



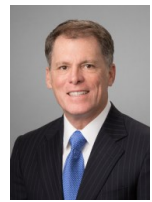
Weekly E&P Update

March 14, 2023

Vol. 10

Willow Field Approval Highlights Nanushuk Potential

By Steve Hendrickson
President of Ralph E. Davis Associates



Earlier this week, the Biden Administration approved ConocoPhillips' Willow Project in the [Alaskan National Petroleum Reserve](#). Approval of the project represents a significant reversal of the Administration's position on new oil development within federal lands. It has prompted an outcry by certain groups concerned about the potential carbon emissions generated if the oil is ultimately produced and burned. The project may produce 600 million barrels of oil equivalent over 30 years, which sounds like a lot, but would account for only about 0.06% of global oil production (if all the "equivalents" are oil) over the same period assuming the current global rate of 100 million barrels per day is maintained.

An accumulation of this size is interesting from a petroleum engineering perspective, so I decided to look closer. Here's a quick summary of a [presentation made in 2018](#) by Joe Chmielowski of the Alaska Division of Oil and Gas.

The Willow Field is located on Alaska's North Slope and occurs in the Cretaceous strata that are part of the "Brookian" sequence. This sequence is so-named because the rocks are related to the erosion of the Brooks Range, which was formed about 126 MYA; deposition of the sequence occurred from then until about 2 MYA. This sequence, combined with Ellesmerian and Beaufortian, makes up the [North Slope Basin](#) which has about 40,000 feet of sediments. Frequent sea level changes during Brookian time set up a condition for sandstone deposition with alternating layers of marine shale.

The Willow Field was "discovered" in 2002 in the Nanushuk formation, but it [wasn't fully appreciated until further delineated in 2017](#). Explorationists initially overlooked the Nanushuk formation, but recognition of its potential has grown significantly. For instance, in 2018, Willow was expected to hold only about 300 million barrels of recoverable resources.

Part of the excitement lies in the excellent reservoir properties of the Nanushuk. At Willow, the Nanushuk occurs at about 3,600 feet, and the low depth of burial has helped preserve reservoir porosity and permeability. A [2021 paper](#) by the Alaska Department of Natural Resources shows the results of core analysis from several Nanushuk wells and photographs in which the quality of the sandstone is readily apparent. Depending on the depositional facies, porosities from rocks above 7,000 feet range from 10-30%, and permeabilities of many samples exceed 100 mD.

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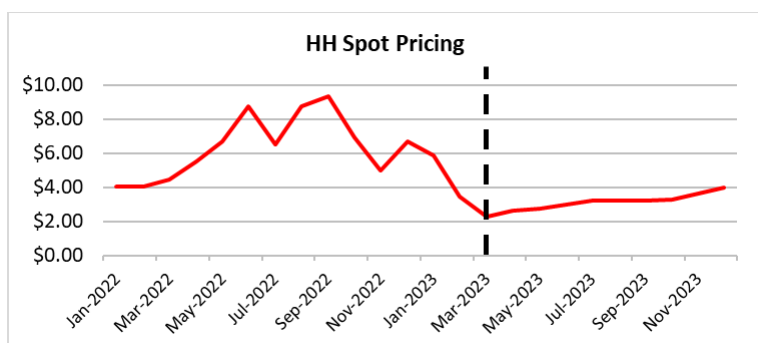
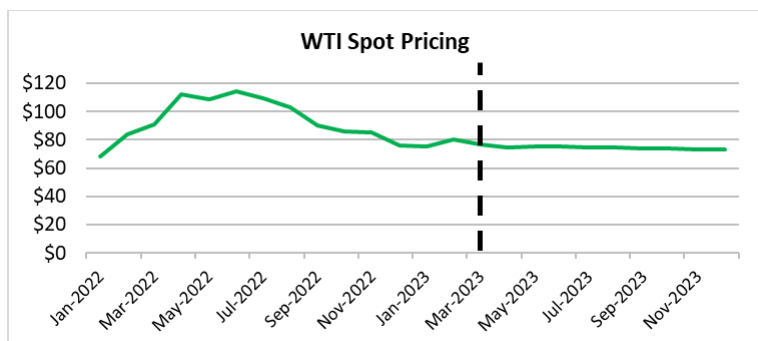
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NYMEX FUTURE PRICING



MONDAY'S MARKET CLOSE

NYMEX WTI CRUDE OIL FUTURES as of March 13, 2023 Close (\$/bbl)

Period	Current	WoW Change	Last Week	1 Yr Ago
2023	\$74.24	(\$5.37)	\$79.61	\$84.18
2024	\$70.57	(\$4.33)	\$74.90	\$76.97
2025	\$66.88	(\$3.24)	\$70.12	\$72.25
2026	\$63.80	(\$2.33)	\$66.13	\$68.84
2027	\$61.11	(\$1.62)	\$62.73	\$66.62

NYMEX HH NATURAL GAS FUTURES as of March 13, 2023 Close (\$/MMBtu)

Period	Current	WoW Change	Last Week	1 Yr Ago
2023	\$3.19	\$0.04	\$3.15	\$3.98
2024	\$3.78	(\$0.01)	\$3.79	\$3.49
2025	\$4.25	\$0.09	\$4.16	\$3.43
2026	\$4.33	\$0.11	\$4.22	\$3.45
2027	\$4.28	\$0.01	\$4.27	\$3.51

