



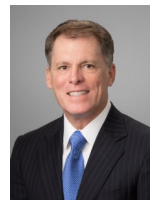
Weekly E&P Update

September 5, 2023

Vol. 35

Bakken Frac Hits May Generate Beneficial Parent/Child Interactions

By Steve Hendrickson
President of Ralph E. Davis Associates



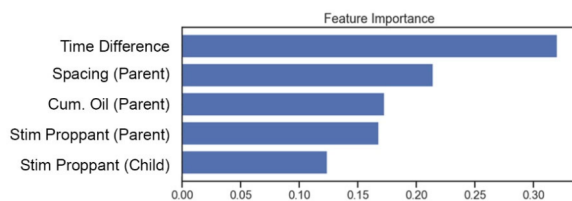
In our practice, we've prepared many type well profiles (TWP), also called "type curves", for wells in the Bakken Play of the Williston Basin. Early on, we developed a technique to [quickly calculate the area available for drainage](#) based on the location of the immediate offset wells to categorize the wells by well spacing (wells per section). We could then examine the impact of well spacing on well performance to help select analogs for our TWP sample set.

We regularly observed that wells on closer spacing performed better than those on wider spacing. We felt this was probably due to some beneficial interaction between the fracs of nearby wells, similar to what we'd seen occasionally in the Barnett. A [recent article](#) in the Journal of Petroleum Technology highlights a [paper](#) published by the [Energy and Environmental Research Center](#) in North Dakota that digs deeper into this observation.

In their study, the authors examined 17,000 wells and found that 45% of them experienced "parent-child interactions". These interactions, also called frac hits, occur when fracture treatments on new wells (children) are completed near existing wells that have been producing long enough to create a pressure sink (parents). This pressure sink causes more of the child's fracture treatment to go towards the parent. In the Bakken, the authors observed that parent well often experienced a production rate improvement after a child well was completed and examined several features to determine what most influenced the magnitude of the change.

In their sample set, they observed that on average the parent well production rates increased by about 75% immediately after the child's completion, and found the most critical factors controlling the size of the increase were:

- How long the parent had been producing and its cumulative production (since these are proxies for depletion and how likely the child's fracture treatment would move towards the parent).
- How closely spaced the parent and child were.
- The proppant intensity (lbs/ft) used in the parent's completion.



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(Source: URTeC 3862589)

Many of the parent wells are considered "understimulated" by today's completion practices. Early completions typically had proppant intensities of 400 to 500 lbs. per lateral foot, but modern completions are in the 900 to 1000 lbs/foot range. The underestimation of the old wells left more hydrocarbons available for production, which were often contacted by the higher intensity fracture treatment of the child, provided the child was close enough to have an impact.

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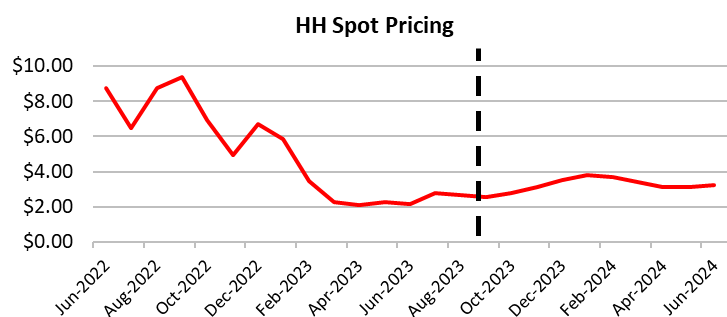
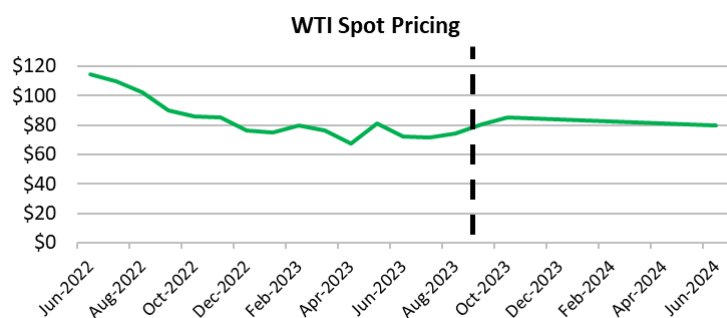
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NYMEX FUTURE PRICING



FRIDAY'S MARKET CLOSE

NYMEX WTI CRUDE OIL FUTURES as of September 01, 2023 Close (\$/bbl)

Period	Current	WoW Change	Last Week	1 Yr Ago
2023	\$84.73	\$5.07	\$79.66	\$81.23
2024	\$79.89	\$3.34	\$76.55	\$74.29
2025	\$74.44	\$2.25	\$72.19	\$69.40
2026	\$70.35	\$1.75	\$68.60	\$65.82
2027	\$66.95	\$1.44	\$65.51	\$63.04

NYMEX HH NATURAL GAS FUTURES as of September 01, 2023 Close (\$/MMBtu)

Period	Current	WoW Change	Last Week	1 Yr Ago
2023	\$3.14	\$0.16	\$2.98	\$6.54
2024	\$3.49	(\$0.01)	\$3.50	\$5.32
2025	\$3.97	(\$0.01)	\$3.98	\$5.05
2026	\$4.00	(\$0.01)	\$4.01	\$4.99
2027	\$3.95	\$0.02	\$3.93	\$5.00

