Oil and Gas Investor

THE MARCELLUS TURNS 20
Domestic Power, LNG Demand Trigger New Boom in Appalachia

NO RUSH
A&D Simmers After M&A Frenzy

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Private Equity Leaders Say Raising Capital is Getting Tougher

EXECUTIVE OF THE YEAR

VICKI HOLLUB
Occidental Petroleum's CEO on Building a Viable E&P for the Future

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NOVEMBER 2024

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$63+ Billion
Energy Investment Banking Transaction Volume Since 2009

~$300 Million
Average Transaction Size

222
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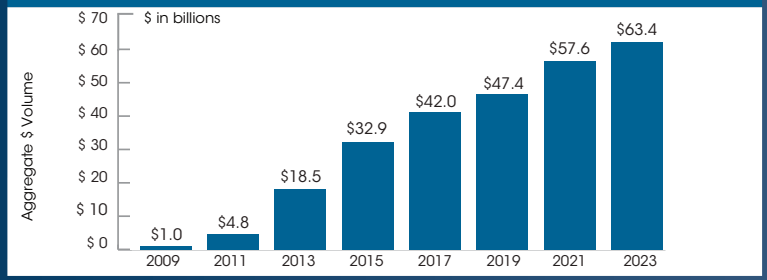

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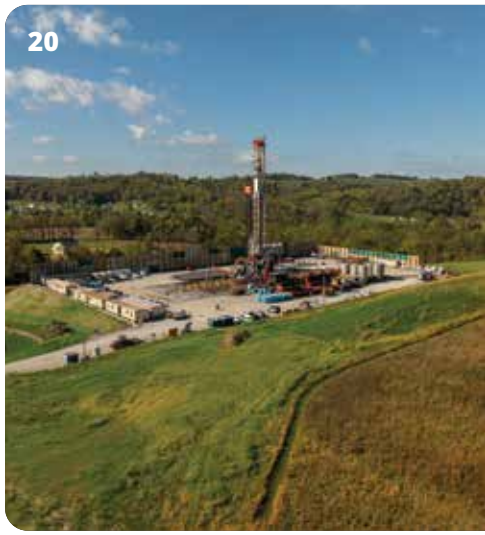
EXECUTIVE OF THE YEAR

20TH ANNIVERSARY MARCELLUS

COMMENTARY



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ABOUT THE COVER:
Felix Navarro captured this image of Occidental Petroleum CEO Vicki Hollub, Hart Energy's Executive of the Year, at the company's Houston headquarters.

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The Next Era

History is in the making, from U.S. politics to the 20th anniversary of the mighty Marcellus.

DEON DAUGHERTY
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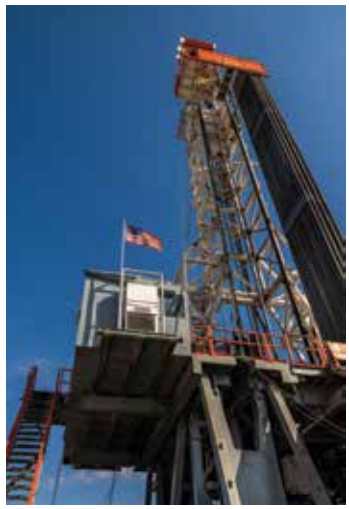


Oil and gas companies focus on the future, and one CEO, in particular, is leading the way into that future.

During my tenure as editor-in-chief, Occidental Petroleum CEO Vicki Hollub has topped my list of must-have exclusive interviews. And I'm thrilled to reveal that she is the recipient of the Hart Energy and *Oil and Gas Investor* Executive of the Year award for 2024. You can read Editorial Director Jordan Blum's fascinating interview with this industry titan, beginning on page 8. Blum's interview delivers compelling insight into how we made the choice. Join us in Midland, Texas, this month at the Hart Energy's Executive Oil Conference, where Hollub and other top industry executives will come together for a day of robust conversation and industry insight.

We also celebrate the 20th anniversary of the mighty Marcellus Shale in a special section beginning on, appropriately, page 20. Range Resources ushered in the Appalachian rush two decades ago, and the company remains excited about its possibilities. Our features on the Marcellus' boom offer insights from its beginning with geologist Ken Zagorski to contemporary players building out the region and bolstering U.S. hopes of dominating the global LNG market.

Our Energy Capital Conference in Dallas last month was a smashing success because the panels and discussions were, frankly, top-notch. Don't miss our coverage of the conference, in which we examine what's next in private equity, what's next for E&P consolidation and how to prepare for the coming A&D trend.

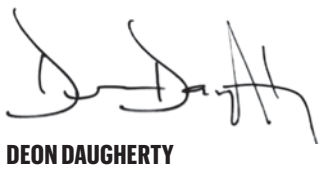
You'll have two opportunities this month to catch the action live. Join us in Pittsburgh on Nov. 7 for DUG Appalachia and in Midland on Nov. 20-21 for the Executive Oil Conference. But if you can't be with us live, follow our news coverage at HartEnergy.com and in the December edition of *OGI*.

Of course, we've got other key news stories and features in the works for you to read on these pages in December. While other news outlets will be looking back at the year and rehashing history, we'll be looking ahead to help you prepare for the industry's future.

With so much of the white-hot Permian Basin in the hands of the industry's biggest producers, some of the fringier parts of the play are gaining attention. We'll examine the space and talk to the top players to bring you the story next month.

We'll analyze the impact of the next OPEC meeting on oil markets, long-term projects coming online next year and how policy will, of course, come into play.

With Thanksgiving on the way for our U.S. readers, please know that at *OGI*, we deeply appreciate each of you and the trust you place in our journalism. OGI



DEON DAUGHERTY
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25 Top Industry Speakers

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Oxy

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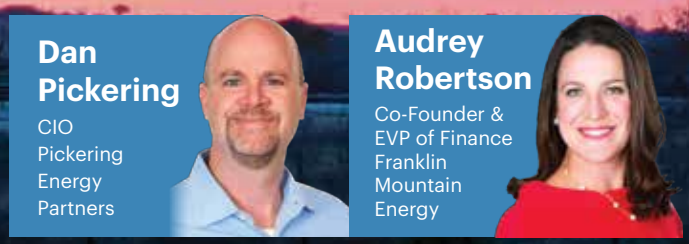

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Building Viability

Vicki Hollub is leading Occidental Petroleum through the M&A wave while pioneering oil and gas in EOR, DAC and the goal of net-zero oil.

JORDAN BLUM | EDITORIAL DIRECTOR | JBLUM@HARTENERGY.COM

Vicki Hollub took over as the CEO of Occidental Petroleum in 2016, becoming the first woman to lead a major American oil company.

But we're not here to discuss gender politics.

Hollub is Hart Energy's and Oil and Gas Investor's *Executive of the Year because she overcame the doubters and critics after outbidding Chevron for Anadarko Petroleum in 2019, beating back the backlash, surviving the pandemic and coming out on top with the necessary scale and inventory needed in the highly-coveted Permian Basin.*

Then, she continued this year to expand Oxy and its massive footprint in the Permian with the recent $12 billion acquisition of CrownRock–a CrownQuest Operating and Lime Rock Partners joint venture–which closed in August.

Next year, Oxy is poised to become the forerunner in North American direct air capture with the startup of the massive Stratos hub in the Midland Basin that will literally suck emissions out of the sky for sequestration or EOR. Oxy loved the technology so much it bought the developer, Carbon Engineering.

The aims for Hollub and Oxy are to keep leading in M&A and drilling and completion efficiencies, while pushing toward net-zero oil solutions and the goal of keeping crude oil and natural gas viable for the long-term in an evolving world.

Hollub sat down with Hart Energy Editorial Director Jordan Blum to discuss dealmaking, oil and gas trends and the role of hydrocarbons in climate solutions.

This interview has been edited for clarity and length.

Q&A

Jordan Blum: Our readers are pretty shale-centric and the CrownRock deal just closed in August. So, can you take me through how CrownRock ended up being the target and what it took to get across the finish line?

Vicki Hollub: Well, CrownRock was brought to us, so the timing was not our choice. If we had the perfect timing, about a year later would've been great. But, because of the timing and that it was available, we looked at it. The reason it was important for us to acquire is that, when we did all the modeling, it was cash-flow accretive from day one, had significant inventory, increased our breakeven at less than $40/bbl inventory by 33% and our breakeven at less than $60/bbl by 25%. So, the inventory was an incredible increase.

The other thing that was important is it made our Midland Basin now a core area. Previously, we had been developing it through the JV (joint venture) with Ecopetrol. Because of the lack of scale there, we felt like that was the best way to convert that to value for our shareholders. But now, with the addition of the CrownRock acreage and production, this makes the Midland Basin much more relevant

FELIX NAVARRO

for us. So, now it is a core area. The scale brings synergies in addition to a deeper inventory there to develop. And our teams have done a really good job with the Midland Basin from the very beginning.

When we first started looking at the Permian, we would’ve categorized the quality of our acreage being New Mexico at the top. Texas Delaware was second and Midland Basin, third. Midland Basin didn’t appear to be really very competitive for capital investment, hence the JV. Then, when we bought Anadarko, that made the Texas Delaware much more competitive. At that point, we started realizing that our New Mexico acreage was really good, too, because we had worked on developing our subsurface modeling. That modeling made what we thought was lower-tier acreage in southeast New Mexico into top tier. We took that modeling, applied it to the Anadarko acreage, applied it to the Midland Basin, and we’re now applying it to the D-J (Denver-Julesburg Basin) and Powder [River Basin]. All of that raised the quality of our inventory across the Permian.

JB: From a modeling and efficiency standpoint, is there any kind of secret sauce or key efficiency that’s unlocked things more than others, whether it’s more contiguous acreage for longer laterals, subsurface imaging or more frac stages?

VH: The contiguous acreage is very important. Drilling the 15,000-foot laterals, that’s very, very important for the economics. It’s made wells even better. Our modeling was the first step to make wells that previously had been producing 300-600 bbl/d initial production to 3,000-4,000 bbl/d initial production. The modeling and frac design is all around how we view where the frac is going to go. And that’s about as much as I can say with respect to what our secret sauce is.

JB: Going back just to CrownRock briefly, is there anything else you can talk about in terms of the competition? I know it wasn’t obviously the public kind like with the Anadarko and Chevron bidding war.

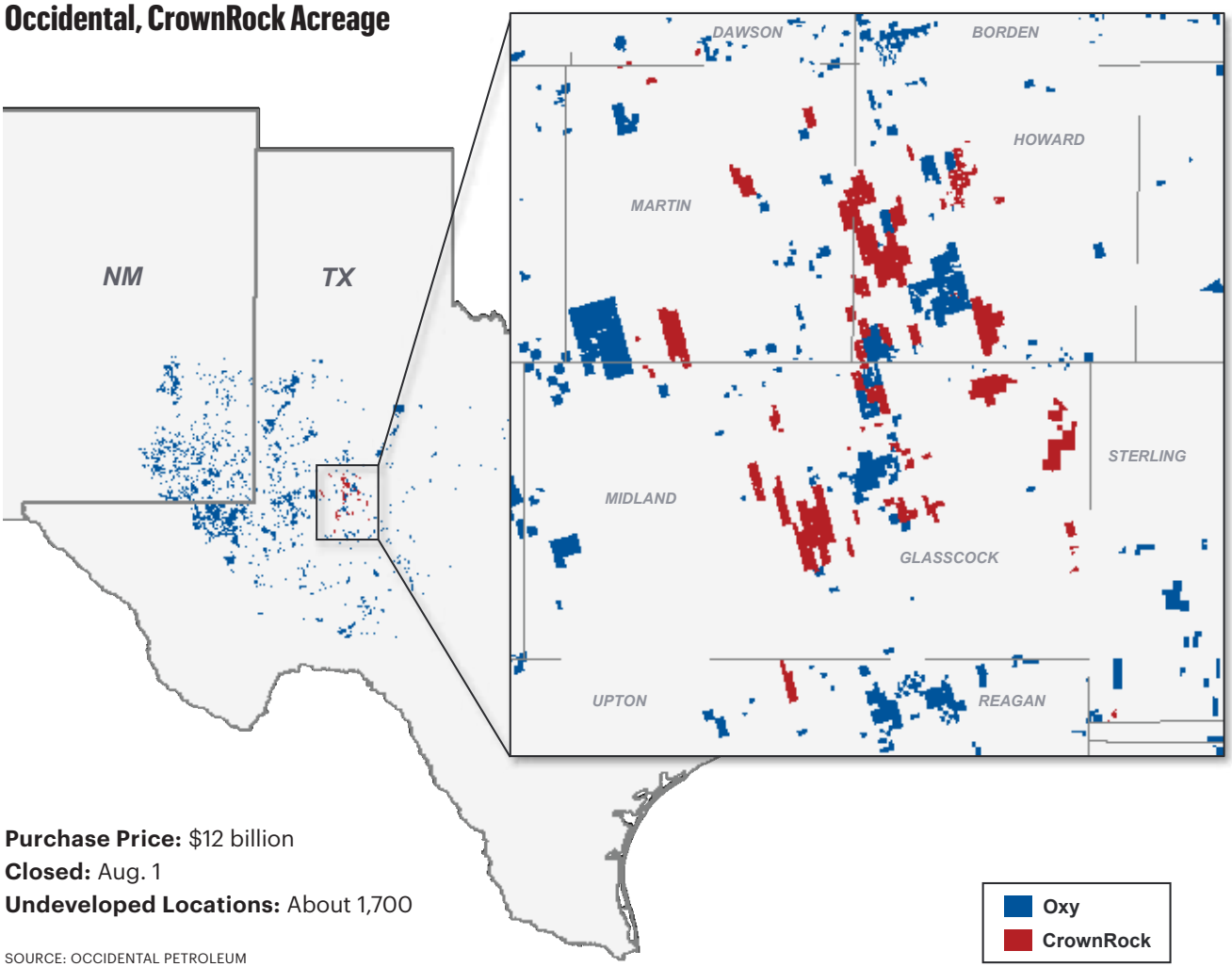
VH: (Laughing) Thankfully. There was competition because

Pro Forma Midland Operating Statistics[1]

9	Operated Rig Count *(Gross)*	↑ 125%
47	Surface Acres *(in Thousands)*	↑ 26%
~200	Current Net Production *(Mboed)*	↑ 344%
>250	Net Leasehold Acres *(in Thousands)*	↑ 58%
>1,300	Water Processing Capacity[2] *(Mbwd)*	↑ 384%

SOURCE: OCCIDENTAL PETROLEUM
[1]AS OF JULY 2024 [2]COMBINED WATER RECYCLING AND DISPOSAL CAPACITY

Occidental, CrownRock Acreage



Purchase Price: $12 billion
Closed: Aug. 1
Undeveloped Locations: About 1,700

SOURCE: OCCIDENTAL PETROLEUM

of the quality of the acreage, but we felt like a couple of things were to our advantage. One being the fact that we had shown significant improvement in our own delivery and recovery of wells in the Midland Basin. I think that the CrownRock people saw that. And, also, unlike others who do these acquisitions, our view is that we need to do our best with respect to the employees. We committed that we were going to offer every employee that CrownQuest didn't want to keep. They were taking some with them. But, every employee that they were not taking with them, we offered a job. And we didn't eliminate any Oxy employees as a result of it. That's kind of our model. When we do acquisitions, we do it in a way that's not damaging to the employees.

JB: I'm sure that helps with retention.
VH: Yes.

JB: How else would you compare and contrast the Midland and Delaware positions after the deal?
VH: I'd say that, now, the Midland and Delaware are pretty close to being competitive. Some in the Delaware are still better than the Midland Basin returns. But what helps the Midland Basin is the fact that the margins are higher because of the takeaway out of the Midland. The second thing is it's shallower, and so that helps on the cost. On the other side of it, the Delaware Basin has some overpressured intervals that make up for the fact that you've got to spend more money to get there. Both basins—and both parts of the Delaware—are core to us now. We're in a much better position than we were before where all three now can compete for capital.

JB: Obviously, the Midland is a bit more mature, but you've become pretty active now in developing or starting to develop the Barnett in the Midland Basin and maybe looking at the Wolfcamp D bit, too. I wanted to get your take on looking into the different benches, and where you call things Tier 1 or Tier 2 positions?
VH: A lot of that is just testing things. When I was running the Permian EOR part of the basin, I want to say there's some claim to fame I have here for having approved the drilling of a couple of Barnett wells way back then—not too far from Levelland—they were huge failures. Which is I think what precipitated my promotion to get me out of doing those kinds of things, and to get me in a role where I can't do those kinds of things anymore. But they were vertical back then. We're still dabbling with other intervals. The Permian is the basin that keeps on giving. It's going to be the last basin standing in the U.S. and maybe one of the last basins standing in the world, especially in view of the fact that we ultimately will apply CO_2-enhanced oil recovery to both the conventional—more of the conventional than we have to date—and to the shale.

It's not only important to have secondary basins or secondary intervals to develop in all these basins, sub-

Occidental Petroleum's Delaware Basin operations. Occidental's Delaware and Midland assets are "pretty close to being competitive," according to CEO Vicki Hollub. Both basins are core to Occidental now, she said.

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basins. That's important. But another way of using the infrastructure in a cost-effective way and getting reserves that you otherwise couldn't get is the use of that CO_2. That doesn't mean there's only one other interval, a secondary interval. In all of our acreage, our teams are looking at third, fourth and fifth intervals that we can add over time.

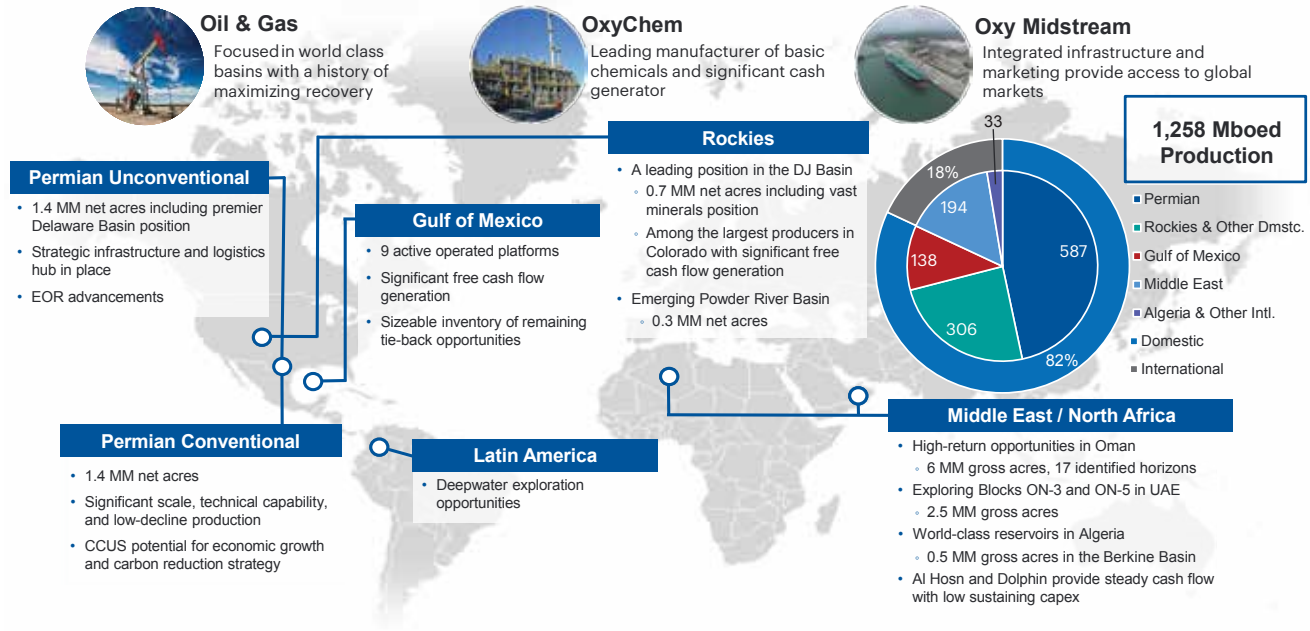
JB: Are you to the point of considering the Emma Barnett field a success, or is it still to be determined?
VH: It's to be determined. We have hopes. You have to hope that the hopes turn into something material.

JB: On M&A, you just did CrownRock. Exxon Mobil bought Pioneer Natural Resources. ConocoPhillips is acquiring Marathon Oil. Diamondback has Endeavor. Chevron and Hess Corp. is still pending. And there's lot of other deals. So how do you feel about all of the M&A, and do you see a lot of runway for additional industry consolidation?
VH: I think it has to happen. If you look at what's happened with respect to exploration around the world, the reality is that the 20 largest reservoirs in the world were discovered before 2000. There hasn't been a lot discovered that are really big since. Kudos to those that are discovering, but it's not enough to ultimately keep the supply coming for the world. And, then, 80% of the world's reserves are managed by national oil companies or countries. So, the private U.S. companies, publicly held U.S. companies and the publicly held companies in Europe and a few other parts of the world are then going to try to get the 20% that's not already managed by someone else. It is getting harder in international to get contracts that really make sense for publicly held U.S. and European companies. So, there's basically a limited amount of remaining resource for the rest of the thousands of companies that want to get those resources to develop. So, the M&A is going to happen in a big way, and it's going to continue for years–despite [FTC Chair] Lina Khan's efforts (laughs).

JB: Fair to say Oxy isn't done growing yet?
VH: I think nobody should be [done]. I don't think anybody would truthfully say that they're done.

JB: You've said you wouldn't be CEO today if the Anadarko deal hadn't happened. In hindsight, can you take me through the timing and importance of the deal? Obviously, a lot was said negatively at the time and shortly afterwards about allegedly overpaying and having poor timing.
VH: Looking at where Oxy was at the time and what we were trying to accomplish, we didn't have the scale that we needed. There was no way that we were ever going to be able to execute a low-carbon strategy either. We were way too small, had far less cash available to even pay the dividend that we had at the time. We were essentially in

OXY's Combined Intergrated Portfolio



SOURCE: OCCIDENTAL PETROLEUM
NOTE: MAP INFORMATION AS OF 06/30/24 AND EXCLUDES CROWNROCK

a bind, and nobody has said that. Nobody went back and looked at the data.

We needed to do something. When we saw the Anadarko assets, we felt like they fit like a glove with what we needed to be and to do. I think everybody is critical of the $5 billion difference between our offer and the other offer (Chevron's) out there. We more than made up that difference. We achieved our synergies in less than six months, and we had synergies of double what the competition had and thought they could do. Our teams were just amazing through this acquisition. We're right on the cusp. We've almost essentially paid out the acquisition in right around five years, or maybe it'll be five and a half years, but that's phenomenal.

We bought a company essentially our size. With synergies and the cash flow from operations that we were able to get from it, it's been to me a phenomenal example of how an organization can do amazing things. And we did it quickly. A good part of it was due to the fact that our teams had–before the Anadarko acquisition–started to crack the nut on how to get more out of these wells than we had originally thought was possible. I do believe that we are still getting more out of our wells than our competition. That was the case when we made the acquisition, that was the case continuing on, and that's what made us so confident that it would work and that we needed to do it and that we could spend the $5 billion incremental, because now that's essentially paid for.

JB: Obviously, you didn't know that prices were going to tank not too long after, but it now looks like there was a lot of foresight in terms of the need that everyone's now talking about for scale and inventory.

VH: Exactly. Some people say that the M&A is just happening now. I think we kicked it off. The only reason it wasn't continuous was because of the pandemic. But, we saw it coming, we knew it was coming and we knew that this would happen. And I feel like we started it, and we had a team that had the capabilities to enable the leadership team to be bold enough to fight for it.

JB: I wanted to pivot just a little bit to divestitures and debt reduction. I know there's not necessarily any rush on these things, but I wanted to get your breakdown of what you've done so far and what you're looking at next. You did the Permian Resources deal. I think there was a small, non-core sale to Continental Resources. What are you looking at with Western Midstream?

VH: Well, the Barilla Draw we sold to Permian Resources. That had become non-core for us. And with our vast acreage in both the Permian and the D-J, there's still smaller areas, nothing big. But accumulations of several smaller things can be significant. There are outliers in all of the basins. There's some stuff in the Midland, there's some stuff in the Delaware and some things in the D-J that could be up for sale.

JB: Anything in the Gulf of Mexico or internationally? Or not at this point?

VH: Not at this point.

JB: What else can you say in terms of the plans for Western Midstream?

VH: (Smiling) We like getting the dividend.

JB: With CrownRock, Ecopetrol ended up declining taking a stake. I think that was something you were expecting to come to fruition. But was it more of a happy accident that it didn't work out?

VH: We wanted all of it.

As you know, according to the agreement, they had the opportunity to buy up to 49%, and we absolutely didn't want that to happen. Since we had a longstanding, very respectful and good relationship with Ecopetrol for decades, going all the way back to the early '80s, and because of that

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November 7, 2024 | David L. Lawrence Convention Center | Pittsburgh, PA

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Gulf of Mexico Overview

SOURCE: OCCIDENTAL PETROLEUM
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partnership we had built and the way we operated with them, we felt like that was a scenario where we wanted to be good partners. So, we didn't have to negotiate for something smaller. It was either they had to take the 49% or nothing. But, we decided we would negotiate and that's how we came to 30% for them. And then, as I said on the earnings call, what really killed the deal at the end was the president of Colombia (Gustavo Petro).

JB: Politics happen. Considering you wanted all of it, I guess there's no consideration to selling a minority stake in the CrownRock assets to anyone else at this point?
VH: No.

JB: Warren Buffett continues to say very nice things about you, but Berkshire Hathaway's ownership of Oxy is up to about 29% now. I wanted to get your take on at what point it's too much, and how you keep the ownership diversified?
VH: We would never consider it to be too much. Having Berkshire in our stock, as we do with our other larger and long-term shareholders, it's good to have conversations with Berkshire and others to make sure that we keep the dialogue going as to what they're seeing, what they like about what we're doing, suggestions and take on the macros. We try to get information from all the sources that we can to make the decisions that we make. Long-term shareholders are the ones that are going to appreciate us the most because we're not really built for hedge funds, although we know that there's some in the stock. We appreciate all of our shareholders that are in the stock, but the hedge fund owners are probably not going to be as happy as the longer-term shareholders. Right now, we're in a good position with about 50% of our company owned by long-term shareholders that we've known for a long time.

JB: And your market cap is right about $50 billion. I wanted to get your opinion on the overall investment thesis for Oxy and just how undervalued you feel the company still is.
VH: We're incredibly undervalued. It's because we've been going through a transformation, and we're not quite done with that yet. It's two-pronged. One was to get out of assets that were geopolitically risky, and to move more to the U.S. to lower that risk, but also to get higher-quality assets. We started that almost 10 years ago. That was the first part of the transformation. The second part was to get bigger in the U.S., and that was the reason for the Anadarko acquisition. CrownRock was helpful for that, too.

When I became CEO, 50% of our production was international and, now, about 83% of our production is domestic, and between 90-95% of our future growth is in the United States. From a geopolitical standpoint and from a quality of assets standpoint, we have the best assets that we've ever had, and they're safe assets. What we did internationally is, we stayed in the areas that we knew were going to be stable. I won't mention the countries we exited, but we're in Abu Dhabi, we're in Oman and in Algeria. We initially did try to sell Algeria, but we couldn't make the sale happen. And now that we are there, we've become more knowledgeable about the reservoirs, and the reservoirs there are really good, and the country is a democratic country. And so now, the three places where we are internationally are what we think are some of the safest in the world. Oman and Abu Dhabi, while they're in the Middle East, we don't believe that those two countries would ever be involved in any of the potential chaos that's happening there now.

JB: Is there anywhere else in the U.S. you might eventually want to be? Obviously, you're more oil-centric, but any of the gas plays at some point?
VH: No, we're strictly Permian, D-J, Powder River. If we saw another oil play onshore, we would go after that. We have no intention of getting into any gas areas. We've always viewed the price of natural gas to be between $2-$3/MMBtu. Except for some short periods of time, that's essentially what it's

been. So, we don't see a benefit for us to expand in that direction.

The Gulf of Mexico is another area that we ultimately want to grow. When we first bought Anadarko, we viewed the Gulf of Mexico [assets] to be more of a cash cow for us—high margins, quality oil—and so we thought that that would be the cash generator to provide the funds for the Permian. However, now with almost 300 blocks offshore and a partnership network that we've built over the last few years, that's given us a big enough footprint to have a database that will allow us to do more work with AI in the subsurface to do offshore what we did in the Permian.

Our Permian Basin modeling and subsurface work didn't happen by accident. We put forth an effort to get the best team that we could put together and isolated from other parts of the business, so they could just focus on the Permian. We gave them the resources to do what they needed to do. And now we're doing that same initiative for the Gulf of Mexico. We've already put the team together. They're working AI for the Gulf. And we believe that, with the massive database we'll have, we'll be able to make a difference here because it's highly complex. It's more complex than some parts of the Permian, and you've had folding of deeper horizons on top of shallower ones. We drilled through one target where we thought maybe it had pinched out or something. But, then, as we drilled deeper, we found the shallower interval deeper than the old formations. It is so complex that we believe with AI we're going to be able to now turn the Gulf of Mexico into a growth asset ultimately.

JB: It used to be that offshore technology would get translated to onshore. Now, is it more the opposite happening?
VH: For subsurface, yes, in my view, at least for us.

JB: Back on gas, obviously the Permian is quite gassy, too. How difficult has it been with pricing, especially Waha pricing?
VH: That's been difficult for the basin, clearly. But that's one of the advantages we have with our midstream business in that we have capacity in various places. When there's a situation where you have people who can't move molecules, get stuck and they're trying to pay people to take gas away, our midstream marketing team has been able to take advantage of that to move gas and get gas moved around.

There are gas intervals deeper [in the Permian], and the current price of gas doesn't warrant drilling as deep as that. But, ultimately, if the LNG projects that are currently planned happen, it could be that 10, 15, 20 years down the road, we would be drilling deeper in the Permian, but we wouldn't go to Appalachia or Anadarko or anywhere else to drill.

JB: Is your bullishness on gas more forward-looking with LNG and all the talk of data centers and AI? You're using AI, but AI also is increasing demand. Do you see more data centers being built up in the Permian region, as well?
VH: We do, and we think what's going to help with the data centers is this technology that we're equity owners in, and that's NET Power.

We own about 40% of NET Power, and it is a technology that creates power by combusting natural gas with oxygen instead of air. There are no volatile organic emissions and, as a part of that combustion process, it generates water and CO_2. The CO_2 drives the turbine to create the electricity, and the excess CO_2 comes off. It's almost a pure stream of CO_2. That's going to be, I think, revolutionary for the power industry here in the United States. Where there's natural gas that we can get the power to the data center, that's really the source that they should plan on using in the future. Certainly, solar could be a part of that. But, to ensure that they have 24-hour, 365-days-a-year power, that NET Power process is going to be the answer for data centers here in the U.S. and anywhere internationally where there's electricity needed and there's hydrocarbon gas.

