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LONESTAR RESOURCES	Cactus	TALOS ENERGY	MARTIN MIDSTREAM PARTNERS	LONESTAR RESOURCES
ACQUIRED BY PENN VIRGINIA CORPORATION	FOLLOW-ON OFFERING	SENIOR SECURED NOTES	HAS SUCCESSFULLY CONSUMMATED ITS DEBT EXCHANGE, FINANCING, AND CASH TENDER	CHAPTER 11 RESTRUCTURING
Fairness Opinion	Co-Manager	Senior Co-Manager	Financial Advisor	Financial Advisor
UNDISCLOSED	$270 MILLION	UNDISCLOSED	UNDISCLOSED	UNDISCLOSED
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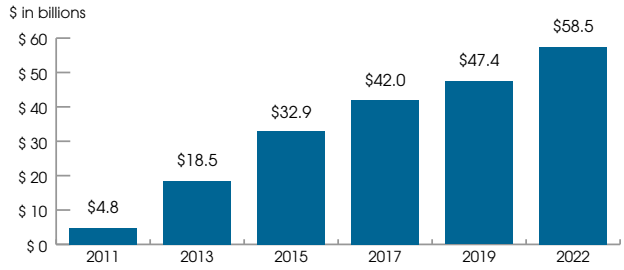
$58+ Billion
Aggregate Transaction Volume since 2009

$310 Million
Average Transaction Size

189
Transactions Closed since 2009

ENERGY GROUP AGGREGATE TRANSACTION VOLUME



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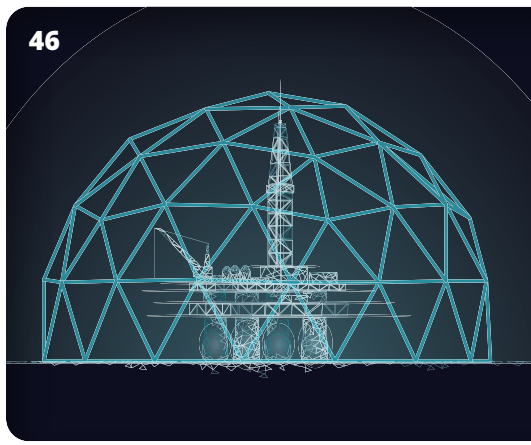

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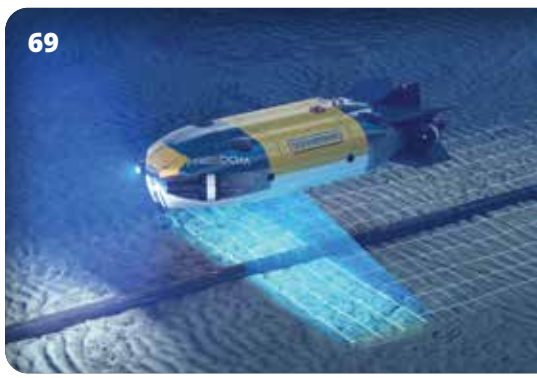

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SHALE

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SHALE

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Nov. 16

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SHALE

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AMERICA'S NATURAL GAS

Sept. 6-7

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ESG

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Feb. 7

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ABOUT THE COVER: Photographer Daniel Ortiz photographed Talos Energy CEO Tim Duncan at the company's headquarters in Houston in December.

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WHAT'S NEXT FOR OFFSHORE ENERGY?

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The U.S. offshore oil and natural gas industry has been operating largely without planning guidance from the federal government since June. At this point, a formal go-forward plan for the next five years' worth of offshore oil and gas drilling leases is seven months past due.

A month after the five-year leasing expired on June 22, the agency charged with its guidance, the Bureau of Ocean Energy Management (BOEM), which is housed within the U.S. Department of Interior, announced its proposed five-year plan.

The "2023-2028 National Outer Continental Shelf Oil and Gas Leasing Proposed Program" currently includes 11 potential lease sale dates. All but one of them are scheduled in the Gulf of Mexico; a plan for a sale in Alaska's Cook Inlet area is slated for 2026.

In December, Hilcorp was the sole bidder in federal and state lease sales in Alaska, snapping up six state blocks and one federal block in a BOEM sale held in conjunction with the state of Alaska.

Meanwhile, the five-year plan remains in the midst of lengthy review.

Few would argue that the federal government operates expeditiously on much of anything. As such, the creeping pace of bureaucracy isn't necessarily eyebrow-raising.

But questions about BOEM's future handling of the nation's offshore oil and gas resources are newly arising with the recent appointment of a new director.

The Biden administration named Elizabeth Klein as BOEM director in January. She fills a vacancy left by the resignation of Amanda Lefton, who has led the agency since the beginning of President Joe Biden's term in 2022.

Interestingly, the Jan. 10 announcement of Klein's appointment made no mention of oil and/or natural gas. And Klein's years in Washington paint a portrait of fossil fuel critique.

Among the highlights on her resume is time served during the Clinton and Obama administrations. Before joining the Biden administration as an adviser to Interior Secretary Deb Haaland, Klein—an attorney—worked as deputy director of the non-partisan State Energy & Environmental Impact Center at NYU School of Law, an initiative that supports state attorneys general with litigation designed to protect environmental regulations and advance climate policies.

At the beginning of the Biden administration, Klein was on a short list of names for deputy secretary of the Interior Department when Biden took office. That role requires Senate confirmation, and there was a chance the nomination would fail because oil and gas industry advocates in Congress reportedly had some reservations about Klein.

Sens. Joe Manchin III (D-W.Va.) and Lisa Murkowski (R-Alaska), both of whom represent key energy-producing states, threw a wrench in the nomination with their objections. Manchin and Murkowski had raised concerns that between Klein and Haaland, also an oil industry critic, the industry would face additional hurdles.

The BOEM chief job doesn't require Senate approval.

The industry's biggest trade group, the American Petroleum Institute, has responded to the news of Klein's appointment with expected advocate diplomacy.

"We look forward to working with Ms. Klein in support of a final five-year program for federal offshore leasing that includes all of the proposed lease sales," Cole Ramsey, API's vice president for upstream policy, told the Washington Post.

Klein will oversee all U.S. offshore oil and gas leasing, a program that has been shrinking but which still underpins roughly 15% of the country's total oil production, according to Energy Department data. OGJ

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MIXED BAG FOR U.S. OIL AND GAS OUTLOOK

ENERGY POLICY

JACK BELCHER
CORNERSTONE GOVERNMENT AFFAIRS
@JackBelcher1
jbelcher@cgagroup.com

The news on the oil and gas front has been a mixed bag lately. However, we are seeing some encouraging data about U.S. production and supply.

The U.S. Energy Information Administration (EIA), for example, recently reported that U.S. proved natural gas reserves jumped 32% year-to-year in 2021, setting a new record of 625.4 Tcf, with dry gas production averaging more than 100 Bcf/d in October and November. The production boost resulted largely because of higher prices and an increase in demand. The U.S. also became the top exporter of natural gas in 2022, increasing its exports to 81.2 million tons as U.S. supplies were increasingly directed to Europe to make up for the cutoff of Russian supply.

In the interim, U.S. crude oil production also grew significantly in 2022 averaging 11.7 MMbbl/d, according to the EIA, and is forecast to average 12.4 MMbbl/d this year. Much of the production increase came from the Permian Basin in New Mexico, where production increased by 24% during 2021, reaching 1.7 MMbbl/d in September.

The U.S. oil and gas industry should be praised for these accomplishments, not excoriated. After demand plummeted and oil prices went below zero during the pandemic, in a matter of months, the industry was able to recover and bring production to pre-pandemic levels for oil and record levels for natural gas. This helped the U.S. avert the kind of energy crisis Europe has been facing. While commodity prices remain high—and unpleasant for consumers—they have yet to reach the levels that were predicted by some, which would have tanked U.S. and global economies.

The industry accomplished these production milestones despite being thwarted by these three factors: the impacts of inflation on production cost, including shortages of equipment and labor; a continued lack of adequate investment capital and a market that rewards discipline with regard to exploration growth; and increasing regulatory and political risk. As to the latter, we continue to see discouraging news on the public policy front. The domestic oil and gas industry remains to be maligned by many in Washington and states such as California, including accusations of price gouging, war profiteering and greedily holding back new exploration and production and refining.

Amid these accusations, the industry is facing mounting threats in the form of windfall profits taxes and punitive policies in terms of regulation and permitting from the Biden administration. All of these threats run counter to what would actually increase production: making acreage and permits accessible and incentivizing production. The oil and gas industry is thus facing a fundamental question: Why invest in new production, infrastructure and refining capacity when the government's goal is to put the industry out of business?

With the continued anti-oil and gas rhetoric and a divided government, what could actually happen over the next couple of years that would impact the industry, for better or worse?

First, expect executive orders and administrative actions to continue that will affect the industry through environmental regulation and enforcement, permitting decisions and federal land policies. While there will likely be actions that make certain areas available to lease or allow certain projects to move forward, there will also likely be a continued onslaught of decisions and regulations that make fossil energy activity more difficult.

U.S. Senate Energy and Natural Resources Committee chairman Joe Manchin's (D-WV) decision late last year not to support the renomination of Federal Energy Regulatory Commission (FERC) chairman Richard Glick has created uncertainty over the agency's future. Two new commissioners, one Democrat and one Republican, are likely to take the reins later this year. It is unclear whether FERC will tighten or loosen approvals of natural gas pipelines.

Finally, there's expected to be important federal court decisions announced in the coming months that will impact the oil and gas industry, including cases related to federal land leasing and the Mountain Valley Pipeline.

Although major federal energy legislation is not expected to pass given the divided government, an opportunity might still exist for a permitting reform bill. Both the renewable energy and fossil energy industries need permitting reform and regulatory certainty. Should a bill emerge that gives something to both interests, then perhaps the Democrats and Republicans could agree upon a measure that could become law. However, in order to get there, politicians will need to have real conversations about the U.S.' current and future energy situation and the policies needed to ensure adequate supply now and throughout the energy transition. OGJ

HART ENERGY

OIL PRODUCTION IN THE POWDER RIVER BASIN AVERAGED

137,000 BBL/D

IN 2021.

PERMITS

With three weeks left in December, the number of 2022 approved drilling permits in Texas approached the figure in the pre-pandemic year of 2019, the Texas Railroad Commission reported.

Permits surpassed 9,000—up 28% over 2021 and 77% over 2020.

Nationally, the story was quite different. Though the permit tally was incomplete in December, 2022 was likely to finish well shy of the 21,910 permits issued in 2021 and possibly only half the total of 37,722 in 2018.

The contrarian nature of the Texas permit trend stems from low breakevens and increased takeaway capacity in the Permian Basin. Texas counties continued to dominate the leader board as 2022 ended.

However, Texas was not the only state demonstrating strength. Though Colorado's monthly total was less than half of Texas, two counties—Rio Blanco and Weld—ranked among the top five. Johnson, Campbell and Converse counties in Wyoming also cracked the top 10.

Among operators leading in issued permits, Pioneer Natural Resources Co. has a very large position in Texas, and EOG Resources Inc. operates extensively in Texas and Colorado. Terra Energy Partners and Crestone Peak Resources operate in Colorado.

Permitted Wells By County

County	Well Count
Martin, Texas	51
Howard, Texas	33
Rio Blanco, Colo.	32
Reeves, Texas	29
Weld, Colo.	27
Johnson, Wyo.	25
Upton, Texas	20
Campbell, Wyo.	18
Converse, Wyo.	17
Canadian, Okla.	16
Karnes, Texas	15
Ward, Texas	14
Crane, Texas	13
Andrews, Texas	12
Caddo, La.	12
Midland, Texas	12
Kingfisher, Okla.	11
DeSoto, La.	10

Permitted Wells By Operator

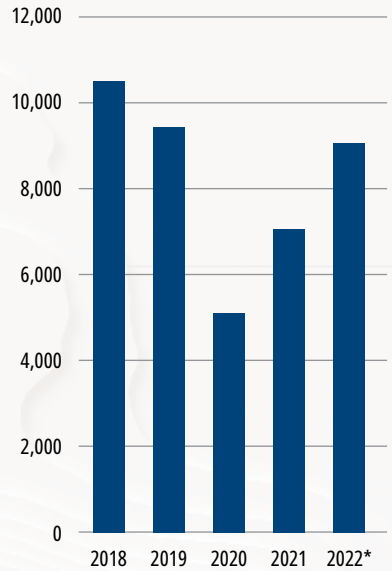
Operator	Well Count
Terra Energy Partners	38
ENG	38
The Anschutz Corp.	35
Verdad Resources	27
Double Eagle IV	23
EOG	20
Chevron Corp.	16
Blackbeard Operating	16
Pioneer Natural Resources	15

Permitted Wells By State

State	Well Count
Texas	384
Colorado	156
Oklahoma	73
Wyoming	73
Louisiana	35
North Dakota	35

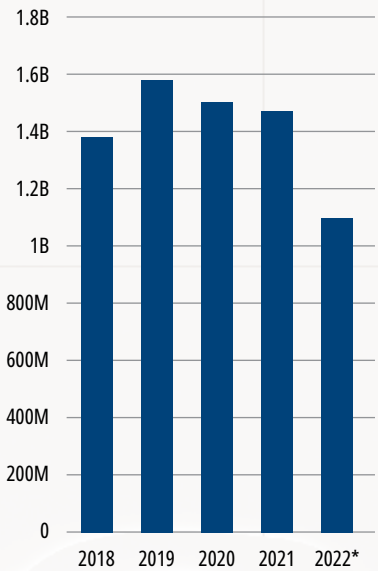
Data from Rextag ENERGY DATALINK

Texas Total Approved Drilling Permits

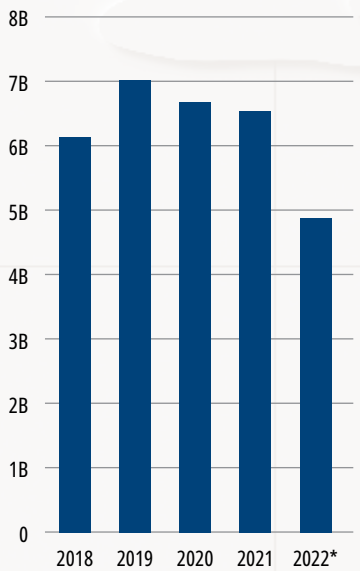


*As of mid-December

Texas Total Oil Production (bbl)



Texas Total Gas Production (Mcf)



Source: Texas Railroad Commission

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- **Adrian Goodisman,** Partner, ***Energy Advisors Group***
- **Brad Gray,** Executive Vice President & COO, ***Diversified Energy Company***
- **Bernadette Johnson,** General Manager, Power & Renewables, ***Enverus***
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FOCUS ON: POWDER RIVER BASIN

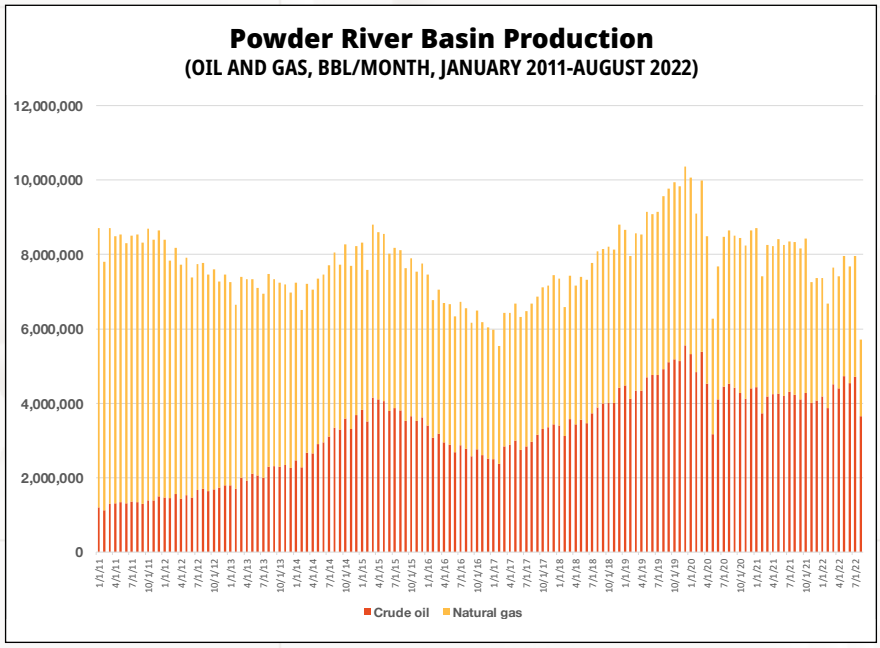
Oil production in the Powder River Basin dipped 6.5% to 137,000 bbl/d in 2021 from 2020, but the outlook is encouraging in a region best known for supplying 40% of U.S. coal.

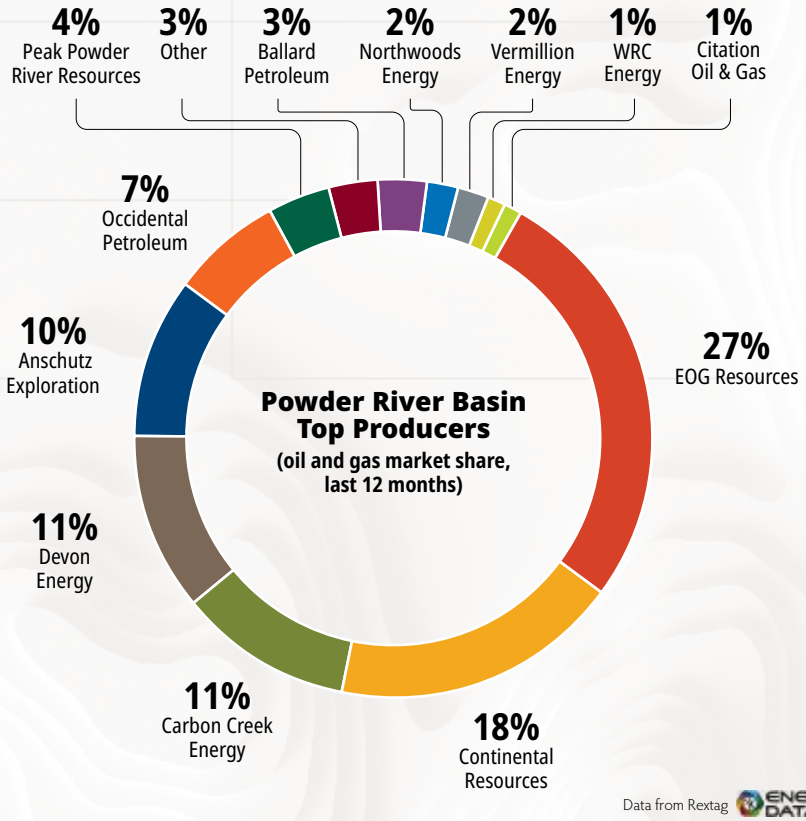
Devon Energy Corp. saw promising results from its third-quarter 2022 spacing test in the Niobrara Formation. Reservoir pressure was strong, and decline rates were shallower than expected.

"While we still have a lot of work ahead of us, this positive result adds to the conviction that the Niobrara will be a repeatable resource play and important growth driver for Devon in the future," Clay Gaspar, Devon's COO, said during the company's third-quarter earnings call.

Anschutz Exploration also anticipates an uptick in its operations. Production in 2022 was expected at 26,000 to 28,000 bbl/d (73% oil, 86% liquids). In 2023, the target is 38,000 to 42,000 bbl/d (62% oil, 86% liquids).

Continental Resources Inc. has also reaffirmed its commitment to the Powder River, purchasing 172,000 acres and about 350 operating wells from Chesapeake Energy Corp. in January 2022 for about $450 million.





Data from Rextag ENERGY DATALINK

Abundant Cash Flow Fuels Batch of Midstream Deals

Source: Hart Energy, Rextag

Midstream companies with improved balance sheets and excess cash flow allowed pipeline operators to go on an extended year-end shopping spree. The prices, however, were not bargain basement.

"There have been a number of smaller, bolt-on acquisitions and non-core asset sales in the midstream space in recent months for pipelines and other infrastructure assets," Stacey Morris, head of energy research at **VettaFi LLC**, told Hart Energy. "Companies that have perhaps wanted to sell assets may be seeing better valuations today than in the recent past, providing opportunity."

While the timing of the deals lumps them together, little else does.

"Deals have varied geographically and by type of asset. Each transaction seems to have some nuance to it and unique motivations," Morris said. "It is hard to paint in broad strokes in discussing recent transactions."

The recent transactions are more situational, she said, and can't be seen as a trend away from operations in the Permian Basin.

"Some of these companies that have bought assets [like Tallgrass and Williams] aren't big Permian players anyways, so I don't think recent deals being outside of the Permian says much about the Permian itself," Morris said.

—Joseph Markman

> ***"Deals have varied geographically and by type of asset. Each transaction seems to have some nuance to it and unique motivations. "It is hard to paint in broad strokes in discussing recent transactions."***
>
> —**Stacey Morris**, *VettaFi LLC*

THE BIG DEALS

DCP Midstream Sells NGL Interests to Phillips 66 for $3.8 Billion

Phillips 66 Co., looking to grow its NGL business, will acquire more than 43% of **DCP Midstream LP** for $3.8 billion, the company reported in January.

The cash deal, which includes the assumption of debt, will increase Phillips 66's interest in DCP Midstream to 86.8%. Phillips 66 said it has targeted operational and commercial synergies of at least $300 million, with the transaction expected to close second-quarter 2023.

In combination with Phillips 66's recent realignment of economic and governance interests in DCP Midstream, the company expects the transaction to generate an incremental $1 billion of adjusted EBITDA.

The deal comes after a flurry of December midstream deals worth billions of dollars.

DCP Midstream, an MLP, owns interests in approximately 4,500 miles of NGL pipelines, including the Sand Hills, Southern Hills, Front Range and Texas Express lines.

At $41.75 per unit of DCP, Phillips 66 deal represents a 20% premium to the company's previously proposed acquisition—at the high end of other MLP roll-ups but likely in line with current investor expectations, said Jason Gabelman, an analyst at **Cowen**.

"The economics on this portion of the DCP roll-up look attractive at $3.8 billion from an incremental $800 million per year cash ex-synergism," Gabelman wrote in a Jan. 6 research note. "The total cost of the deal, incorporating the previously announced midstream realignment, comes to $3.8 billion cash plus $5.1 billion debt to acquire DCP, plus an additional $0.4 billion in the initial midstream realignment."

Overall, Phillips 66 will acquire $1.2 billion EBITDA and $1 billion in cash, including synergies.

"The unlevered cost of the deal, after adding back $100 million [in] interest payments to FCF [free cash flow], looks attractive with synergies," he said.

Gabelman added that Cowen sees some downside to Phillips 66 fourth-quarter earnings relative to peers, "which could create near-term volatility in the stock despite the positive outcome for this deal."

Phillips 66 plans to fund the approximately $3.8 billion cash consideration through a combination of cash and debt while maintaining its current investment grade credit ratings.

Shutterstock

"We are delivering on our commitment to grow our NGL business."

—**Mark Lashier,** ***Phillips 66***

"We are delivering on our commitment to grow our NGL business," said Mark Lashier, president and CEO of Phillips 66. "Our wellhead-to-market platform captures the full NGL value chain. As we continue integrating DCP Midstream, we are unlocking significant synergies and growth opportunities."

The transaction was unanimously approved by the board of directors of **DCP Midstream GP LLC**, the general partner of **DCP Midstream GP LP**, which is the general partner of DCP Midstream.

Affiliates of Phillips 66, as the holders of a majority of the outstanding DCP Midstream common units, have also approved the transaction. As a result, DCP Midstream has not solicited and is not soliciting approval of the transaction by any other holders of DCP Midstream common units.

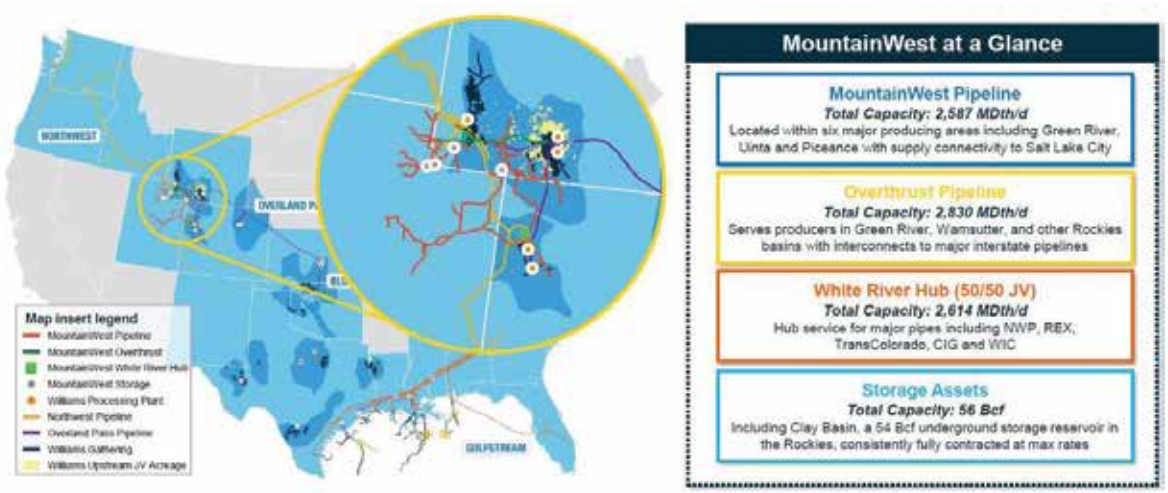
Barclays acted as exclusive financial adviser to Phillips 66. **Bracewell LLP** acted as legal counsel to Phillips 66, and **Morris, Nichols, Arsht & Tunnell LLP** acted as special Delaware counsel to Phillips 66.

Evercore acted as financial adviser to the special committee of the board of directors of DCP Midstream GP LLC, and **Hunton Andrews Kurth LLP** and **Richards, Layton & Finger PA** acted as legal counsel to the special committee.

—Darren Barbee

Williams Buys MountainWest Pipeline System from Southwest Gas for $1.5 Billion

Key infrastructure in Rocky Mountain basins



Rocky Mountain energy hub with interconnections to multiple interstate pipelines, integrated storage assets and access to multiple regional supply basins

Source: The Williams Companies, Inc.

Pipeline giant **Williams Cos.** reached an agreement Dec. 15 to acquire **MountainWest Pipelines Holding Co.** from **Southwest Gas Holdings Inc.** for about $1.5 billion, including debt.

Williams will pay $1.07 billion in cash and assume $0.43 billion of debt to acquire MountainWest, which comprises roughly 2,000 miles of interstate natural gas pipeline systems primarily located across Utah, Wyoming and Colorado.

The sale comes nearly a year after Southwest Gas completed the acquisition of **Dominion Energy's Quester Pipeline LLC** and related entities, which was rebranded as MountainWest. Southwest Gas paid about $2 billion for Questar, including the assumption of $430 million in debt and closed the transaction on Dec. 31, 2021.

The Rocky Mountain system's total transmission capacity is about 8 Bcf/d, according to a press release announcing the transaction. MountainWest also holds 56 Bcf of total storage capacity, including the Clay Basin underground storage reservoir, providing valuable service to western markets. The acquisition price represents an approximate 8x estimated 2023 EBITDA multiple, Williams said.

The addition of MountainWest will expands services to major Rockies demand markets by providing natural gas delivery into Salt Lake City and other areas not currently served by Williams, the company said. Williams said that the bolt-on would be incrementally accretive, meaningfully expanding EBITDA without materially effecting the company's leverage.

"Our natural gas-focused strategy is anchored in having the right assets in the right places to serve our nation's growing demand for clean, affordable and abundant natural gas. MountainWest is complementary to our current footprint, providing us with infrastructure for natural gas deliveries across key demand markets, including into Salt Lake City," said Alan Armstrong, Williams' president and CEO.

"We also see this acquisition as an opportunity to bring value to both Williams and MountainWest customers as we integrate business processes and systems, allowing us to potentially offer new flow paths for next generation natural gas that could create additional market optionality for our shippers," he continued.

The transaction is expected to close this year, following satisfaction of customary closing conditions, including regulatory approvals and the expiration or termination of any applicable waiting period under the Hart-Scott-Rodino Antitrust Improvements Act of 1976.

Williams owns and operates more than 30,000 miles of pipelines system wide —including Transco, the nation's largest volume and fastest growing pipeline— and handles approximately 30% of the U.S. natural gas supply used for power generation, heating and industrial use.

TD Securities and **J.P. Morgan** served as co-financial advisers to **Williams. Moelis & Company** and **Lazard Freres & Co. LLC** served as co-financial advisers to Southwest Gas Holdings.

Williams was represented by **Davis Polk & Wardwell LLP**. Southwest Gas Holdings was represented by **Morrison & Foerster LLP**.