INDUSTRY METRICS—QUICK SNAPSHOT

	Current	Last Week	WoW Change	%Change
Crude Oil Near-Month Price (\$/bbl)	\$76.60	\$77.89	(\$1.29)	(2%)
Natural Gas Near-Month Price (\$/MMBtu)	\$2.43	\$2.79	(\$0.36)	(13%)
Weekly Upstream-Deal Transaction Value (\$MM)	\$145.00	\$2,830.00	(\$2,685.00)	(95%)
Weekly Number of Upstream-Deal Transactions	5	6	(1)	(17%)
Current Total US Rig Count	746	749	(3)	(0.4%)
US Field Crude Oil Production (MMbbl/day)	12.2	12.3	(0.1)	(0.8%)
US Field Dry Natural Gas Production (Bcf/day)	105.1	105.9	(0.8)	(0.8%)
Commercial Crude Oil Stocks-Excluding SPR (MMbbl)	479	480	(1)	(0.4%)
Natural Gas Stocks-Working Gas Underground Storage (Bcf)	2,030	2,114	(84)	(4%)
Total Drilled But Uncompleted Wells (DUC-Last Month)	4,671	4,671	0	-

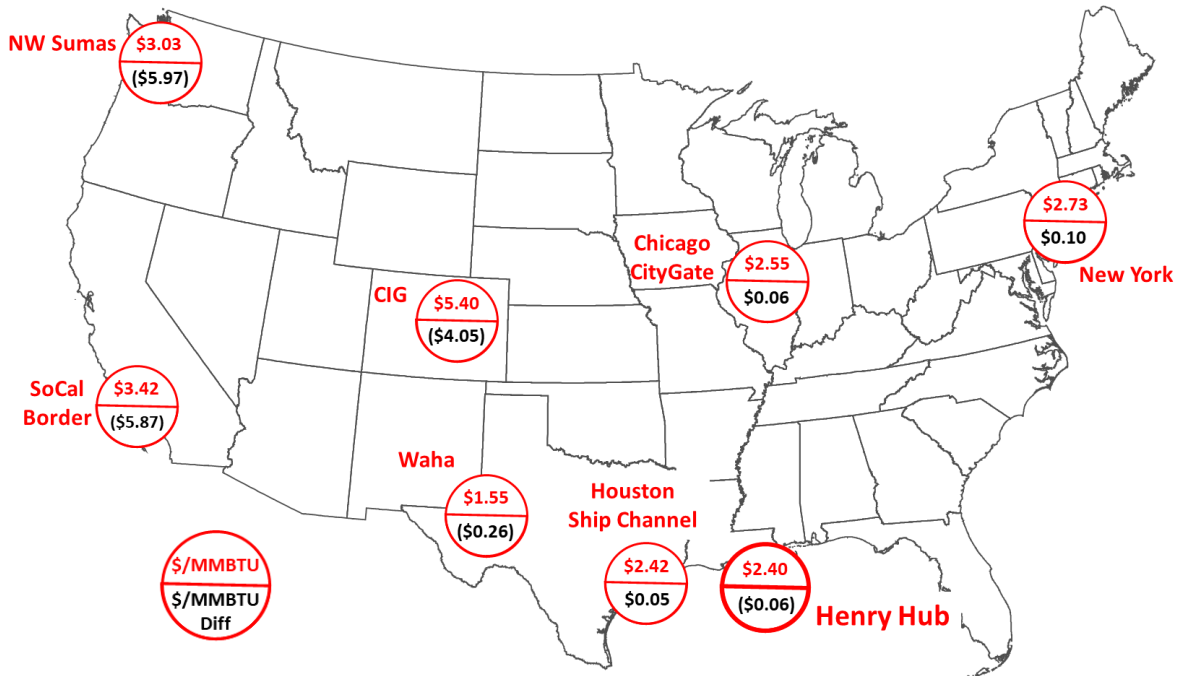
*Source—Energy Information Administration, United States (EIA)