JB: You're already the leaders on EOR, but you're on the verge of being pioneers on direct air capture, as well. Where are we on the Stratos project, and what's ahead in terms of the challenges of scaling up DAC and making things economic?
VH: Stratos, we'll have starting to produce by [the middle of] next year, starting to get CO_2 out of the atmosphere. Stratos for us is the thing that we needed to do to make sure that the world understands that this is a reality, that it can happen, that we can ultimately lower the cost. Already with Stratos, we're building it in a couple of phases, and we're already starting to use some of the innovations that we put together for the second phase. We're already innovating. That was part of the reason we bought (DAC developer) Carbon Engineering, because it was to provide a group of incredibly innovative and passionate people to give them the resources and the capital they needed to start testing some of their innovative ideas. They didn't have the people, resources, nor the cash to do what they needed to do to advance the first phase of Stratos to the point where it was lower cost.

We took our board up there to visit with them a couple of times now, and from their first visit to their last visit, the dramatic increase in the ideas and how they're advancing those was pretty dramatic. We're excited about the fact that the first one won't be the best one. Clearly, it never is in any technology. For wind and solar, it took about 10 years to make those technologies more successful and lower cost. We think we can do direct air capture faster because we have people working on ideas that are just amazing. We also have the benefit of using a digital twin as we build the one here in the Permian. And that digital twin will enable us to test some of those ideas that they're having before we actually build it in the field. So, by the time we get to build the first one at the King Ranch (South Texas DAC Hub), we're pretty excited about what that one's going to look like. It's not going to be a 10-year cost down curve for us. It's going to be something less than that. Can't say what it'll be.

I would love to give the team a target through your article, but I think I'll hold off on that (laughs). We're very excited about where we are and where we're going with that. It's going to provide CO_2 not only for companies to make sustainable aviation fluids if they want, but also for our enhanced oil recovery in both the conventional and the shale where we can then produce net-zero-carbon oil.

JB: A lot of both CCUS and permanent sequestration?
VH: We're doing the permanent sequestration initially because that's what the purchasers of the carbon reduction credits preferred. I think, ultimately, as we help people understand what net-zero-carbon oil means and how it works and why it is potentially a better approach, we will do whatever our clients want us to do.

Construction is ongoing for Oxy's massive Stratos direct air capture plant in the Midland Basin, which would represent the first of its kind in the North American oil and gas sector.

OCCIDENTAL PETROLEUM

JB: King Ranch is going to be the next DAC project, but do you have a timeline for that yet?
VH: No, not yet, because we've been working with the DOE (Department of Energy). That negotiation has gone really well. We are moving forward with it, but we do have to do an environmental assessment, and so it's the timing of that that really is uncertain at this point.

JB: And you're working on CCS hubs in the Houston area and Louisiana as well? The Bluebonnet and Magnolia projects?
VH: The Bluebonnet one is going to be specifically carbon sequestration, and we've advanced negotiations with some other companies on that. We hope to make some announcements regarding that over the next six months or so. Bluebonnet is the one where we've made the most progress so far. But we're working on all of them.

JB: I wanted to delve deeper into the net-zero oil talk. You just dealt with protestors at a New York climate conference, but you stuck around and pushed back. I wanted to get your take on the net-zero debate, and I guess the counterargument to those who oppose producing all hydrocarbons.
VH: What we have to get the world to understand is that somebody, somewhere started this concept and this idea that we need to eliminate the production of fossil fuels in order to deal with the emissions—that that's the only way. That's not the only way. And so, those who want oil and gas to go away, we're trying to help them understand that we've got to all—as a world—we've got to refocus on what the problem is. The problem is not the fuel source; the problem is the emissions.

If we could all get on that same page and just work together and collaborate and say, OK, the emissions are the problem, now let's see what we can do to attack those emissions and to mitigate to the degree that we can those emissions with the lowest-cost way to do that. Because, right now, the models that are being put together are absolutely unaffordable. The world cannot afford it, and they throw numbers out. And, everybody goes—behind the scenes, behind closed doors goes—"Where are we ever going to come up with that money? There's no way."

If you could do it for a lower cost and allow the developing countries to use their natural resources, but use it in a way where we're offsetting those emissions, why not do that? What some are trying to eliminate is the highest-intensity energy at the lowest per energy unit cost of anything that anybody's come up with in the world. Then, what we have to do is get people to realize that there is a different way and stop trying to kill oil and gas. Start including us and helping us, working with maritime and aviation on how to make it happen. We believe that's going to require a lot of things. We believe that we certainly have to continue solar and—I guess for people that insist—wind, and nuclear and geothermal and, for us, oil and gas. With a combination of all those, we can then come up with the right combination of sustainable aviation fuels along with net-zero oil, which will create net-zero fuels for maritime and aviation.

I think that there's even a segment of the population who believes—believe me, I know this—that wind and solar is the only answer that we need. They forget about the liquid part of the fuels that you have to provide for

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Geothermal power and lithium production at the edge of the Salton Sea near Calipatria, Calif. in Imperial Valley.

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aviation, and they're thinking of batteries or hydrogen or something for aviation. Even with sustainable aviation fuels, what people forget is, it's just a man-made hydrocarbon in most cases.

So, what's the difference in a man-made hydrocarbon versus oil that comes out of the ground? The difference is that sustainable aviation fuels are a combination of hydrogen and carbon—in the way that they should be made—would be about 25-50% of the emissions of a normal barrel of oil, but still require some additional reduction of carbon in some way. And that's how we can work with those that produce and want to make sustainable aviation fuels. We can work with them, too, to provide the carbon reduction credits that offset that part of the emissions that still exist from the manmade hydrocarbons.

JB: And you have a new subsidiary and JV with Berkshire Hathaway for domestic lithium mining, TerraLithium?

VH: Lithium is another component of our business which we believe will be helpful, and will be lower cost than bringing in lithium to the United States from mining sources that are much less environmentally friendly, and also that are more costly having to be imported into the U.S. We're trying to provide a solution to getting lithium out of brine water. It's a great source to create what we need to provide for the batteries.

What we're doing first with Berkshire in the Salton Sea is we've already tested our technology there. It works. Our view and plans are to ultimately expand TerraLithium's technology beyond the Salton Sea to places like Arkansas and places internationally. There are lots of waters around the world where you can get lithium. We think that this is just the first step for us to start broadening that out.

The reason that we saw that as a core competence, too, is because, when you combine the brine water that our chemicals business uses with the brine that we produce as a part of our oil and gas operations, we probably are one of the largest handlers of brine in the U.S. And so, that's a core competency for us.

JB: Lastly, can you reflect on what drew you to the energy sector in the first place, and what you see the future holding from here?

VH: Some people say fail quickly if you're going to fail. I failed quickly in a music career. I was the first, and I think still only person from my high school, to make All State playing French horn. I didn't have a lot of knowledge about what was out there in terms of other things to do. I went to the University of Alabama to major in music. One of the advantages of being a music major at the time was to be in the band and to go to the football games for free. That was a part of my thought process back then, which shows how little research I'd done on anything. First semester, my French horn instructor asked me what I aspired to be and to do, and I told him to play in the Boston Symphony or the Philadelphia Philharmonic, and I had always dreamed to do that. He said, "Well, then we need to talk." And his talk was very open, transparent, but kindly done, that told me basically I've got to change my career plans.

So, I then started looking at mining, went down into a coal mine on a field trip from our Engineering 101. I decided to go into engineering. This was a class that tried to introduce you to various types of engineering. And thank God for that class. I went down into a mine. It was cold, dark and damp. I got claustrophobic and I couldn't do it. About a month later, we then went out to a drilling rig that was drilling near the university, and it was amazing. From the moment I walked onto location and saw this humongous thing, pulling something out of the ground, I decided then I'd go into petroleum engineering. OGI


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Jumpstarting the Marcellus Boom

Range Resources launched the Appalachia shale rush, and rising domestic power and LNG demand can trigger it to boom again.

JORDAN BLUM
EDITORIAL DIRECTOR
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The Renz No. 1 well in Washington County, Pa., was an abject failure, or so it seemed.

The year was 2003, and a little-known Range Resources geologist, Bill Zagorski, worked with the upstart producer trying to make vertical natural gas wells in southwestern Pennsylvania at depths of more than 8,000 ft, aiming for the Lower Devonian Oriskany Sandstone and the deeper Silurian Lockport Dolomite.

There's a reason those formations aren't household names, not even within the oil and gas industry.

"We already had a couple misses on here. We retired this well. They were literally ready to plug it, and then reclaim the location," said Zagorski, who, spoiler alert, is now known as the "Father of the Marcellus."

The idea was close to right, but the strategy and execution needed work. Around this time, Zagorski traveled to study a Floyd Shale prospect in Alabama. That effort was inspired by East Texas' Barnett Shale, where the shale revolution remained in its infancy, and where Fort Worth, Texas-based Range had a limited acreage position. After all, Devon Energy had just bought the Barnett's Mitchell Energy from the "Father of Fracking," George Mitchell.

Then, Zagorski realized the Barnett Shale resembled the Marcellus Shale just above the Oriskany. The Marcellus depths had been explored before, but never with any commercial success.

"That really was my 'aha' moment," Zagorski said. He told *Oil and Gas Investor (OGI)* he was filled with both excitement and fear. After previous misses, "I'm going to go back to them to say, 'Hey, we've got to try this.'"

So, 20 years ago in October 2004, after returning to the failed well at the Renz farm off of Sabo Road in the Mount Pleasant Township of Pennsylvania, Range successfully fracked the well that would turn the Marcellus Shale into the largest natural gas-producing basin in the world.

This tiny, rural point in southwestern Pennsylvania–120 miles south from the famed Drake well drilled 165 years ago–helped move the shale boom into overdrive. In 10 years, Marcellus production had surged beyond expectations to nearly 14 Bcf/d. Today, the Marcellus produces more than 25 Bcf/d, and the combined Marcellus-Utica sits near 36 Bcf/d, according to the U.S. Department of Energy.

With Range Resources remaining at the epicenter, the region is holding steady but poised to surge again to service the growing domestic power demand–on the uptick for the first time in decades–and the next wave of the LNG boom that's currently under construction.

Under the current leadership of CEO and President Dennis Degner, who joined the company in 2010 and helped keep Range on the forefront of drilling and completions techniques before taking the CEO chair last year, Range could remain a core Marcellus leader for decades to come.

"Success begets success," Degner said, and Range successfully jumpstarted a land rush throughout the Appalachia region. "A lot of other companies watched what Range did

Drilling rig on location for Range Resources in southwestern Pennsylvania in October 2024.

ANTHONY MUSMANNO

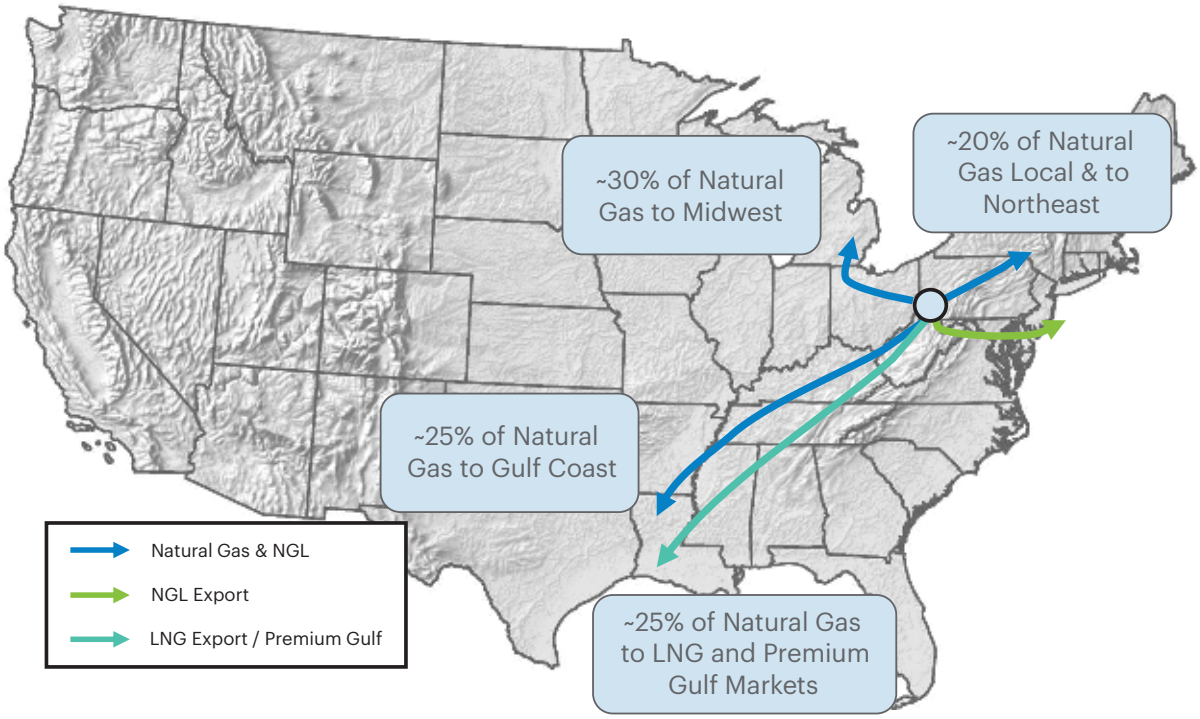
TOM FOX

"The company had quickly reached a point where the belief was, we've just got to go drill a horizontal. We're at that decision point–that fork in the road. In order for this to be successful, we've got to move forward, and we've got to drill a quality horizontal in a target that we feel gives us the best chance of success. And put our best completion on it, which we knew at that time was a Barnett-style completion. And that's where we had our breakthrough."

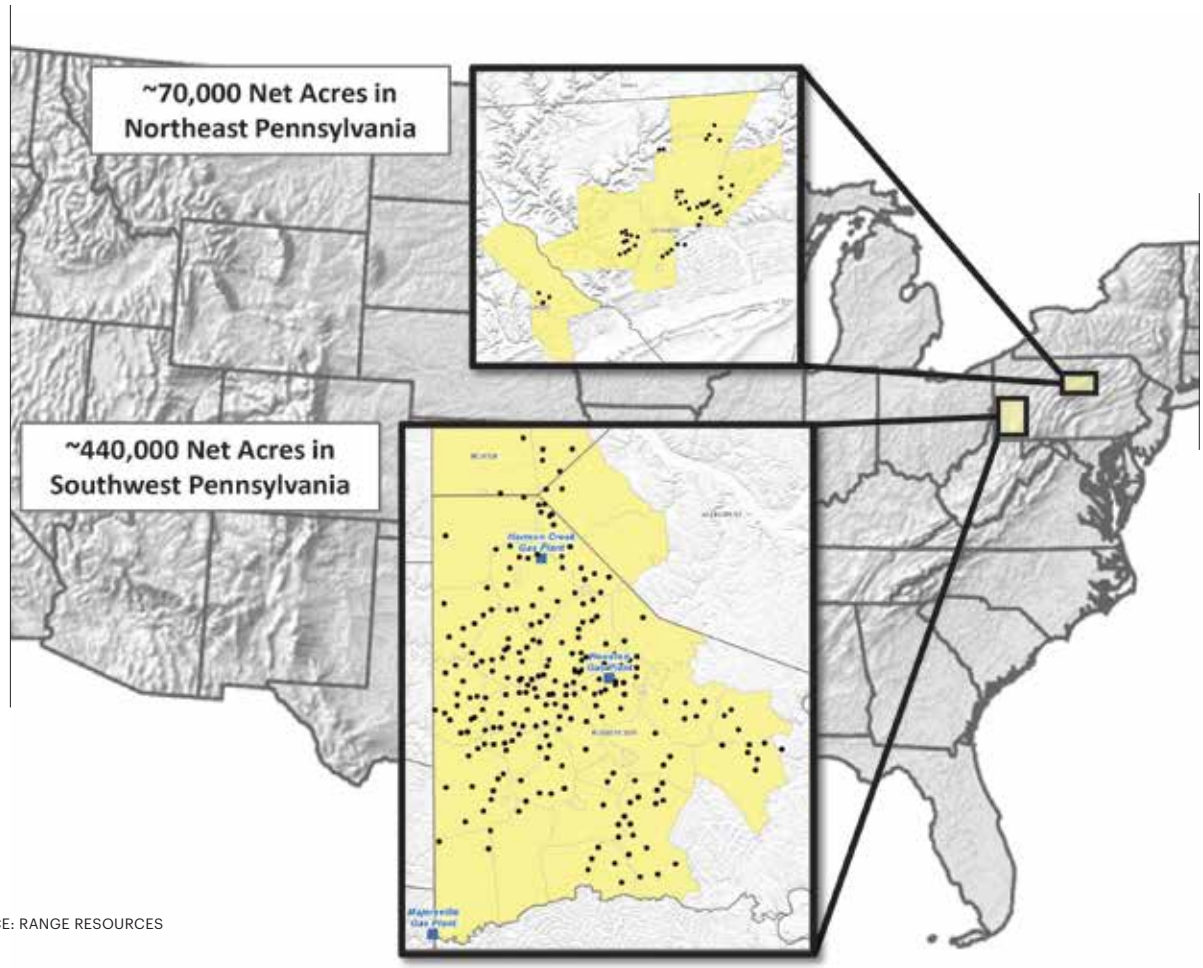
DENNIS DEGNER, CEO and president, Range Resources

Diversified Market Outlets

Range's access to multiple end-markets for natural gas and NGL provides price diversification



30+ Years of Core Marcellus Inventory



SOURCE: RANGE RESOURCES

U.S. Supply and Demand Outlook (Bcf/d)

NOTE: ASSOCIATED GAS SUPPLY ASSUMES 5% CAGR. OTHER SUPPLY REPRESENTS LEGACY SHALE, CONVENTIONAL, OFFSHORE AND IMPORTS.
SOURCE: RANGE RESOURCES

over the course of time and started to move from being a skeptic to a believer in unconventional shale development in Appalachia."

Home, Home on the Range

Back in 2010, when Degner joined, Range was in full unconventional mode in the Marcellus, but Range averaged three frac stages a day with average lateral lengths of 3,000 ft. Now, Range is at an average of 9.5 stages daily with the mean length of laterals over 14,000 ft, and several exceeding 3 miles.

"From where I sit today, our focus is basically 100% on our Marcellus footprint," Degner told *OGI*. He said, of Range's over 500,000 net acres in the Marcellus, 87% of the lateral footage inventory has a breakeven of $2.50/MMBtu or less. "When you think about drilling 60, 70 wells a year, you can do this for over 30 years before you get to a Utica or an Upper Devonian."

Longtime oilfield services analyst Jim Wicklund, now an investment banker with PPHB, remembers being amazed by the success of the Marcellus after many doubted its potential.

"The Marcellus has just been a giant home run from a technical point of view, from a gas supply point of view," Wicklund said. "An upstart gas company, like Range, they were the ones riding the crest of the wave of natural gas. They had the cojones to be the first mover and take the risk."

"Between the Barnett and the Marcellus and the Haynesville, the Barnett is in decline, the Haynesville is higher-pressure gradient, and the Marcellus is just Goldilocks. That has been a pleasant surprise: the size, the productivity."

JIM WICKLUND, managing director, PPHB

"I was embarrassed. I thought they're going to throw me out. They're going to think I'm crazy. Nobody could imagine the thing could have been that big."

BILL ZAGORSKI, retired vice president of geology, Range Resources

The problems for the Marcellus are not scientific; they're political and regulatory, especially when it comes to pipeline permitting, he said.

"Between the Barnett and the Marcellus and the Haynesville [Shale], the Barnett is in decline, the Haynesville is higher-pressure gradient, and the Marcellus is just Goldilocks," Wicklund said. "That has been a pleasant surprise: the size, the productivity. Now, if they just had access to markets."

But it wasn't all so obvious in 2004, not even after the eventual success of the landmark Renz well. And the Renz could have easily failed again without the right completion.

Because the Barnett is thicker than the Marcellus, common sense easily could have resulted in a smaller hydraulic fracture on the Renz, Zagorski said. Instead, new Range COO Jeff Ventura, who would become CEO in 2012, intervened in favor of a full, Barnett-style, slickwater frac.

"It's probably the smartest thing anyone did on this because they took literally the most successful-sized Barnett frac, which is about 1 million gallons of water and maybe 350,000 pounds of sand, and they put that on our completion," Zagorski said. "No gel, just slick water. And the frac went fine. And next day we got a flowback."

The Renz started out at about 350 Mcf/d but quickly rose to 800 Mcf/d, he said, which was on the high end of a good Barnett vertical well.

It took Mitchell Energy almost two decades to find the right formula, but Range succeeded on the first slickwater frac try–the first Barnett-style frac east of the Mississippi. And Mitchell, Zagorski, Ventura and then-Range CEO John

Pinkerton all deserve credit.

"Having the Barnett as a template, to basically pull off the shelf and use that as a guidepost template was incredibly impactful and helpful for us," Degner said.

Home Where the Prospectors Roam

Degner gives Zagorski a lot of the plaudits, calling him a "data junkie" and a "prospector at heart."

"He was the guy who came forward and said, 'Hey, this data that we've collected and what we're seeing as an industry in the Barnett, I think we're drilling through something that is a very strong analogue comparison to the Barnett, if not better,'" Degner said.

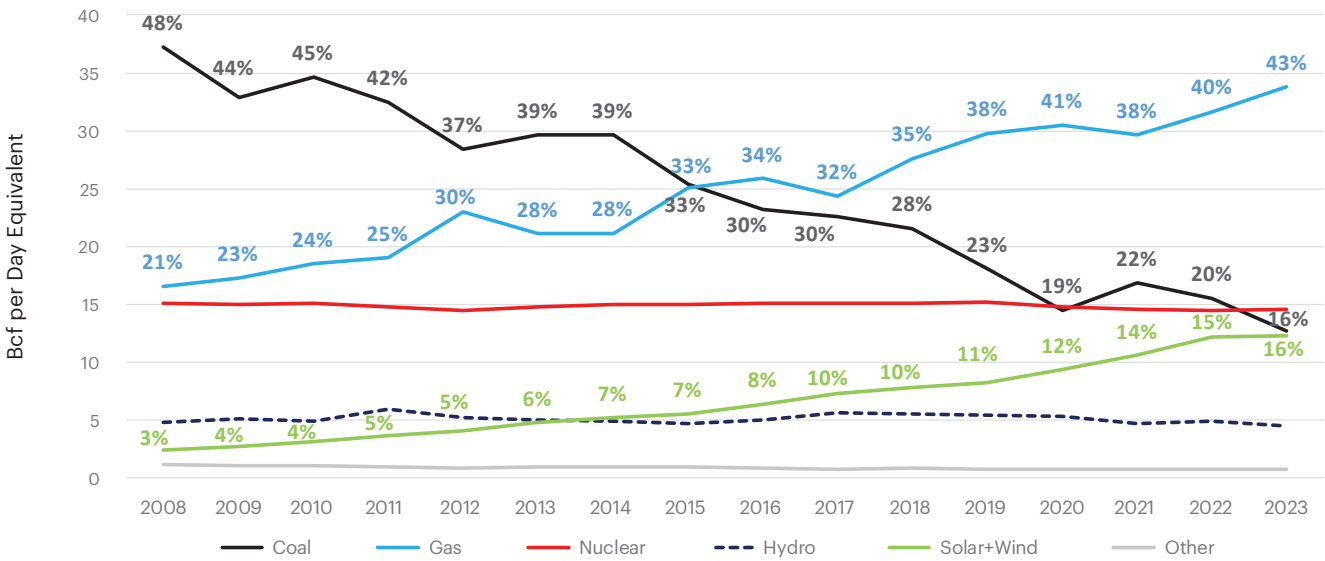
The Renz results were certainly promising, but they did not yet beget a boom.

After the flowback, Zagorski put together a pitch to Ventura to hire 40 land brokers to lease another 50,000 acres or so in Pennsylvania's Washington, Beaver and Greene counties, as well as into the northern panhandle of West Virginia. Range ended up leasing more than double the proposal.

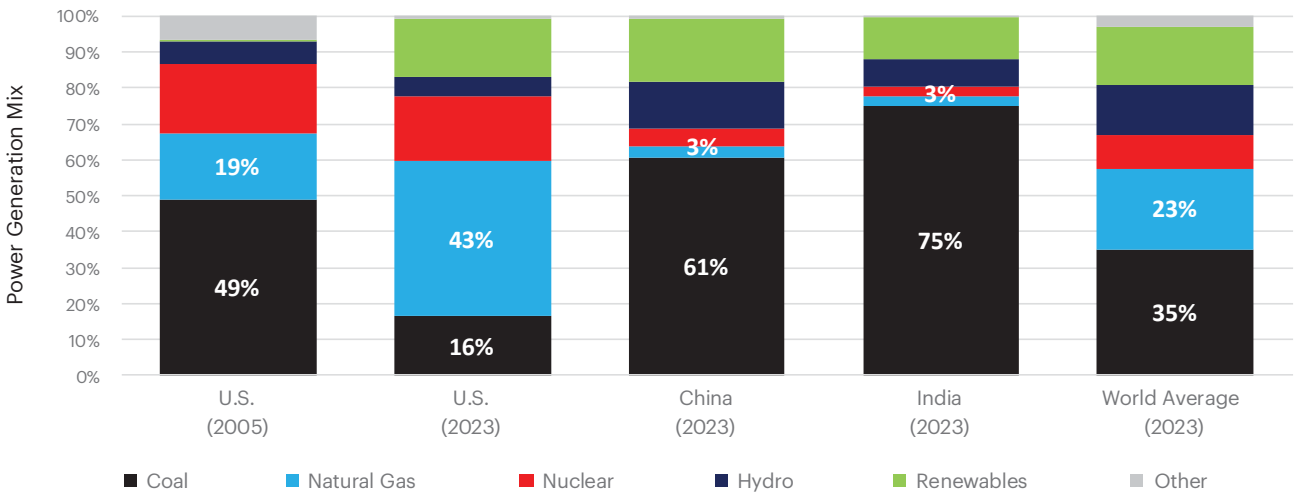
Zagorski projected the Marcellus as up to a 1 Tcf natural gas prospect. For context, in early 2008, Penn State University geoscientist Terry Engelder estimated the Marcellus' natural gas reserves as 50 Tcf. He later revised it way higher to 392 Tcf in late 2008, and then to as much as 489 Tcf in 2009.

"There were times when we were looking at it and comparing the size of the Marcellus to the size of the Barnett and the Fayetteville [Shale], and we knew this thing was huge," Zagorski said. "But we didn't know it was going

U.S. Power Generation by Source[(a)]



Significant Global Coal Displacement Potential Remains[(b)]



(A) SOURCE: EIA
(B) SOURCE: ENERGY INSTITUTE STATISTICAL REVIEW OF WORLD ENERGY 2024
SOURCE: RANGE RESOURCES

ANTHONY MUSMANNO

to be that big."

Ventura kept encouraging Zagorski to "Just think bigger," but it remained beyond his wildest dreams. "I was embarrassed," Zagorski said. "I thought they're going to throw me out. They're going to think I'm crazy. Nobody could imagine the thing could have been that big."

Zagorski thought they'd be able to lease land for $40 an acre. And they didn't get a lot for less than $200 per acre. Once the land rush really kicked off in 2008, prices surged to $5,000 an acre and even higher later on.

At the time, the enthusiasm around the Haynesville in Louisiana was fading because of the exorbitant costs associated with the higher-pressure drilling and completions and, back then, the need for pricier ceramic proppants, Wicklund said. "We didn't have LNG at the time. And so, it was like, 'Screw this noise. Let's go drill the Marcellus.' And we did. And it was a giant land grab."

But we're not there yet. In 2005, the Marcellus was still pretty quiet as Range continued to build up its fortuitous acreage position.

Where the Brokers and the Geologists Play

The equation that Range was yet to solve, though, was taking the full horizontal shale boom to the Marcellus with unconventional drilling and completions.

The initial horizontal well in the Marcellus that Range tried in 2005 produced less than the verticals. The second try in 2006 was a complete bust with zero gas production. And then a third, again, came in less than the verticals.

Range, in 2006, had already opened a regional Marcellus development office with a dedicated team and a capital budget of roughly $200 million to make the Marcellus economically viable—"low risk, high repeatability"—as desired by Ventura and Pinkerton.

Well, by 2007, Ventura told the team they'd spent three quarters of the budget, and the pressure was mounting. "He did not scold the team; he just encouraged us to figure it out," Zagorski said.

At this point, with an admitted fear of failure and stress levels rising, Zagorski had his second "aha" moment.

Utilizing gamma-ray mapping and focused ion-beam scanning electron microscopy (FIB-SEM) imaging technology, the Range team charted the first few tries and realized the wells were producing better the farther away they were from the bottom or base of the Marcellus.

In a 15-page memo, Zagorski essentially proposes moving the landing zone 20-30 ft. higher than the best of the initial horizontal wells.

"I send it to all the technical guys and say the next lateral we do is going to be the one," Zagorski said.

The Gulla No. 9H well proved to be the breakthrough horizontal in the Marcellus, coming online at nearly 3.5 MMcf/d, comparable to the successful Barnett horizontals, and the Gulla lateral was only about 3,000 ft.

After one follow-up lateral failed, the next few were all incrementally more successful than the Gulla.

The Marcellus breakthrough had truly arrived.

"In the thrill of discovery and the challenge of finding something, there was no rule book on this. There was nobody to help you figure out how to frac it. You just basically had to figure it out on your own intuitively and use creative thinking," Zagorski said. "All these scientists and experts said it can't work. And you're saying, 'Yeah, it can work.' You had to have the insight and the long-term dedication to it to try new things and make stepwise increments. There was nothing like it in my career, nothing like it."

> *"The great thing about the Barnett isn't the production that it provided to Range during that timeframe or the financial benefits that came out of it. The benefit of the Barnett for Range was it became the analogue for us to then discover the Marcellus."*
>
> **DENNIS DEGNER,** CEO and president, Range Resources

Degner summarized, "The company had quickly reached a point where the belief was, we've just got to go drill a horizontal. We're at that decision point—that fork in the road. In order for this to be successful, we've got to move forward and we've got to drill a quality horizontal in a target that we feel gives us the best chance of success. And put our best completion on it, which we knew at that time was a Barnett-style completion. And that's where we had our breakthrough."

In December 2007, Range, as a public company with shareholders to inform, announced the newest U.S. shale gas play, reporting three new horizontal Marcellus tests that made 3.7, 4.3, and 4.7 MMcfe in their first 24 hours.

"By the seventh or eighth lateral, we were testing laterals that had 10 MMcf/d, which is way higher than anything in the Barnett," Zagorski said.

