



PULSE

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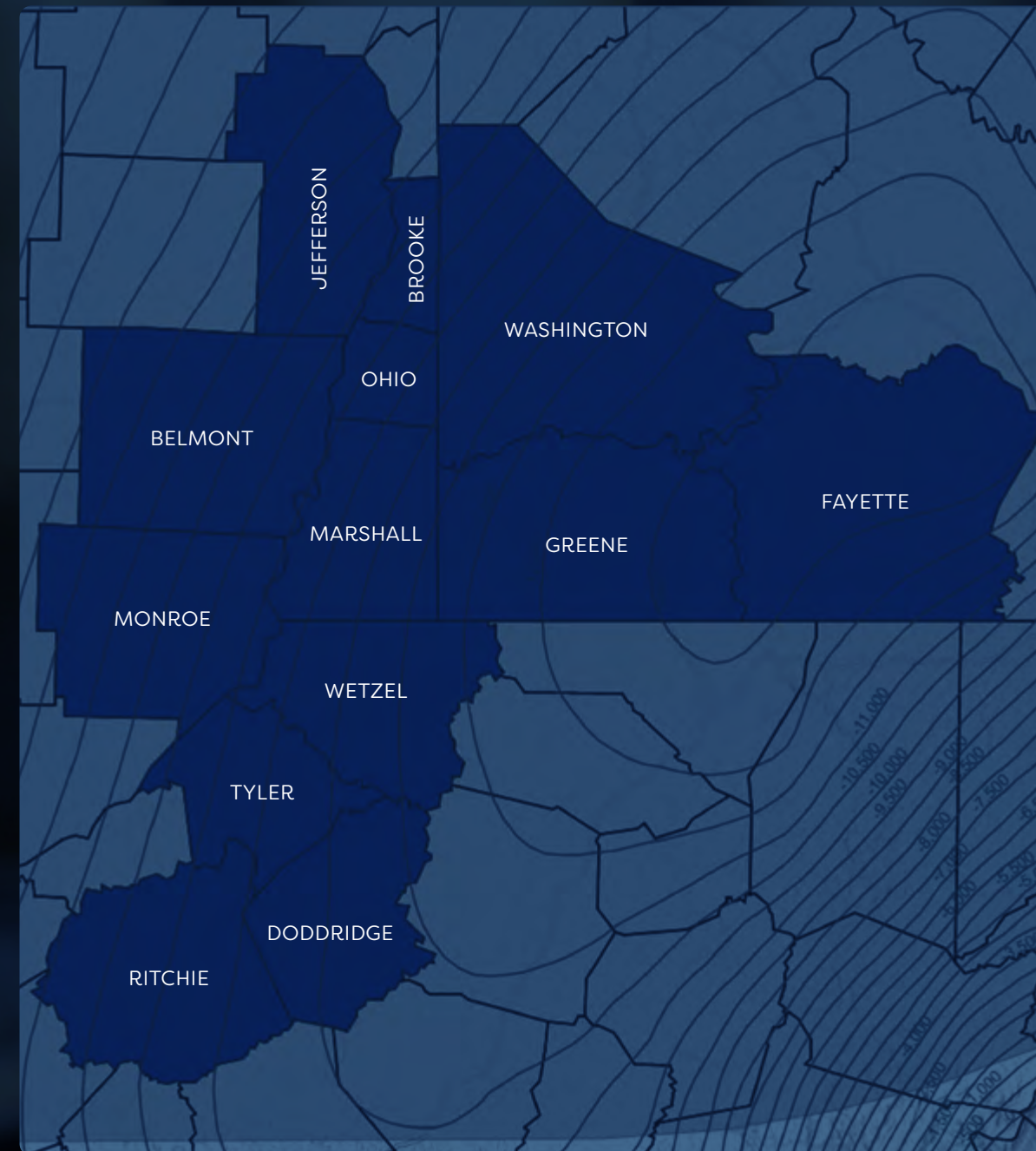
MINERALS &
ROYALTIES
COUNCIL



INTRODUCTION

Welcome back to the Pulse! We are delighted to return to the Appalachian Basin of this 14th issue of the Pulse. In this issue we focus our analysis on the tri-state region of the basin depicted on the map. This multi-stacked area where the Marcellus Shale and Utica/Point Pleasant overlap is interesting not only because of the formations, but also the gas-oil ratio moving east from dry gas to liquids. The trials of 2020 have brought some favor to natural gas, which we examine from an activity perspective over the course of the past year. Our analysis begins with leases and permits, moving on to Completions, Production and Minerals. This issue concludes with a special section dedicated to our interview with Peregrine Energy Partners and a review of the A&D sector.

