("Ellipsis"), a portfolio company of Westlawn Group LLC ("Westlawn"), recently announced the acquisition of additional assets located in the Delaware Basin of Texas and New Mexico

Exxon Mobil Agrees to Buy Pioneer Natural Resources for Nearly \$60 Billion in All-Stock Merger

Exxon Mobil said recently that it agreed to buy shale rival Pioneer Natural Resources for \$59.5 billion in an all-stock deal, or \$253 per share.

Kimmeridge Signs Deals for Eagle Ford Assets, Gas Transport

Kimmeridge Texas Gas (KTG), an affiliate of investment firm Kimmeridge, has signed a definitive agreement to acquire certain upstream assets from an undisclosed private seller in a bid to expand its footprint in the Eagle Ford shale play.

Vitesse Energy Acquires \$50 Million in Oil, Gas Interests in North Dakota's Williston Basin

Vitesse Energy has acquired additional oil and gas interests in the Williston basin of North Dakota that will result in approximately \$50 million of acquisition and related development capital expenditures, primarily in the third and fourth quarters of 2023, the company said recently.

Civitas Resources to Buy Permian Assets For About \$2.1 bln

Civitas Resources will buy acreage in the oil-rich Permian Basin from global energy trader Vitol's U.S. upstream venture for about \$2.1 billion in cash and stock, the U.S. oil and gas producer said recently.

1979 Royalties, LP Announces Northern Midland Basin Minerals & Royalty Acquisition From Peacemaker Royalties

1979 Royalties, LP a subsidiary of Endeavor Energy Resources, announced it has closed the acquisition of oil & gas mineral and royalty interests from Peacemaker Royalties, a portfolio company of EnCap Investments, in the Midland Basin for \$61 million in cash.

W&T Offshore Acquires Eight Oil, Gas Producing Assets in Gulf of Mexico

W&T Offshore, Inc. has completed the acquisition of working interests in eight shallow water oil and gas producing assets in the central and eastern shelf region of the Gulf of Mexico from an undisclosed private seller.

Santos to Divest Half of Working Interest in 148 Leases at Alaska North Slope

Australian oil and gas major Santos said recently it would divest half of its working interest in 148 exploration leases in the Langiappe area on the Alaska North Slope in a farm-down agreement with two U.S.-based companies.

Momentum Minerals Operating II, LP Closes Permian Basin Mineral and Royalty Acquisition

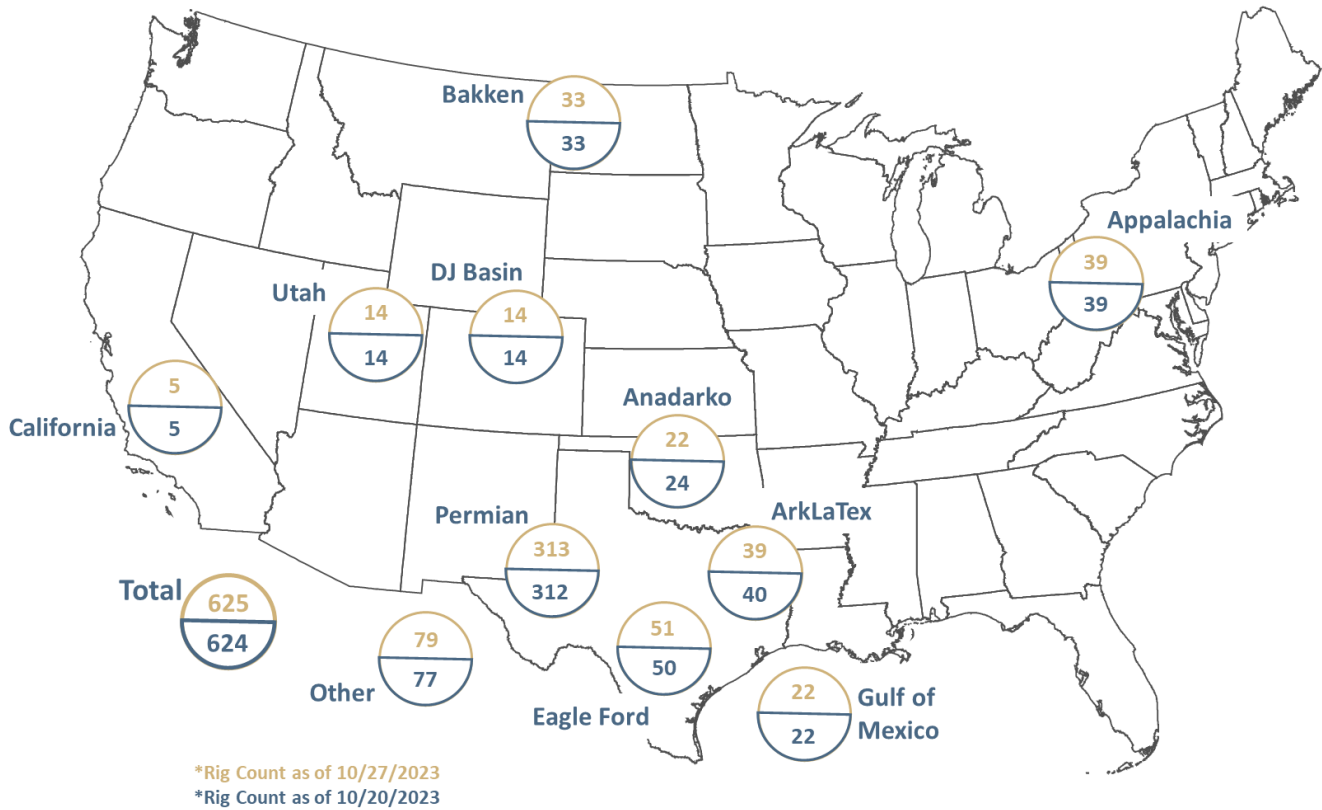
Momentum Minerals has closed the acquisition of a Permian Basin mineral and royalty package from Post Oak Crown Minerals, LLC and Post Oak Legacy Assets I, LLC, both of which are affiliates of Post Oak Energy Capital, LP