The land rush was on and, in three years or so, the industry drilled more than 2,500 horizontal wells throughout the Appalachian Formation.

Critics had said the Marcellus was too thin and uneconomic to make work. They were wrong.

"It ended up down in southwestern Pennsylvania, we have the highest porosity and the highest perm (permeability) and highest TOC (total organic carbon) content all concentrated into a third of the area that they would have up in northeast Pennsylvania," Zagorski said. "If you frac something that's that concentrated, and if your frac is all concentrated, then it's like mining low-grade coal versus high-grade coal. You're mining and fracking something that's much richer."

Give Me the Hills and the Ring of the Drills

At the time, Range Resources was far from a Marcellus pure-play producer. Range was still expanding in the Barnett until at least 2008. And, in 2016, Range erred, in hindsight, by buying—and later selling during the COVID

NOG CLOSES DEALS

~$4B of deals signed across the Permian, Williston, Marcellus and Utica since 2018

CREATIVE NON-OPERATED CAPITAL SOLUTIONS

Traditional Non-Operated and Ground Game Acquisitions

$3.0B

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INCLINE ENERGY PARTNERS
W Energy Partners
ALPHA PERMIAN
COMSTOCK RESOURCES
PIVOTAL PETROLEUM PARTNERS
VERITAS ENERGY, LLC
Undisclosed Majors
Private Sellers

Drilling Partnerships

$180M

Hibernia resources
Undisclosed Majors
Private Sellers

Operated Co-Purchase and Buydowns

+$1.0B

NOVO
MIDLAND-PETRO D.C. PARTNERS, LLC
Fe Forge energy II

NOG

Northern Oil and Gas, Inc.

Adam Dirlam, *President*
Nicholas O'Grady, *Chief Executive Officer*

952.476.9800
bizdev@northernoil.com

pandemic–Haynesville producer Memorial Resource Development.

Over time, Range was focusing more and more on just the Marcellus.

"The great thing about the Barnett isn't the production that it provided to Range during that timeframe or the financial benefits that came out of it. The benefit of the Barnett for Range was it became the analogue for us to then discover the Marcellus," Degner said. "The Barnett really became the testing ground and that lab for us to collect data, and get comfortable with what unconventional shale development looks like. What does the rock quality look like? How do you get gas out of something that has picodarcy permeability?"

"We looked at what the opportunity set was for an Appalachia, and we said, 'Hold on a second, we have half a million net acres in Appalachia versus the smaller footprint that we had here in the Barnett. Here's the opportunity.'

"And it was large, contiguous and allowed us to think differently about starting almost with a clean sheet of paper-type development," Degner said. "It's the one thing as an industry that, as an engineer, we always wanted.

"We had that in Appalachia." Once the successful horizontals came in, he said, "You could see the Marcellus had the ability to surpass the Barnett."

Over the years, Range divested from non-core, non-Marcellus positions until becoming a pure play in 2020.

"You saw us go from a production level that was essentially zero out of the Marcellus to now over 2 Bcf/d equivalent today and being a top 10 NGL producer in the U.S.," Degner said.

And the Rich Natural Gas in the Ground

Indeed, Range Resources has come a long way from drilling hundreds of shallow, small-volume gas wells in Pennsylvania from coalbed methane before, eventually, tackling the Middle Devonian Marcellus.

What we now know as Range started almost 50 years ago as Lomak Petroleum in 1976 from Ohio.

Then came the 1980s oil bust and, on the verge of bankruptcy, Fort Worth-based Snyder Oil acquired Lomak in 1988, bringing the company to the Texas headquarters it still claims today.

Starting in 1990, Snyder began to divest from Lomak, which, now in a better financial position, went on a buying spree, including Appalachian Exploration and Pittsburgh-based Mark Resources, which employed Zagorski. Those deals also set up the company with some of its legacy Marcellus positions. Pinkerton, who worked at Snyder, stayed with Lomak and became CEO in 1992.

Snyder was fully divested by 1995 and, in 1997, Lomak increased its Pennsylvania position by buying assets from Cabot Oil & Gas.

In 1998, Lomak and Domain Energy merged, finally adopting the Range Resources name, maintaining the Fort Worth headquarters, and keeping Pinkerton as CEO.

In 1999, Range formed a 50:50 joint venture with FirstEnergy Corp. called Great Lakes Energy Partners to own properties in the Appalachian Basin, and Range fully bought the Great Lakes JV out in 2004, further strengthening the Appalachia position.

And that brings us back to the Renz, the shale boom, and a focus on the geology and making smart economical decisions.

"When I think about what unlocked the Marcellus for us, it really started with that subsurface evaluation of, what does the rock quality look like? And, where do you land your horizontal? Where do you target within that section?" Degner said. "It was fascinating to see the changes in the perm and porosity, so to speak, through the respective core sections. It changed the way we started thinking about our landing targets.

"Over the course of time, our well performance continued to improve as we enhanced our geological models."

> *"You saw us go from a production level that was essentially zero out of the Marcellus to now over 2 Bcf/d equivalent today and being a top 10 NGL producer in the U.S."*
>
> **DENNIS DEGNER,** CEO and president, Range Resources

The energy sector loves sports clichés, and Degner opted for mixed sports baseball and football metaphors.

"I feel like we're proverbially stuck in the seventh inning. That's probably not a great way of describing it. But, it's because we keep pushing the goalpost. So, I'm mixing sports now," he said with a laugh.

The industry feels like it's maturing, and then a new efficiency paradigm shift occurs that allows Range to unlock new inventory affordably, he said.

"When I was using rigs that can only drill 10,000 ft, I was approaching what I thought was the upper limit–maybe the ninth [inning]," Degner said. "But, now, I've got a rig that can drill 20,000 ft, so we move the goalpost in a way where it feels like the innings have gone backwards.

"We're seeing that continual growth, whether it's well performance, geological assessment or even our efficiency. I would say the two things that stick out to me most are that subsurface technical work that's still ongoing today and completion design."

And the Place Where the Cash Does Flow

A victim of its own success, natural gas prices remain muted because production is so high while the industry awaits new LNG facilities and increased domestic demand from data centers and electrification.

Range is producing about 2.15 Bcfe/d, but that's in the fourth consecutive year of "maintenance production mode" while operating no more than two drilling rigs in 2024.

That represents a stark contrast to the natural gas activity peak of 2008 when Range operated a whopping 33 rigs while averaging production of just 386 MMcfe/d by comparison.

For now, Range is keeping costs down, increasing efficiencies and remaining bullish for the longer term. Rivals keep expanding, but Degner is confident Range doesn't need to acquire because of its vast, contiguous and untapped inventory. EQT Corp. keeps growing and Chesapeake just combined

ANTHONY MUSMANNO

RANGE RESOURCES

Clockwise from top left: The frac spread for the original Renz well in 2004, employees working on the Renz well, and the pumpjack that kept the Renz well in production for years.

with Southwestern Energy to form the new, well, Expand Energy, which is now the nation's top natural gas producer by volume.

"One of the reasons why you haven't seen Range be as active in that M&A conversation is because of how much inventory we have," Degner said. "It allows us just to continue to focus on our Marcellus activity and then push out higher-risk opportunities to decades down the road."

That includes sitting on the deeper, costlier Utica and other formations in favor of sticking with the Marcellus for now, including holding off on exploring the Utica's oil window for years to come.

And with greater efficiency and reduced debt, Range has reduced its hedging from almost 80% to just over 50% now to more than 30% in the year or two ahead, he said.

While the Appalachia region struggles with long-haul takeaway, even after the Mountain Valley Pipeline came online, the growth of data centers can increase regional demand. And Range feels well positioned with its existing infrastructure network of gathering and processing with MPLX, as well as its zero-vapor protocols for keeping emissions down, Degner added.

But incremental efficiency progress is critical, too, with more gains to be made in frac stages completed per day and on lateral lengths, which average close to 14,000 ft., he said.

"You're rooting out non-productive time," he said. "When we return to pad sites with existing production for a second wave of development, we traditionally see our efficiencies across the board improve about 30%."

"And, now, we have somewhere in the neighborhood of right around 80 wells that are greater than 15,000 ft. Over the course of time, I'd expect us to continue to progress toward an average that could look like 15,000 ft," he said.

Since retiring as vice president of geology, Zagorski has watched those gains with amazement.

"Once you had the combination of the longer laterals and the better, closer stage spacing combined with all kinds of cost efficiencies, that's when you saw the metrics and the economics of the wells really drastically changed," Zagorski said. "That's basically what they've been doing over the last several years, just perfecting how to get more and more out."

From an perspective, Wicklund is confident more Appalachian takeaway capacity will be built because the demand will become too great, especially as U.S. LNG capacity more than doubled in the years ahead. The only question is the exact timing.

"You have a huge amount of pull on natural gas," Wicklund said. "You're going to have to increase gas production in the U.S. fairly significantly.

"It's going to happen. It's just a matter of pace. The Marcellus will get developed. It's just the inevitability of demand." OGI

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Waiting to Exhale

After years of exploitation as one of the country's first unconventional shale plays, the Marcellus still has plenty of natural gas for producers, even if regional and economic factors have kept much of it bottled up.

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The U.S. natural gas market is in the midst of a sea change.

Prices, adjusted for inflation, are as low as they've been in the last 30 years. Energy companies, however, continue to spend billions on new infrastructure in the hopes of a massive demand increase expected to hit before the end of the decade.

Yet most of that development is happening on the Gulf Coast, via pipelines in Texas and LNG plants in Louisiana. The nation's largest gas field on the eastern side of the U.S., the Marcellus Shale, has seen little of the transformations shaking the industry along the Gulf Coast.

The Marcellus has steadily produced natural gas for more than a century and has plenty of reserves for a future of increased demand for exports and power generation. While producers continue to develop the region and extol the basin's low-cost, high-quality virtues, low prices have led to flattened and–in some cases reduced–production.

CEOs are often fighting political battles for permission to build infrastructure. An appeals court recently revoked a permit for a pipeline infrastructure project that was already operational, and the Mountain Valley Pipeline faced never-ending protests and court actions until the government intervened.

"It's never been more important for us to produce energy in this country–whether it's increasing LNG exports to protect our allies, addressing the situation in Ukraine or powering the AI boom that's taking place," Toby Rice, president and CEO of EQT Corp., told *Oil and Gas Investor (OGI)*. EQT bases its operations primarily in the Marcellus and the Upper Devonian in West Virginia.

"It's also never been more difficult to produce energy in this country. The last pipeline built in this country took an act of Congress. In order to provide the energy we need, we have to get back to building things."

Shallow and Dry

The Middle Devonian Marcellus Shale stretches from the northeast in New York, to the mid-Atlantic in Pennsylvania, West Virginia and Maryland, and to the Midwest in Ohio.

The formation is generally about a mile beneath the surface and about 1,000 feet above the Utica Shale. Due to the different depths, the two basins provide different products.

The Utica is a major producer of oil and NGL. The Marcellus provides mostly dry gas, meaning it's composed primarily of methane and requires little processing before being shipped to market. API describes it as the second-largest natural gas find on Earth.

There are advantages and disadvantages to the Marcellus' makeup. As of a result of its shallower depth, it's cheaper to drill into the Marcellus than the Utica. Dry gas also costs less to commercialize because of lower processing fees.

Williams Cos. operations in the Marcellus. The midstream giant is the largest gas gatherer in the Appalachia Basin.

THE WILLIAMS COS.

"It's also never been more difficult to produce energy in this country. The last pipeline built in this country took an act of Congress. In order to provide the energy we need, we have to get back to building things."

TOBY RICE, president and CEO, EQT Corp.

However, NGL can be a useful buffer for producers when natural gas prices dip. The NGL composite price held steady for much of the first half of the year at $6.91/MMbtu, while the cost of natural gas had fallen by about one-third, the Energy Information Administration said.

The Marcellus does produce some NGL, but natural gas is the primary product by far. Pennsylvania led the basin in gas production, producing 85% of the region's output in 2024, according to Rextag.

At the end of 2023, the region had almost 40 rigs in operation. That figure declined to around 25 by the middle of the summer, according to East Daley Analytics, as low prices forced production cuts.

"What's happening in the U.S. over the last 15 years is that demand has grown 50% for natural gas but natural gas infrastructure has only grown 25%," Rice said in a separate interview with NPR. "Most importantly, natural gas storage infrastructure has only grown 12%. That means that we haven't built up enough pipelines to keep up with demand and the infrastructure is maxed out. We need more infrastructure built in America and, if you have the opportunity, build it in Appalachia."

Appalachia, known for its coal production, has usually trailed in the development of its petroleum resources. The Marcellus, however, did play a pioneering role in the shale gas revolution.

The Marcellus Shale

2	Ranking Among Largest Gas Finds on Earth
1	Egress Pipeline Completed in 2020s
1	Mile Underground
5	States involved in primary production (Pennsylvania, West Virginia, New York, Ohio, Maryland)

The Yom Kippur War Connection

The discovery and eventual exploitation of the Marcellus was triggered by the Yom Kippur War in 1973.

U.S. support for Israel led to an oil embargo by Arab members of OPEC, which caused a panic on the

international market. The price of a barrel of crude in the U.S. doubled and then quadrupled, eventually leading to long lines and short supplies at the country's gasoline stations.

President Richard Nixon declared the need for energy independence and began several programs aiming to boost domestic energy supplies. President Jimmy Carter placed those programs under the umbrella of the newly formed Department of Energy (DOE) in 1977.

One of the first projects brought under the DOE's purview was the Eastern Gas Shales Program, which focused on developing gas fields that had been marginal or unreachable.

Appalachian gas deposits were known since the late 1800s, according to the U.S. Department of the Interior. The department estimates that the first natural gas companies had already extracted 3 Tcf by the end of the 1970s from the area's shallow deposits.

The Eastern Gas Shales Program, run by the DOE's Bureau of Mines, focused on the Dunkirk and Huron shales in Ohio, said Terry Engelder, who took part in the DOE research as a professor of geosciences at Penn State University.

"The Marcellus was actually an afterthought in terms of sampling, and there were only three or four wells of those 32 (in the program) that penetrated the Marcellus off of that program," Engelder said.

Engelder would play a large role in the eventual development of the Marcellus, and he's currently writing a book about the basin's history, with the working title, "Breaking Rocks."

Engelder grew up in Wellsville, N.Y., a small town in the western part of the state, close to the Pennsylvania border. He had an early interest in geology and once won a high school science fair with his project on geological faulting near his home town.

As an academic, Engelder studied the Marcellus with the sponsorship of a DOE grant in 1978. The formation is geologically interesting, and Engelder found evidence that a wealth of gas in the formation was pushing upward, causing vertical cracks in the horizontal layers noticeable through cuts made by rivers.

Nothing immediately happened in the Marcellus after the studies, and the Eastern Gas Shales Program ended in 1992.

The program's research, however, aided Barnett Shale pioneer George Mitchell and his team in Texas in their project to build the world's first successful unconventional shale play.

As Mitchell's success opened up new plays, attention focused back on the Marcellus, and the earlier studies that had shown the potential for development.

By 2004, Range Resources, convinced by company geologist Bill Zagorski, decided to "put a massive frack on the Marcellus," Engelder said. "They started leasing land like mad in southeastern Pennsylvania–Washington County mainly."

Chesapeake Energy (now Expand Energy) followed with a major move in the area. In 2007, Engelder, now a full-time academic at Penn State, was asked after a lecture just how big the potential natural gas reserves were in the area. His initial calculations, using the latest geologic data, showed a potential for more than 40 Tcf.

After Penn State published the data, accompanied by some of Range Resources production numbers, lease rates in the area jumped from under $100 an acre to as much $5,000.

Slow Build

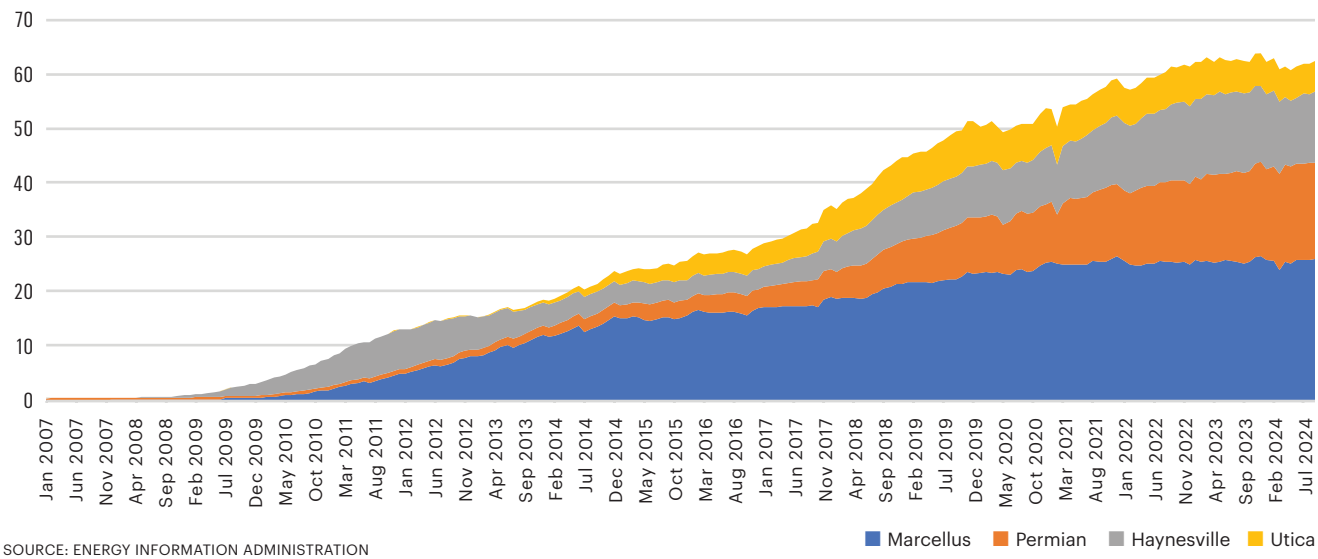
That initial boom has slowed, as compared to the continued rapid development of the Permian Basin in Texas and New Mexico. However, infrastructure companies have seen their deliveries increasing.

"Over the past five years we have grown volumes significantly, and increased margins without any large-scale acquisitions, but instead through expansion projects," said Williams Cos.' Larry Larsen, senior vice president of gathering and processing.

The recent focus in the Marcellus has been on

U.S. Dry Shale Natural Gas Production in Major Formations

monthly, Bcf/d



SOURCE: ENERGY INFORMATION ADMINISTRATION

infrastructure projects needed to take the natural gas to market. Williams, the largest gas gatherer in the Appalachians, has spent the latter part of 2024 battling in the courts to continue operating a project that was already completed.

In July, the Court of Appeals for the D.C. District vacated the Federal Energy Reserve Commission's (FERC) permits for the Regional Energy Access (REA) project, which delivers natural gas to utilities in the mid-Atlantic. The move came after the company had completed the project.

The REA is a $950 million expansion that adds about 829,000 dekatherms of energy capacity to an existing pipeline system.

The appeals court ruled that the market need for the gas had not been sufficiently proved to FERC. The company filed for a temporary permit to continue operations until the courts and FERC could work through the problem.

"The United States has a vast natural gas resource in the Marcellus, but supplies are constrained due to lack of infrastructure. Costly pipeline project delays occur due to duplicative permitting processes, a lack of cooperation among regulatory agencies, and inadequate judicial review standards," Larsen told *OGI*.

"In fact, between 2013 and 2022, natural gas demand has grown by 43%, with only 25% growth in infrastructure to handle it. We can, and should, modernize the federal permitting process to benefit all energy sources, not just natural gas. Specifically, we are calling on Congress to restore the balance intended in the Natural Gas Act by removing the one-state veto power loophole in the current law."

Williams plans to continue expanding in the Northeast and delivering gas to other markets. The Transco Southeast Supply Enhancement project will distribute supplies from the newly operational Mountain Valley Pipeline to the southeastern United States. Once approved by FERC, the system will add about 1.6 Bcf/d of natural gas capacity to Williams' Transco system in 2027.

Old and Hale

Engelder said he was hopeful about production in the Marcellus. Some of the first wells drilled in the region continue to provide strong output for producers.

"It's very difficult to say when you talk about the foreseeable future, but we know that gas wells last up to 40 years," he said. "My suspicion is that a well that is drilled in 2020—it is pretty easy to imagine that that well will still be going in the year 2060."

He said the key for producers was to keep active, as the market for gas in the region will eventually catch up to other parts of the U.S.

"I'm optimistic that these gas wells will just really keep going," he said. "Like the Energizer Bunny." OGI

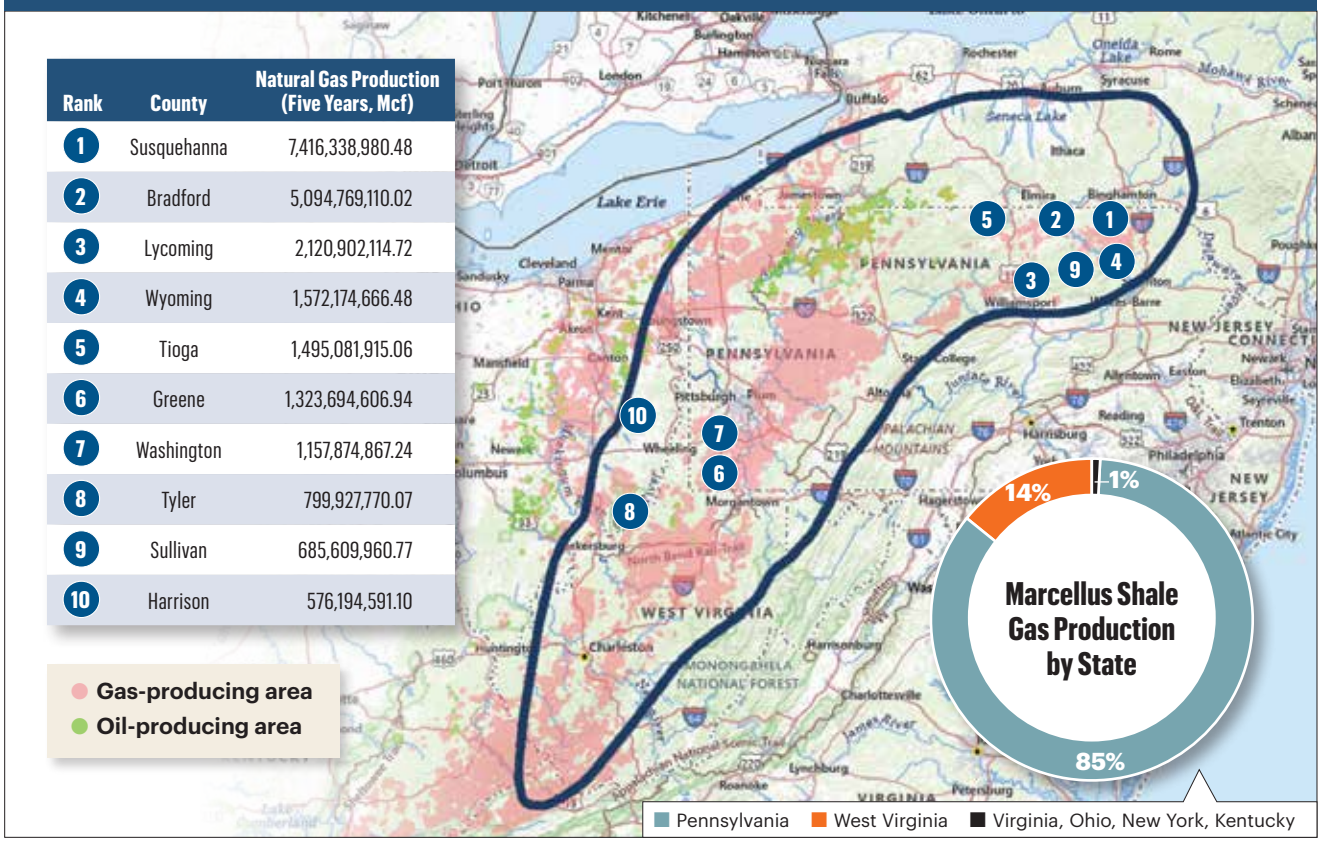
ANTHONY MUSMANNO

BASIN FOCUS: MARCELLUS SHALE

Natural gas output rose 6.1% in the play from 2022 to 2023.

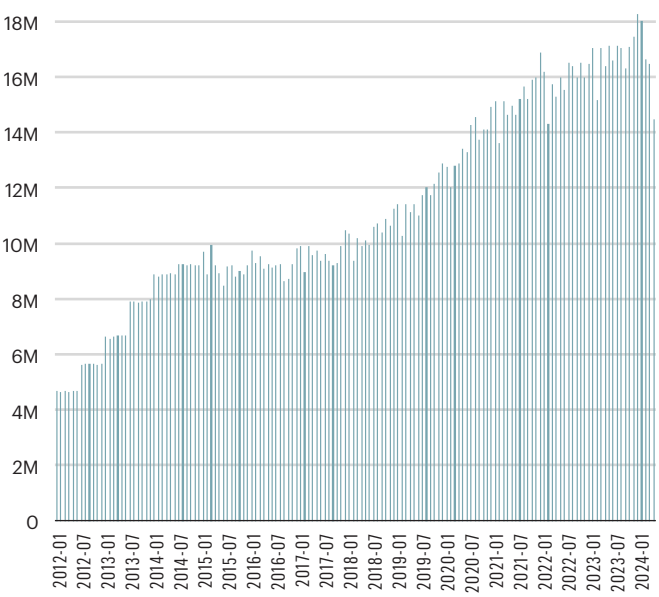
MARCELLUS SHALE GAS PRODUCTION BY COUNTY

Rank	County	Natural Gas Production (Five Years, Mcf)
1	Susquehanna	7,416,338,980.48
2	Bradford	5,094,769,110.02
3	Lycoming	2,120,902,114.72
4	Wyoming	1,572,174,666.48
5	Tioga	1,495,081,915.06
6	Greene	1,323,694,606.94
7	Washington	1,157,874,867.24
8	Tyler	799,927,770.07
9	Sullivan	685,609,960.77
10	Harrison	576,194,591.10



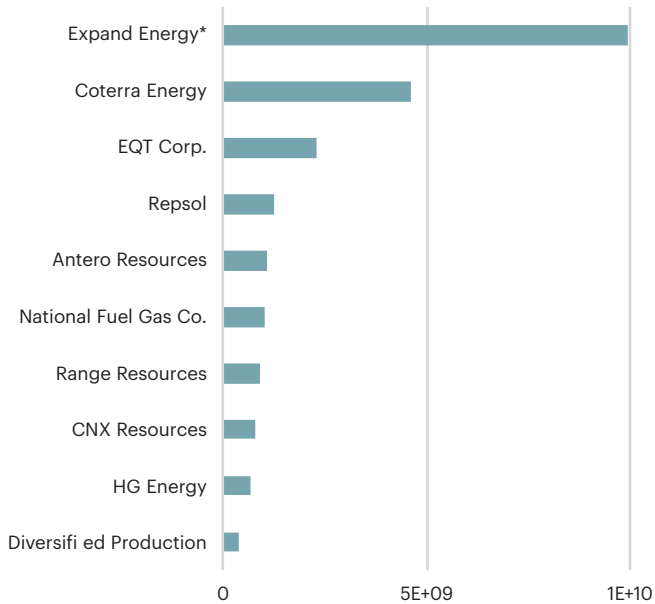
Marcellus Shale Natural Gas Production

(Mcf)



Marcellus Shale Natural Gas Production by Operator

(five years, Mcf)



SOURCE FOR CHARTS AND MAPS: REXTAG.COM

*COMBINED PRODUCTION OF CHESAPEAKE ENERGY AND SOUTHWESTERN ENERGY PRIOR TO MERGER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PERMITS

Weld County, Colo., in the Denver-Julesburg Basin, led all counties in well permit approvals in the last month.