Appalachian Basin



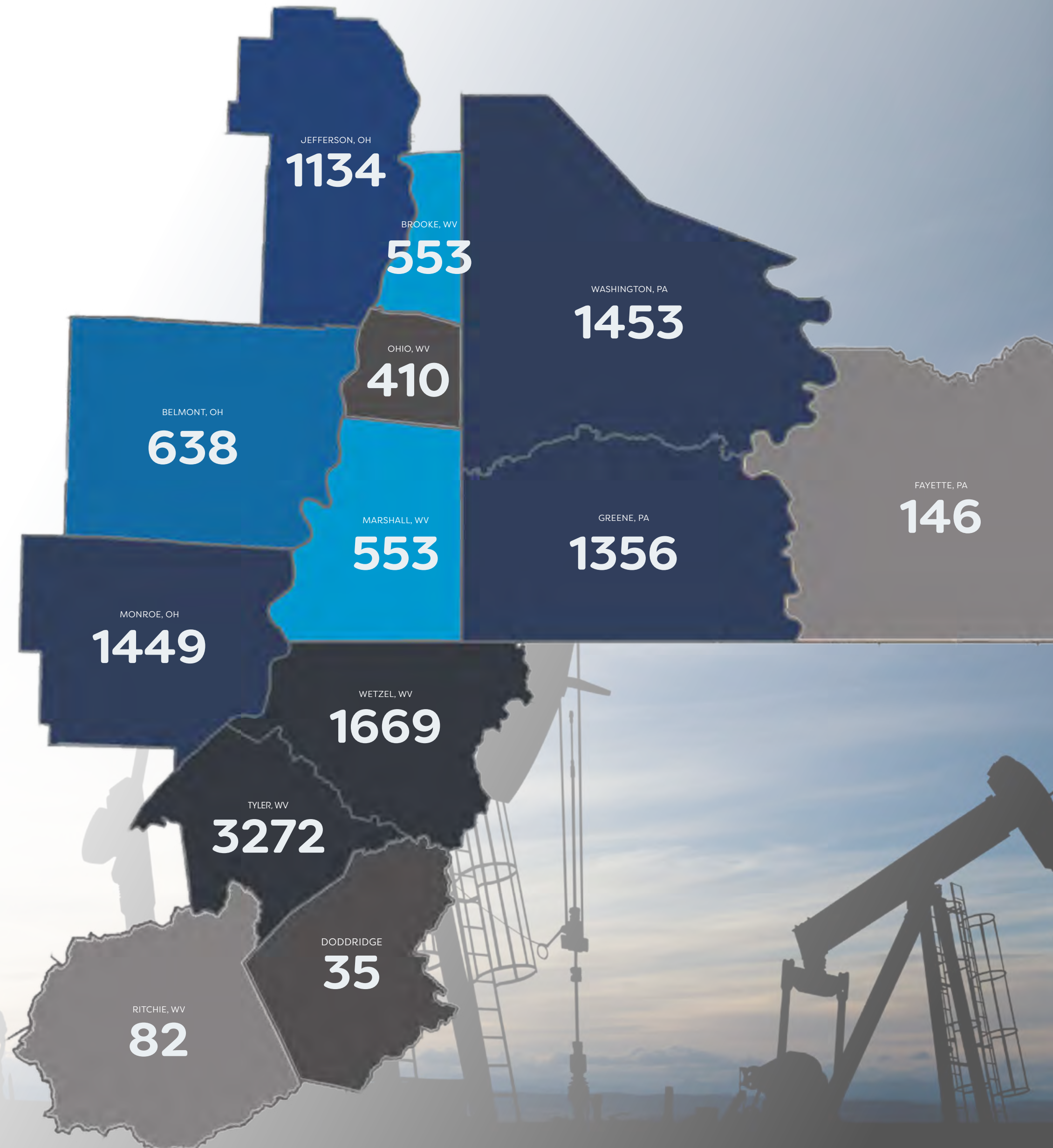
WHAT'S INSIDE



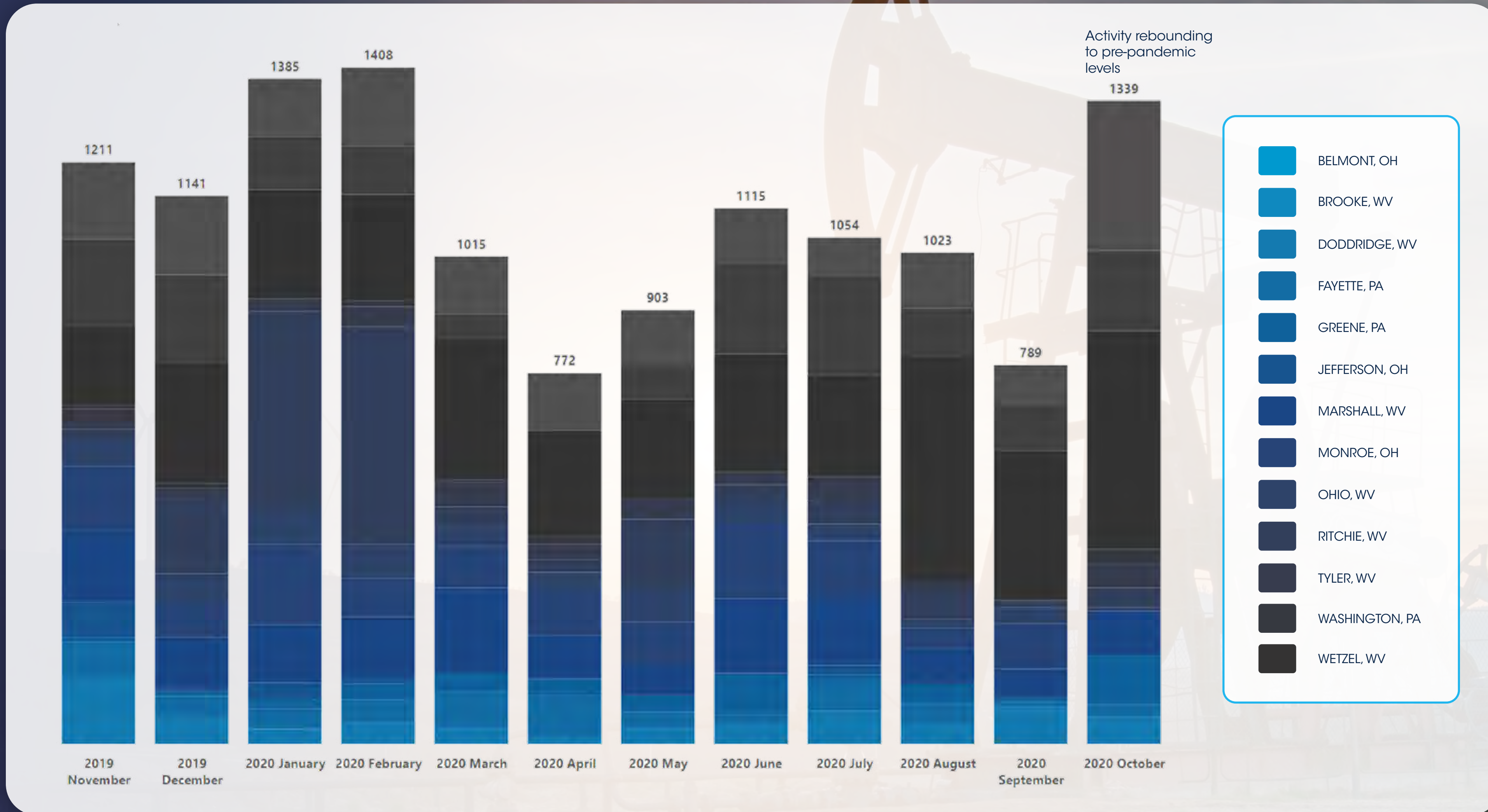
LEASE ACTIVITY

Where Is The Leasing?

Totals for the number of new leases taken within the past year are shown on the map. Tyler County, West Virginia leads the way with an astounding 3,272 new leases, 25% of the overall lease activity in this region of the basin. Wetzel County comes next with 1,669 new leases, followed by Washington County, Pennsylvania with 1,453 leases. These top three counties are primarily in the liquids-rich region of the Marcellus Shale, demonstrating the continuing appetite for LNG production. Fourth comes Monroe County, Ohio with 1,449 leases, a drier region of the play focused on Utica Shale development. It has been proclaimed that the COVID pandemic has been favorable for natural gas. However, what we see in Monroe County is that 71% of the leasing activity occurred more than eight months ago. Over the past eight months, Monroe has averaged only 51 new leases per month, evidence that the pandemic has been less than favorable for the Utica.



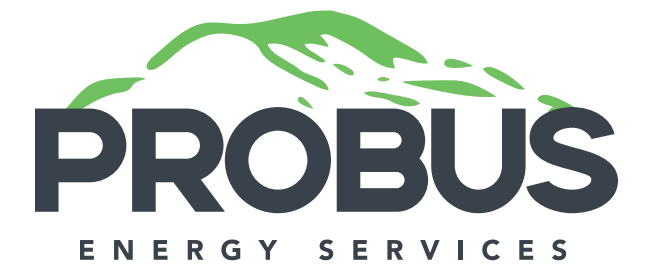
Lease Activity by Month



Top 20 Lessees

The top 20 lessees are identified, calculated by the number of leases, not acreage, over the past year. We also examine where these companies were active on the bar chart. Unique to the Appalachian Basin, is that every company on this chart is an operator with wells in the basin. That might seem relatively unsurprising, but we have never seen that before in any other basin. It is safe to say that lease brokerage volume is lower in Appalachia than any other major basin in the country.

Antero Resources has been busy dominating the leasing front with 4,535 new leases. Nearly 7% of these leases are from minerals that Antero has acquired through Antero Minerals and then leased back. Most of their lease activity was in Tyler County, West Virginia, with 3,067 leases, accounting for 94% of the leasing activity in the county over the past year. EQT Production comes next with 1,992 leases, primarily in Greene County, Pennsylvania. Equinor follows with 1,103, then Ascent Resources (995) and Range Resources (855) wraps up the top five.



Leases	Company	Leases	Company
4535	ANTERO RESOURCES	55	HG ENERGY
1992	EQT PROD	40	ECLIPSE RESOURCES
1103	EQUINOR ONSHORE PROPERTIES	32	TUG HILL
995	ASCENT RESOURCES	22	BLUE RIDGE ROYALTIES
855	RANGE RESOURCES	18	TRIBUNE RESOURCES
425	EAP OHIO LLC	16	AMERICAN PETROLEUM PARTNERS
374	CNX GAS	13	LOLA ENERGY
356	TH EXPL	9	GREYLOCK ENERGY
272	CHEVRON	9	GULFPORT
192	SWN PROD	8	DC PETROLEUM INC
		8	XTO

Top 20 Lessees by County



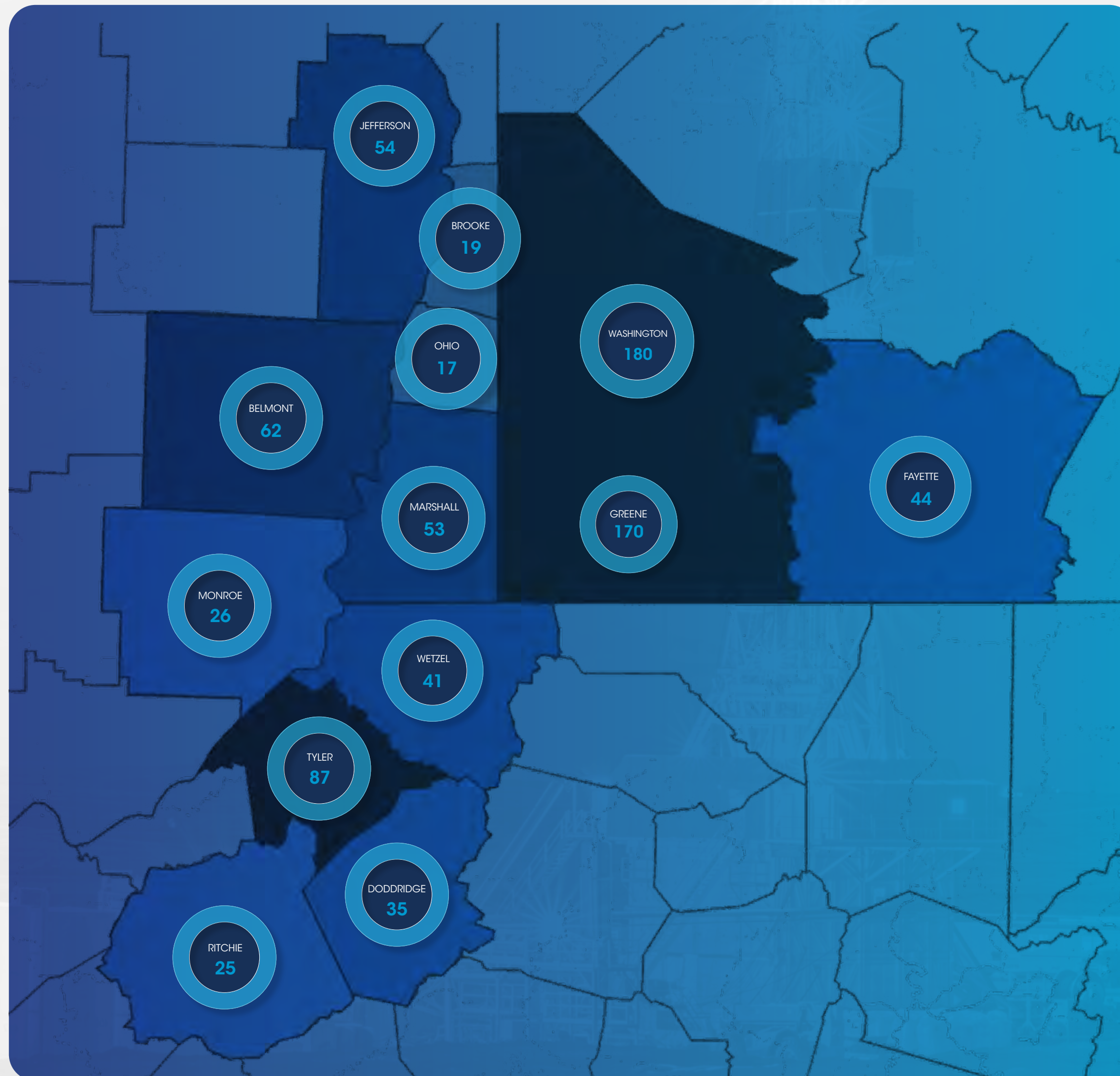
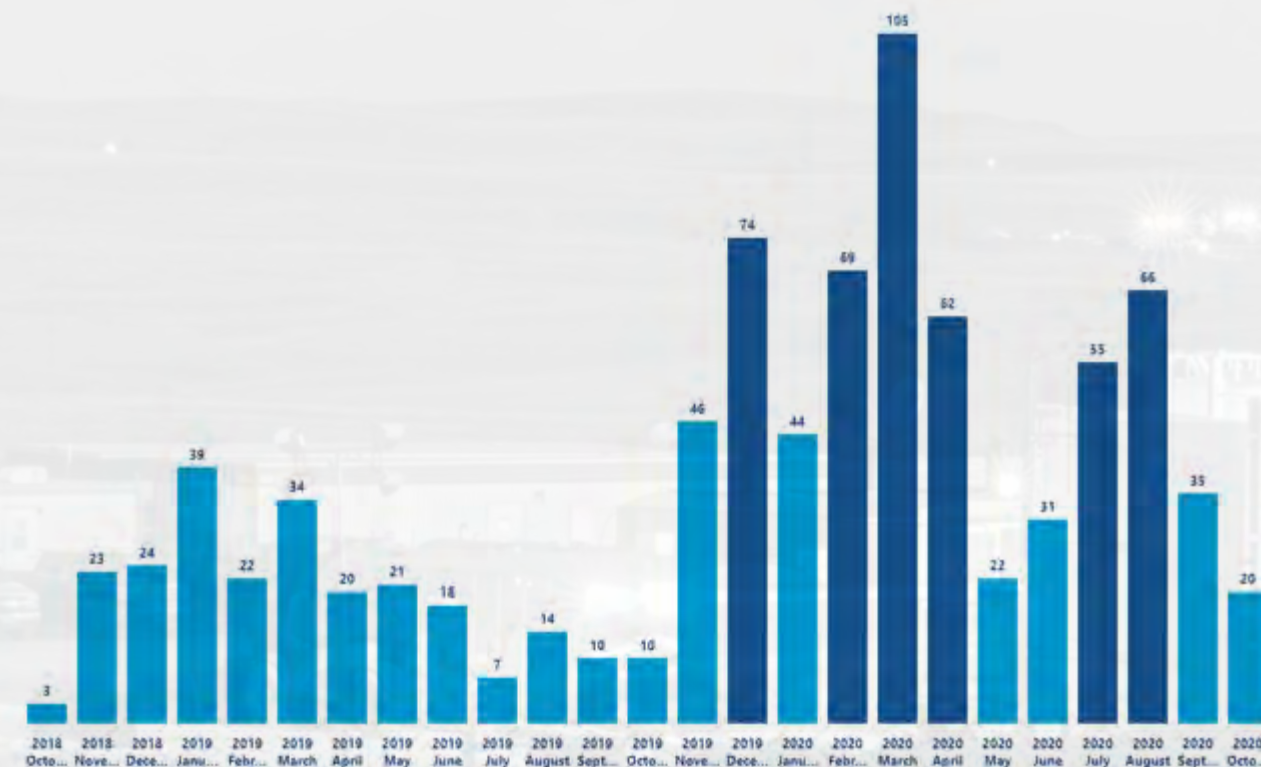