INDUSTRY METRICS—QUICK SNAPSHOT

	Current	Last Week	WoW Change	%Change
Crude Oil Near-Month Price (\$/bbl)	\$86.06	\$80.15	\$5.91	7%
Natural Gas Near-Month Price (\$/MMBtu)	\$2.70	\$2.64	\$0.06	3%
Weekly Upstream-Deal Transaction Value (\$MM)	\$0.00	\$5,013.60	(\$5,013.60)	(100%)
Weekly Number of Upstream-Deal Transactions	1	3	(2)	(67%)
Current Total US Rig Count	631	632	(1)	(0.2%)
US Field Crude Oil Production (MMbbl/day)	12.8	12.8	0	-
US Field Dry Natural Gas Production (Bcf/day)	108.8	108.5	0.3	0.3%
Commercial Crude Oil Stocks-Excluding SPR (MMbbl)	423	434	(11)	(2%)
Natural Gas Stocks-Working Gas Underground Storage (Bcf)	3,115	3,083	32	1%
Total Drilled But Uncompleted Wells (DUC-Last Month)	4,787	4,787	0	-

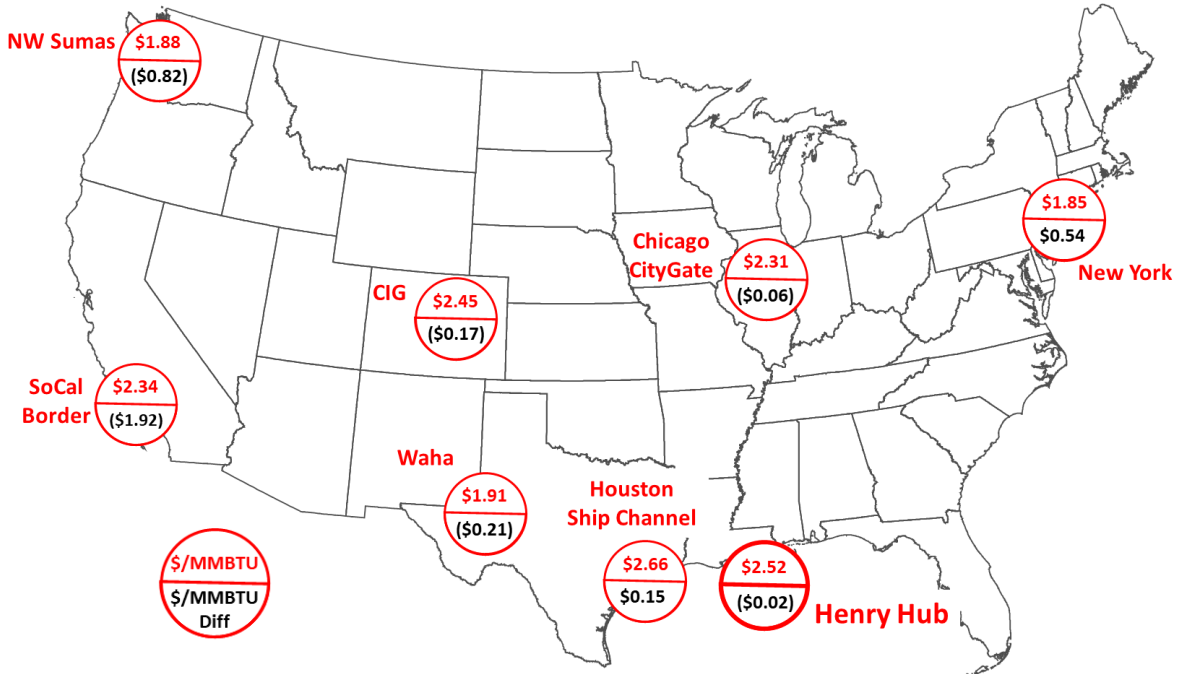
*Source—Energy Information Administration, United States (EIA)