—Darren Barbee

Targa to Buy Remaining Stake In NGL Pipeline From Blackstone For $1.05 Billion

Targa Resources Corp. announced on Jan. 3 it will buy the remaining stake in its Grand Prix NGL Pipeline that it does not already own, for $1.05 billion in cash from **Blackstone Inc.**

Targa, which will purchase 25% stake from **Blackstone Energy Partners**, acquired 75% interest in the pipeline last year when it repurchased interests in its development company joint ventures from investment firm **Stonepeak Partners LP** for about $925 million.

The Stonepeak deal also included 100% interest in its Train 6 fractionator in Mont Belvieu, Texas, and a 25% equity interest in the Gulf Coast Express Pipeline.

Grand Prix has the capacity to transport up to 1 MMbbl/d of NGL to the NGL market hub at Mont Belvieu.

"The performance of our Grand Prix NGL Pipeline has exceeded expectations since it began full operations in the third quarter of 2019, integrating our leading NGL supply aggregation position in the Permian Basin to key demand markets in Mont Belvieu and along the U.S. Gulf Coast," said Targa CEO Matt Meloy.

The pipeline connects Targa's gathering and processing positions throughout the Permian Basin, North Texas and southern Oklahoma to Targa's fractionation and storage complex at Mont Belvieu.

Targa management said the price of the Blackstone Energy Partners deal, which is expected to close in the first quarter of 2023, represents about 8.75 times Grand Prix's estimated 2023 adjusted EBITDA multiple.

—Hart Energy Staff

Pembina to Sell $500 Million Stake in KKR-Backed Gas Pipeline System

The joint venture between Canadian pipeline operator **Pembina Pipeline Corp.** and **KKR & Co.** will sell its 50% stake in the Key Access Pipeline System (KAPS) to private equity firm **Stonepeak Partners** for C$662.5 million ($484.89 million).

The deal provides Stonepeak access to a pipeline system that moves NGL to processing facilities for export to Asia, a market with a growing appetite for North American LNG as it moves away from coal and as reduced Russian exports leave a void in global supply.

Formed in March through deals worth C$11.4 billion, the joint venture PGI is owned 60% by Pembina while KKR's global infrastructure funds hold the rest.

KAPS is a 560-km pipeline system that transports NGL between western Canada's Montney and Duvernay fields to Keyera's processing facilities in Fort Saskatchewan.

Keyera Corp. will continue holding the remaining 50% stake in KAPS and will operate the asset, Stonepeak said.

Both the companies said the sale is expected to close in the first quarter of 2023.

—Hart Energy Staff

Summit Midstream Partners Acquires Outrigger D-J Basin System, Other Infrastructure for $305 Million

Outrigger Energy II LLC announced the sale of Denver-Julesburg (D-J) Basin midstream system in Weld County, Colo., to **Summit Midstream Partners LP** in December.

Summit Midstream said in a separate press release that it had acquired Outrigger's assets along with infrastructure from **Sterling Energy Investments LLC, Grasslands Energy Marketing LLC** and **Centennial Water Pipelines LLC** for a total of approximately $305 million in cash.

The recently sold Outrigger system includes a 60 MMcf/d cryogenic natural gas processing plant with product distribution to the Cheyenne Plains gas pipeline and DCP Midstream LP's NGL system.

The D-J system's high-pressure gas gathering footprint will now provide Summit with a connection to multiple midstream systems in the D-J Basin, Outrigger president and CEO Dave Keanini said in a company release.

With the sale, Outrigger will now concentrate on developing its Williston Basin midstream system in Williams and Mountrail counties, N.D. Positioned to provide reliable service to upstream as well as other midstream operators in the basin, its 24-inch and 20-inch diameter pipeline extends over 100 miles and has a capacity of approximately 450 MMcf/d.

The Williston Basin system pipeline services multiple customers at various points after extending the high pressure, rich gas pipeline from east Williams County into Mountrail County.

—Hart Energy Staff

Tallgrass to Buy Bankrupt Ruby Pipeline for $282.5 Million

Tallgrass has agreed to purchase bankrupt **Ruby Pipeline LLC** for $282.5 million, the company announced on Dec. 16.

In a court-ordered auction on Dec. 13, Tallgrass beat out a $276 million bid by **EP Ruby LLC**, a **Kinder Morgan Inc.** entity, according to court documents. EP Ruby also served as the auction's stalking horse bidder with an initial offer of $236 million.

Tallgrass said the acquisition of Ruby Pipeline will provide access to established markets with an additional 1.5 Bcf/d of natural gas capacity to its portfolio and would provide "immediate and strong cash flow to the company."

The investment will provide Tallgrass a platform to enhance natural gas service to West Coast markets, the company said. The acquisition also provides Tallgrass an opportunity to utilize Ruby's 683-mile existing infrastructure network to advance its initiatives to offer decarbonized energy solutions such as responsibly sourced and renewable natural gas to customers across the U.S.

In March, Ruby Pipeline filed for bankruptcy citing "significant cash flow shortage" when two-thirds of its long-term contracts expired in mid-2021 without any substantive replacements, according to **Fitch Ratings**.

The 42-inch transmission pipeline began service in July 2011, transporting natural gas from the Opal Hub in Wyoming west through Utah and Nevada and terminating at pipeline interconnects near Malin, Oregon. The line increased the regional capacity to move gas from the Rockies region to the west by over 50%, according to the Energy Information Administration.

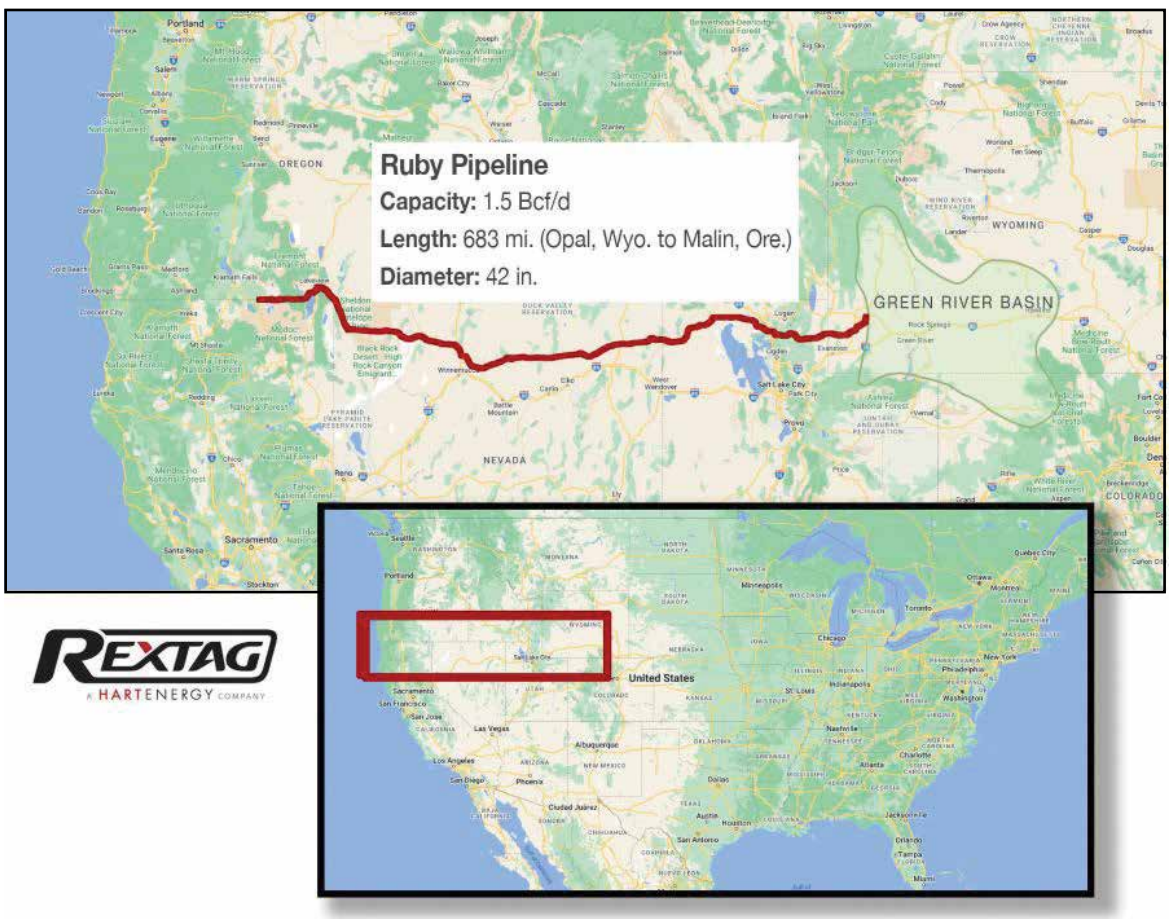
"Ruby's capabilities maintain our nation's energy security and provide long-term opportunities in the transportation of the molecules that will be required in the energy transition," said Matt Sheehy, president and CEO of Tallgrass. "In addition to gaining new teammates, this acquisition further advances our track record of optimizing existing infrastructure to lead energy solutions."

The transaction is expected to close in the first quarter of 2023 subject to customary regulatory approvals and closing conditions.

Tallgrass' outstanding equity interests are owned by an investor group led by **Blackstone Infrastructure Partners**, which includes **Enagás SA, GIC, NPS** and **USS**.

—Darren Barbee

Ruby Pipeline Map



Chesapeake Energy Sells Chunk of Eagle Ford Operations in $1.43 Billion Deal

Chesapeake Energy Corp. has found a buyer for part of its sprawling Eagle Ford Shale acreage, entering an agreement on Jan. 18 to sell its Brazos Valley region assets to **WildFire Energy I LLC** for $1.425 billion.

Chesapeake will retain other assets in the Eagle Ford that at one time were valued at potentially $4.6 billion to $5.9 billion by **Enverus Intelligence Research**, based on strip prices in mid-2022.

Chesapeake may have defied some expectations by selling to a private company. In 2022, the reverse occurred, as two high-profile Eagle Ford deals were transacted by public companies **Devon Energy Corp.** and **Marathon Oil Corp.** for privately-held E&Ps. Devon and Marathon Oil spent a combined to spend a total of $4.8 billion in the mature shale play.

Chesapeake agreed to sell approximately 377,000 net acres and approximately 1,350 wells in the Brazos Valley, along with related property, plant and equipment, the company said. The company has used a subsidiary, **Brazos Valley Longhorn LLC**, to manage those assets. In 2019, Chesapeake purchased about 420,000 net acres from **WildHorse Resource Development Corp.** for nearly $4 billion.

In something of a twist, WildFire, backed by **Warburg Pincus**, and the **Kayne Private Energy Income Funds** platform, is led by CEO Anthony Bahr, the former president of WildHorse as well as its former COO, Steve Habachy.

Chesapeake said that the assets it is selling to WildFire averaged net daily production of about 27,700 boe (85% liquid) during third-quarter 2022. As of Dec. 31, 2021, net proved reserves associated with these properties were approximately 96.8 MMboe.

The company will receive $1.2 billion upon closing, subject to customary adjustments, with the additional $225 million paid in yearly installments of $60 million over the next three years and a final $45 million payment in year four.

"Today marks an important step on our path to exiting the Eagle Ford as we focus our capital on the premium, rock, returns and runway of our Marcellus and Haynesville positions," said Chesapeake president and CEO Nick Dell'Osso. "We remain actively engaged with other parties regarding the rest of our Eagle Ford position."

For WildFire, the acquisition follows the company's acquisition of MD America Energy in March 2022 and the acquisition of Hawkwood Energy LLC, which began the process of consolidating the basin in August 2021.

Chesapeake's Eagle Ford Stats:

610,000 net acres

90 – 100 net production (mboe/d)

15% of total company production

2 – 4 active rigs

65 – 75 wells drilled

40 – 50 wells TIL'd

230 local employees

Field offices in Caldwell and Carrizo Springs, TX

The Chesapeake acquisition adds acreage in Burleson, Brazos, Robertson, Madison, Lee, Washington and Grimes counties Texas.

"This acquisition is highly synergistic with our existing assets and the combined size of the overall business positions WildFire Energy as a leading operator in the eastern Eagle Ford basin. The consolidation of 600,000 contiguous acres is transformative to the business and will drive economies of scale to deliver more high margin barrels to the advantageous Gulf Coast market," said Habachy, president and COO of WildFire Energy.

Chesapeake said it anticipates proceeds will be used to repay borrowings under its revolving credit facility and be available for its share repurchase program. Chesapeake expects the WildFire transaction to close in first-quarter 2023.

Chesapeake's Eagle Ford divestiture comes as it pivots toward a focus of producing natural gas. Analysts had anticipated that, given the size of its holdings, the Oklahoma City-based company would look to divest its South Texas assets in pieces.

In November, Andrew Dittmar, director at E**nverus Intelligence Research**, said Chesapeake's acreage was divided into large, more traditional deep South Texas footprint in the Eagle Ford in counties such as LaSalle and Dewitt counties, as well as the Brazos Valley acreage.

Dittmar said that were Chesapeake to sell off assets in packages, rather than as a whole, "you're definitely going to have a much larger buyer pool for the assets if you're willing to sell it in multiple pieces."

RBC Capital Markets, Citi and **Evercore** are serving as financial advisers, **Haynes and Boone LLP** is serving as legal adviser, and **DrivePath Advisors** is serving as communications adviser to Chesapeake.

—Darren Barbee

SOLAR, WIND TO DRIVE RENEWABLES GROWTH

Total renewable capacity is increasing, including in Europe, but supply chain constraints could be looming.

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Coming off a year of landmark legislation strengthening the U.S. clean energy market and roadmaps to lower emissions elsewhere, the outlook for the next year of renewable energy appears favorable.

However, analysts expect some challenges, especially when it comes to the supply chain.

Renewable power generation capacity is forecast to continue rising in 2023 as investment pours in, boosted by government incentives, on the road to net zero by 2050.

"In total, we'll be seeing around 219 gigawatts of solar PV [net capacity additions] across the world and close to 134 gigawatts of wind also across the world," Carlos Torres Diaz, senior vice president and director of power and gas market research for Rystad Energy, said on a recent 2023 outlook webinar.

"Gas-fired capacity will continue to increase," Diaz said, with data indicating net capacity additions of 33 GW globally, "and this will help keep the balance in power generation across the world."

Energy security and climate concerns have led many to embrace renewables in an effort to reduce reliance on fossil fuels, particularly in wake of Russia's invasion of Ukraine. Though the year 2022 saw setbacks—such as coal made a strong comeback with more capacity additions anticipated (mainly in Asia)—momentum builds for renewables.

Renewables in Europe

Added renewable generation capacity in 2023 could also improve the energy situation in Europe, where the power sector has been rocked by not only skyrocketing gas prices due to a decline in supplies from Russia but also less nuclear and hydropower generation.

"These two sources erased close to 200 terawatt hours [TWh] of power supplies from the market," Diaz said.

"There were some new solar and wind generation coming online, and this helped at around 80 terawatt hours, which helped compensate for some of the decline in nuclear and hydro," he said. "But then despite this, we needed more coal and gas power generation throughout 2022, and these sources increased by around 40 terawatt hours in combination."

Will the situation improve in 2023?

Nuclear is not expected to add substantial supplies in Europe because of more scheduled decommissioning and planned maintenance, Diaz said. However, hydro generation—down in 2022 due to drought conditions—is already back in major-producing regions such as Norway and France. Rystad's outlook shows about a 20% increase in hydropower generation.

Plus, the commissioning of new solar and wind capacity is expected to continue with onshore and offshore wind adding nearly 30 TWh, utility-scale solar adding 10 TWh and rooftop solar close to 20 TWh.

"If we take into consideration the additional hydro and potential for demand destruction, then Europe could likely depend less on coal and gas power generation. This could range in between 60 to 350 terawatt hours," Diaz said. "So, this definitely will be helping the situation across Europe and will be leading to a decline in gas demand, which will help the global balance for gas supplies and could gradually lead to a decline in power prices."

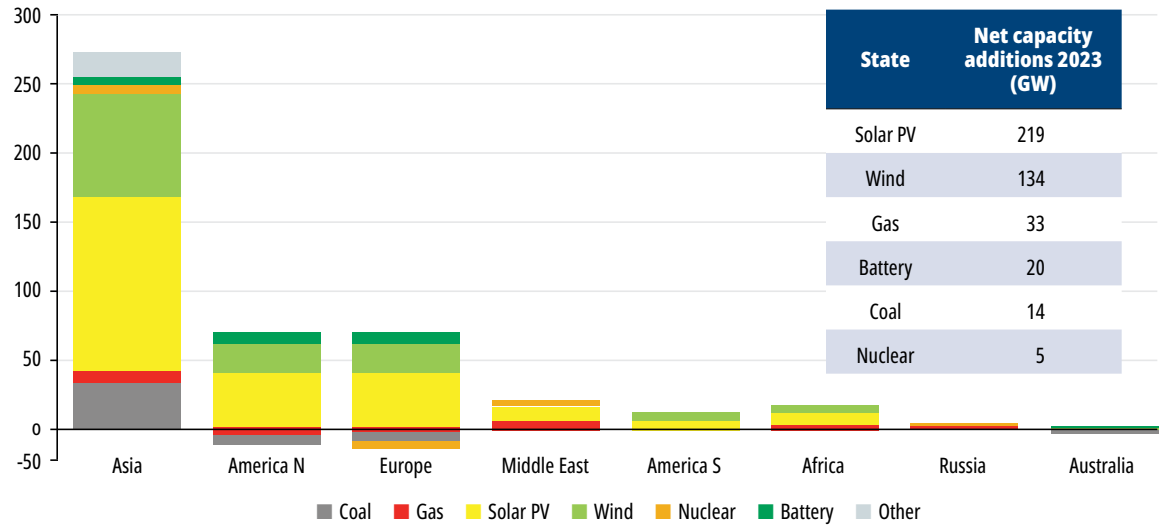
Growing and growing

Total renewable capacity growth is set to nearly double worldwide in the next five years, accounting for more than 90% of global electricity expansion, the International Energy Agency (IEA) said earlier this month. With nearly 2,400 GW of growth, equivalent to the entire installed capacity of China, renewables are on track to surpass coal to take the biggest share of the power mix.

"Electricity from wind and solar PV more than doubles in the next five years, providing almost 20% of global power generation in 2027," the IEA said. "These variable technologies account for 80% of global renewable generation increase over the forecast period, which will require additional sources of power system flexibility."

Change In Power Generation Capacity 2022 Vs. 2023

GW



State	Net capacity additions 2023 (GW)
Solar PV	219
Wind	134
Gas	33
Battery	20
Coal	14
Nuclear	5

Source: Rystad Energy PowerCube Beta

China, the U.S. and India could each double their renewable capacity expansion during the next five years, according to the IEA. Together, the countries make up two-thirds of the global growth. Policy guidelines, especially in the U.S. with the passage of the Inflation Reduction Act and Bipartisan Infrastructure Law, are accelerating development.

Looking at global installations seen in 2022, the biggest winner was pumped storage and battery projects as projects stalled during the global pandemic either started construction or came online, said Francesca Bjørnflaten, senior analyst of renewables research for Rystad.

"When it comes to the pumped storage projects, 70% out of all of these projects are in China," she said. China aims to grow its installed battery energy storage capacity to about 30 GW by 2025.

"The main installers for these big utility-scale batteries happened in the U.S. and in China," Bjørnflaten said. "Five battery projects were connected to the grid every week during the course of 2022."

Challenges ahead

Overall, investments in renewables continued to rise in 2022. Rystad analysts forecast investment in renewables will reach $494 billion, outpacing that of oil and gas' $446 billion, this year. Investment, however, is being influenced by cost inflation alongside rising activity.

Also expected to rise are average prices in power purchase agreements (PPA), which dominate the U.S. and are expanding into other regions. PPAs are long-term contracts to buy renewable energy such as wind and solar at volumes and prices agreed upon by the producer and consumer.

"Rystad analysts forecast investment in renewables will reach $494 billion, outpacing that of oil and gas' $446 billion, this year."

"What we've seen in the final months of this year is that the PPA prices are starting to rise," Bjørnflaten said. "For those projects starting construction in late 2023, 2024, 2025 and onward, we will expect the PPA prices to increase. This really further emphasizes the challenging environment that the developers are working under and the cost inflation. They're really signaling here that we cannot expect the PPA prices to remain at the level that we're seeing today."

There could also be some constraints on the solar photovoltaic supply chain ahead.

"Currently, we're seeing that the lead time for inverters are really pushing out. So, that will almost definitely be a hiccup. But also getting hold of transformers will be a constraint in the supply chain," Bjørnflaten said.

She added there are also workforce challenges, particularly in Europe where there are not enough qualified people to install solar panels to meet demand. OGJ

UNIVERSITY OF HOUSTON'S JOE POWELL TALKS ENERGY

Joe Powell, former chief scientist of chemical engineering for Shell Plc, shares insight on the energy transition, his new role, how the oil and gas industry fits in and the potential to bring stakeholders together.

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When Joe Powell first heard about the chance to lead the University of Houston (UH)'s newly formed Energy Transition Institute, the former chief scientist for Shell saw it as a "dream opportunity."

This from a man with a sterling resume: that includes a 33-year stint at Shell, dozens of patents and induction into the National Academy of Engineers. He's also served as a consultant, adviser and as an industry lecturer at the university.

The UH institute's focus areas—hydrogen, carbon management and circular plastics—aligned with his passions, he said.

"I thought this is something that I just can't pass up in terms of the next stage," Powell said of the director position at Energy Transition Institute, where Shell is a sponsor. "I don't call it retirement; I call it Phase 3."

"Phase 3" comes at a time of transition for the entire energy sector.

Countries and companies are targeting net-zero emission goals, portfolios are getting greener and Houston is looking to become the energy transition capital of the world.

Powell understands the skepticism of the oil and gas industry—it's their livelihood. But he also sees the industry playing a pivotal role in the transition, agreeing with industry leaders who see responsibly sourced gas as essential for the future. And, for renewables, he said wind and solar aren't the end game.

Powell spoke with Hart Energy about his new role, the energy transition, opportunities for oil and gas and the potential to bring stakeholders together.

Velda Addison: ***As director of the institute, what do you hope to accomplish during your first year in each of the institute's four key work streams: science, engineering and technology; policy and regulation; equity, diversity and justice; and workforce and talent?***

Joe Powell: There's a lot to accomplish. Fortunately, we have a lot of research programs already going on at the University of Houston in terms of hydrogen, from seawater electrolysis to pipeline coatings for the transport of hydrogen and other opportunities in direct air capture of CO_2. We'll be leveraging that opportunity and expanding those Tier 1 research programs. The student education and workforce development is also really key: looking at expanding courses like the hydrogen economy course into a broader set of energy coursework for the students and professionals continuing their education. We want to solidify training and make sure all UH graduates have an understanding and foundation in energy, so they can connect with their careers, whether it be in communications or policy or social sciences or the sciences and engineering.

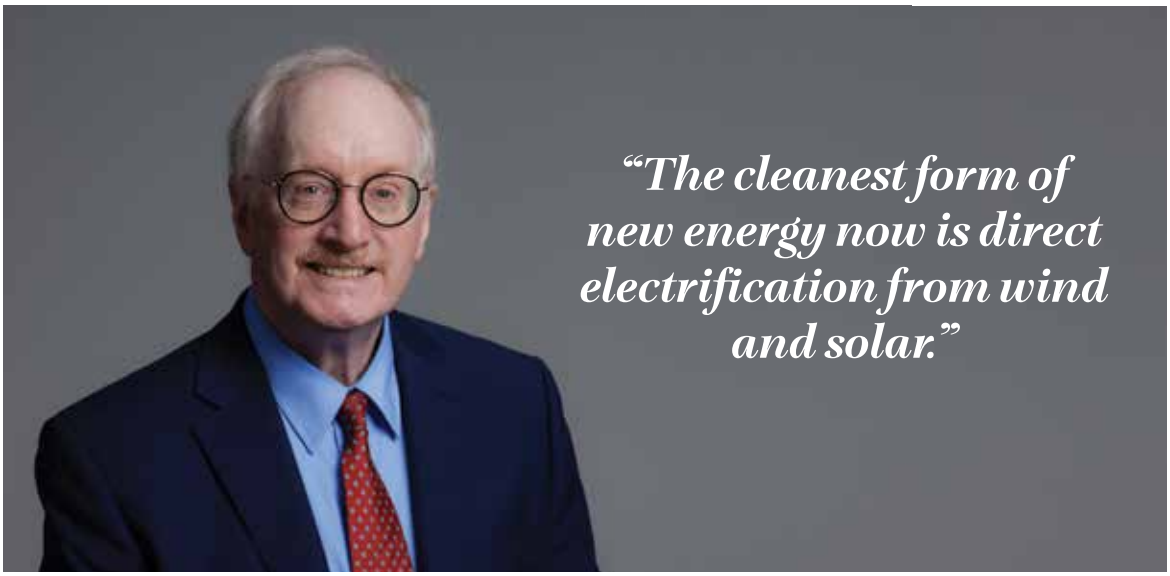
Then, the equity and the Justice 40 [Initiative for disadvantaged communities] aspect of things. The University of Houston is a minority-serving institute. When you look at the funding opportunities and aspirations coming out of the DOE [Department of Energy], front and center is making sure all stakeholders are engaged in the new energy and chemicals opportunities going forward. We need to transition Houston for future jobs in the area but do so in an equitable way. You can only do that effectively by having very strong community and stakeholder engagement. We're working to create those opportunities at the University of Houston.

Houston has an air quality attainment issue. The infrastructure is located in a lot of disadvantaged communities. We want to look at how to make that better via cleaner energy systems like hydrogen.

VA: What do you find most challenging about global ambitions to transition to cleaner forms of energy?

JP: The cleanest form of new energy now is direct electrification from wind and solar. Many people think, well, that's it. Game over. We'll just do wind and solar. It's low cost and that's all that's needed. But what about the energy storage needed to make that available 24/7 and the higher power density that's needed for industry, to fly a jumbo jet, etc.? There are very challenging problems out there in terms of how you take advantage of some of these new low-cost renewable resources and generate the types of energy density and power density needed to provide services that people expect.

Then, energy globally needs to grow about 50% by 2050. We have the developing world needing more access to energy, namely India and China and the like. So, fossil fuels—natural gas in particular—will play a large role in the transition. How do you optimize a system that has renewable resources, but also fossil resources that you want to make clean and



more sustainable? How do you manage that going forward? I'm really big on systems analysis and getting into the details of those problems and finding the best solutions.

VA: ***As the co-inventor of more than 125 patent applications, with more than 60 granted. It's safe to say you're a technology expert. Does the technology already exist to get the world to net-zero or near net-zero emissions by 2050? If not, where are the major technology gaps?***

JP: The technology is there. The gaps are in the cost and how efficient they are. Research can improve further on cost and energy efficiency utilization. That's why we continue to have R&D programs in energy storage, and safe deployment of vectors like hydrogen is very important. Talking about carbon removal and direct air capture as a possibility and so many opportunities to become more efficient via research. We need to be moving on that today because today's investment will be with us for 30 years.

There's a lot of good technologies that have been developed out there, from carbon capture and storage coming off of natural gas supply chains, using hydrogen as a clean vector in place of diesel to clean air in cities and use of the same for the industrial complexes. We need to get moving with the implementation of what we know how to do now, and we need to continue with the R&D to further drive down the costs.

VA: ***There has been much focus on hydrogen and its decarbonization abilities. You chaired the U.S. Department of Energy Hydrogen and Fuel Cell Technical Advisory Committee. What do you believe is crucial in growing a hydrogen market in the U.S. and abroad?***

JP: That's an excellent question. Always look at electrification first because that is low cost, instantaneous; wind and solar, that's available. Then, look at where you need to go beyond electricity. That's where hydrogen comes into play. It is those situations where you need 24/7 access to energy and you need higher energy density applications. One of the most exciting opportunities is in heavy-duty transport. If you look at one of those larger Class 8 trucks that's bringing all those gifts that you ordered online over the holidays, you really need the higher energy and power density that hydrogen can provide above battery electrification in order to get the duty cycles and the range for that mode of transport that works most effectively. If you combine that with the fact that the vehicles are actually lighter weight and have simpler drive trains, the potential for lower maintenance costs, then you have a nice value proposition for hydrogen as a replacement for diesel. It also delivers clean air because no longer do you have to worry about particulate matter and ozone. You're running off of fuel cells that are clean. So, that's a really exciting value proposition when you look at that overall equation.

Similarly, then, for heavy industry like petrochemicals, there are many places where hydrogen can provide clean process heating and fuel to replace some of the imported natural gas in that application. Again, you have that higher energy density and power density needs. So, the DOE calls that Hydrogen at Scale. Houston is the perfect location for that because we have hydrogen production already. We have a heavy industry, which knows how to manufacture, store and use it. We have the Port of Houston with all the transport modes that come into play. So, it's really an ideal location for a hydrogen hub to get to the economies of scale and make it affordable for all.