Vital Energy acquires Permian Basin Assets from Henry, Maple and Tall City

Vital Energy has signed agreements valued at about \$1.17 billion to expand its acreage in the Permian Basin, where dealmaking is gathering pace as drillers tap the largest U.S. oil patch to quickly replenish their depleting reserves.



RIG ACTIVITY BY US REGION

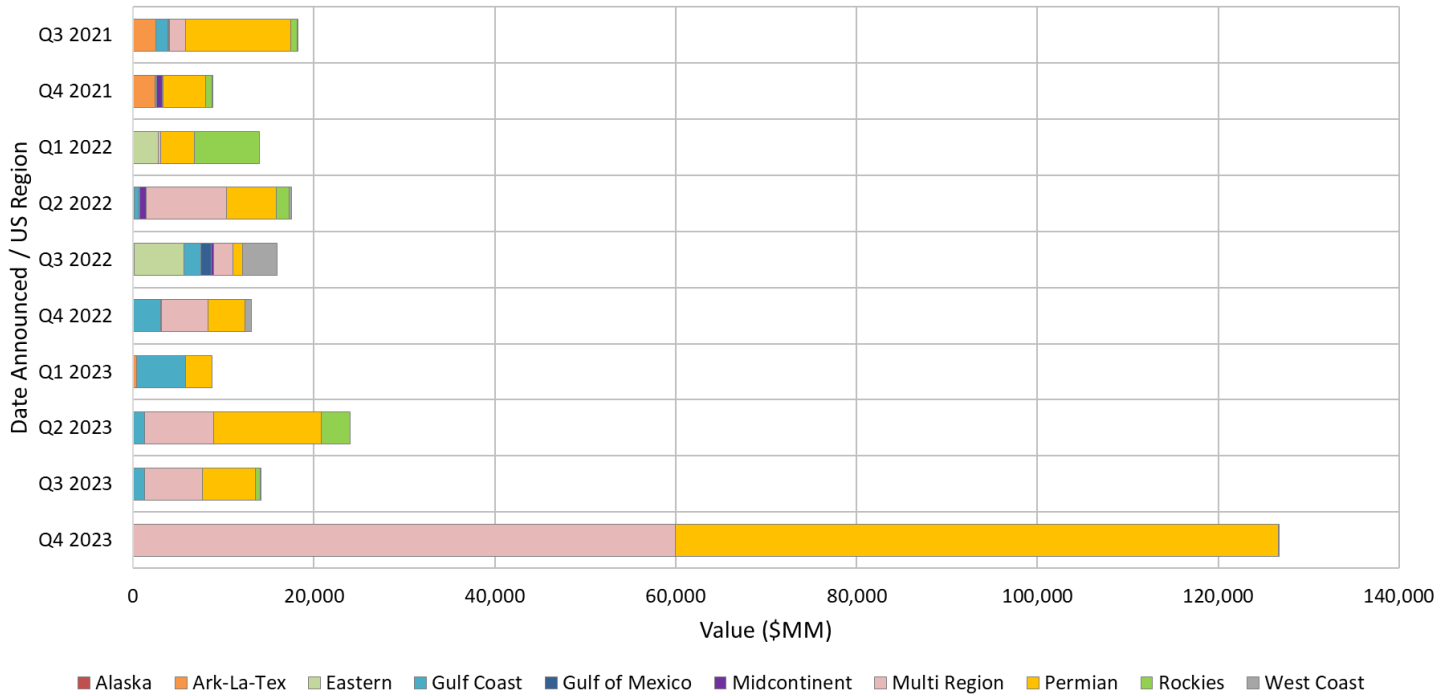


	Week Ending 10/27/2023			Week Ending 10/20/2023		Week Ending 10/28/2022
U.S. Rig Breakouts	Count	+/-	Count	+/-	Count	
Oil	504	2	502	(106)	610	
Gas	117	(1)	118	(39)	156	
Not Specified	4	0	4	2	2	
Directional	53	3	50	10	43	
Horizontal	558	1	557	(145)	703	
Vertical	14	(3)	17	(8)	22	
Land (Inc Others)	600	1	599	(152)	752	
Inland Waters	1	0	1	(1)	2	
Offshore	24	0	24	10	14	
US Total	625	1	624	(143)	768	