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

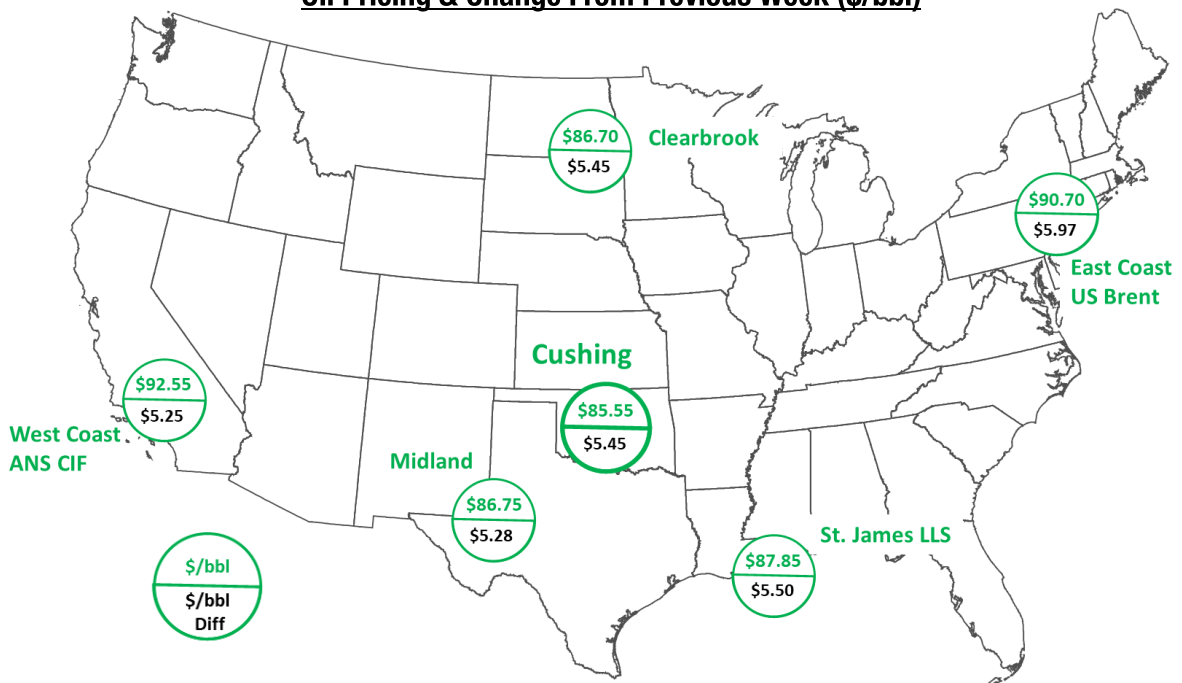


US COMMODITY PRICES CONTINUED

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



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



*Source—Bloomberg LP



SELECTED INDUSTRY HEADLINES

Oil Prices Surge After Saudi Arabia And Russia Extend Production Cuts

Oil prices hit a new high for the year so far after Saudi Arabia and Russia — the world's biggest crude exporters — said they would extend output cuts by at least another three months.

China Is the Oil and Gas Crowd's Biggest Unknown (LOGIN REQUIRED)

As traders, analysts and producers gather for the first time since Asia's largest economy reopened, everyone is reading the tea leaves.

Global Gas Prices Still Seen Volatile, Even As Europe In A Better Position

Global gas prices are expected to remain volatile, even though Europe is better positioned heading into winter this year.

The EU Looks To Make Joint Natural Gas Purchases Permanent

The European Union is considering making its joint natural gas purchasing scheme permanent after its successful launch earlier this year.

Strategists Look At USA Oil Patch Labor Trends

Labor output in the U.S. oil patch has already significantly exceeded the pre-Covid January 2020 level, some strategists highlighted in a report sent to Rigzone recently.

Low US Heating Oil Stockpiles Could Cause Winter Sticker Shocks

Americans could face a sticker shock with their heating bills this winter, especially if it is a chilly one, due to unusually low U.S. stockpiles of distillate fuels following OPEC+ crude supply cuts and higher demand from Europe, analysts said.

China Continues To Lead Wind Power Development

China continued to have the lion's share of wind power activity across the globe in the first half of 2023 accounting for 44 gigawatts (GW) of the world's 69.5 GW of wind turbine order demand during the six months, according to recent reports.

The New Alliance Attempting To Accelerate Hydrogen-Powered Aviation

Several major aviation, transportation, and renewable energy firms have announced the creation of the Hydrogen in Aviation Alliance.

Canada's Oil And Gas Industry Cuts Emissions While Boosting Output

Over the decade to 2021, Canada's oil and gas industry managed to boost production while lowering carbon dioxide and methane emissions.

How Can We Use AI To Address Global Challenges Like Climate Change? (LOGIN REQUIRED)

Climate change is an existential threat, but AI might be our secret weapon against its most destructive impacts.



SELECTED RECENT TRANSACTIONS

Dorchester Minerals, L.P. Completes Acquisition of Mineral and Royalty Interests

Dorchester Minerals, L.P. announced today that it has completed an acquisition of mineral and royalty interests totaling approximately 3,355 gross acres and 568 net royalty acres located in three counties in Texas.

Permian Resources To Buy Earthstone In \$4.5 bln Deal

Permian Resources said it would buy Earthstone Energy in an all-stock transaction valued at about \$4.5 billion, including debt, boosting the shale producer's presence in the Delaware Basin.

Crescent Point Announces Sale Of Its North Dakota Assets

Crescent Point Energy Corp. is pleased to announce that it has entered into an agreement with a private operator to sell its North Dakota assets for US\$500 million.

PHX Minerals Announces Accretive Acquisitions in Haynesville and SCOOP

PHX Minerals Inc. recently announced that it has agreed to acquire approximately 988 net royalty acres targeting the Haynesville play in Louisiana and Texas and the SCOOP play in Oklahoma from five separate sellers for aggregate consideration of \$13.6 million in cash subject to certain closing conditions and adjustments.

Empire Petroleum Announces Acquisition Of Additional Interests In New Mexico Units

Empire Petroleum recently announced that it closed on the acquisition of COERT Holdings 1 LLC's interests in Empire's three New Mexico assets, Eunice Monument South Unit A, Eunice Monument South Unit B, and Arrowhead Grayburg Unit, all of which are located in Lea County. The purchase price for the Transaction was approximately \$6.7 million.

ExxonMobil Announces Acquisition Of Denbury

Exxon Mobil Corporation (NYSE: XOM) today announced it has entered into a definitive agreement to acquire Denbury Inc., an experienced developer of carbon capture, utilization and storage (CCS) solutions and enhanced oil recovery. The acquisition is an all-stock transaction valued at \$4.9 billion, or \$89.45 per share based on ExxonMobil's closing price recently.

Sandridge Energy, Inc. Announces The Closing Of An Acquisition Which Increases Its Interest In Wells It Operates In The Northwest Stack

SandRidge Energy, Inc. today announced the closing of an acquisition which increases its interest in twenty-six producing wells operated by the Company within the Northwest Stack play for approximately \$11.25 million.

Ring Energy Announces Accretive All Cash Asset Acquisition Strategically Expanding Core Operating Area

Ring Energy, Inc. today announced it has entered into an agreement to acquire the Central Basin Platform assets of Founders Oil & Gas IV, LLC for \$75 million in cash. Founders' CBP operations are located in the Permian Basin in Ector County, Texas and are focused on the development of approximately 3,600 net acres that are similar to Ring's CBP assets acquired in 2022 from Stronghold Energy Operating II, LLC and its affiliate.

