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Gulf coast energy outlook: traditional resources and the energy transition

AAPL/Gulf Coast Land Institute Meetings
New Orleans, LA

David E. Dismukes, Ph.D.
Center for Energy Studies
Louisiana State University

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2023 Gulf Coast Energy Outlook

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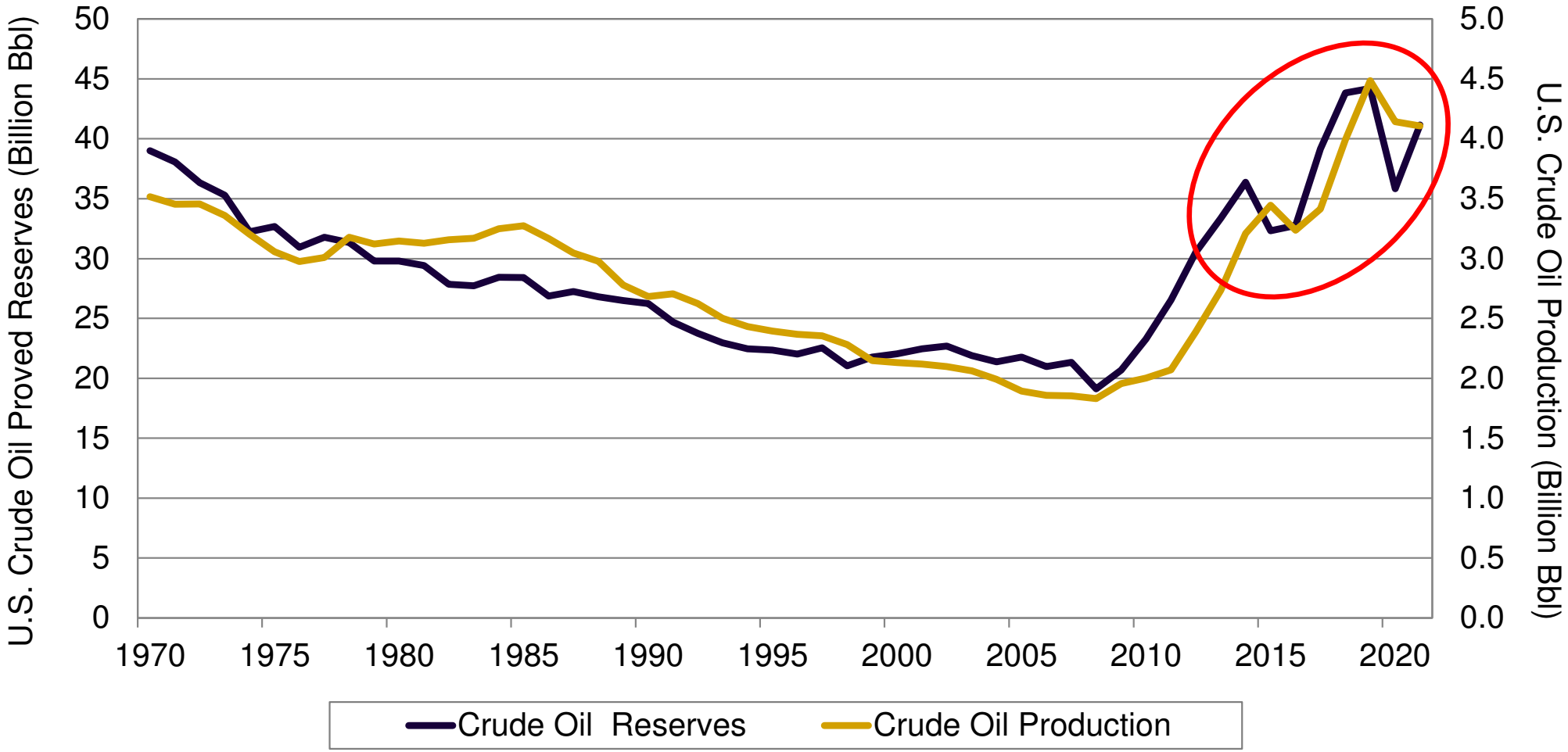
Takeaways....Opportunities and challenges.

- Three factors highly influencing gulf coast energy: **globalization; decarbonization; and politicization**.
- Crude oil and natural gas markets continuing to **"run sideways"** and are range-bound. **Considerable economic, financial and political uncertainty**.
- Unconventional basins are still productive, but **significant "pull-back" on upstream investment**. Continued work on **balance sheet improvement and ESG concerns**.
- Capital investments continue but increasingly tied to **energy transition activities.**
- **Regional renewable capacity development is surging** and will likely continue to advance.

Upstream trends

Changes in crude oil reserves and production

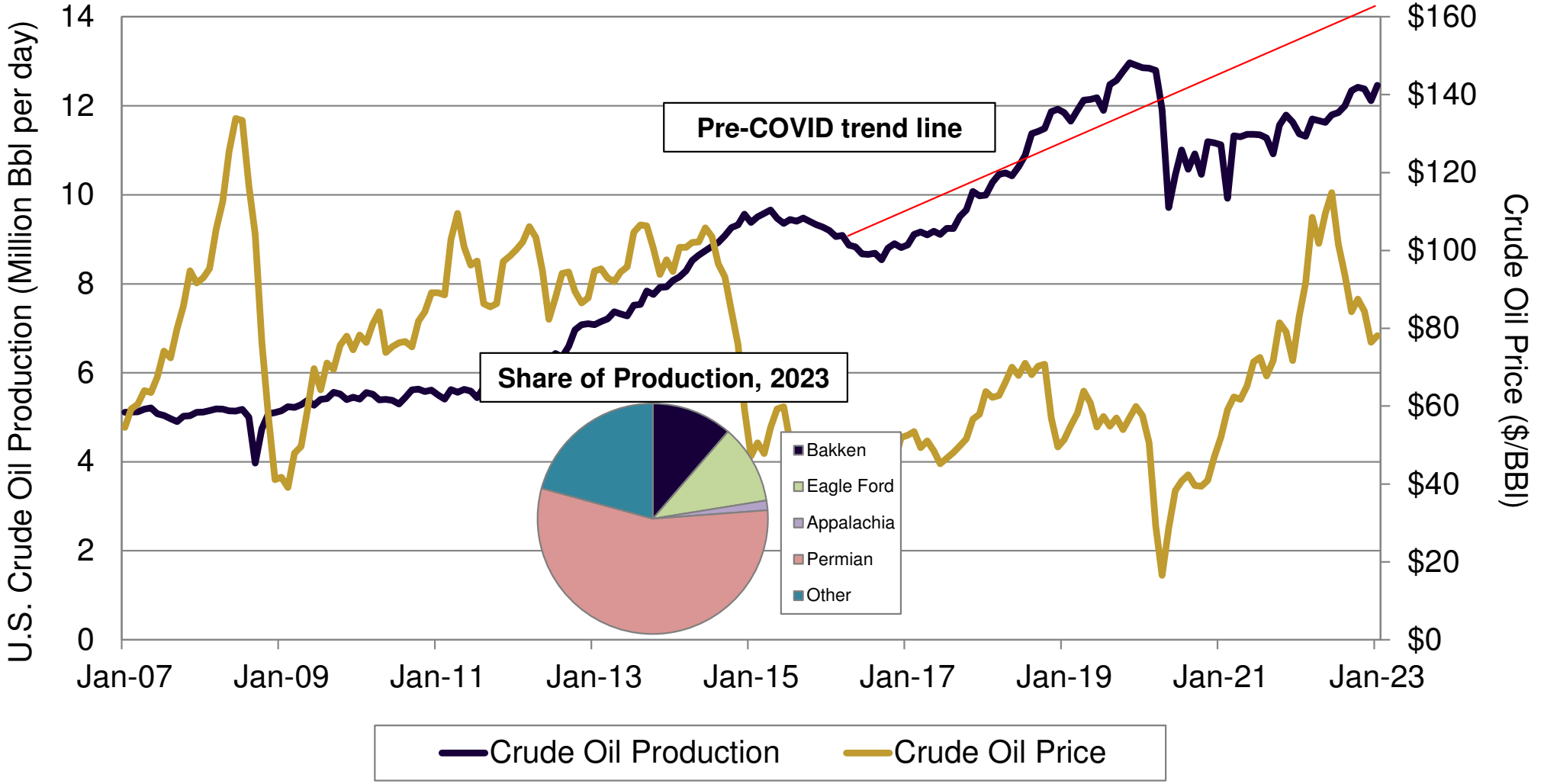
Crude oil production and reserves are climbing back to **record levels.** Creates **new domestic resource opportunities** for U.S. refineries.