PERMIT ACTIVITY

Where Are The Permits?

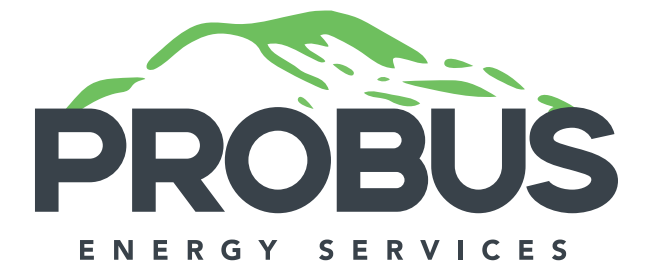
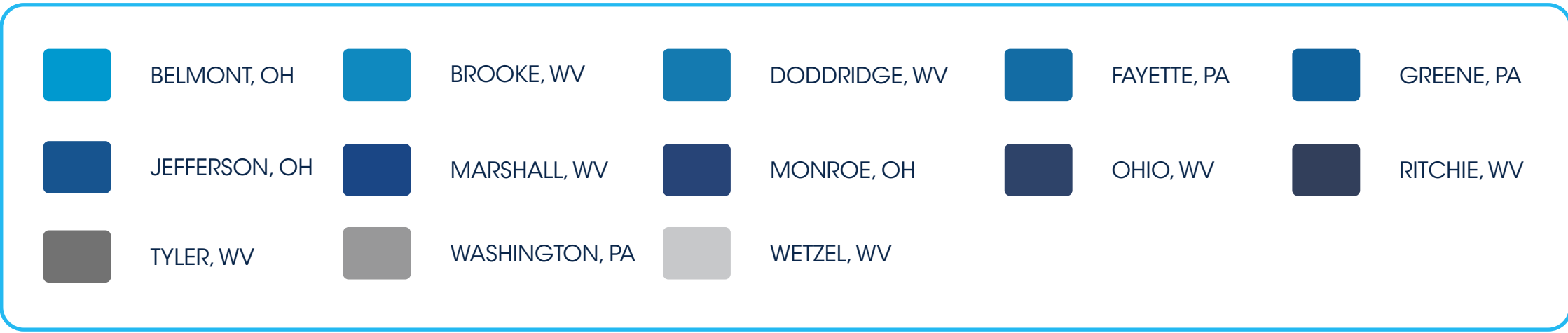
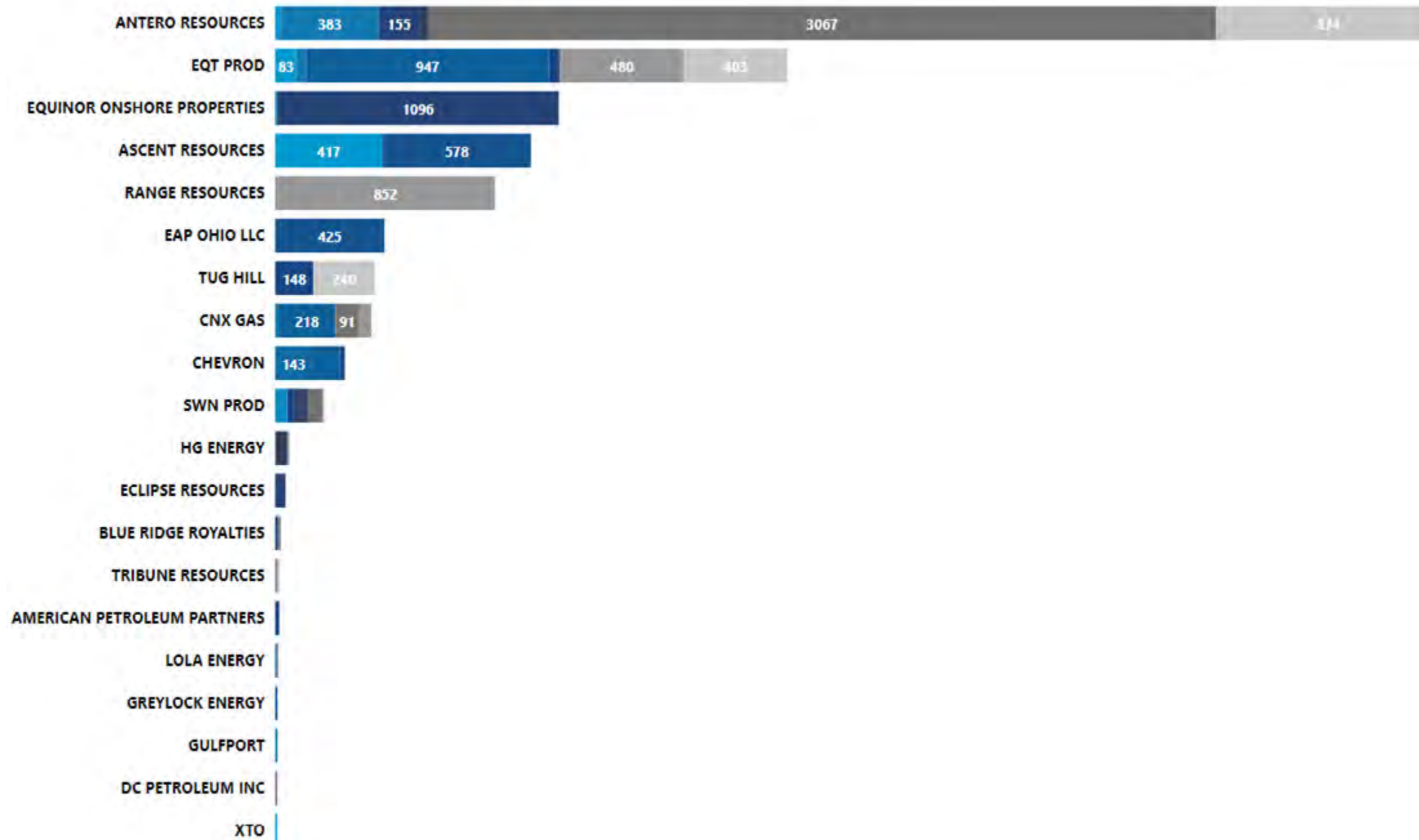
Washington County, Pennsylvania leads the liquids rich region of the Appalachian Basin for most permits with 180 active permits. Greene, Pennsylvania follows with 170. Following these top two counties, things drop off significantly. Tyler, West Virginia comes next with 87, followed by Belmont, Ohio (62) and Jefferson, Ohio (54).