Zenith Energy Expands Its US Presence With Stateside Energy LLC Deal

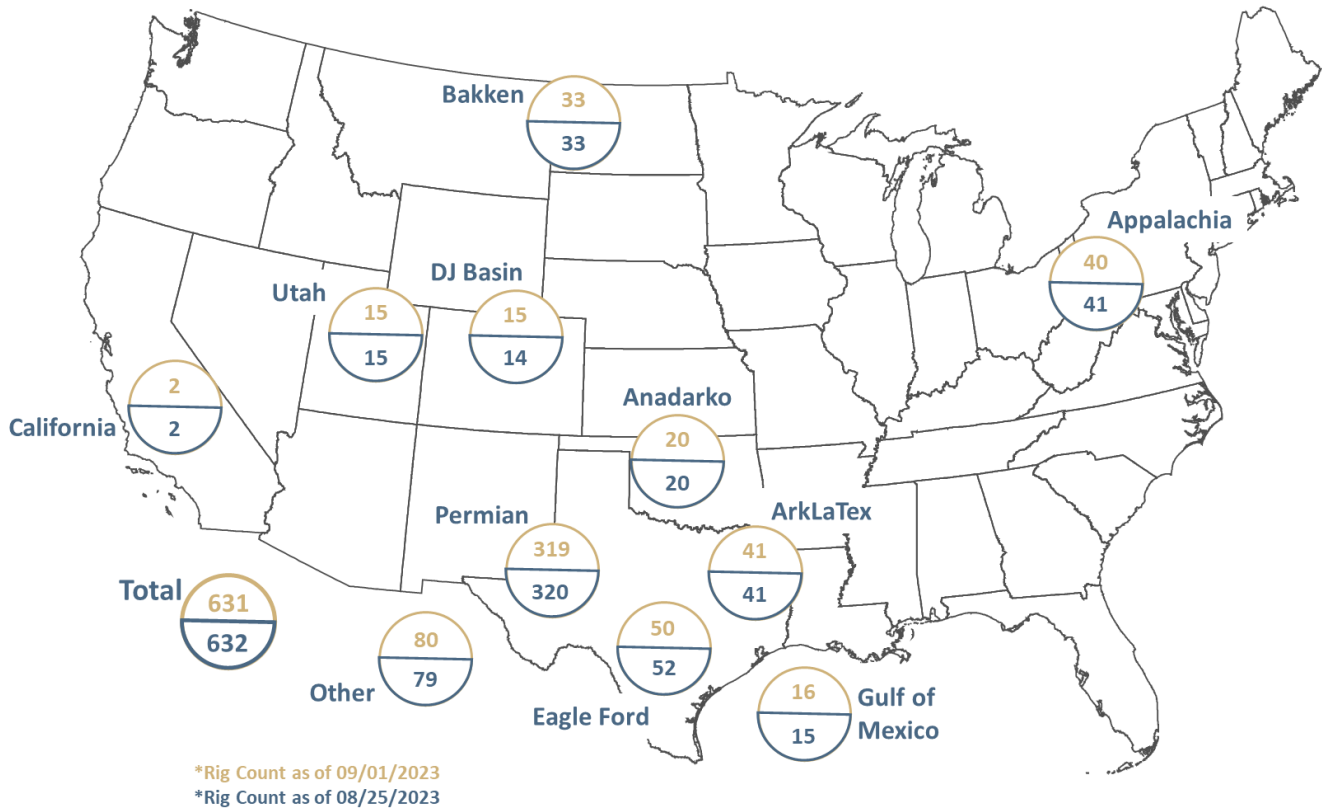
Zenith Energy Ltd. the international energy production company with assets in Africa and Europe, has announced that it has entered into an agreement with Stateside Energy LLC, an Oklahoma-based oil and gas operator, to acquire and operate a portfolio of oil production and development licences in Oklahoma, as well as certain other states in the USA.

Civitas Resources to Enter Permian Basin through Transformative Transactions

Civitas has also agreed to purchase Hibernia's Midland Basin assets for \$2.25 billion in cash, subject to customary purchase price adjustments.