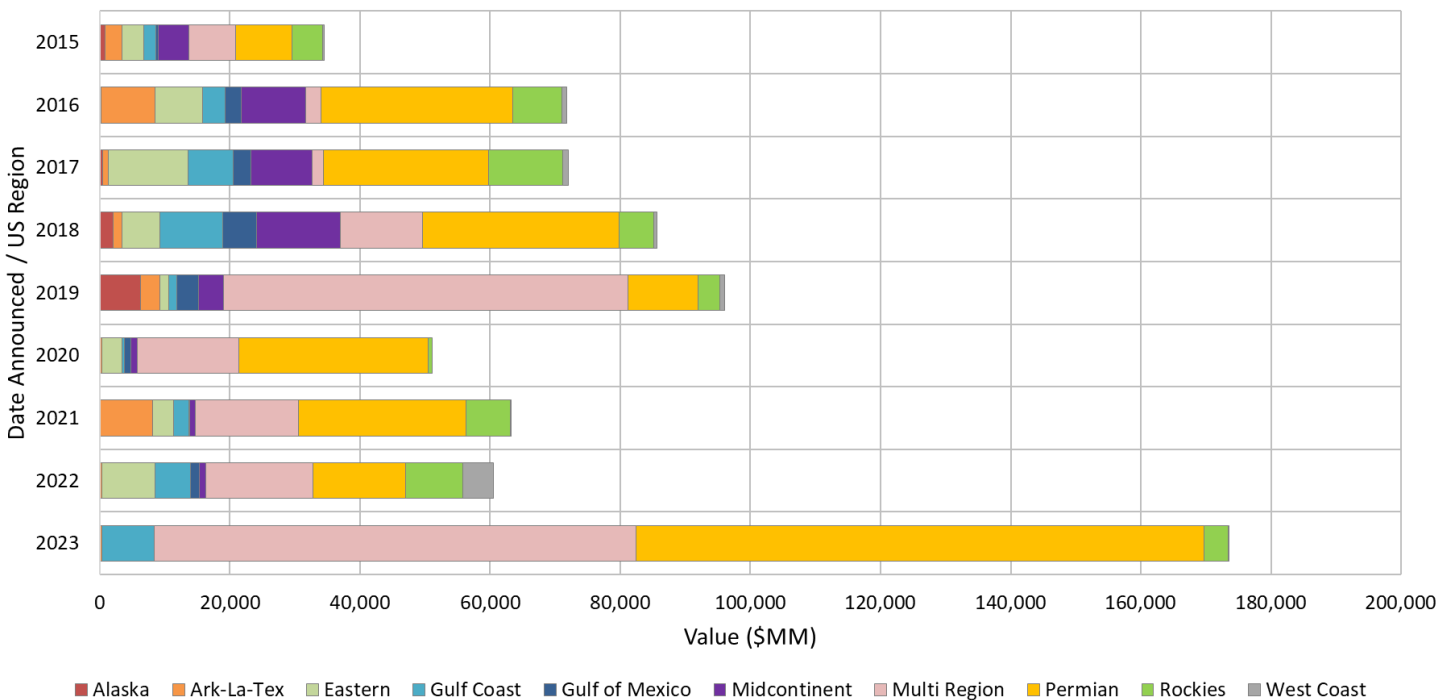
*Source—Baker Hughes Weekly Rig Counts



DEAL VALUE BY US