These permit numbers are lower than we see in other basins. However, new permits are on the rise along with a renewed interest in natural gas. The first quarter of 2020 saw a peak high with 218 permit approvals, with sustained activity in the second (111) and third (150) quarters.



Top 20 Companies

Operators in the Appalachian Basin form a small, exclusive group of predominantly pure play operators. The bar chart shows the top 20 operators with the most active permits in the basin. The operator with the most permits is EQT with 206 permits. EQT is primarily concentrated in Pennsylvania with 114 permits in Greene County and 48 in Washington. Range Resources follows with 120 permits, all in Washington County, Pennsylvania, accounting for 61% of the total permits in the county. Antero Resources comes next with 90 permits across four counties, with the majority (61) in Tyler County, West Virginia. CNX currently has 59 permits in the basin and Ascent Resources Utica wraps up the top five companies with 54 active permits.

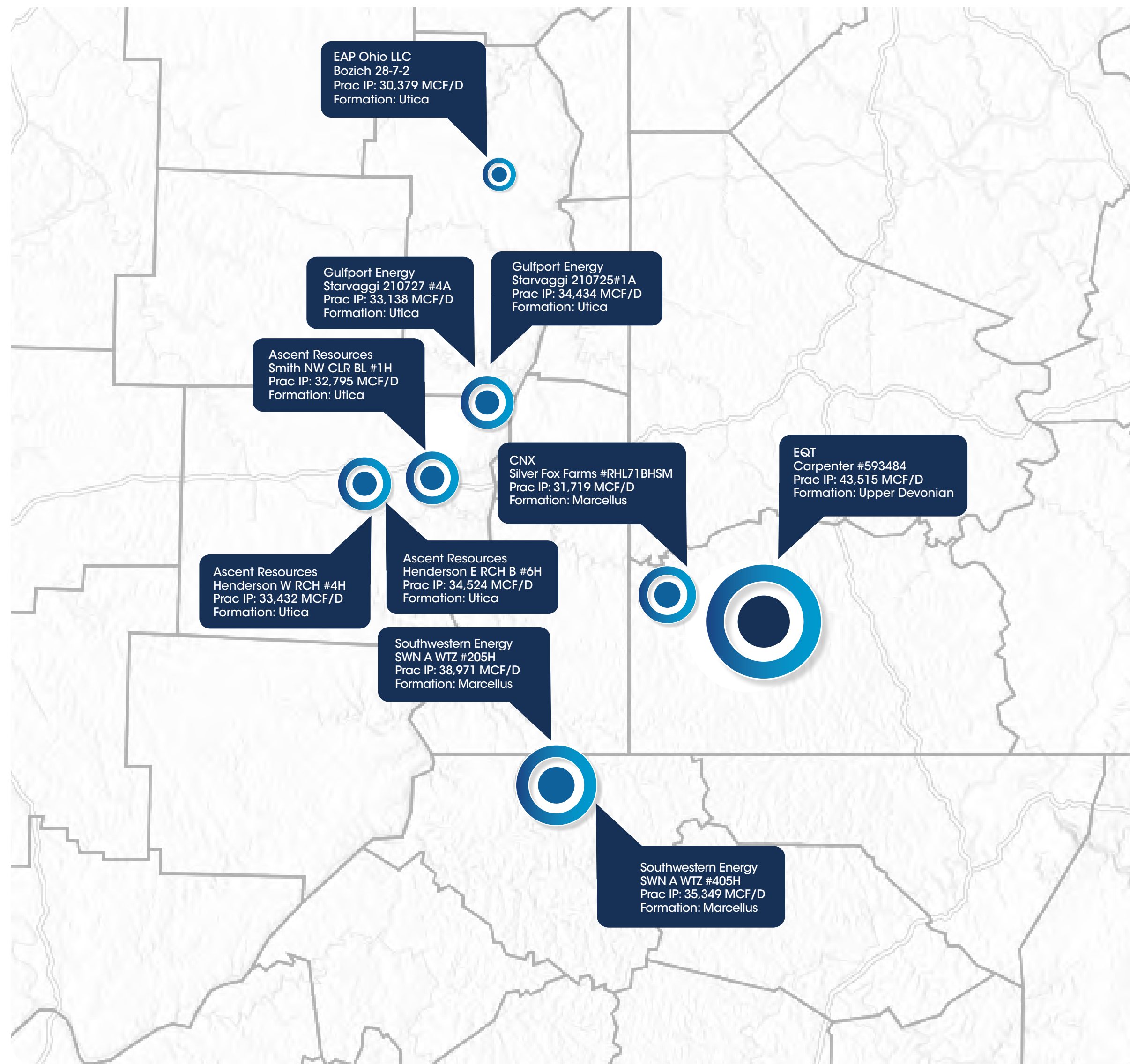




COMPLETIONS

Top 10 Wells

Congratulations to these companies for their astounding well results! EQT's Carpenter Well in Greene County, Pennsylvania led the pack with a second month production rate of 43,515 Mcf per day. CNX and Southwestern showed strong Marcellus well results while Ascent, Gulfport and EAP are masters of the Utica.



PRODUCTION

Production By County

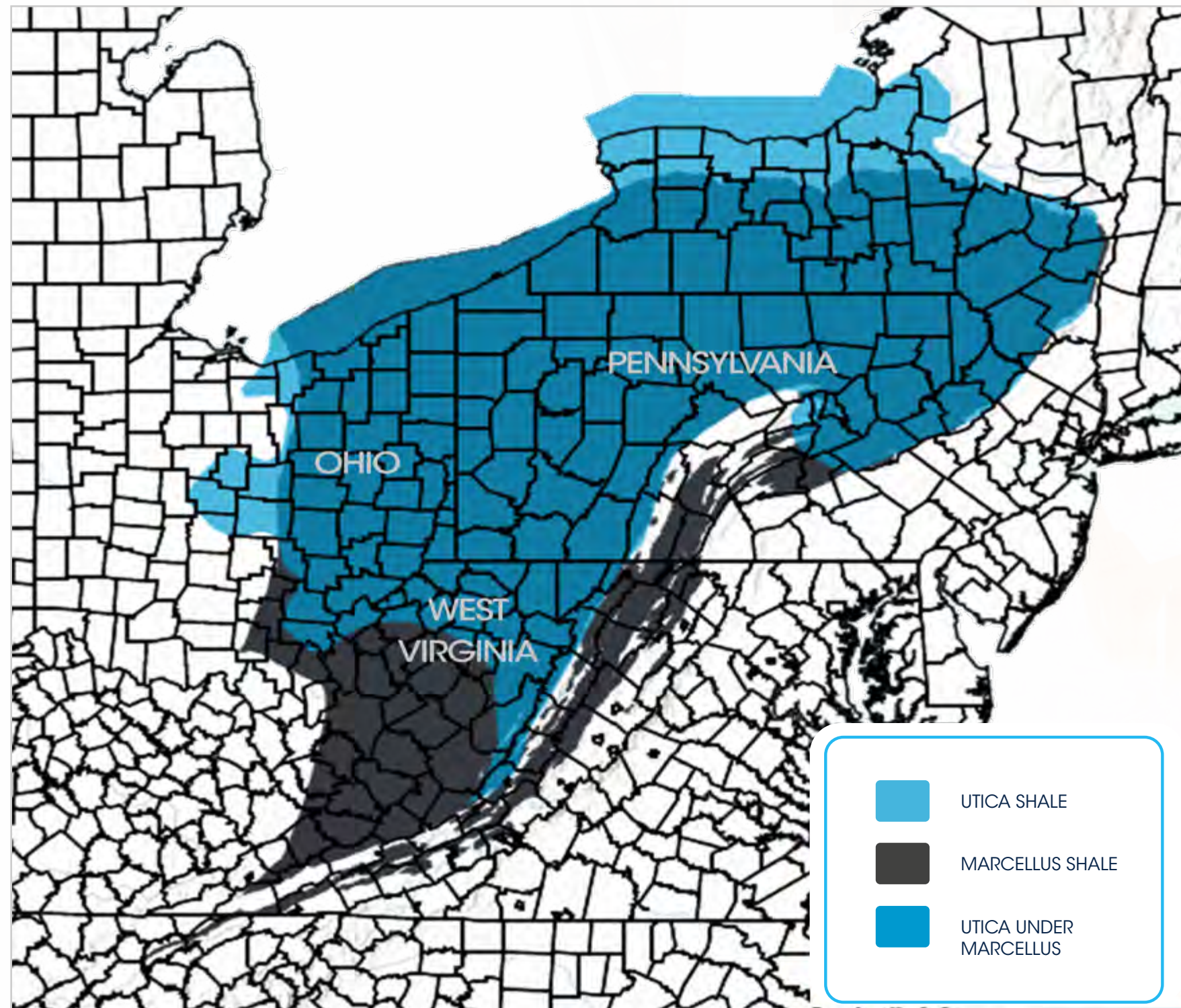
Southwestern Pennsylvania leads the way with the highest natural gas production over the past year. Washington County had the most with 1,191.8 MMcf produced, followed by Greene County with 1,070.3 MMcf. Moving over to Ohio, Belmont County showed the third highest gas production with 901.2 MMcf, then Jefferson County with 543.7 MMcf and Monroe County with 522.9 MMcf. County size plays a role in these ranking for this region. An example of this is seen with the overall size of Washington County (861 mi²) being more than three times the size of Tyler County, West Virginia (261 mi²). Tyler County had 492.4 MMcf of natural gas production in the past year. However, normalizing by square mile, Tyler County produces 0.5MMcf more natural gas than Washington County.