RIG ACTIVITY BY US REGION

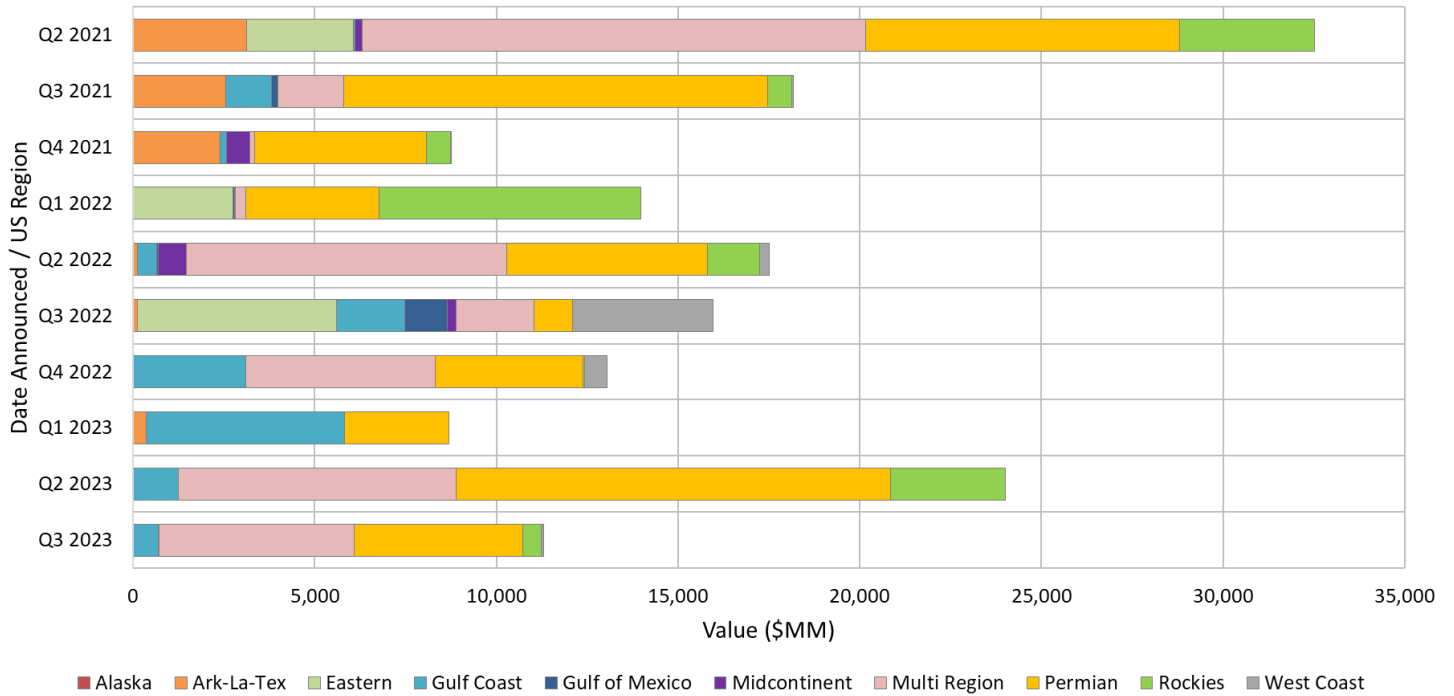


	Week Ending 09/01/2023			Week Ending 08/25/2023		Week Ending 09/02/2022
U.S. Rig Breakouts	Count	+/-	Count	+/-	Count	
Oil	512	0	512	(84)	596	
Gas	114	(1)	115	(48)	162	
Not Specified	5	0	5	3	2	
Directional	51	1	50	12	39	
Horizontal	566	(1)	567	(129)	695	
Vertical	14	(1)	15	(12)	26	
Land (Inc Others)	611	(2)	613	(130)	741	
Inland Waters	3	0	3	0	3	
Offshore	17	1	16	1	16	
US Total	631	(1)	632	(129)	760	

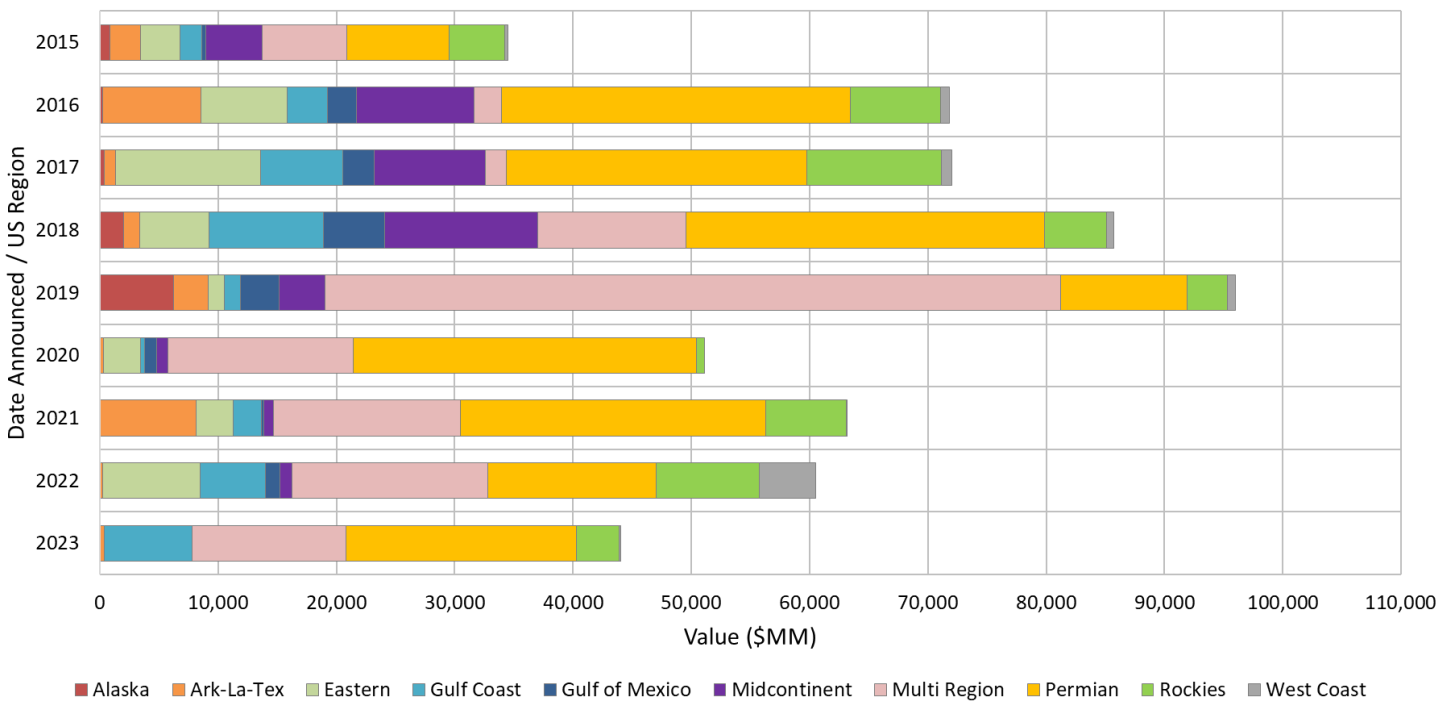
*Source—Baker Hughes Weekly Rig Counts



DEAL VALUE BY US REGION (BY QUARTER)