VA: ***A fair share of the oil and gas industry is either skeptical or openly hostile about the energy transition. How do you overcome that, particularly when the industry's livelihood is tied to the commodities they produce?***

JP: This is your livelihood. Many call this the energy addition era, and I say that's part of the energy transition. The energy transition includes the need to globally supply 50% more energy. We need all of the above in order to be able to supply the increasing global demand for energy. We also need to do that in a cleaner and more sustainable manner.

SHUTTERSTOCK/ ZHENGZAISHURU

So, we're looking at how to make the fossil economy more sustainable and provide that growth in energy. Where is it appropriate to bring in the renewables with storage? How do you manage both of them cleanly?

Then, think about the value of exports, especially the chemical industry in the U.S. That's one of the largest industries with a positive export market. It's growing faster than GDP globally, and it's hugely important to the U.S. and especially the Houston area economy. So, if you want to be exporting to Europe, you need to be paying attention to carbon footprints or you're not going to be allowed into those markets. Another factor is technology. We've developed a lot of the clean energy technologies here in the U.S., and we want to be exporting that knowhow and technology to be deployed elsewhere in the world.

So, basically, you're looking at economic activity and opportunities … to be a future player in those export markets and developing technologies. There's tremendous economic opportunity there to leverage that knowhow.

VA: ***What opportunities, economic or from a social license perspective, do you think the oil and gas sector is missing out on if it rejects the energy transition?***

JP: There's a lot of ESG investing and a lot of incentives and regulation coming in globally and [to] markets to be accessed in that transition. It would be a huge mistake to not look at supplying all of those stakeholder needs. Some of them may be willing to pay a green premium. Others will be requiring it in their supply chains, either by market influence or by policies coming from outside of the U.S. and in some cases within the U.S., from California and elsewhere. Being able to serve all of those markets is extremely important.

I would point out things like responsibly sourced gas, looking at emissions/methane in the natural gas supply chain. Doubling down on being able to certify the carbon footprints of those products is just extremely important for this area in terms of being able to play into those global markets. And then also leading the way on carbon capture and storage. We have the most amenable environment and the best geology to lead the path to deployment of carbon capture and storage that can underpin these products and reduce carbon footprints. There are tremendous opportunities for the Houston area.

VA: ***Last year natural gas was added to the EU's taxonomy for renewables. EQT Corp. CEO Toby Rice, among others, are proponents of natural gas as a low-carbon fuel for decades to come. Do you agree and how do you see natural gas fitting into the transition in general? Will it eventually need to be phased out?***

JP: I agree, and I think the issue is how clean can you make it. We've talked about the responsibly sourced gas and doubling down on the methane leakage coming through those supply chawins. But using the best technologies, those leakage rates can be managed and the greenhouse-gas footprint can be quite low for natural gas. The opportunity is wide open to prove how clean natural gas can be. And then, have the transparency, so that it's accepted globally in terms of how it is utilized and managed.

Also know that it is a great source of hydrogen. So, you can switch from natural gas to hydrogen. That gives natural gas, namely blue hydrogen, a long and sustainable future. It's going to have to compete in cost and footprint with the green hydrogen opportunities. But there's about a 50:50 investment in each if you look globally at this time. The opportunity is certainly there.

So, I see great opportunity to be progressing in that space.

VA: ***How important are partnerships, such as those between industry, universities and governments, in the energy transition?***

JP: They're extremely important. Industry needs to look externally for those sources of new innovations. When you look at how we economically develop and deploy these technologies, industry can really be the voice and help with orchestrating those stakeholder engagements.

A university can be that honest broker and a trusted resource of the information and evaluations needed to make credible sustainability arguments on future energy. That's what we're looking to do at the University of Houston, and get communities, the NGOs and industry involved. Let's get the facts on the table, and find the most equitable and valuable solutions for all. That's really where the Houston Energy Transition Institute will play the most significant role in bringing these stakeholders together.

"There are very challenging problems out there in terms of how you take advantage of some of these new low-cost renewable resources and generate the types of energy density and power density needed to provide services that people expect." OGI

U.S. REMAINS THE MAIN CONTRIBUTOR TO GLOBAL ENERGY BALANCES

Market Watchers

ED MORSE
CITI

Ed Morse is global head of commodities strategy at Citi.

The U.S. upstream sector has been showing far more vitality than is commonly believed, at a time when European and global energy security have been viscerally challenged by both the choppy nature of the energy transition and the Russia/Ukraine crisis.

Monthly data for both oil and gas indicate that U.S. supply is hitting record levels, which look bound to continue to grow through 2023 if not for years longer. Moreover, those record levels are having global impacts at exactly the time fossil fuel needs globally have been difficult to fulfill for multiple reasons. These include: (1) the lack of redundancy of fossil fuels in power generation as inadequate battery power has exposed overreliance on interruptible renewable resources in the world's three largest economies—China, Europe and the U.S.; (2) the distortions entering global markets from Europe's shunning Russian natural gas, crude oil and petroleum products; (3) the loss of production capacity from both OPEC and non-OPEC countries. Five OPEC countries alone (Iran, Iraq, Libya, Nigeria and Venezuela) are collectively producing some 8 MMbbl/d below their production potential and could conceivably lift collective output by 4 MMbbl/d during the next half decade; and (4) OPEC+ decided to reduce output even further to assure what appears to be a targeted $90 average price.

When it comes to the petroleum sector, the U.S. has been contributing far more than has been recognized, both domestically and globally. The latest monthly data from U.S. Energy Information Administration (EIA) in the December release "Petroleum Supply Monthly" report indicate that total liquids supply for October 2022 was a global record of 21 MMbbl/d for a single country, some 250,000 bbl/d higher than the previous record of 20.76 reached in September and about equal to the total supply provided by Russia and Saudi Arabia combined. The December data saw 12.381 MMbbl/d of crude and condensate output (still some 450,000 bbl/d lower than the monthly record as the pandemic started to spread). But add NGL (6.12 MMbbl/d), biofuels and other liquids (1.24 MMbbl/d) and refining processing gains (at least 1.23 MMbbl/d) to that and a better picture of the U.S. contribution on the supply side becomes apparent.

U.S. crude oil/condensate production might still lag record levels by some 450,000 bbl/d, but when the total liquids' contribution is counted, it exceeds the pre-pandemic level by 800,000 bbl/d. It is noteworthy that both the September and October field production data are significantly higher than the weekly EIA data by over 300,000 bbl/d. That provides evidence that the "missing barrels" data in the weekly numbers reflect higher real production.

"U.S. crude oil/condensate production might still lag record levels by some 450,000 bbl/d, but when the total liquids' contribution is counted, it exceeds the pre-pandemic level by 800,000 bbl/d."

Yet it is at the global level that the U.S. has been making a massive difference to supply/demand balances, pushed even further by releases from the U.S. strategic stockpile. U.S. net exports of crude oil and petroleum products, which skyrocketed after the initial embargos rolled out against Russian westward exports of crude oil, appear to have been the critical elements in balancing the market after Brent and WTI reached peak average physical spot prices levels of $123 and $114 in the first half of 2022, when the OPEC basket reached an average spot price of $118, helping to bring prices down. Most of those toppy price levels were the results of significantly lower liquidity in markets, higher volatility and distortions occurring as Western nations reduced their take of seaborne crude exports from Russia and bid up alternative crude slates such as Nigerian crudes spiking above $125 and North African grades hitting close to $130.

For the first nine months of 2022, total U.S. liquids exports averaged near

9.5 MMbbl/d, close to 900,000 bbl/d above average 2021 exports. Third quarter alone had record U.S. exports of 9.7 MMbbl/d, well over 1 MMbbl/d higher year-on-year. The last weeks of 2022 saw total exports well over 10.5 MMbbl/d, buttressed by lower demand year-over-year, as four-week average apparent demand was down more than 800,000 bbl/d and at a time when Strategic Petroleum Reserve (SPR) releases were coming to an end. Given the drop in imports and the expansion of exports between December 2021 and December 2022, oil exports are up about 1 MMbbl/d, and product imports are down some 340,000 bbl/d, with a total swing of around 1.4 MMbbl/d of incremental supply the U.S. was responsible for on a global basis, alleviating Europe's dependence on Russian material.

Citi foresees a continuation of these trends. We see total U.S. crude oil (+600,000 bbl/d) and NGL (+400,000 bbl/d) output rising, along with another 100,000 bbl/d of U.S. biofuels and refining processing gains, pulled by profitable refining margins keeping refinery utilization elevated. The economic slowdown and likelihood of a recession by year-end portend flat to slightly negative demand growth, leaving the U.S. in a good position to see continued export strength and reduced imports of both crude oil and petroleum products. If Citi's forecasts of inventory builds in 2023 materialize,, the U.S. will likely play a role in putting a floor under prices at around $70 WTI by refilling the SPR, joining the likes of China, India and OPEC+ in stabilizing prices and protecting an industry that is still needed to assure a smooth energy transition.

Meanwhile, U.S. LNG exports have played a more recognizable role globally than in the case of oil. LNG volumes have grown, reaching some 12.75 Bcf/d at peak this winter, with another 2.3 Bcf/d coming back online by late winter/early spring, reaching a level of 115 mtpa—by far the largest in the world. With no destination restrictions on U.S. cargoes, Europe has doubled imports from the U.S. since the start of the Russia/Ukraine crisis. With 9 Bcf/d of total LNG imports in 2021, Europe imported around 14.5 Bcf/d in 2022 and capacity should expand to see 2023 imports rising to ~16 Bcf/d. In 2021, the U.S. sold around 35% of its LNG to EU countries, or around 3.2 Bcf/d (a year in which its exports rose by 55.4%), rising to over 65% of its exports last year, or ~7 Bcf/d. About 50% of planned LNG exports to 2026 would be based in the U.S.

Clearly, the U.S. has been playing a unique role not only in helping assure European energy security but in balancing global oil and gas markets. OGJ

UPSTREAM CAPEX TO RISE IN 2023

Moody's Investor Service is forecasting a 10% to 15% sequential uptick in upstream capex in 2023 and an overall strong year for the sector.

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Upstream capital spending is set to reach $460 billion to$480 billion in 2023, up 10% to 15% sequentially compared to 2022, according to Moody's Investor Service.

Overall spending though this year will come in lower than the levels seen between 2015 and 2019, Moody's vice president and senior credit officer Sajjad Alam said Jan. 5 in the company's report titled "Demand and policy uncertainty will temper the energy industry's overall strength in 2023."

"More than half of the incremental spending in 2023 will go just to cover cost inflation, leaving relatively little capital for volume growth," Alam said. "Rising costs for oilfield services globally, a tight labor market in the U.S. and lingering supply-chain delays will all limit any E&P company efforts to expand production capacity quickly in 2023."

Each dollar reinvested will generate fewer volumes, lower margins and less return on invested capital, Alam said. That shouldn't spoil the party for upstream companies set to benefit from favorable supply and demand in 2023.

The upstream sector is poised for another strong year, even though energy prices and free cash flow (FCF) will not be on par with levels seen last year. Many producers are expected to generate FCF and have capacity to reduce leverage, maintain or increase shareholder returns and pursue acquisitions or reinvestment opportunities, Alam said.

Sharp price swings are expected due to supply and demand uncertainties, which could impact the long-term investment decisions of many companies, he warned—and U.S. shale producers aren't excluded from the list.

Oil and natural gas prices are expected to trend lower in 2023 amid global economic uncertainties, according to forecasts from institutions such as the World Bank, the Energy Information Administration, Wells Fargo and Enverus.

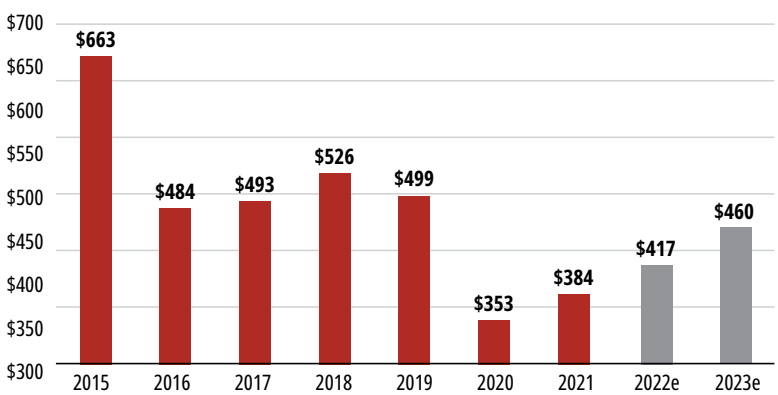
"Breakeven costs have been rising across all geographies, and producers focused on U.S. shale basins are gradually exhausting their top drilling locations over time," Alam said. "Yet reinvestment rates will remain low by historical standards with most companies planning to dedicate only 50% to 70% of their operating cash flow to maintain productive capacity."

Some stronger companies could opt for acquisition and consolidation opportunities instead of dedicating more capital to drilling activities in order to minimize inflation risks, surplus supply and shareholder resentment.

"Margins for services such as hydraulic fracturing will not improve substantially in 2023 after a great expansion in 2022," Moody's vice president and senior analyst James Wilkins said in the company's report. "As supply chain restrictions ease, OFS [oilfield service] companies will add new frac spreads to the market to meet demand, potentially alleviating high prices. Tight capacity for wireline and drilling product lines imply higher margins for those segments in 2023."

Wilkins said he still expects oilfield service companies to benefit from increased demand for their services to come from rising capex from the upstream sector. Service providers are expected to keep a keen focus on "cash flow and return on investment, rather than pursuing greater market share," the analyst said. OGJ

Upstream Capital Spending Set To Rise 10%-15% In 2023 Compared To 2022
($US Billions)



Source: 2015-2022e IEA; 2023e Moody's Investors Service

NEW FINANCINGS

EQUITY

Company	Exchange/ Symbol	Headquarters	Amount ($MM)	Comments
Enbridge Inc.	NYSE, TSX: ENB	Calgary, Alberta	$1,500	Was approved to purchase up to 27,938,163 outstanding common shares for cancellation through new normal course issuer bid (NCIB). Maximum number of shares for the company to repurchase for cancellation represents approximately 1.38% of the 2.024 million common shares issued and outstanding as of Dec. 23. The company will limit daily common share purchases on the Toronto Stock Exchange (TSX) to no more than 25% of the average daily trading volume of the common shares from July 1, 2022, to and including Dec. 31, 2022, during any trading day. Purchases under NCIB commenced on Jan. 6 until Jan. 5, 2024, and to be made through the facilities of the TSX, NYSE and other designated exchanges and trading systems.
Superior Plus	TSX: SPB	Toronto	$128	Agreed to sell its unsecured promissory notes received as part of the purchase price from the 2021 sale of its specialty chemicals business to **ERCO Worldwide LP**. Proceeds of the note sale will go toward repaying indebtedness under the company's revolving credit facility. Note matures on Oct. 9, 2026, with an interest rate of 6% compounded annually. The note has accrued $10.9 million in interest as of Sept. 30, 2022, and has an earn-out adjustment feature based on the business results of the chemicals business for three years following the transaction close. Sale to close in first-quarter 2023.
Energy Dome	N/A	Milan	€17.5	Awarded funding from the **European Innovation Council (EIC)** through the EIC Fund to scale up the deployment of the CO_2 battery product across global markets. The company was selected from over 1,000 company applicants. Other strategic investors include **Barclays**, **CDP Venture Capital SGR**, **Novum Capital Partners** and **360 Capital**, who have collectively contributed $25 million in the company's growth.
ReneSola Ltd.	NYSE: SOL	Stamford, Conn.	$13.2	Will repurchase 3 million American depositary shares (ADS) from **ReneSola Singapore Pte. Ltd.** for $4.4/ADS through a privately negotiated securities repurchase agreement. The remaining 2.05 million ADSs owned will be purchased by **Shah Capital** for the same price. Share repurchase will close three business days from Jan. 4 subject to standard closing conditions, after which the company's primary shareholders will all be domiciled outside of China.
Trinity Gas Storage	N/A	Houston	N/A	Closed financing by **Transition Equity Partners LLC** to finalize engineering for the company's East Texas greenfield natural gas storage facility, the first of its kind constructed in Texas in over a decade. Expects to reach notice to proceed within the first quarter of 2023, with the company having already secured most of the necessary contracts required and anticipated commercial operations beginning in the second quarter of 2024.
OPAL Fuels Inc.	NASDAQ: OPAL	White Plains, N.Y.	N/A	Completed exchange offer and consent solicitation relating to: public warrants to purchase shares of Class A common stock valued at $0.0001 per share and private placement warrants to purchase shares of Class A common stock. Issued approximately 3.31 million Class A common stock shares in exchange for warrants tendered in the offer.

Scan to see the New Financings database.

DEBT

Company	Exchange/ Symbol	Headquarters	Amount ($MM)	Comments
Enterprise Products Partners LP	NYSE: EPD	Houston	$1,750	Priced a public offering of aggregate principal amount of **Enterprise Products Operating LLC**'s notes comprised of $750 million principal amount of senior notes due Jan. 10, 2026, and $1 billion principal amount of senior notes due Jan. 31, 2033. Net proceeds will be used for general purposes and debt repayment. 2026 notes issued at 99.893% of their principal amount with a fixed-rate interest coupon of 5.05%. 2033 notes issued at 99.803% of their principal amount with a fixed-rate interest coupon of 5.35%. **J.P. Morgan Securities LLC**, **BofA Securities Inc**., **Morgan Stanley & Co. LLC** and **RBC Capital Markets LLC** were joint book-running managers.
PBF Energy Inc.	NYSE: PBF	Parsippany, N.J.	$525	Delivered notice of full redemption of the aggregate principal amount outstanding of **PBF Logistics LP**'s 6.875% senior notes due 2023. Notes redeemed on Feb. 3 at redemption price of 100% in addition to accrued and unpaid interest to the date of redemption. Trustee for the notes is **Deutsche Bank Trust Company Americas**, who is serving as the paying agent for the full redemption.
W&T Offshore Inc.	NYSE: WTI	Houston	$275	Priced the offering in aggregate principal amount of 11.75% senior second lien notes due 2026 at par in a private offering, according to a Jan. 12 press release. Closing of the offering is expected on Jan. 27, 2023, subject to customary closing conditions. Intends to use the net proceeds of the offering, along with cash on hand, to redeem all of its 9.75% senior second lien notes due in 2023. On Jan. 9, the company delivered a conditional redemption notice of $552.5 million on the principal amount of its existing second lien notes.
Expro Group Holdings	NYSE: XPRO	Houston	N/A	Priced underwritten offering of 8,000,000 shares of common stock currently owned by affiliates of **Oak Hill Advisors** at $16.50 per share. Upsized from original offering of 7.25 million shares, expected to close Jan. 18. Underwriters were granted a 30-day opportunity to purchase an additional 1.2 million shares of common stock. Book-running managers were **Goldman Sachs & Co. LLC**, **J.P. Morgan Securities LLC**, **DNB Markets Inc., Barclays Capital Inc.**, **Evercore Group LLC**, **HSBC Securities (USA) Inc.**, **Piper Sandler & Co.**, **RBC Capital Markets LLC** and **Wells Fargo Securities LLC**.
Clean Energy Fuels Corp.	NASDAQ: CLNE	Newport Beach, Calif.	$150	Entered four-year sustainability-linked senior secured term loan with **Riverstone Credit Partners LP**, providing the company with additional capital to execute its renewable natural gas (RNG) growth strategy. Proceeds will be used to help fund RNG project expansion to dairy farms to capture fugitive methane emissions an turn it into fuel made from organic waste. Obtained a second-party opinion from **Sustainable Fitch**, which confirmed the loan to be aligned with the five principles of the Loan Syndications and Trading Association's sustainability-linked loan principles.
Forum Energy Technologies Inc.	NYSE: FET	Houston	$123	Satisfied conversion require-ments under its 9% convertible senior secured notes due August 2025. 47.8% of the notes will convert to 4.5 million shares of company common stock on Jan. 3 with a Jan. 5 settlement date. Remaining notes are not subject to optional or further mandatory conversion provisions. Annualized interest payments for the company will decline by over $11 million following the conversion.
Seminole Financial Services	N/A	Belleair Bluff, Fla.	$104	Closed debt facility providing financings for **Revity Energy LLC**'s 55+ MW solar project in Rhode Island through partnership with **Blackstone Credit**. Prior to this deal, the company has invested over $2.2 billion in construction and permanent debt financing plus tax credit equity to Revity for more than 325 solar and wind installations, providing over 1.1 GW.
Amplify Energy Corp.	NYSE: AMPY	Houston	$5	Extended credit agreement to May 31, 2024, from Nov. 2, 2023, and redetermined borrowing base effective immediately from $215 million, with reductions of $5 million. Total net debt was $167 million as of Nov. 30, 2022, with $190 million outstanding under credit facility and $23 million of cash on hand.

THE AMERICAS' OFFSHORE BOOM

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Offshore exploration in the Americas is arguably booming—at least in some regions of Latin America and the Caribbean.

This is amid a global energy transition, a move from fossil fuels to cleaner energy, and global net-zero ambitions set by many countries.

While the COVID-19 pandemic temporarily slowed global energy demand and greenhouse-gas (GHG) emissions, Russia's invasion of Ukraine moved the energy transition, then on the front burner, elsewhere.

Russia's energy exports have collapsed in the aftermath of the war in Ukraine, wreaking havoc on global energy markets. Look no further than Europe and the U.K. to see what an energy crisis looks and feels like.

No surprise, energy security is on the front burner for many world leaders.

Enter Latin America and the Caribbean and their ongoing quests to achieve energy security, independence and sovereignty as they aim to reduce energy import dependency and boost government coffers.

The region has an abundance of resources such as heavy oil in Venezuela's Orinoco Belt, pre-salt reserves offshore Brazil, low-carbon oil offshore Guyana and shale oil and gas in Argentina's Vaca Muerta, or the "dead cow" formation.

While Putin's aggressions have slowed the global energy transition's pace, many energy sector pundits still argue that developing countries in Latin America and the Caribbean should contribute more to combat climate change. Despite the region being blessed with hydropower, a dominant energy source, carbon sinks such as forests and small countries contribute little to emitting GHG.

Why pundits would suggest countries with newfound resources like Guyana not move forward with new exploration projects is beyond belief, but that is something the government of the small English-speaking country is steadfast on doing and rightfully soon.

Offshore Guyana, an Exxon Mobil Corp.-led consortium that includes Hess Corp. and CNOOC has found gross recoverable resources of 11 Bboe in just around eight years. The new-found oil wealth could potentially lift many citizens out of poverty and provide things such as paved roads and cheaper electricity.

Guyana Vice President Bharrat Jagdeo has argued for years that to impose a freeze on investments in new oil and gas projects would only lock in investments for the incumbents, confining Guyana into a cycle of low-carbon emissions but low income. Guyana wants its share of the market and is against lobbying for a "monopoly," as Jagdeo calls it, for the existing producers.

Guyana will continue to seek foreign assistance to develop its offshore resources despite calls to the contrary. The government looks to increase the financial and economic benefits associated with the developments to guarantee the prosperity of the country for decades to come, while the energy transition remains important but on the back burner.

Many governments in Latin America and the Caribbean share similar views to those of Jagdeo and are moving forward with bid rounds, new exploration and developments.

Brazil's oil regulator ANP awarded three blocks to state-owned Petrobras in December 2022: the Sudoeste de Sagitário, Água Marinha and Norte de Brava in the 1st Cycle of Permanent Production Sharing Offer. Petrobras' participation in the round is part of its plans to strengthen its profile as the main operator of deep and ultradeep oil fields.

Colombia's National Hydrocarbon Agency has remained active in recent years with its permanent process, awarding record blocks. The process has slowed after the election of Colombia's new president, Gustavo Petro, as his administration sizes up potential to move forward with a clean energy strategy amid a recent uptick in positive offshore drilling results involving gas.

Guyana recently launched its first licensing round for 14 blocks located in shallow-water and deepwater areas. The government is pursuing a "balanced approach of fast-tracking hydrocarbon developments … and ensuring that Guyanese derive the maximum economic benefits of our petroleum potential," the Ministry of Natural Resources said in December.

In Suriname, Staatsolie Hydrocarbon Institute, a wholly owned subsidiary of Staatsolie Maatschappij Suriname N.V., launched a competitive bid round for six new blocks in the sparsely explored Demerara acreage. The blocks are located east to the current offshore discoveries, and bids need to be submitted by May 31.

Uruguay's state-owned ANCAP awarded two offshore exploration blocks in December after receiving bids from an APA/Shell consortium for OFF-4 Block and Argentina's state-owned YPF for OFF-5 Block. OGI

SUBMIT YOUR NOMINATION

2023 ENERGY ESG Awards

Hart Energy is recognizing innovations in reducing environmental impact, social efforts and community contributions, as well as leadership practices/directives and company cultures within a corporate structure.

Nominations are open to producers, operators, services companies and midstream companies in the oil and gas industry. Winners are chosen based on achievements, not only on goals.

Awards will be presented during Hart Energy's upcoming **Energy ESG conference, September 12, 2023,** in Houston. These ESG champions will also be highlighted with in-depth profiles inside a special section of ***Oil and Gas Investor*** in September and promoted through Hart Energy's multi-channel network.

Nominations due June 2, 2023.

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hartenergy.com/energy-esg-awards

LATIN AMERICA PRODUCTION OUTLOOK 2023

Several countries in Latin America look to boost production in 2023, with the lion's share coming from developments in exploration hotspots Brazil and Guyana.

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Latin America and the Caribbean may not be the solution to Europe's energy crisis, but it will add significant new production volumes next year and beyond.

The region's two exploration hotspots, Brazil and Guyana, will anchor production growth in 2023 and could add 3.6 MMbbl/d between 2023 and 2027, according to data compiled by Hart Energy.

This growth will come from the installation of six new FPSO units next year and 15 during the next four years.

New production from two emerging countries, among others, will provide some assistance to a global energy market still rattling from the loss of Russian supply, sanctioned after its invasion of Ukraine in early 2022.

Notwithstanding, Latin America will continue to encounter formidable headwinds, such as rising energy costs, despite an abundance of resources due to a high dependency on imports from LNG to refined petroleum products, which will continue to stoke inflation.

While Brazil and Guyana will garner the most investor attention and capital spend, other Latin American countries such as Colombia, Mexico and Venezuela could also boost production over the near term if aboveground risks mainly related to political uncertainties are kept to a minimum.

Leading the pack: Brazil and Guyana

Brazil: Brazil's state-owned Petrobras announced a capex budget of $78 billion between 2023 and 2027 in its five-year strategic plan revealed last December. Approximately $64 billion of the capex will be destined for the prolific pre-salt, including $38 billion for the Santos Basin and $18 billion for the Campos Basin.

Petrobras looks to boost production with the addition of new FPSO units that will offset production declines from mature fields and basins, decommissioning, maintenance and asset divestments. The new production approximation for 2023 forecasts about 630,000 bbl/d from five FPSOs: Itapu P-71 (150,000 bbl/d), Marlim 2 Anna Nery (70,000 bbl/d), Buzios 5 Alm. Barroso (150,000 bbl/d), Marlim 2 A. Garibaldi (80,000 bbl/d) and Mero 2 Sepetiba (180,000 bbl/d). Another 13 new FPSO units will come online between 2024 and 2027, creating an additional 2.2 MMbbl/d of production.

Investors' primary headwinds in Brazil will come by way of actions that could be taken by the recent election of Luiz Inácio Lula da Silva (Lula) as Brazil's next president. Lula, who will be serving his third term as president, will try to steer clear of another corruption scandal like "Operacão Lava Jato" or "Operation Car Wash," which tarnished his and Petrobras' reputations.

Guyana: Newcomer to the Latin America oil production and exporting club, Guyana continues to ride a wave of successful exploration in its prolific offshore Stabroek Block. There, an Exxon Mobil Corp.-led consortium that includes Hess Corp. and China's CNOOC has found gross recoverable resources estimated at around 11 Bboe. The three companies will continue with exploration efforts in Stabroek, while other international oil companies (IOCs) explore other blocks. A recently announced offshore bid round for 14 blocks is likely to attract old and new IOCs and national oil companies (NOCs) seeking to replicate Exxon Mobil's feats in Stabroek.

Currently, Exxon Mobil's first two developments in Stabroek, Liza I and Liza II, are producing around 360,000 bbl/d from the Liza Destiny FPSO (140,000 bbl/d) and Liza Unity FPSO (220,000 bbl/d), respectively. New production forecast for late 2023 will come from incorporation of the 220,000-bbl/d capacity Prosperity FPSO, which corresponds to the third development, Payara. Two additional FPSO units (with 250,000 bbl/d capacity each) are forecast for 2025 and 2026, corresponding to the fourth and fifth developments of Yellowtail and Uaru, respectively.