Source: U.S. Energy Information Administration.

Monthly U.S. crude oil production and prices.

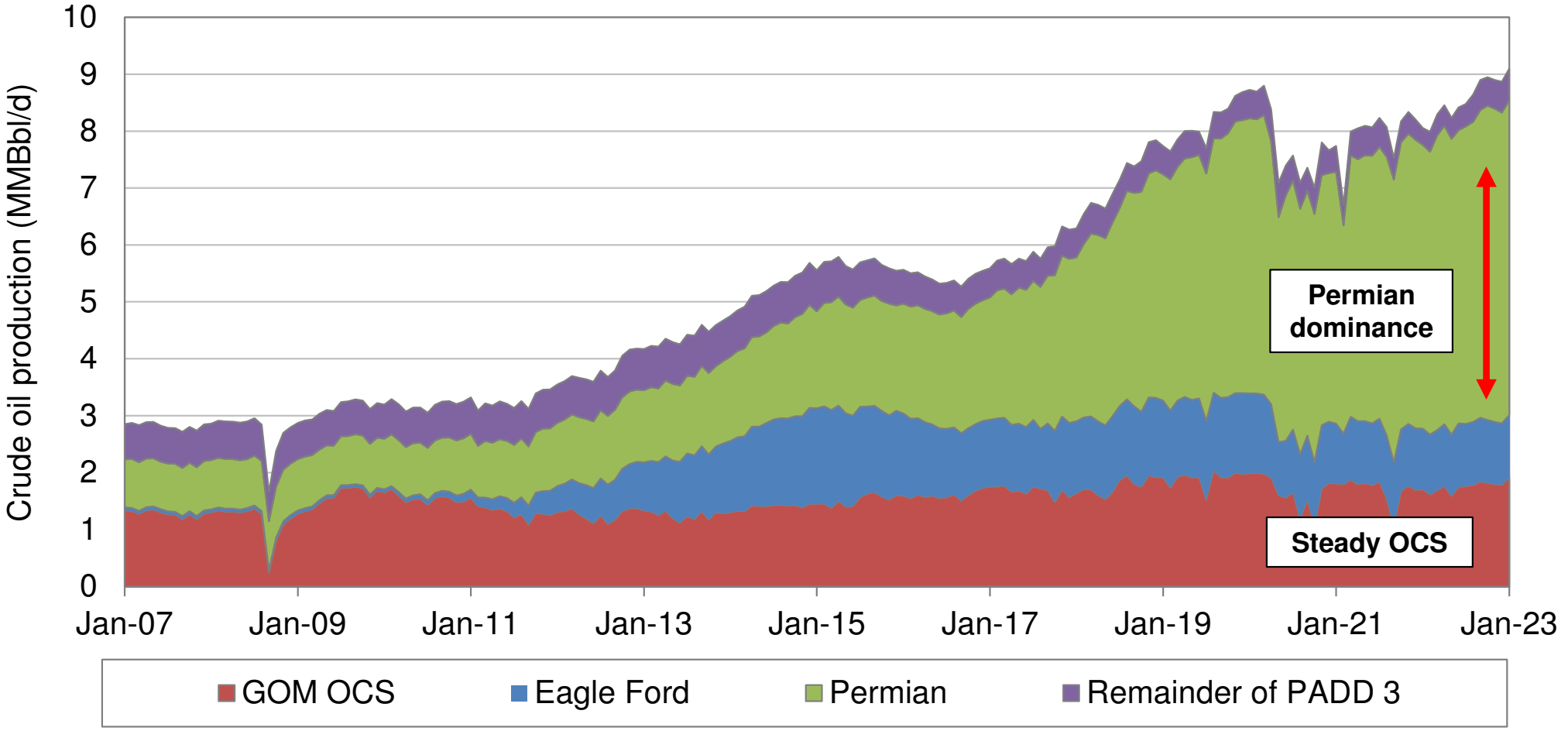
U.S. crude oil production volumes have not recovered from pre-pandemic levels. Currently about **2 MMBbl/d down**.



Source: U.S. Energy Information Administration.

Regional crude oil production by major area/play (PADD 3 only)

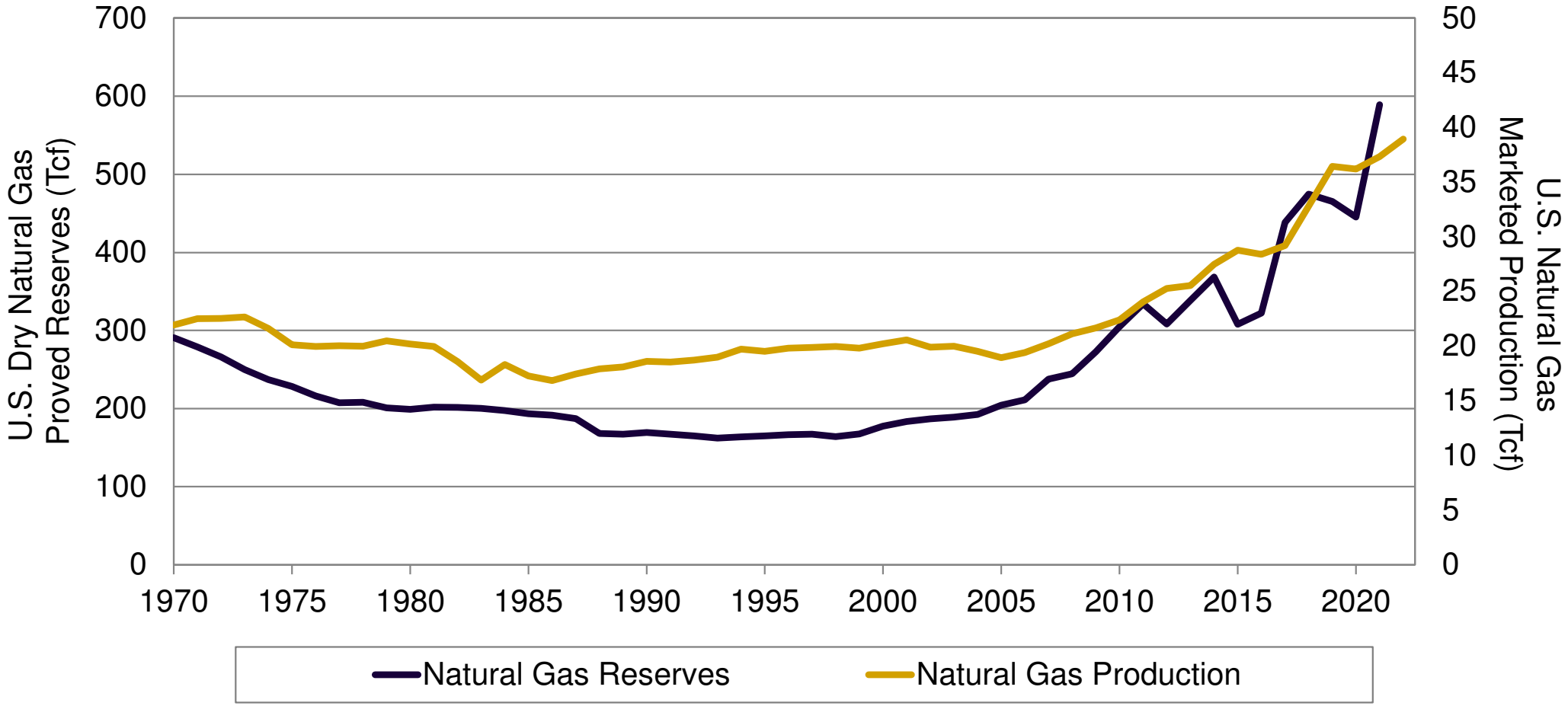
The **Permian has dominated** regional crude oil projection in recent years at over 5 **MMBbl/d**. The **OCS** continues to be a regional workhorse at 1.9 **MMBbl/d**. Eagle Ford follows closely behind at 1.1 **MMBbl/d**.