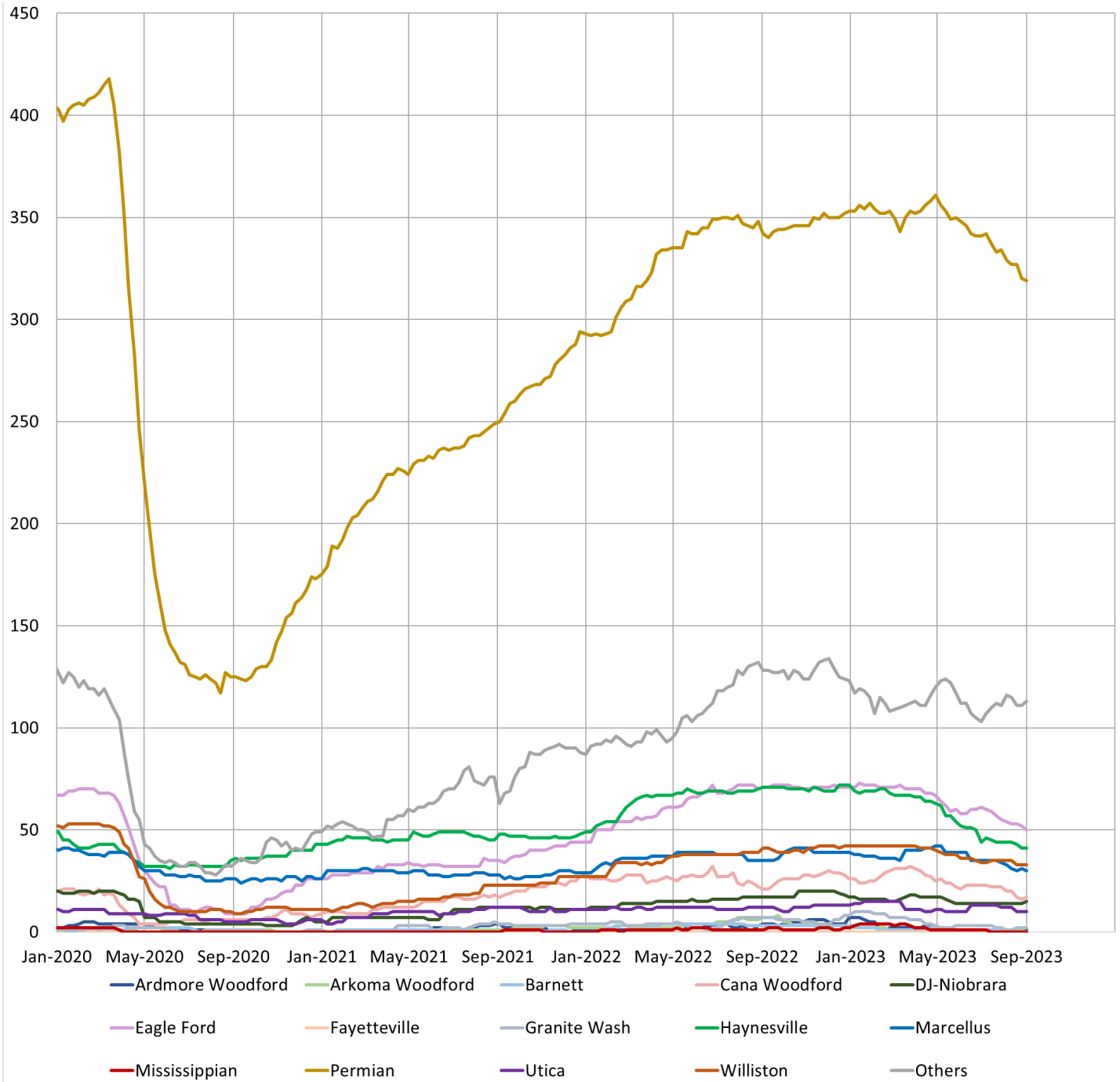
DEAL VALUE BY US REGION (BY YEAR)