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

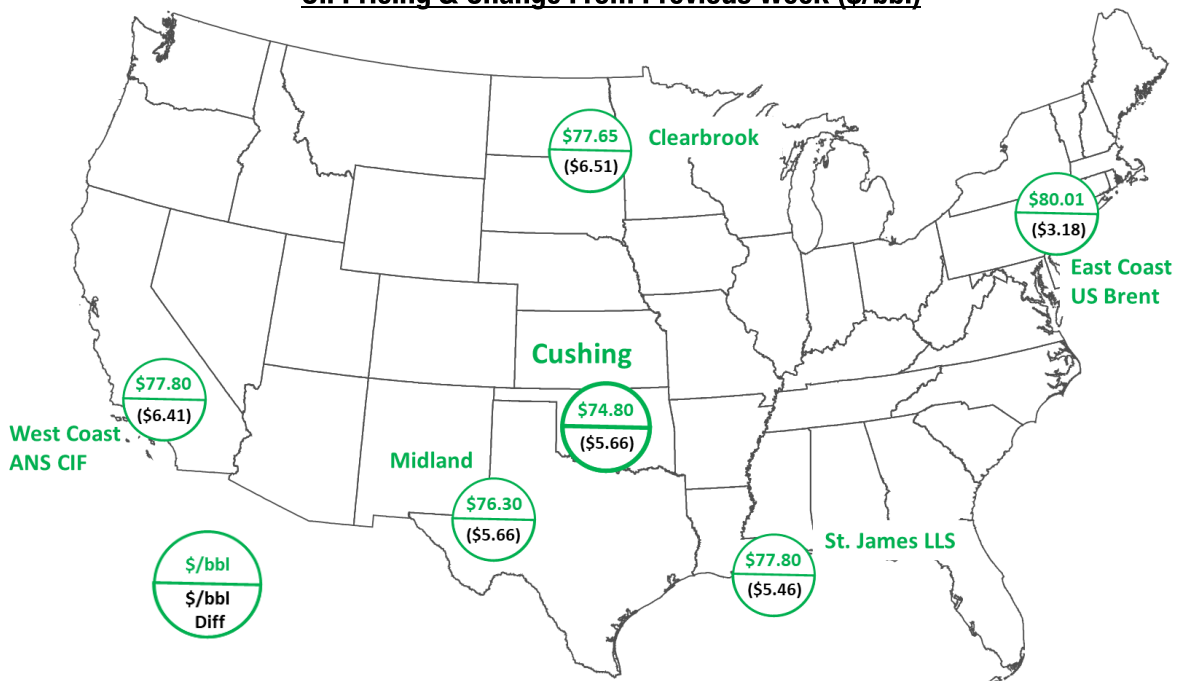


US COMMODITY PRICES CONTINUED

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



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



*Source—Bloomberg LP



SELECTED INDUSTRY HEADLINES

Biden Administration To Limit Oil Leasing In Arctic Amidst ConocoPhillips' "Willow" Oil Project Approval

President Biden is expected to prohibit oil and gas leasing across the entirety of the United States' territory in the Arctic Ocean, an administration official confirmed recently.

Big Oil Is Flush With Cash, But Doesn't Know Where To Spend It

Oil majors are considering a change in strategy for Europe because of windfall taxes and want to spend more on upstream oil and gas, but need long-term demand for their products in order to do so.

Will We See A Return Of Triple Digit Oil This Year?

Despite fears of rising interest rates, many large oil traders expect crude prices to creep back toward \$100 in the second half of 2023.

Regulators Cut Pressure On Pipeline After Kansas Oil Spill

U.S. government regulators have stopped allowing a large part of the Keystone oil pipeline to operate at higher-than-normal pressures following a massive oil spill in northeastern Kansas in December.

Kazakhstan Faces Political Pressure To Diversify Its Oil Export Routes

Kazakhstan aims to increase its oil exports via the main export pipeline to Russia by more than a third by the end of next year.

Saudi Arabia Set To Supply Full Crude Oil Volumes To Asia In April

Saudi Arabia's oil giant Aramco will supply next month the full contracted volumes of crude to at least four refiners in North Asia, sources shared recently.

Scientists Find A Way To Suck Up Carbon Pollution, Turn It Into Baking Soda And Store It In The Oceans

Scientists have set out a way to suck planet-heating carbon pollution from the air, turn it into sodium bicarbonate and store it in oceans, according to a new study.

Are Oil Prices Likely to Remain Volatile Throughout 2023?

Recent reports from a source told Rigzone that there are still many unanswered questions, "chief among which is the extent of the rebound in China's oil demand as its economy opens up".

Saudi Arabia and Iran Ease Mideast Rift That Rattled Oil

Iran and Saudi Arabia will restore diplomatic ties, easing a geopolitical rivalry in the Persian Gulf that has unnerved oil markets.

Oil Production From Argentina Shale To Create Surplus In Energy Trade

Booming oil production out of shale patch Vaca Muerta will create surpluses in energy trade for Argentina to the tune of \$8 billion within a few years, Energy Undersecretary Flavia Royon said in an interview recently.

World Bank To Support African Natural Gas Development To Boost Energy Security

The World Bank will support the development of Mozambique's giant natural gas resources if it's the cheapest way to boost energy security in one of the world's poorest nations, according to a recent official statement.



SELECTED RECENT TRANSACTIONS

Carrier Energy Partners II Sells Eagle Ford Assets

Carrier Energy Partners II, LLC has closed on the sale of its oil and gas assets in the Eagle Ford Shale in South Texas for total cash consideration of \$145 million.

CPP Investments Partners with IKAV to Acquire Aera Energy

Canada Pension Plan Investment Board (CPP Investments) will partner with international asset management group IKAV to acquire California energy producer Aera Energy LLC.

Riley Permian Announces New Mexico Yeso Trend Acquisition

Riley Exploration Permian, Inc. recently announced that it has entered into a definitive purchase agreement to acquire oil and gas assets from Pecos Oil & Gas, LLC, an affiliate of Cibolo Energy Partners LLC, for cash consideration of \$330 million.

Baytex to Acquire Eagle Ford Operator Ranger Oil, Accelerates Shareholder Returns and Introduces a Dividend with Enhanced Free Cash Flow

Baytex Energy Corp. recently announced that it has entered into a definitive agreement to acquire Ranger Oil Corporation, a pure play Eagle Ford company.

Diamondback Energy, Inc. Announces Fourth Quarter And Full Year 2022 Financial And Operating Results; Increases Base Dividend

Diamondback Energy, Inc. recently announced financial and operating results for the fourth quarter and full year ended December 31, 2022, which includes entering into definitive agreements to divest certain Midland and Delaware Basin assets in Texas.

Chesapeake Energy Corporation Announces Sale Of Second Eagle Ford Package For \$1.4 Billion

Chesapeake Energy Corporation recently announced that it has executed an agreement to sell a portion of its remaining Eagle Ford asset to INEOS Energy for \$1.4 billion.

Verde Bio Holdings, Inc. Announces Acquisition Of Haynesville Shale Mineral And Royalty Interest

Verde Bio Holdings, Inc. recently announced that it has entered into an agreement to acquire revenue producing mineral and royalty interests in the prolific Haynesville Shale of Northern Louisiana, held by a private seller for a purchase price of \$425,000 in cash.

Foothills Exploration Acquires Certain Leases and Wells In Oklahoma

Foothills Exploration recently announced that it had managed to complete the acquisition of some wells and leases in Comanche County in Oklahoma.

Vital Energy Announces Midland Basin Acquisition

Vital Energy, Inc. recently announced the signing of a definitive purchase and sale agreement to acquire the assets of Driftwood Energy Operating, LLC, inclusive of all leasehold interests and hedges, in exchange for 1,578,948 shares of Vital common stock and \$127.6 million of cash.