Source: U.S. Energy Information Administration.

Changes in natural gas reserves and production

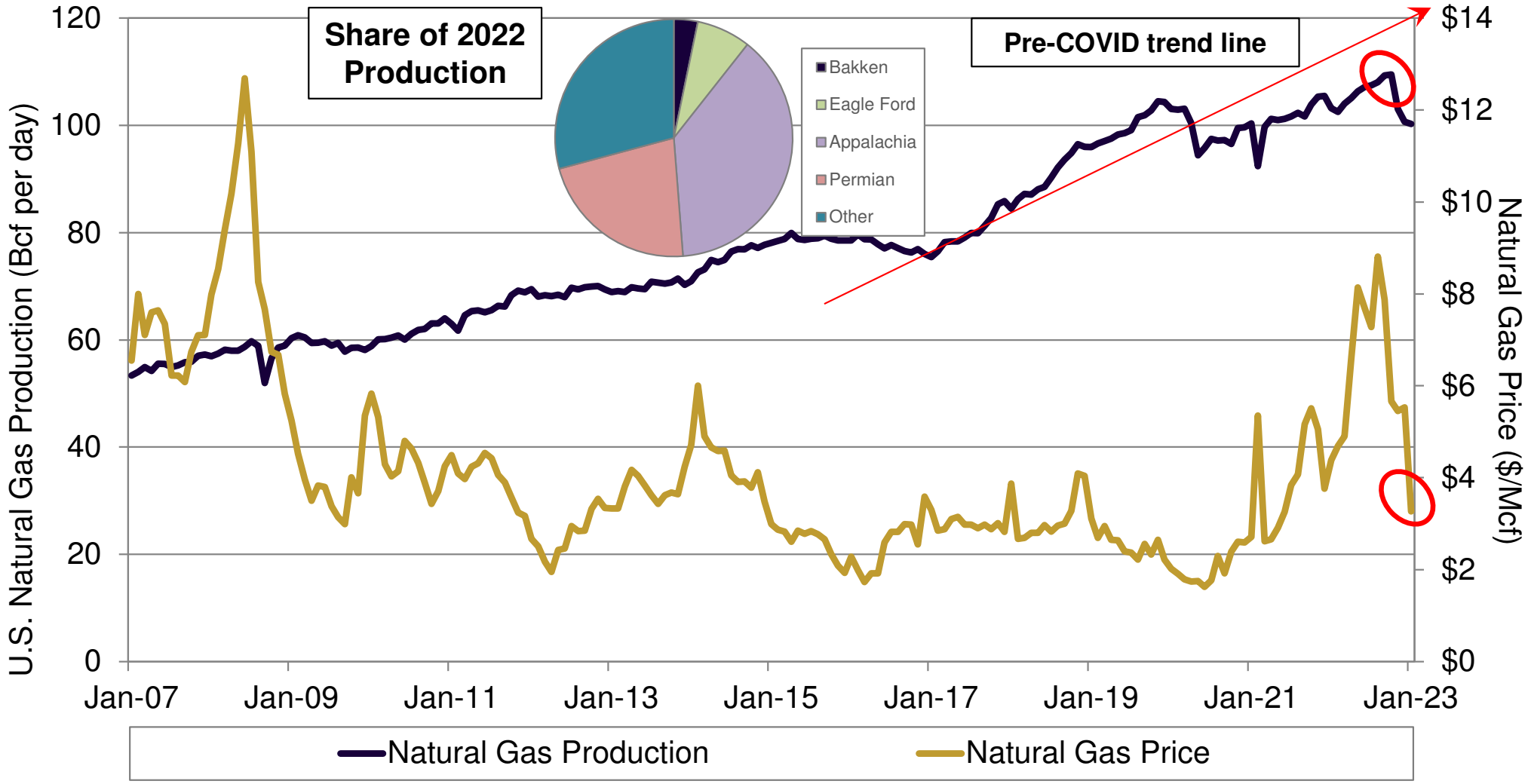
Natural gas production and reserves surpassed prior levels and are now at **all-time recorded peaks.**



Source: U.S. Energy Information Administration.

Monthly U.S. natural gas production and prices.

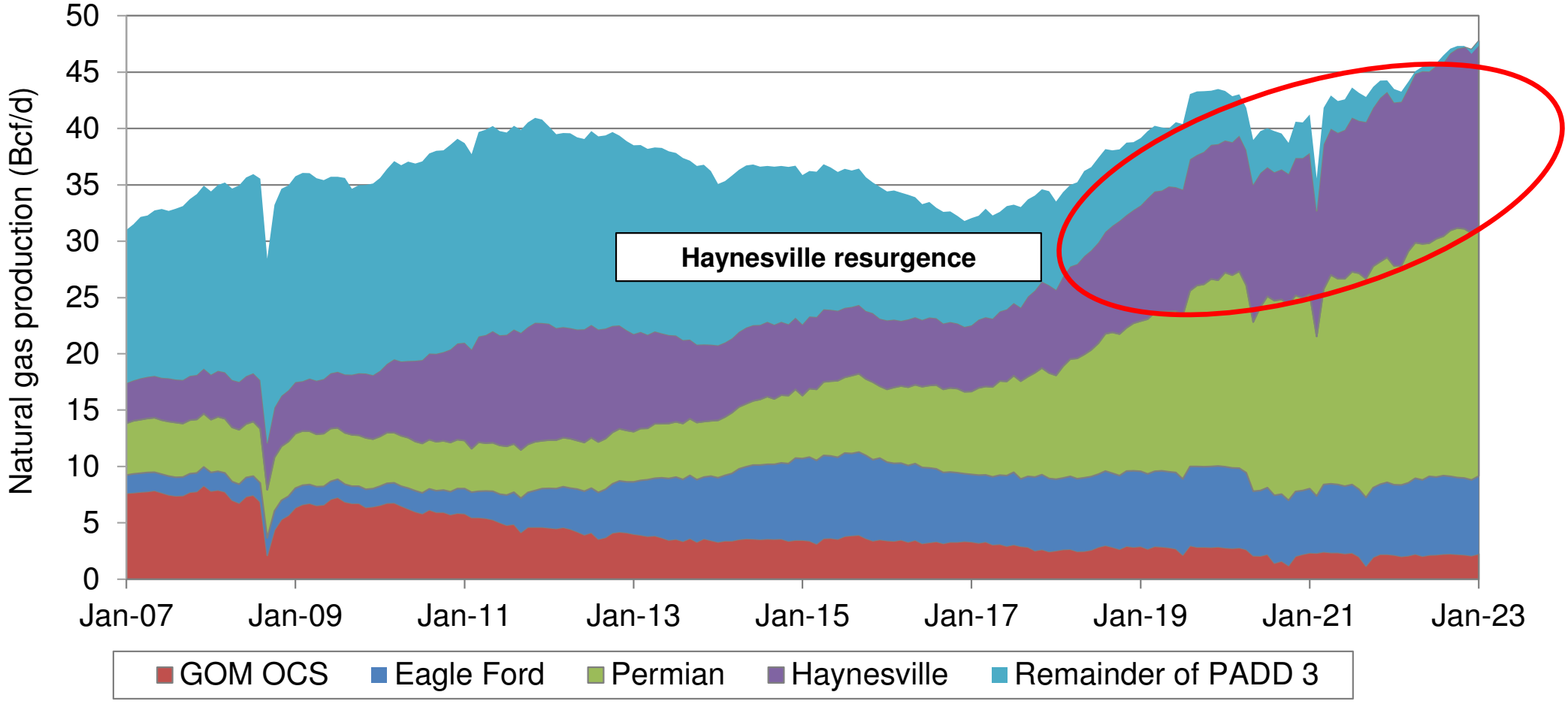
U.S. natural gas production now above 2019 prior-peak levels.