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



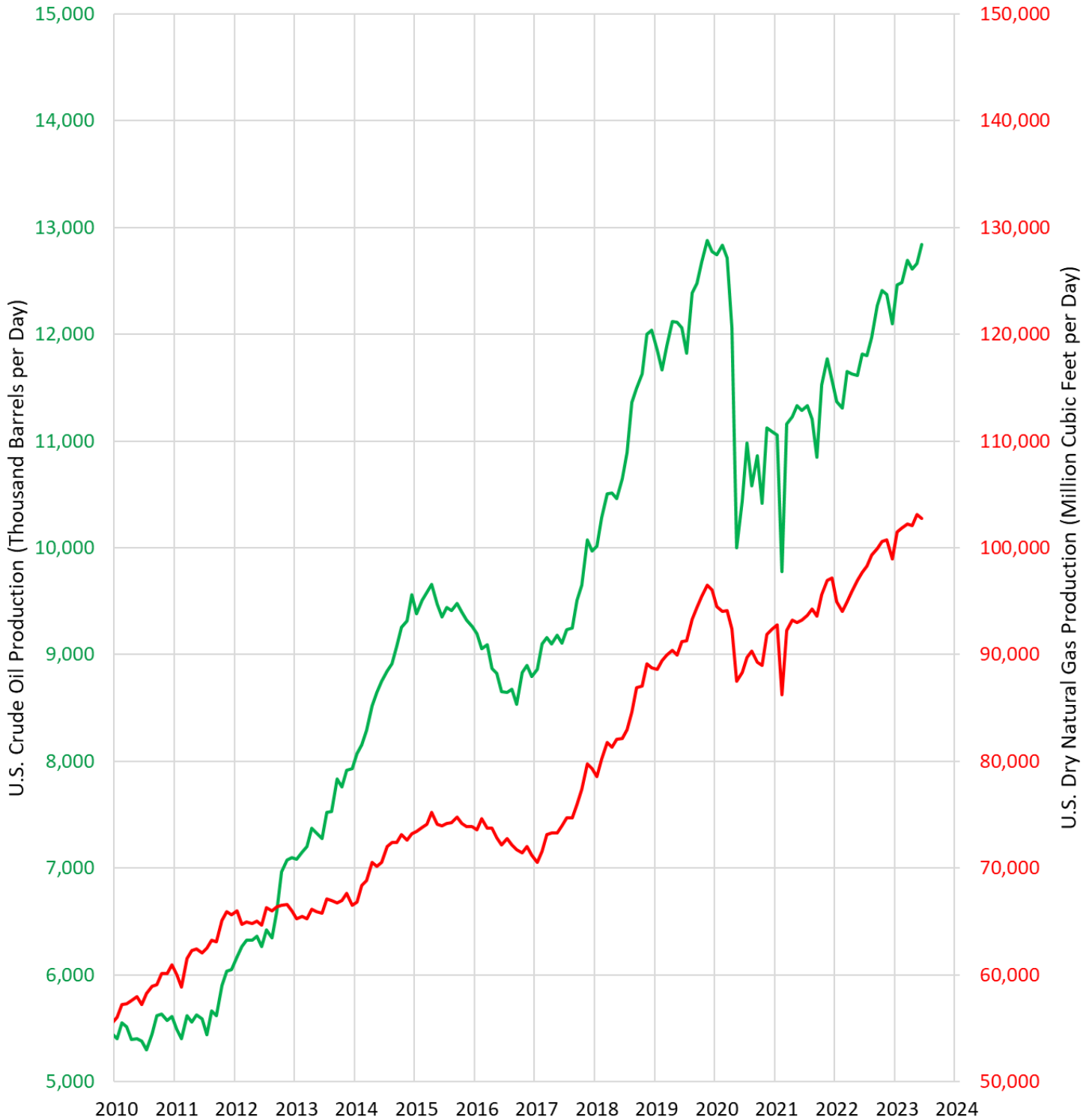
RIG ACTIVITY BY US REGION



*Source—Baker Hughes Weekly Rig Counts



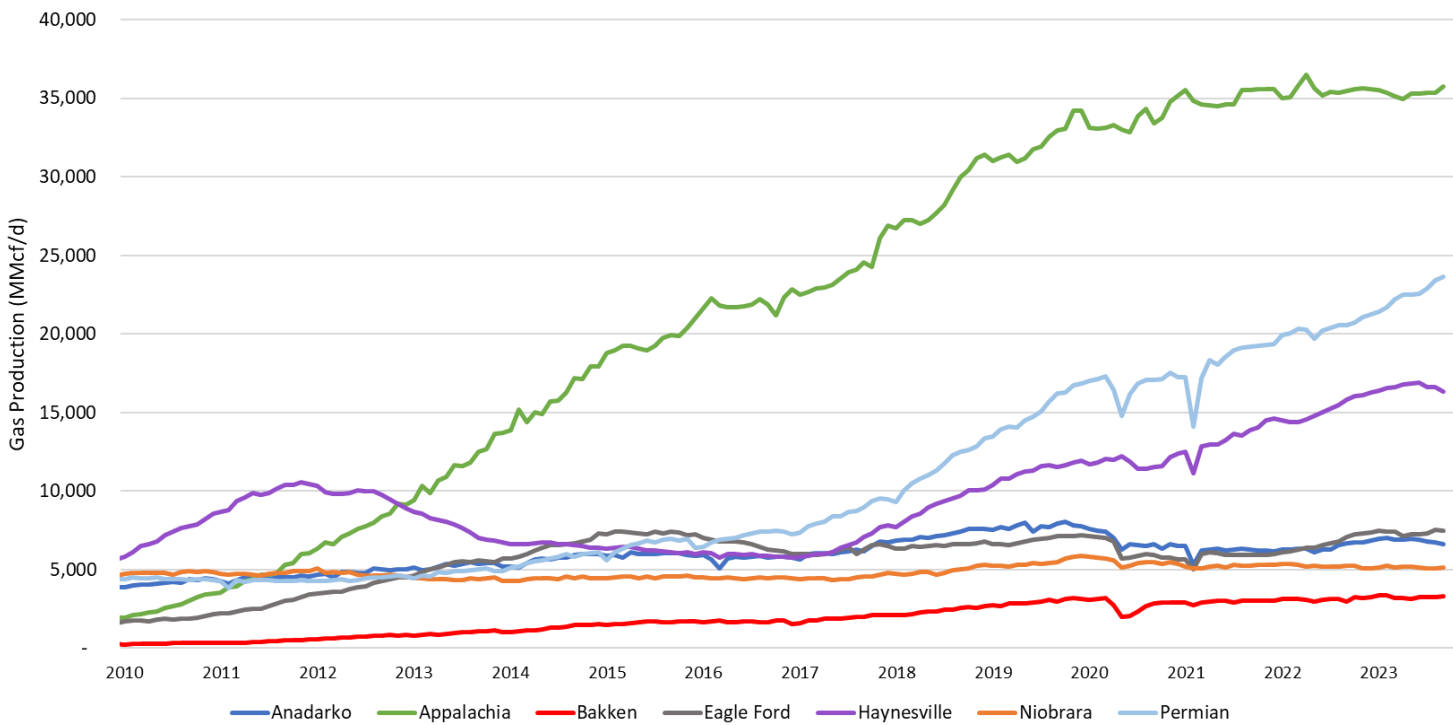
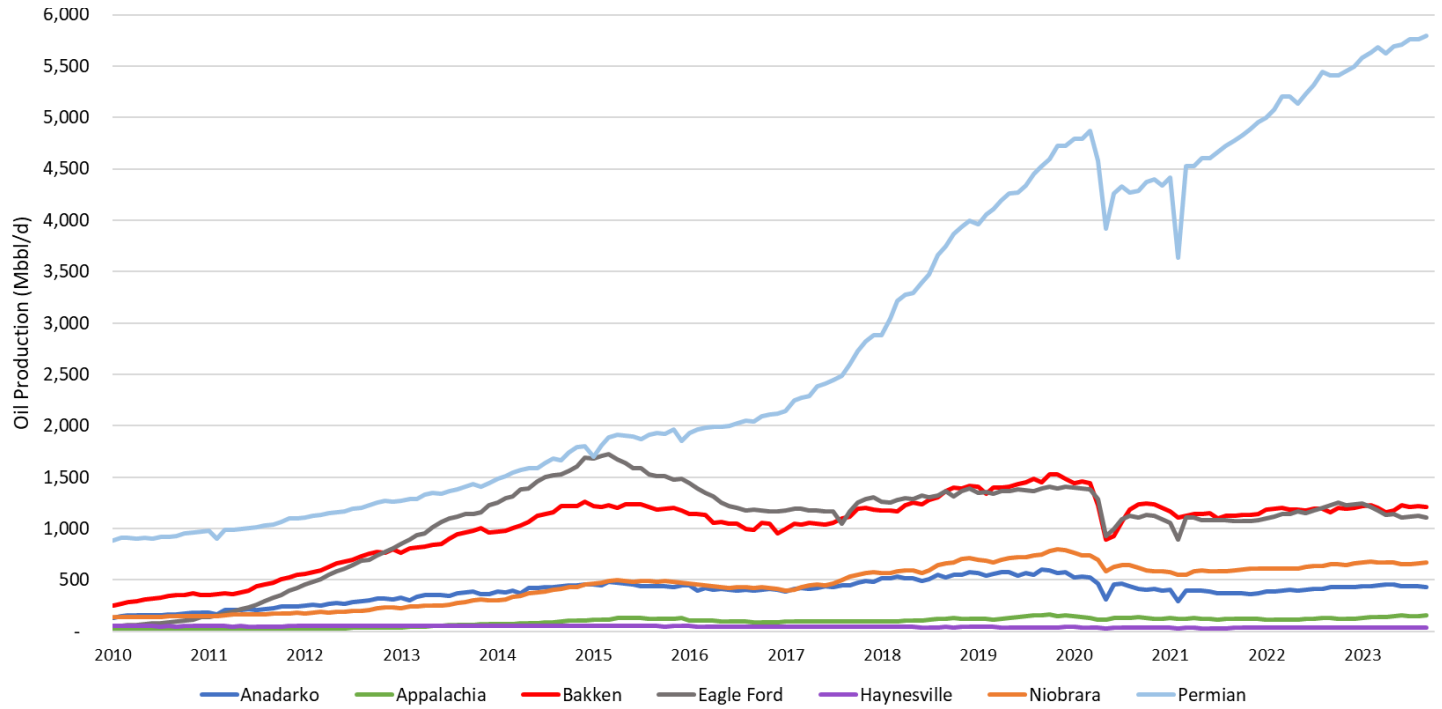
US DAILY CRUDE (MMbbl) & DRY NATURAL GAS PRODUCTION (MMcf)



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



HISTORICAL PRODUCTION OF SELECTED US SHALE REGIONS



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



UPCOMING EVENTS

September 2023

<u>YPE 11th Annual Clay Shoot For A Cause</u>	September 12	Houston, TX
<u>DCAC Art For Advocacy</u>	September 16	Dallas, TX
SEARCH 3rd Annual Cornhole Tournament	September 20	Houston, TX
<u>SPE Business Development – Permian Panel</u>	September 20	Houston, TX
<u>HEFG Wine and Whiskey Event</u>	September 21	Houston, TX
<u>Enertia User Conference</u>	September 21-22	Fort Lauderdale, FL
<u>HPF 29th Annual Golf Tournament</u>	September 25	Cypress, TX
<u>World Oilman's Overnight Poker Tournament (WOOP)</u>	September 28-29	Lake Charles, LA

October 2023

<u>Hart Energy—Energy Capital Conference</u>	October 2	Dallas, TX
<u>Hart Energy—A&D Strategies and Opportunities Conference</u>	October 3	Dallas, TX
<u>2023 National Conference of Bankruptcy Judges (NCBJ)</u>	October 11-14	Austin, TX
<u>Tulsa Octoberfest</u>	October 19-22	Tulsa, OK
<u>Small Steps Golf Classic</u>	October 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.