Surge Energy America Announces Recent Acreage Acquisitions and Finalization of Houston Corporate Office Move

Surge Energy US Holdings Company recently announced it has recently added incremental acreage to the Company's portfolio. Additionally, earlier this month the company finalized the previously announced move of its corporate office.

Alliance Resource Partners, L.P. Announces \$72.3 Million Mineral Acquisition

Alliance Resource Partners, L.P. recently announced a \$72.3 million acquisition of oil & gas mineral interests in the Permian Basin from JC Resources LP.

INPEX Sells Eagle Ford Tight Oil Production And Development Assets To Repsol

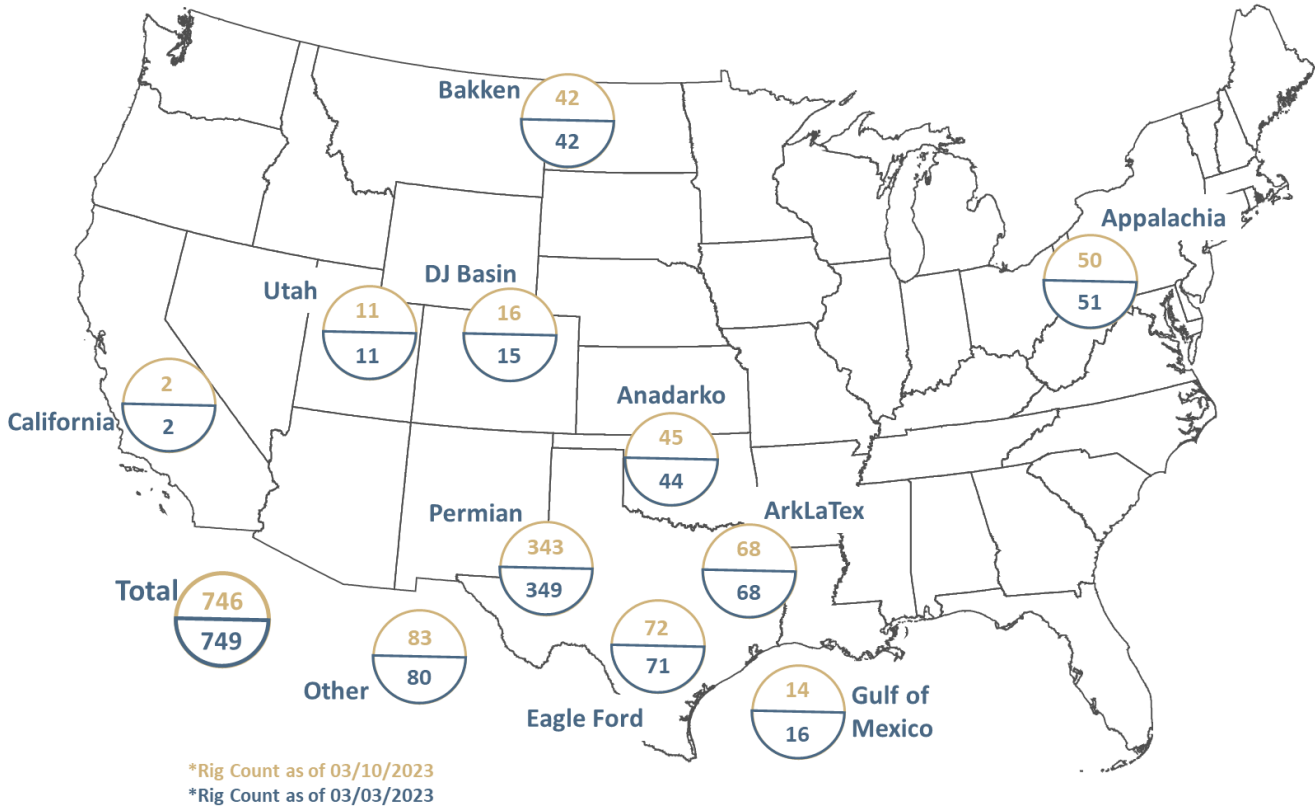
Japan's INPEX Corporation has sold its Eagle Ford assets to Repsol Oil & Gas USA, a subsidiary of Spanish energy company Repsol.

Elk Range Royalties Announces Acquisition in the Permian Basin and Launch of Elk Range Royalties II

Elk Range Royalties, LP recently announced it has closed an acquisition of Permian Basin mineral and royalty interests pursuant to a purchase and sale agreement with Tower Rock Oil & Gas and its affiliates.