Investor's primary headwinds in Guyana relate to potential changes to new contracts offshore that will give better benefits to the government as it tries to reverse its misfortunes related to initial contracts with Exxon Mobil, which benefited the U.S. company more than the country, many energy sector pundits argue.

Runner-ups

Colombia: Colombia's state-owned Ecopetrol is widely regarded as the industry-leading NOC in Latin America based on its investment track record, dividends, and pursuit and achievement of strategic goals. Additional production forecast for 2023 will be minimal and come from the NOC's efforts to maintain production around the 720,000 boe/d range. The company's production in 2022

SHUTTERSTOCK/MAARTEN ZEEHANDELAAR

is likely to average 705,000 boe/d, Ecopetrol executives announced during the company's third-quarter webcast.

Investor's primary headwinds in Colombia relate to political uncertainties around the country's new leftist president, Gustavo Petro, who campaigned against fracking and new exploration in favor of clean energies.

Mexico: Mexico's state-owned Petróleos Mexicanos (Pemex) is Latin America's most indebted NOC, with a debt load just over $100 billion. Additional production forecast for 2023 will come about as the company looks to maintain a production floor at about 1.8 MMbbl/d of oil and condensates, compared to an average close to 1.76 MMbbl/d forecast in 2022. Production growth in 2023 under this scenario could come in the upper end of the 1% to 2% range, which has been the average range in recent years, Pemex executives alluded to during its third-quarter webcast.

On the high end of the spectrum, Pemex is optimistic it can go beyond single-digit production growth in 2023, according to details revealed on Dec. 21 in the company's business plan for 2023 through 2027. Pemex's plan envisions production reaching 1.96 MMbbl/d in 2023, growing to 2.32 MMbbl/d by 2027. Pemex has always been high on hopes, while realities have tended to paint a different picture.

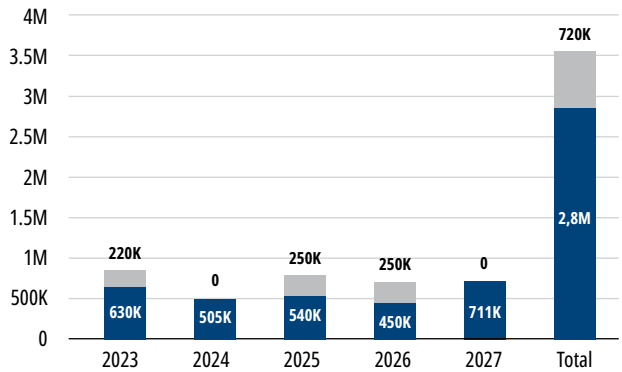
Investor's primary headwinds in Mexico relate to political uncertainties around the country's leftist president, Andrés Manuel López Obrador, and his vision for the energy sector. Pemex's dire financial situation means foreign investors are needed to substantially move the production needle.

Venezuela: Venezuela's state-owned Petróleos de Venezuela (PDVSA) looks to boost production next with the assistance of Chevron Corp., which just received authorization from Washington to pursue such goals. Additional production forecasts for 2023 could emerge if Chevron joint ventures in the OPEC country can boost production by 100,000 bbl/d as predicted by numerous energy sector pundits. Production growth could potentially reach 200,000 bbl/d if the investment climate remains relatively stable.

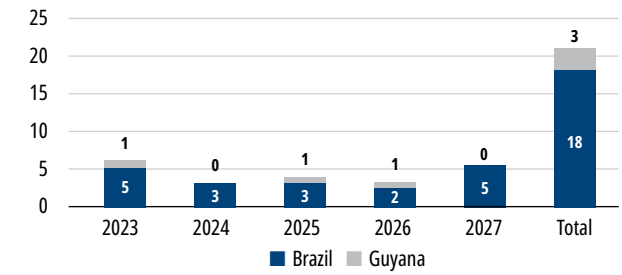
Investor's primary headwinds in Venezuela relate to the political uncertainties around the U.S.' long-sought "free and fair" elections in 2024, which are premised on continued and fruitful negotiations in Mexico City between the ruling party and opposition around a solution to the country's political stalemate. OGJ

Brazil And Guyana Anchor Latin America Growth

Exploration hotspots Brazil and Guyana will add 21 FPSOs between 2023 and 2027 and anchor oil production growth in Latin America, with the addition of around 3.6 MMbbl/d.



FPSO Growth



Source: Data compiled by Hart Energy from company reports, Petrobras, Exxon Mobil Corp. and Hess Corp.

Voices

New technology and increased interest brings attention to offshore energy.

"When you're looking at traditional basins, for example, Brazil, West Africa or relatively new entrants into the market like Guyana or Suriname, or even old producers like Canada—all of those reservoirs are far from shore. They are and they will be requiring floating production facilities."

—**Mark Adeosun**, *western hemisphere offshore manager, Westwood Global Energy Group*

"Floating wind technology is in its early stages, but it is an advanced technology that will lead to strong growth in the deployment of offshore wind. The timely scaling and deployment of floating wind technology will be vital in meeting U.S. and global renewable energy goals."

—**Erik Milito**, *president, National Ocean Industries Association*

"The Caribbean has a lot of potential. These are world class discoveries that we want to bring into the production before the end of the decade. We're trying to accelerate development. We're looking at some ... things like subsea to shore to start providing early production and cash flows."

—**Felipe Bayón**, *CEO, Ecopetrol*

Scan to read more

"The plans [for development, operation and installation] submitted by Aker BP contain several important elements for further development of the resources on the Norwegian shelf. The plans include establishing new infrastructure in new areas, further developing fields that are currently producing, utilizing available capacity in existing infrastructure in addition to developing resources in an entirely new type of reservoir."

—**Kalmar Ildstad**, *director of license management, Norway Ministry of Petroleum*

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THREE TACTICAL MOVES FOR OIL AND GAS IN 2023

The reality of energy transition is not a stark choice between hydrocarbons today and renewables tomorrow, EY says.

PATRICK JELINEK AND DAVID KIRSCH
EY

Patrick Jelinek is EY Americas oil and gas leader. David Kirsch is managing director at Ernst & Young LLP.

The past year has been one of seemingly good fortune for oil and gas companies. Price increases, spurred higher by geopolitical factors but fundamentally reflecting stronger global economic activity, put companies in the black.

Strong revenues enabled companies to fund spending out of earnings and still return capital to shareholders—in part allowing for share prices to decouple in a positive manner from underlying oil and gas prices.

But the medium-term outlook remains uncertain. Buyers of natural gas are reluctant to sign long-term purchase agreements, given the questions about climate change and future demand requirements. Similar questions complicate capital planning or approval for long-term projects where the price and demand uncertainties are seemingly growing, despite current conditions that underscore the viability of oil and gas through the energy transition.

The reality of energy transition is not a stark choice between hydrocarbons today and renewables tomorrow. Instead, the answer to solving tomorrow's energy requirements involves understanding how oil and gas companies can lead energy transition, embrace decarbonization as a catalyst to innovation and actively seek opportunities in a lower-carbon world.

New technologies, expanded energy sources, innovative business models and collaborative ecosystems will unlock opportunities in the energy transition. Policies like the landmark Inflation Reduction Act (IRA) further accelerate the commercial possibilities. To successfully embrace new zero-carbon fuels—especially hydrogen—plentiful capital, technical expertise and experience of complex operations and markets will be critical. Rather than running afoul of the energy transition, can oil and gas companies utilize their expertise and experience to lead it?

Successfully navigating this future will require companies to define a new core, develop markets further downstream and innovate new business models. To this end, three tactics are anticipated to help U.S. oil and gas companies make progress in 2023:

- **Optimize operations:** Arguably at the heart of oil and gas operations for a century, further optimization through the energy transition will require thinking in terms of portfolios of energy technologies, rather than a single asset or asset class. In a similar vein, digitalization efforts at most companies need broadening to approach providing insights across the enterprise. But there must also be a recognition that digital initiatives rather than an IT service are becoming core assets themselves and are invaluable to the successful management of an energy company.

  Optimizing operations will require a reappraisal of the back office as well. The next-generation back office can be an important lab for incubating some of these commercial and operational innovations. Companies that can successfully implement them will be in advantaged positions to capitalize on new market opportunities and win the ongoing competition for talent.
- **Manage emissions:** Oil and gas cannot completely decarbonize, but customers and regulators will increasingly seek progress on various emissions metrics, such as production's carbon intensity. Coupling emissions management strategies with digital technology provides an enterprise-wide and full lifecycle view of the emissions portfolio and allows management teams to execute growth strategies aligned with customer needs in a future energy system.
- **Execute capital strategy:** The two metrics EY is watching are the forward price strip and the cost of capital—specifically borrowing costs to inform the velocity of these estimates. Driving this trend is a continued high grading of portfolios among energy producers. For example, in the third quarter of 2022, oil and gas had 198 deals worth approximately US $52.1 billion, according to EY analysis.

The expanded investor focus on energy security and the energy transition will maintain private equity's appetite for renewed opportunities, however. Corporates are anticipated to leverage a capital allocation strategy via oil and gas assets with low-carbon solutions. Low-carbon businesses like carbon capture, utilization and storage, or carbon capture, utilization and sequestration allow producers to gather up IRA capital to scale solutions with existing assets and offer a differentiated proposition to both customers and investors. Ecosystem strategies, like tech-energy partnerships and joint ventures, will increase as well.

Current outlooks support a healthy attention to these three areas in 2023 and beyond, allowing U.S. oil and gas companies to not only continue to reap the benefits of recent efficiency improvements and an improved price environment but also to take steps to realize a robust future and leadership position in defining the energy system of tomorrow. OGJ

FINELY TUNED FIRST MOVER

Talos Energy Inc. CEO Tim Duncan goes deep, testing international waters and new markets.

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Tim Duncan may lead one of the top U.S. Gulf of Mexico producers at Talos Energy Inc., but he refuses to let go of the "scrappy underdog" mentality that has guided his whole career.

Duncan started his petroleum engineering career in the lean 1990s at Pennzoil E&P before taking the risk to join a little-known startup, Zilkha Energy.

When the Gulf of Mexico was waning in popularity, Zilkha started a risky buying spree of seismic data and leases just as 3-D seismic technology was emerging, eventually ensuring much better success rates on drilling prospects.

The successful company sold in 1998 for more than $1 billion.

"This small company found its first-mover advantage. But you had to have the courage," Duncan said. "I saw that as a young engineer, and it influenced me. I thought, 'I'm just going to put that into my memory box and tap into it one day if I'm lucky enough to be in a position of influence.'"

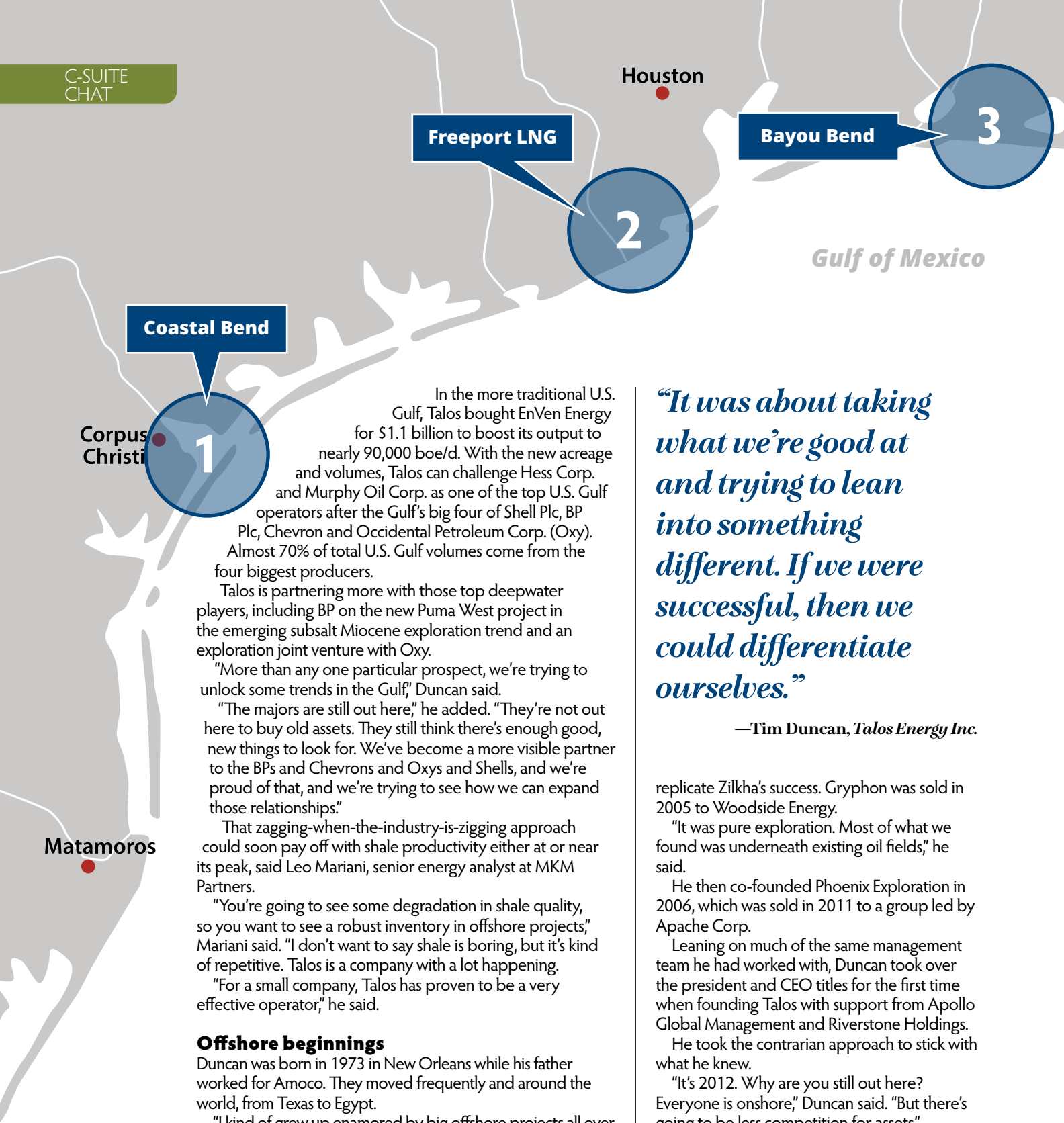
The strategy, Duncan decided, was to stay nimble and take smart risks.

After working executive roles at a couple of other Gulf of Mexico startups that were sold, Duncan cofounded Talos in 2012—before turning 40 years old—with a Gulf focus when the rest of the industry was pivoting to the emerging tight oil boom onshore.

Duncan's strategy led Talos into the newly opened offshore Mexico market, making the potentially groundbreaking Zama discovery in 2017.

And, last year, Talos became a first mover—if you are noticing a pattern here—into the offshore carbon capture and storage (CCS) market in the shallow U.S. Gulf, buying up acreage for CCS hubs when the ongoing energy transition is focusing more on net-zero emission goals. Chevron Corp. recently became a 50% partner on Talos' pioneering Bayou Bend CCS project offshore of the Texas-Louisiana border.

PHOTOGRAPHY BY DANIEL ORTIZ



In the more traditional U.S. Gulf, Talos bought EnVen Energy for $1.1 billion to boost its output to nearly 90,000 boe/d. With the new acreage and volumes, Talos can challenge Hess Corp. and Murphy Oil Corp. as one of the top U.S. Gulf operators after the Gulf's big four of Shell Plc, BP Plc, Chevron and Occidental Petroleum Corp. (Oxy). Almost 70% of total U.S. Gulf volumes come from the four biggest producers.

Talos is partnering more with those top deepwater players, including BP on the new Puma West project in the emerging subsalt Miocene exploration trend and an exploration joint venture with Oxy.

"More than any one particular prospect, we're trying to unlock some trends in the Gulf," Duncan said.

"The majors are still out here," he added. "They're not out here to buy old assets. They still think there's enough good, new things to look for. We've become a more visible partner to the BPs and Chevrons and Oxys and Shells, and we're proud of that, and we're trying to see how we can expand those relationships."

That zagging-when-the-industry-is-zigging approach could soon pay off with shale productivity either at or near its peak, said Leo Mariani, senior energy analyst at MKM Partners.

"You're going to see some degradation in shale quality, so you want to see a robust inventory in offshore projects," Mariani said. "I don't want to say shale is boring, but it's kind of repetitive. Talos is a company with a lot happening.

"For a small company, Talos has proven to be a very effective operator," he said.

Offshore beginnings

Duncan was born in 1973 in New Orleans while his father worked for Amoco. They moved frequently and around the world, from Texas to Egypt.

"I kind of grew up enamored by big offshore projects all over the world," Duncan said.

With the oil and gas industry in shambles at the end of the 1980s, Duncan still opted to major in petroleum engineering at Mississippi State University—another place that helped shape his underdog mentality similar to the recently deceased MSU football coach Mike Leach and his quirky, pirate-loving, air-raid style.

"We felt like 'the other guys'—if you will, compared to the bigger programs," Duncan said. "It was that scrappy, hard-working attitude."

After Zilkha, Duncan was recruited to join the private equity-backed startup Gryphon Exploration that wanted to replicate Zilkha's success. Gryphon was sold in 2005 to Woodside Energy.

> ***"It was about taking what we're good at and trying to lean into something different. If we were successful, then we could differentiate ourselves."***
>
> —**Tim Duncan,** ***Talos Energy Inc.***

"It was pure exploration. Most of what we found was underneath existing oil fields," he said.

He then co-founded Phoenix Exploration in 2006, which was sold in 2011 to a group led by Apache Corp.

Leaning on much of the same management team he had worked with, Duncan took over the president and CEO titles for the first time when founding Talos with support from Apollo Global Management and Riverstone Holdings.

He took the contrarian approach to stick with what he knew.

"It's 2012. Why are you still out here? Everyone is onshore," Duncan said. "But there's going to be less competition for assets."

The goal was to buy up acreage and lease areas in relatively mature areas and explore nearby. And, using that same mentality, Talos has moved to increasingly deeper depths.

"We'll keep exploring, but we'll use other companies' platforms and infrastructure," he said. "We believed in improving seismic technology. Computing speeds were changing everything. Rig technology, mud technology [and] subsea technology. All of those things were going to be in our favor to be an independent that can grow the company in

Talos CCS Project Portfolio: 800 Million MT CO_2 Storage

Supporting 150 MTPA of regional emissions on ~80,000 acres

	1. Coastal Bend	2. Freeport LNG	3. Bayou Bend	4. River Bend
Industrial Region	Corpus Christi	Brazoria Co. (TX)	Beaumont / Port Arthur	Baton Rouge / New Orleans
Regional Emissions (MTPA CO_2)	~20	~20	~30	~80
Lessor	Port of Corpus Christi	Freeport LNG	Texas	Private Landowner
Footprint (Acres)	13,000 Onshore	~500 Onshore	40,000 + Offshore	26,000 Onshore(1)
Storage Capacity (MM MT CO_2)	50 - 100+	~25	225 - 275	500+
Annual Injection Rate (MTPA CO_2)	1.0 - 1.5+	0.5 - 1.5	5.0 - 15.0	5.0 - 15.0
Estimated First Injection	Late 2026	Late 2024	Late 2025	2026
Partners	Howard Energy	Storegga	Carbonvert, Chevron	Storegga, EnLink Midstream

(1): River Bend CCS acreage additionally includes 63,000 on right of first refusal in addition to leased 26,000 acres.
Source: Talos Energy

deep water using the same shallow-water principles."

There was a fear though with all the money moving onshore. "How were we going to get out of it? What if there weren't functioning capital markets?" After all, all of his previous companies were founded and sold.

Then came the oil downturn in 2015 and 2016, and those fears were realized. The capital was largely gone.

The solution: Rather than sell, Talos opted to go public by entering into a reverse merger in 2017 with Stone Energy Corp.

"That changed the dynamic," Duncan said.

He was so determined, he said, that he was negotiating the Stone deal while his family evacuated his Houston-area home that was severely flooded during Hurricane Harvey.

"It kind of changes your perspective when you lose everything you own," he said. "It kind of defines your before and after."

Crossing the nautical border

Prior to the Stone deal, the government in Mexico had enacted energy reforms to open its oil and gas sector to international investment for the first time in nearly 80 years.

Major companies nervously eyed the Mexican side of the Gulf to see if the reforms would stick.

With the idea of going public, Duncan said, Talos had to think bigger.

"Should we be thinking about international? How do we cast a wider net? How do we get more people interested in our story?" Duncan said. "We saw what was happening in Mexico with opening up the energy sector, and we decided to bid because we didn't think anybody would pay attention to us."

In this case, being smaller and nimbler helped. Talos led a consortium to make the shallow-water Zama discovery in 2017, which was considered potentially the biggest global find of the year.

"It was about taking what we're good at and trying to lean into something different," Duncan said. "If we were successful, then we could differentiate ourselves."

And they proved they could do it. The plan was to work with state-owned Pemex, reach a final investment decision by the end of 2020 and achieve first oil right around now.

However, politics intervened.

The goal now is to reach FID by late 2023 at the earliest.

What happened is that Andrés Manuel López Obrador, known as AMLO, succeeded Enrique Nieto as the president of Mexico in late 2018 and sought to roll back some of the energy reforms.

Talos was essentially forced to hand over operatorship to Pemex and to reduce its 35% operating interest in Zama down to a participating 17.35% stake.

"We knew there was a reasonable likelihood, although we disagreed with it, that they would pick Pemex to be operator," Duncan said. "Once they did, we weren't going to change that, but we needed to stand up for our efforts and the value of the asset."

However, since Talos led the appraisal, discovery and front-end engineering and design work, Duncan managed a pivot: The goal now is to still play a significant role in an integrated project team that is still being negotiated.

"Our hope is somewhere in the first quarter we'll be able to put in the final development plans and talk about final

commercial arrangements with Pemex," Duncan said. "Then this thing finally gets to FID by the end of 2023."

Fernando Zavala, Pickering Energy Partners vice president, said Talos took a hit from the political changes but that most of the bad news is now done. Hopefully, all the parties can move forward amicably this year.

"That really was just a very unfortunate chain of events for them. That's just the risk of dealing with the Mexican government," Zavala said, joking that he can say that because he is a native of Mexico.

But would Talos ever look to sell its Zama position?

"There's no reason for us to think about that until we can get this project down a glide path of being financeable and getting to a final investment decision," Duncan said.

"The story is still being written," he added. "The bottom line is it's still one of the biggest discoveries in the history of the country, and that was us."

Embracing the transition

Despite some of the political hiccups, Talos was riding high in 2019, after the big discovery and going public.

At the end of the year, the company scaled up and bought a portfolio of producing U.S. Gulf assets and acreage from ILX Holdings, Castex Energy and Venari Resources for $640 million.

"We're going into 2020 feeling pretty damn good. And, here comes the pandemic, and everything falls apart," Duncan said with a resigned laugh.

Talos had a strong enough balance sheet to survive the temporary crash in demand, but many companies did not. With investor sentiment already pushing for more financial conservatism and greater shareholder returns in 2019, that trend continued even stronger after 2020.

"We knew we weren't going to be ready to do 'returning capital to shareholders' as a small company coming out of the pandemic," Duncan said.

So, with the investment community focusing on dividends and emerging ESG trends, Talos ultimately decided to pursue CCS projects, especially with the Biden administration focusing on the energy transition.

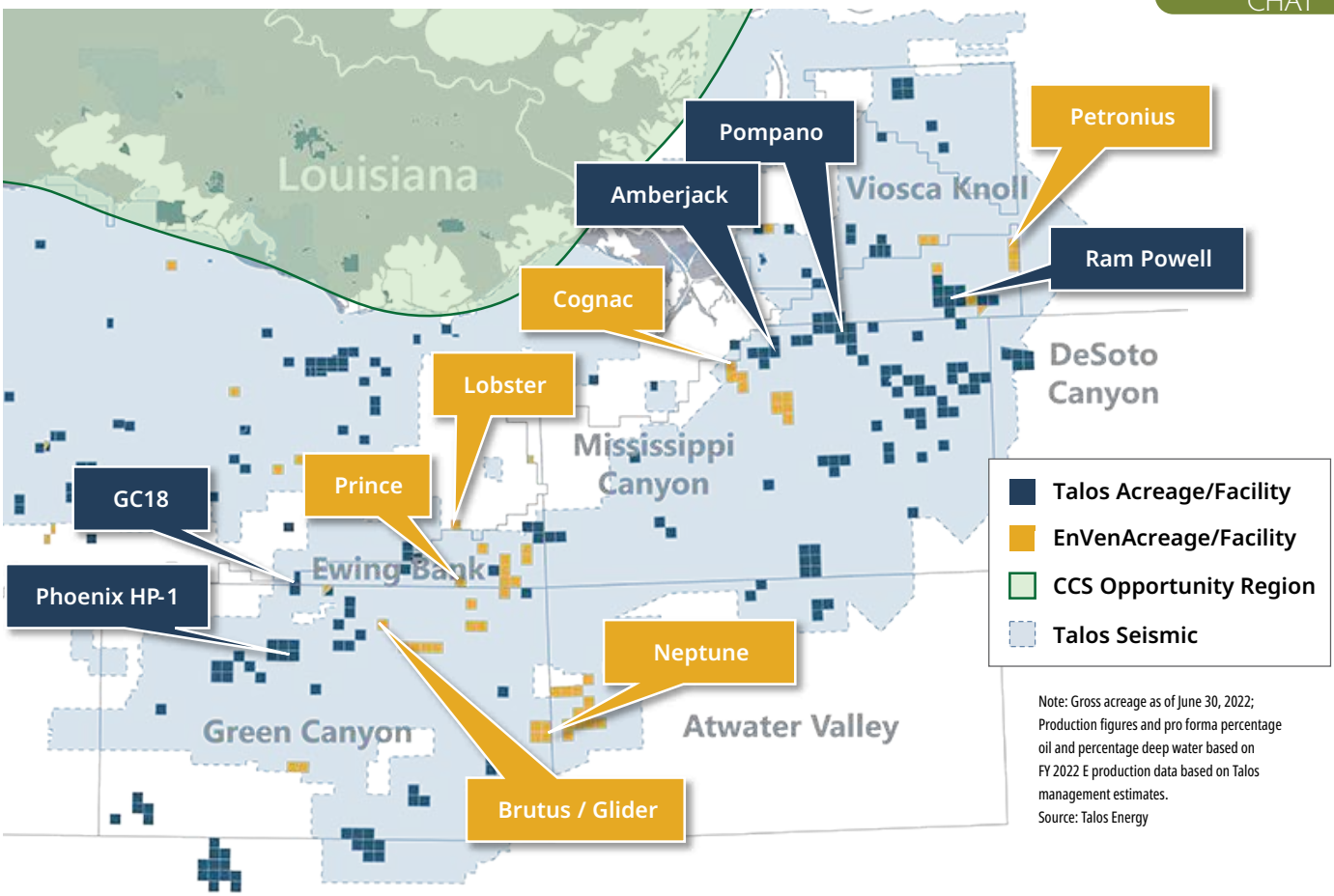
"The idea was what can we do on the low-carbon side?" Duncan said. "CCS springs up, and we said, 'Hey, this is just about putting together land positions.'"

Talos focused on marshy areas in southern Texas and Louisiana—both onshore and offshore—with good geology and proximity to industrial emitters. "We decided to lean in and chase it."

That land race all happened very quickly, starting in 2021. And it seemed on the verge of paying off in 2022, with the U.S. Inflation Reduction Act (IRA) expanding tax credits for both carbon capture projects and restoring deepwater lease sales after Biden had initially implemented a moratorium. After all, Talos was one of most active bidders in lease sale 257, with high bids on 10 blocks totaling 57,000 gross acres.

"We were one of the few public companies that benefited from multiple parts of the IRA," Duncan said.

Compelling Overlap In Core Deepwater Areas



Note: Gross acreage as of June 30, 2022; Production figures and pro forma percentage oil and percentage deep water based on FY 2022 E production data based on Talos management estimates.
Source: Talos Energy

The main Bayou Bend CCS project has more than 40,000 acres offshore and the potential to hold roughly 250 million metric tons of CO2. Apart from initial partner Carbonvert, Chevron signed on in May. Duncan acknowledged Chevron buying in gave Talos "legitimacy" in the burgeoning CCS industry.

"They could easily compete against us, but they saw more value in partnering with us," Duncan said of Chevron. "Everything they do is thoughtful and highly engineered, and they are fully committed to the space. So, it brought a tremendous amount of validation."

The next challenge is getting all the emitters—the refiners, chemical plants, LNG hubs and more—to invest in technology to capture their CO_2, Duncan said. Talos can then transport and permanently sequester the carbon for a negotiated tolling fee.