REGION (BY QUARTER)



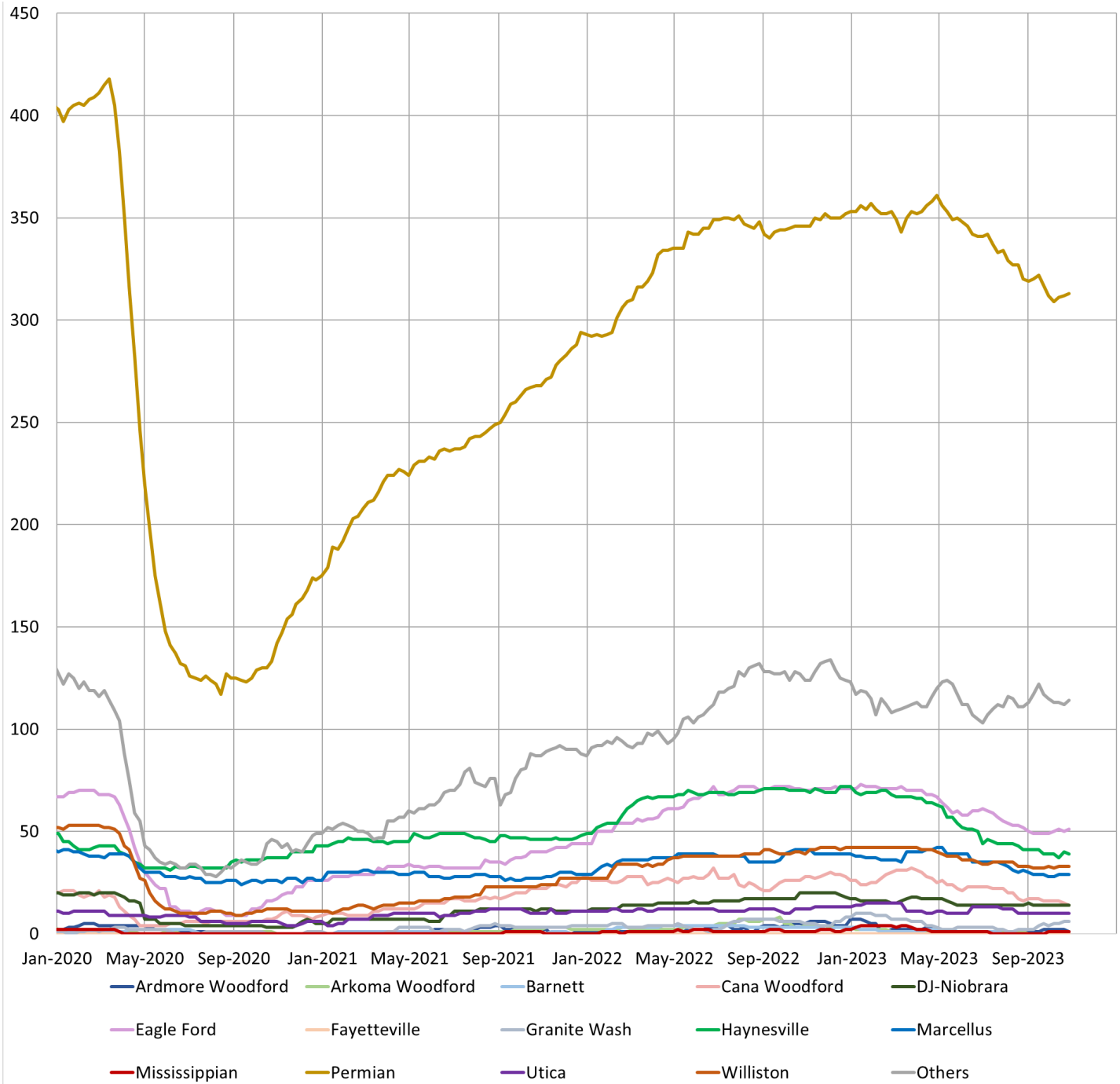
DEAL VALUE BY US REGION (BY YEAR)