RIG ACTIVITY BY US REGION

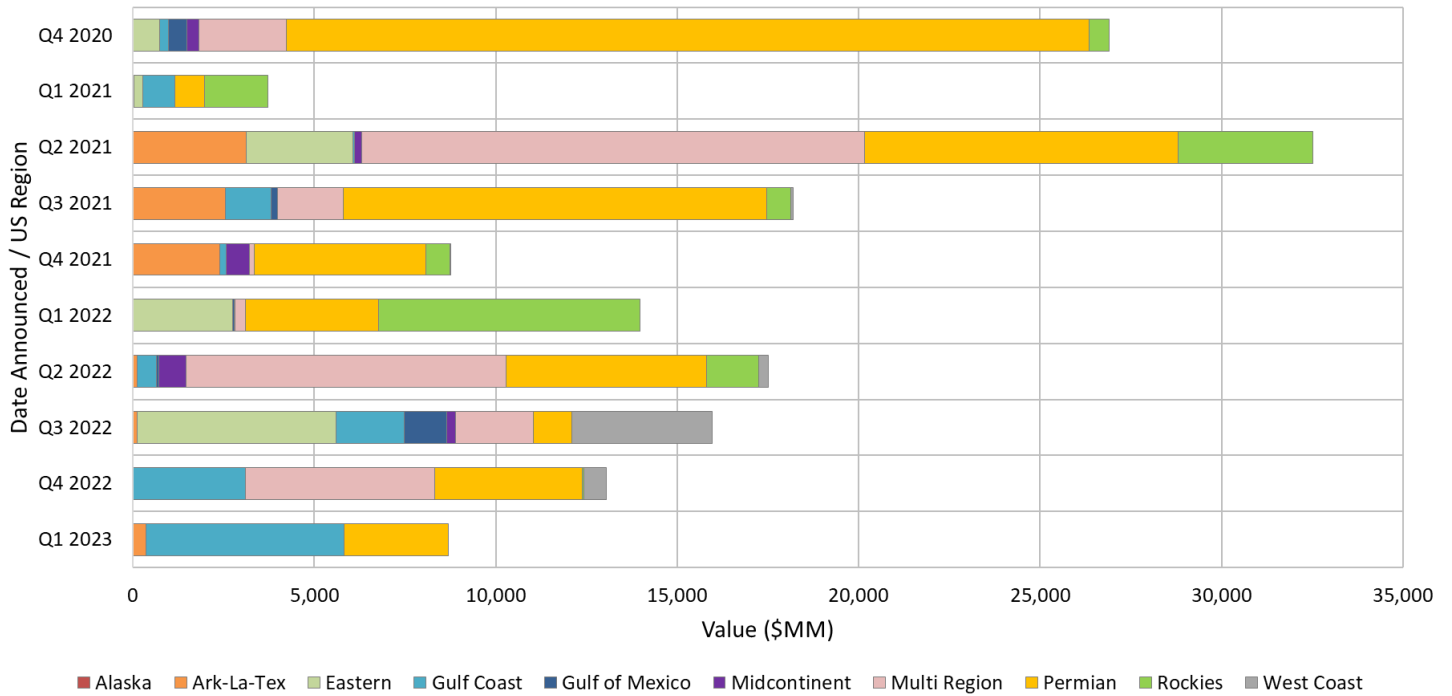


U.S. Rig Breakouts	Week Ending 03/10/2023			Week Ending 03/03/2023		Week Ending 03/11/2022
	Count	+/-	Count	+/-	Count	
Oil	590	(2)	592	63	527	
Gas	153	(1)	154	18	135	
Not Specified	3	0	3	2	1	
Directional	42	(3)	45	9	33	
Horizontal	692	2	690	85	607	
Vertical	12	(2)	14	(11)	23	
Land (Inc Others)	731	(1)	732	82	649	
Inland Waters	1	0	1	(2)	3	
Offshore	14	(2)	16	3	11	
US Total	746	(3)	749	83	663	

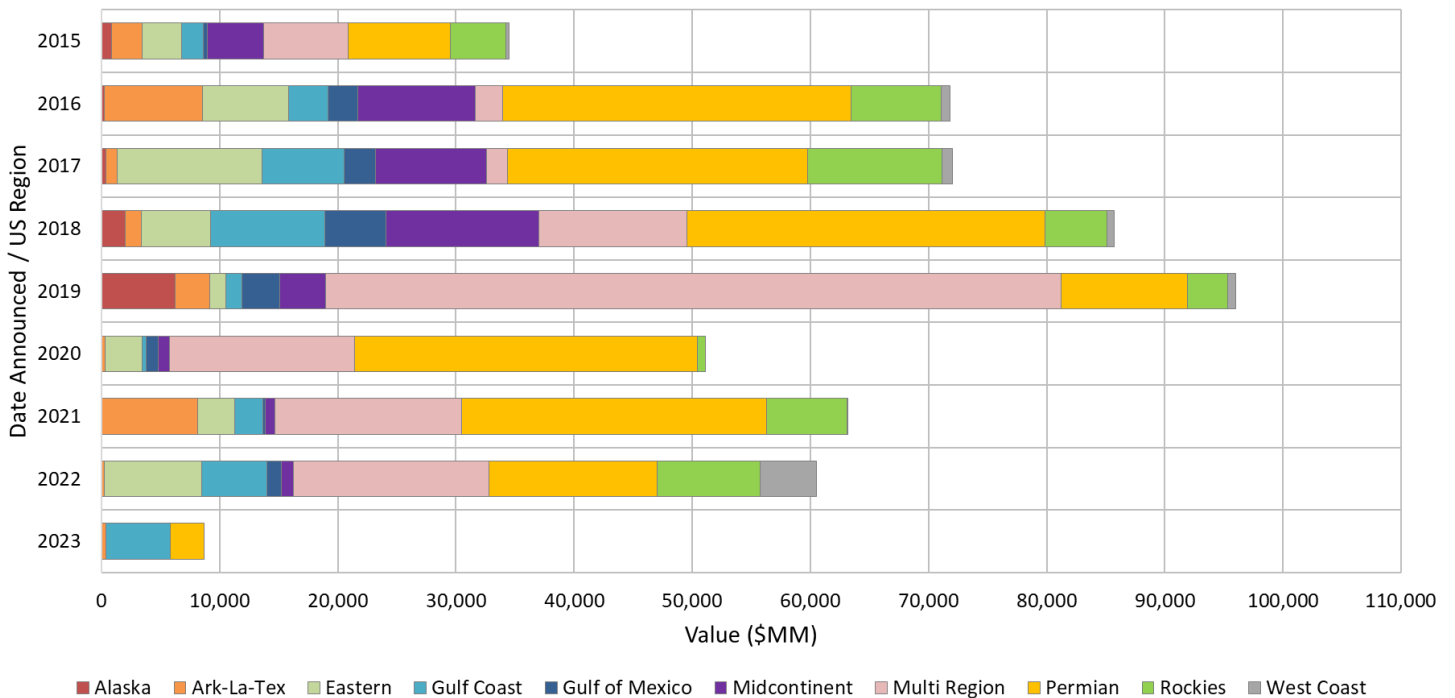
*Source—Baker Hughes Weekly Rig Counts



DEAL VALUE BY US REGION (BY QUARTER)