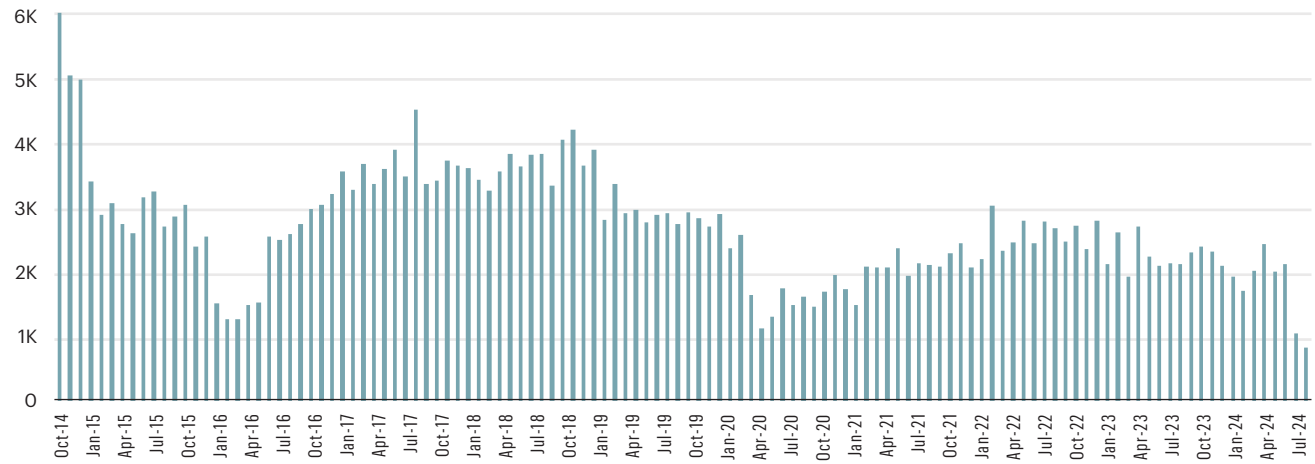
Permitted Wells by County

Rank	County	Well Count
1	Weld, Colo.	80
2	Martin, Texas	73
3	Lea, N.M.	41
4	McKenzie, N.D.	29
5	Midland, Texas	21
6	Bourbon, Kan.	19
7	Eddy, N.M.	17
8	Reeves, Texas	17
9	Duchesne, Utah	16
10	Dunn, N.D.	14
11	Loving, Texas	12
12	Campbell, Wyo.	11

Permitted Wells by State

State	Well Count
Texas	291
Colorado	140
North Dakota	41
Oklahoma	23
Kansas	15
Louisiana	14
Wyoming	9
New Mexico	7

U.S. Permitted Wells



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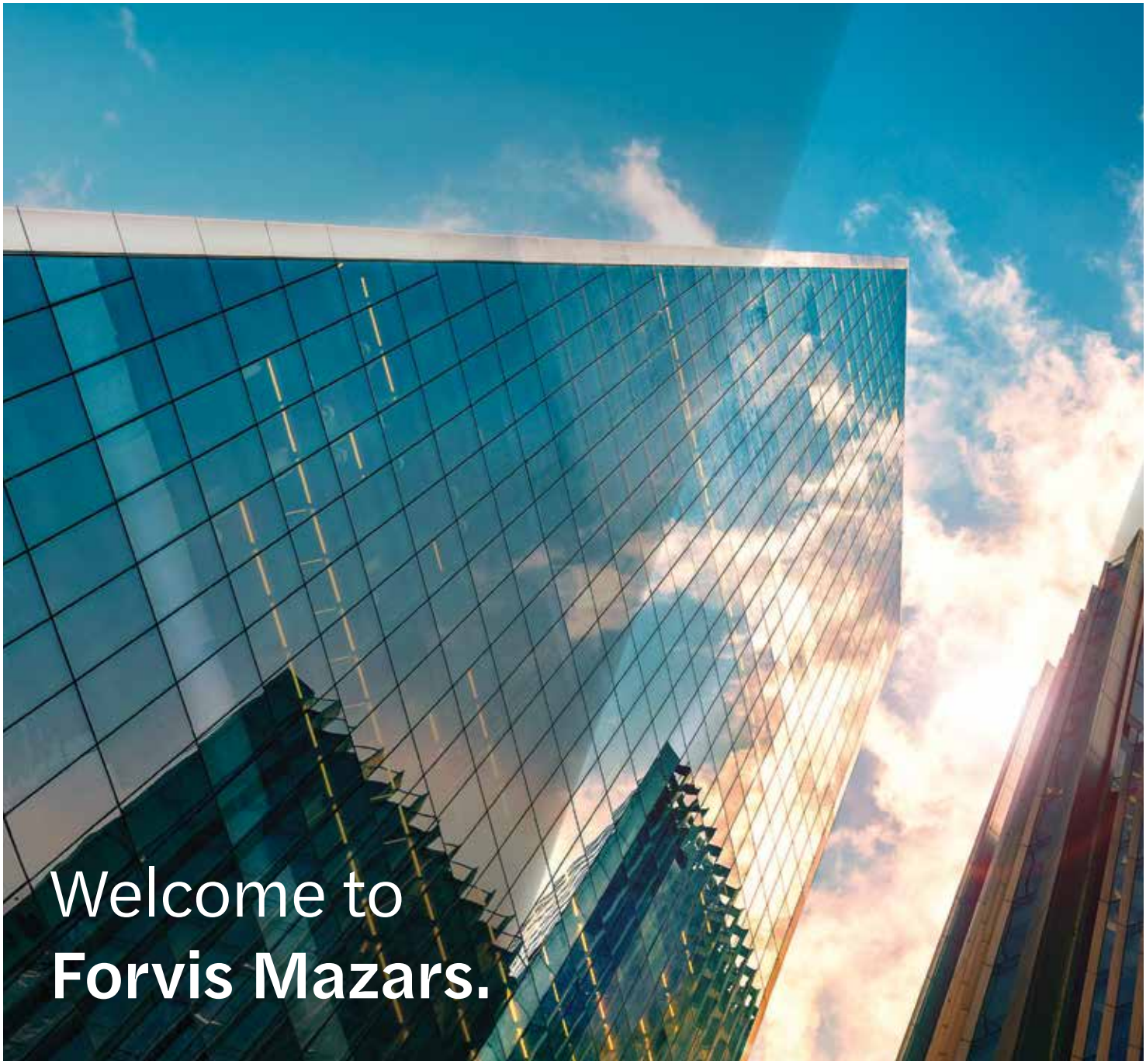

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No Rush: Post-M&A Frenzy, Divestiture Market to Pick Up

Lenders with a variety of capital structures are poised to fund the upcoming portfolio rationalization in the post-consolidation era, bankers and deal advisers said at Hart Energy's Energy Capital Conference.

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Bankers eager for a deal and E&Ps salivating over potential assets on the selling block may have to wait longer than they'd like for a deluge of hot assets to hit the market.

There are roughly half the number of public upstream companies today relative to 2016, and most have far stronger balance sheets, said Will Hodge, managing director and co-head of E&P at Raymond James, during the "Buy Side/Sell Side Perspectives" panel at Hart Energy's Energy Capital Conference.

In short, those companies don't need to speed through an A&D process, taking whatever they can get for assets they've acquired but not fully vetted, simply to lower their debt profile. It's a more measured approach to past cycles that could benefit the industry across the chain of its finance.

"I think we're all optimistic that the A&D market picks up mainly from portfolio rationalization early next year or [the next] two, and I think the private credit market's going to benefit from that," he said.

Market consensus is that the industry's portfolio capitalization will take place during the next two to three years, he said. And it will be a lot of activity. But first, the consolidation rationalization phase takes place, and some large cap companies have forecasted that while momentum exists, they don't necessarily have a sense of urgency to make deals.

"Talking to a lot of private equity clients, they're looking for that to happen, as well. I think credit providers and other capital providers are looking for that to happen, but there's not the same catalyst there used to be as far as balance sheet pressure," Hodge said. "Most of the large caps are very strong from a balance sheet perspective, and so there is some question in regard to timing and how quickly they go through that portfolio rationalization."

Still, there's so much momentum that key players, capital providers and private equity are pushing for portfolio rationalization, he said.

"When I meet with those large caps and their boards, they're definitely starting to think about it and understand that it should happen over time, but again, we'll be interested to see how fast it unfolds," Hodge said.

Thriving in Chaos

Institutional investors' flight from the oil and gas industry has created an opening for alternative sources of capital to step up, said panel moderator Chad Nichols, a partner in the Houston office of Gibson, Dunn & Crutcher where he is a member of the finance and business restructuring/reorganization practice groups.

Nicholas Fersen of EOC Partners said both the type of credit that is needed and the function of capital markets have shifted since he founded the firm in 2022.

"In private credit, there's kind of a lull in 2024. We're in this 'Goldilocks' period, where the bank market is functioning [and] the high-yield market is robust. You're seeing private companies—Aethon [Energy], Kraken Resources, Wildfire Energy, all private companies—access the high-yield market. It's sub-8% coupon. It's cheaper than their bank revolver," he said. "When the high-yield market is functioning like that, I think private credit takes a backseat."

In addition, Fersen said, the U.S. bank market for oil and gas is "fairly robust" for the first time since COVID, at least in part because the European banks' exit from the space means there are fewer players.

The consolidation impact cannot be overstated. Not only has it decreased the number of companies looking for capital, but the companies that are merging—Fersen referenced the $7.4 billion combination of Chesapeake Energy and Southwestern Energy to form Expand Energy—don't need to access 2x or 3x the value of their revolvers.

"And so, bank portfolios have shrunk," Fersen said, adding that, from his vantage point, it appears that banks' loan books are between 33% and 50% less their 2022 value.

Coming out of COVID in 2022, when EOC was founded, there was little indirect lending, he said. Almost three years later, there are significantly more participants.

Moreover, the private credit market is functioning well, he said.

"Private credit's got this golden age where the [private equity firms] Apollos and the KKRs in the world, they're partnering with Citibank on the direct lending side, and that market is so frothy that there's not as much

HART ENERGY

An Energy Capital Conference panel entitled "Buy Side/Sell Side Perspectives." From left to right: Chad Nichols, partner, Gibson, Dunn & Crutcher (moderator); Nicholas Fersen, co-founder, EOC Partners; Will Hodge, managing director, co-head of E&P, Raymond James; Daniel Hoverman, head of corporate and investment banking, Texas Capital.

opportunity there," Fersen said. "They're starting to peek over the fence and we're starting to see some of what I consider the generalists come back into the space. It'll be interesting to see whether those generalists actually come back in or they're kind of dancing around the edge.

"But right now, if you're a company, you've got a wonderful functioning bank market [and] high-yield market," he added.

Fersen said the oil and gas business "thrives in chaos."

"We're just kind of sitting and waiting, and inevitably in this industry something will happen," he said. "Either oil will go to $50 because of the Saudis, or the high-yield market breaks because of existential macro factors that have nothing to do with energy."

Reoriented for Growth

"You've seen a lot of banks that are now reoriented towards loan growth and doubling down on their covered industries," said Daniel Hoverman, head of corporate and investment banking at Texas Capital. "I would say the bank market is healthy, but it is still at, I think, a more conservative attachment point. One of the things that I would note about private credit: We've had some notable success in placing capital where we come in and lend with a smaller bank facility and a larger institutional capital structure."

Hoverman said that a persistent challenge remains: a deficit of capital relative to capital needs. That represents a challenge for fund managers coming to the space and serving the market.

Nichols added that there's "no longer the idea that you can just have a revolver and RBL [reserve-based lending] and be at 4x or 5x leverage."

"It seems like I'm seeing two and a half, three times and a lot more deals, and even that's kind of high," Nichols said. "Hence the importance of private credit coming in or high-yield debt for that matter, and providing a company with leverage that they might need."

At the end of the day, Hoverman said, "it comes down to risk management."

"The reality is, in this bank market, the revolver may be sized small enough that you don't necessarily need hedging and other requirements because you would've passed through some minimum funding threshold on a much larger facility," he said. "I don't think that the fundamental approach to credit underwriting has changed as much as the structure and the mix of capital within the facility,"

Raymond James' Hodge said most are optimistic that the A&D market picks up from portfolio rationalization in the next year or two.

"And I think the private credit market's going to benefit from that," he said. OGJ

PE Faces Uphill Fundraising Battle

As private equity begins the process of recycling inventory, executives acknowledge that raising funds has become increasingly difficult.

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Post Oak Energy Capital is making moves in the Permian Basin, backing a new team focused on the Delaware Basin, Ichthys Energy Partners. Post Oak also recently closed an equity commitment with a new company in the Haynesville Shale.

However, as private equity begins the process of recycling inventory likely to be cast off from large M&A transactions in the past couple of years, executives at Hart Energy's Energy Capital Conference said that raising new funds for oil and gas development has become increasingly difficult.

Post Oak's current fund is backing Ichthys, whose leadership was spun out of Permian Resources, said Frost Cochran, managing director at Post Oak. Dallas-based E&P Ichthys is led by co-founders Michael Poynter, CEO, and Will Weidig, CFO.

Frost Cochran

Cochran told Hart Energy the team is a group of "young guys who are just getting started with their first company, but they're focusing in the area that they know best, which is the Permian and, more specifically, the northern Delaware."

Post Oak also recently closed an equity commitment with Quantent Energy Partners, which completed an initial acquisition of natural gas assets in the Haynesville Shale in early September.

"In the case of Quantent … they captured an asset in the Hayesville … offsetting an existing asset we had in the Hayesville," he said. The management team "was the execution team with that prior asset we worked with. So, it's really a second iteration with that team on a similar asset."

However, Cochran said Post Oak remains largely focused on the Permian Basin.

Post Oak has also had a banner year in minerals, deploying about $475 million, "which is way about our average annual run rate, but it's in and around the basins we operate … predominantly Permian."

Post Oak typically makes equity commitments between $75 million and $150 million. Cochran said the Permian Basin represents 50% of the firm's exposure, with the Eagle Ford, Haynesville and Bakken taking smaller slices of the PE pie. To a lesser extent, the firm also invests in the Appalachian Basin and a couple of other basins where the breakevens are low but very much focused on conventional oil and gas strategies.

The Ichthys team is slightly unusual for Post Oak in that the company has yet to make an acquisition.

"The team is fresh, so it's a fresh line of equity for them. They don't yet have assets. A lot of our startup teams actually do have a captive asset when they start, but it's an area that has a lot of current activity."

Cochran said that after consolidation in the space at larger scale, there are still opportunities for smaller startup teams, even in the Midland and the Delaware basins.

Post Oak said continued industry consolidation is generating attractive opportunities for motivated entrepreneurs. And Cochran noted that some of the companies being sold in the wave of consolidation are backed by Post Oak and other firms such as Pearl Energy Investments.

Post Oak and Pearl are participating as "large shareholders and a consolidator in the form of Permian Resources," said Cochran, who serves on Permian Resources' board of directors. "But at the same time, we've got to start up new teams as well because we have to recycle that capital and show that compound opportunity for our partner base."

Cochran said private equity has to constantly source new young teams "who have the skill sets and capabilities … with some support from us from the capital side. And whatever we can do to try to match assets with teams, we do as well," he said. "But in the same basin we're selling things, we have to be starting new companies. It's just the walking and chewing gum at the same time."

Billy Quinn

Billy Quinn, managing partner at Pearl Energy, agreed. With the consolidation that has happened, "this is the same song, different verse."

"We've seen this in our business before and for us what we have that fits into selling into that, we've looked to exit if it's made sense, but on the backside of that, all this consolidation, begets more A&D because all the consolidation," he said. "Exxon buys Pioneer, and the next thing you know they've got billions of dollars of assets coming out the back door that were not meaningful to them before and are less meaningful to them now."

'Hurricane Force Winds'

However, making acquisitions and backing teams requires capital, which private equity and asset management executives say are increasingly difficult chores.

Quinn, alongside Cochran and Eric Mullins, chairman and CEO of asset management company Lime Rock Resources, all agreed that fundraising, particularly since COVID-19, has become something of a slog, though gradually it's improved.

Quinn noted that as the company launched its third bund in the fall of 2021, "we put the boat out in the water into hurricane force winds. It was crazy," he said. "We raised $720 million, but it took the better part of 15, 16 months."

Quinn said that, at the time, two-thirds of Pearl's regular investor were either officially out or on the sidelines.

Hardline ESG, non-fossil fuel investors remain out.

"Everybody in the middle, it just depends on the institution," Quinn said.

While some are returning, others are still on the sidelines. Another factor: there's more money available today for investment than three years ago, Quinn said.

"Having said that, it's still incredibly selective," he said. "It's not easy raising money and the return threshold to raise money in our business is much higher. These institutions, when they go back, there needs to be a differentiated rate of return that you're providing them."

Mullins agreed with Quinn's assessment, adding that he estimates there's roughly 5,500 pension funds, college endowments and foundations in North America.

Lime Rock, which is raising its sixth fund, started to feel pressure when raising its fifth fund, Mullins said.

The firm targeted a $750 million fund in 2020 before COVID. Mullins said investors were interested prior to the pandemic.

"When we came back, the whole environment had changed. Just like Billy said, the sentiment on some boards, on some committees about climate change and about ESG and not investing in fossil fuel was really [present], and we ended up raising $400 million plus another $150 million in a co-investment vehicle," he said.

Mullins said half to two-thirds of the "universe of historical investors" refuse to invest in fossil fuel private equity funds. The result was that firms were all calling the remaining one-third of investors still willing to put money into hydrocarbons.

"I think everybody was just being very cautious and patient in terms of making decisions to come into funds," he said. "So, it's been a real headwind and I'd say it's continuing." OGI

Kissler: Is a Nuclear Power Revival on the Horizon?

With Wall Street and Congress on board, projects may be on the verge of charging forward.

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Once the bogeyman of energy, nuclear power has been receiving a great deal of positive attention in the news lately.

Between Wall Street's pledge to help triple nuclear power output by the year 2050 and growing bipartisan political support, it would seem that a nuclear power revival might indeed be on the horizon.

On one hand, this warming up to nuclear energy makes sense. It is arguably the non-carbon-producing energy source with the most potential to gain traction. Wind-powered energy, while environmentally friendly, has proven too costly and tends to be unreliable in the months when there is the highest power demand, and solar energy is only really appropriate in areas of the U.S. where there's a lot of sunshine, like Arizona and New Mexico.

Meanwhile, the demand for cheap, reliable energy is projected to rise sharply over the next three decades, driven by the immense power needs of large artificial intelligence (AI) data centers. The more advanced we make AI, the greater its power requirements.

For instance, Microsoft's planned Stargate AI supercomputer may require as much as four to six gigawatts of power, almost the equivalent to the power needs of a large city such as New York. This trend indicates that the energy demands of even more advanced AI could reach unforeseen levels.

Add Nuclear, Keep Fossil Fuels

On the other hand, it is important to keep in mind that, while support for nuclear is growing, it is unlikely to entirely supplant fossil fuels in the near future. Rather, fossil fuels likely will remain a key energy source until clean energy sources are more reliably available and cost-effective.

Furthermore, right now, nuclear power's contribution to U.S. energy needs is still relatively small. As of the end of 2021, it made up only 18.9% of the total annual electricity generated in the U.S., according to the U.S. Energy Information Administration (EIA).

That percentage will grow as more nuclear power plants are built, and political support for doing so is growing. However, there are still headwinds that could limit nuclear power's growth in the U.S.

There are the initial infrastructure costs to consider. Nuclear power plants tend to take a long time to build and construction costs can increase rapidly over the life of the project. A nuclear reactor can cost $7 billion, which is extremely expensive compared to natural gas costs.

Recently we've seen nuclear projects go extremely over budget and over schedule. A prime example of this is expansion of Plant Vogtle in Georgia—a project that cost a total of $35 billion, based on some estimates. To put this figure into perspective, the new reactors were originally projected to cost $14 billion and be completed by 2017, according to the Associated Press.

Meanwhile, although the cost of operating a nuclear power plant has gone down over time, it remains more expensive than operating a fossil fuel steam-electric power plant. For example, in 2022, it cost 10.51 mills per kilowatt-hour to operate a nuclear plant, compared to 6.75 mills for a fossil steam plant and 7.68 mills for a hydroelectric plant, according to the EIA. A mill is equivalent to one-10th of a cent.

Finally, there's the environmental waste to consider. Although nuclear power plants do not emit air pollution, they do create radioactive wastes such as uranium mill tailings and used reactor fuel, which can be dangerous to human health for thousands of years.

Give it Time

Despite these downsides, the growth of nuclear power has its upsides, too, so it's understandable why Wall Street and politicians alike are warming up to it. Nuclear is a long-lasting and relatively cheap source of energy, even with the large infrastructure costs upfront, which can be paid for through a large bond issuance. Once up and running, a nuclear plant's power generation can go for years and years and years without causing problems.

Meanwhile, nuclear energy is considerably safer than it was 25 years ago. Nuclear plants in the western world use what's known as a "defense-in-depth" approach that includes physical barriers between the radioactive reactor core and the environment, and multiple safety systems, each with backup and designed to accommodate human error. That's not to say that another nuclear disaster is impossible, but that the measures in place reduce the chances of one happening and will continue to do so as technology advances.

The potential for a nuclear power revival in the U.S. is certainly present, but it will not be without challenges. The demand for reliable, clean energy is growing, and nuclear power is well-positioned to help meet that demand. OGI

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SHALE

DUG APPALACHIA

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November 7

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Nov. 20-21

Midland, TX

COMING IN 2025

AWARDS

INFLUENTIAL WOMEN IN ENERGY

CONFERENCE & EXPO

February 27

Houston, TX

COMING IN 2025

GAS

DUG GAS

CONFERENCE & EXPO

Mar. 19-20

Shreveport, LA

COMING IN 2025

SHALE

SUPER DUG

CONFERENCE & EXPO

May 13-15

Fort Worth, TX

2024 CONFERENCE & EXPO BROCHURE

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The Benefits of Capital Starvation

Less dry powder means more discernment in investing, says Formentera Partners' Bryan Sheffield.

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The oil and gas industry is struggling with a lack of capital in general, and private equity's dry powder has declined from $100 billion earlier in the shale revolution to $15 billion today.

But while E&Ps are being squeezed financially, in some respects that's not necessarily a bad thing, said private equity executive Bryan Sheffield.

Sheffield, managing partner of Formentera Partners, said the industry has learned as an investor community. During the shale rush, deals that would raise eyebrows—"why in the world would they do that? They overpaid for that or the spacing on those wells are not working."—are no longer executed, he said.

"I've not seen any of that and it's probably because [private equity firms] NGP, EnCap, they're all being really stingy," he said at Hart Energy's Energy Capital Conference in October. "They're picking just a few management teams, and I think they really do go through the process of understanding what they're buying into."

Gone are the days when 40 management teams were rapid-fire signing deals.

"I would say we're in the sweet spot of any kind of deal that you're getting into," Sheffield said. "You should end up getting your money back with some sort of return."

That said, Sheffield said that he might have a different view in a couple of years. "Right now, with the capital I've mentioned, right around $15 billion that's in the system, it seems like that's just enough to help."

Formentera was largely built through M&A, Sheffield said. The company holds 630,000 net acres across the Permian Basin, Bakken and Eagle Ford shales, and other Lower 48 plays. In Australia, Formentera has sunk its teeth into 1.6 million net acres in the Marcellus Shale-like Beetaloo Basin.

Sheffield also evolved on operations, including his once firm belief that 3-mile laterals were foolhardy.

And he gave a nuanced view of capital that goes beyond ESG and what he called the "anti-fossil fuel" movement.

'Victim of Our Own Success'

When Sheffield started Formentera, he reached out to a list of contacts he had accumulated at Parsley Energy, which he founded. They once invited him to reach out if he were to "ever start over."

"It was a struggle," he said.

Sheffield called contacts at the University of North Carolina, Duke University, Princeton and Yale. Around the time of the $7 billion sale of Parsley to Pioneer Natural Resources, he started pitching his own company.

He would call. The "energy guys" at an endowment would get excited.

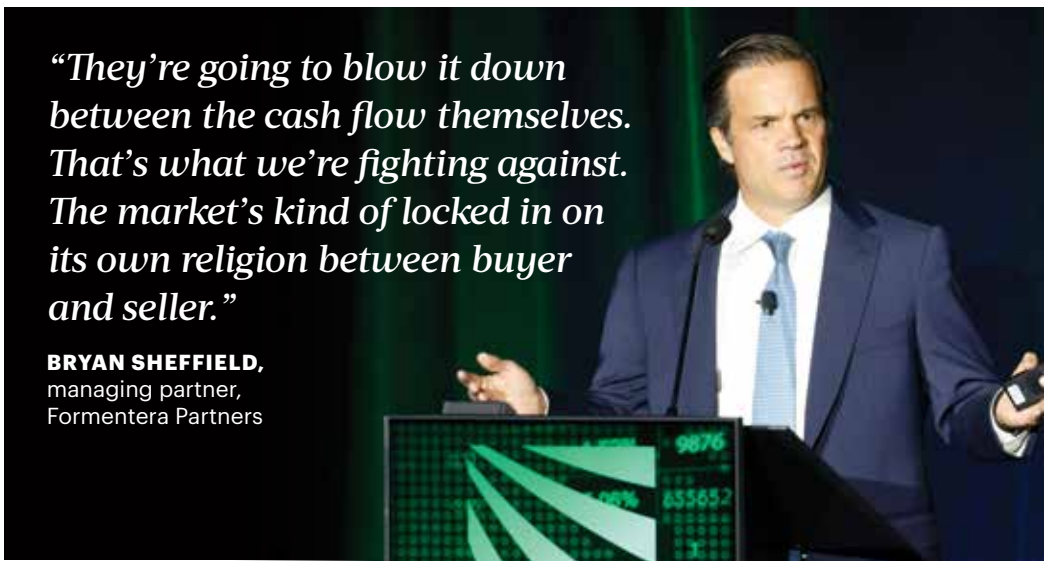
Then, inevitably, they would all call back with a similar message: "we can't invest in energy."

"So, it kind of gives you a sense of how hard it was," he said.

Sheffield used his own money to backstop Formentera, including G&A, and recruited people he knew at Parsley and elsewhere.

Then Sheffield went to family offices and one pension fund, thus growing the Formentera brand.

The problem, he said, was that after



HART ENERGY

establishing a track record as a founder of a company in shale's growth era, creating a new model focused on returns and dividends required "proof of concept."

Once Sheffield was convinced of the model himself, he went from a $50 million stake to $75 million in future funds.

"So, from the proof of concept, 'Hey, I like these dividends. I'm seeing 15% dividends with 17% to 18% returns, with low leverage," he said. "It's not easy. You've got to hustle."

There are two forces at work draining confidence and capital from the oil and gas sector, Sheffield said. One is fossil fuel opponents. The other is the industry itself.

But, he said, some investors may have a long memory.

"We were a victim of our own success. We drilled too much in the Midland Basin, in the Delaware and the Bakken and in the Eagle Ford," he said. "We drilled so much, we pissed off OPEC and Russia," resulting in a price war.

"We went to zero oil—negative $37 or something like that [during COVID]. I have it framed in my office to always remember that it can happen in this business."

630K
Formentera's acreage in the Lower 48

M&A Therapists Needed

Sheffield started Formentera at a time when banks were used to E&Ps based on a growth model.

"It took some time for the banks to get used to the dividend-paying model," he said.

Sheffield said the company has continued to grow, but only through acquisitions. Over time, those transactions have proven to be more and more tricky.

Sheffield added, "we're not growing through the drill bit."

Sheffield acknowledged that the company does do some drilling, but it's largely been rolling up proved developed producing (PDP) assets while "inheriting PUDs with the PDP."

"We call ourselves a PDP-plus fund or a company. I kind of look at Formentera as a company because we are the operator," he said. "We don't have multiple CEOs underneath us. We're kind of that operating model where we do fundraise, over time acquiring deals."

$15B
PE capital available

The company's commodity mix is 80% oil, although the heavy oil content "just kind of naturally happened," he said.

"I'd rather be 50% on both sides on our portfolio, but we keep losing gas deals because of the contango curve, and I think there's a lot of private equity out there that want to bet on gas and have this view on gas," he said.

And deals—gas in particular—continue to be hard to negotiate.

$75MM
Sheffield's own stake in Formentera

Sheffield, who has previously spoken out about the need for sellers to receive bid/ask "therapy," said M&A still tilts toward a buyer's market.

Formentera worked on a deal for APA Corp. that "we probably shouldn't have worked on because there's rigs everywhere there." APA Corp. agreed to sell its non-core Permian Basin assets for $950 million. Sheffield said it's widely believed that Hilcorp was the buyer.

"The bid-ask spread has gone for the seller's market. It has definitely gone its way in the core of Permian, in the core of the Eagle Ford," he said. "It feels like you can still pick up acreage at a PV-15, maybe underwrite a few handfuls of wells to get maybe up to a PV-16 or -17" on a discounted cash flow basis.

"So, the market's moved somewhat, but I hate it when the banks don't really educate the sellers [on] what they're really worth," he said. "I have seen more failed process deals than you can ever imagine. Our No. 1 competition is sellers' reservation price. We end up winning the deal 20% to 30% of the time and they just can't transact."

Instead, they look at Formentera's model and decided to hold it.

"They're going to blow it down between the cash flow themselves," he said. "That's what we're fighting against. The market's kind of locked in on its own religion between buyer and seller."

Growth Mode Redux?

Sheffield said he's always trying to think forward, to imagine what's next. He says that's happening now.

He concedes he thought the industry went "crazy" when it began attempting 2- and 3-mile laterals.

Sheffield was always concerned that longer laterals would result in having to "fish that drill bit" after it had been drilled 2.5 miles.

Now, "it seems like the industry and the technology, it's a piece of cake," he said.

Permian and Bakken laterals are routinely 4-milers.

"The growth model could come back over a few years," Sheffield said. "If we continue drilling 3- to 4-mile laterals, we have accelerated drilling. That's downspacing."

Downspacing is a bad word on Wall Street, he said. "You would never say downspacing to them, to investors, that you're going to downspace your PUDs (proved undeveloped)."

He said downspacing typically leads to a 25% cut on the previously drilled wells at a wider spacing.

But Sheffield has lately been talking to his business development team about PUDs and asking about well spacing.

The conversation between Sheffield and his team goes something like this:

"Can you downspace?"

"Yes, but it's uneconomic."

"OK, if oil is at $120, can you downspace?"

"Yes, that would be very economic and it's something to kind of look out for..."

Operational efficiencies and downspacing have already produced results that justify the Scarlett D practice of reducing space between wells—with the tradeoff resulting in well interference.

In the Bakken, for example, "they're drilling 3- to 4-mile laterals even on Tier 2 acreage," he said.

Wellhead returns have moved from 30% to 40% to north of 50% to 60%, he said. Similar results have been seen in Oklahoma.

"So, there's a lot of things happening in these plays and the technology around us," he said. "There's a lot of low-hanging fruit left behind because we were more focused on big shale, Midland Basin, Delaware.

"But all these other smaller fields have so much serendipity." OGJ

Chesapeake, Southwestern Close Deal, Rebrand as Expand

Formed by a megamerger, Expand Energy is the largest by volume natural gas-weighted E&P in the U.S.

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Chesapeake Energy's $7.4 billion merger with Southwestern Energy closed on Oct. 1, ending a push-pull dynamic with federal regulators that delayed the deal by a quarter. The newly dubbed Expand Energy is now trading on the Nasdaq with the ticker symbol "EXE."

The two natural gas players said they had cleared the waiting period under the Hart-Scott-Rodino Antitrust Improvements Act of 1976 in late September. Expand Energy will become the largest gas producer in the U.S. with its massive dual footprints in both the Appalachia and Haynesville shale plays.

The all-stock acquisition of Southwestern by Chesapeake was first announced in January; Chesapeake exchanged Southwestern shares on a 0.0867:1 basis, but additional scrutiny and information requests by the U.S. Federal Trade Commission caused some delays. The new Expand name was only announced in late September.

Nick Dell'Osso

"The world is short energy," said Chesapeake CEO Nick Dell'Osso, who will lead the combined company, in a statement. "With a premium scaled position across leading natural gas basins in the United States, a peer-leading returns program and a resilient financial foundation, Expand Energy is uniquely positioned to compete on an international scale to expand America's energy reach and deliver opportunity for the world's energy customers."

While natural gas prices remain relatively low, Dell'Osso and many industry analysts are bullish on prices returning to healthy levels going forward with the rise of LNG demand as new exporting facilities come online, as well as from the rise of domestic demand in the Americas from the growth of data centers, infrastructure electrification and more.

Expand will maintain Chesapeake's Oklahoma City headquarters and keep a presence in the Houston area.

Meanwhile, analysts are looking ahead to the third-quarter reporting period in which more guidance on integration should illuminate the go-forward planning.

At Jefferies, analyst Lloyd Bryne said Expand is "positioned as a must-own U.S. natural gas player" with strong, complementary acreage in the Haynesville Shale and Appalachia Basin holding at least 15 years' worth of inventory that should product strong free cash growth and shareholder returns.

"Market focus will likely remain on [Southwestern] integration and execution with higher-than-expected synergies, timely debt reduction, higher share buybacks and continued progress toward LNG strategy, all acting as key upside catalysts," he said in an October note to investors.

There was a time during the tumultuous story of Expand's forebear, Chesapeake, that it, itself, was a "must-own" natural gas producer.

Founded in 1989 by Aubrey McClendon and Tom Ward—both 29—with about 10 employees and $50,000, the Chesapeake story is one of epic proportions. The company went public within four years valued at $25 million, and the stock price soared.