Source: U.S. Energy Information Administration.

Regional (PADD 3) natural gas production by major area/play.

Regional natural gas production has reached **record levels** with 2021 production on course to be at **42 Bcf/d**. This accounts for about **37 percent of total U.S. production**.

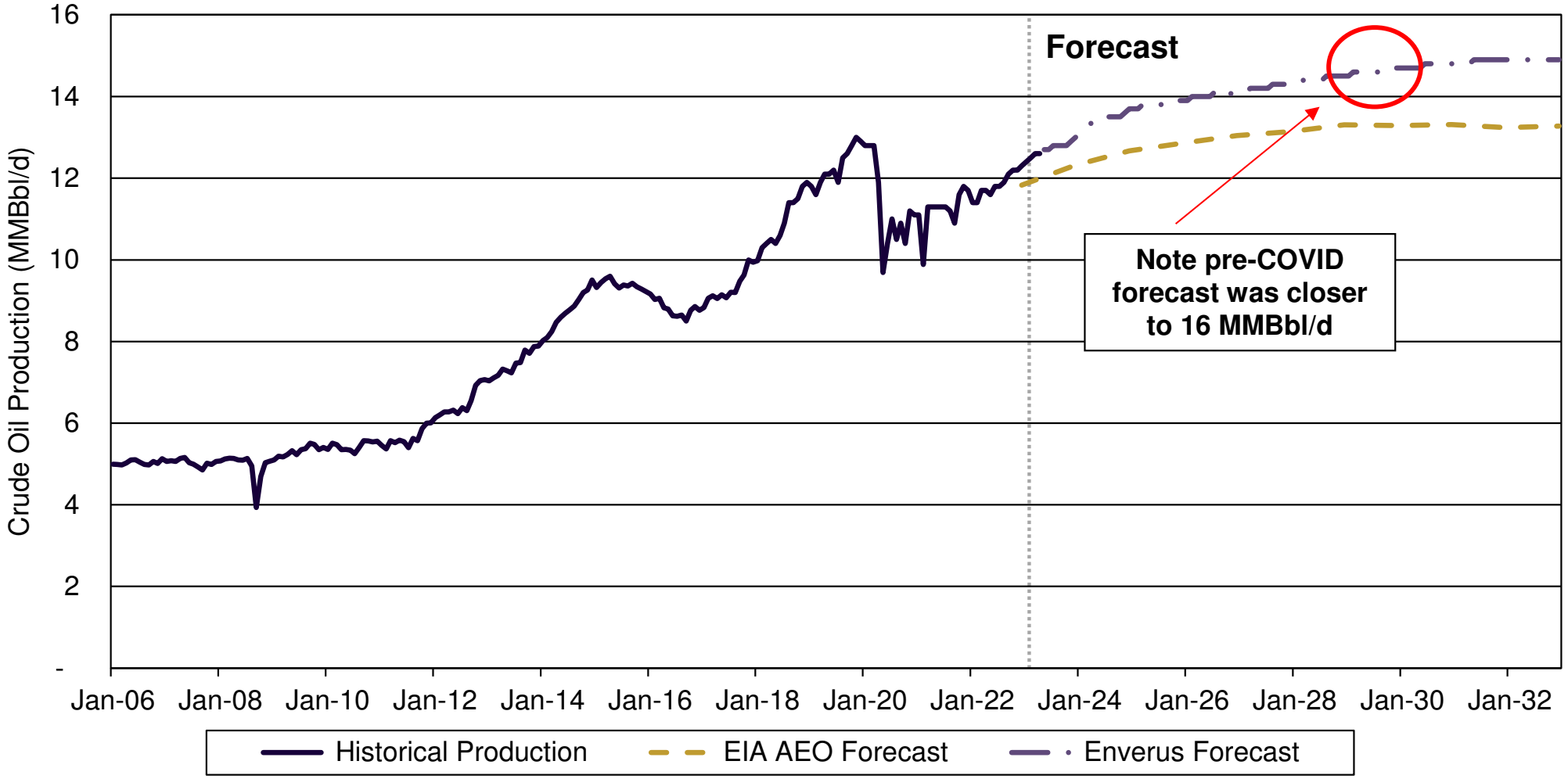


Source: U.S. Energy Information Administration.

Upstream outlook

U.S. crude oil production forecast.

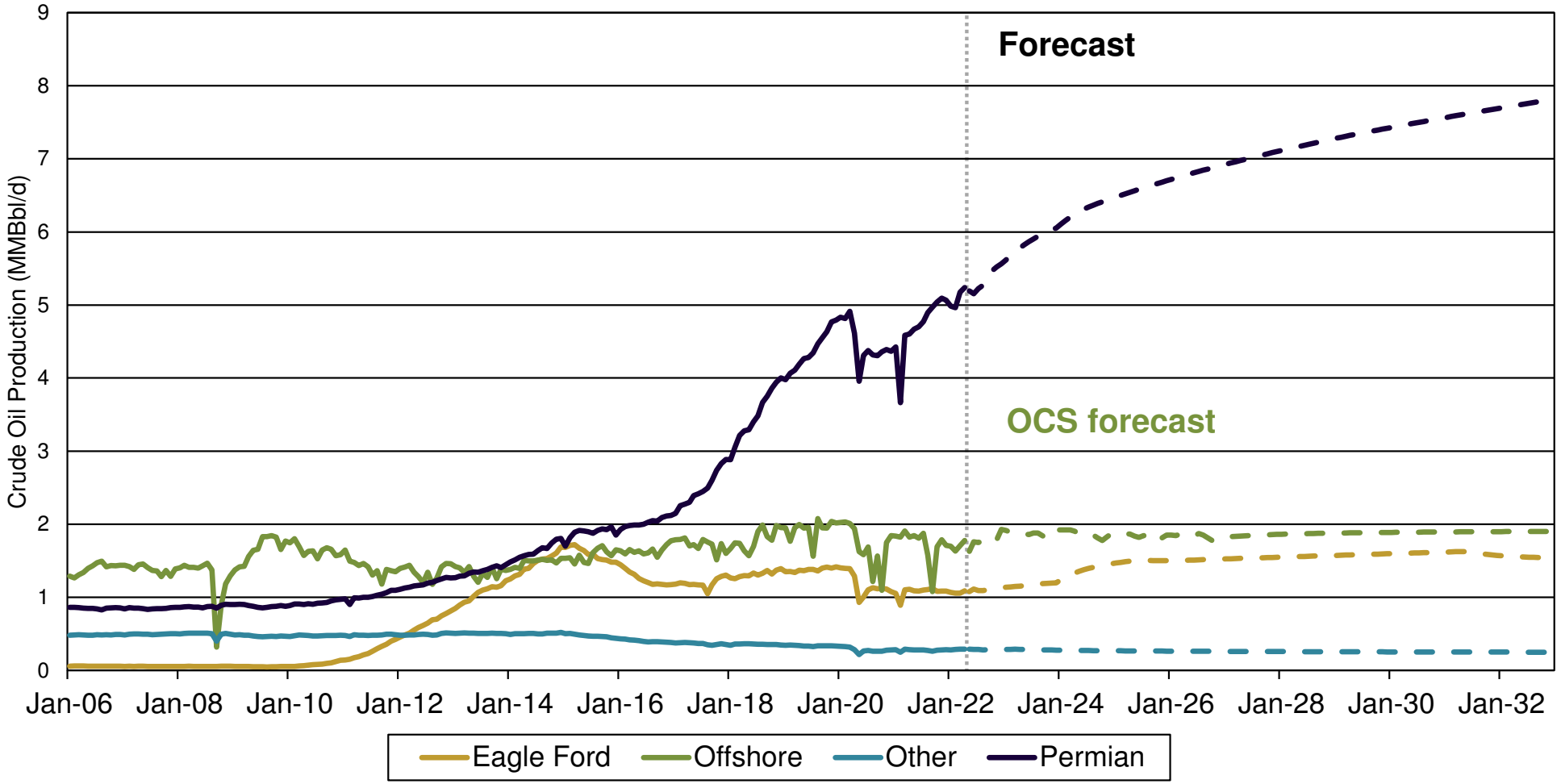
GCEO anticipates **U.S. crude oil production will increase to 2030**. Near term and longer term **GCEO is higher than EIA.**