Nate Pendleton, energy analyst and vice president at Stifel, said Talos' CCS projects are "economic today" with the tax credits.

"We're really bullish on the fundamentals of CCS, and it's needed to meet climate goals," said Pendleton, who is particularly high on the Bayou Bend CCS project. "I would offer that offshore has less risk for CCS than onshore. It's mostly not drinking water, and it's located away from communities.

"When Talos saw the opportunity, they were able to jump on it before the majors were able to go through their processes," Pendleton said.

Big picture

Talos is well-positioned for a strong 2023, even if the CCS projects will not come online for another three years, Pendleton said.

The company's other CCS projects are its onshore River Bend project near the Mississippi River in Louisiana, the Coastal Bend project near the Port of Corpus Christi and an emissions-source project near Freeport LNG in Texas.

In the meantime, Talos is focused on its "high-impact" drilling prospects like Puma West, Duncan said, and its more "middle-market," subsea-tieback prospects near existing infrastructure, including its Venice, Lime Rock and Rigolets ventures, all of which are underway. Talos also is drilling its Mount Hunter prospect from the Pompano platform.

Other acquisitions and potential international expansions remain possible, Duncan said.

"We've looked down in South America and West Africa in the past 12 to 15 months and looked in a significant way," Duncan said, confirming that they are "still" looking. "We've looked at M&A hard since the pandemic knowing that we can impact synergies and impact things quicker in the Gulf of Mexico but, long term, knowing that outside of the Gulf of Mexico might need to be in the portfolio."

Duncan definitely does not want to rule out any additional nimble, smart bets. He remembers his early lessons in the industry.

"We've fine-tuned a strategy on how to make money in the U.S. Gulf of Mexico, but we also think we can expand that into new business opportunities that really differentiate who we are as a public energy company," he said. OGJ

MARKET POWER

Enverus general manager Bernadette Johnson takes charge.

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Bernadette Johnson has a prestigious title at a premier industry consultancy. But it wasn't the pursuit of an executive role that placed her in the top tier of management at Enverus shortly before she turned 40 years old.

She was following her leaders.

"I've wanted to work for a good leader, someone who can do something amazing," she told Hart Energy. "I think I've done that throughout my whole career."

The strategy has paved the way for Johnson to earn a reputation for expertise throughout the industry: whether providing analysis on crude oil, natural gas, the power sector or political dynamics, Johnson is a go-to source for insights on the North America and global energy markets.

Deon Daugherty: ***Your career began in traditional oil and gas but, like the energy industry itself, your work has evolved and now you're running Enverus' power and renewables (P&R) business. Tell us about your transition.***

Bernadette Johnson: I took this role as general manager about two years ago, and so far, I think the most interesting thing is that it's not very different from oil and gas. I've analyzed power markets as part of the overall energy mix for a long time, particularly because of the overlap with natural gas markets, but as I spend more time in the space, the similarities stand out more.

Whether it's NIMBY activism like banning of renewables in various counties all over the country, price volatility, dramatic changes in the LCOE [levelized cost of energy] from renewables in the past five years (similar to the dramatic change in oil and gas prices as a result of the shale revolution) or capital investment ebbs and flows … I see things every day that remind me of past times in oil and gas. This time in P&R mirrors where oil and gas was in 2008 to 2009, before the whole energy industry changed as a result of the shale revolution.

DD: ***What is the dynamic of the P&R market?***

BJ: One of the surprising things I've observed is the speed at which things are changing, despite the disconnect between the aspirational goals of policy makers and the general public and the physical science that underpins renewable energy and batteries.

I have no doubt we'll see some technological breakthroughs in the coming years/decades, particularly in the battery space, but in the meantime, we're seeing key milestones: Electric vehicle market share has increased to 10% of all new (light-duty) vehicles sold—much sooner than anyone thought could happen.

Bernadette Johnson

DD: ***What are the challenges and opportunities for the businesses in the P&R space?***

BJ: One of the things about the P&R market today that is similar to oil and gas in 2008 is a flood of capital, pace of new market entrants joining the industry and this perception that investing in this space is easy and low risk. We saw how that unfolded for actual investors on the oil and gas side, and I think many of us would now say that oil and gas prices should have been higher and between 2009 and 2020 didn't accurately capture the market and price risk inherent in commodities.

We're doing the same thing in power. We're overbuilding capacity in some areas, seeing congestion and bottlenecks pop up all the time, supporting projects that otherwise wouldn't work economically with tax and policy incentives, creating more merchant risk as contract terms get shorter and shorter, seeing supply chain issues—and all of these things will continue to get worse before they get better.

This is not an easy market to invest in. However, that also creates a lot of opportunity for those market players that can accurately predict and time these events into the future.

Where you invest, who you contract with, how you structure contracts, how you optimize your assets, etcetera, will make or break these investments.

DD: ***How do challenges abroad play out in P&R?***
BJ: I believe the Russia/Ukraine conflict has fundamentally changed the way energy markets will function in the future. The impact to commodities and pricing in the short term is just the tip of the iceberg and we'll see the fallout for years to come.

Even if there was a peace brokered tomorrow and Russia left Ukraine, the relative peace the west has taken for granted in the decades since the cold war ended is over. The idea that mutual dependence (economic and energy) is enough to prevent conflict has been dispelled and that shift is meaningful—and not just related to Russia but other countries as well. Whether it's food scarcity because of fertilizer shortages, economic disruption because factories have to shut down because of gas/oil shortages and high prices, rerouting of global shipping routes, growing concerns of sensitive supply chain components … Everyone has been impacted by this event, and the global economy is worse off than it was before.

DD: ***Is Europe the next major market for U.S. LNG?***
BJ: I do think this creates opportunities for stronger alliances between the U.S. and Europe, related to energy, but also trade in general. The global LNG import market was already growing double digit percentages before this happened and can now be expected to grow faster as those countries look to source energy and commodities from friendly nations, investment decreases in Russia impacts the long-term productivity of their resources, and overall global demand for energy continues to grow.

Europe is a very logical destination for U.S. LNG, and U.S. LNG will grow in the coming years as new export terminals begin service. We're bottlenecked right now, but as more facilities come online, Europe, Latin/South America and Asia will continue to be growing demand centers for us.

DD: ***Hart Energy is hosting its 25 Influential Women in Energy event—which you participated in two years ago—this month, so let's dig into the industry's diversity a bit. Is there parity between women and men within the energy business?***
BJ: When you're in it and you've really had an opportunity to grow your career and rise through the ranks day-to-day, it doesn't feel like things are so bad. But that's me and that is my experience.

When I go back to look at the data, I think it's pretty clear that we have much more room to improve. Women only represent about 25% of workers in energy-related companies and slightly more than 32% of the renewable energy workforce, despite making up about 47% of workers broadly, according to American Progress. There are also significant wage gaps that remain.

The statistics are clear, and we still have a ways to go to see true equal representation. When you look at leadership metrics (women executives, managers, leaders, board seats), we also have a long way to go.

DD: ***Does the sector make a difference?***
BJ: It's not unique to oil and gas, although there's this perception that oil and gas is an old school kind of boys' club. The same issues exist across power and renewables and other areas.

DD: ***Where do you see the solutions?***
BJ: I think that's the hardest thing to figure out. Most people are doing their best and trying to do the right thing, but each company is facing unique challenges. I work within a company that's making a real effort every day to diversify our employee group, and we still have a long way to go. Figuring out how to affect change while being fair is really challenging. I don't have the silver bullet, and I don't think one exists. I think change happens through small decisions and behaviors every single day across a whole organization or industry, [and they] really add up to progress.

DD: ***What's the point? What does pursuing diversity do for a business?***
BJ: It's an imperative in a few different ways. I think it's the right thing to do, but it's also a business imperative. The research shows that businesses perform better, the more diverse they are.

When you have diversity, you have differences in thought, you have more creativity, you have folks that don't lean toward just doing the same thing they've always done—and that can be very, very good for business. That's what the data show.

It's not just the right thing to do. It's a good business decision, and it's a good economic decision to do that early on.

DD: ***Where do we go from here?***
BJ: We really don't know what 2023 is going to look like. I don't know of any industry, economy or business environment that's this tricky. We're coming off of the pandemic, coming off of supply chain issues, inflation pressure, the skyrocketing interest rates, Russia/Ukraine … I can't think of a time that's been more tumultuous. There are a lot of questions. I do think we're going to look back at '23 and be shocked at what played out. OGJ

CYBER PIRATES THREATEN US OFFSHORE OPERATORS

Cyberattacks could potentially trigger a Deepwater Horizon scale disaster, but the Bureau of Safety and Environmental Enforcement has been slow to act, a federal report found.

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Tracy W. Krohn distinctly remembers April 20, 2020, as a "multiple Martini night"—and not just because WTI plunged to a bizarre -$40.32/bbl. That same day, W&T Offshore was hit with a ransomware attack.

"They threatened to put a bunch of our data out over the internet, and some of it they did," Krohn, the company's founder, chairman, CEO and president, said during a presentation at EnerCom in Denver.

W&T was able to corral its data and protect itself without any meaningful impacts, Krohn said.

"We certainly didn't pay any ransom," he said. "I'm not daring anybody, but truth is, we handled it pretty well."

If high seas and hurricanes weren't enough to contend with, cybersecurity has become an urgent matter for offshore oil and gas producers.

A U.S. Government Accountability (GAO) report released in 2022 warned that cybercriminals or state actors could trigger the equivalent of another 2010 Deepwater Horizon disaster.

The GAO report found that despite explicitly identifying the need to address cybersecurity risks to offshore infrastructure seven years ago, the Bureau of Safety and Environmental Enforcement (BSEE) remains in the early stages of establishing a program to do so.

"Offshore oil and gas infrastructure faces significant and increasing cybersecurity risks in the form of threat actors, vulnerabilities and potential impacts," the October report said. "Threat actors are becoming increasingly capable of carrying out attacks on critical infrastructure, including offshore oil and gas infrastructure."

At the same time, offshore infrastructure is becoming more vulnerable to attacks as operational technology (OT) used by offshore oil and gas producers is increasingly vulnerable to exploits by cyberattacks that could cause serious harm "to human safety, the environment and the economy," the report found.

Uncharted cyber risks

No one is sure about the extent of past cyberattacks on offshore infrastructure. None of the federal officials or industry representatives GAO contacted were aware of any cyberattacks or specific requirements to report them if they occur. W&T, which is publicly traded, has disclosed in Securities and Exchange Commission reports that it has experienced cybersecurity incidents to its systems but that it did not suffer any material impacts to its business as a result.

> *"Offshore oil and gas infrastructure faces significant and increasing cybersecurity risks in the form of threat actors, vulnerabilities and potential impacts."*
>
> —U.S. Government Accountability Office

GAO identified two cybersecurity incidents involving offshore oil and gas infrastructure during its review.

In 2009, a grand jury indicted an offshore oil and gas company's former employee on allegations of temporarily disabling a computer system for detecting pipeline leaks for three oil derricks off the southern California coast.

In 2015, a U.S. Coast Guard official made statements regarding a cybersecurity incident where malware was unintentionally introduced onto a mobile offshore drilling unit. According to the USCG, the malware affected the dynamic positioning system, which resulted in the need to maneuver to avoid an accident.

Other publicly reported cyberattacks have demonstrated the risk from successful

Exploits: How Cybersecurity Vulnerabilities Caused Real-World Harm

Impact	Description	Example
Property Damage	Damage or destroy infrastructure, equipment and the surrounding environment when attacking control systems. This may result in device and operational equipment breakdown or represent tangential damage from other techniques used in an attack.	In December 2014, a cyberattack resulted in the mis-operation of an OT system, including the improper shutdown of a furnace and physical damage to a German steel mill's facilities.
Productivity, revenue loss	Attackers may cause a loss of productivity and revenue by damaging or disrupting the availability or integrity of industrial control systems operations, devices and related processes.	In December 2019, a form of ransomware named EKANS infected various OT devices, reportedly in the U.S., Europe and Japan, by encrypting files and displaying a ransom note, which impaired operations.
Safety	Attackers may compromise safety system functions designed to maintain safe operation of a process when unacceptable or dangerous conditions occur.	In 2017, Russian cyber actors manipulated a foreign oil refinery's safety devices, which resulted in the refinery shutting down for several days.
Loss/denial of control	Malicious actors may seek to prevent operators and engineers from interacting with process controls.	In 2015, Russian attackers uploaded malicious software to certain devices in Ukraine, with the intent of ensuring that utility operators could not issue remote commands to bring electricity substations back online.
Manipulation of control	Command messages are used in OT networks to give direct instructions to devices. Attackers may send unauthorized command messages to instruct industrial control systems devices to perform actions outside their desired functionality for process control.	In the 2015 Ukrainian attacks, Russian attackers issued unauthorized commands to open the breakers at substations that three regional electricity utilities managed, causing a loss of power to about 225,000 customers.

Source: U.S. Government Accountability Office

cyberattacks, including shutting down industrial furnaces, overriding an oil refinery's safety devices and cutting off power to hundreds of thousands of people.

Growing cyber threats

U.S. intelligence officials have assessed that China, Iran, North Korea and Russia pose the greatest cyber threats of disrupting critical infrastructure, according to the 2022 Threat Assessment of the U.S. Intelligence.

But cybercriminals are also increasingly a hazard, growing the number, scale and sophistication of ransomware attacks. The GAO also said that hackers and hacktivists, as well as company insiders, pose significant cyber threats to offshore oil and gas infrastructure.

In 2013, the hacker activist group, Anonymous, threatened to target the oil and gas sector in a June 20 operation. The group said that it would target several countries, including the U.S., China and Russia. Press reports indicated that the threats did not result in significant disruptions.

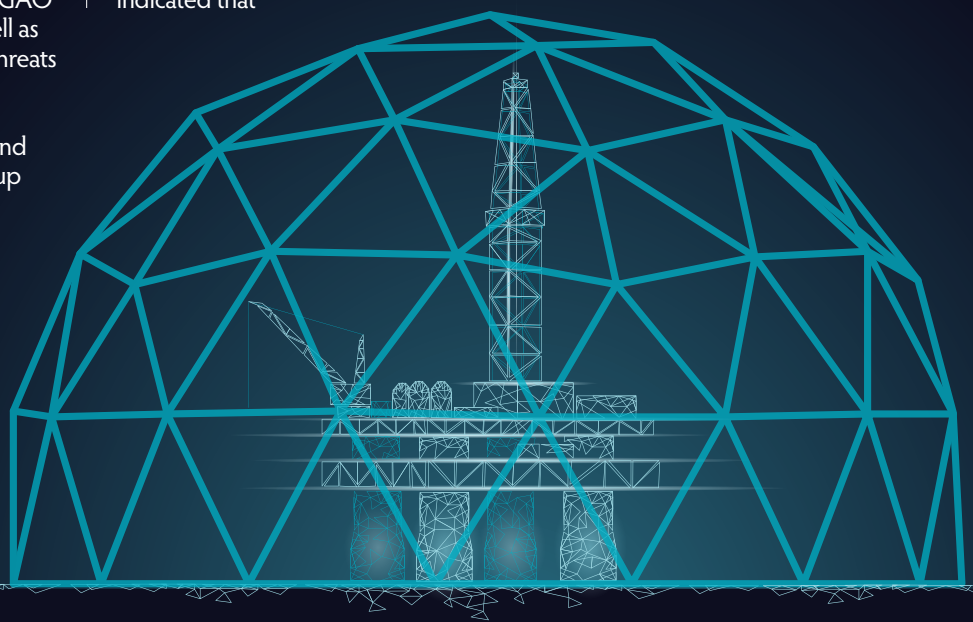
The Coast Guard and Bureau of Safety and Environmental Enforcement told the GAO the effects of a successful cyberattack would likely resemble that of other incidents related to OT systems that have occurred in the outer continental shelf (OCS).

According to BSEE incident investigation documentation, these can include "deaths and injuries, damaged or destroyed equipment and pollution to the marine environment."

But the worst-case scenario would be multiple attacks that simultaneously cripple an operator's OT.

"For example, the failure of the mobile offshore drilling unit Deepwater Horizon's blowout preventer—an OT system—contributed to its explosion and sinking, as well as 11 deaths, serious injuries and the largest marine oil spill in the history of the U.S.," the report said.

Pipeline and Hazardous Materials Safety Administration officials have also indicated that



cyberattacks against pipeline OT—such as valves controlling oil and gas flow—could disrupt production and transmission.

In a now infamous attack, in 2021 criminals extorted Colonial Pipeline, which was forced to shut down a major pipeline system because of a ransomware attack. Disruptions to the pipeline resulted in a temporary halt to operations, which led to gasoline shortages throughout the southeast U.S.

BSEE slow to act

BSEE has taken few actions to address cybersecurity risks to the more than 1,600 oil and gas facilities and structures on the OCS, GAO found.

"This creates significant liability, given that a successful cyberattack on such infrastructure could have potentially catastrophic effects," the report said.

BSEE officials say the severity of cyberattacks could be mitigated by onsite manual controls that can override automated systems, although they could not point to any specific analysis supporting that conclusion.

"Specifically, these officials stated that operators have the ability to manually shut down operations, in the event of an emergency, to prevent the worst outcomes," GAO reported, noting that the statements were generally based on the professional experience of the BSEE officials who "were not aware of any assessments confirming that manual controls could mitigate the impacts of cyberattacks."

Since recognizing the need to act in 2015, the scale and scope of cybersecurity risks have continued to increase, creating even greater urgency for the bureau to respond.

BSEE has struggled to address cybersecurity risks to offshore oil and gas infrastructure and only recently has taken steps to start a new initiative, the GAO said.

"This effort remains in the earliest stages of development," the report said.

According to the report, BSEE should be guided by an overarching strategy that identifies:

- Cybersecurity risks and relevant practices to address them;
- BSEE's role in addressing them;
- Formalizing relationships with other federal agencies and industry organizations;
- Identifying resource needs, such as appropriate staffing levels; and
- Performance measures to assess results.

Without a strategy to guide the development and implementation of its new cybersecurity program that incorporates these key features, the effectiveness of any cybersecurity program that BSEE ultimately establishes could be constrained, GAO warned.

"This, in turn, would jeopardize the bureau's ability to address the significant and increasing cybersecurity risks facing offshore oil and gas infrastructure on the OCS." OGI

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WOMEN IN ENERGY GLOBAL STUDY 2022

Labor shortage persists, but workers are speaking up.

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More than half of global energy workforce is looking for a new job, according to new research —and that could be a problem of epic proportions for the industry and economies around the world that rely on it.

Roughly 67% of the workers canvassed for the annual Women in Energy Global Study are contemplating a move within the next two years. Split along gender lines, it's 61% of women and 72% of men surveyed.

Among women workers, the results reflect a 17% from the previous year.

The impetus behind apparent worker wanderlust can be difficult to pinpoint, Vicki Codd, group marketing director for NES Fircroft, told Hart Energy.

However, it does reflect the pandemic-induced macro trend of the so-called "Great Resignation."

More than half of those surveyed considered seeking a new role in 2022, a 17% increase from the previous year.

	2020	2021	2022
Considering whether to leave current role	65%	44%	61%
Lack of leadership opportunities	45%	14%	17%
Lack of training/mentoring opportunities	40%	—	—
Interested in new challenges	—	18%	40%
COVID-19 forced change	—	—	34%

Source: NES Fircroft/Energy Jobline

Women In Energy Global Study Results, 2020-2022

	2020	2021	2022
How many women responded to the survey?	916	1,330	1,641
Female respondents in renewable sector	16%	23%	29%
Female respondents in O/G sector	50%	39%	23%
Employer offers formal mentoring programs (internal/external)	32%	58%	87%

Source: NES Fircroft/Energy Jobline

"People are generally across all industries reassessing their options following the pandemic," she said. "The market is buoyant, and engineering talent is in demand, making it easy to move."

Investigating the barriers to women working in the field both in the U.S. and abroad, NES Fircroft, an industry staffing services firm, teamed with the global energy job board hub, Energy Jobline, to circulate the survey between Aug. 1 and Sept. 30, 2022.

A group of 2,444 people answered the firms' 21 questions; 67% were women. The two firms reviewed and collated the results with supporting partner, POWERful Women, an initiative of the U.K.'s Energy Institute.

The "Great Crew Change"—an industry bogeyman that haunts the space on its own boom-and-bust cycle—preceded the "Great Resignation." The one-two punch of those dynamics set the scene for a worker shortage—or, perhaps more specifically, a "talent crisis"—that has been years in the making.

COVID-19 took some 100,000 workers out of the North American oil patch and roughly only one-half of them have returned, according to market research. Large companies, small firms and the various sized shops in-between continue to feel the pinch.

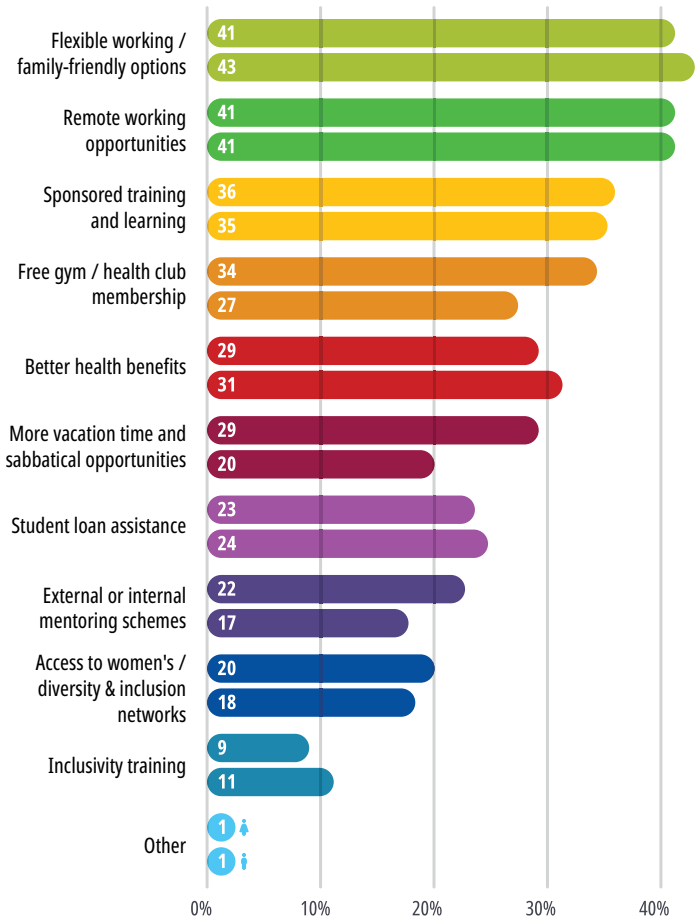
The case can be made that there are people to fill the jobs. Women represent almost half of the U.S. workforce, according to World Bank data. But the figure falls dramatically when it's applied to the energy workforce. Women represent about 25% of the workforce in the U.S. industry, despite accounting for 47% of total labor.

In short, management at energy companies—particularly in the U.S.—cannot afford to apply business as usual tactics to retaining talent.

The women in energy report is de-

The most attractive workplace benefits

Which workplace benefits would you like to see more of in your organization?



Source: NES Fircroft/Energy Jobline

signed to shed light on the female energy workforce across five continents and all sectors. But in 2022, the researchers found small differences between men and women when it came to where they work, what they do and what they need.

"Both women and men are still struggling to progress their careers, more than two years since the start of the health crisis, and it seems to be getting worse," said Georgina Worrall, project manager at POWERful Women.

"With the energy sector facing a skills shortage as it transforms for the energy transition, companies need to be offering more opportunities and focusing on developing their people. They should ensure that they are supporting, cultivating and retaining the female talent that already exists within their organizations."

In its fourth annual questionnaire, the women in energy survey asked whether women are more interesting in working for companies that area focused on reaching net zero or being carbon neutral. A resounding 83% said yes.

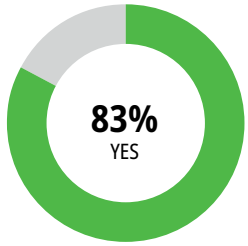
Women in the energy workforce have said in previous years that these corporate commitments align with their own values.

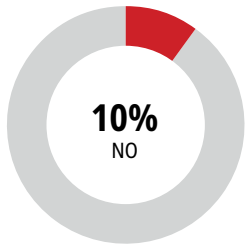
"But I think there is also an element of seeing it as the future and where the exciting projects will come on line for engineers," Codd said.

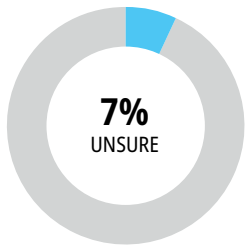
Indeed, the key aspects of the industry that attracted many of the women surveyed included addressing climate

Company commitments to net zero

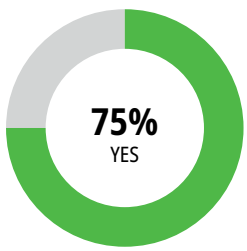
Are you more interested in working for companies that are focused on reaching net zero / carbon neutral?

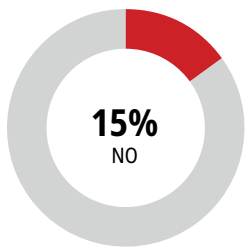


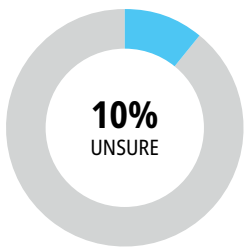




Do you believe your company is genuinely committed to achieving net zero or reaching its climate change targets?

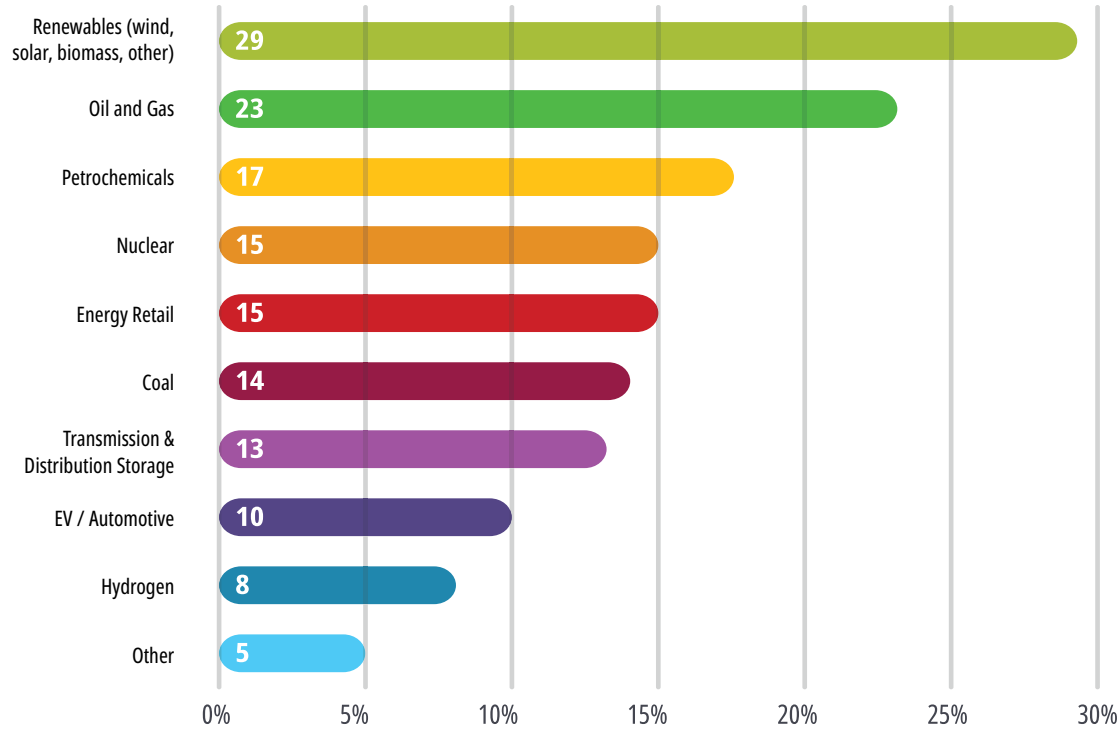






Source: NES Fircroft/Energy Jobline

Which energy sector do you work in?



Source: NES Fircroft/Energy Jobline

change needs and contributing toward net zero/carbon neutrality; developing solutions to meet evolving energy demands; and experiencing the opportunity to work on new technologies, she said.

Net-zero messaging is clearly an important part of the "employee value proposition," said Energy Jobline director Josh Young.

"Following the Great Resignation, companies need to have things up their sleeves in their talent strategy; these messages are a key way to attract and retain women in the energy sector," he said.

And workers—regardless of gender—indicate they expect more than lip service.

"Companies are expected to have a clear ESG strategy in place and demonstrate they are making a real impact affecting positive change," Codd said. "It's something investors and candidates applying for jobs look at.