But as all things cyclical in the energy space go, natural gas prices collapsed in the late 1990s and weighed down the company's stock.

And then, Chesapeake expanded.

A multibillion-dollar spending spree to build an enormous U.S. footprint ranked Chesapeake second only to Exxon for natural gas production in 2005. At one point, Chesapeake owned rights to 16 million acres. More than 1,700 employees worked at the company that year, according to The Oklahoman.

The following year, Ward resigned. Today,

▸ BY THE NUMBERS

Rating – Buy Price
$86/share

Price Target
$105/share % to PT – +22%

52-week high/low
$93.58 / $659.12

Market Cap:
$12.4B

SOURCE: JEFFERIES, AS OF OCT. 9

he is CEO of Mach Natural Resources.

In 2008, amid economic collapse, the enigmatic McClendon sold off most of his Chesapeake stock. Four years later, the board of directors announced a review of McClendon's financial dealings. In 2013, he left Chesapeake following a shareholder revolt. McClendon founded another company, American Energy Partners, but it struggled in the low commodity price environment. On March 1, 2016, McClendon was indicted by a federal grand jury for alleged conspiracy to suppress bids on oil and natural gas leases. He vowed to fight the charges. McClendon died the following day in a single vehicle crash on a two-lane highway in Oklahoma City, his hometown.

A series of CEOs have worked to revive Chesapeake. Archie Dunham, the former CEO of ConocoPhillips, replaced McClendon. Later, Doug Lawler took the company into the South Texas Eagle Ford Shale to make a try for oil. Dell'Osso was appointed president and CEO in October 2021, the same year Chesapeake emerged from bankruptcy.

Dell'Osso, previously the firm's CFO, said at the time, "I am confident Chesapeake's best days lie ahead of us and look forward to working tirelessly with my colleagues to generate and return to our shareholders sustainable free cash flow while aggressively lowering our emissions profile."

SOUTHWESTERN ENERGY

Now that the $7.4 billion merger between Chesapeake Energy and Southwestern Energy has closed, the newly formed Expand Energy is the largest gas producer in the U.S.

He sold off the more recently acquired oily assets and reset the company's sites on natural gas, in part based on a large Haynesville purchase. Dell'Osso was Chesapeake's fourth and final CEO.

Expand Energy was prepared to rebrand upon closing in October. A new website touts the company's responsible development and sustainability commitment. OGJ

‘Worried’ E&Ps Keep Merging

With just half as many public companies as there were in 2017, Kimmeridge thinks the space still has–and needs–plenty more M&A.

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With half as many public E&Ps in the market today as there were in 2017, Kimmeridge says there needs to be even fewer.

Bankruptcies and go-private transactions have taken down a few players, but consolidation is the real driver behind the decline.

The U.S. shale patch has been awash in a historic run of corporate consolidation, with some of the biggest public E&Ps getting plucked off the board in the past year.

Exxon Mobil closed a $60 billion acquisition of Pioneer Natural Resources. Chesapeake Energy closed a $7.4 billion merger with Southwestern Energy. Chevron is acquiring Hess Corp. for $55 billion, though the deal has hit several snags.

But despite a record $192 billion in upstream M&A in 2023 and $51 billion in deals announced in first-quarter 2024, there’s still room for U.S. upstream to consolidate, according to the alternative asset manager Kimmeridge.

Even if every public E&P in the sector today merged with another operator–and then merged everyone together again–the industry would still be less concentrated than the financial, automotive and technology industries, Kimmeridge Managing Partner Ben Dell said.

“The E&P industry in the U.S. is still a highly disaggregated industry,” Dell said during Hart Energy’s Energy Capital Conference. “I think there’s a lot of running room to go from a corporate M&A standpoint.”

Compare the E&P sector to the smartphone space, Kimmeridge suggested in a whitepaper published in early October.

Nearly everybody owns a cellphone made by three or four companies. Apple “holds a commanding 55% share of smartphones,” while the top five companies collectively own 90% of the market, the firm reported. The smartphone sector is one of the most concentrated on Earth.

The E&P space remains much more highly fragmented: The top five E&Ps account for only 29% of domestic oil and gas production. To reach 50% of U.S. production requires stacking production from the top 14 companies together, according to Kimmeridge’s analysis.

The breakneck speed of E&P consolidation has drawn scrutiny from antitrust regulators. The U.S. Federal Trade Commission requested additional information about several proposed mergers and actually intervened in the Exxon-Pioneer and Chevron-Hess transactions.

“I think [FTC intervention] has been largely unwarranted,” Dell said, “because there’s no real argument about market domination in this space.”

‘They Are Worried’

Executives and analysts cite several reasons for the whirlwind of consolidation sweeping the U.S. shale patch.

Producers want scale and lower G&A costs. They crave quality drilling inventory able to sustain profitability through periods of low oil and gas prices. They want to set themselves up for decades to come.

Kimmeridge thinks E&Ps “are combining because they are worried”–about their ability to squeeze more out of aging shale rock as drilling and exploration costs rise.

The firm analyzed recycle ratios across the industry, measuring cash flow per barrel produced versus the finding and development (F&D) costs to add a barrel to reserves.

While cash flow per boe has fluctuated due to volatile commodity price swings, “a consistent trend since the onset of COVID-19 has been rising F&D costs,” Kimmeridge said.

F&D costs have grown during the past three years, from a record low of $5/boe in 2021 to $10/boe in 2022 and $17/boe in 2023. Capital spending also grew each of those years.

And while spending rose 42% in 2022, proved developed reserves fell 31%. Spending rose another 28% the next year, yet reserve additions fell by 25%.

Of the 43 public E&Ps in the peer group, 40 experienced worse F&D metrics in 2023 than in 2022, Kimmeridge said.

The firm says the data start to poke holes in the rosy picture the E&P sector has been painting since emerging from the pandemic: that there are years–maybe even decades–of high-quality shale drilling inventory yet untapped, and that declining capital efficiency should be worried about in the future.

Kimmeridge suggests that the decline is already underway, even as E&Ps publicly convey a different message.

“Why? Because nobody wants to admit that their time might be running out,” Kimmeridge said in the report.

E&Ps are delivering greater efficiencies by merging. Larger companies outperform on both cash flow per unit and F&D per unit metrics, thereby achieving higher recycle ratios compared to their smaller peers.

Activist Scorecard

As self-described fans of consolidation,

"I think [FTC intervention] has been largely unwarranted, because there's no real argument about market domination in this space."

BEN DELL, managing partner, Kimmeridge

Kimmeridge analysts pat themselves on the back for using successful activist investor campaigns to drive M&A and investor value in the E&P sector.

Internally, the firm is probably most proud of the three-way combination in Colorado's Denver-Julesburg (D-J) Basin that yielded Civitas Resources in 2021.

Dell said that might have kicked off further consolidation in the D-J Basin. Not long after Civitas was formed, Chevron rolled up D-J Basin E&P PDC Energy in a $6.3 billion acquisition.

"Now, [the D-J] is one of the most concentrated basins in the U.S.," Dell said. "I think it still has some of the best rock and best economics."

Indeed, the D-J Basin, by Kimmeridge's analysis, is by far the most concentrated shale basin in North America. The top five operators in the D-J Basin own around 90% of the basin's market.

It's a significantly different story in other shale plays like the Delaware and Anadarko basins, where the top five operators make up just around 50% of total market share in their respective basins.

The lack of consolidation in the Delaware Basin "is perhaps the most surprising case" to Kimmeridge, because it's one of the top basins in terms of returns and size.

Lateral lengths are increasing in the Delaware–but at a slower rate compared to the Midland Basin and other peers due to operators' fragmented land positions.

The data suggests that "the Delaware is well-positioned for further consolidation," Kimmeridge's report said.

Kimmeridge expects to see additional consolidation, particularly in basins that remain highly fragmented.

There's a "good question" about what happens to large-cap players like EOG Resources and Devon Energy: "Do they scale up? Do they combine? Do they sell?" Dell asked.

Smaller names like Permian Resources and Civitas also screen as attractive on a shrinking list of M&A targets.

SilverBow Saga

Kimmeridge considers the Civitas story a win. Dell is more frustrated with how the firm's takeover bid for SilverBow Resources turned out.

Kimmeridge, a major SilverBow investor, aimed to combine the public Eagle Ford E&P with its Kimmeridge Texas Gas assets nearby. The campaign may ultimately have forced SilverBow into making a deal–but not the deal Kimmeridge put forward.

Instead, SilverBow signed a deal to combine with Crescent Energy, an emerging upstream power that had quietly been lurking behind the scenes for years courting SilverBow.

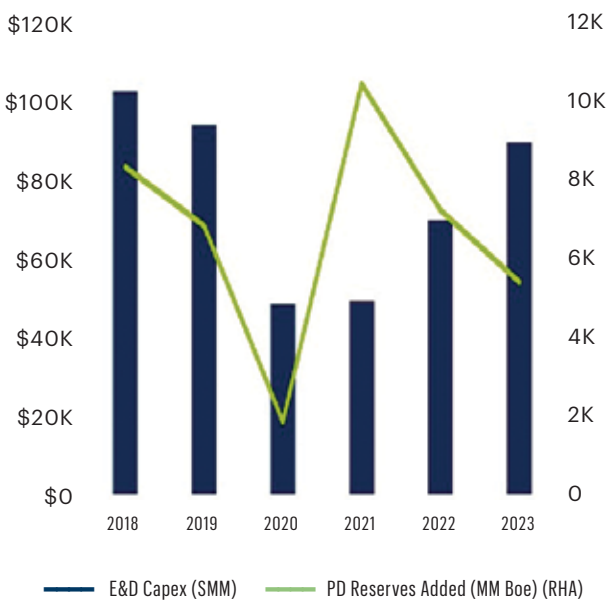
SilverBow signing a deal with Crescent ended a long and public back-and-forth between Kimmeridge and the Eagle Ford E&P.

"At the end of the day, they took another path. They sold the company," Dell said. "Shareholders made money. We made money. It kind of is what it is."

But the SilverBow campaign certainly left a sour taste in Kimmeridge's mouth.

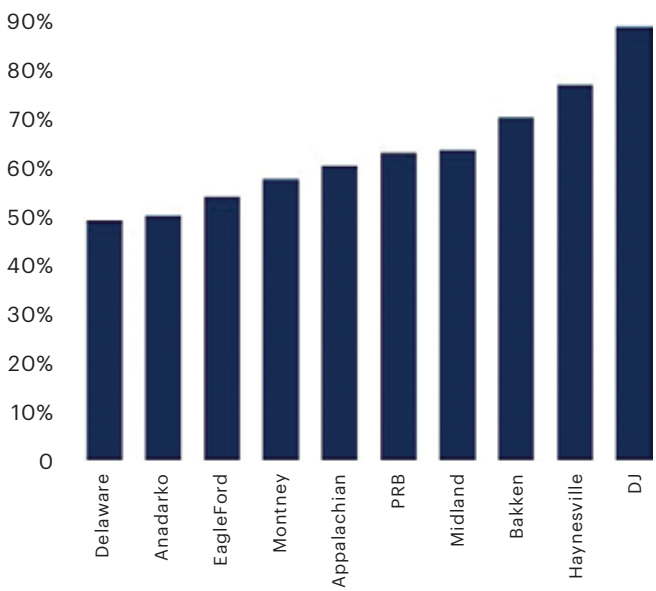
"I'll go down on the record saying this: I've never been involved in discussions with a more dishonest management or board," Dell said.

Exploration and Development Capex Vs. Added Reserves



SOURCE: KIMMERIDGE INTERNAL ANALYSIS.

Current Market Share of Top Five Operators by Basin



SOURCE: KIMMERIDGE INTERNAL ANALYSIS.

Making Midstream's Case

Q&A with GPA Midstream Association President and CEO Sarah Miller

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The political and legal environment in the U.S. has thrown plenty of challenges at midstream businesses. Sarah Miller, the new leader of the GPA Midstream Association, one of the sector's most venerable organizations, spoke with Oil and Gas Investor *at the organization's annual conference in September in San Antonio about working within the industry and defending the sector in Washington, D.C.*

Miller, an attorney, took over the organization's role as president and CEO from Joel Moxley, who had been in the position from 2019 and retired in September. Miller's career includes 17 years with the Williams Cos. Miller had been GPA Midstream's outside general counsel since 2019 and was a shareholder and director at the Hall Estill law firm in Tulsa.

Sandy Segrist: How do you feel about taking over the organization at this point in time?
Sarah Miller: I'm excited about it. I've spent my whole career either in or supporting the midstream industry. I think it's a very dynamic time. We are a very important part of the solution for the energy needed not only in the U.S. but around the world, and we are eager for that to be as reliable and sustainable and affordable as possible. We have challenges in front of us, but I think we're the solution providers that we always have been, and we're members of the same community that wants us to have a sustainable world. And so, it's really exciting to be able to be part of the organization and to have our members solve some of those issues.

SS: Joel Moxley's been the GPA president and CEO since 2019. How do you feel about taking over his position and priorities?
SM: Joel and I have worked together since he came on board because he hired me as outside general counsel. I've had the opportunity to not only work with him but work with the executive committees and boards over the past several years in order to understand what their priorities are.

I raised my hand, having interest in joining the organization on staff, already fully aware of what those priorities were and eager to be part of jumping in and continuing to support them. So, I would say some of those priorities are not only just making sure the organization continues to run smoothly from a governance and employer standpoint–within budget and all those sorts of organizational goals–but the big-picture item for our members is to make sure that we're being heard in Washington, D.C., as legislation and regulations are being developed, because we have the technical know-how to help guide those laws or regulations to be practical, technically feasible, cost-effective and developed within statutory mandates.

I want to continue working on all those things with our members, staff and outside advisers.

Similarly, our communication goal is to help the world understand our invisible industry and how everything that we enjoy in our daily lives, our standard of living, really pivots on what midstream supplies through our infrastructure.

And then, we also need to make sure that we are continuing to build on our roots, which is our technical know-how. We're the organization that was originally formed to develop standards to help the industry function well–you know, what are the specs for a product? We wrote those in the beginning and we're here still building on that knowledge today, but meeting the next challenge, too.

SS: Many in the industry have talked about how midstream has a negative image with a lot of people outside of the sector. Going back to your law background, how do you plead your case to the public?
SM: I think we can keep doing what we've been doing. We want to operate our assets safely.

We do not want to have emissions. Think about our own self-interest. We work hard to keep the natural gas within our system and the liquids within our system. We don't want to lose any gas or liquids. Those are our products that we want to be able to provide to the market and make money. This is not something that we take cavalierly. We also are members of the community. We live here. We're parents and grandparents, and we want a sustainable future for ourselves and our employees and our communities. So, we're good partners for all those self-serving reasons.

But we also are wanting to make sure that we're fairly treated when the regulations are addressing our industry. We want to make sure that regulators are staying within the scope of what legislation has determined, including when there are benefits intended within the legislation, that we get the benefits of the legislation. It needs to be cost-effective too.

SHUTTERSTOCK

GPA Midstream joined an amicus brief filed in the D.C. Circuit Court of Appeals in support of Williams' Transco Pipeline. The brief asks the full court to reconsider the decision to vacate the company's permit because there is a market need for the gas it transports.

"Having clear, predictable, understandable requirements that our industry follows is really important. The rules can't change in the middle of the game."

SARAH MILLER, president and CEO, GPA Midstream Association

It's always very interesting when we think about the importance of energy for all of our communities and how there's an ever-growing need for more and more and more energy to do all that we're going to need to do–that we all want in our everyday lives as well as all the products that make our lives very simple, that bring us joy. Those things come out of our industry and it's overlooked that we are the supplier of that. We have the convenience of electricity on demand every day. Well, natural gas is one of the primary sources of that energy.

It's just kind of unbelievable sometimes that we're not recognized for it, but I think it's in some ways to our own credit that we've done our job so well, for so long, and we've just kept our head down and been a successful supplier of a great portion of the energy in our world today. We haven't spoken up for ourselves.

So, back to your point. I think we just need to make ourselves more visible on how integral we are to not only energy but to the conveniences we have in our lives today.

And that demand is growing. You think about how there's more and more demand for electricity. Whether it's coming from data centers or growing economies, everybody wants the standard of living we enjoy today. Our allies want that, too.

We can be part of that solution, and we need to be proud to stand up and say so.

SS: There's been a lot of legal action happening lately: the LNG pause, the D.C. Court of Appeals vacating the permits for two LNG projects and the Williams Regional Energy Access project.

SM: We're more involved with the Regional Energy Access project right now. Certainly, we think it's prudent for LNG exports to happen.

Natural gas is a safe and clean and sustainable energy source, particularly compared to the alternatives that our allies around the world might otherwise tap into. It doesn't seem prudent to the aims of good environmental stewardship to suspend LNG exports like that.

The suspension has been at least temporarily lifted by court action.

But, focusing back on where we're spending our energy and time: We did join in an amicus brief that was just filed at the D.C. Circuit to highlight the need for [Williams'] Transcontinental Gas Pipe Line's [Transco] vacatur of its permit to be reconsidered by the full en banc court.

We believe, and Transco believes, the panel made errors when it did vacate that permit.

For example, in the amicus brief we joined with some other organizations, we highlight that there's longstanding FERC policy and also court precedent that when FERC is determining market need, it can look at precedent agreements–meaning that the customers who are

"We want to make sure that regulators are staying within the scope of what legislation has determined, including when there are benefits intended within the legislation, that we get the benefits of the legislation."

SARAH MILLER, president and CEO, GPA Midstream Association

purchasing the gas or purchasing capacity on that pipeline, which Transco had in this case–that's the best evidence of market need.

FERC actually doesn't have authority to go behind state-regulated utilities to question whether they are serious in their need. Independently negotiated contracts, which Transco had with multiple unaffiliated utilities, that's the best evidence, and that's what the history has been. So, to change that and create uncertainty about what the requirements are, to suggest that there's a change of rules in the middle of the game is really difficult for the long planning process for capital investment in infrastructure that New Jersey needs, that the New Jersey utilities are saying they need.

So that's one of the errors we believe exists there.

The second error is that the action that that panel took was to actually vacate the permit. But that permit governed not only new capacity being built on the pipeline, but also, they replaced some of the older facilities on the system that were serving the existing customers–right as we go into the winter. To vacate that permit would suggest that existing customers would not be able to access the capacity they already had on the pipeline, which is a little bit nuts.

They did that on the suggestion that the FERC couldn't remedy what it claimed were the supposed errors in issuing the permit, when the long-standing practice is to remand it, so FERC can correct the record but allow the permit to continue.

Those are the two key things we highlighted as errors.

Of course, Transco itself has other positions that it notes, and there are other amicus briefs filed, as well. But I think the point about this is that infrastructure is really important for our energy to be delivered, as we all expect it to be. We don't want rolling blackouts. We don't want to be cold when a terrible winter storm hits. And it takes a long time for infrastructure to be built.

Having clear, predictable, understandable requirements that our industry follows is really important. The rules can't change in the middle of the game.

SS: What are operators talking about right now?

SM: We're talking a lot about the regulations that are coming out, particularly the methane emission and reporting requirements, and then the waste-emission charge. The final rule is not published yet, but we expect it soon. It's going to have a significant financial impact on our operators.

We are talking about what can we, and the GPSA (service and suppliers to midstream organization) members as well, do to make sure we understand how we can technically improve our operations. It is our goal as well to reduce emissions and make sure we're operating as efficiently as possible.

But then we also need to make sure that we understand whether those rules have been written in compliance with the scope of the agency's authority, that they're technically possible, that we understand the rules and the factors behind them, so that we have the technology possible to be able to best understand the data, and that it's based on empirical data.

We have technical committees, of course, that were meeting all across this convention this week. And they–as well as our advocacy groups who are meeting independently–they are thinking about how we can collaborate, both to help our members be compliant with rules, that the rules make sense and that we all understand them well.

SS: What is the time frame for those new laws to take effect?

SM: For one example, the waste emissions charge–its final rules are not published yet–the final rule is expected in December. Under the legislation, the Inflation Reduction Act, the charge is to be $900 per metric ton (of waste emissions) reported in 2024, and then it'll be $1,200 per metric ton reported in '25 and then $1,500 per metric ton in 2026.

The charge is going to be real for our members soon. It's just that we don't have all the regulations about how the emissions are going to be identified to be reported. So, it's kind of like the industry and regulators are flying the plane while we're building it.

SS: Beyond that, has the organization been involved in discussing technical advancements?

SM: Yeah, we definitely have been talking about things. We had a couple of presentations during the course of this convention about how artificial intelligence can help us do our jobs better.

For example, we had one operator who shared some of the findings that they had using artificial intelligence to make sure that our equipment operates with the safest processes.

Certain equipment can have, for example, cycling errors or failures and we want to make sure we understand. There's been so much data out there, it's been difficult for our operators in the past to identify the patterns that would help us understand where there are risks. AI has been helpful in doing that.

SS: Overall, how did you think the convention went this year?

SM: I thought it was really exciting because I've never been to a full convention before. I've come for board meetings before to do my job as an outside counsel, but now I got to go to the whole thing starting on Saturday and meeting with our research committees, and then I got to spend time with our members and really hear from them about the hard work that they're doing to help us solve the issues that are in front of the organization and are in front of our operators–technically.

I heard how our members are really fired up about engaging with regulators and finding our partners in the legislature who understand the importance of our industry and partnering with us to make sure that we're able to continue to solve the challenges to supply the energy the world needs. It's been really fun to see. OGI

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Segrist: Minding the Storage

Several projects are on the drawing board to meet the rising demand for natural gas along the Gulf Coast.

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Followers of the natural gas and midstream market couldn't have missed the oncoming rise of LNG output on the Gulf Coast in Texas and Louisiana by the end of the decade.

The amount of U.S. LNG produced on a yearly basis is expected to more than double to 24.3 Bcf/d by 2028 from 11.4 Bcf/d in 2024, with the vast majority of new capacity coming from the Gulf. Major new pipelines, aimed toward the Texas and Louisiana coasts, have come online or are in the planning stages. The buildout has sparked national controversy, with environmental groups battling with businesses and the U.S. Federal Energy Regulatory Commission in the courts.

Getting a little less attention: All of that extra gas will need a place to stay, and plenty of people in the business have taken notice.

It may seem counterintuitive that a lot of companies are publicly planning natural gas storage projects at a time when the prices have been low enough for many E&Ps to cut back on production. The oncoming storage buildout, like any energy infrastructure, is not tied to immediate market shifts but is instead a long-term bet made over the projected future jump in natural gas demand.

Midstream majors Williams Cos. and Enbridge have been acquiring storage over the past few years, according to an analysis by RBN. Some companies, such as Kinder Morgan, are planning to expand the facilities they already have, and some independents are planning to build the first salt dome storage project in the Houston area since 2008.

"Most of our storage is in these areas where LNG exports are going to be," Alan Armstrong, Co-CEO of Williams, told the audience at the Barclays Annual CEO Energy-Power Conference in September.

The overall level of natural gas storage in the U.S. has been flat for more than a decade, at about 4.6 Tcf, according to the U.S. Energy Information Administration. Nameplate capacity in the U.S. dropped by 3 Bcf from 2022 to 2023.

However, demand for LNG and gas-fired power generation has been rising steadily in the 2020s and explosive growth in both sectors is expected well before 2030.

In the natural gas market, storage serves as a buffer, keeping supplies steady while demand jumps sporadically. LNG export terminals do not continuously offload product, and an electrical market heavily dependent on wind and solar tends to rely on gas as the steadiest backup.

"We think storage is going to be absolutely critical to both backing up renewables as well as being there for utilization as we start to build out the fleet of LNG exports here in the U.S.," Armstrong said.

LNG facilities will usually not run at 100%, Armstrong said. "It will be coming off of that. And when you have that, you're going to put a lot of demands on both fast injection storage and storage that's close to where it can serve those facilities."

Williams has experience in natural gas storage, thanks to its years of operating the 10,000-mile Transco pipeline. In January, Williams closed the $1.95 billion purchase of 115 Bcf of storage in Louisiana and Mississippi from an affiliate of Hartree Partners. The facilities included four underground salt domes and two depleted natural gas reservoirs.

Over the last three years, Enbridge has bought storage at either end of the Permian natural gas pathway: the Waha Hub near Pecos, Texas, and along the Gulf Coast. In April 2023, Enbridge closed a $335 million acquisition of the three-cavern Tres Palacios facility in Matagorda County, Texas.

Brand New Domes

Tres Palacios, the last salt dome cavern gas storage project on the Gulf Coast, began service in 2008.

In 2024, the sponsors of two new salt dome projects aim to reach a final investment decision (FID) by the end of next year.

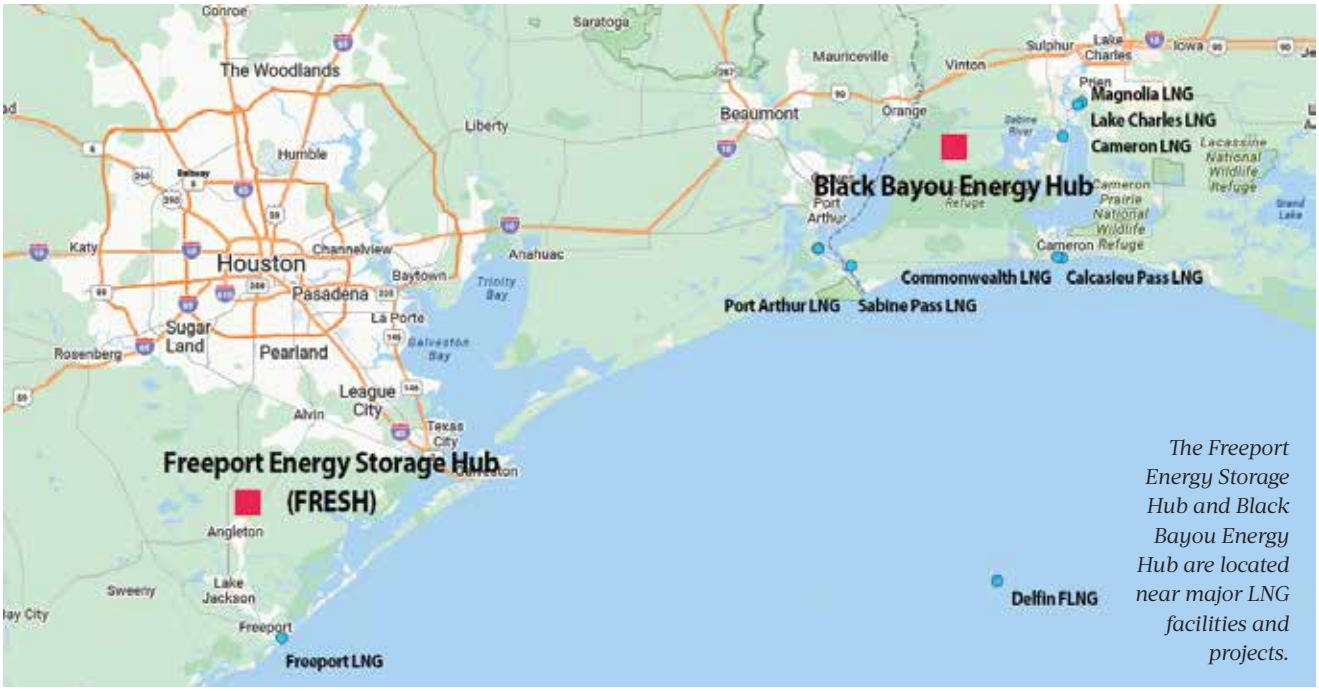
The proposed Black Bayou Energy Hub in Cameron Parish, La., would be halfway between some of the country's major LNG facilities in Port Arthur, Texas, and Lake Charles, La.

According to RBN, the company held an open season for capacity in June. Thirty-five bidders requested 70 Bcf of space—more than four times the available capacity. After the season, the company announced it planned to double the scope of the project, from two salt domes to four.

On the other side of the Louisiana-Texas border, the Freeport Energy Storage Hub (FRESH) held an open season in October. The facility is also in the middle of several major natural gas pipeline pathways and the Freeport LNG terminal, already in operation.

FRESH plans to open two salt caverns with

Natural Gas Storage Hubs

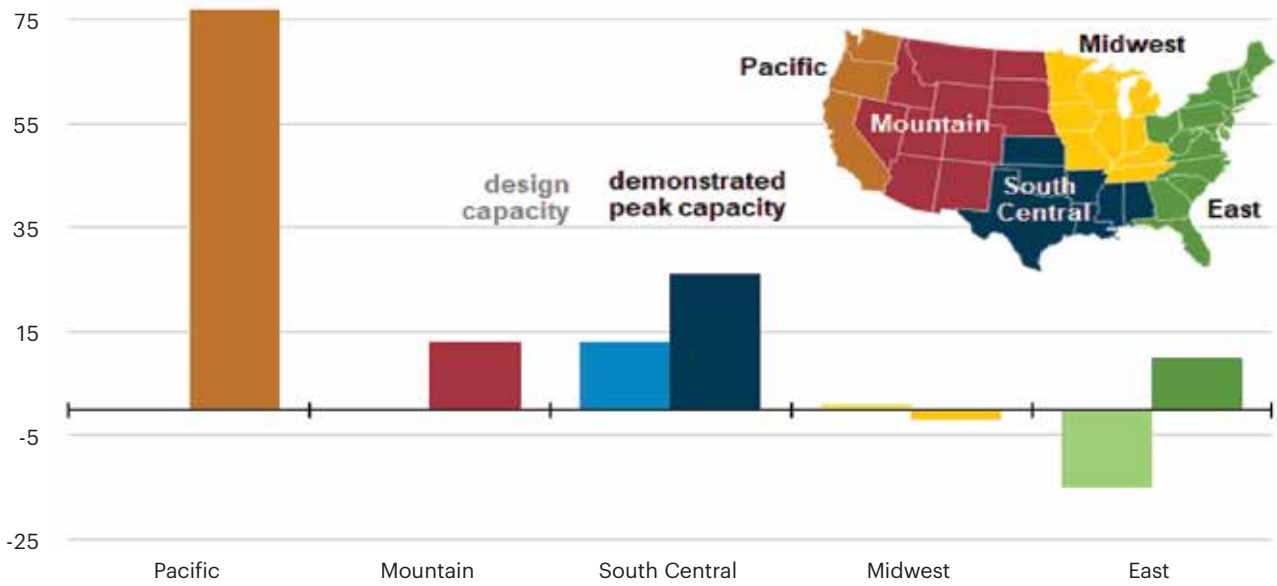


The Freeport Energy Storage Hub and Black Bayou Energy Hub are located near major LNG facilities and projects.