■ 1191820698 WASHINGTON, PA	■ 492390950 TYLER, WV	■ 121026264 OHIO, WV
■ 1070275933 GREENE, PA	■ 395287820 MARSHALL, WV	■ 78470056 BROOKE, WV
■ 901164856 BELMONT, OH	■ 376682888 DODDRIDGE, WV	■ 76611124 FAYETTE, PA
■ 543717339 JEFFERSON, OH	■ 278135329 RITCHIE, WV	
■ 522873442 MONROE, OH	■ 200652884 WETZEL, WV	

Formation Distinctions

Formation Structure



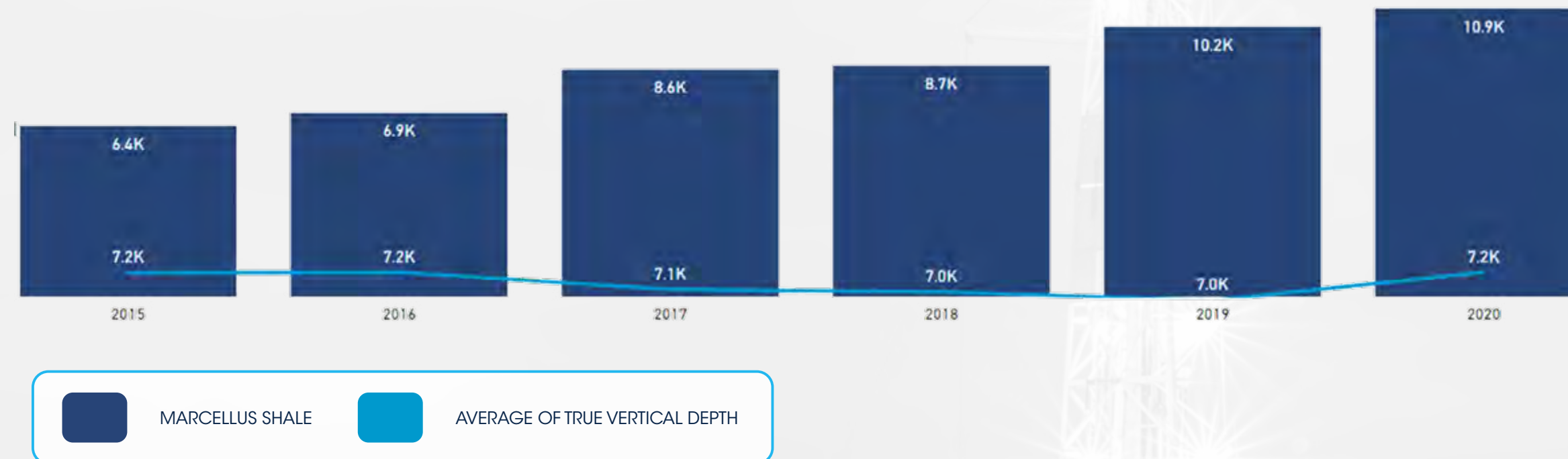
Regional Stratigraphy

MISSISSIPPIAN	POTTSVILLE GROUP
	MAUCH CHUNK GROUP
	GREENBRIAR LIMESTONE
	POCONO GROUP
DEVONIAN	OHIO SHALE
	GENESEE / SONYEA / WEST FALLS
	TULLY LIMESTONE
	HAMILTON GROUP
	MARCELLUS SHALE
	ONONDAGA FORMATION
	BOIS BLANC FORMATION / HUNTERSVILLE
	RIDGELEY SANDSTONE
	HELDERBERG GROUP
SILURIAN	BASS ISLANDS DOLOMITE / KEYSER
	SALINA GROUP
	LOCKPORT DOLOMITE AND MCKENIE
	CLINTON GROUP
	MEDINA GROUP / TUSCARORA FORMATION
ORDOVICIAN	QUEENSTON SHALE / OSWEGO FORMATION
	REEDSVILLE SHALE
	UTICA SHALE
	TRENTON / BLACK RIVER LIMESTONE
CAMBRIAN	LOYSBURG FORMATION
	BEEKMANTOWN GROUP
	ROSE RUN SANDSTONE
	COPPER RIDGE DOLOMITE

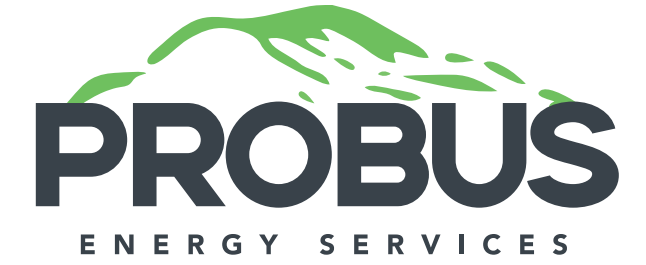
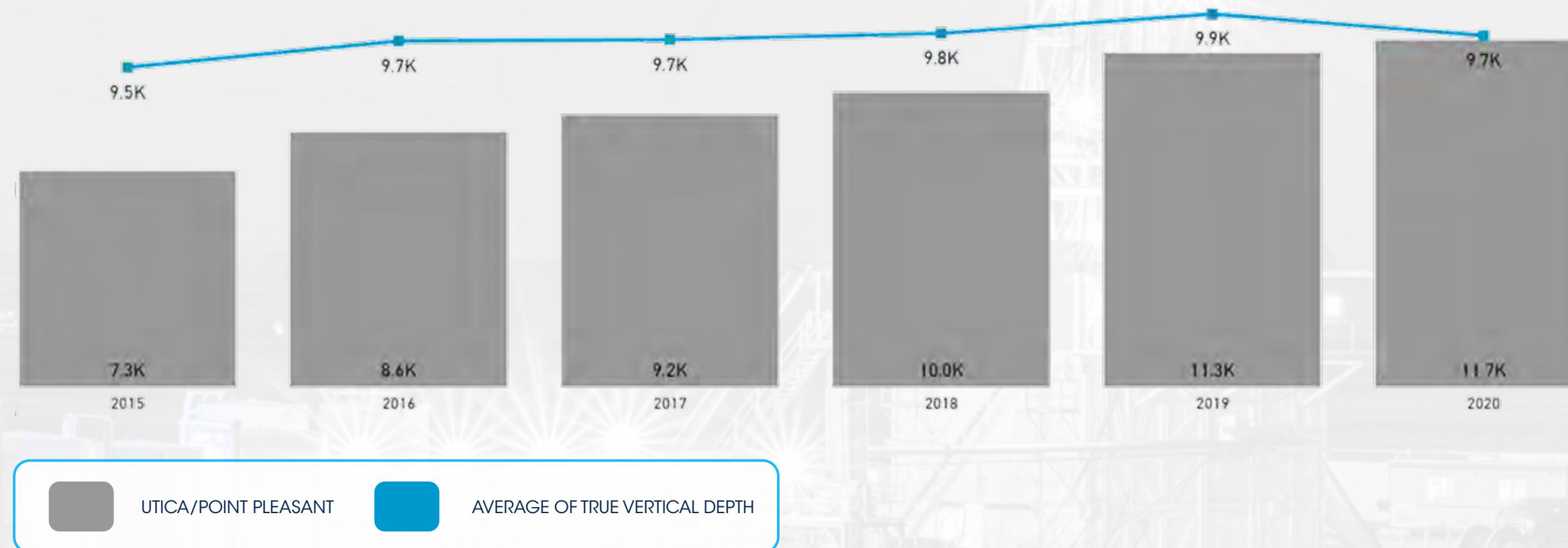
Formation Distinctions

This region of the Appalachian Basin is unique because of the multiple stacked pay opportunities. There are distinct differences between the Utica Shale, Marcellus Shale and Upper Devonian including well costs, type curves, natural gas liquids ratios, depths, completion design and lateral length. On average, wells for both the Marcellus and Utica have been increasing in lateral length over the past five years. There has been a 68% increase in lateral length in the Marcellus from 2015-2020 and a 61% increase in the Utica. In 2020, the average lateral length for a Marcellus well was 10,877 feet while the Utica average was 11,734 feet. In addition, the Utica wells in 2020 have been, on average, 2,531 feet deeper (vertical length) than Marcellus wells. All wells are not created equal and this is especially important to keep in mind as we continue our high-level overview of the basin.