Source: Enverus.

PADD 3 crude oil production forecast.

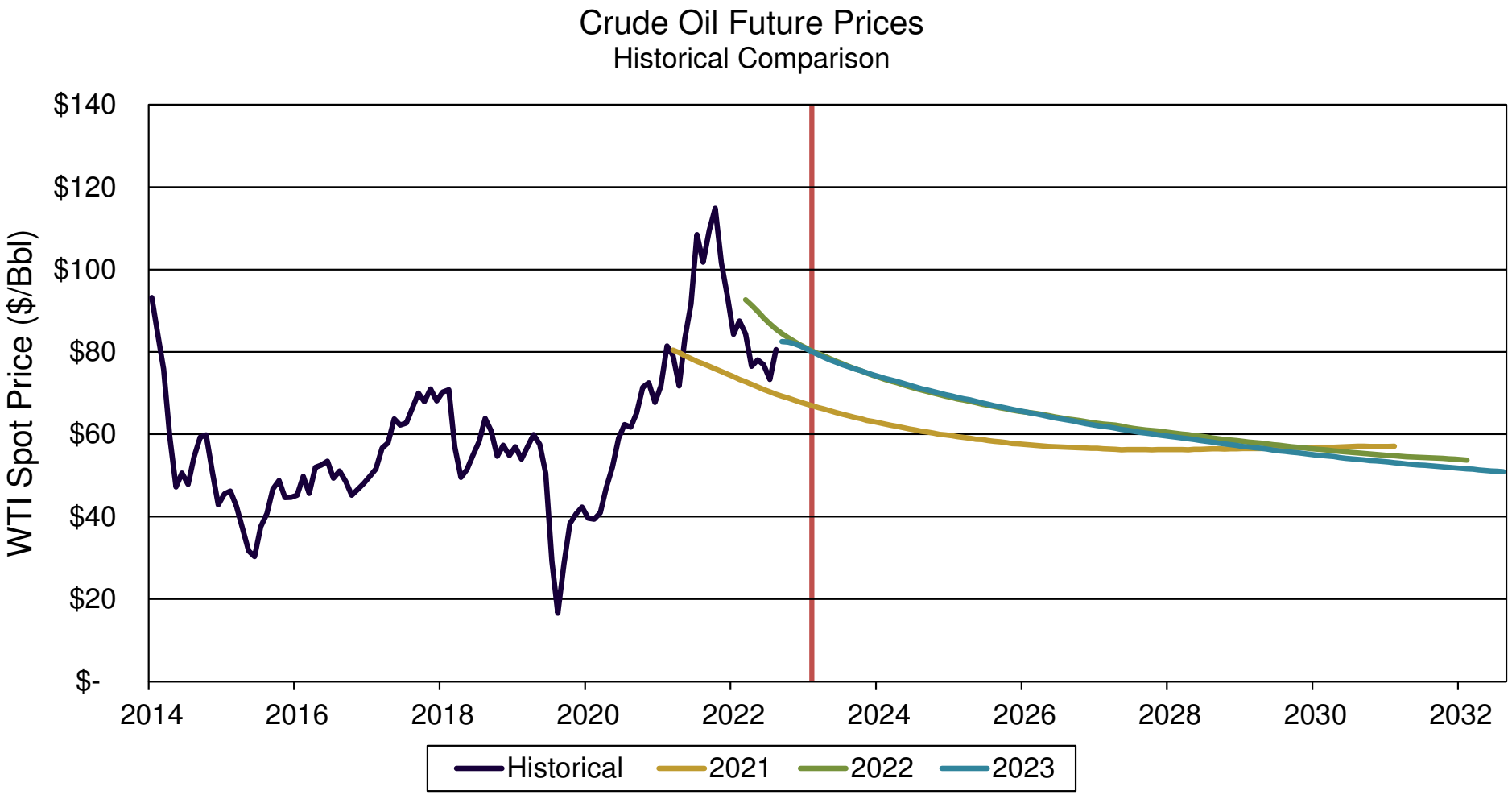
Regionally, **GCEO anticipates Permian will dominate** followed by continued consistent **OCS crude oil production slightly under 2 MMBBl/d.**



Source: Enverus.

Crude oil price outlook.