SOURCE: REXTAG

Change in U.S. Natural Gas Storage Capacity by Storage Region (2022-2023)

billion cubic feet



DATA SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION, FORM EIA-191, MONTHLY UNDERGROUND NATURAL GAS STORAGE REPORT
NOTE: MEASURES OF CAPACITY REFLECT FINAL REVISED VALUES AS PUBLISHED IN THE UNDERGROUND NATURAL GAS STORAGE CAPACITY REPORT

potentially 20 Bcf capacity in the first phase of the project, with additional capacity to be determined by customer demand.

Gulf Coast Midstream Partners, the company developing FRESH, hopes to reach FID next year. Black Bayou developers have targeted FID within a year or two, according to RBN. Both plan to start operations in 2028.

Building new salt domes is the most difficult sector of the storage market, RBN said in its analysis. Demand for storage is definitely up, but customers are usually going to be picky over where they ultimately put their product.

"While gas storage capacity is increasingly valued for its role in providing volume assurance and the opportunities created by high deliverability, that doesn't necessarily mean storage values will be high enough to support the large-scale buildout of new facilities," wrote RBN analyst Housley Carr. "Instead, the development of new storage capacity is likely to be very targeted– it will happen only where it has strong customer support and makes economic sense." OGJ

East Daley: Deals Continue ONEOK's Climb to Elite Status

Mergers with EnLink and Medallion lift the company into the ranks of Energy Transfer and Enterprise Products Partners.

AJAY BAKSHANI
DIRECTOR OF
MIDSTREAM EQUITY

Ajay Bakshani is director of midstream equity at East Daley Analytics.

ONEOK continues its climb to the top circle of midstream companies through aggressive dealmaking. The Tulsa, Okla.-based company has reached separate deals to acquire EnLink Midstream and Medallion Midstream for $5.9 billion, moving the needle in several ways.

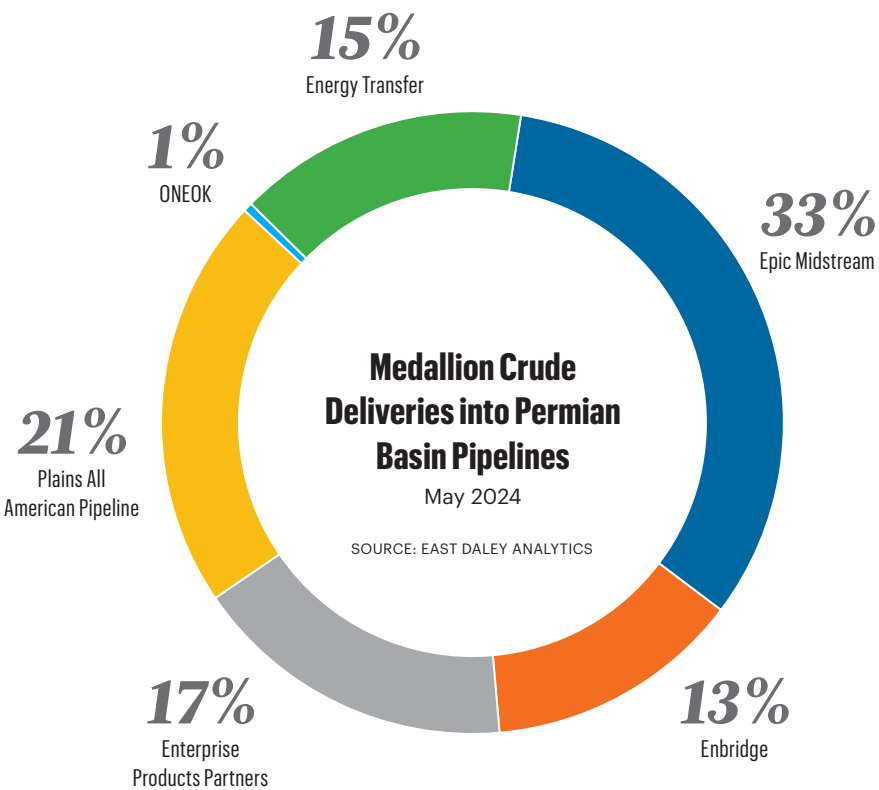
ONEOK announced the EnLink and Medallion acquisitions in late August. The company signaled its intention to compete with top midstream companies like Energy Transfer and Enterprise Products Partners in 2023 when it brokered the $19 billion merger with Magellan Midstream. The latest transactions help round out ONEOK's portfolio as a full-service midstream provider.

In the case of EnLink, ONEOK will acquire GIP's 43% limited partner stake and 100% of the general partner interest for $3.3 billion. ONEOK intends to acquire the remaining public units of EnLink in a tax-free transaction.

East Daley projects EnLink to earn $1.48 billion for 2025, 5% above consensus estimates of $1.416 billion. That implies a pre-synergy multiple of 8.8x (vs. 9.2x consensus) and synergies of $100-$150 million. The clearest of those synergies is EnLink's $120 million in annual selling, general and administrative (SG&A) costs and a reduction in its $100 million of interest and preferred distributions.

The EnLink purchase helps ONEOK in several ways. EnLink's assets help ONEOK establish a gathering and processing presence in the Permian Basin, which in turn will support volumes on ONEOK's West Texas NGL Pipeline as competitors fight over third-party barrels. In addition to the Permian, EnLink also brings exposure to Louisiana gas markets and bolsters its presence in the Anadarko Basin.

On the commercial side, the most obvious synergy is EnLink's 150,000-200,000 bbl/d of Permian NGL that become uncontracted in three to four years. ONEOK is short NGL production and long pipeline capacity in the Permian, which means it relies on volumes from third-party processing plants to fill its West Texas NGL system. ONEOK already sources a significant chunk of NGL from



Data from the Railroad Commission of Texas indicates Medallion gathered 850,000 bbl/d in May. Only 4,000 bbl/d is currently delivered into existing ONEOK systems, providing a clear upside opportunity for pipelines like BridgeTex and Longhorn.

EnLink's gas processing plants in the basin, including Midmar, Deadwood, Phantom, Riptide and Bearkat. We expect EnLink already sends half of these NGL to ONEOK, but even the remaining 75,000 bbl/d uplift could result in an additional $50 million in annual EBITDA.

EnLink also gives ONEOK its first gathering and processing assets based in the Permian, filling a big hole in its midstream portfolio. East Daley has been tracking 17-21 rigs since August between EnLink's Delaware and Midland gathering and processing systems.

Outside the Permian, EnLink boosts ONEOK's position in the Anadarko Basin. We expect limited synergies on the NGL side as EnLink primarily ships on ONEOK's pipelines already, but the additional scale in the basin could allow ONEOK to attract new customers and ship additional purity products on the refined products system it acquired via Magellan. EnLink's Oklahoma assets also provide some upside if higher gas prices spark increased activity in the basin.

An underappreciated component of EnLink could be its Louisiana assets. EnLink helps position ONEOK to take advantage of higher Haynesville production and LNG demand growth on the Gulf Coast. Both companies are expanding natural gas storage, and rates on those assets have been increasing dramatically. EnLink also runs a carbon sequestration project using its pipeline network in the Mississippi River corridor, giving ONEOK exposure to an emerging area for investment.

The Medallion Impact

The $2.6 billion acquisition of Medallion Midstream expands ONEOK's services into Permian crude gathering. Strategically, the move makes sense for ONEOK and follows a strategy we're seeing with other gathering and processing and NGL asset deals: move closer to the wellhead to secure supply for downstream pipes and marketing.

Recent crude acquisitions have generally flown under the radar, yet the Medallion deal continues a trend: Plains All American and Oryx merged their Permian crude gathering assets in 2021, Energy Transfer acquired crude gatherer Lotus Midstream in 2023, and Energy Transfer recently merged its Permian crude gathering assets (including systems acquired via Lotus) with Sunoco's NuStar Permian gathering system. Like these deals, the Medallion acquisition gives ONEOK the opportunity to leverage crude volumes to feed downstream pipelines, storage tanks, export terminals and marketing operations.

However, the multiple screens high for crude gathering assets, and implies a significant amount of synergies. Medallion's trailing 12-month EBITDA from the first quarter only totals $275 million across its entities regulated by the Federal Energy Regulatory Commission. East Daley arrives at 9.5x multiple before synergies, much higher than our 7.5x multiple estimate for Energy Transfer's acquisition of Lotus Midstream.

ONEOK cited a 6.3x multiple post-synergies, implying $100-$150 million of growth and synergies, which seems high on an EBITDA base of $275 million. That said, Energy Transfer's acquisition of Lotus seems to have generated significant commercial synergies for the company, so it is not out of the question that ONEOK can do the same with Medallion, which is even bigger than Lotus. OGJ

LNG's Quicker Route to Asian Markets

Mexico Pacific's 30-mtpa Saguaro LNG terminal promises a connection to Asia for Permian Gas that avoids the Panama Canal.

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Mexico Pacific's 30 million tonnes per annum (mtpa) Saguaro Energía LNG project will connect low-cost Permian Basin gas with high-demand markets in Asia. The project on Mexico's Pacific Coast will provide an outlet for stranded, and in some cases, flared gas associated with oil production in the Permian, an ongoing challenge for producers there.

Saguaro is the largest proposed liquefaction facility on Mexico's Pacific Coast, which is set to emerge as a new and potentially massive North American supply point targeting Asia. Mexico Pacific intends to make a final investment decision on the anchor project in early 2025.

Saguaro LNG's location on Mexico's Pacific Coast gives it a competitive advantage over U.S. Gulf Coast LNG projects because tankers will not have to pass through the Panama Canal to reach Asia. The voyage from Saguaro is 11 days shorter than from the Gulf Coast, which also translates into reduced CO_2 emissions en route to key Asian markets.

Avoiding the highly congested Panama Canal isn't a novel idea, and it is a key driver behind interest in projects on Mexico's West Coast. But it joins Russia's invasion of Ukraine in early 2022 and other geopolitical issues as factors bolstering the project, Mexico Pacific CEO Sarah Bairstow told *Oil and Gas Investor (OGI)*.

"Asia, in particular [is] a region that has such great need for international imports for energy security," said Bairstow, who took over as Mexico Pacific's CEO in April following the resignation of Ivan Van der Walt. "That's nothing new; that's always been the case. They've got depleting reserves and a high reliance on, particularly, allied nations [for] support with energy imports. For them, it's always been about diversification, which is why you've seen Asian buyers take offtake from the Middle East, Australia, Indonesia, Malaysia, the U.S., et cetera. For us, it was an absolute diversification play that was coupled with the cheapest landed LNG into Asia, which helps."

Saguaro LNG will be built in two phases. Phase 1 will include three trains with a processing capacity of 5 mtpa each (15 mtpa combined). Phase 2 will also have three trains with a processing capacity of 5 mtpa each (15 mtpa combined), according to Mexico Pacific.

> *"People are starting to recognize that the next big wave of lower-cost LNG that has higher reliability that the market really needs now will be the West Coast of Mexico."*
>
> **SARAH BAIRSTOW,** CEO, Mexico Pacific

Saguaro LNG's location in Puerto Libertad in Sonora, Mexico, will offer a 55% shorter shipping route to Asia, which translates into savings of at least $1/MMBtu and a 60% lower carbon emissions profile compared to Gulf Coast peers, according to Mexico Pacific.

It's not just the shorter shipping distance, but also the combined emissions reductions from tapping Permian gas, shipping it along pipeline crossing the U.S.-Mexican border and then liquefying it at the facility before sailing it off to Asia, said Bairstow, a native of Australia.

"The Permian is about 99% less CO_2 than Haynesville and Eagle Ford. That gives you a big starting advantage in terms of CO_2 content. You've then got a pipeline. Newer pipelines have newer technologies, so methane leakage is far lower. On the LNG production side, it's a very proven out technology and equally contained. And then, of course, you halve the emissions shipped to market," she said. "When you aggregate that value chain, you start to see that it's not just about low-cost LNG. It's done in a way that has a much lower emissions profile that then is supplemented."

But is it Texas LNG or Mexican LNG? Or Tex-Mex?

"It's not up to us to determine what this LNG is classified as," Bairstow said. "It's actually determined by every importing country. They have their own importing regulations that determine whether the product is U.S. or Mexican or otherwise. And frankly it differs.

Proposed Saguaro Connector and Sierra Madre Pipelines

SOURCE: REXTAG, MEXICO PACIFIC

The Sierra Madre Pipeline will originate in the municipality of Guadalupe, Chihuahua, where it connects to the Saguaro Connector Pipeline that originates in the Permian Basin. Sierra Madre will traverse 16 municipalities across the states of Chihuahua and Sonora, before reaching its end destination at the Saguaro LNG facility in Puerto Libertad, Pitiquito, Sonora.

Some of [the Asian markets] deem it as Mexican LNG. Others deem it as U.S. LNG. But we don't really have too much influence in that. We've really got to work with our customers and how they view that in terms of their own existing regulations."

Saguaro LNG and Mexico LNG Potential

Companies looking to build LNG export facilities in Mexico confront their own unique set of challenges, according to an analyst at Poten & Partners.

"Headwinds include regulatory hurdles, a high-skilled labor shortage, limited natural gas pipeline capacity and in some cases, disinformation on social media," Sergio Chapa, a U.S. LNG analyst at Poten, wrote in a September report. "U.S. regulators with the DOE (Department of Energy) also appear to be becoming wary of re-export projects in Mexico that do not provide domestic jobs or boost energy infrastructure."

Saguaro LNG is among five liquefaction export projects planned on Mexico's Pacific Coast. The projects present a vast opportunity for Mexico, as well as potential for Permian and other shale producers to boost gas exports to Asia.

The five projects—Saguaro LNG, 30 mtpa; Energía Costa Azul, 15.3 mtpa; Amigo LNG, 7.8 mtpa; Vista Pacifico LNG, 3 mtpa; and Salina Cruz LNG, 3 mtpa—could add around 59.1 mtpa (7.8 Bcf/d) of processing capacity to the global market, according to data compiled by *OGI*. Such a figure could convert Mexico into the third-largest LNG exporter in the Americas, trailing only the U.S. and Canada, according to Rystad Energy.

However, Bairstow pegged the Mexico LNG potential at a higher 70 mtpa.

"Whether that 70 million tons is incremental growth from us as well beyond our initial growth plans or other projects, we'll see, but there's a lot of room for a lot of projects here," Bairstow said, referring to Mexico's Pacific Coast.

In January, the administration of President Joe Biden announced a temporary pause on pending LNG exports permits until the DOE completed an analysis of greenhouse gas emission impacts when making the authorizations. And, discussion around the pause remains topical due to its impacts—from delays and subsequent higher costs—on U.S. LNG developers.

"Macro-wise, it's obviously an unfortunate thing to happen here in the U.S. from an investment certainty perspective. We, like many others in the industry, know it will be resolved, it's just a matter of time. But the bigger challenge is how long will it delay all of those other projects," Bairstow said.

She said the pause had been a bit of a tailwind for Mexico Pacific as no other U.S. LNG projects are currently moving through financing.

"As we talk with lenders [and] equity providers, all of them are looking to further invest in North American energy," Bairstow said. "It's seen as a very safe, very reliable and a very important investment over the coming decades, particularly around the energy transition and energy security. But there aren't a lot of places for people to put that capital these days."

Under Mexico's former President Andrés Manuel López Obrador, the private sector was mostly sidelined. President Claudia Sheinbaum Pardo officially took office on Oct. 1. Sheinbaum is from the same Morena Party as Obrador

and isn't expected to drastically change course. However, a recent judicial reform passed during Obrador's last days as president has raised a red flag for many watching the Mexican political and energy spaces.

Mexico Pacific has been working closely with the Mexican federal government under Obrador and now Sheinbaum and the Sonoran state government under Gov. Alfonso Durazo Montaño. The federal and state governments continue to support Saguaro LNG, Bairstow said. In terms of the recently passed judicial reform, she said her team hasn't seen any impact, and didn't expect to be impacted either.

Saguaro LNG: The Initial Phase

In Puerto Libertad, Mexico Pacific—which boasts Houston-based Quantum Capital Group as its controlling owner and lead sponsor—owns 1,500 acres of land. The anchor Saguaro LNG facility will have two 180,000 cubic-meter tanks. The facility will use ConocoPhillips' proprietary Optimized Cascade Process to liquefy the gas, which will save money and maximize efficiency of the overall facility, according to Mexico Pacific and ConocoPhillips' websites.

At 15 mtpa, Phase 1 of Saguaro LNG will be on par with Freeport LNG's three-train, 15 mtpa liquefaction facility on Quintana Island on Texas' Gulf Coast. Freeport LNG is the seventh-largest liquefaction facility in the world and second-largest in the U.S. Its daily capacity is enough to power and light a metropolitan area about the size of San Antonio for a full day, according to the company.

Bairstow said FID on Phase 1 would be made in early 2025 and will move forward as a modularized project. The decision was made based on expected growth, as well as a way to keep the project on time and on budget.

"We would much prefer to pivot and take the time if we think it will reduce our execution risk than to simply rush through to an FID," Bairstow said. "And modularization was a big part of that. When you look at the project now, there's no offshore element. All of it is onshore. We'll naturally have a significant amount of labor on site, but we will complement that with a number of the components being modularized offshore in Asia and brought to site just to further de-risk the project. It took longer, but it's been the right decision for the project, and I think our stakeholders are all happy with the decision."

Bairstow and her team—many of whom labored with her on the Gladstone LNG project in Australia—have worked on around 15 trains with Bechtel and ConocoPhillips. Bairstow said the traditional modularized scale hasn't been employed much in the U.S. Gulf Coast due to the risk involved in transporting the modules through the Panama Canal and to site. She said Saguaro LNG doesn't have that issue.

Train 1, Train 2 and Train 3 are ready in terms of permits and offtake contracts, Bairstow said.

Saguaro LNG boasts offtake agreements with Exxon Mobil, ConocoPhillips, Shell and Woodside Energy, and others from Asia like Posco International, Zhejiang Energy Group and Guangzhou Gas Group. The agreements are indexed to the Waha Hub and/or Henry Hub and are said to include combined liquefaction and pipeline fees ranging from $2.50/MMBtu to $3.77/MMBtu, according to Poten.

In February, Mexico Pacific issued a six-month limited notice to proceed (LNTP) to Bechtel, the liquefaction facility's EPC contractor. The LNTP called for ground-clearing work and other preliminary works that were completed in early August, according to Poten.

Mock-up of storage tanks for Mexico Pacific's Saguaro LNG project.

MEXICO PACIFIC

"We have been moving through capital markets, both debt and equity. That's the primary focus now, and rounding that out," Bairstow said. "We will seek to maintain that flexibility as to whether we do a two train with a subsequent third or whether we close as one phase. We'll really work with the market to figure out what's the best fit and the best outcome for the project."

1,052-km Pipeline Needed

In the U.S., Permian feed gas will be shipped along the 252-km Saguaro Connector Pipeline to the Texas border with Mexico. From there, it will be shipped along the 800-km, 48-inch Sierra Madre Pipeline on the Mexican side of the border to the Saguaro LNG facility. Both segments have the capacity to handle 2.8 Bcf/d, according to Mexico Pacific.

The engineering, procurement and construction (EPC) contract for the Sierra Madre Pipeline will be executed under a lump-sum-turnkey arrangement and will be undertaken by a joint venture of Bonatti and GDI Sicim Pipelines. The two companies are leading pipeline EPC contractors with substantial experience in Mexico, according to Mexico Pacific. And, Bonatti's scope of work will extend to the required compressor stations.

In late August, Mexico's Energy Regulatory Commission (CRE) granted Mexico Pacific permission to hold an open season on the pipeline. Now Mexico Pacific can book capacity on the pipeline and a related storage project, Chapa said.

But energy analysts from Mexico City to Chicago who cover the Mexican energy space are somewhat divided on the outlook for the Sierra Madre Pipeline, owing to the region of Mexico where it is located and potential issues with drug cartels and/or communities in its vicinity.

"When you look at LNG on a global basis, projects always have pipelines. So, this is not different in terms of risk profile when you look at other LNG projects and historically how things have been developed. It's just simply different to the U.S. Gulf Coast," Bairstow said. "We now have the right of way and, equally, the pipeline EPCs completed to a point that we can finance the project.... We feel very confident about that pipeline, particularly on the back of the routing and all the support that we've got from the [Sonora] government."

Mexico Pacific was announced as the cornerstone of Plan Sonora, which promotes clean energy development, investment and economic prosperity for the region. The plan has been endorsed by both the U.S. and Canada and "is this tripartite effort where everybody sees the ability to grow out and create a hub off the West Coast of Sonora," Bairstow said.

Mexico Pacific studied taking the initial portion of the pipeline across the U.S. and then down the West Coast of Sonora. That plan encountered bio reserves and key environmental areas, among other issues. The current route "avoids every environmentally sensitive area, every indigenous community and every community," Bairstow said.

A total of three FEEDs were carried out by Mexico Pacific on the pipeline to identify the best route to "naturally [try to] balance the scale that you need, but equally the execution path itself," Bairstow said. She said the final pipeline path "wasn't the cheaper decision, it's more expensive to do it that way, but we think it's the right way to do it."

On the U.S. side, Mexico Pacific will utilize an interstate pipeline running from Waha to the border. That one is not

MEXICO PACIFIC

Mock-up of liquefaction facilities that could potentially house six trains at Mexico Pacific's Saguaro LNG.

a Federal Energy Regulatory Commission (FERC) regulated pipeline, according to Bairstow. The two key permits Mexico Pacific needs in the U.S. include the non-free trade agreement (non-FTA) export permit from the DOE and the presidential permit for the cross-border infrastructure. The latter is comparatively very small and covers just that cross-border footprint.

"We have both of those for all of the offtake on the anchor project. But we've really experienced a lot of demand here, and again it all ties back to the Permian," Bairstow said.

While Saguaro LNG is now 94% sold out, Chapa said Mexico Pacific still needs to seek an extension to its non-FTA export permit.

Saguaro LNG: Growth Potential

While Mexico Pacific has yet to take FID for Phase 1 of Saguaro LNG, it is already looking to the future. Phase 2 would likewise consist of three trains (4, 5 and 6) with a combined capacity of 15 mtpa, according to Mexico Pacific. The baseline infrastructure from Phase 1 will be leveraged for growth with some compression in the second phase, Bairstow said.

Bairstow said an FID on Train 4 could be taken within 12 months of the anchor project. After that, Bairstow said Mexico Pacific would explore how to manage growth in terms of its execution approach and equally incremental permitting. And part of that revolves around an ability to create an LNG and broader industrial export hub in Sonora, she said.

"Train 4 is a pretty simple expansion effort. [Regarding] Train 5 and Train 6 and what we choose to do beyond that, we're in the process now of looking at existing right of way paths, et cetera, to identify, do we want to replicate what we have and leverage that or do we want to go in a different direction, and we'll take that decision pretty near-term."

"It's a great place for the project to be in right now. But we'll immediately move into growth and starting to execute off the back of that, which will mean cycling through the permitting process again," Bairstow said. "This is a bigger project, and we've got phasing and a lot of demand across all of that. We've been able to show that we've got the anchor project fully committed, and a great evacuation route to monetize into Asia. We've equally already optioned out over half of Train 4, Train 5 and Train 6, and we have over 18 million tons of incremental offtake negotiations beyond that."

Bairstow added that the Permian needed about another 100 million tons of LNG offtake to evacuate the gas to accommodate growth and access to the liquids.

"People are starting to recognize that the next big wave of lower-cost LNG that has higher reliability that the market really needs now will be the West Coast of Mexico," Bairstow said. "And so, while we're very proud that people are understanding and supporting our project, it represents so much more than just our project. It represents a whole new supply point." OGI

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Venezuela Loses Citgo, But the Battle Goes On

Amber Energy's $7.3 billion purchase of PDVSA's refining unit fell well short of analysts' valuations, but an appeal is in the works.

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Venezuela has officially lost its most prized international asset: Citgo Petroleum, the 807,000-bbl/d U.S. refining arm of state-owned Petróleos de Venezuela (PDVSA).

The final auction price was $7.3 billion and the winning bidder was Amber Energy, which has the backing of a group of strategic U.S. energy investors, including Florida-based Elliott Investment Management.

Citgo's valuation should be at least $12 billion, officials from both Venezuela's ruling party and opposition have long said. And, considering Citgo's reported EBITDA of $3.3 billion in 2023 and a 5x EBITDA multiple, the potential value is around $16.5 billion, according to *Oil and Gas Investor (OGI)* calculations.

Lawsuits from numerous international investors and companies have targeted Citgo as a way to recoup capital lost from asset expropriations in Venezuela under the South American country's late leader Hugo Chávez.

A PDVSA 2020 bond issuance, this time under Venezuelan leader Nicolás Maduro, was backed by a majority stake in Citgo. Venezuela has since defaulted on those bonds. Bondholders are lining up to seek compensation, and at least 21 creditors, including Canada's Crystallex and the U.S.-based ConocoPhillips, continue to seek compensation for asset expropriations in Venezuela.

The claims total about $21 billion, according to Reuters.

Energy pundits in Venezuela say it's possible that the Citgo assets will be broken off and sold if the deal moves forward.

For its part, Amber said it was committed to enhancing Citgo's assets and continuing to deliver Citgo products to market, according to a press release posted on Amber's website in September.

Amber's plan for Citgo includes a focus on the future and prioritizing the refiner's operational excellence, an Amber spokesperson reiterated to *OGI* in October.

Next Steps

According to U.S. court documents, the Citgo sale was to involve as many shares of Citgo owner PDV Holding as necessary to satisfy financial judgments. As a result, the auction process hasn't been without its critics.

Citgo's three U.S.-based refineries have a processing capacity of 807,000 bbl/d. They are based in Corpus Christi, Texas (167,000 bbl/d); Lemont, Ill. (177,000 bbl/d); and Lake Charles, La. (463,000 bbl/d).

Additionally, Citgo wholly and/or jointly owns 34 active refined product terminals with a total storage capacity of 18.1 MMbbl. Citgo also has pipelines, as well as lubricants-blending

CITGO PETROLEUM

Citgo Petroleum's 167,000 bbl/d refinery in Corpus Christi, Texas.

CITGO PETROLEUM

Citgo Petroleum's 177,000 bbl/d refinery in Lemont, Ill.

SHUTTERSTOCK

Opposition leaders Maria Corina Machado and Edmundo Gonzales Urrutia wave to Venezuelans following the July elections.

SHUTTERSTOCK

Venezuelan President Nicolás Maduro waves during a rally. His claim of an election victory has been disputed by the U.S.

and packaging plants. Citgo marketers sell gasoline and other motor fuels through more than 4,000 independently owned, branded retail outlets, all located east of the Rocky Mountains, according to its website. Citgo has had a presence in the U.S. for over 100 years.

Creditors seeking compensation from the Citgo auction criticized terms of a conditional offer, according to Reuters. The offer was revealed by Robert Pincus, special master for the District of Delaware U.S. District Court, which selected Amber.

For its part, PDVSA Ad Hoc reiterated its unwavering commitment to defend Citgo.

"Although the road has been challenging, there is still much we can and will do to protect Citgo and ensure the best possible outcome in safeguarding PDVSA's assets," PDVSA Ad Hoc said on its website.

PDVSA Ad Hoc was established in 2019 as an administrative board parallel to the one controlled by the Venezuelan ruling party. It aims to manage "PDVSA's assets abroad, transparently and by law," according to statements on its website.

PDVSA still has an opportunity to exercise its appeal rights before or at the Amber deal's court hearing in November.

"It is also important to highlight that if the process does not satisfy most creditors—who may see this recommendation [of Amber as the acquirer of Citgo] as insufficient and unfair—they, too, will have the opportunity to present objections to the process," PDVSA Ad Hoc said.

CITGO PETROLEUM

Citgo Petroleum's 463,000 bbl/d refinery in Lake Charles, La. Creditors seeking compensation from the recent Citgo auction criticized terms of a conditional offer which named Amber Energy.

Citgo Drama and Amber's Vision

Citgo has been shielded by Washington since 2019. The plan was to relinquish the refiner to a U.S.-friendly Venezuelan government in the future. Despite the recent Amber announcement and Citgo's importance to Venezuela and PDVSA, the company confronts an ongoing Venezuelan feedstock headwind.

Citgo is currently restricted from processing PDVSA's oil exports since Maduro's government continues to control PDVSA's operations in Venezuela, forcing the refiner to source oil from other providers.

Venezuelan presidential elections on July 28 saw Maduro again claim victory and, this time, without releasing the final voting data. Opposition leaders both in Venezuela and in exile continue to argue the election was won by opposition candidate Edmundo González Urrutia, citing voting data collected on election day.

Enter Elliott via Amber

Elliott is reported to be an indirect holder of the PDVSA 2020 bonds, according to Reuters, while Amber has no experience operating a refinery.

Amber is committed to enhancing Citgo's assets and continuing to deliver the refiner's products to market, the company said. Confident in Citgo's fundamental strength and long-term potential, Amber believes the refiner is well-positioned and aims to enhance its strong market position.

Amber's leadership team—led by CEO Gregory Goff and President Jeff Stevens—has decades of experience, according to details on Amber's website.

Goff is a member of Exxon Mobil's board of directors as well as the board of Avient (formerly PolyOne Corp.) and XEnergy. Goff was previously chairman, president and CEO of Andeavor from 2010 until its acquisition by Marathon Petroleum in 2018. He spent nearly 30 years at ConocoPhillips and serves as CEO of the technology company Claire Technologies.

Stevens is president of Denver-based Franklin Mountain Energy. He is also a principal at the investment firm Franklin Mountain Capital. Stevens was also a founding partner of Western Refining and served as CEO from 2010 to 2017. OGJ

Pitts: US Energy Pioneers Wanted

Argentina looks north for help in unlocking its shale potential.

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When Argentina looks north of its border in particular and Latin America's border in general, it sees the U.S. and one thing: opportunity. Especially as it relates to shale and U.S. companies with experience in American shale plays. Why? Two words: Vaca Muerta.

Vaca Muerta or "Dead Cow" in English, is a massive shale formation in Argentina's Neuquén Basin. It's home to around 802 Tcf of shale gas. Geologically, it's comparable to the Permian. And on some technical metrics it's even better than the Permian, many energy pundits active in the Argentine energy patch say. But, despite its vast potential, Argentina lacks the resources–both in capital and technical expertise–to fully tap the true potential of the play.

Enter the aforementioned U.S. energy companies with shale experience.

Argentine energy ministers at the provincial and federal level, along with state-owned YPF, have set their sights on those companies, especially those that have mastered the art of extraction, production and export. The bigger the company, the deeper the expertise, the more capital at hand, the more Argentina wants them on board.

And that sense of urgency for U.S. investment is also being repeatedly relayed in research reports by the likes of Rystad Energy and other consultancies.