Marcellus Average Well Lateral Length and Vertical Depth

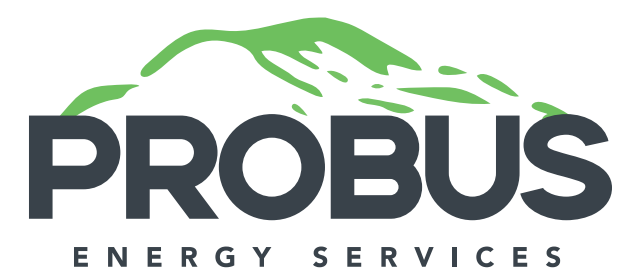
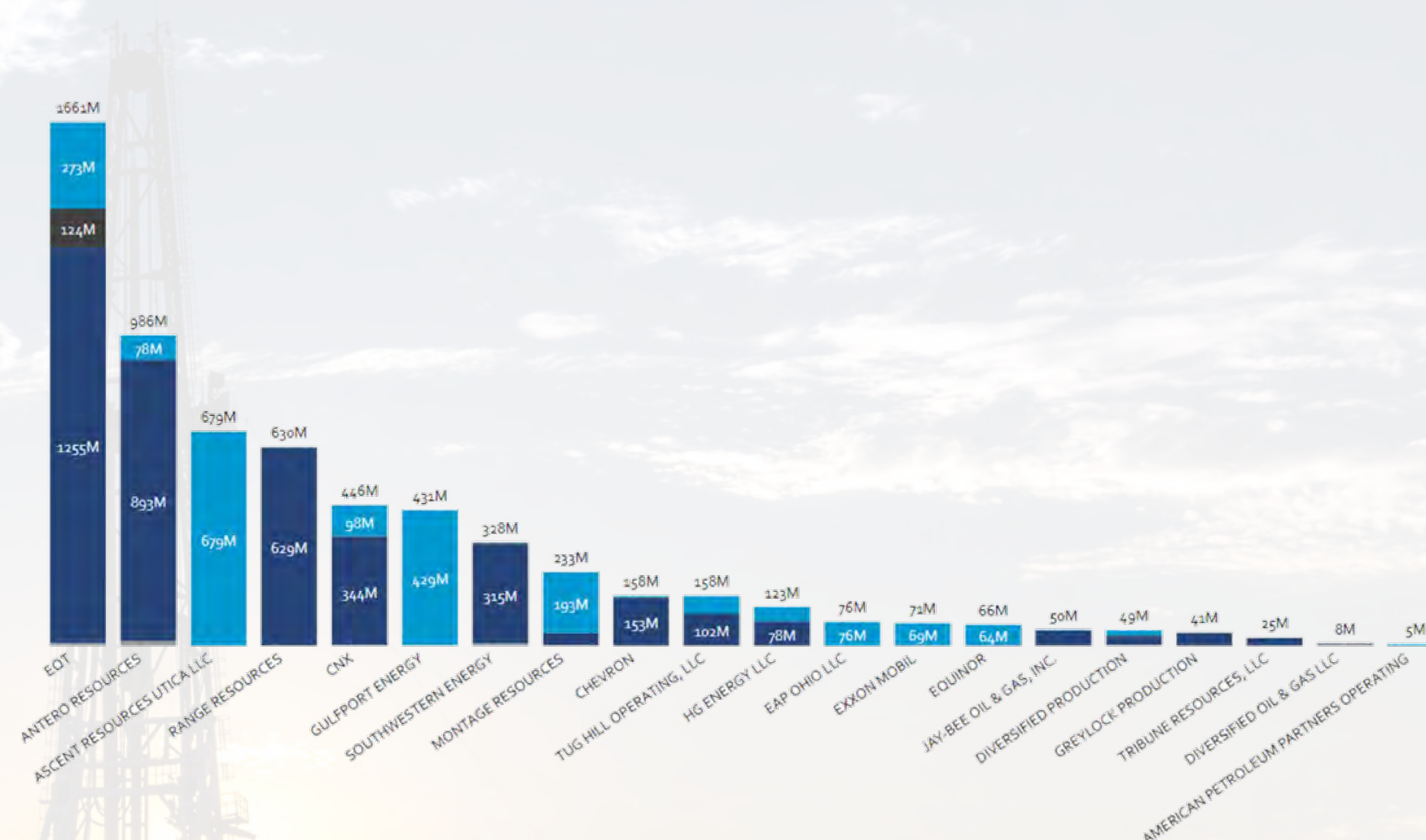


Utica Average Well Lateral Length and Vertical Depth



TOP 20 OPERATORS

The Top 20 Operators with the most natural gas production over the past year are shown on the graph, with the production from the most economic and formations. Since the takeover of EQT by the Rice team, EQT has dominated this region of the Appalachian Basin. The Marcellus operator produced a total of 1.66 Bcf during the past year, the majority of their production coming from the Marcellus Shale. Antero Resources comes next with 986 MMcf of natural gas produced, followed by Utica operator, Ascent Resources Utica (679 MMcf) and Range Resources (630 MMcf). It will be interesting to see if the return to favor of natural gas will bring new operators to this prolific basin.



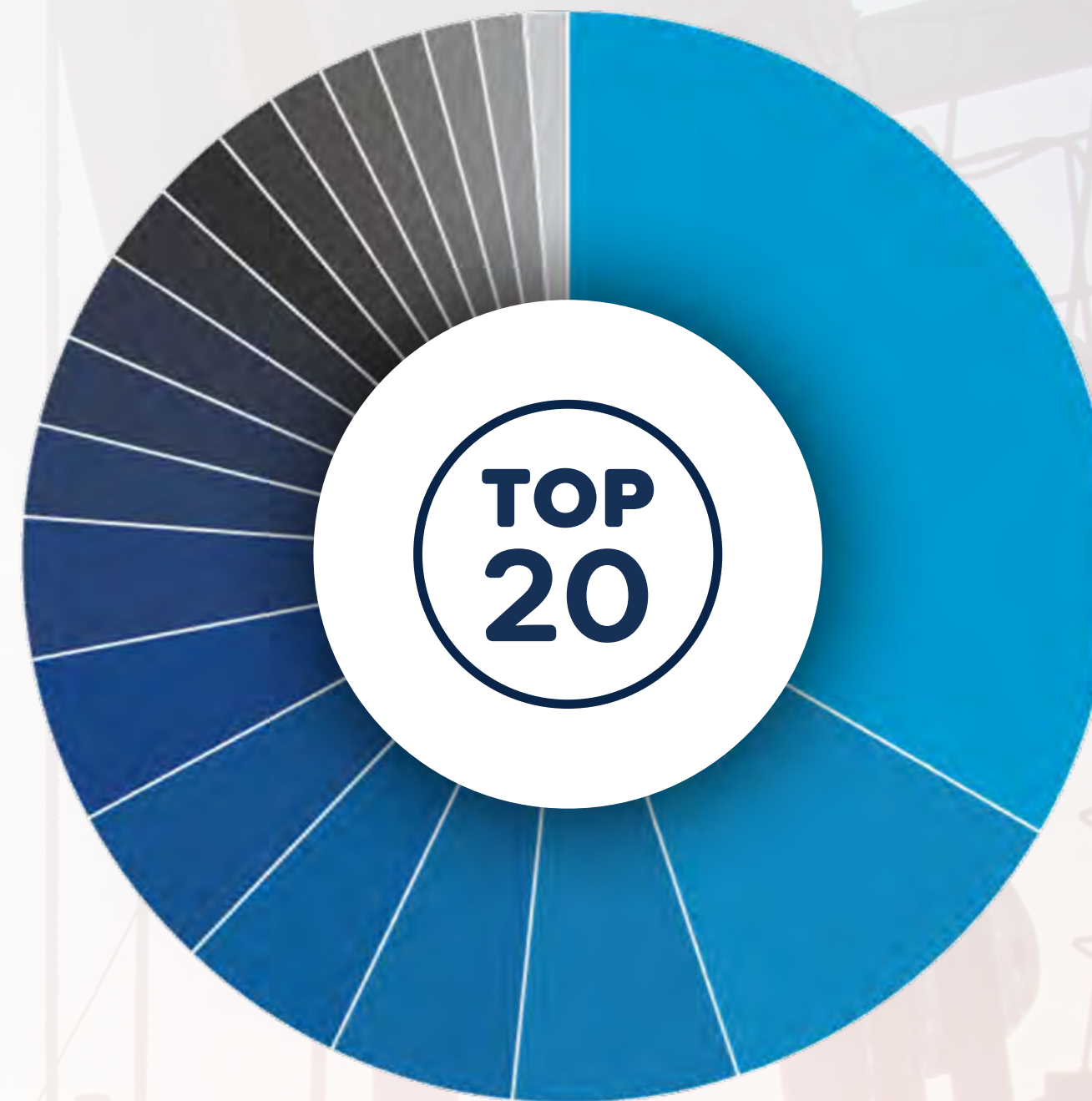



MINERALS

Top 20 Mineral Buyers

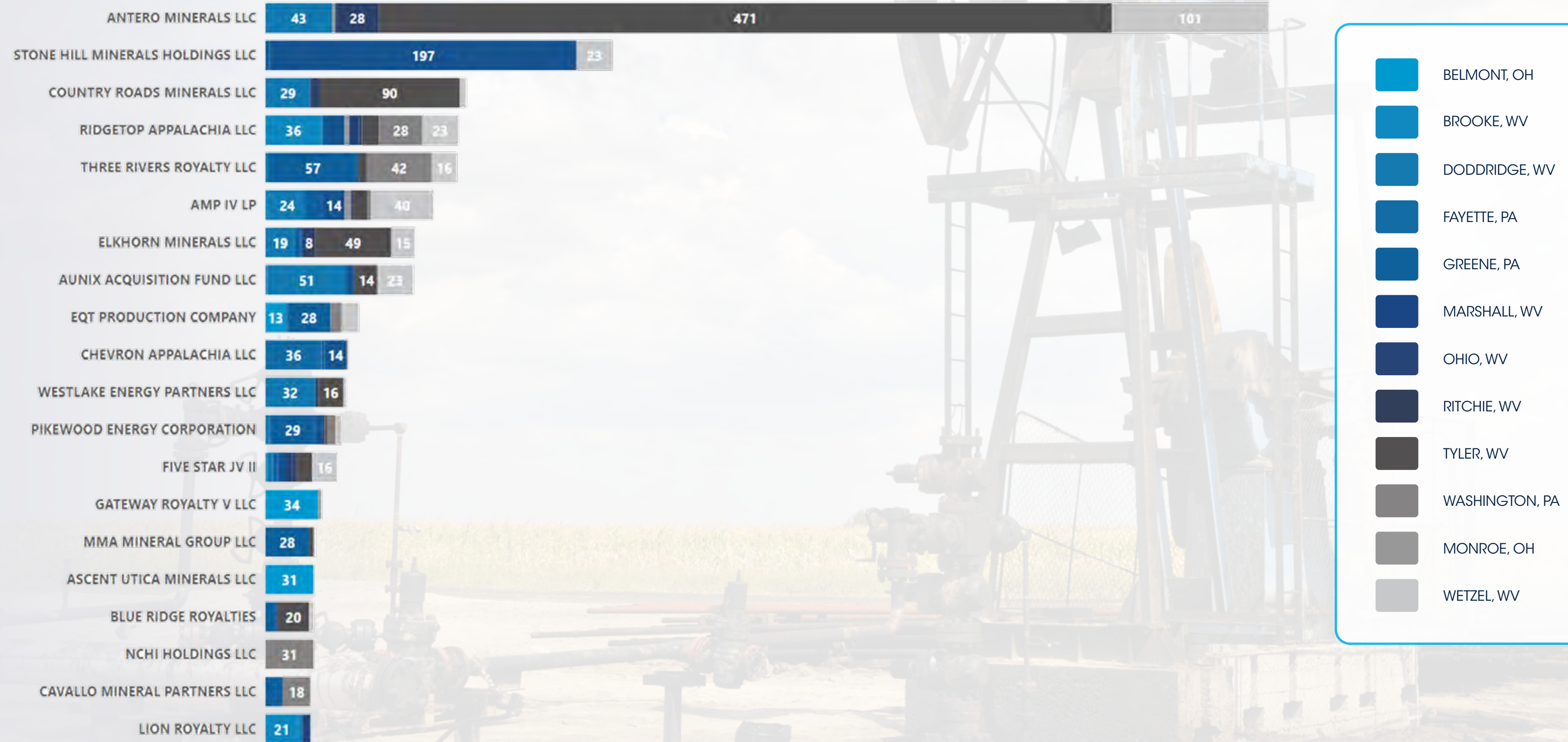
The mineral landscape in this region of the Appalachian Basin is unique with record numbers of buyers exclusive to the region. We also see a band of operator subsidiaries buying minerals in Appalachia, a total of five within the top 20 mineral buyers. Operator presence within mineral acquisitions is a characteristic unique to the basin, with the notable exception of Diamondback/Viper in the Permian.