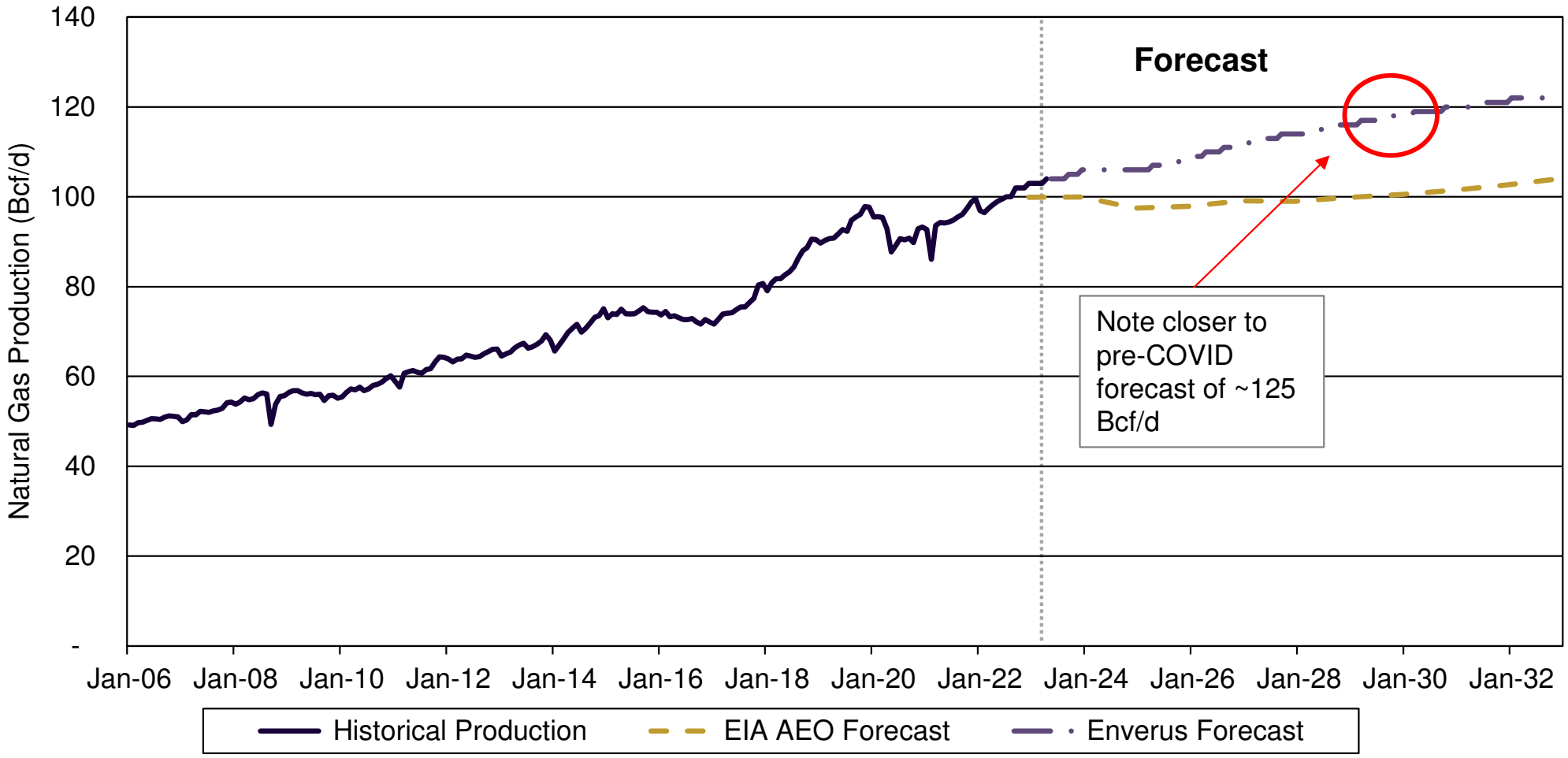
Crude oil prices (futures) are likely reverting to longer run mean, which is somewhere **around $60/Bbl**. Notice the **tightening of the range over time.**



Source: S&P Global Market Intelligence.

U.S. natural gas production forecast.

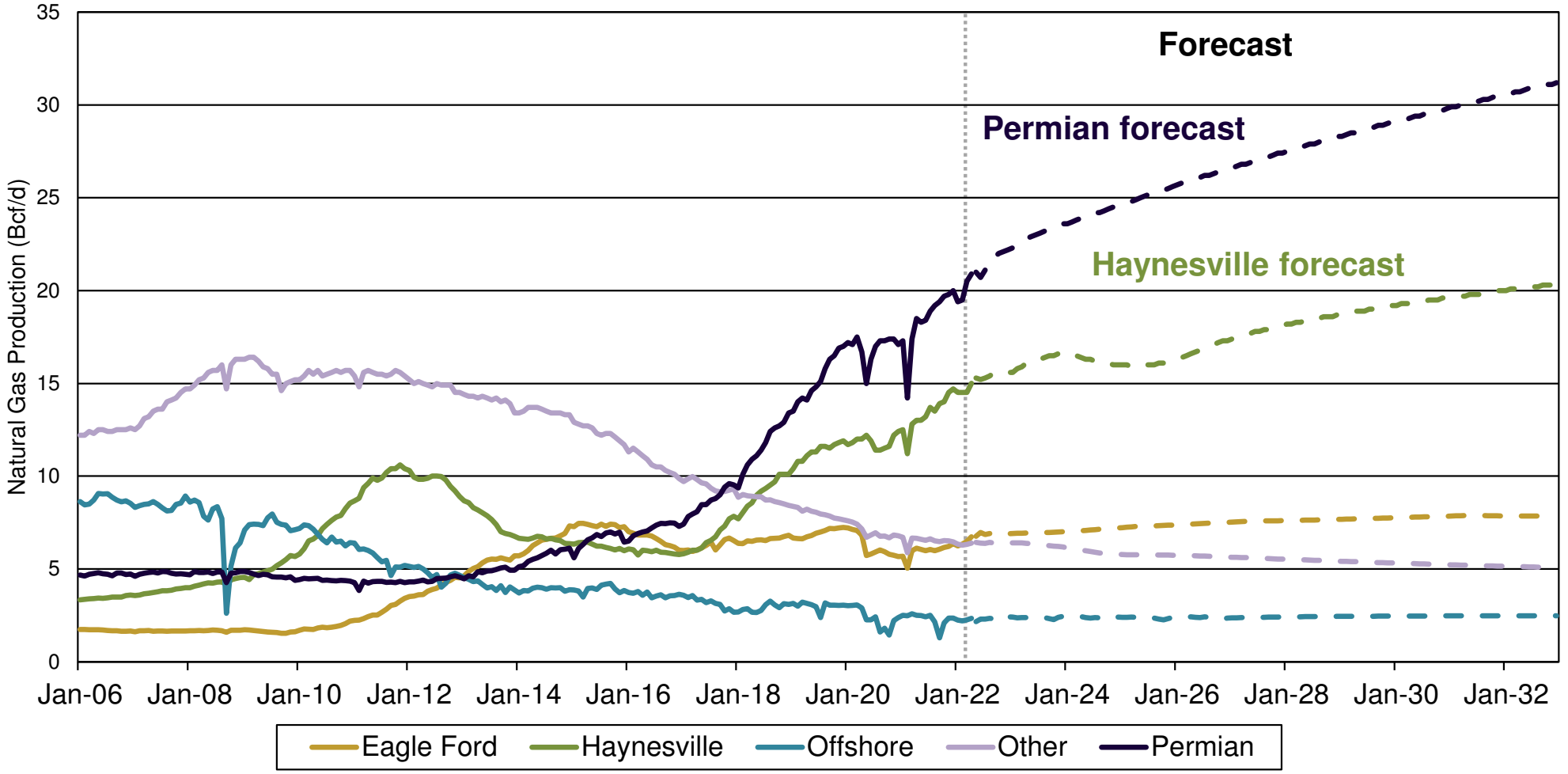
GCEO anticipates continued **growth of natural gas supplies** moving **past 120 Bcf/d** (43.80 TCF market).



Source: Enverus.