A full 75% of all workers surveyed said they believe their company is "genuinely committed" to achieving net zero and/or reaching climate change targets.

"Greenwashing by companies on their environmental commitments might be becoming a thing of the past," she said. "Not only do people want to work for companies that are committed to the transition to net zero and finding solutions to climate change, they believe that commitment is genuine."

Almost half of the women who responded to the survey held senior positions, and 72% of them have less than a decade in the industry.

Rather than being a knock-on effect of the Great Crew Change, Codd said it could be an indicator that efforts to encourage young women to study the sciences and technology are working.

"This could be a really positive indicator that times are changing and more women are studying STEM [science, technology, engineering and math] and coming through in to the sector," she said.

Survey results also indicate that companies are finding ways to develop those young women in the field. In 2021, women reported a dearth of formal mentoring options at work. Almost 40% said their employers offered no mentoring opportunities; that dropped to 9% in 2022.

Among the firms that have created mentoring initiatives, 77% of respondents—women and men —have made use of them.

Companies likely saw the writing on the wall, which the Great Resignation put in graffiti across all energy sectors. Mentoring helps retain current talent—and it can be largely expense neutral.

"Mentoring programs are a relatively low-cost activity, a fantastic addition to any [diversity, equality and inclusion] strategy and can bolster retention," Worrall said. "In a year when budgets are tight, mentoring could be an attractive option to offer employees." OGI

25 INFLUENTIAL WOMEN IN ENERGY

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The deadline for nominations is **October 20, 2023**

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US FLOATING WIND CHARTS COURSE

Floating offshore wind is expected to play a key role in helping to decarbonize the U.S. electric grid but obstacles await.

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The U.S. has started its journey to deploy 15 gigawatts (GW) of offshore floating wind energy by 2035 as it works to combat climate change, but the road ahead won't be without challenges.

There are needs for deepened ports and other infrastructure. There is a need to scale, and scale quickly and safely.

Then, there is the technology. The basics, analysts say, are proven. However, ongoing research and demonstration projects indicate a need to further de-risk technology.

Add to these challenges the need for transmission upgrades, permits and regulations plus any supply chain and inflationary pressure that could surface.

Then, there's the relative newness of it all, considering only 0.1 GW of floating offshore wind has been deployed globally compared to more than 50 GW of fixed-bottom offshore wind, according to the Biden administration.

"Even developing all of the proposed floating offshore wind projects in the U.S. would only result in 11.5 GW, and this is before you consider the economic, technical and supply chain challenges that will need to be overcome for this to be achieved," said Peter Lloyd-Williams, senior commercial analyst for the Westwood Global Energy Group. "For any new projects being conceived by developers, the timeline is going to become an issue. Some projects have taken a decade to receive final approval, so you can see the time pressure."

However, energy companies appear to be up for the challenge.

Floating offshore wind is expected to play a key role in helping to decarbonize the U.S. electric grid. Investments in the sector will tap into 2.8 terawatts of potential power, more than double the current U.S. electricity consumption, according to the U.S. Department of Energy (DOE).

"For floating wind in particular, there isn't too much of an installation or operational history around the globe, so the U.S. projects will be learning lessons that are still to be learned elsewhere."

—**Peter Lloyd-Williams,** ***Westwood Global Energy Group***

Leading the journey

Provisional winners of five wind lease areas offshore central and northern California, offered by the U.S. Bureau of Ocean Energy Management (BOEM), will set the course for commercial-scale floating wind projects. The December 2022 lease sale was the first of its kind for the Pacific Ocean, where deepwater depths necessitate floating wind technology.

Winners of the sale were RWE Offshore Wind Holdings, California North Floating, Equinor Wind U.S., Central California Offshore Wind and Invenergy California Offshore Wind.

Wind speeds and location near large load centers in California attracted

Equinor to the state's Morro Bay area where it secured floating wind development rights, according to Elisabeth Treseder, head of area development for Equinor Renewables U.S.

"While still at a very early stage, we believe the site has the potential for about 2 gigawatts of energy, enough to power some 750,000 California homes with renewable electricity," said Treseder. "Development at the site will show the important role that floating offshore wind can play in adding electricity to California's grid, improving regional electricity reliability and accelerating the state's achievement of its climate goals."

Previous U.S. offshore lease sales have been in shallow-water areas of the Atlantic Ocean.

However, about two-thirds of the wind potential offshore the U.S. is over water too deep for wind turbine foundations that are attached to the seafloor, or fixed-bottom turbines. Water that is at least 60 meters (m) deep generally calls for floating wind technology.

"Floating offshore wind is new to the U.S., and like any new industry, significant investments and collaboration are needed to develop it successfully."

—**Elisabeth Treseder**, *Equinor Renewables U.S.*

Demonstrations underway

The first floating demonstration projects in the U.S. could begin coming online within the next several years, said Lloyd-Williams, but each will be limited to a handful of turbines.

The New England Aqua Ventus 1 floating offshore wind demonstration project could start up in 2023 or 2024. Led by Mitsubishi Corp. subsidiary Diamond Offshore Wind, RWE Renewables and the University of Maine, the project features an 11 megawatt (MW) wind turbine mounted on a floating semisubmersible hull called the VolturnUS offshore Maine.

Startup of the 60-MW CADEMO, which features taller and larger blades than conventional onshore wind turbines offshore California, could follow.

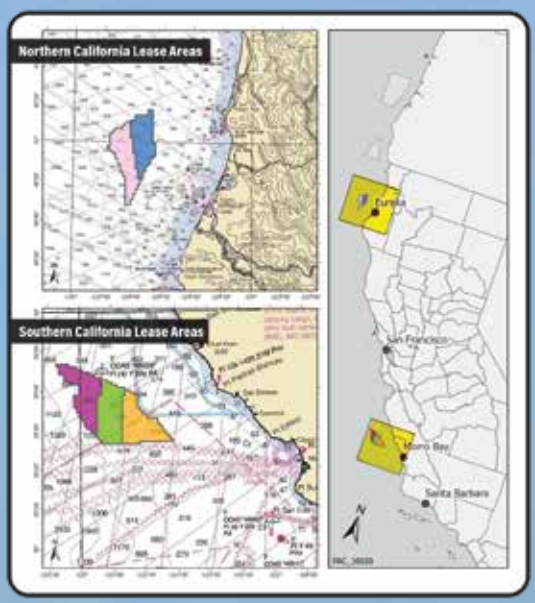
"In terms of the utility-scale projects, we don't see these coming online until the 2030s," Lloyd-Williams said.

Equinor, which was the highest bidder for an 80,062-acre area offshore California, is in the early planning

Provisional Winners of the California Lease Areas, $757,100,000 in High Bids

LEASE AREA		
OCS-P0561	RWE Offshore Wind Holdings, LLC	$157,700,000
OCS-P0562	California North Floating LLC	$173,800,000
OCS-P0563	Equinor Wind US LLC	$130,000,000
OCS-P0564	Central California Offshore Wind LLC	$150,300,000
OCS-P0565	Invenergy California Offshore LLC	$145,300,000

BOEM Bureau of Ocean Energy Management



MCCANN ENTERPRISE UK / EQUINOR

OLE JØRGEN BRATLAND / EQUINOR

stage for the area, proceeding with the site assessment and permitting process.

"It is too early to say how the timeline will unfold for this project, as it depends on a variety of factors, including the state's ambitions and decisions around power offtake, environmental considerations, and stakeholder considerations, among others," Treseder said.

While the U.S. is pushing to deploy 30 GW of offshore wind energy capacity by 2030 and 15 GW of floating offshore wind by 2035, California aims to produce up to 5 GW of electricity from offshore wind by 2030 and 25 GW by 2045.

Rising to challenges

Above: Hywind Tampen is assembled at the Wergeland Base in Gulen, Norway. The finished turbines float in Fensfjorden before getting towed out to the field.

"Floating offshore wind is new to the U.S., and like any new industry, significant investments and collaboration are needed to develop it successfully," Treseder said. Goals set by California and the U.S. provide "an ambitious, long-term outlook for floating offshore wind which is important for establishing a level of certainty needed to develop the industry."

Substantial port, transmission upgrades and infrastructure developments will be required, she said. Successful coexistence and collaboration with stakeholders, such as other marine users and environmental justice communities, are also crucial.

Calling floating wind a "different beast" compared to fixed-bottom wind, Lloyd-Williams said most floating wind foundations require deep-water berths when marshaled in port. That puts a premium on suitable ports, he said, adding "it's generally harder to deepen a port than it is to expand quayside facilities, which is where most of the port development prompted by fixed bottom wind has come."

Reaching goals would also test the supply chain, considering manufacturers and infrastructure would have to scale at levels never seen before.

"In the oil and gas sector, developers tend to only install one or two large floating production systems at a time; whereas, floating wind developers will be installing dozens of units," Lloyd-Williams said.

A few aboveground obstacles that came to mind for the analyst were the build-out of the onshore grid, not only building generation facilities but also engaging with stakeholders to secure approvals to build transmission infrastructure to get power to

where it is needed. The difficulty, he said, isn't unique to floating wind or to the U.S.

The regulatory environment could also present challenges.

"The Biden administration has made some progress here, and the speed of the federal permitting process has increased significantly since 2021, but there are still a host of state/local/federal requirements that need to be complied with," Lloyd-Williams said. "Again, this isn't just a U.S. issue. Many jurisdictions are trying to find the right balance between a thorough permitting process and an overly onerous one."

Inconsistent regulations and leasing have already delayed some projects in Asia and Europe, he noted, as governments reformed regulatory processes with developers midway through projects.

The technology continues to evolve as players look for ways to lower costs.

Advancing technology

Unlike conventional fixed-bottom wind turbines in shallower water, floating turbines are moored to floating structures to harness power in deeper waters.

Sitting atop a platform, the turbines are attached with mooring lines connected with anchors to the seafloor. They work the same as other wind turbines: wind pushes the turbine's blades, causing them to spin and turn the rotor that is connected to a generator.

"At commercial scale, the costs of the first floating offshore wind projects are estimated to be more than 50% higher than costs of fixed-bottom offshore wind," according to the DOE.

The DOE has launched an initiative to reduce floating offshore wind costs in deep water by more than 70% to $45 per MWh by 2035.

Ask whether floating wind foundation technology is proven, the response may vary.

"On the one hand, the basics of the technology are fairly well established. On the other hand, there are still new demonstration projects being proposed, so clearly there is some desire to de-risk the technology further," Lloyd-Williams said. "At the same time, some industry players are saying 'the technology itself is proven; focus on achieving scale.'"

The main types of floating foundations are the spar buoy, semi-submersible and tension-leg platform. Each has pros and cons. According to the International Renewable Energy Agency, floating foundations are proven in harsh operating conditions, and designs are adapted for different dynamic characteristics and loading patterns.

Others, including offshore wind experts at DNV, say more attention is needed on other components, particularly floating offshore substations. The offshore substations have heavier topsides than wind turbines, which DNV says affects weight distribution and center of gravity.

Equinor began its initial research on floating wind concepts two decades ago, having successfully demonstrated the world's first floating wind turbine 13 years ago, Treseder said.

In water depths between 95 m and 120 m, the company brought the world's first commercial floating wind farm—the 30-MW Hywind Scotland—online in 2017.

The project has demonstrated the world's highest capacity factor, a measure of how often a wind farm runs at maximum power, since its startup, Treseder said. That "gives us tremendous insight into the performance of floating technology.

"Through Hywind, we've also augmented our ability to build projects at scale to deliver cost efficient renewable energy to benefit customers."

Equinor is currently developing a floating wind farm that will provide electricity for the Snorre and Gullfaks oil and gas fields in the Norwegian North Sea. The 11-turbine Hywind Tampen will have a capacity of 88 MW. Building on the Hywind concept, technology and execution methods, the project aims to reduce capital by 40% compared to Hywind Scotland, Treseder said.

Looking ahead

The Morro Bay Call Area has annual wind speeds between 8 m and 10 m per second, which is greater than the average speeds of several commercial developments in the North Sea, according to BOEM.

Equinor's lease area is about 60 miles off central California's coast. The company planned to deploy metocean facilities to deepen its understanding of wind conditions in the area.

"Generally speaking, winds are stronger and more consistent farther out to sea. Morro Bay is located farther from the shore than Hywind Scotland, but we need to further build our understanding of the conditions in the lease area before making any comparisons," Treseder said. "By using floating turbines, wind farms can be located where the wind is best, which allows us to gain a higher capacity factor."

Other regions of the world, including the U.K. and Asia, are further along in floating wind developments.

However, "for floating wind in particular, there isn't too much of an installation or operational history around the globe, so the U.S. projects will be learning lessons that are still to be learned elsewhere," Lloyd-Williams said.

He suspects large floating projects off South Korea, including some being developed by a few of the California lease round winners, will be watched closely.

Treseder called California's entry into offshore wind a game changer for the state. It shows the time for offshore wind has arrived in the U.S.

"As the world's leading floating offshore wind operator and developer—and one of the first developers of large-scale projects on the East Coast—we're very excited to apply our experience here and overseas to helping advance California's offshore wind industry," she said. "This industry will be here in California for the long haul, and we're proud to play a role in getting it started." OGJ

ENERGY'S CRISIS

As the world clamors for energy, the oil and gas industry is facing its own dilemma: attracting talented employees.

BY MARK DRUSKOFF
CONTRIBUTING EDITOR

The roots of oil and gas' looming talent challenge began with the end of the World War II. Returning GIs anxious to start a new life began getting married and having kids, lots of kids. An estimated 78 million baby boomers were born between 1946 and 1964. They began retiring in 2011 and most will be done by 2029.

Oil and gas had managed to put off the so-called "Great Crew Change" for a time because equity values were "crushed" between 2014 and 2020, said Les Csorba, partner in the Houston office of executive search firm Heidrick & Struggles. But no longer. Oil and gas is now one of the best performing equity classes, and rising stock prices means the sector is seeing more retirements, Csorba said.

To be sure, the pandemic has also played a role, accelerating the pace of retirements for older workers.

"Companies are worried about retirements over the next year to 18 months across the C-suite," Csorba told Hart Energy. Succession planning is becoming a real issue as oil and gas enterprises wrestle with how to replace experienced senior managers with younger, less experienced workers. It's for that reason that Csorba, along with his colleague, Clayton Spears, produced the recent report "The next energy crisis? Talent."

Replacing those retirees is made more complicated by factors specific to the oil and gas industry.

"There's a huge gap in middle management," said Csorba. Previous downturns forced layoffs that pushed talent from the sector as well as growing anti-hydrocarbon rhetoric have tamped down interest in careers in oil and gas.

The true scale of the problem has been masked to a degree by private-equity investment in the sector between 1997 and 2017, said Chuck Yates, a former managing partner at Kayne Anderson Capital Advisors. Such investment created opportunities for young executives to gain experience as part of a startup management team and create the potential for significant rewards, he said.

Private equity's decreased prevalence shrinks those opportunities for young talent, Yates told Hart Energy. Meanwhile the current state of the market scares off potential new entrants because it creates "unlimited downside and limited upside," he said.

Yates himself lost his job at Kayne Anderson in 2020 and is now a self-proclaimed "social media influencer" through his podcast, "Chuck Yates Needs a Job."

Start at the top

The scale of the oil and gas talent problem is so large that it demands board-level involvement, similar to ESG risks, said Csorba. Companies might consider creating reports to demonstrate the sustainability of their talent pipeline.

"I would argue that leadership and succession planning and talent is also a material risk to the longevity of a business," said Csorba.

Csorba and Spears suggest

THE NITTY GRITTY

In the report "The next energy crisis? Talent," authors Les Csorba and Clayton Spears make the following points in planning for and developing new leaders.

- While affirming a bias for the development and promotion of internal leaders, consider selectively going outside the industry to reinvigorate cultures and bring more experiential diversity.
- Double down on building inclusive cultures, role-modeled by leaders and aligned with operating systems and processes that engage employees, enhance the free flow of innovation and, in turn, create an attractive environment for outsiders to join.
- Invest in best-in-class governance and leadership initiatives as a way to attract the best and the brightest from any industry (as well as to demonstrate shareholder stewardship). For example, rigorous 360-degree assessments should be expected not only for high potentials but also for CEOs, executive leadership teams and, yes, boards.
- Oil and gas boards should be more intentional about adding diverse voices of energy expertise (climatologists and "new energies" leaders, for example).
- Discuss ways that companies across the energy sector can collaborate and learn from each other, such as collaborating in planting the seeds for new leaders with industrywide support of initiatives in STEM education.

US Oil And Gas Employment By Subcluster

Cluster Name	2008 Employment	2013 Employment	2018 Employment	2020 Employment
Support Activities for Oil and Gas Operations	37.8%	43%	43.7%	43.4%
Oil and Gas Extraction	18.8%	19%	18.5%	18%
Petroleum Processing	16.9%	13.8%	11.9%	12.5%
Drilling Wells	12%	9.2%	11.6%	11.4%
Pipeline Transportation	7.8%	7.6%	8.2%	8.3%
Oil and Gas Machinery	6.7%	7.5%	6%	6.4%
U.S. Totals (Subcluster)	**569,344**	**695,109**	**580,744**	**555,851**

Source: U.S. Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School

Overall US Workforce By Age

Total	% of Workforce	Employed Total 2021
16 years and over	100%	152,581
16 to 19 years	3.45%	5,266
20 to 24 years	8.79%	13,409
25 to 34 years	22.66%	34,578
35 to 39 years	11.01%	16,804
40 to 44 years	10.44%	15,930
45 to 49 years	9.92%	15,142
50 to 54 years	10.10%	15,413
55 to 59 years	9.47%	14,442
60 to 64 years	7.52%	11,470
65-plus years	6.64%	10,127

Source: Bureau of Labor Statistics

companies should report on efforts to develop, recruit and retain the next generation of leaders; leadership initiatives, academies, coaching and mentoring programs; C-level executives of the future programs; and whether external leaders are being recruited to continually reinvigorate leadership, innovation and diversity of experience.

Csorba said chief human resources officers (CHROs) may play a strategic role in such efforts. Just as a CFO and head of audit work closely with audit committee chairs, CHROs should more actively report to and participate in nominating and governance committee meetings on boards and be accountable alongside the CEO for the company's leadership strategy. Such executives should probably be reporting quarterly to the board of directors and be more involved in executive compensation. The board's key responsibility, after all, is to hire and fire the CEO, he said.

Boards should hold management teams more accountable for rigorous talent acquisition and leadership development programs, Csorba and Spears said, and maybe consider making this metric a part of executive compensation plans.

"Boards really ought to be focused on that," said Yates, adding that talent management is "business 101."

The directors' role is not necessarily to tell companies what to do but rather to provide guidance on what not to do, he said. They should also ask questions. The board should get answers to basic questions such as what's the company's recruiting plan, how many people are needed, what is the average cost when an employee leaves and what happens if something were to occur to senior management, Yates said.

Yates sits on the board of directors of Black Mountain Acquisition Corp., a Fort Worth, Texas-based special purpose acquisition company focused on opportunities in the energy industry in North America led by CEO Rhett Bennett. He is also on the advisory board of Montrose Lane, a venture capital firm focused on digital solutions for the energy industry, and a "big brother" to the founders of Digital Wildcatters, a social media company focused on the energy industry.

Needs assessment

When considering how to develop future leaders, Csorba and Spears said that energy executives must move away from being specialists and look to become more like decathletes, who are proficient in many areas. Those include financial performance, investor confidence, innovation, social or people or safety leadership, environmental stewardship, reputation, and risk and resilience.

Executives are shouldering new demands that didn't exist previously. Expectations include increased disclosure and transparency regarding ESG factors to investors and analysts, more aggressive shareholder activist campaigns and the ever-rising importance of technology.

Technology holds a stark duality, Csorba said. Leveraging big data offers great potential, for instance, in aiding decision-making on proper well spacing or other operational matters.

But greater reliance on technology exposes companies to cybersecurity risks, as the Colonial Pipeline ransomeware hack demonstrated. Future leaders will need to balance that risk/reward. For that reason, some companies look to have generational diversity within executive teams and boards to enhance their digital expertise.

Despite the technical sophistication of oil and gas when it comes to applying technology to solving large problems, such as using 3-D seismic to make massive new oil finds, the industry does less well in using technology to run more efficient businesses, Yates said. He points to the large

amount of written ledgers and actual paperwork in the sector that does not help when recruiting younger talent who grew up using apps on their phone.

Other applications of technology likely going underutilized in oil and gas include those focused on employee health and mental wellbeing, Yates said.

"If I have employees that are at the top of their game, particularly with mental health, I'm going to get better performance," he said. Other sectors have invested significant effort into using technology to deliver those offerings, Yates said.

Think outside the sandbox

Not all the hurdles oil and gas companies face are negative. According to the International Energy Agency (IEA), the industry meets more than 81% of current global energy demand, and will only see moderate declines in the future. Hydrocarbon market share is only expected to drop to 78% during the next 20 years as overall worldwide energy demand is expected to grow by as much as 50% by 2050, IEA estimates show.

That means oil and gas companies must not only develop leaders who can meet existing requirements efficiently and profitably but also do so in an environment of rising demand. Csorba and Spears said that future leaders may benefit from looking outside the oil and gas sector for potential solutions in related industries. Specifically, they see the potential for cross-pollination between oil and gas and renewables. They share much in common, not the least of which is powering all other industries and contributing to the flourishing of human civilization.

Renewables is one of the fastest growing portions of the energy sector, averaging 15% compound annual growth rate between 2015 and 2020, according to the U.S. Energy Information Administration. Although renewables are often held up in opposition to oil and gas, the truth is addressing the energy supply challenge will require maximum effort by both sectors, Csorba and Spears said.

Renewables' fast growth has created a need to "get creative" to get bodies in the door, said Spears, who focuses on the sector for Heidrick & Struggles. One approach is to appeal to the mission-driven concerns of younger generations by focusing on sustainability and benefits to the environment to attract new leaders. The renewables sector leads with their mission, not profits, he said.

In many ways, the oil and gas industry has "stuck its head in the sand for 50 years" when it comes to marketing its value to the world, said Yates. Part of the problem he attributed to the fact that oil and gas does not have a culture of marketing because it sells a commodity. Nevertheless, the sector needs to demonstrate its thought leadership and better control its narrative, Yates said.

"Cleaner and greener" is important to oil and gas to fill the pipeline for talent, Spears said. Large upstream players have already begun the pivot by highlighting their investments in new energy segments, he noted.

Last March, Exxon Mobil Corp. announced plans to build a 1-Bcf/d hydrogen production plant in Baytown, Texas, as well as carbon capture facilities to handle up to 10 million metric tons per year. In December 2022, Chevron Corp. announced a joint venture with Baseload Capital to develop geothermal projects in the U.S. Last March, Occidental Petroleum Corp. disclosed efforts to build 70 carbon capture facilities by 2035 to remove 1 million metric tons per year directly from the air.

Csorba also pointed out oil and gas services companies such as National Oilwell Varco and Kirby Corp. announcing plans to provide support for the burgeoning offshore wind power industry.

While oil and gas can learn from renewables, it has much to offer itself from an operational perspective, particularly in terms of operational, regulatory and safety matters, said Csorba. Those are important as renewables have a very large scalability challenge ahead of it, he said.

Closer collaboration stands to benefit both segments, said Yates.

In the future, Yates expects companies to focus more on delivering a diversified slate of energy offerings. That means companies will be less focused on energy type and more concentrated on geographic position. For instance, West Texas not only has world-class oil and gas reserves but also generates a record amount of solar and wind power.

Regardless of the particulars, the large-scale trends are clear. Oil and gas, along with the rest of the energy sector, has a bright outlook but must take steps today to avoid creating a crisis in the future. OGI

ADDRESSING STRUCTURAL CHALLENGES

Young 20-somethings looking at careers in oil and gas could easily be put off by the volatility of the industry, said Chuck Yates, a former managing partner at Kayne Anderson Capital Advisors. Meanwhile, such risk is not countervailed by large potential reward since oil and gas' tenured system requires slow progression up through the ranks.

Companies looking to address this issue could consider arrangements that reduce uncertainty by granting employment guarantees, for instance, through rolling, 12-month employment contracts. Though he acknowledges such structures could face resistance from shareholders.

Companies would be wise to consider how oil and gas' countercyclical performance impacts views on the industry.

"When oil and gas does its best is when the economy is bad," he said.

In contrast, technology entrepreneurs are celebrated for their success, but that is usually when the economy is also at its best. "It's easier to cheer for someone when you can put burgers on the table," Yates said.

CEO SUCCESSION PLAN

Does your company have a plan to continue leadership? Experts who advise oil and gas companies warn that companies that don't plan ahead put themselves at risk if a CEO departs unexpectedly.

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Trem Smith took the reins of Berry Petroleum Corp. in March 2017 after the company emerged from the bankruptcy of former owner Linn Energy. Sixteen months later, on July 26, 2018, Berry launched a successful IPO.

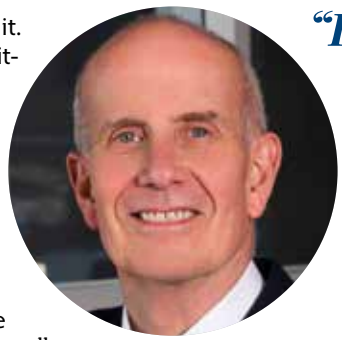
And a few minutes after that (give or take), Smith began talking to Berry's board about who would replace him as CEO.

Not that he didn't like his job. Far from it. But finding a successor was, to Smith, a critical component of doing his job.

"Everyone thinks my main job is to run the company, but really my main job is to find my successor," Smith told Hart Energy, quoting an executive from earlier in his career.

"When we went public, it became very clear that that was a cue," he said. "I understood what he meant. And so, the board and I started thinking about this, literally meeting after we went public: 'What would happen if I got hit by a bus?'"

The solution: long-term succession planning.



"I feel like I can leave as CEO having been quite successful."

—**Trem Smith**, *Berry Corp.*

'You've got to have a plan'

The approach to succession taken by Berry Corp. (the company changed its name in 2020) is not universal, specifically in the oil and gas space or the corporate world in general. A lot can get in the way of a smooth, orderly transition.

Sometimes it's office politics, such as nepotism precluding a search for a qualified leader. Sometimes it's conventional politics, such as new Brazilian President Luiz Inácio Lula da Silva choosing the CEO of state-owned Petrobras.

And other times, it's considered a conversation to put off for another day.

"I walk through conferences and I talk to business owners and I get, 'we're not there yet, we'll get to it later,'" Kendall Rawls, director of development for Rawls Succession Planners, told Hart Energy. "But the problem is, without them having any sort of strategy for the future, they're basically setting themselves up for failure."

A PwC survey of members of boards of directors found the biggest challenge to more timely and effective CEO succession planning was the current CEO performing as expected. That reasoning leaves the company vulnerable to a CEO's sudden debilitating illness or death or, for that matter, unexpected resignation.

"Our world has thrown us a few curveballs lately in terms of succeeding through COVID and the 'Great Resignation,'" Rawls said. "You can't have a successful business without great people and talent to push the mission forward and serve customers. What we do is work with business owners to partner with them to build strategies for the possible, the probable and potential issues impacting their business."

Succession planning aims for the ongoing success of a business through the next generation of owners, leaders and managers, she said. And that takes time.

"You ought to be thinking of a successor CEO, No. 1, before you know you need a successor CEO," Joe Ahmad, founding partner of the AZA law firm in Houston, whose practice focuses on executive employment, told Hart Energy. "In other words, I think you ought to have a plan at all times. You shouldn't wait for the CEO to announce they're going to leave because you may not get any warning. You've got to have a plan."

'Don't screw it up!'

Berry Corp. traces its roots to 1909 in Kern County, Calif.'s San Joaquin Basin, where the current iteration of the company concentrates its efforts with mature, low-decline oil wells. Production in third-quarter 2022 averaged 25,800 boe/d from wells in California and Utah's Uinta Basin.

Net income in the quarter was $191.7 million, with adjusted EBITDA of $97 million. Quarterly dividends totaled $0.47

per share, a result of the company's shareholder return model that will end up paying shareholders the equivalent of the company's $700 million market capitalization in three years.

The largest institutional investors in the company include Oaktree Capital Management, AllianceBernstein, Hotchkis & Wiley Capital Management, BlackRock Inc., Fidelity, Vanguard Group, State Street Corp. and Benefit Street Partners. Furthermore, stock rating outlet stocknews.com mentioned it as the one energy stock to buy in 2023.

"I feel like I can leave as CEO having been quite successful," said Smith, who now holds the title of executive chairman. "I'm very proud of that."

Smith hired Fernando Araujo, who took over as CEO on Jan. 1, as the company's COO in September 2020. Araujo, an industry veteran with experience in executive roles at Schlumberger, Apache and Repsol, became the prime candidate for the top job.