*Source—PLS M&A Database (Charts exclude terminated deals)



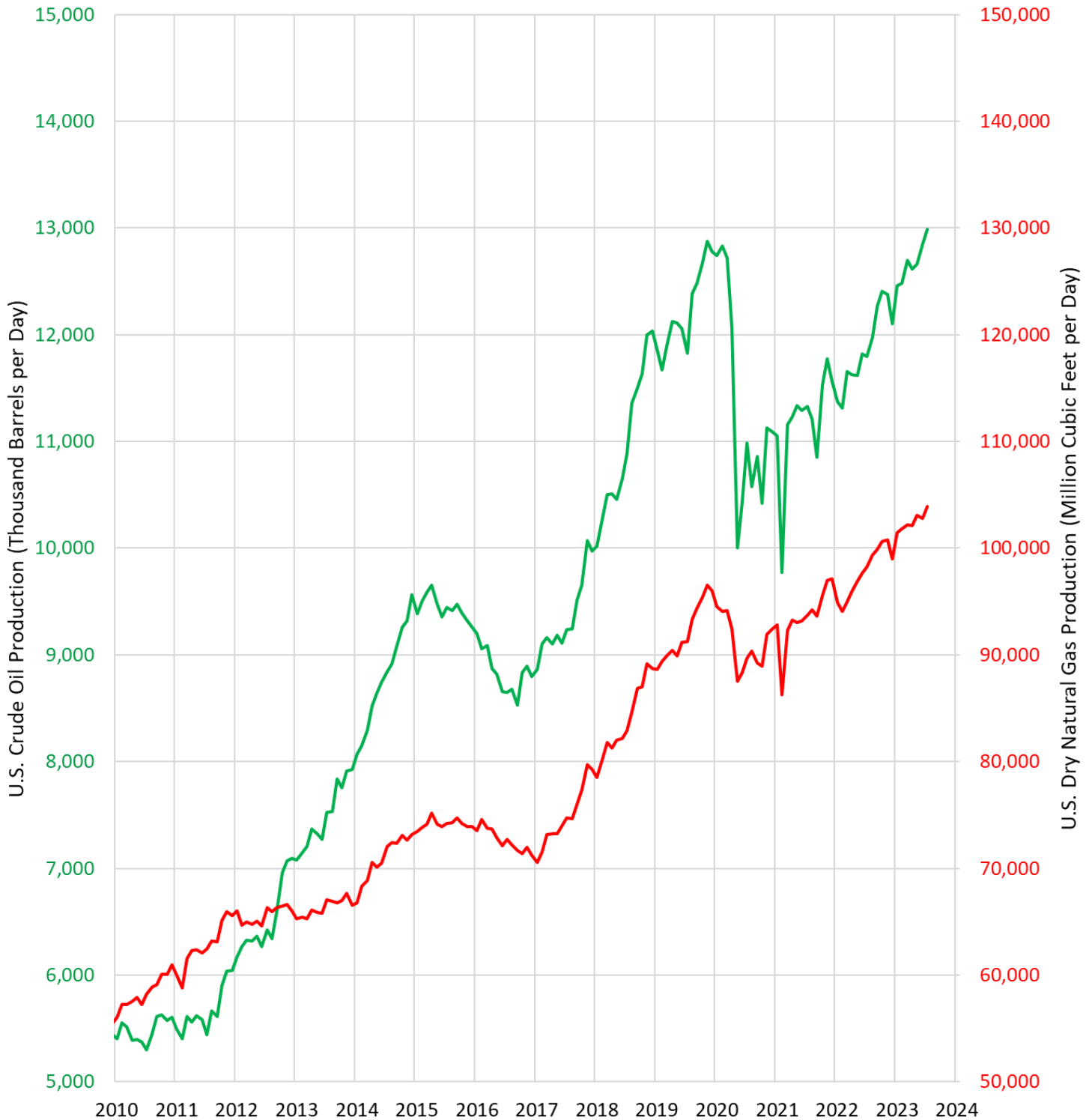
RIG ACTIVITY BY US REGION



*Source—Baker Hughes Weekly Rig Counts