The top 20 mineral buyers have been determined by the number of mineral transactions filed within the past year. Leading the way is Antero Minerals, with 645 mineral transactions, a number far and above the nearest competitor. The majority (471, 73%) of Antero's acquisitions were in Tyler County, West Virginia. Upping their stake in the liquids-rich region of the Marcellus Shale, Antero had 101 acquisitions in Wetzel County and 43 in both Doddridge County and Ritchie County. Next, comes another operator subsidiary, Stone Hill Minerals with 223 transactions. Stone Hill's primary target was Marshall County with 197 acquisitions there. Country Road Minerals follows with 129 transactions, then Ridgetop Appalachia (124) and Three Rivers Royalty (123).



	645	ANTERO MINERALS LLC		52	WESTLAKE ENERGY PARTNERS LLC
	223	STONE HILL MINERALS HOLDINGS LLC		49	PIKEWOOD ENERGY CORPORATION
	129	COUNTRY ROADS MINERALS LLC		46	FIVE STAR JV II
	124	RIDGETOP APPALACHIA LLC		36	GATEWAY ROYALTY V LLC
	123	THREE RIVERS ROYALTY LLC		32	MMA MINERAL GROUP LLC
	108	AMP IV LP		31	ASCENT UTICA MINERALS LLC
	96	ELKHORN MINERALS LLC		31	BLUE RIDGE ROYALTIES
	95	AUNIX ACQUISITION FUND LLC		31	NCHI HOLDINGS LLC
	60	EQT PRODUCTION COMPANY		29	CAVALLO MINERAL PARTNERS LLC
	53	CHEVRON APPALACHIA LLC		29	LION ROYALTY LLC

Where they Bought



Peregrine Energy Partners focuses exclusively on producing oil and gas royalties and works directly with mineral owners as well as local land professionals in multiple basins across the country. The Texas-based royalty buyer has been actively acquiring in the Marcellus Shale as well as across the country since the company's inception. Over the past 16 years, the company's founders have enjoyed working with hundreds of mineral owners in 30 states across millions of acres.

We were able to visit with **Co-Founder and Managing Director, CJ Tibbs** and **Managing Director Josh Prier**, regarding the Appalachian Basin and the future of the minerals space.

Q: What is it about natural gas that makes it an attractive asset for a mineral buyer?

A: In general, our goal is to maintain a balanced portfolio of oil and gas. After several high quality, long term oil acquisitions we are regaining that balance with near term focus on gas. We do feel as though gas went through the consolidation period that it looks like oil is going thru now, so we like the potential upside story with natural gas.

Q: Is it attractive to buy right now in Appalachia because of the ability to lock in hedges on future gas prices?

A: We don't lock in hedges on the properties we buy, again because we feel as though fundamentally- we're at or near the bottom for gas prices and want the exposure to be able to float up with the market.

Q: What has Peregrine done over the past year to weather the double black swan events of the OPEC / Russian price war and the demand collapse caused by COVID-19?

A: We've focused a bit more on natural gas this year, with 25 of our 30 acquisitions being representative of that product. We've also continued to do the little things well that helped us grow our business. We're transparent, we talk to our clients about their options and what's best for their families. We've paid a fair price and moved quickly alongside our clients. The benefits of doing things the right way have really paid off for us in an otherwise challenging year.

Q: How is Peregrine going to take advantage of the opportunities that arise in 2021?

A: We're going to continue looking for opportunities to help royalty owners better understand the nature of their properties, and the various options around them.

Q: How is Peregrine preparing now for future opportunities?

A: For many of the owners we work with, the decision to monetize is a once-in-a-lifetime transaction, and therefore the conversation has to be on their terms, with professionals they can trust. We're currently ramping up not only our internal staff, but also our efforts to gather vast amounts of owner data to reach as many royalty owners as possible next year. Those two factors can be a laborious and expensive exercise, but we are willing to invest the time in those relationships to ensure Peregrine is the group they choose to work with when they're ready.

Q: Under a Biden Administration, are you concerned about restrictions on future Midstream infrastructure expansion in Appalachia?

A: Yes. We are watching that closely. We've already pipelines. For example, the lawsuit filed by Governor Whitmer against Enbridge. Rumors also have a Biden administration targeting the Dakota Access Pipeline as well. This would be devastating to energy consumers, mineral owners, and the operators.

Q: Looking back over the past year, what are the key takeaways and/or things you've learned as an organization?

A: There are benefits to being able to pivot quickly in the oil and gas space.

Our commitment to working efficiently and to being transparent for our royalty owners is an enormous value-add when dealing with an intangible asset. Not all assets are created equally. While there's been capital destruction on the oil side of our industry, natural gas has provided a welcome port in the storm.

Q: What does the minerals space look like in 5 years? 20 years?

A: If you are a mineral owner with producing assets, we feel you are in good position. It is the ownership of undeveloped acreage, and the timing or incentive for an operator to spend additional CAPEX that concerns us. If you are a mineral buyer, things are going to get more difficult as time goes on.

Q: What are the pros and cons of buying nature gas minerals in Appalachia vs other gas basins like the Barnett, Haynesville and Piceance?

A: Appalachia has solid predictable producing wells with well capitalized Operators.

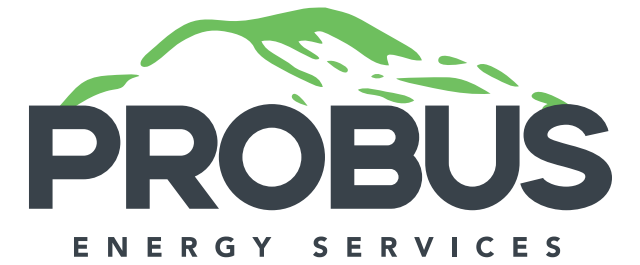
Conversely, Operators deductions in Appalachia tend to be less predictable and much higher. This has been litigated out in other basins and has been kept to more reasonable levels. At the same time, we evaluate and purchase natural gas RI/ORRI in Basins nationwide, as we're somewhat agnostic in where we'll work.



Peregrine Energy Partners has been acquiring large mineral packages in the Appalachian Basin during the past year. Here are some of the transaction highlights:

- **November 2020:** Peregrine acquired 2,995 NMA across 36 counties in the Appalachian Basin
- **October 2020:** Peregrine acquired 4,755 gross acres in Bradford County, Pennsylvania