Smith had a clear idea of what he was looking for in a successor. The chief executive of a California oil and gas company must be able to navigate a much different cultural landscape than a counterpart elsewhere in the country.

"When you're in California, it's like being in a foreign country compared to Texas," he said.

Araujo had experience managing operations in Egypt, Canada and, with Schlumberger, E&P assets in 10 countries. He had run profit/loss centers at those companies and, as a trained mechanical engineer, brought a depth of understanding of the oil industry to his role as COO and present role as CEO. What he lacked, Smith said, was familiarity with the demands on a CEO of a public company, and Smith was happy to teach him.

"I think one of the biggest roadblocks for an owner not doing succession planning is humility."

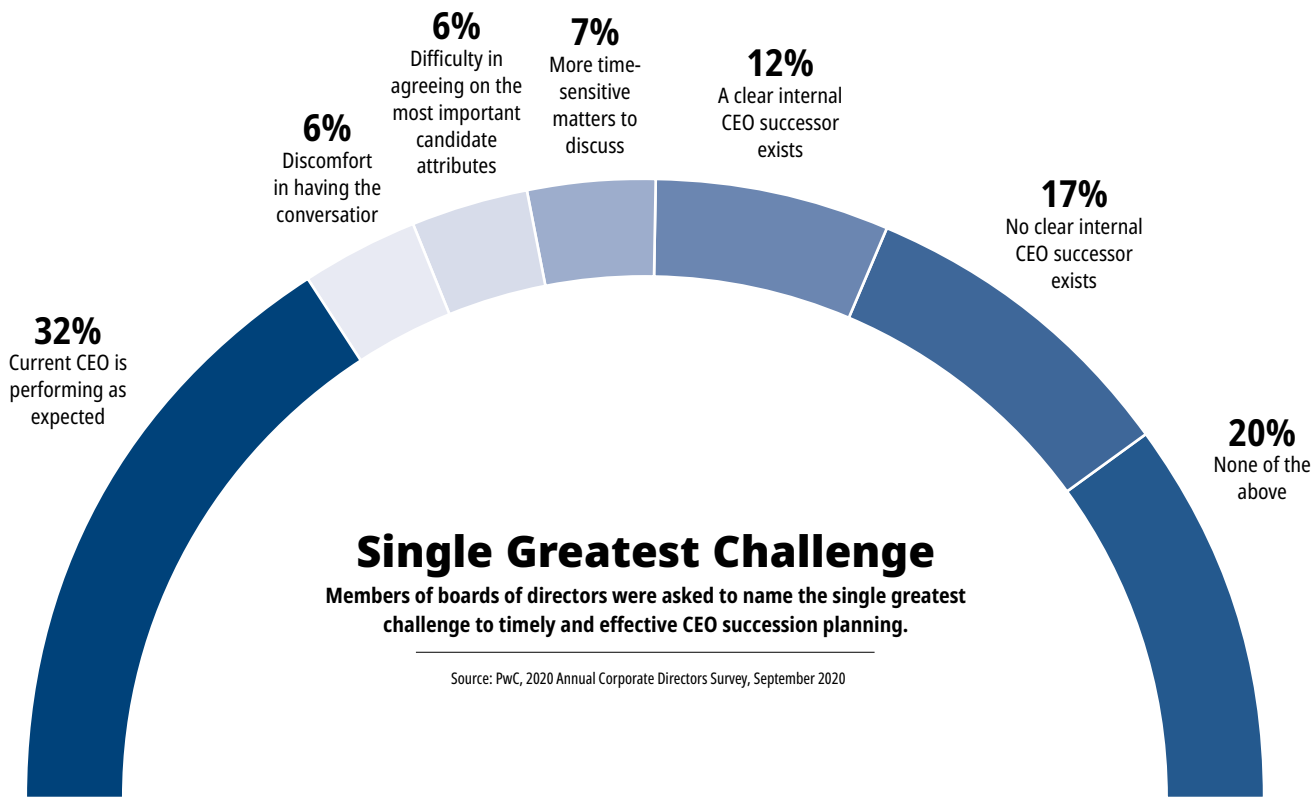
—**Kendall Rawls,** ***Rawls Succession Planning***

High-level transitions are not always easy but can be rewarding for the executives and the company's stakeholders when done right.

"If I sound enthusiastic about this—and I am—it's because it's really hard," he said. "Most things you read about succession planning are failures, OK? That's why you read about it, because it's a story. It looks like we've done this fairly well, and that's good."

And as an investor with a substantial financial stake in Berry, Smith has a personal interest in Araujo's success.

"We're counting on him," he said in December prior to the succession. "I just basically told him the other day, 'Don't screw it up!'"



Single Greatest Challenge

Members of boards of directors were asked to name the single greatest challenge to timely and effective CEO succession planning.

Source: PwC, 2020 Annual Corporate Directors Survey, September 2020

'Big egos'

Critical to a succession plan is determining who is in charge of choosing an eventual replacement for a company's top leader. Typically, that is a committee of members of the board. Sometimes it is delegated to the CEO, which has the potential of pushing the process sideways.

"I hate to say it, but CEOs have big egos," Ahmad said. "They're really good at making themselves look good. They're not always good at finding somebody else that can have that spotlight."

The board, he said, has to take the primary responsibility and not completely delegate.

"I think if they look at it purely in terms of what's best for their shareholders and not in terms of what's best for the outgoing CEO, oftentimes they'll reach a different decision," Ahmad said. "They can create a mess if they do otherwise."

Smith is well aware of CEOs whose egos simply won't allow them to step away.

"I would like to think I'm not like that," he said, "and so, I don't think it'll be a problem whatsoever to give up the control. I like the idea that we're handing off a solid foundation for the team. There's everything in place for this team to be successful and, to me, that is really a big win."

Bob Iger, who reclaimed his post as CEO of the Walt Disney Co. three years after retiring, found it difficult to step away. He kept an office and was reported to have undermined his successor, Bob Chapek, by holding meetings with senior executives without his knowledge. The Wall Street Journal reported Iger told people that Chapek was not up to the job.

General Electric (GE) chairman and CEO Jack Welch insisted on control of his succession process. He later admitted that pushing the board to hire Jeff Immelt was the worst decision of his career.

"Mr. Welch at GE, he probably had a ton of business advisers around him giving him advice and perspectives," Rawls said. "My assumption is, if he regretted it, he wasn't open to listening to other people's perspectives."

In fact, it's been reported that several board members warned Welch against Immelt.

Titans of the corporate world are not alone, allowing their egos to get in the way. Smaller, private and family-owned businesses face the same hurdles.

"I think one of the biggest roadblocks for an owner not doing succession planning is humility," Rawls said. "They don't know it all. No one can know it all. They can be really great at their job. They can be really great at knowing the industry, knowing the business and being an entrepreneur, but unless they're open to listening to other people's perspectives, I would say that is another potential detriment that impacts the organization."

Part of the problem is the misperception that succession planning is code for retirement and exit from the business, she said. This can be rough on the psyche of a leader for whom the business provides a creative space and social network.

"Businesses involve people and involve emotions and visions and expectations for the future," Rawls said. The succession planning process needs to account for what the owner and all key players in the business want.

"There's no way to develop a successful strategy without delving into the interpersonal dynamics," she said.

'Golden parachute'

The human factor is one that boards of public companies grapple with, as well.

"In high-performing companies, directors may be concerned that broaching the topic of succession will cause the current CEO to think they are looking for a replacement," PwC said in its "How the best boards approach CEO succession planning" report. "In underperforming companies, directors may want to avoid doing anything to make the CEO worry about job security when they need to focus on driving strategy."

To counter that, PwC suggests making succession planning part of the board's regular discussions with a CEO, no matter how the executive or company is performing. That can make the issue feel less personal—avoiding a messy CEO transition in the future is simply a part of the job, thus preparing for it won't feel threatening.

> ***"You ought to be thinking of a successor CEO, No. 1, before you know you need a successor CEO."***
>
> —**Joe Ahmad,** ***AZA law firm***

One aspect of CEO employment, usually negotiated when the executive takes the position, is change-of-control, or severance, compensation. The so-called "golden parachute" is designed to allow the CEO to focus on the company, without worrying about the impact of losing the job due to firing or the elimination of the position in a merger.

"Oftentimes, the sale of the company makes the shareholders money and the reason it's selling at that price is because of what the CEO has done," Ahmad said. "So, I can easily justify some of these payments, particularly change of control payments, where the shareholders have really benefited from the CEO and the management teams' efforts."

Don't rush the process

The consequences of not putting together a succession plan in advance vary, depending on the circumstances of a particular company. But there are consequences, nevertheless.

"What they're doing is putting their entire business at

risk," Rawls said. "And their successful competitors, the ones who are winning at the consolidation game, are in a position to either compete against the big guys or be in a position to buy up smaller organizations or those who are struggling."

Even owners unsure whether they want to continue running the business, or who intend to sell, put themselves at risk. A leaderless company with an uncertain future is unlikely to command top dollar.

At a larger public company, chances of collapse are less likely, but consequences from a lack of planning can be almost as harsh.

"You end up with a CEO that's either unqualified or not ready, not prepared," Ahmad said. "No. 1, you shouldn't be in a rush to find somebody, and you can be in a rush if you don't have a plan in place. A CEO can make all the difference in the world for shareholder value."

Boards without a plan in place when a CEO departs often turn to an internal choice just to keep the company going as is. That person, he said, may or may not be the best to lead the company. And that thinking ignores the complexity of choosing an executive to lead.

"It takes a long time," he said. "It's not easy. You don't call the search firm one day and have a CEO candidate the next. So, my thought is, really, the earlier, the better."

Delaying the process also limits options. Berry was able to transition not just a CEO but an entire team. The former general counsel is now the president, and the chief accounting officer has taken on the role of CFO. But promotion from within may not be the best strategy for every organization.

'All sorts of shapes and sizes'

Even hiring from within the oil and gas industry may not always be the best option. Ahmad said that, ideally, he would prefer a candidate to have an oil and gas background because oil and gas, like every other field, is unique. It helps to be part of a network of people in the field.

"But I think having somebody who's not a great leader, just knows a lot about the oil and gas industry, is probably worse than having somebody that's a great leader that doesn't have that background," he said.

Rawls agrees. Her company has, in multiple instances, recruited a CEO from a different industry based on a skill set and ability to lead and build a strong culture.

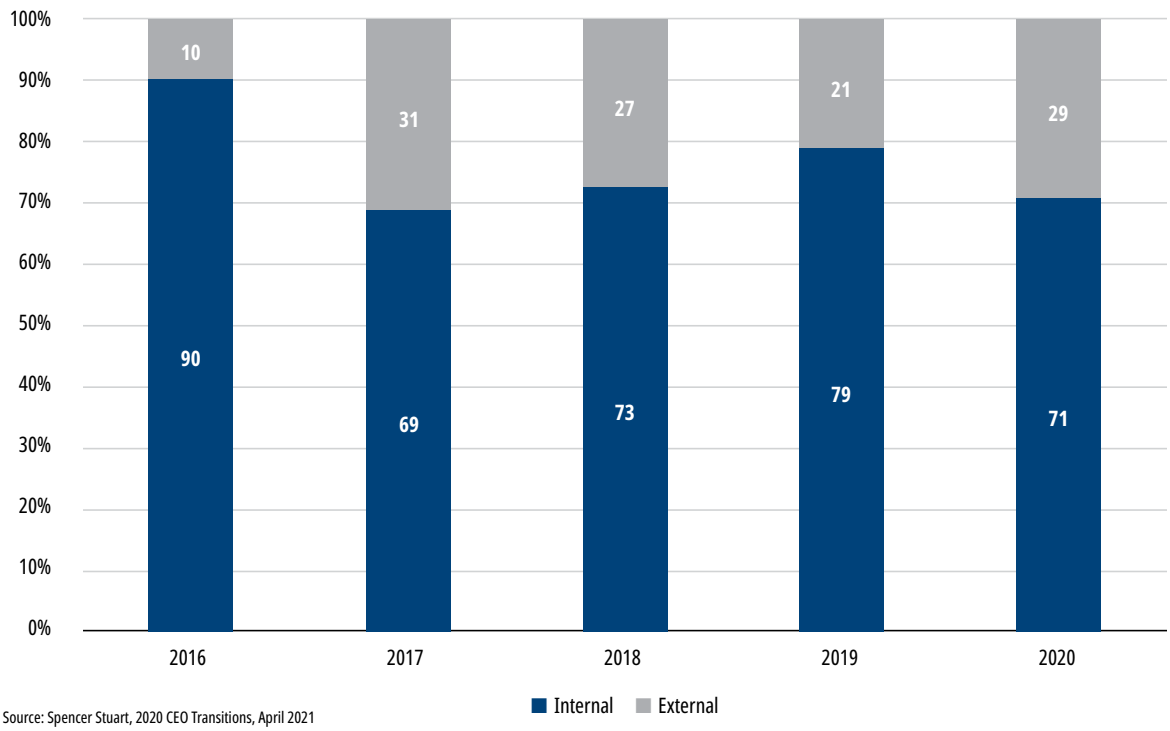
"I think leaders come in all sorts of shapes and sizes," she said. "When you look at some of the greatest leaders, one of the things that they have been known to do is hire great people around them. Everyone has strengths and weaknesses that they bring to the table, but that layer of humility—you need to know that you don't know it all and that you're able to bring in somebody who can support you."

Succession planning can arouse fears among leaders about losing control over companies they lead and, in some cases, founded. A way to alleviate that is to change the paradigm to one of developing talent to ensure legacies.

"It is our belief, which is not a very popular one, that the day you start your business you should start your succession plan," Rawls said.

"And if you think about succession planning from an HR perspective, that's all about developing a bench of talent. When it's thought about that way, it becomes a lot more exciting for an entrepreneur because when you're building a bench, that's supporting growth." OGI

CEO Successors: Internal Vs. External Candidates



Source: Spencer Stuart, 2020 CEO Transitions, April 2021

TAKING CARE OF ORPHANS

As Diversified Energy Co. Plc expands its plugging and abandonment operations, the company anticipates exploring innovative approaches.

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Diversified Energy Co. Plc spent the better part of 2022 buying up plugging and abandonment (P&A) companies to handle their own wells and extend services to other E&Ps. But it's a business that comes with its share of red tape.

The company got a leg up through two pieces of legislation that help fund P&A services for states, but those same states have a hodgepodge of regulations that hamper their ability to innovate.

The company hopes to educate states to the industry's strengths, enabling them to refine P&A techniques that are also more cost-effective.

In 2022, Diversified acquired three plugging services—Next Level Energy, Nick's Well Plugging and Contractor Services Inc.—to expand the company's strategy of vertical integration and control the costs of internal P&A requirement

With Diversified's extensive plugging capabilities, the company has gone from solely handling its own plugging requirements to capping orphan wells for states and third-party companies.

In the past two years, the federal government earmarked about $25 million to states to work through a backlog of abandoned wells. Those funds were allocated through the recently passed Inflation Reduction Act and 2021's Infrastructure Investment and Jobs Act, which seek to address environmental concerns over abandoning orphan wells.

The U.S. Department of Interior has identified 10,000 high-priority well sites across the country ready for immediate remediation efforts. In 2021, states identified more than 129,000 orphaned wells on state and private land.

Diversified does not directly receive federal funds to plug its own wells. The Interior Department awards P&A service grants to states, who then administer them in a competitive bidding process. If Diversified wins the bid, the company plugs the wells, and the states pay for its services, said Brad Gray, executive vice president and COO of Diversified Energy.

Diversified confines its P&A services to the Appalachian Basin. Regulations within each state dictate the process, materials and techniques to plug wells.

That can be a problem because plugging techniques have been the same for decades, Gray said. Innovation in the oil and gas industry has mainly been upon drilling and completing wells, with little focus or funding on improving plugging efficiency, he continued.

To plug a well, Diversified removes the piping in the vertical wellbore and fills the hole with cement. Gray said better alternatives could be available as long as state regulators are willing to be more receptive.

"We think that our team does a great job with reclamation generally within the Appalachian. After a spring growing season, you can go back to where that well site was, and you really can't even tell there was ever a well there."

—**Brad Gray,** ***Diversified Energy Co. Plc***

"There does need to be a partnership with industry and with regulatory authorities to change and update some of the regulations that guide and dictate how wells are plugged," he said. "We're excited about that opportunity and really think there can be some good changes to the industry."

Innovative techniques

Improvements to plugging techniques could help overcome common challenges to P&A services. With wells that have been producing for 50 years or more, piping below the surface can deteriorate and sometimes break apart during attempts to remove it. Operators then have to go in with additional tools to remove the separated piping.

"We think there's an opportunity to use different materials and techniques and look at different ways to get the same effect in a more efficient, cost-effective manner," said Gray. "In order to achieve that, we believe as an industry we can come up with better ways to do it, but the states are going to need to be able to work with us to change the regulations so

DIVERSIFIED ENERGY CO. PLC

Diversified confines its P&A services to the Appalachian Basin. Pictured is one of Diversified's P&A team.

that they can be implemented."

Interactions between a wellbore and water table can also create environmental issues. Plugging a well eliminates the possibilities of leaks or emissions and prevents the wellbore from damaging subsurface formations. Surface equipment is also removed to eliminate interactions between abandoned surface equipment and people, such as the landowner, who might come across the site, Gray said.

"We think that our team does a great job with reclamation generally within the Appalachian," said Gray. "After a spring growing season, you can go back to where that well site was, and you really can't even tell there was ever a well there."

Minimal environmental impact

From an environmental perspective, Diversified-owned wells don't contribute negatively to their surroundings, Gray said.

"There's some people who would try to paint a different picture, but from our experience with the large inventory of wells that we own in the Appalachia Basin, we have tested these wells, and they have very little environmental impact," he said.

While Diversified has producing assets in basins outside Appalachia, including Oklahoma, Louisiana and Texas, Diversified doesn't conduct P&A services outside of Appalachia. Though the company does not anticipate moving P&A services outside of the basin any time soon, there are no plans on slowing down plugging on the horizon.

Diversified currently owns 15 rigs—one service rig and 14 dedicated to plugging. The company employs 12 crews to operate its P&A rigs. By March 2023, Diversified anticipates being fully staffed so that the company can run all 14 rigs. OGI

PERMIAN'S DECEMBER PRICE PLUNGE IS A WARNING FOR 2023

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EAST DALEY ANALYTICS

Justin Carlson is co-founder of East Daley Capital Advisors in Colorado.

How does "close to zero" sound for your natural gas?

East Daley Analytics has been warning of a challenging year in 2023 for Permian Basin gas. We see the recent market volatility as a warning of what's likely in store for producers and midstream companies: close-to-zero value for their gas and close-to-zero hope for a quick turnaround.

For two weeks in December, natural gas at the Waha hub was nearly free. Day-ahead Waha prices traded as low as $0.04/MMBtu on Dec. 8, and the following week, Waha traded as low as $0.05/MMBtu on Dec. 13.

Traders pointed to pipeline maintenance for the plunge in Permian natural gas prices. Work on the Permian Highway Pipeline (PHP) removed up to 1 Bcf/d of Permian takeaway at times, leaving gas supply bottled in the basin. In early November, Waha prices fell below zero during similar maintenance events on outbound Permian pipelines.

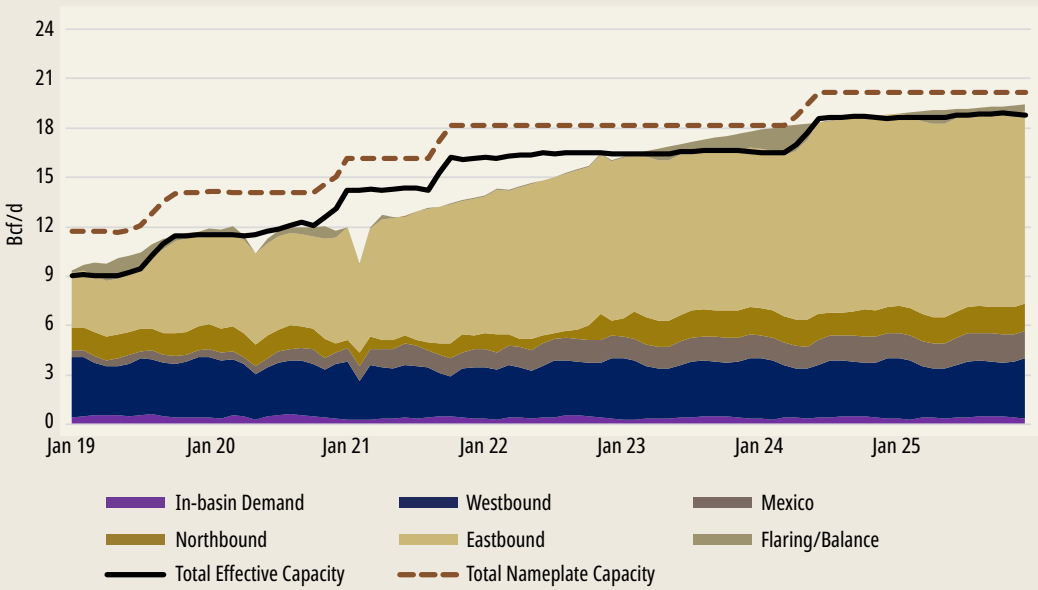
Adding insult to injury, the latest collapse occurred as West Coast gas prices traded as high as $45/MMBtu at the Southern California border amid extended below-normal weather across the western U.S. But with El Paso Line 2000 system offline, pipeline capacity from the Permian to the West Coast was limited.

While pipeline maintenance is the proximate cause for the market plunge, this fails to capture the big picture. For the real culprit, we look to the industry downturn in 2020 to 2021. Producers in the Permian slashed spending as commodity prices fell, and midstream companies mothballed pipeline expansions. That lull in planning left the industry unprepared as oil and gas prices rebounded in 2022 and Permian drilling activity rose sharply.

The looming Permian gas pipeline shortage has been a focus of East Daley's dating back to the firm's "2022 Dirty Little Secrets" (DLS) report a year ago. The annual report highlighted that 68% of U.S. gas supply growth through year-end 2025 would come from the Permian. This growth puts tremendous pressure on the midstream sector to move growing volumes to markets and would require another large takeaway pipeline from the Permian by 2023. In a follow-up note to clients in March 2022, East Daley said, "Permian egress capacity steadily tightens in our model through 2022, and dry gas supply hits the effective pipeline capacity leaving the basin by early to mid-2023."

Since then, several pipeline projects

Figure 1: Permian Basin Residue Gas Egress Flows



Source: East Daley's Permian Supply & Demand Forecast, December 2022

moved ahead in 2022. Partners WhiteWater Midstream, EnLink Midstream, Devon Energy Corp. and MPLX reached a final investment decision (FID) on the Matterhorn Express Pipeline. New compressor expansions on the Whistler and Permian Highway systems are also moving forward. These projects will add much-needed capacity to industrial markets and planned LNG export projects on the Gulf Coast. But building new pipelines requires long lead times, and most of these projects under FID will be "too little, too late" to address the supply bottleneck in 2023.

East Daley tracks the Permian supply and midstream outlook each month in its Permian Supply & Demand Forecast, including perspectives on gathering and processing and gas pipeline takeaway. The latest forecast for Permian residue gas supply and pipeline egress is shown in Figure 1. Currently, Permian residue gas supply is expected to grow by 1.6 Bcf/d at year-end 2022 and add nearly 1.9 Bcf/d of growth by year-end 2023 in East Daley's "unconstrained" outlook.

While nameplate pipeline capacity out of the Permian suggests there is room for growth, some portion of this capacity is only used for seasonal demand (i.e. exports to Mexico) or is unavailable due to downstream constraints. More important is the "effective" pipeline capacity leaving the Permian (illustrated in Figure 1), which is East Daley's estimate of the available capacity that determines constraints and thus basis blowouts. With steady production growth, our basin model shows Permian gas supply reaching the upper limits of effective pipeline takeaway as soon as February 2023.

Given that Permian rig activity remains strong and spare takeaway is on a knife's edge, recent price volatility as the new norm is expected. Based on East Daley's Permian model, pipeline takeaway in first-quarter 2023 will become a steady constraint on supply that is likely to lead to a daily drumbeat of low prices for shippers trapped in the basin.

Looking ahead, East Daley expects pressure on Permian gas prices to grow as winter heating demand wanes, cutting some northbound demand for gas. There is no relief in sight until Kinder Morgan completes repairs to its El Paso Line 2000, which we estimate in the spring of 2023. Thereafter, basin operators see only modest relief as compressor expansions are added to PHP and Whistler pipelines. In fact, our basin outlook shows a near-constant friction between supply growth and access to markets until the Matterhorn Pipeline begins service in fourth-quarter 2024.

In this market environment, pipeline contracts are an increasingly valuable commodity. Operators who planned ahead will separate from those who failed to secure downstream access to markets. And for the midstream sector, systems in the Permian that perform services priced off commodity prices will likely see their financial performance suffer, while fixed-rate providers weather the storm.

In the meantime, buckle up for a wild ride ahead. OGJ

An illustration of the Freedom AUV conducting a pipeline survey.

OCEANEERING

OCEANEERING OFFERS PATH TO 'FREEDOM'

The company's new Freedom AUV marks a change in the subsea landscape, a maneuverable autonomous vehicle that reacts to what it finds subsea.

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Freedom can be defined in any number of ways, but to Oceaneering, it is simply the future—and the name of its new autonomous underwater vehicle (AUV).

"The Freedom AUV is a new fresh approach to autonomous underwater vehicles. We're combining the benefits and features of an ROV [remotely operated vehicle] into an AUV system," Casey Glenn, electrical engineering lead at Oceaneering, said.

Oceaneering's Freedom AUV is the next step in a series of developments the company has been making toward autonomous vehicles operating under the sea.

Glenn said Freedom is able to collect many types of data, including "still images with high resolution and high dynamic range, laser imagery and multibeam imaging sonar." It has a laser imaging system that projects a laser beam onto the seabed, enabling cameras to capture a contour map.

The AUV can be equipped with hydrophones, magnetometers and cathodic protection sensors to monitor corrosion and hydrocarbon detection sensors to detect leaks.

"Our vehicle is a platform for our client to come up and say, 'Hey, can you sense this? Can you detect this while you fly this pipeline? Or can you fly around here and, collect data?'" Glenn said. "If we can fit it on the vehicle, we'll put that sensor on there and do it."

Freedom can travel as fast as four knots, whereas traditional ROVs typically travel at one knot. The increased speed gives the AUV faster turnaround time for inspections than ROVs scanning the seabed and pipelines in closer proximity than traditional AUVs. The torpedo-like build of Freedom is also equipped with both fins and thrusters for improved maneuverability.

"We've got thrusters all around the vehicle, enough thrusters to do vertical motion, to stop and pivot or to turn," Glenn said. "We actually have two obstacle avoidance sonars and a control algorithm … If an unknown obstacle comes up, we're actually able to not only just go around the object but to, if possible, go up and over, mapping it as we go, providing that data to the customer instead of just avoiding it."

> *"The Freedom AUV is a new fresh approach to autonomous underwater vehicles."*
>
> —**Casey Glenn,** ***Oceaneering***

Freedom's autonomy

The autonomous nature of Freedom makes it seem as if it has a mind of its own, which is exactly what Oceaneering was aiming for.

"Traditional autonomous underwater vehicles, they're really a vehicle executing a set of instructions planned from the surface, whereas Freedom is taking that autonomy to another level," said Nick Rouge, Oceaneering's subsea robotics product manager. "It actually reacts to what it finds in its environment and initiates and adapts its behaviors."

Despite Freedom being able to react on its own, the biggest challenge for the developers with the AUV was being able to trust the vehicle, said Rouge. Reaching its current level of competency took more than 650 pipeline runs. Now the vehicle is at API Technology Readiness Level 6 (API TRL 6), with the next goal of being API TRL 7, which is "as qualified as it can get out in the field," Glenn said.

Even though the autonomous capabilities of Freedom were tailor-made for the vehicle, the behaviors aren't limited to Freedom, could be put into a work-class ROV. This level of compatibility was only

"We've continued to work hard on using equity and other sources of capital in order to minimize the amount of debt that we have to take on."

—Nick Rouge, *Oceaneering*

able to be developed due to the experience Oceaneering had with previous subsea robotics systems.

"We developed this in Freedom in part because we, at the time, had the most total miles of pipeline survey executed with traditional AUVs," Rouge said. "We had a lot of history with problems experienced with those system designs, their limitations, what we liked and what we didn't like. We had contributed a lot of feedback and field experience into the development of their control systems.

Another issue: traditional subsea vehicles operating without a fiber optic tether must rely on low-bandwidth communication. Airborne drones have the options of radio communication, 4G mobile phone signal via LTE coverage or satellite signals. There's even GPS for positioning so the drone can be easily located. Underwater, communications and positioning systems don't work as effectively. Freedom's autonomy looks to solve that by putting the decision-making on the vehicle.