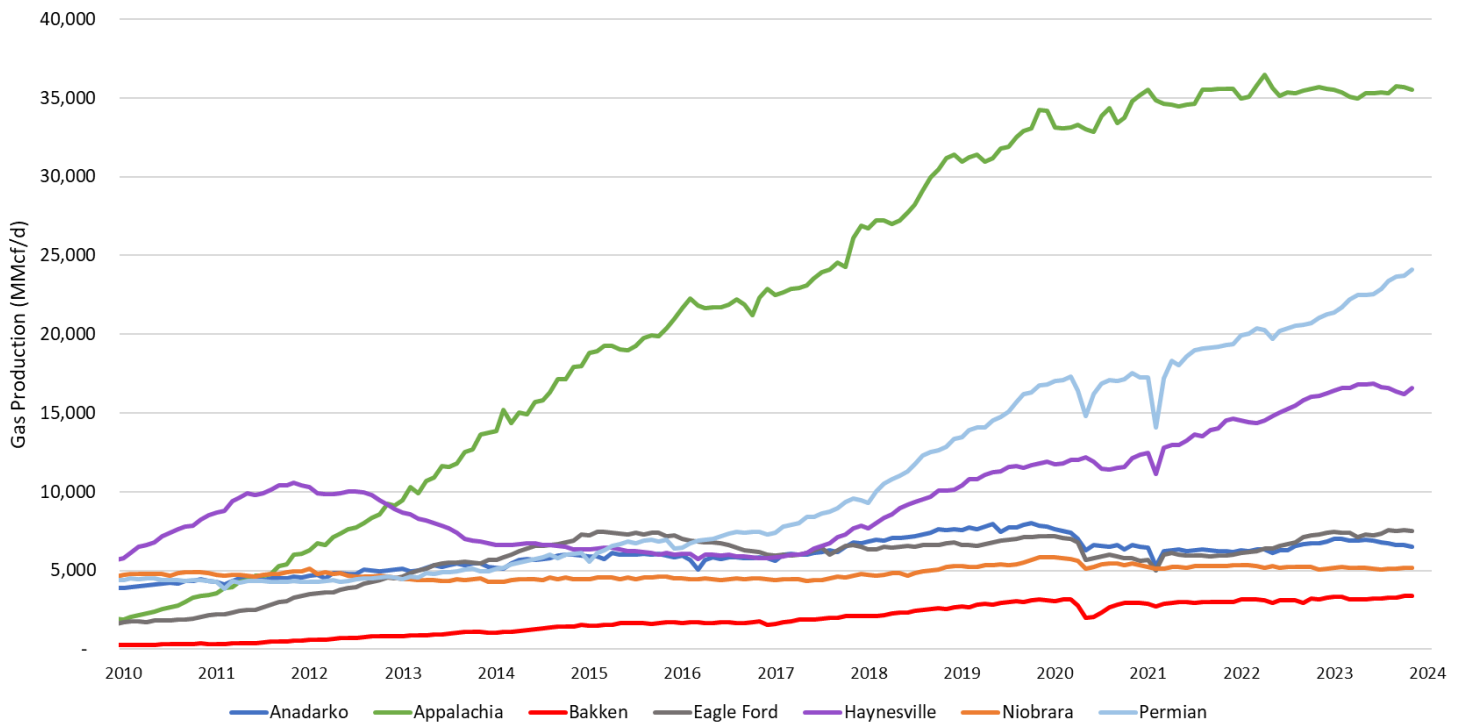
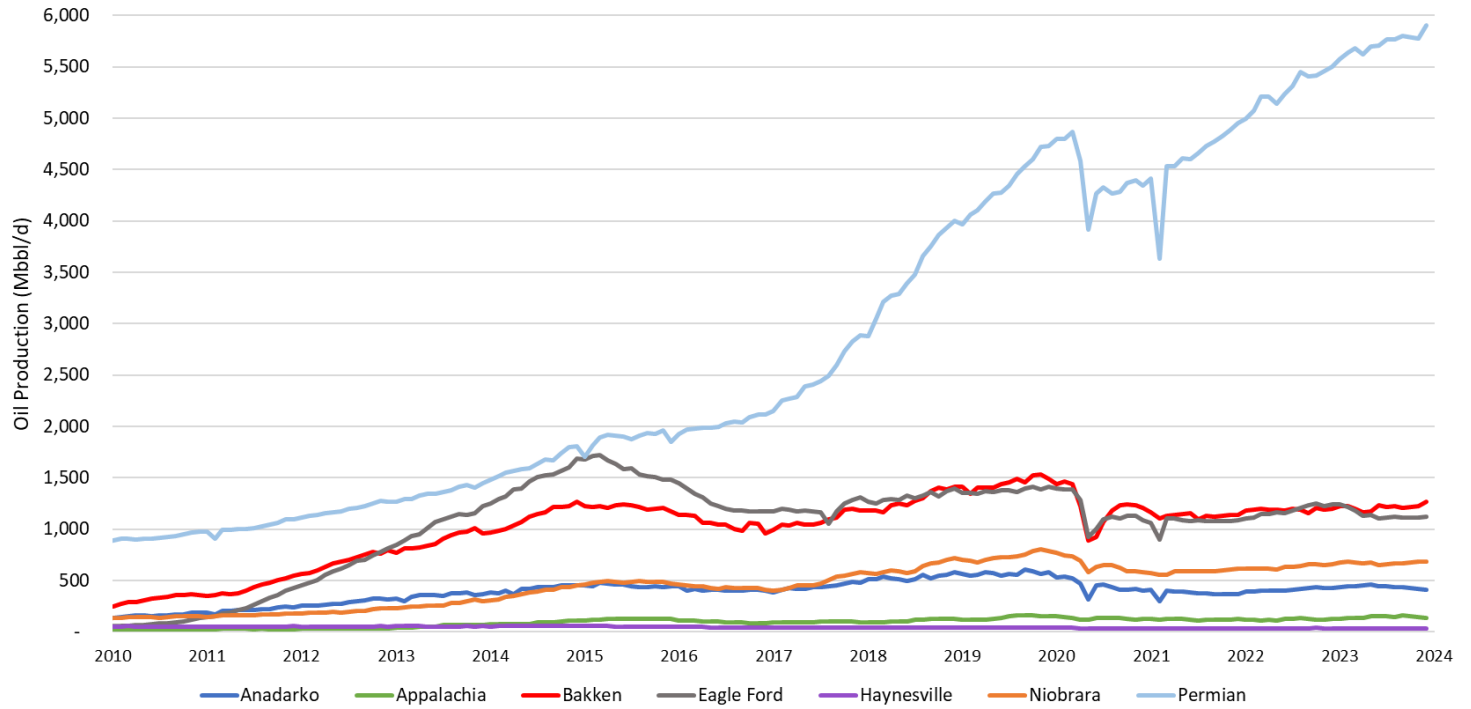
US DAILY CRUDE (MMbbl) & DRY NATURAL GAS PRODUCTION (MMcf)