The call for U.S. investors is also coming from Argentine governors of key shale provinces, Argentine shale producers, and even from Argentina's populist and ultra-liberal President Javier Milei.

Javier Milei

Argentina's latest legislative push is called RIGI, which is a Spanish acronym for Milei's Incentive Regime for Large Investments. It is a law designed to provide long-term investment security for 30 years as well as tax benefits and is intended to provide the kind of stability that international investors in the country, and those looking to enter the country, demand. RIGI is at the centerpiece of Milei's pitch for greater foreign direct investment in Argentina's energy sector.

But the collective Argentine pitch to the U.S. shale patch isn't just to attract know-how and capital. Argentina is also eyeing the equipment that powers the U.S. shale patch–rigs, compressors and the technology driving the Permian's success. With an eye on drastically boosting oil and gas production, Argentina is keen to leverage U.S. expertise to transform itself into a reliable exporter of piped-oil and gas. By 2030, Argentina wants to become a year-round exporter of LNG, with Vaca Muerta providing the critical feed gas.

In the Argentine oil space, Vaca Muerta is producing just under 400,000 bbl/d. By around 2030, the formation could be producing close to 1 MMbbl/d, according to Rystad and Pluspetrol.

In the Argentine gas space, Vaca Muerta is producing around 3 Bcf/d but will need to increase that total at least an additional 4 Bcf/d to feed Argentina's planned LNG facility, which is currently the top end of range for a 23-30 million tonnes per annum (mtpa) liquefaction project planned on Argentina's Atlantic Coast.

Neuquén's impact on Argentina's total oil and gas production is massive. Vaca Muerta accounts for almost 59% of Argentina's total oil production. The play accounts for 60% of total gas output.

The world's biggest upstream and oil service companies are already active in Argentina. The main IOCs in Vaca Muerta include: Chevron, Petronas, Shell, TotalEnergies, Wintershall Dea, Equinor, Vista Oil & Gas, and Exxon Mobil. The main Argentine companies include YPF, Pan American Energy, Tecpetrol, Pluspetrol, Pampa Energía, Phoenix and GyP.

In the oilfield services space, the players already there with an operating footprint include Halliburton, Nabors and SLB.

But to realize Argentina's full ambition in the sector, the Southern Cone country will need additional assistance. And such assistance will require the full force of U.S. industry–capital, technology and, above all, the experience that only American shale pioneers can bring to the table.

Milei's government is traveling the world promoting investments in the nation's energy sector as it looks to maximize revenues during a small window of opportunity that is the 2030 investment horizon. His model aims to convince investors they can invest and export from Argentina.

With Argentina's history of debt defaults and seemingly ongoing talks with the International Monetary Fund (IMF) for financial backing, RIGI is a massive bet on Vaca Muerta's resources and revenue generating potential. OGI

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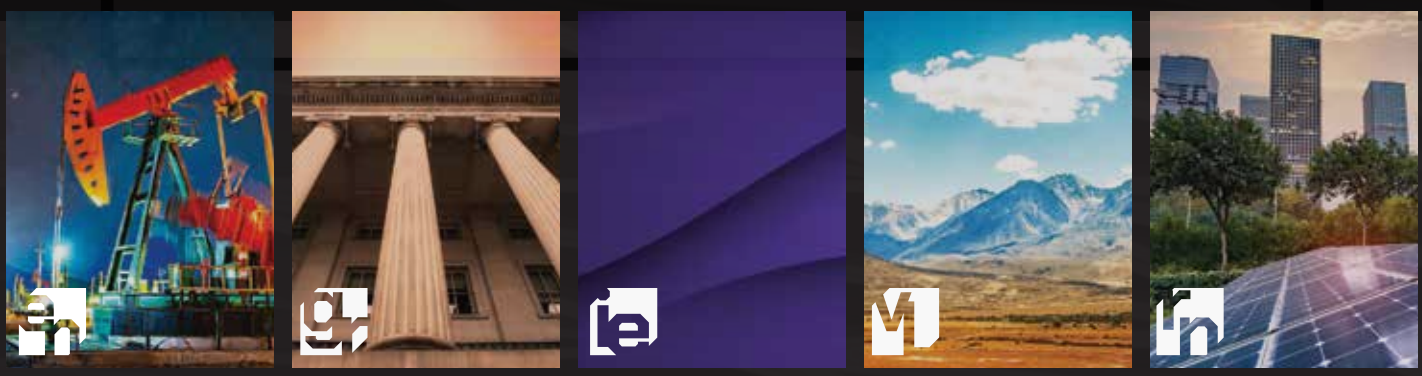

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Paisie: Favorable Fundamentals Will Lift Q4 Crude Prices

China, OPEC+ and the Middle East continue to feed volatility in the market.

JOHN PAISIE
STRATAS ADVISORS

John Paisie is president of Stratas Advisors, a global research and consulting firm that provides analysis across the oil and gas value chain. He is based in Houston.

Despite moving forward with a stimulus plan, China's economic performance continues to disappoint, with weak domestic demand, less favorable export markets and a poor real estate market putting downward pressure on oil prices.

SHUTTERSTOCK

Since the latter part of July, oil prices have bounced around from lows to highs approaching a difference nearing $20/bbl because of the competition between factors that are negative for oil prices and factors that are positive.

Concerns about China's economy and the influence on the extent of oil demand growth has been a recurring theme for many months. The data surrounding the performance of China's economy continue to disappoint as China struggles with weak domestic demand and less favorable export markets, coupled with a substantial decrease in foreign direct investment, within the context of excessive debt, especially with respect to the real estate sector.

Consequently, the oil market responded favorably to China moving forward with a stimulus plan that includes lower interest rates and the issuing of 2 trillion yuan (around $285 billion) of special sovereign bonds. Additionally, China's central bank reduced the reserve requirement ratio by 50 basis points, which will add 1 trillion yuan (around $142 billion) into the banking system.

While the announcement of a stimulus plan provided an immediate boost to oil prices, the lack of any further announcement of additional stimulus measures, plus more disappointing economic data associated with the official Purchasing Managers Index (PMI) for September—for the manufacturing sector, as well as for the non-manufacturing sector—put downward pressure on oil prices.

Besides the concerns about oil demand, there are also concerns about oil supply—mainly because of the uncertainty surrounding OPEC+. At the beginning of June, the members of OPEC+ agreed to maintain their supply cuts through 2024 (including Saudi Arabia's voluntary cut of 1 MMbbl/d) and then unwind the cuts during 2025. The associated concerns were magnified when it was reported that Saudi Arabia is ready to abandon its $100/bbl crude target in exchange for an increased market share.

The U.S. economy is also adding to the volatility of oil prices. The Federal Reserve decided at its September meeting to reduce interest rates for the first time since 2020 from a range of 5.25% to 5.5%, to 4.75% to 5% with a cut of 50 basis points, instead of the more typical 25 basis point cut, along with signaling that more rate cuts are on the way.

The better-than-expected jobs report for September, which showed the U.S. economy added 254,000 jobs, plus other positive economic news, however, created the possibility that the Federal Reserve might be more cautious about the pace of interest rate reductions. As such, the dollar strengthened against other currencies, which tends to put downward pressure on oil prices.

Besides the above factors, the influence of geopolitics on oil prices has been shifting. For most of the year, the influence of the military conflicts on the oil prices has been muted because the flow of oil has continued for the most part unabated, resulting in the oil market dismissing the potential risks. That risk, however, came to the forefront with the exchange of attacks between Iran and Israel and the possibility of a wider and more intensive conflict breaking out in the Middle East.

Stripping away the noise, we think that oil prices will be supported by more favorable supply/demand fundamentals and that the price of Brent crude oil will move back above $80/bbl during the fourth quarter.

From a supply-side perspective, it is our view that Saudi Arabia leaked information about taking back market share as warning to the market that Saudi Arabia is not willing to take on the burden of reducing production to support oil prices by itself–and not as an intention to crash oil prices. This warning is meant mainly for other members of OPEC+–especially those who have been overproducing and have promised to reduce future production to account for their earlier overproduction but have yet to do so–because It is imperative that OPEC+ exhibits cohesive and disciplined behavior to maintain credibility, especially when the sentiment of the oil traders is already very negative.

The warning is also for non-OPEC producers–including U.S. shale producers. Saudi Arabia wants to make sure that these producers consider the risk of significantly lower oil prices when making capital investment decisions. From a demand-side perspective, we are forecasting that demand will outpace supply during the fourth quarter with our forecast for demand growth being 1.2 MMbbl/d for 2024.

Oil prices will also get some support from the geopolitical uncertainty; however, not to the extent implied by the price action in the immediate aftermath of Iran's missile attack on Israel. It is our view that the initial price movement was a market overreaction, in part, because we think Iran will continue to show restraint in responding to Israel since Iran is not interested in a major conflict with the Israeli military that will be supported by the U.S. and allies.

Additionally, while the U.S. will support Israel against attacks, the current administration is unlikely to support Israel in a major offensive action against Iran, including attacks on Iranian nuclear facilities and attacks on Iran's oil and gas infrastructure, especially with the presidential election on the horizon. Furthermore, such an aggressive move cannot be taken without considering the response from other countries, including China, which is a supporter of Iran and the most significant buyer of Iranian crude oil.

Without U.S. support, Israel will find it difficult to carry out these types of attacks with access to only fighter jets, which do not have the necessary range to reach the required targets. Therefore, we think the probability of major conflict between Israel and Iran is much lower than reflected by the initial price spike, and therefore, unlikely that there will be any material interruption to the flow of oil.

The risk of such an interruption, however, is higher now than before the Iranian attack, which translates into a non-trivial risk premium, which was not the case prior to the Iranian attack, when the risk premium had essentially disappeared. OGJ

Oil production from the Vaca Muerta Shale in Argentina could reach 1 MMbbl/d.

SHUTTERSTOCK

Argentina

Vaca Muerta Production to Reach 1 MMbbl/d by 2030

Production from Argentina's Vaca Muerta shale formation is expected to reach around 1 MMbbl/d over the mid- to long-term compared to less than 400,000 bbl/d now, Pluspetrol Country Manager Julian Escuder said in September during the Shale en Argentina event in Houston.

The shale formation accounts for around 59% of Argentina's oil supply, based on official data from January through August.

Vaca Muerta's potential remains vast and growth could accelerate with the right incentives, Alex Ramos-Peon, head of shale research at Rystad Energy, said during the event.

Vaca Muerta could produce more than 1 MMbbl/d by early 2030 with only 50% more rigs, he said.

"The Vaca Muerta boasts superior oil well performance compared to U.S. peers and has some of the best-in class breakevens due to exceptional production performance," Ramos-Peon said.

Argentina LNG Eyes Initial FID in Second-Half 2025

Argentina's state-owned YPF and its Malaysian counterpart Petronas have an eye on taking a final investment decision (FID) in the second half of 2025 for Argentina's initial LNG exporting facility on the South American country's Atlantic Coast.

An initial FID could be taken in either the third or fourth quarters, YPF CEO Horacio Marín said in September during the Shale en Argentina event in Houston.

The proposed Argentine LNG facility will have a capacity of 23 million tonnes per annum (mtpa) to 30 mtpa, Marín said. The facility would be constructed in two phases.

The first phase would consist of two floating LNG barges with potential to produce 8 mtpa to 10 mtpa. The time frame for completion or having the barges in operation is 2029-2030. Petronas is expected to bring in the first barge, analysts told *Oil and Gas Investor (OGI)* during the shale event.

A second phase would consist of onshore modules with the potential to produce 15 mtpa to 20 mtpa, with completion expected sometime between 2030 and 2032.

YPF will have a 25%-30% interest in the facility. Petronas will likely be another owner in the project, along with other companies expected to join the project in the future, Marín told *OGI* during the event.

Suriname

APA and TotalEnergies Take $10.5B FID in Block 58

APA Corp. and TotalEnergies announced a $10.5 billion FID for the GranMorgu project located offshore Suriname in Block 58. First production is slated to flow in 2028.

APA and TotalEnergies (operator) each hold a 50% interest in GranMorgu. State-owned Staatsolie Maatschappij Suriname is expected to exercise an option to enter the project with a 20% interest, APA and TotalEnergies said in separate early October press releases.

Staatsolie will contribute to GranMorgu following the FID and finalize its interest before June 2025, TotalEnergies said. Such a move would reduce APA and TotalEnergies' respective interests to 40% each. Staatsolie has yet to

announce how it will finance its portion of the capex.

GranMorgu will include a 220,000 bbl/d FPSO vessel designed to accommodate future tie-backs, which could extend its four-year production plateau, APA and TotalEnergies said.

Both the FID amount and the size of the FPSO exceeded original estimates prior to the FID announcement, said TD Cowen analysts.

The analysts at TD Cowen said they initially expected an FID amount of around $9 billion, and a smaller FPSO with a capacity of around 200,000 bbl/d.

U.S.

Woodside Seeks Partners for Driftwood LNG Project

Woodside Energy—which is adding a U.S. LNG export development to its global portfolio of assets in Mexico, Senegal, and Trinidad and Tobago—isn't looking to build a U.S. onshore upstream position, CEO Meg O'Neill said in late September during a Live Enverus broadcast.

O'Neill downplayed suggestions of any potential urgency for an upstream position. Instead, the Australian company plans to secure its gas supplies through partnerships, O'Neill said.

Woodside announced a deal in July to acquire Tellurian, which was struggling to develop its 27-million tonnes per annum (mtpa) Driftwood LNG project. The implied enterprise value of the deal is $1.2 billion.

Woodside expects to take FID on the project, since renamed Woodside Louisiana LNG, sometime during the first part of 2025, O'Neill said during a press conference at Gastech in Houston.

The site covers 880 acres and civil engineering work is well advanced, according to O'Neill.

O'Neill also said Woodside is planning on keeping at least a 50% interest in the project and is looking for different partners to join in what she called "the dream team."

Woodside is weighing four types of partners: U.S. upstream E&Ps that want to get some of their product exposed to international pricing; strategic LNG players interested in building out their position; infrastructure players; and U.S. companies specializing in pipeline to get "products from Point A to Point B," O'Neill said.

Expand Energy Looks to Move 10% of US Shale Gas into International Markets

Expand Energy, created from the merger of Chesapeake Energy and Southwestern Energy, wants to send its natural gas, via LNG, to high growth markets abroad like Asia, despite some political unknowns in the U.S.

The company remains bullish on getting at least one-10th, and possibly more, of its production out of the U.S. and onto the international market.

"We are targeting currently 10% to 15% of our production to be based off of an international index," Katrina Kaufman, executive LNG adviser said in late September during the Asia-U.S. LNG Roundtable in Houston.

The company's production is concentrated in the Haynesville and Marcellus shales. The company sold its oily Eagle Ford Shale position last year.

In the Haynesville, Expand has a deep inventory that could support 15-year to 20-year LNG deals.

"We're actively seeking to provide production into the [U.S.] LNG facilities to sell free-on-board (FOB) or otherwise," Kaufman said. She did not give a timeline.

Poten: North American LNG Projects to Double Capacity by 2027

Nine liquefaction projects under construction in North America, with an ability to add capacity of 98.6 mtpa, are expected to come online by year-end 2027, according to an analysis by Poten & Partners.

North American's LNG capacity is currently about 86.6 mtpa, based on U.S. Energy Information Administration (EIA) data. The additions tracked by Poten would more than double LNG export capacity.

Of the projects, six are located in the U.S., two in Canada and one in Mexico, Poten said in September.

In late 2024, two projects will come online in the U.S.: Venture Global LNG's 13.3 mtpa Plaquemines LNG Phase 1 (Louisiana); and Cheniere Energy's 10 mtpa Corpus Christi Stage III (Texas).

In 2025, three projects will come online: QatarEnergy and Exxon Mobil's 18.1 mtpa Golden Pass LNG (Texas); Shell, Petronas, PetroChina, Mitsubishi and Korea Gas' 14 mtpa LNG Canada (British Columbia); and Venture Global's 6.7 mtpa Plaquemines LNG Phase 2 (Louisiana) in mid-2025.

In 2026, one project will come online: Sempra's 3.3 mtpa Energía Costa Azul (Mexico), according to Sempra's new timetable.

In 2027, three projects will come online: NextDecade's 17.6 mtpa Rio Grande LNG Phase 1 in early-2027; Sempra's 13.5 mtpa Port Arthur LNG Phase 1; and Pacific Energy and Enbridge's 2.1 mtpa Woodfibre LNG (British Columbia).

Poten expects LNG supply growth of around 186 mtpa over the next 10 years, which would represent a 3.8% CAGR. Also, within the next 10 years, Poten expects the market share of the top 10 LNG producers to rise to 88% from around 82% now. Five of the top 10 producers are state controlled or state monopolies, according to Poten.

The U.S.' share of the LNG market is expected to reach 29% in 10 years from 21% now, Poten said.

Uruguay

Chevron Gets Approval for Farm-in Offshore

Chevron received approval for a farm-in at the AREA OFF-1 block offshore Uruguay, a Chevron spokesperson told *OGI* in late September.

"Chevron, through its affiliate in Uruguay, confirms that it has been granted approval by the national oil company, ANCAP, to acquire a 60% interest in the AREA OFF-1 block, offshore Uruguay from CEG Uruguay SA, a subsidiary of Challenger Energy," the spokesperson said.

"Completion of the transaction is in final stages, pending further notifications and local registration. This acquisition further strengthens Chevron's upstream exploration portfolio in the Latin America region," the spokesperson said.

Financial details regarding the transaction were not revealed by Chevron nor CEG Uruguay.

After the transaction closes, Challenger Energy will have a 40% non-operating interest in AREA OFF-1 compared to 100% before the deal. OGI

‘Hydrogen is Happening’

Facing a myriad of challenges that include policy uncertainty and costs, companies such as Chevron are moving forward with projects and partners to make progress.

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Hydrogen is known in the energy world as the Swiss Army knife of decarbonization.

Stepping in where greenhouse gas emissions reduction is essential, the carbon-free energy carrier’s versatility has industry players factoring in its potential as a fossil fuel alternative in hard-to-abate sectors, heavy-duty transportation, energy storage and industrial processes.

Hydrogen, however, faces some headwinds: higher production costs compared to less expensive fossil fuels, policy uncertainty and a large investment gap, as well as other challenges. Some organizations, including the International Energy Agency, have even lowered growth projections for some forms of hydrogen.

However, the downgrade and doubts by some have not stopped some hydrogen producers and others in the value chain from turning hydrogen hype into reality. Chevron is among the energy companies pushing forward with hydrogen projects.

Chevron has said it aims to produce 2.2 tonnes of hydrogen per day—enough to fuel a vehicle for 132,000 miles—using solar energy from its Lost Hills Field in California. Production at Lost Hills could begin in early 2026, adding hydrogen to an area long known for its oil production and powered in recent years by a 220-acre solar field.

The soon-to-be Houston-based company is also the majority stakeholder in the Advanced Clean Energy Storage (ACES) hydrogen storage project in Delta, Utah, and is among the companies working to establish the HyVelocity Gulf Coast Hydrogen Hub.

The challenges and opportunities of hydrogen are something Austin Knight is all too familiar with as vice president of hydrogen for Chevron New Energies and chair of the National Petroleum Council’s hydrogen study, a roadmap to scaling low-carbon intensity hydrogen production in the U.S. Knight spoke to Oil and Gas Investor *about the company’s projects and what the hydrogen sector needs to overcome obstacles.*

Velda Addison: Chevron has a ton of hydrogen initiatives underway: ACES Delta, a solar to hydrogen project in California, the HyVelocity Hydrogen Hub. Why is Chevron so bullish on hydrogen?

Austin Knight: Hydrogen is happening … and it’s one of our core beliefs that, in the future, as we move to lower-carbon energy solutions, hydrogen is not only something that’s necessary, it’s something that fits really well with what we know how to do. We’ve looked, of course, at all the things that could be necessary to help get to the climate goals that are in place. That helps inform us about how we think the energy system’s going to evolve. But not every one of those is right for us. Hydrogen is one of those areas where, for certain sectors, it is the best solution to reduce the CO_2 emissions of the current sectors. It’s really around heavy industry, large-scale refining, petrochemical plants, steel production—things that require a lot

Sites of Two Chevron Hydrogen Projects

SOURCE: REXTAG

CHEVRON NEW ENERGIES

ACES Delta will initially convert more than 220 megawatts of renewable energy into 100 metric tonnes per day of hydrogen to be stored in two gigantic 4.5 MMbbl salt caverns.

CHEVRON NEW ENERGIES

Austin Knight, vice president of hydrogen for Chevron New Energies, sits in front of eectrolyzers during a visit to the Advanced Clean Energy Storage (ACES) project site in Delta, Utah.

"Hydrogen is one of those areas where, for certain sectors, it is the best solution to reduce the CO_2 emissions of the current sectors. It's really around heavy industry, large-scale refining, petrochemical plants, steel production—things that require a lot of heat. Hydrogen is a great way to do that without the resulting CO_2 emissions."

of heat. Hydrogen is a great way to do that without the resulting CO_2 emissions.

Heavy-duty transportation is another one because today we see a drive toward the desire to have more and more zero-emission vehicles. But for large trucks that go long distances, carry big loads and have high utilization, that's a difficult solution for batteries to fill, but hydrogen can fill that gap. Again, zero emissions from hydrogen. And, you mentioned ACES. ACES is a great solution for the energy system. As we expand renewables, you still want to be able to keep the lights on. And so, the way I think about it in ACES is there's a giant battery that hydrogen can act as to ensure that, although you can't control wind, you can't control sun, you can use the excess in the system, store that energy as hydrogen, and then allow that to be sent back to the grid as power production when it's needed. There's also a lot of places in the world that don't

CHEVRON NEW ENERGIES

Electrolyzers for the ACES Delta project in Utah.

have wind and sun, so they need these types of solutions as well. That's where I think hydrogen fits.

VA: It seems hydrogen storage is not talked about as much as it probably should.
AK: Hydrogen storage is really important, especially in that grid reliability case. A lot of what you may see when we talk about how hydrogen might move around the world and where it goes, moving hydrogen, say, between continents, is oftentimes a difficult feat. Ammonia is something that people talk about. So, then it's ammonia storage rather than hydrogen storage. ACES' massive hydrogen caverns can store the equivalent of 300 gigawatt hours of electricity [and] put [it] onto the grid, and 300 gigawatt hours is multiples over what is currently installed in terms of batteries connected to the grid today.... But not only that, it's long-term storage. A lot of the batteries being connected today are intraday batteries. They will charge a bit during the day. They'll discharge some in between the sun and the wind profiles, but they're not seasonal. So, I think you really will see a system where you need both, right? This is an all-in type of system. Hydrogen will play one of those roles.

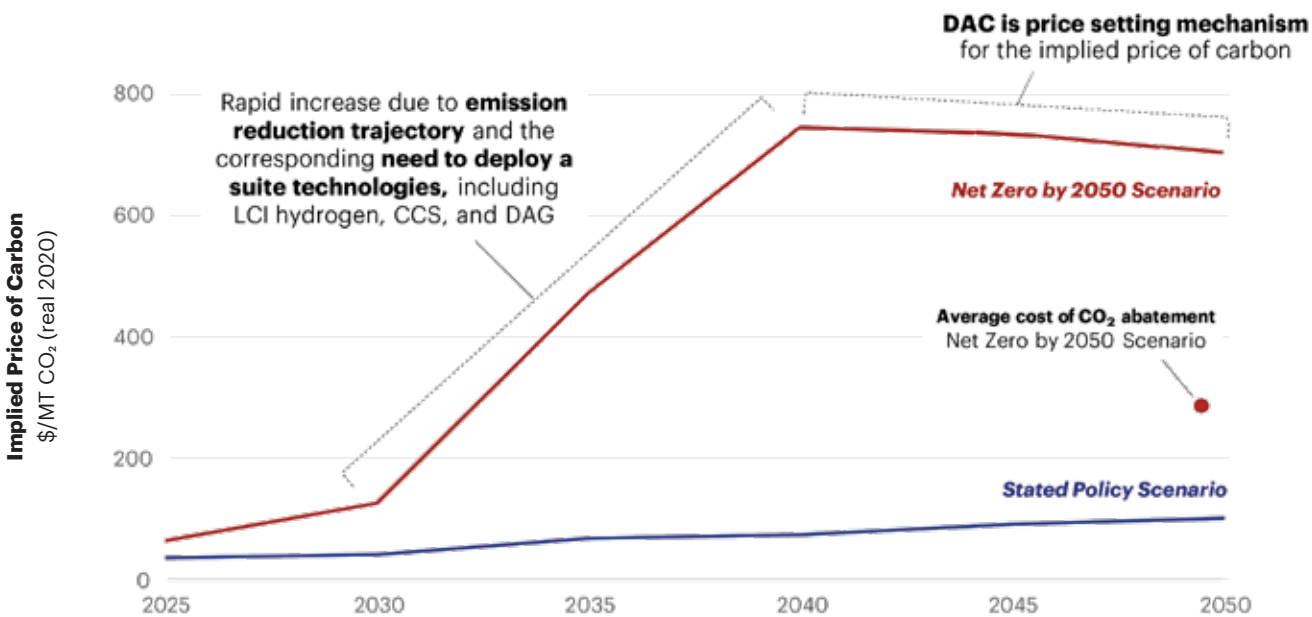
VA: You speak a lot about the positives, and the momentum is building. But hydrogen is not without its challenges when it comes to cost, infrastructure and building up demand. What do you believe is key to overcoming some of these challenges?
AK: How do we get from where we are now to where we think hydrogen needs to go in the future is the question that the secretary of energy asked us. Secretary [Jennifer] Granholm wanted to know not only what is the role of hydrogen, where does it fit, but what are the gaps in actually making this a reality? And so, Chevron led a study that I led across all industry. We had 100 different organizations involved, 200 different people or more, not just industry. NGOs participated, academics participated. We did a ton of modeling with MIT to not only look at where does hydrogen actually fit in the system in a way that makes sense towards the climate goals, but what's the reality of the gaps.... Now and over the long term, even by the time you get to 2050, the cost gap still exists between the lower-carbon intensity solutions and the higher-carbon alternatives.

We have quite a few recommendations, but the key thing is around valuing those carbon emissions. Do you have a price on carbon; some way to value this reduction? We think it's a great solution. It's something then that the markets can work, solve technological challenges, scale up the solutions, build out the infrastructure, but all of that's required to then get these costs down. And we have to remember, we're at the early activation stage right now and we basically laid this out in activation, into expansion and then at scale deployment of what does this look like and what are those critical factors? So much is about policy and at the same time, as you start to activate the system, you start to build out infrastructure and bring down the cost of some of the technology solutions.

VA: Of the 23 recommendations, which ones do you think should be tackled sooner rather than later?
AK: The biggest one, when you look at the policy piece, we really had two primary recommendations that I would highlight. One is a price on carbon. We recognize, the study recognizes, and I think Chevron would agree, a price on carbon is going to be the most efficient way to achieve these goals.... We also proposed a couple alternatives, recognizing that maybe politically that's going to be difficult to get across the line. There are a couple other things you could do, but it's only a surrogate for carbon pricing.

The other piece was permitting. Even with great policy, economic incentives, clarity on policy and everything that you would want, you have to be able to permit these

Price of Carbon to Reach Price Parity for Marginal CO_2 Emitter



SOURCE: MIT MODELING FOR NPC HYDROGEN STUDY;
$/MT COZ: DOLLARS PER METRIC TON OF CARBON DIOXIDE EMISSIONS (IN REAL 2020 DOLLARS)
CCS: CARBON CAPTURE AND STORAGE
DAC : DIRECT AIR CAPTURE

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projects. And it means carbon storage, it means large-scale production hubs and it means the electricity buildout. So, it's renewables; it's all the infrastructure associated with that. It's these pipelines to move this product around. Again, we're not trying to put hydrogen everywhere. We want to target that where it makes the most sense to achieve our goals as the best alternative. It still requires all of that to be built out, which requires the ability to permit.

VA: There's a clear cost gap between blue hydrogen and green hydrogen. Blue hydrogen has ... a lower emissions profile compared to other fossil fuels but a higher emissions profile compared to renewables. Looking at emissions, what steps are being taken or can be taken to make natural gas cleaner when it comes to hydrogen production?

AK: Today, we have solutions that can be implemented and can start at scale with a very low carbon intensity. And that's based on making sure you're responsibly sourcing your gas upstream, reducing methane emissions, which we're already doing and committed to.... That's one element of it. And another one is renewable natural gas/biogas. These are recognized in California's Low Carbon Fuel Standard as negative emissions. We can ramp that up. And I think these things all are actually true emissions reductions that can be tracked and can be credible in the system. The policy needs to recognize it. I want the policy to recognize all of these solutions without only picking winners and saying, it can only be this or can't be that, because we need viable valid solutions.

Now, that blue path can be done at a much larger scale today than green. And so, we're in green with the ACES project. And we also think large-scale blue is a great solution because as you build that out and you build out the infrastructure associated with that, you can also continue to transition to lower and lower carbon with the benefit of having, already, the infrastructure that you can add onto with the green pathway. The green pathway today is still very, very young and it's scalable, but it's still very small.

And so, you not only have a cost difference between the two, you have a carbon intensity difference and you have a very significant feasibility difference on the scale of what can be done. This is an area where these two things should go hand in hand, and we're going to be in both. There are different reasons or justifications behind the pace of which either one would be adopted because the world is not uniform and resources aren't the same everywhere and policy's not the same everywhere.

VA: Let's talk about more about Chevron's projects. ACES Delta, that's the big one. What's happening there now and what are the upcoming milestones that you're looking to hit this year and next year?

AK: I love this project.... You can touch it. You can see it. You can put your hands on something real, and there aren't many projects at that scale and at that stage in the world today. We are wrapping up construction, moving into commissioning. We expect that next year we'll be operating. There are 40 electrolyzers in place already today, and we'll have to hit the point of the project very soon where you start to energize these and move toward hydrogen production. We have two massive salt caverns being solution mined, and both of these sit about a mile below the surface of the earth. They're about the size of the Empire State Building. We're talking 1,500 feet tall. All of the infrastructure is there. The final bits of the solution mining are going on right now. It's real progress that you can see.

Across the street, there's the development with the Intermountain Power Project; they call it IPP Renewed. You can see there, in real time, the replacement of coal. There's a coal plant that served that area for quite some time, for more than 30 years. And next door being built out are the new gas turbines. What's just fantastic about all of this is as the world goes to more and more renewables, you need something that can ensure you keep the lights on. And this is just the confluence of all those great elements, and it's a lot of renewable build out. It's also the geology that's required, the customer commitments and all the infrastructure to connect it. It's all there and you can see it. You can put your hands on it. It's really real.

VA: You think that's something you all can replicate maybe in Texas?