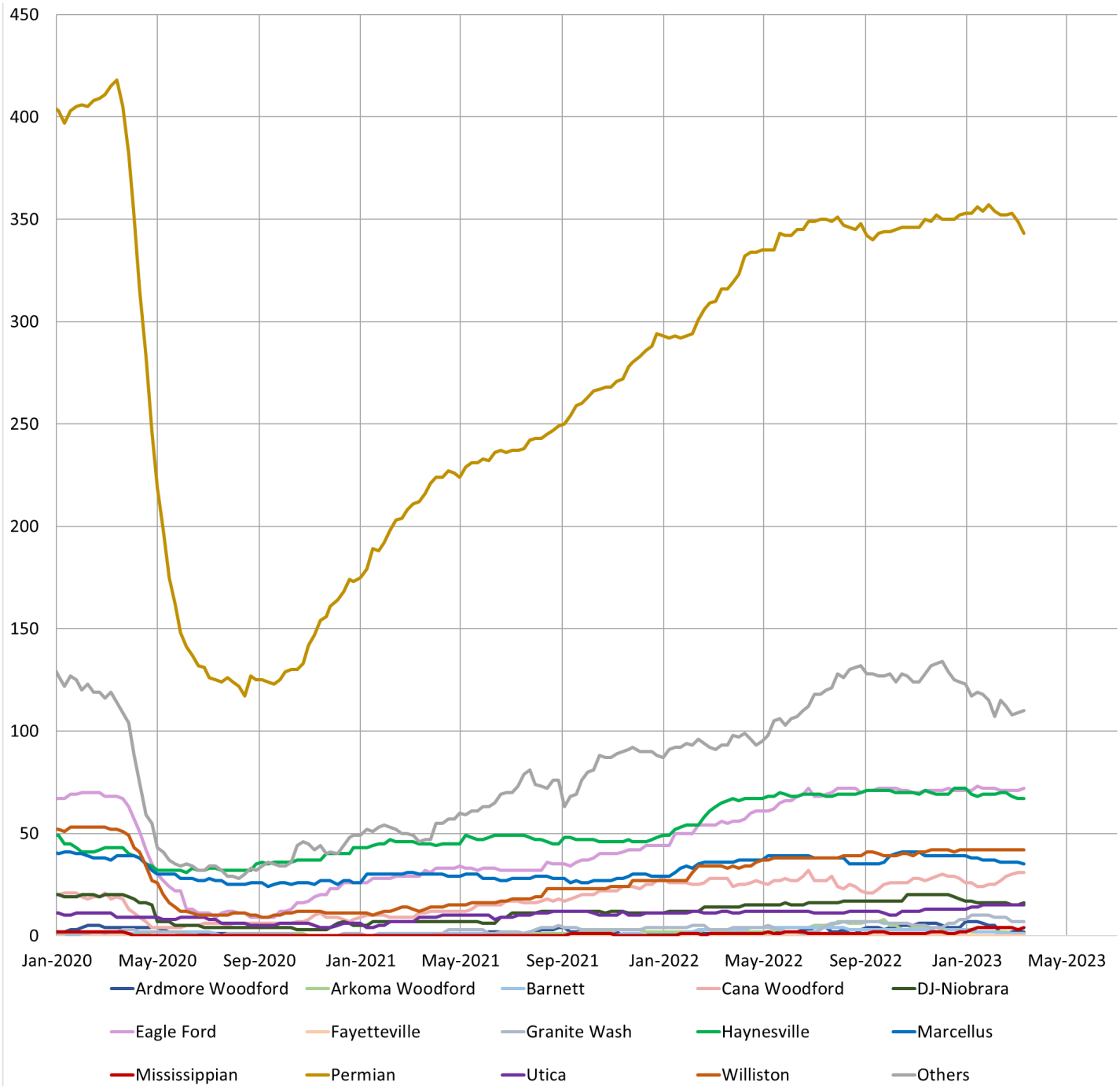
DEAL VALUE BY US REGION (BY YEAR)