*Source—Energy Information Administration, United States (EIA)



HISTORICAL PRODUCTION OF SELECTED US SHALE REGIONS



*Source—Energy Information Administration, United States (EIA)



UPCOMING EVENTS

October 2023

Digital Wildcatters—FUZE

October 30-31

Houston, TX

November 2023

IPAA Annual Meeting

November 6-8

San Antonio, TX

AICPA Oil & Gas Conference

November 8-10

Las Vegas, NV

OSU Accounting and Financial Reporting Conference

November 16

Tulsa, OK

OSU Oil and Gas Accounting Conference

November 17

Tulsa, OK

Boys & Girls Club 8th Annual Sporting Clays Tournament

November 17

Houston, TX

IPAA Texas Hold'Em Tournament

November 30

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).



Yvonne Trujillo is a Senior Petroleum Engineer at Ralph E. Davis Associates, an Opportune LLP company. Yvonne has over 25 years experience in the oil and gas industry with extensive expertise in reserves engineering, SEC and PRMS/SPE reporting and economics and asset evaluation in conventional and unconventional reservoirs in the U.S. Lower 48. Yvonne earned a B.S. in Mechanical Engineering at Simon Bolivar University in Caracas, Venezuela and an M.S. in Petroleum Engineering at the University of Houston.



David Edwards is a Petroleum Engineer at Ralph E. Davis Associates, an Opportune LLP company. David has over three 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.