PADD 3 natural gas production forecast

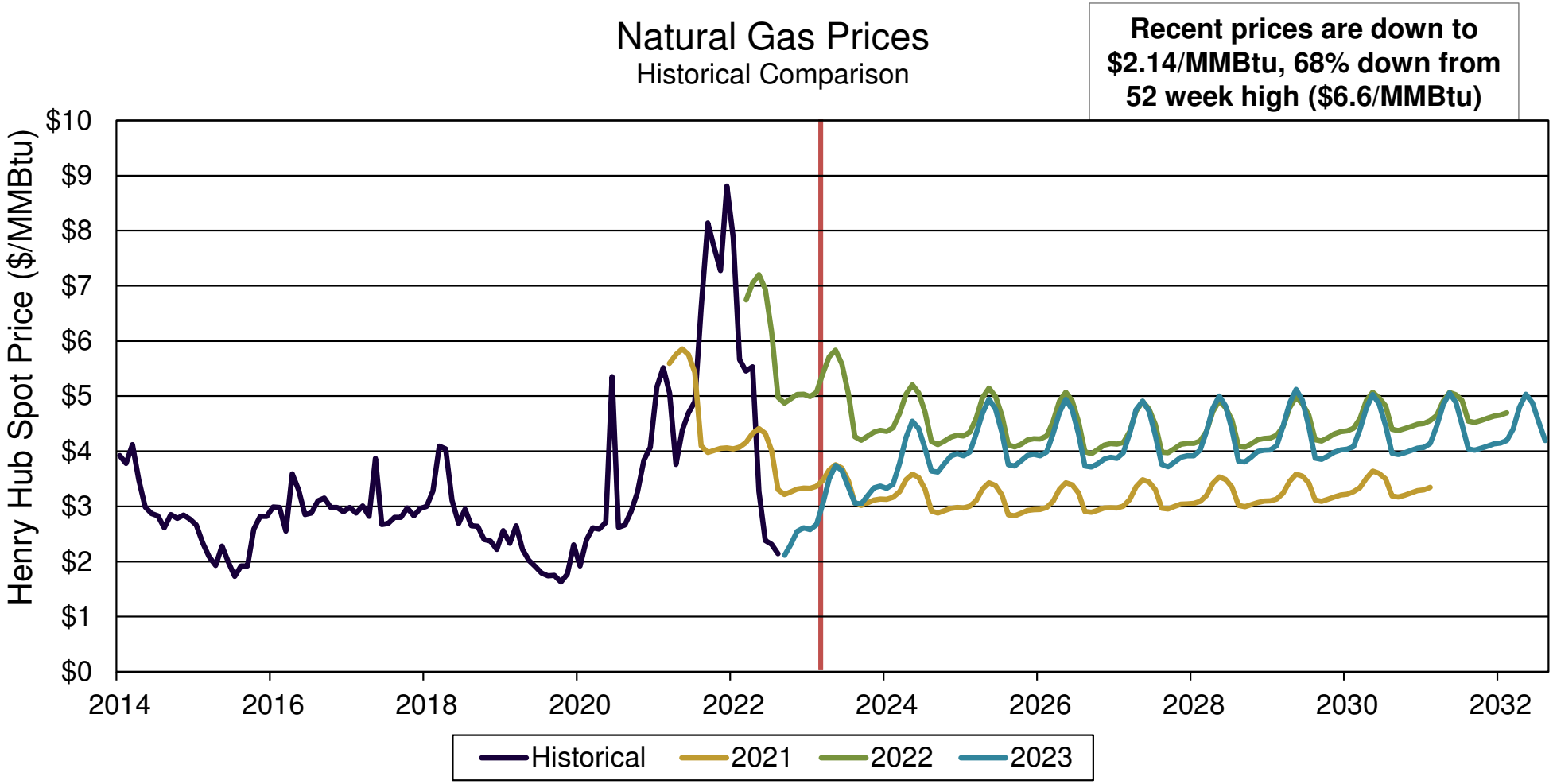
Regionally, Permian and Haynesville will dominate future natural gas production.



Source: Enverus.

Natural gas price outlook.

Natural gas prices **returning to trend**, however prices are drifting to **about $1.00/MMBtu** higher than 2021 expectations.

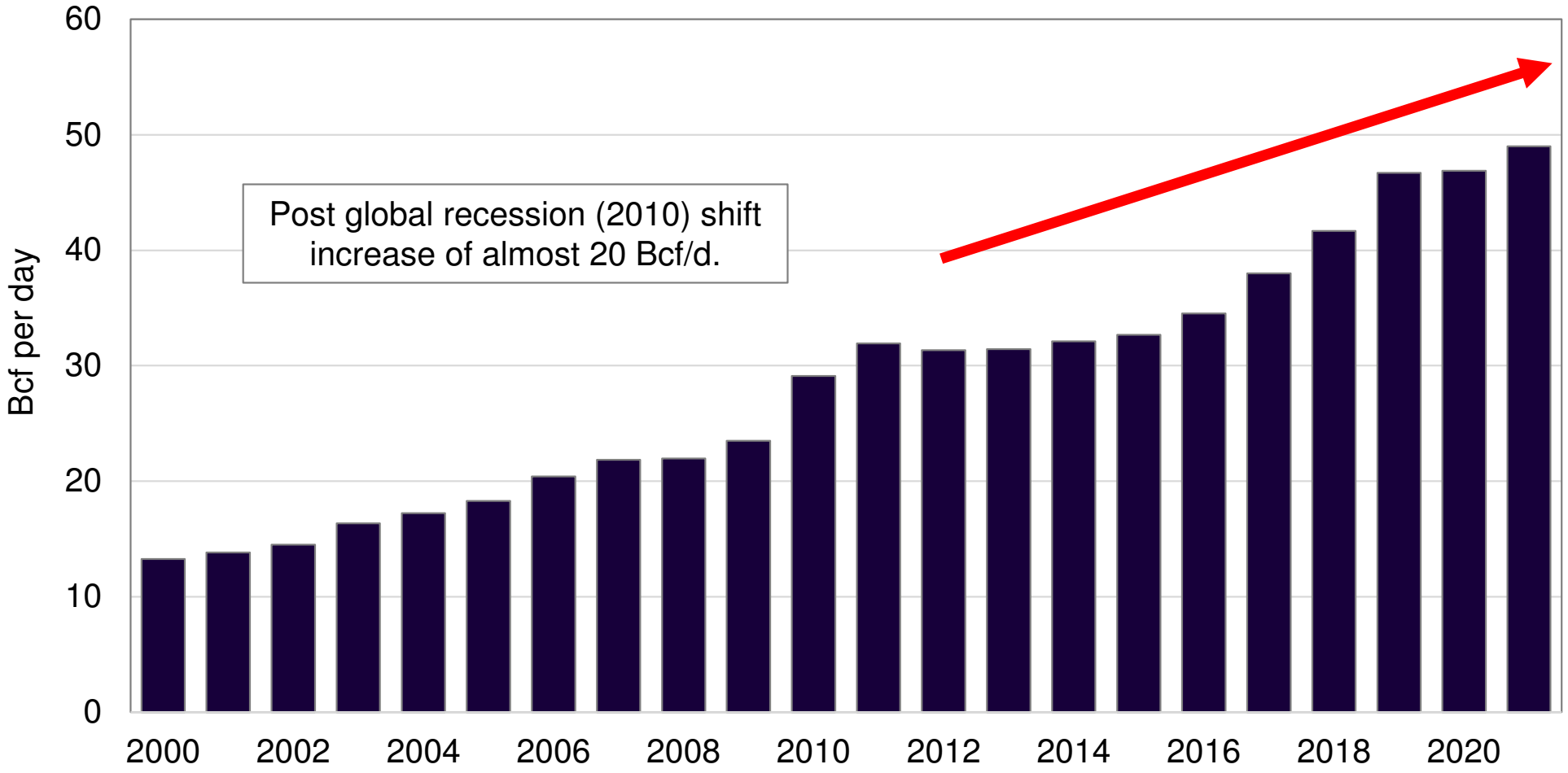


Source: S&P Global Market Intelligence.

LNG development & challenges.

World LNG trade volumes.