"So this autonomy and the capabilities of Freedom, they're going to enable us to open up underwater behaviors that look like modern aerial drone inspections where you issue an instruction, the vehicle goes and does its work, then it returns to home base, and you no longer need continuous monitoring of the vehicle from a vessel," Rouge said. "You no longer need an expensive diesel-burning, CO_2-producing surface vessel to travel along with the vehicles."

With one Freedom AUV currently operational, Oceaneering has demonstrated its capability to three international oil companies and is ready to work on a global basis, starting in second-quarter 2023, Rouge said.

Moving forward

This is only the beginning, as Oceaneering is already working to have another vehicle out by 2024. This new vehicle might even have a different shape than the current Freedom, as Oceaneering looks to optimize the technology for different tasks, as it's "never going to be done with testing phases," Rouge said.

The team is always looking to develop and test new features and behaviors and prove out more autonomy to a high degree of confidence. The software within Freedom holds the key to the future of inspection within the energy industry, according to the company.

When talking about the impact that Freedom could have on the future of subsea, Rouge said, "The autonomous flight control system and the physical hardware developed for Freedom are the stepping stones necessary to enable vessel-less operations over a large distance." OGJ

ACOUSTIC TELEMETRY AIDS DEEPWATER COMPLETIONS

Bidirectional communications give operators more data about the downhole environment, allowing them to make better real-time decisions.

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While mud pulse telemetry enabled efficiencies in drilling, the completions environment lagged. For a long time, no telemetry system could send signals in both directions.

The application of acoustic technology in the completions environment makes it possible to decouple communication from fluids and the formation. Now, bidirectional acoustics communications can help make completions more efficient.

With that capability, operators are finding more ways to take advantage of the wealth of downhole data being sent up to the surface. But acoustic technology holds even more promise, according to Duncan Groves, product line director for smart services at Baker Hughes. And that's because acoustics can be used to enable downhole control in completions. The service company is also coming out with its first acoustic-actuated liner hanger.

For some time the drilling side of operations has had the luxury of bidirectional communications through mud-pulse telemetry and other technologies, and as a result of all the measurements available in the drilling environment, drilling operations have become so more efficient that "drilling a mile a day is a common thing now," Groves said.

The goal was to make the improvements taken for granted in the drilling and production environments possible in the completions and intervention environments, he said, and that required a bidirectional telemetry system that didn't rely on fluids or the formation.

For completions to achieve efficiencies means getting the right measurements from the right places and transmitting those measurements to a place where the data can be analyzed and acted upon, he said.

At the same time, completions are "extremely challenging operations," Groves said. "We think drilling is bad with equipment banging around the hole, but here we're dealing with aggressive completion fluids, proppants and frac fluids, high compressional loads [and] high pressures."

In the past, the industry just didn't have a telemetry system that would send measurements from downhole to the surface and back down, he said.

That started changing when acoustic communications were experimented with in the U.S. land drilling environment as the shale plays started gaining traction. But clients really wanted to have access to that technology in other places, Groves said.

"Our clients said to us, 'We have information in U.S. land drilling. Where we don't have it is deepwater Gulf of Mexico completions,'" he said.

"Our clients said to us, 'We have information in U.S. land drilling. Where we don't have it is deepwater Gulf of Mexico completions.'"

—Duncan Groves, *Baker Hughes*

So, Baker Hughes worked on the engineering necessary to enable acoustic telemetry to work in the completion environment offshore. In 2015, the service company started field testing the solution in the Gulf of Mexico. The resulting acoustic telemetry system, XACT, has been fully commercial for years and makes bidirectional communication possible in the drilling, completions and interventions environments, he said. It's in use in the Gulf of Mexico and the U.K. North Sea.

Sound technology

Acoustic telemetry can measure downhole pressures, tension and torque with other sensors possible to install. A tool within the acoustic transmission system creates sound waves and sends those signals up or down the line. The signal attenuates the further away the signal gets from the source, so booster or repeater tools are placed along the drill string to propagate the digital encoded signal further up or down the line. The signal is actually a packet of information complete with data redundancy checks to minimize the chance for single points of failure.

According to Groves, Baker Hughes's XACT bidirectional acoustic network doesn't interfere with any component of the drill string, and no equipment is modified at the surface. That said, there are a few pieces of equipment needed for the network to, well, work.

At the surface, Baker Hughes places the

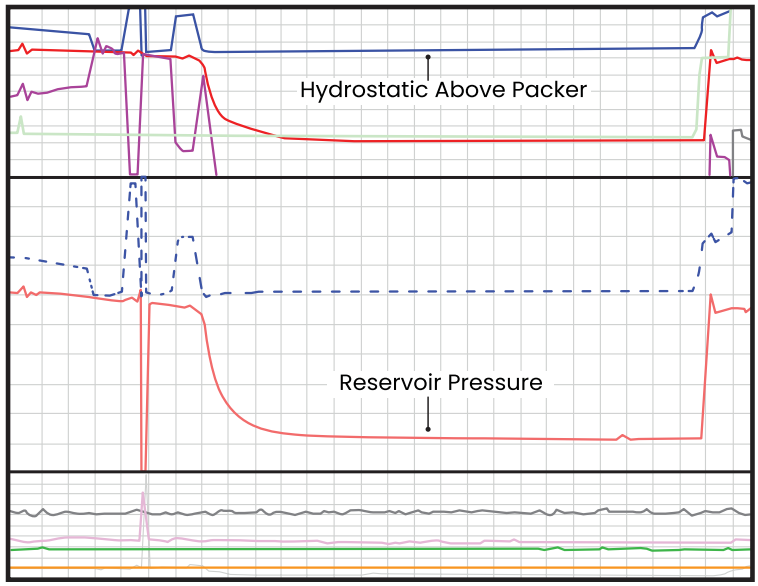
Bi-Directional Acoustic Surface Tool and the Electronic Acoustic Receiver (EAR). A laptop at the surface is used to act on information received. Downhole, the acoustic system's XACT Acoustic telemetry nodes resemble a drill collar, and multiple tools are spaced on the drill string to boost the signal as it propagates the sound wave up or down the pipe. Groves said a 30,000-ft well might use six or seven XACT Acoustic telemetry nodes on the drill string.

"That gives them bidirectional communication," Groves said. "It gives them a pathway to see what's going on."

And that's never been more important when it comes to completions, he said.

In the world of completions, acoustic telemetry can be used to monitor downhole pressure, confirm tool position in real time, improve troubleshooting efficiency, monitor losses and influx, and measure tubing and annulus for complete coverage.

Real-Time Reservoir Pressure Data



Source: Baker Hughes

Real-time reservoir pressure data during tubing conveyed perforation operations to optimally overbalance from multiple sands.

In the field

In the Gulf of Mexico, a client had uncertain reservoir pressures in multiple sands. Attempts to perforate the multiple reservoir sands in one run had caused delays due to not knowing the net downhole pressure. As a result, the rig had to deal with influxes and losses until the well could be brought into balance. To mitigate that risk, the client elected to make multiple perforation runs until it found a solution that would provide accurate real-time information.

Groves said the client chose Baker Hughes' XACT bidirectional telemetry system because it was simple to mobilize, required minimal rig time to implement and enabled them to rapidly fine-tune completion fluid weights to trip safely.

"They just changed the risk profile of the well. That saved them five days of rig time," Groves said.

Now, he said, running real-time data during tubing conveyed perforating operations is standard with the operator, who has operations in 6,000- to 10,000-ft water depth.

Elsewhere in the Gulf of Mexico, a client was dealing with a narrow formation fracture to collapse a pressure window in the reservoir. While the well could be drilled with managed pressure drilling, the ideal completion system was deemed too risky to be achievable, so the client elected to use a different completion system that could have led to a shorter production life or shorter time to intervention.

The client deployed XACT and integrated real-time pressure data into decision making on the initial wells.

"The downhole data completely changed what they were going to do," he said.

Based on confidence in the system performance, the client switched the completion type from standalone screens to a gravel pack and used real-time downhole data to manage the installation and pressure pumping operations. The client was able to keep the downhole pressures within an extremely tight window using the real-time data. Multiple wells were successfully gravel packed, and the client plans other wells in a field that was initially deemed uncompletable, which will bring significant new production to an existing production facility, according to Groves.

Clear and concise

Another client wanted better operational control on deepwater frac pack wells, which require manipulation of downhole service tools between several critical positions. Because the tools have to be moved up and down several feet but are 30,000 ft away from the surface where the parameters are being controlled, a lot of rig time is spent verifying what is happening 30,000 ft away. An incorrect interpretation of what has happened downhole can lead to delays and poor production from a suboptimal frac pack.

Groves said the client elected to deploy the XACT system to understand downhole weight, pressures and temperatures during the whole frac pack process. The downhole data provided clear and concise visibility of what was going on so decisions could be efficiently made. He said other possible efficiencies and risk reductions were identified that could enable more stages to be completed in a single run with a reduced completion time.

Acoustical actuation

With bidirectional communication, Groves said, it is possible to actuate downhole equipment in the completions environment. The acoustic system operates without the need to pressure up or drop actuation tools.

The new acoustic Sonus Liner Hanger System is still awaiting field trial with multiple clients in discussion to run it. Baker Hughes is evaluating what the next actuated tool system will be and has plans to kickoff that project this year. OGI

STRENGTHENING SUSTAINABILITY PRACTICES

The demonization of oil and gas leaders is partially to blame for the industry's lagging sustainability practices and prevents it from thriving, according to lecturer and author Wayne Visser.

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A bad carpenter, the saying goes, blames his tools. Environmentalists often point the finger at the entire oil and gas industry and, in the process, may be casting aside the means—and minds—needed to solve key climate challenges, an author and lecturer recently told the Society of Petroleum Engineers (SPE).

Environmental groups have fostered hostility and sometimes openly vilified fossil fuel producers, engendering feelings of hopelessness in the industry's leaders and rank and file who may be key to solving sustainability challenges, Wayne Visser said during a SPE webinar. His perspective: inspire realistic enthusiasm instead.

The author of 42 books, Visser's latest endeavor, "Thriving: The Breakthrough Movement to Regenerate Nature, Society and the Economy," explores reaching and surpassing sustainability targets to fight climate change and, more specifically, how the oil and gas sector can help.

Demonizing tactics by some environmentalists may have dispirited professionals within the oil and gas industry and left them unmotivated to help solve sustainability tasks despite having the skills, resources and talent to make significant contributions.

"It's a sector that contributes to the problem and it has an enormous resourcefulness and innovation to contribute to the solution," Mindset Results founder Marinma Dorado said during an SPE Live discussion with Visser, a fellow at the University of Cambridge.

Moving past defensiveness

Having grown up in South Africa during the transition from apartheid to democracy, Visser is familiar with how quickly dramatic change can occur. While issues such as the energy transition may face several years of resistance—about 45 years, in Visser's apartheid example—change can come about rapidly when it was finally accepted.

"I know what transformational change looks like and feels like, and I do see some parallels with what's happening in oil and gas or in the energy transition," Visser said. "It has to go through a dramatic change.

"If you in any way are open to the science of what's happening around climate change, how quickly it's happening, how much worse it is every year that new science comes out than we even predicted according to the models, then you have to face up to the fact that transformation is coming," he said.

Getting the industry to the tipping point, however, would require a wider range of companies within the oil and gas industry to abandon the "business-as-usual" mindset and explore sustainable solutions to help battle climate change.

"The change will also come from within the oil and gas; it has to so can you get involved in the green hydrogen projects or in the projects that eliminate methane leaks, for example, or the things that will have a dramatic effect," Visser said. "Move into the solution space rather than the business as usual, defensive continued sort of impact space."

Changing minds, investment

Aside from shifting away from a defensive mindset, devoting more capital toward clean energy, such as green hydrogen or other renewables, is the best step to becoming sustainable, Visser said.

According to Visser, Denmark's Ørsted, one of the largest global fossil fuels companies 13 years ago, has emerged as one of the top offshore wind companies through a radical change in its investments.

"It was by changing their investment, going from investing more than most of their money back into fossil fuels to investing 99% of their annual budget in renewables," he said. However, "I think this is the tough transition that some people in the industry [have] not yet faced up to and not yet prepared to make.

"It's not that [they lack] the skills and that it's not that we won't need energy. It's not that we won't need engineers. It's not that we won't need fuels," he continued, "but we have to make dramatic shifts, and it has to be fast."

Visser said that he didn't see "enough ambition" from the industry in reducing carbon emissions and, in turn, reaching net-zero targets, but investments made in chemical recycling, green hydrogen and green ammonia can help rectify this.

Additionally, "a lot of those skills are transferrable, especially when you look at offshore," he continued.

But first, minds need to change—on both sides. OGJ

BAKKEN, US SHALE TO PLATEAU IN COMING YEARS

Hess Corp. CEO John Hess expects his company's shale production in the Bakken to plateau at 200,000 boe/d in 2024 and remain steady for eight to 10 years and overall U.S. shale production to flatten in 2025 or 2026.

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Hess Corp. CEO John Hess sees his company's production in the Bakken—and overall U.S. shale production—plateauing from 2024 to 2026.

Bakken production will level out at 200,000 boe/d in 2024 and remain at the rate for eight to 10 years, Hess said during an audio live-streamed fireside chat on Jan. 5 at Goldman Sachs Global Energy & Clean Technology Conference.

Hess' net Bakken production averaged 166,000 boe/d in third-quarter 2022, according to the company's website.

Hess said his company had moved up to a four-rig program but will not go to five rigs even at higher oil prices. The four rigs allow Hess Corp. to optimize its infrastructure without having to make incremental investments. Work remains in the midstream sector, but it's incremental in nature, he said.

"So, running at a four-rig rate, we actually have a 15-year inventory," Hess said. "Now, we don't want to do M&A to add to it; that 15-year life is ... what we see is optimal."

Looking outside the Bakken and at U.S. shale production in general, he said production would likely plateau in 2025 or 2026 between 13 MMbbl/d and 13.5 MMbbl/d.

"People need to understand, as the world needs more oil and demand grows… shale will be important, but it's no longer the swing producer," Hess said. "I'd say OPEC's back in the driver's seat."

New York-based company"s portfolio includes assets in the Bakken and Gulf of Mexico, as well as in Malaysia and Guyana. The company remains focused on advantaged low-cost, low-carbon barrels over the short to medium term while maintaining its balance sheet and cash position.

"So, we look at both the Gulf of Mexico and Malaysia as cash engines to complement the cash engine that we have in the Bakken," Hess said. "And Guyana is not only a cash engine; it's also a growth engine."

Hess is eyeing capex of $3.7 billion in 2023 compared to $2.7 billion in 2022. At least 80% of 2023 spending will be split between two major assets: Guyana and the Bakken.

Guyana 'growth engine'

Guyana is arguably Hess' most impressive asset outside the U.S. The company is part of an ExxonMobil-led consortium in the Stabroek Block that also includes CNOOC. Production from the first two offshore developments—Liza Phase I and Liza Phase II—is averaging around 360,000 bbl/d.

"As the world needs more oil and demand grows ... shale will be important, but it's no longer the swing producer. I'd say OPEC's back in the driver's seat."

—John Hess, *Hess Corp.*

"And over time, as more debottlenecking happens, there'll be some upside to that," Hess said.

Guyana could have six ships or FPSOs operating offshore in Stabroek in 2027 producing an average 1.2 MMbbl/d, Hess said.

The company is moving forward with efforts to drill deeper horizons of Stabroek found at 18,000 ft. Appraisal work is ongoing at Fangtooth, but the company sees potential at deeper horizons than already seen at 15,000 ft.

"We think Fangtooth has the potential, subject to the appraisal that we're drilling one well now and another well later in the year and could potentially be the seventh boat," Hess said.

In 2022, the consortium boasted nine discoveries. Overall, the companies have reported 30 discoveries which are underpinning about 11 Bboe in gross discovered recoverable resources found to date in Stabroek, excluding the 2022 discoveries.

These resources have grown from 1 Bboe to 11 Bboe and multibillion barrels remain, he said. OGI

Events Calendar

The following events present investment and networking opportunities for industry executives and financiers.

Scan me

EVENT	DATE	CITY	VENUE	CONTACT
2023				
Women In Energy Luncheon	**Feb. 7**	**Houston**	**Hilton Americas-Houston**	**hartenergyconferences.com**
SPE A&D Symposium	Feb. 8	Houston	Petroleum Club of Houston	spegcs.org
The Energy Venture Investment Summit	Feb. 16-17	Golden, CO	The Colorado School of Mines	theenergyventuresummit.com
Global Energy Forum	Feb. 22-23	Houston	Petroleum Club of Houston	usenergystreamforums.com
LOGA Annual Meeting	Feb. 27-28	Lake Charles, LA	Golden Nugget Casino	loga.la
CERAWeek by S&P Global	Mar. 6-10	Houston	Hilton Americas-Houston	ceraweek.com
GoM Energy Transformation Conference	**Mar. 21**	**Houston**	**Norris Conference Centers**	**hartenergyconferences.com**
TACC Energy Summit	Mar. 21	Tyler, TX	Green Acres Crosswalk Conf. Ctr.	tylertexas.com
DUG Haynesville	**Mar. 28-29**	**Shreveport, LA**	**Shreveport Convention Center**	**dughaynesville.com**
Mineral & Royalty Conference	April 10-11	Houston	Post Oak Hotel	mineralconference.com
Energy Infrastructure Conference	**April 12-13**	**Houston**	**Norris Conference Centers**	**hartenergyconferences.com**
SPE Innovation & Entrepreneurship Summit	April 26	Houston	Norris Conference Centers	spegcs.org
Energy Workforce & Technology Council Annual Mtg.	April 26-27	Austin, TX	Omni Barton Creek Resort & Spa	energyworkforce.org
Offshore Technology Conference	**May 1-4**	**Houston**	**NRG Park**	**2023.otcnet.org**
Williston Basin Petroleum Conference	May 2-3	Regina, Saskatchewan	Delta Hotels Marriott Regina	wbpc.ca
ASA Energy Valuation Conference	May 11	Houston	The Briar Club	houstonappraisers.org
AGA Financial Forum	May 20-23	Fort Lauderdale, FL	Ft. Lauderdale Marriott Harbor Beach	aga.org
DUG Permian/Eagle Ford/Midcon/Bakken	**May 22-24**	**Fort Worth, TX**	**Fort Worth Convention Center**	**dugpermian.com**
Louisiana Energy Conference	May 31-June 2	New Orleans	Ritz-Carlton New Orleans	louisianaenergyconference.com
Energy Cyber Security Conference	**June 7**	**Houston**	**Norris Conference Centers**	**hartenergyconferences.com**
Texas Energy Forum	Aug. 23-24	Houston	Petroleum Club of Houston	usenergystreamforums.com
SEG/AAPG IMAGE Conference	Aug. 27-Sep. 1	Houston	George R. Brown Conv. Ctr.	imageevent.org/2023
Carbon Management Conference	**Aug. 30**	**Houston**	**Norris Conference Centers**	**hartenergyconferences.com**
America's Natural Gas Conference	**Sept. 6-7**	**Houston**	**Hobby Center**	**hartenergyconferences.com**
Energy ESG Conference	**Sep. 12**	**Houston**	**Hobby Center**	**hartenergyconferences.com**
GPA Midstream Association National Convention	Sep. 17-22	San Antonio	Marriott Rivercenter Hotel	coga.org
Energy Capital Conference	**Oct. 2**	**Dallas**	**Statler Hotel**	**hartenergyconferences.com**
A&D Strategies and Opportunities Conference	**Oct. 3**	**Dallas**	**Statler Hotel**	**hartenergyconferences.com**
Monthly				
ADAM-Dallas	First Thursday	Dallas	Dallas Petroleum Club	adamenergyforum.org
ADAM-Fort Worth	Third Tuesday, odd mos.	Fort Worth, TX	Petroleum Club of Fort Worth	adamenergyfortworth.org
ADAM-Greater East Texas	First Wed., odd mos.	Tyler, TX	Willow Brook Country Club	etxadam.org
ADAM-Houston	Third Friday	Houston	Brennan's	adamhouston.org
ADAM-OKC	Bi-monthly (Feb.-Oct.)	Oklahoma City	Park House	adamokc.org
ADAM-Permian	Bi-monthly	Midland, TX	Petroleum Club of Midland	adampermian.org
ADAM-Tulsa Energy Network	Bi-monthly	Tulsa, OK	The Tavern On Brady	adamtulsa.com
ADAM-Rockies	Second Thurs./ Quarterly	Denver	University Club	adamrockies.org
Austin Oil & Gas Group	Varies	Austin, TX	Headliners Club	coleson.bruce@shearman.com
Houston Association of Professional Landmen	Bi-monthly	Houston	Petroleum Club of Houston	hapl.org
Houston Energy Finance Group	Third Wednesday	Houston	Houston Center Club	hefg.net
Houston Producers' Forum	Third Tuesday	Houston	Petroleum Club of Houston	houstonproducersforum.org
IPAA-Tipro Speaker Series	Third Tuesday	Houston	Petroleum Club of Houston	ipaa.org

Email details of your event to Brandy Fidler at bfidler@hartenergy.com.
For more, see the calendar of all industry financial, business-building and networking events at HartEnergy.com/events.

API PUSHES BACK ON BIDEN'S ENERGY PRIORITIES

API's annual report offers a plan to bolster investment in oil and gas projects and streamline the permitting process even as the White House prioritizes renewable energy sources.

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The hints from the White House could not have been much of a surprise to API executives, but leaders of the largest oil and gas trade association still expressed exasperation over treatment of their members' work—and favoritism toward renewables.

"Just the disparate treatment of oil and natural gas projects to renewables with respect to the overall GHG [greenhouse gas] impacts across the value chain—not just downstream but across the value chain," Frank Macchiarola, API's senior vice president for policy, economics and regulatory affairs, said during a media call on Jan. 11.

The call was to discuss API's annual State of American Energy report, which argued for a shift in policy priorities to support investment in the domestic oil and natural gas industry.

The prime takeaway from API's request for interim guidance from the White House Council on Environmental Quality (CEQ) was that President Joe Biden's administration is seeking to expand the reach of the National Environmental Policy Act (NEPA).

"NEPA is one of the most important environmental statutes that, historically, started out as a very small statute that has grown, through the [environmental impact statement and environmental assessment] process, to impede critical energy infrastructure for years," Macchiarola said. "Now, CEQ is seeking to expand the reach of NEPA when we should be limiting the expansion of NEPA and moving projects along."

Setting priorities

Pushing back on expanding regulations is what API's members expect from the trade group, Emily Easely, CEO of Novus Energy Advisors, told Hart Energy. But of greater importance is tracking how the rollout of legislation such as the Inflation Reduction Act (IRA) and the Bipartisan Infrastructure Law affects the industry. Another point of focus? Permitting reform.

"There's no way that there will be one standardized package for infrastructure projects," Easely said. "There are regional issues, so it can't be a one-size-fits-all."

For example, on the East Coast, delays in pipeline permitting have dogged the industry for years. Citing the problem in a report won't push Congress to flip the switch in the year or so left to legislate before the 2024 campaigns kick in.

"I think that's why they were so hopeful about [Sen. Joe Manchin] bringing that pipeline [permitting reform] bill, but I don't think Manchin has any political currency anymore," she said.

API's report did succeed in pointing out issues of concern to the oil and gas industry, even if doing so won't move the legislative or regulatory needle immediately, according to Jack Belcher, principal at Cornerstone Government Affairs.

"I think they did a good job of starting at, 'OK, here are the problems that we've identified and here are the solutions,'" he said. "They can't get into the weeds too much on the legislative technique because quite frankly, none of that's going to happen, right? They'll pass bills in the House all day long, but they're not going to go anywhere. So, what they're doing is laying the groundwork here for a future bill."

Report's suggestions

API's report offered numerous concrete suggestions to resolve issues, including increasing oil and gas production, adding pipeline infrastructure and supporting continued innovation to lower carbon emissions. Among them:

- The U.S. Department of the Interior issuing a new five-year program for offshore oil and natural gas leasing;
- The department holding quarterly onshore lease sales with "equitable terms" and reinstating canceled leases and valid leases on U.S. lands and waters;
- Allowing U.S. refineries to continue to use hydrofluoric acid alkylate—replacing HF units would cost $12 billion-$19 billion;
- The SEC reconsidering its climate disclosure proposal, which would boost investor confidence in future development;
- Congress recognizing major energy infrastructure projects as critical to the national interest and enact strict deadlines for environmental reviews, as well as revamping the cross-border permitting process;
- Amending the Natural Gas Act to streamline the review process for LNG facilities;
- Halting overreach by the Federal Energy Regulatory Commission;
- Rescinding Trump administration-era steel tariffs;
- Enacting performance-based regulations to push innovation in pipeline safety technologies;
- Supporting use of natural gas to lower emissions in power generation; and
- Providing additional guidance for Section 45Q tax credits to develop carbon capture, utilization and sequestration. OGI

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While you were producing the fuel that means civilization's continued existence, the spoiled lot proposed that gas stoves are the cause of their existential pantophobia.

The topic was a political distraction of the cat-and-laser-pointer type that is known in social media as the "timeline cleanse." (The laser was among the methods Twitterverse offered to find the Dallas Zoo's missing clouded leopard.)

Even a spokesman for a Democrat, Virginia's U.S. Representative Don Beyer, told Politico, "It was a very stupid news cycle." (Sidebar: Our mother forbade "stupid" in our lexicons; I vividly recall her instructing this while cooking on our gas stove.)

Sadly, Dan Pashman took the bait. To not miss the oh-so-15-minutes-ago window of relevance/interest, the host of the entertaining "Sporkful" podcast dropped a special Friday episode.

"Not Dan Pashman too," I thought, as I drove my gasoline-fueled car and in a suddenly prickly state. "Dan's an omnivore. He's from New Jersey!"

But it was a replay of a June 2021 episode, "Gas Stoves Have Ignited a Firestorm." A new introduction was added to it, explaining the rerun. I recalled listening to it back then and being nonplussed.

A good podcast was not ruined after all. It was thoughtful and fun.

Pashman: "I have always had gas stoves. I'm partial to gas stoves. I like being able to see the flames, so I know exactly how high it is … I just think that cooking is so much about feel … I like the clicking sound when you turn it on. I like gas."

"Sporkful" producer Andres O'Hara: "And you know, you turn (an electric stove) up to nine, and it's hot. You turn it back down to three. It's still hot. It's just not a great way to cook. And when I started cooking on gas stoves, truly, I fell in love with cooking thanks to my gas stove."

What about the indoor NO_2 level that is a byproduct of burning natural gas? Well, turn on the vent.

Meanwhile, the induction stove—that is the trendy go-to for some for absolving the sin of exhaling CO_2—uses electricity. So it's still electric. Pashman made fun of it.

Pashman: "I'm just gonna assume it works with lasers."

O'Hara: "Dan, I hate to tell you, but there are no lasers."

Pashman: "It would sell better if they made it with lasers."

After multiple demonstrations, Pashman was unmoved. He still preferred gas. And he didn't want to give up some of his favorite cookware.

O'Hara (in jest): "I say take those beautiful heirloom pots. You fill 'em up with soil. Maybe you can plant a nice tomato plant in there."

Pashman: (laughing)

O'Hara (piling on): "Teach your children about growing their own food. Because when the climate apocalypse comes for us all, because everyone loves their gas stove too much like you, Dan, it's gonna be a pretty useful skill to grow your own food."

Laughter.

A "Consumer Reports" writer, Liam McCabe reported in July on the cost of converting the family stove from gas to induction.

"At first," he wrote, "I thought about calling this article 'Do-Gooder Pays Through the Nose to Boil Water a Little Faster,' which is totally accurate, in a sense." The cost was a few grand, including needing to hire an electrician (and at Boston rates).

"But I'd still recommend an induction range to anyone who has the means," he concluded. His family is able to "bang out meals five or 10 minutes faster," and "we rarely scorch anything anymore."

In addition to the cost, though, they tossed a third of their cookware and a gas stove that was only 15 years old.

He ended up titling the article "The Surprising Things I Learned When I Ditched My Gas Stove for an Induction Range."

My title: "The Wastefulness When Converting from Gas to Induction."

When Steve Jobs wanted the Mac II to boot up faster, insisting on paring at least 10 seconds, he pointed out that 10 seconds a day and 5 million users accumulate to several lifetimes during the course of a year. (The engineer was able to cut 28 seconds.)

Cooking five minutes faster certainly is more efficient. But is burning a few grand worth it?

And what about when the Texas power grid is shut down? You're not cooking at all unless you're cooking with gas.

The next half of this century, the angst may be over cooking with fusion. Dan might like it. The slogan: "Now you're cooking with lasers." OGI

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