AK: I hope so. The project itself has a lot of scalable potential, and this is the first phase. It's something that I think you're going to need more of as the energy system grows and as the energy system moves to more renewables. Others are very interested in similar concepts. What I think makes any of this work are those elements that you could replicate. It's the customer commitment to decarbonize, to value that carbon abatement. It's really strong partnerships across the value chain that make it work. And it's all of that infrastructure and technology. It's people taking the chance to do the problem solving and to develop the solutions that actually work. So, we'll see what's next.

VA: What's the latest with HyVelocity?

AK: HyVelocity still represents one of the best opportunities there is to benefit from everything the Gulf Coast has to offer. You've got the gas supply, again, this responsibly sourced gas. You've got the infrastructure. You've got pipelines and energy systems and export facilities and all these things. So, there's a number of partners at HyVelocity that are very committed to that type of vision. We are still finalizing the negotiations with DOE to enter in to what DOE is calling Phase One of these seven hubs. And so, we continue and we still like the concept of HyVelocity.

VA: Is there anything else you want to speak on?

AK: Out in the Central Valley of California, we've also been testing some concepts. We have a trial that's been going on with Solar Turbines, which is a Caterpillar company, in our operations there to make sure that hydrogen can be used at high quantities in gas turbines [and] that you can control for [nitrogen oxides] if the technology will work. That's been really a great success and something we're proud of, where we've stepped out and started to make commitments to do that on our own, to prove what's possible.

And at the same type of site, not exactly the same area, but Central Valley, California, as well, we are going to utilize a solar field that we have already that's underutilized and take that excess and produce hydrogen with that to support some of the early markets in California around transportation. It's a really great reuse case of oil field production where we have water, infrastructure and underutilized solar. We think there's possibilities to do more of that and scale it, but it's going to have to make sense and fit with the market adoption. OGI

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An important trend has been developing over the past couple of years: nuclear energy is making a comeback, and it could be a significant development for the oil and gas industry.

In recent weeks there have been two major nuclear energy announcements. First, Constellation Energy, the owner of the Three Mile Island nuclear power plant in Pennsylvania, announced a 20-year power purchase agreement with Microsoft to restart the Three Mile Island nuclear power plant in Pennsylvania and support the company's data center electricity needs. Second, Holtec closed a $1.5 billion loan with the U.S. Department of Energy to restart operations at its Palisades Nuclear Power Plant in Michigan.

The reopening of these traditional nuclear facilities is largely being driven by a surge in load demand, much of which is coming from the proliferation of data centers and other artificial intelligence (AI) needs. At the same time, coal-fired power plants continue to be decommissioned, and while many new sources of wind and solar are coming online, they lack the reliability and dispatchability attributes of coal and natural gas. On the other hand, nuclear has a capacity factor of 92.5%, the highest of any source of electricity, not to mention near-zero greenhouse gas emissions.

Another factor driving a nuclear renaissance is the development of smaller reactors, including small modular reactors (SMRs) that can produce 20 to 300 megawatts (MW) of power, and microreactors, which can produce up to 20 MWs of power. These units could be deployed to provide power to manufacturing facilities, data centers, refineries and chemical plants, and oil and gas operations. Moreover, they could be placed behind the meter to provide onsite generation or operated by an independent power producer to provide power to multiple users.

At the federal level, President Joe Biden recently signed into law the ADVANCE Act, which directs the Nuclear Regulatory Commission (NRC) to quickly develop guidance and regulations for microreactor designs and eliminate costs for pre-application and early site permits for the deployment of small reactors at DOE and other locations.

The State of Texas is playing a leading role in enabling the use of SMRs to address the state's surging power demand and need for dispatchable, reliable and sustainable power. The Advanced Modular Reactor Working Group, commissioned by Texas Gov. Greg Abbott and chaired by Texas Public Utility Commissioner Jimmy Glotfelty, recently presented its recommendations to the governor.

The group has focused its effort on identifying and overcoming barriers to SMR development, including market design, and siting and safety challenges. Securing approvals from the NRC was identified as the primary regulatory challenge to deploying new and advanced reactors, and the group is working to identify ways the state can work with the NRC to address those challenges.

A big part of the Texas effort is to build a nuclear supply chain in the state, something that the oilfield services (OFS) sector could play a major role in ensuring. Relevant to this opportunity, in October the Energy Workforce and Technology Council (EWTC) had Commissioner Glotfelty address its Energy Technologies: Advancing Sector Capabilities seminar in Houston, where representatives of the nuclear energy industry, oilfield services sector and energy finance community also convened to discuss the promises and challenges of nuclear energy in Texas and the growing nexus between nuclear and the oil and gas sector.

The participants discussed how Texas is taking a leading role nationally and globally on nuclear energy development, and creating the regulatory atmosphere, financial climate and fiscal terms necessary to encourage investment in and deployment of nuclear energy facilities.

An example of this progress is the generation IV molten salt reactor that Natura Resources is developing at Abilene Christian University. Natura has obtained the first-ever construction permit from NRC for a liquid-fueled advanced reactor.

Natura Founder and President Doug Robison is a third-generation oilman and a co-founder, president and executive chair of Permian Basin producer ExL Petroleum. His vision is to bring nuclear power to the oil and gas sector to provide reliable, dispatchable, zero-carbon power to operations, including treatment of produced water. Last summer, Natura entered into a partnership with the Produced Water Consortium at Texas Tech University to explore the deployment of Natura's liquid-fueled molten salt reactor (LF-MSR) technology to

NEWCLEO

U.K.-based Newcleo is developing small lead-cooled reactors for deployment on North Sea platforms.

power the Permian Basin.

As part of the Texas Working Group's efforts to build on this work and incentivize and build the nuclear supply chain in Texas and a corresponding workforce, it is focusing on several areas, including the construction of facilities and components, mining and enrichment of uranium (low-enriched uranium and high-assay low enriched-uranium) and other fuel sources, disposal and recycling of nuclear waste, and maintenance of nuclear facilities. Given its technical and manufacturing capabilities, the OFS sector is uniquely situated to play a significant role in meeting these supply chain needs, and is already positioning itself to do so.

OFS powerhouse NOV recently established Shepherd Power to provide the benefits of reliable, baseload, emissions-free nuclear energy to traditional energy companies and other companies in the industrial sectors. All of these companies face the "triple mandate" to satisfy the growing demand for energy, provide competitive returns to their investors and reduce greenhouse gas emissions.

NOV/Shepherd intends to make fleet purchases of technologies that can satisfy these demands, own and operate reactors, and sell power through structured energy purchase offtake agreements. This is particularly attractive to oil and gas producers who are increasingly facing pressure to secure reliable sources of power for operations in an increasingly constrained market while meeting low-carbon goals.

Additionally, Diamondback Energy has signed a letter of intent with California-based small modular reactor developer Oklo Inc. to explore a 20-year power agreement for powering its Permian Basin operations from zero-carbon nuclear fission. Nuclear power is also being considered to power offshore oil and gas operations. For example, U.K.-based Viaro Energy has signed a memorandum of understanding with nuclear technology provider Newcleo for the future deployment of lead-cooled SMRs in North Sea operations.

With Abbott set to determine what specific legislative and public policy nuclear energy priorities will be presented during the upcoming session of the Texas Legislature, and the commercial nexus between nuclear energy and the oil and gas industry clearer than ever, Texas is poised to lead the way on nuclear development. OGJ

Carbon Management

Oxy's 1PointFive Lands US Funding for Carbon Sequestration Hubs

Occidental Petroleum's carbon capture and storage (CCS) subsidiary 1PointFive secured $36 million from the U.S. Department of Energy (DOE) to support development of the company's Bluebonnet and Magnolia sequestration hubs in Texas and Louisiana.

The federal funding, part of the DOE's Carbon Storage Assurance Facility Enterprise (CarbonSAFE) Initiative, was awarded as the U.S. works to boost deployment of CCS projects to address growing emissions.

The CarbonSAFE Initiative aims to lower technical risks associated with storing carbon underground as well as reduce uncertainty and the cost of commercial-scale saline storage projects.

1PointFive plans to use the funding to advance site characterization activities, permitting and environmental approvals for construction at each hub, Occidental said. Located near industrial emissions sources, the Bluebonnet hub is in Chambers County, Texas, and the Magnolia hub is in Allen Parish, La.

Exxon Mobil Ramps Up $400MM CCS Project in Wyoming

MCO-I

Mitsubishi Heavy Industries Compressor International Corp. (MCO-I) delivered a CO_2 product compressor package for Exxon Mobil's CCS expansion project in LaBarge, Wyo.

Exxon Mobil's $400 million CCS expansion project in LaBarge, Wyo., is progressing toward startup in early 2025, a move expected to reduce the company's net greenhouse gas (GHG) emissions.

"The new well will start up February next year," Kathleen Ash, CEO of Exxon Mobil-owned Denbury, said during an energy summit in Houston. "It was fully funded.... Construction has been pretty impressive."

CCS is considered a must when it comes to bringing down emissions as the world's energy needs grow. Companies with the technical know-how and capital, backed by regulatory support and communities' blessings, are moving forward with such projects.

Exxon's LaBarge expansion project will add up to about 1.2 million tonnes per annum (mtpa) of CO_2 per year of capture capacity to the facility's existing 6 mtpa to 7 mtpa capacity.

The company's proposal to sequester carbon deep underground in Wyoming's Lincoln and Sweetwater counties was approved by the U.S. Bureau of Land Management in 2022. The expansion project includes modifying the existing gas treatment facility to increase capture capacity and installing pipeline to transport CO_2 to the reservoir where it will be stored.

Located at the Shute Creek Treating Facility, Exxon's LaBarge opened in the 1980s and is one of the world's largest carbon capture facilities. It is also the largest U.S. producer of helium, which is made with natural gas from Exxon's LaBarge Field. Shute Creek processes CO_2-rich natural gas from the LaBarge Field.

Marubeni Acquires 50% Stake in Ozona's Eagle Ford CCS Project

Marubeni, a Japan-based trading and investment conglomerate, has acquired a 50% stake in Ozona CCS' South Texas CCS project, according to a news release.

The project aims to capture CO_2 emitted from gas production and processing plants in South Texas, transport it via pipelines and store it in saline aquifers about 2 km to 3 km underground. The project will be in the Eagle Ford Shale's Hawkville Field, according to Latham & Watkins, which represented Marubeni in the transaction.

Marubeni, which produces oil and gas, and Ozona plan to combine their development, subsurface and infrastructure expertise to develop the project, Marubeni said in the release. The companies plan to make a final investment decision on the project by the first half of 2025.

The partnership formed as companies continue taking steps to lower GHG emissions in the U.S., with a goal of lowering GHG emissions 65% by 2030.

Energy Storage

E3 Lithium Commissions Lithium Carbonate Reactors

Calgary, Alberta-based E3 Lithium said the company commissioned its demo-scale lithium carbonate conversion reactors in the lab for use in field demonstrations.

The reactors enable the company to "produce lithium carbonate using similar, yet small-scale equipment operating at the same temperature and chemical operating conditions as a commercial system," E3 said in a news release. The reactors will eventually be used at its planned Lithium Brine Demonstration Facility, which aims to produce battery-grade lithium carbonate from brines in the Leduc reservoir in Alberta.

"By expanding our Calgary lab with advanced equipment and know-how for producing battery-grade lithium carbonate, E3 can advance its engineering initiatives with more efficiency and lower cost," said E3 Lithium CEO Chris Doornbos. "These developments strengthen E3's ability to establish a reliable and competitive lithium supply in Alberta that will help with the increasing demand for battery-grade lithium in North America."

Geothermal

US Grants 4-Year Extension to Utah FORGE Geothermal Initiative

UTAH FORGE

The Utah Frontier Observatory for Research in Geothermal Energy (FORGE) project area is near Milford in Utah's Beaver County.

The Utah Frontier Observatory for Research in Geothermal Energy (FORGE) initiative, known for its efforts in advancing geothermal energy technologies in the U.S., will continue through 2028 after an agreement was reached with the U.S. Department of Energy (DOE).

Utah FORGE said the agreement with the DOE includes $80 million more in funding over the next four years. The extension will enable Utah FORGE, led by the University of Utah's Energy & Geoscience Institute with partner organizations, to add to enhanced geothermal system breakthroughs the program has made since it began.

"This next phase allows us to build on our important achievements and to further develop and de-risk the tools and technologies necessary to unlock the potential of next-generation geothermal power," said Joseph Moore, managing principal investigator for Utah FORGE.

US Navy Taps Sage Geosystems for Geothermal Initiatives in Texas

Sage Geosystems is taking its collaboration with the U.S. Department of Defense to another level as the U.S. Navy explores geothermal baseload power generation.

The Houston-based geothermal and energy storage company said it was selected to conduct geothermal project development initiatives at the Naval Air Station in Corpus Christi, Texas. By harnessing heat from belowground to generate energy, microgrids could be created for use at the base, reducing its dependence on the utility grid while providing continuous power supply on-site.

Sage's geopressured geothermal systems collect energy from pressurized water stored underground for both short- and long-duration periods. That energy, which leverages hot dry rock, can be dispatched when needed to the grid.

The company said it plans to work in partnership with the Department of Defense Innovation Unit and the Environmental Security Technology Certification Program to assess geothermal technologies and the integration of hybrid energy solutions such as energy storage, thermal use and dispatchable power for the U.S. Navy.

U.S. AIR FORCE/SAGE GEOSYSTEMS

This test well in Starr County, Texas, will be used to determine whether a power plant using geopressured geothermal systems can generate the clean energy needed for a base to achieve energy resilience.

The expanded collaboration with the U.S. Department of Defense follows Sage-led geothermal initiatives at Fort Bliss and the Ellington Field Joint Reserve Base where geothermal energy solutions are being analyzed. The U.S. Department of the Air Force in September said it awarded Sage a $1.9 million grant to construct a scaled-down version of a geopressured geothermal power plant in Texas next year.

Sage is also collaborating with California Resources Corp. for geothermal power generation in California. Under a memorandum of understanding, the companies will pursue commercial projects and joint funding opportunities for geothermal as well as subsurface energy storage.

BLM Approves Fervo Energy's Geothermal Project in Utah

Fervo Energy's Cape Station geothermal power project in Utah has been approved by the U.S. Bureau of Land Management (BLM), lifting the amount of approved clean energy power projects on federal lands to nearly 32 gigawatts (GW).

Located in Beaver County, Houston-based Fervo's Project Cape will be capable of generating up to 2 GW of baseload power, which the BLM said is enough to supply more than 2 million homes, if fully developed. Fervo uses existing oil and gas technologies to harness heat and unlock geothermal energy. Its enhanced geothermal system injects water into hot rock formations belowground and extracts the heated water to generate electricity.

"The BLM is committed to supporting the responsible growth of geothermal energy on public lands," BLM Director Tracy Stone-Manning said in a statement. "We need all the tools in the toolbox to reach a clean energy future, and this proposed categorical exclusion will be helpful in accelerating the process of locating new geothermal resources."

If fully developed, Fervo's project will span some 631 acres, including 148 acres on public lands. OGJ

Hirs: AI and Energy—Is There Enough to Go Around?

Grids will be strained to keep up with insatiable demands for data.

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The wave of smart devices that can answer your questions, provide driving directions and steer you to buy things you need, as well as those you don't, is behind the current surge in electricity demand. Midline estimates are that the U.S. will need at least 50% more installed electricity capacity by the end of the decade. That's a lot. These artificial intelligence (AI) data centers need a constant supply of electricity, and the nation's grids are unprepared.

AI has been the stuff of science fiction and the goal of computer programmers for more than 70 years. Every advance in computer processing power brings humankind closer to the goal.

We began to see it in our daily lives as search engines learned our patterns and directed us to websites aligned with our prior searches. The advent of smart TVs, with microphones that are always listening, brought us personalized advertisements for clothing, vacations and health care.

That our credit card companies and banks sell our data to their partners means that somewhere in the cloud, there is a data entry for each of us that knows our buying habits, down to when it's time for an oil change or trip to the dentist.

This year's Nobel Prize in chemistry recognized scientists who used advanced techniques, including AI, to understand and design novel proteins with applications for creating new drugs and other materials. DNA sequencing that used to take years has been reduced to minutes.

AI applications for seismic analysis and measurement while drilling, or MWD, are reducing costs for oil and gas companies. These applications of AI are typically driven by a single user. What happens when millions ask ChatGPT or some other generative AI to write a term paper that is due at 5 p.m. tomorrow?

In his 1982 book "Critical Path," Buckminster Fuller calculated that humankind's knowledge doubled every century up to 1900, speeding up to every 25 years by the end of World War II. IBM predicted that knowledge would double every 12 hours by 2020.

Regardless of whether it is 12 weeks, 12 days, 12 hours or 12 minutes, the avalanche is more than individuals can manage. And presumably, these forecasters were speaking about scientific facts and verifiable studies. They couldn't have anticipated the "alternative facts" and deliberate disinformation now spreading across the Internet.

This exposes a critical weakness of the technology. A preponderance of misinformation is often interpreted as valid by these generative AIs.

Examples abound. Term papers written with footnotes citing studies from Prague in 1957 coupled with articles from the New York Times in 1963 and the Wall Street Journal from 1974 applied to oil market conditions in 2024. It even shows up in investment analysts' newsletters that repeat myth after myth to justify their current investment strategies. Shame!

As Mark Twain said, "Nothing spoils a good story like the arrival of an eyewitness." But these AIs are not yet eyewitnesses and are only beginning to gain the ability to sort out what is true and what is false. Until they can accurately discern the truth, the computing power needed to sort through fact and fiction will increase at an even higher exponential rate.

Think back to your school days. Your teacher could easily handle one or two inquiries at a time but would be overwhelmed by more than a dozen. To handle millions of simultaneous queries, the internet repositories of all this information will need to be replicated many times in addition to the new algorithms necessary to manage our simultaneous queries.

No one can anticipate accurately how much electricity will be required by the coming AI centers, but those operating with subscription services have the advantage because they already have the cash flow necessary to construct their own power supplies.

Microsoft has contracted to restart Unit 1 at Three Mile Island, and Google has contracted to buy small modular reactors for its AI needs. Apple, Netflix, Amazon and others are sure to follow.

Those AI centers that have to rely upon grid operators to admit them will be handicapped because electricity markets such as those in California, Texas and the Pennsylvania-Jersey-Maryland region don't reward capacity growth, meaning those markets will scramble to provide enough electricity to power the insatiable demands of AI.

Stephen Hawking was concerned that AI could lead to the collapse of civilization if it was not used as a helpful tool or if it somehow developed into the robotic scourge of science fiction. But before AI destroys civilization, Hawking's prediction that humankind's ever increasing use of electricity "will turn earth into a giant ball of fire" could happen first. I'll have to ask Alexa about that. OGI

CALL FOR ENTRIES

2025 Special Meritorious Engineering Awards (MEA)

Now celebrating its 55th year, the Special Meritorious Engineering Award is the most prestigious and well-established engineering awards program in the industry. This program honors companies, engineers, and scientists for their innovative tools and techniques in exploring, developing, and producing hydrocarbons.

SUBMIT YOUR ENTRY IN 3 EASY STEPS!

- Gather the required documents to support your award submission. A complete list is available at **MEAentry.com**
- Go to **MEAentry.com** and create an online account
- Use your personal entry page to submit and edit your entry. Enter at **MEAentry.com**

Entry is free, and winners will be featured in the May 2025 issue of *Oil and Gas Investor*. Additionally, the awards will be presented at SUPER DUG 2025, taking place from May 13-15 in Fort Worth, TX.

MEA CATEGORIES

- Artificial Lift
- Carbon Management
- Digital Oil Field
- Drill Bits
- Drilling Fluids/Stimulation
- Drilling Systems
- Exploration/Geoscience
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- Machine Learning and AI
- Marine Construction & Decommissioning
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- Onshore Rigs
- Subsea Systems
- Water Management

Deadline for submissions is March 31, 2025.

Contact: meainfo@hartenergy.com with any questions.

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EVENTS CALENDAR

Investment and networking opportunities for industry executives and financiers.

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EVENT	DATE	CITY	VENUE	CONTACT
2024				
SEG 4D Forum	Nov. 4-6	Galveston, Texas	Grand Galvez	seg.org
ADIPEC 2024	Nov. 4-7	Abu Dhabi, UAE	Abu Dhabi National Exhibition Centre	adipec.com
DUG Appalachia	**Nov. 7**	**Pittsburgh**	**David L. Lawrence Convention Center**	**hartenergy.com/events**
International Geomechanics Conference	Nov. 18-21	Kuala Lumpur, Malaysia	Intercontinental Hotel Kuala Lumpur	igsevent.org
DUG Executive Oil Conference & Expo	**Nov. 20-21**	**Midland, Texas**	**Midland County Horseshoe Arena**	**hartenergy.com/events**
North American Gas Forum	Dec. 2-4	Washington, D.C.	TBD	energy-dialogues.com/nagf
SPE Thermal Well Integrity and Production Symposium	Dec. 2-5	Banff, Alberta, Canada	The Fairmont Banff Springs	spe-events.org
2025				
Floating Wind Solutions 2025	Jan. 15-17	Houston	The Marriott Marquis	floatingwindsolutions.com
Mexico Infrastructure Projects Forum	Jan. 22-23	Monterrey, Mexico	Hotel Camino Real Monterrey	mexicoinfrastructure.com
SPE Hydraulic Fracturing Tech Conference and Exhibition	Feb. 4-6	The Woodlands, Texas	The Woodlands Waterway Marriott & Convention Center	spe-events.org
Pipe Line Contractors Association Annual Convention	Feb. 5-9	Marco Island, Fla.	JW Marriott Marco Island Beach Resort	plca.org/annual-convention-events
NAPE	Feb. 5-7	Houston	George R. Brown Conv. Ctr.	napeexpo.com
6th American LNG Forum	Feb. 10-11	Houston	Westin Galleria	americanlngforum.com
Oil & Gas Automation and Technology Week	Feb. 11-12	Houston	Hyatt Regency Intercontinental Airport Hotel	oilandgasautomationandtechnology.com
Influential Women in Energy Luncheon	**Feb. 27**	**Houston**	**Hilton Americas-Houston**	**hartenergy.com/events**
SGA 2025 Spring Gas Conference	March 2-5	Charlotte, N.C.	TBD	southerngas.org
SPE/IADC International Drilling Conference and Exhibition	March 4-6	Stavanger, Norway	Stavenger Forum	drillingconference.org
CERAWeek	March 10-14	Houston	Hilton Americas-Houston	ceraweek.com
DUG Gas	**March 19-20**	**Shreveport, La.**	**Shreveport Convention Center**	**hartenergy.com/events**
SPE/ICoTA Well Intervention Conference & Exhibition	March 25-26	The Woodlands, Texas	The Woodlands Waterway Marriott & Convention Center	spe-events.org
AI in Oil & Gas Conference	April 8-9	Houston	Hyatt Regency Houston West	aioilandgas.energyconferencenetwork.com
Energy Workforce & Technology Council Annual Meeting	April 9-10	Frisco, Texas	The Westin Dallas Stonebriar Golf Resort	energyworkforce.org
SPE Improved Oil Recovery Conference	April 23-25	Tulsa, Okla.	River Spirit Casino and Resort	speior.org
Offshore Technology Conference	May 5-8	Houston	NRG Park	2025.otcnet.org
Canada Gas Exhibition & Conference	May 6-8	Vancouver, Canada	Vancouver Convention Center	canadagalng.com
Monthly				
ADAM-Dallas	First Thursday	Dallas	Dallas Petroleum Club	adamenergyforum.org
ADAM-Fort Worth	Third Tuesday, odd mos.	Fort Worth, Texas	Petroleum Club of Fort Worth	adamenergyfortworth.org
ADAM-Greater East Texas	First Wed., odd mos.	Tyler, Texas	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, Texas	Petroleum Club of Midland	adampermian.org
ADAM-Tulsa Energy Network	Bi-monthly	Tulsa, Okla.	The Tavern On Brady	adamtulsa.org
ADAM-Rockies	Second Thurs./Quarterly	Denver	University Club	adamrockies.org
Austin Oil & Gas Group	Varies	Austin, Texas	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 Jennifer Martinez at jmartinez@hartenergy.com.
For more, see the calendar of all industry financial, business-building and networking events at HartEnergy.com/events.

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Asked, Unanswered: What are We Supposed to do Without Hydrocarbons?

Oil and Gas Investor asked individuals who understand fossil fuels if any "end oil" agitator has ever explained what the world would do without hydrocarbons. No, they haven't gotten an answer either.

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The "end oil" camp is coming for the toothbrushes.

SHUTTERSTOCK

The "end oil" types basked in late September on X.com in their, um, "brilliance" after halting what was to be a daylong, New York Times-hosted forum—on *climate* solutions.

Have any anti-oil purveyors ever answered the question, "What are we supposed to do without hydrocarbons?"

Oil and Gas Investor (OGI) polled those who've had proximity to the anti-fossil-fuel camps. None has been able to get an answer either.

Steve Pruett, for example. A longtime oil producer, Pruett is currently chairman of the Independent Petroleum Association of America.

"They refuse to answer," he said. Other groups, such as the Environmental Defense Fund and Ceres, do communicate with oil producers, he said. These groups are solution-oriented. "Neither espouse a world of 'no petroleum.'"

What the "no petroleum" camp doesn't understand is "how pervasive petroleum is in our products and lives." Nor do they understand that among the products made possible by hydrocarbons are wind turbines, solar panels and other low- or no-carbon energy sources.

"Their 'no petroleum'-scenario defies math, physics and humans' well-being," Pruett said.

Mark Mills hasn't gotten an answer either. Mills has spoken at many energy events that have been targeted by "end oil" types.

An author, physics faculty fellow at

Northwestern University and energy-tech venture capital partner in Montrose Lane, Mills said he hasn't heard one explain a viable hydrocarbon-free future.

"They either ignore the question or engage in hand-waving, PowerPoint, vacuous solutions," he said.

Among the "climate apocalyptics," there are those who have published and claim that there is a path to replacing hydrocarbons in nearly every application, including chemical feedstocks, he said.

But "they are, at best, wildly unrealistic about the cost and scaling of the laboratory-scale biofuels and other semi-imaginary alternatives."

When he has encountered the rare, "honest anti-hydrocarbon campaigners," these are in the camp of "de-growth" as the solution.

They want others to "fly less or not at all, use less, vacation less, live in dense communities in tiny apartments, etc.," Mills said.

OGI asked David Gelles, too. Gelles is lead editor of the New York Times' Climate Forward newsletter, which hosted the ruckus-abridged forum: "What would we do without hydrocarbons?"

Gelles did not respond by the time *OGI* went to press three weeks later.

When the forum resumed, Occidental Petroleum CEO Vicki Hollub retook the stage, after police cuffed and cleared it of marauders.

"It is a sad day for them … that they have nothing better to do with their time," Hollub said. Eliminating global oil and gas "is not the right answer."

She added, "… What they're trying to do is get some publicity, raise some funding and continue a business."

Gelles told Hollub that people believe the solution to climate problems is "to phase out fossil fuels as rapidly as possible" yet "we're still burning oil and gas."

Hollub said, "I find it really hard to understand how we got to where we are that people like you believe that."

She told *OGI* later, "What we have to get the world to understand is that somebody, somewhere started this idea that we need to eliminate the production of fossil fuels in order to deal with the emissions—that that's the only way.

"That's not the only way."

To solve for climate, "stop trying to kill oil and gas. Start including us and helping us … make [emissions solutions] happen."

In a "Good Morning Britain" interview in the spring of 2022 with a "Just Stop Oil" spokesperson, anchor Richard Madeley said, "Let's talk about hypocrisy."

He read a viewer's question that he said was typical of most questions GMB was receiving. At the time, U.K. residents were panicking about fuel supply in the midst of Russia's invasion of Ukraine.

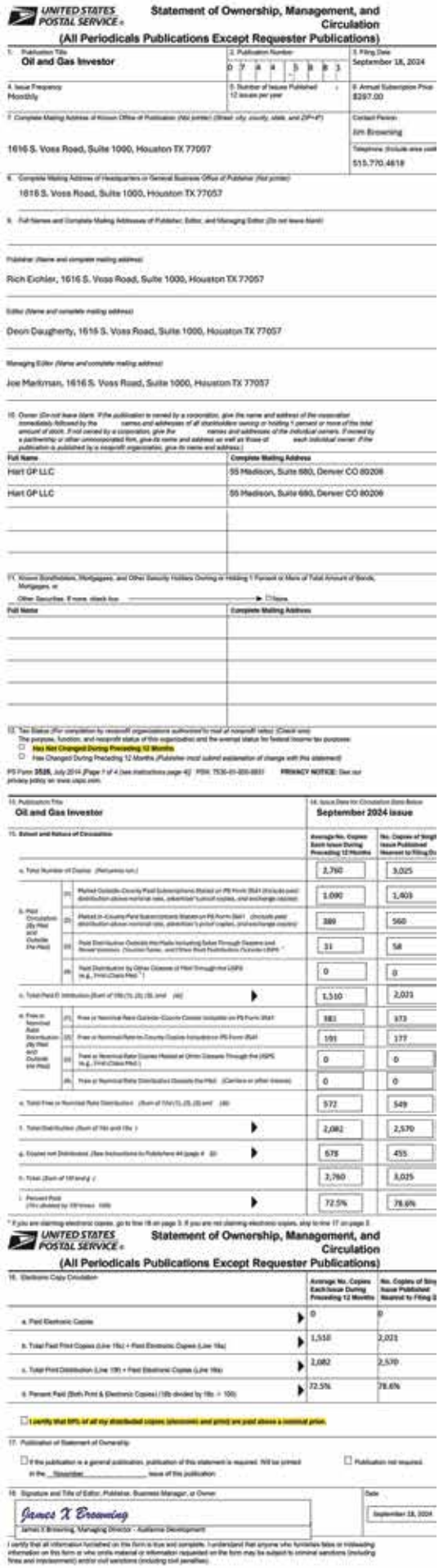
He added that, to be fair, he would read a viewer message in support of the Just Stop Oil group, but "we haven't had one. Not one. We've had nothing but furious complaints from people."

The one Madeley read: "Everything these 'stop oil' protesters wear or buy or eat was delivered or manufactured using oil and that includes the glue that they use to stick themselves to the road with. …

"The clothes that you're wearing, to some extent, owe their existence to oil … but you don't acknowledge that."

The distraught spokesperson replied. "[We're] talking about crop failure … and you're talking about the clothes that I'm wearing. This is so serious."

She didn't answer the question: "What are we supposed to do without oil?" OGI



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☐ If the publication is a general publication, publication of this statement is required. Will be printed in the November issue of this publication. ☐ Publication not required.

18. Signature and Title of Editor, Publisher, Business Manager, or Owner: James T Browning, Managing Director - Audience Development. Date: September 18, 2024

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