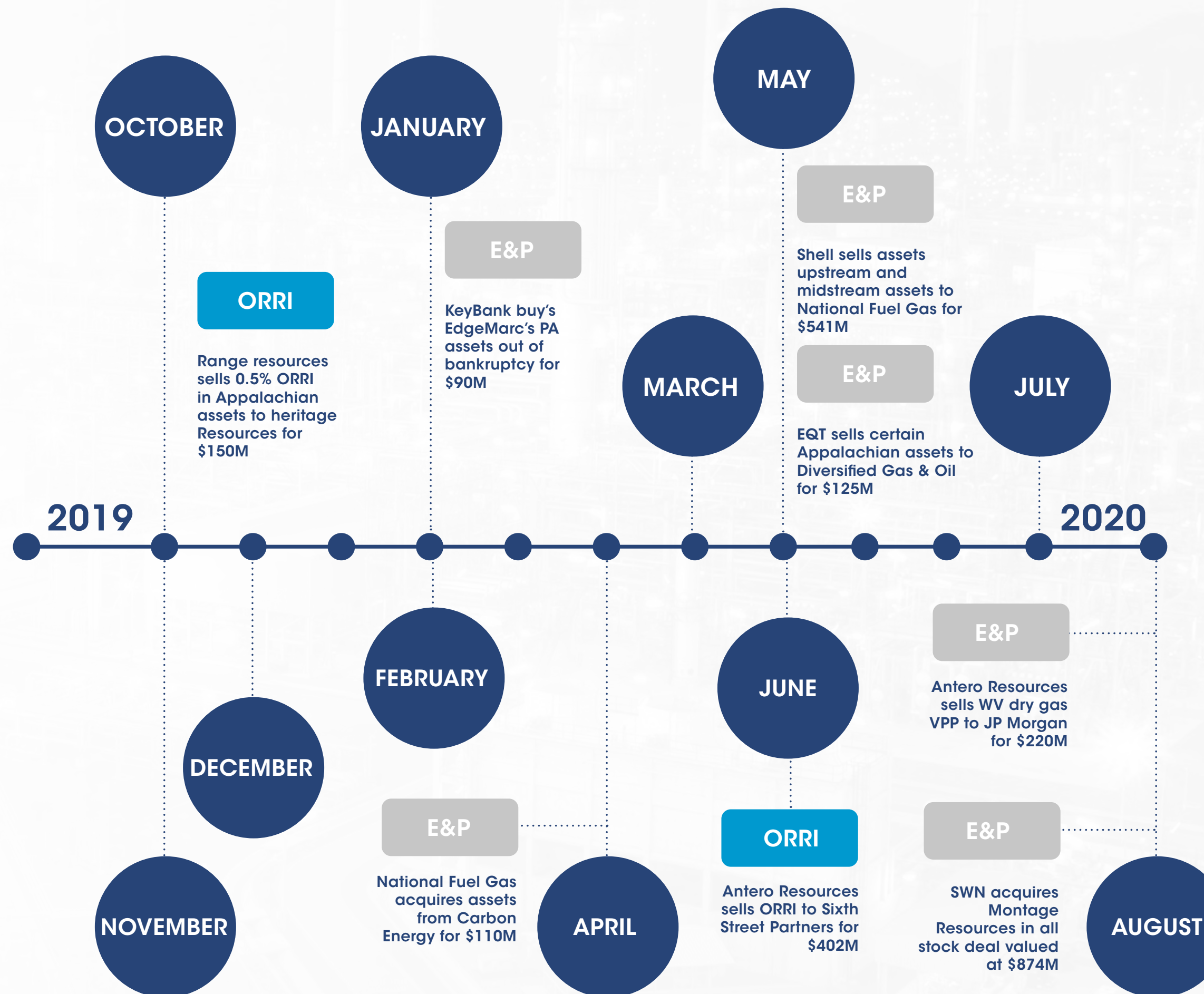
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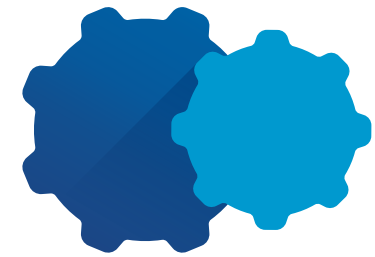
A&D LOOK

The past year in, well, life has been challenging. The silver lining has been the upsurge in acquisitions, divestitures, and mergers. With valuations down, all stock mergers have been on the rise. Specific to the Appalachian Basin, 2020's unique COVID oil demand collapse and international oil price war was favorable for the former red headed stepchild of the industry, natural gas.

Last fall, Range Resources sold certain overriding royalty packages, monetizing assets to improve their balance sheet without altering production. In January, KeyBank made a successful bid for EdgeMarc's Pennsylvania assets out of bankruptcy. KeyBank was the secured lender under EdgeMarc's DIP credit facility, financing drilling and exploration activities in the "stacked" liquids-rich Marcellus shale in Pennsylvania and dry gas Utica shale in Ohio. Prior to the sale, EdgeMarc controlled contiguous positions of approximately 45,000 net acres across Ohio and Pennsylvania. In June, Antero followed in Range's footsteps, monetizing \$402M worth of ORRIs. In August, the biggest deal of the year was announced, with Southwestern's acquisition of Montage Resources (the result of previous merger between Blue Ridge Mountain Resources and Eclipse Resources). The deal is an all stock transaction, valued at \$874M. Now the question becomes, who's next?



INTRODUCING



**MINERALS &
ROYALTIES
COUNCIL**

The Home of CEOs and Investors in the Minerals & Royalties Space

What is the Minerals & Royalties Council?

Since 2014, minerals & royalties has been an increasingly important part of Oil & Gas Council's network and in 2020 we officially launched the Minerals & Royalties Council.

The Minerals & Royalties Council is the industry's go to platform for thought leadership and networking in the minerals & royalties space. Through our offering of webinars, podcasts, PULSE reports, dinners, receptions, and conferences, we help executives access capital, buy/sell deals, and form new partnerships.

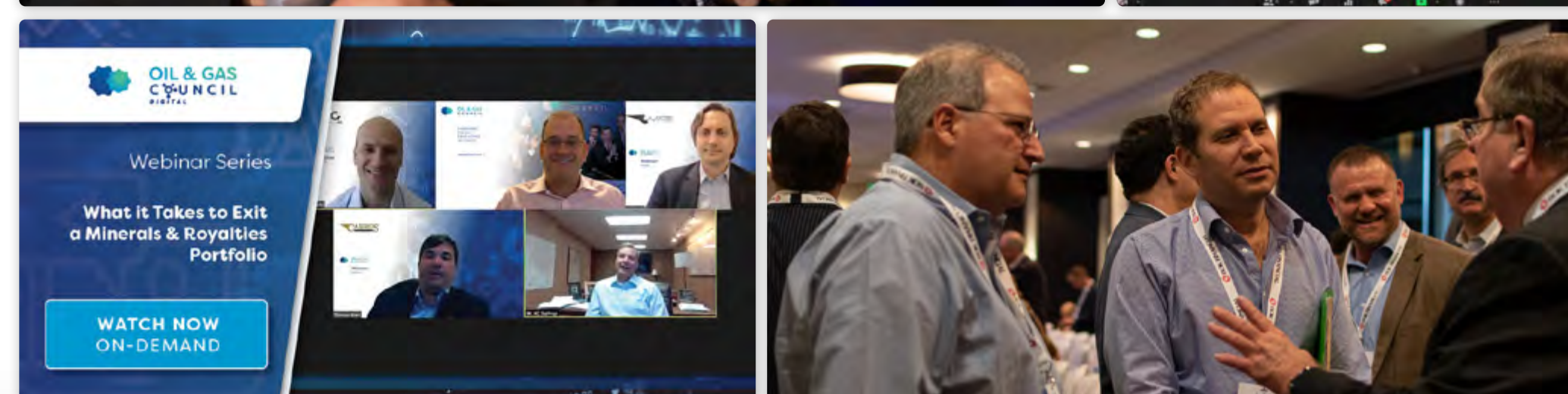
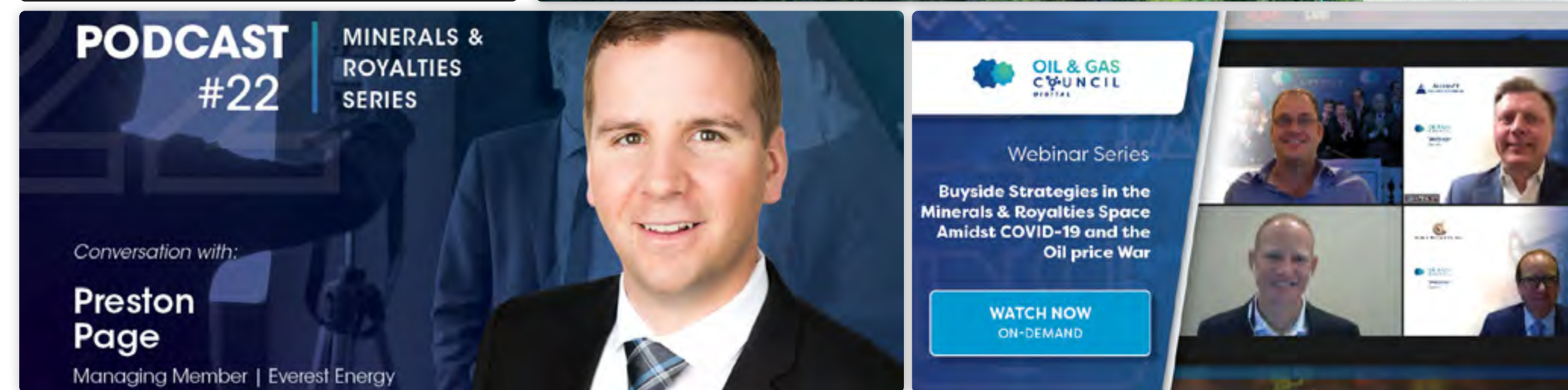
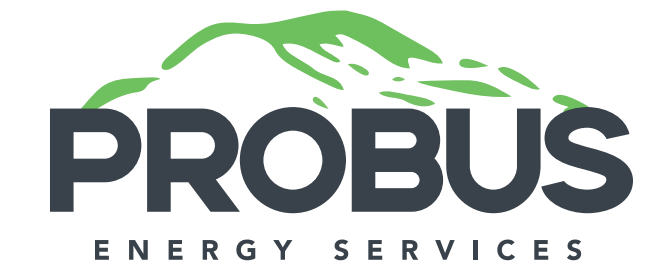


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We created the Pulse to be the perfect union and natural product of our love for data and staying informed about

what's happening in the major oil and gas basins in the United States. The Pulse is a monthly report, focused on a different basin in each edition. If there is somewhere you want to know more about, just let us know.

Probus provides actionable land intelligence, and we want to assist you in using information more efficiently. Our skilled team can support you no matter where you are at, from identifying opportunities, acquisition, asset management and strategic exits, we are by your side every step of the way. Let us help you with your next project, deliver solutions, execute effectively and reach your goals.

We love hearing from you, drop us a line and let us know what you think. Can't wait for the next edition of the Pulse? Our email subscribers get the first look, sign up on our website.

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