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



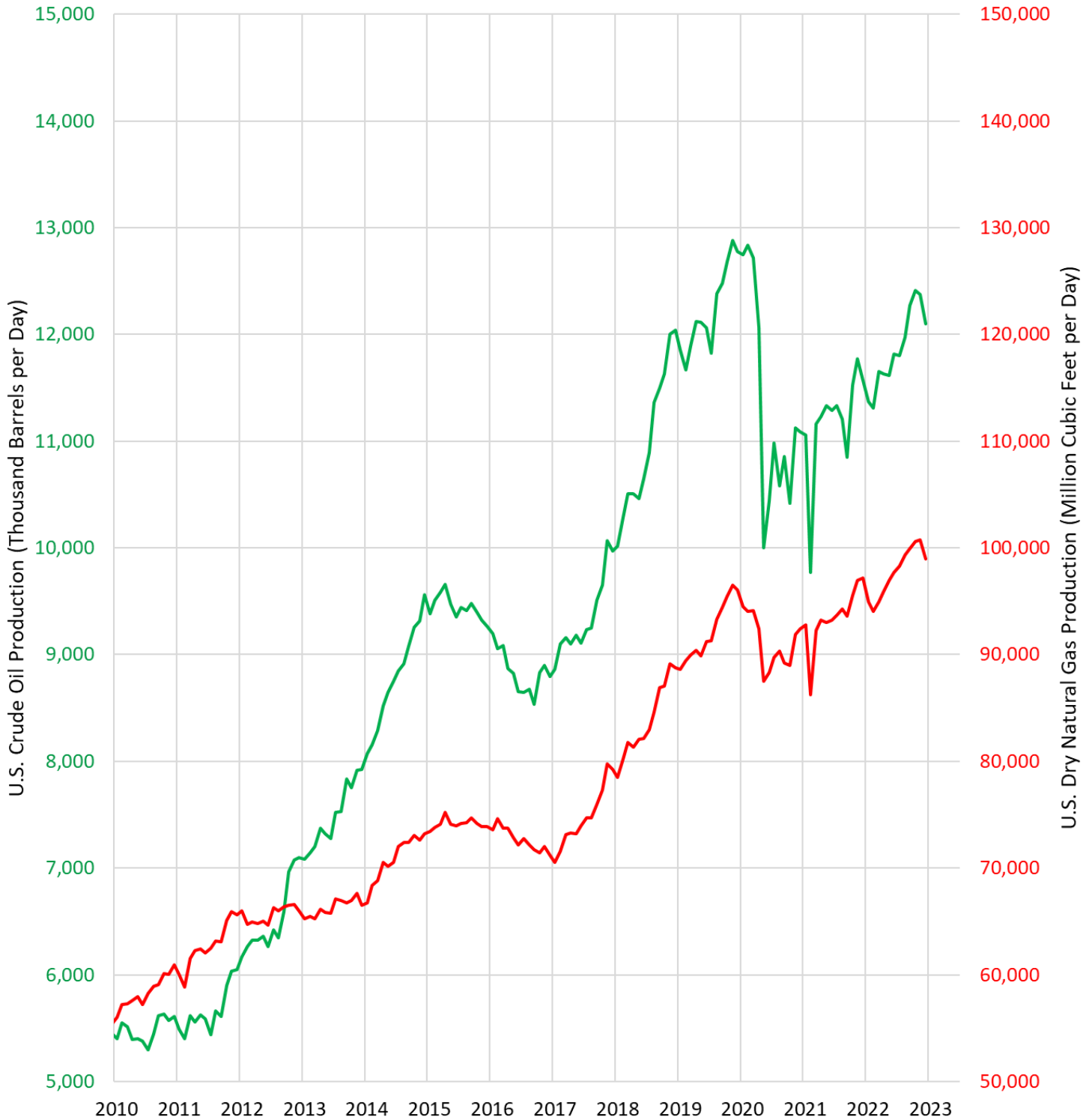
RIG ACTIVITY BY US REGION



*Source—Baker Hughes Weekly Rig Counts



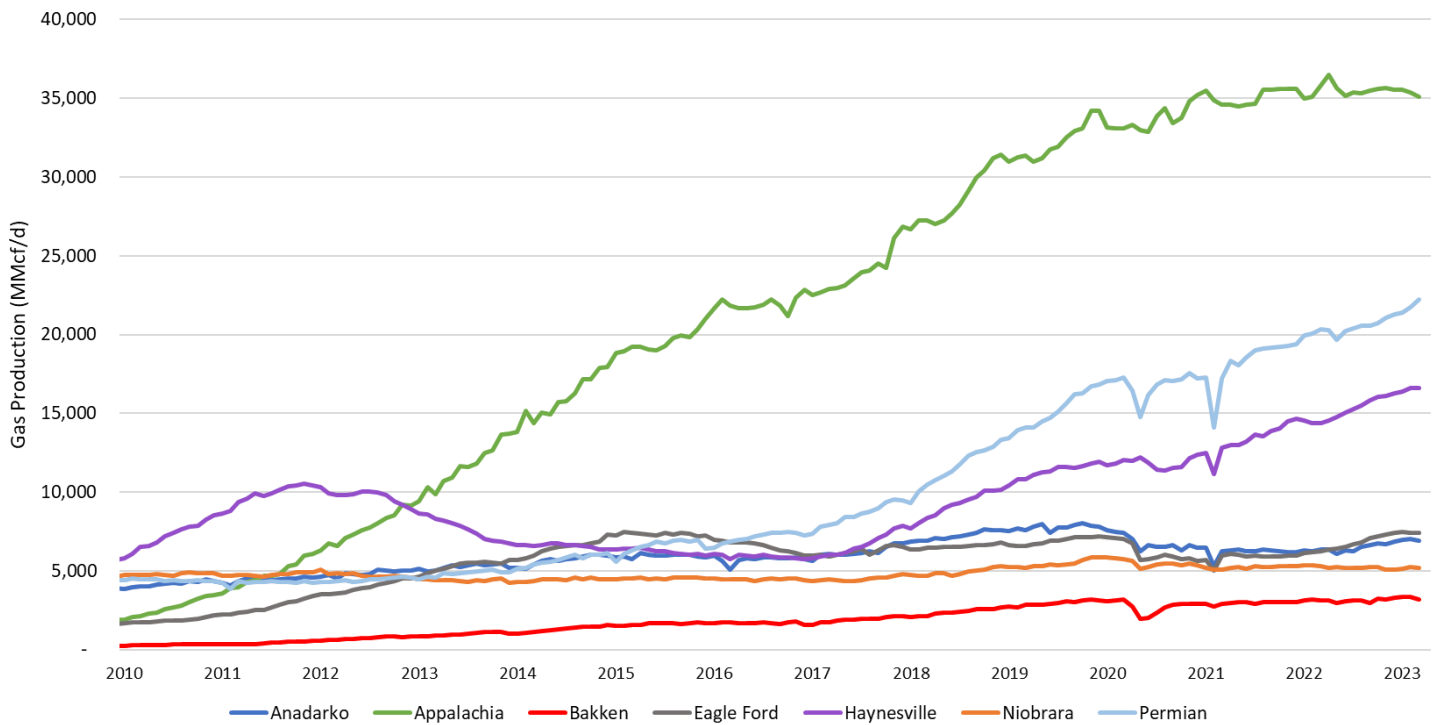
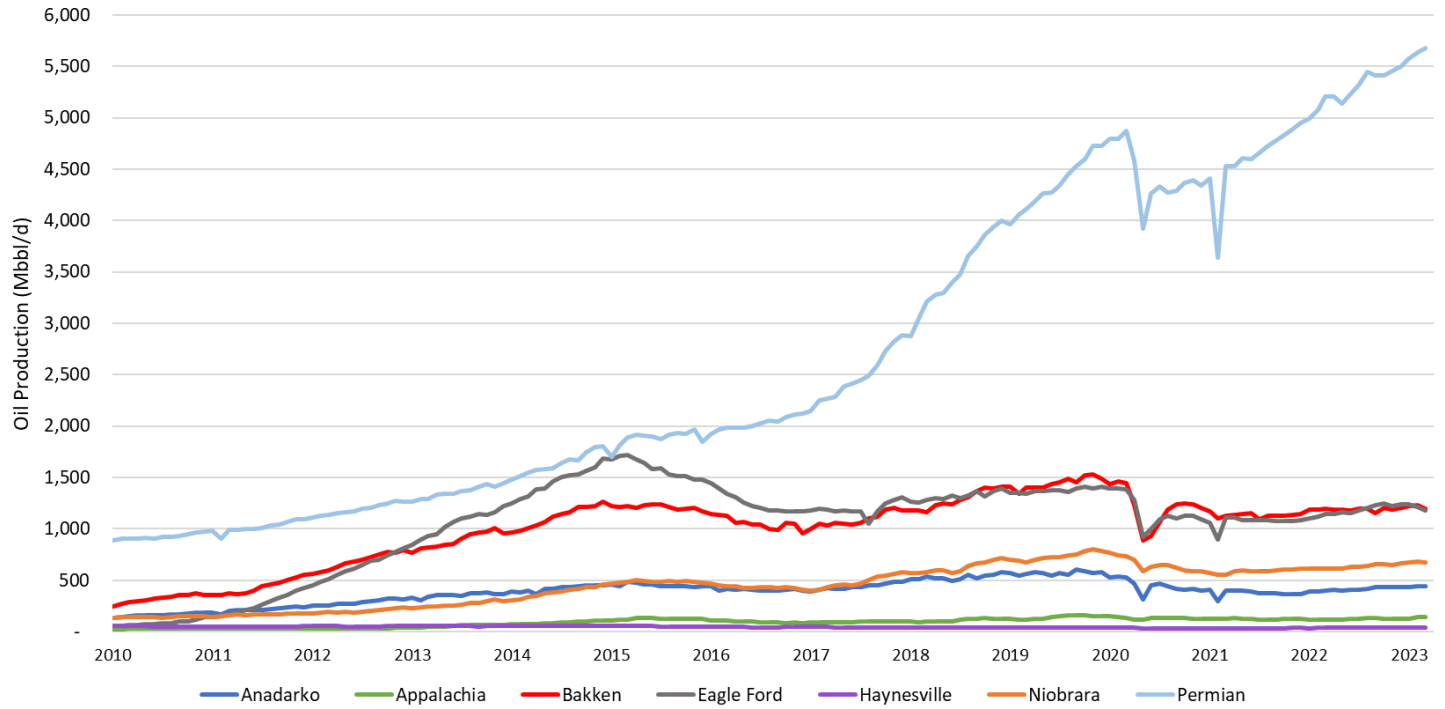
US DAILY CRUDE (MMbbl) & DRY NATURAL GAS PRODUCTION (MMcf)



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



HISTORICAL PRODUCTION OF SELECTED US SHALE REGIONS



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



UPCOMING EVENTS

March 2023

[Qnections 2023](#)

March 27-29

Las Vegas, NV

[DUG Haynesville Conference & Exhibition](#)

March 28-29

Shreveport, LA

April 2023

[US Men's Clay Court Championship 2023](#)

April 1-9

Houston, TX

[World Oilman's Minerals & Royalty Conference \(MARC\)](#)

April 10-11

Houston, TX

[Small Steps Wine Classic](#)

April 19

Houston, TX

[2023 World Oilman's Poker Tournament](#)

April 26-28

Las Vegas, NV

[World Oilman's Tennis Tournament \(WOTT\)](#)

April 26-29

Houston, TX

[Houston Producers Forum/SPE Fourth Annual Crawfish Boil](#)

April 27

Houston, TX

May 2023

[Offshore Technology Conference 2023](#)

May 1-4

Houston, TX

[Energy Valuation Conference](#)

May 11

Houston, TX

[North American Petroleum Accounting Conference](#)

May 18-19

Dallas, TX

[DUG Permian Basin & Eagle Ford Conference & Exhibition](#)

May 22-24

Fort Worth, TX

June 2023

[Society Of Petroleum Evaluation Engineers \(SPEE\) Annual Meeting](#)

June 17-20

Newport, RI

*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 two years of reserves engineering experience. Before RED, David was a Petroleum Engineer at Energy Advisors Group where he handled the technical processes for marketed conventional and unconventional assets across the Lower 48. He began his career with Longfellow Energy where he contributed to its engineering, operations, and A&D teams. David holds an MBA from The University of Texas Permian Basin and a B.S. in Petroleum Engineering from The University of Oklahoma.