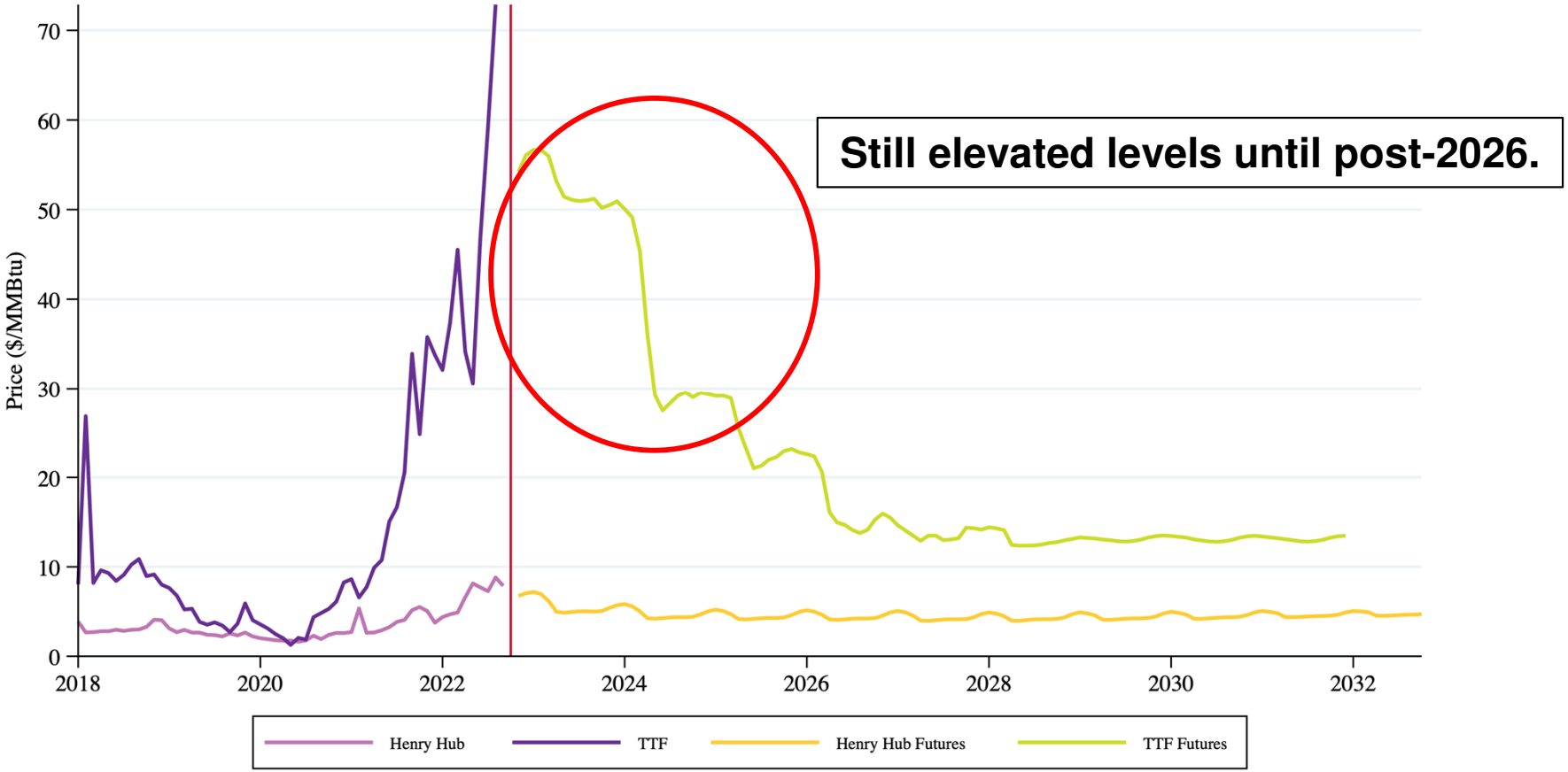
World LNG trade volumes have increased at an **average annual rate of 12.7 percent over the last 20 years** and have increased **54 percent over the last 10 years.**



Source: BP Statistical Review of World Energy.

European spot natural gas prices

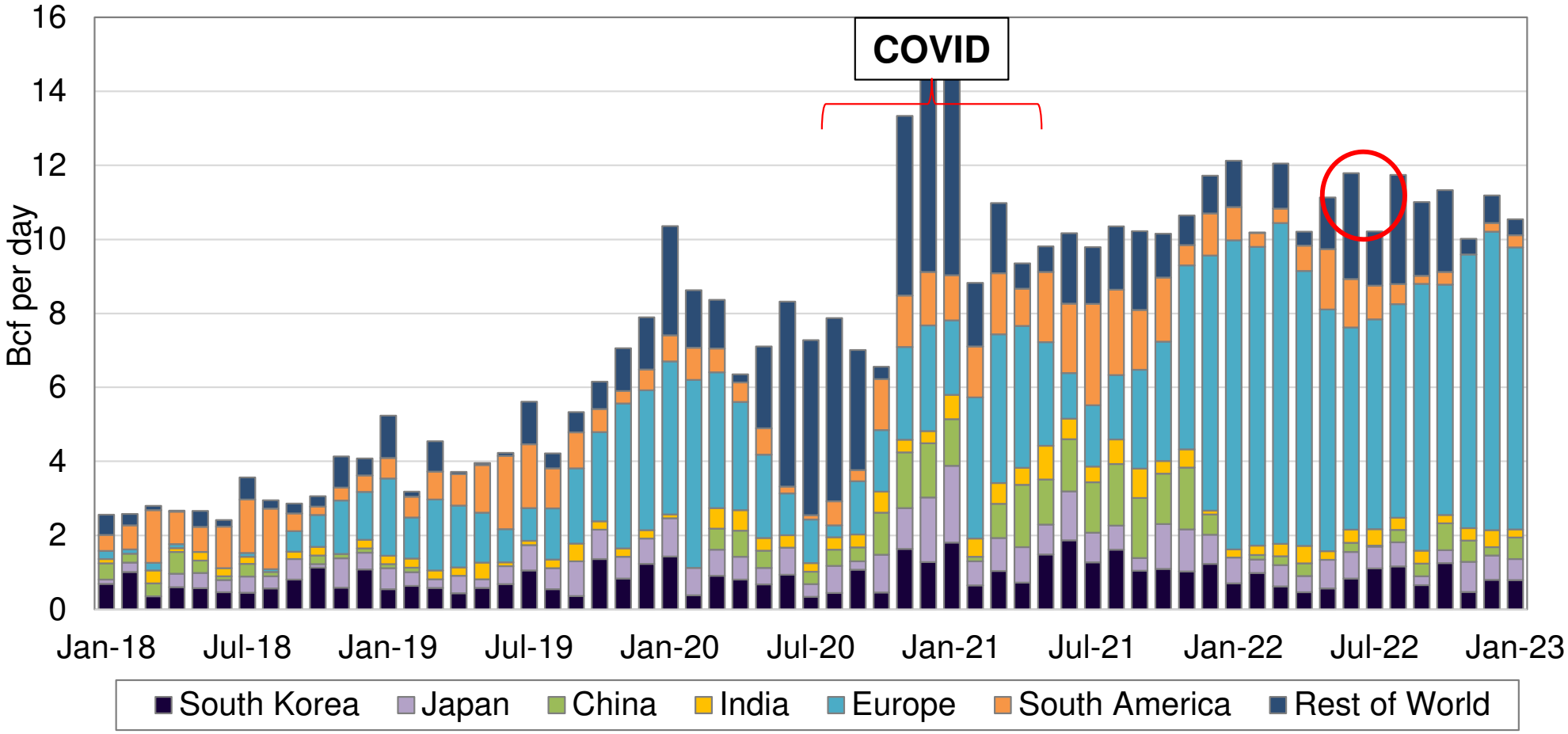
European **natural gas prices are astronomical** but expected to return to more normal levels over longer run (?).



Note: Spot-LNG" refers to LNG that are traded on a cargo to cargo basis and does not mean term contracts of LNG (so-called long, medium, short-term contracts). In addition, for spot-LNG, the price of which is linked to a particular price index (for example the Henry Hub link, and the JKM link) is excluded from these statistics. Objects of these statistics are spot-LNGs the prices of which are determined at the time of contract (so-called "fixed price").
Source: Bloomberg.

U.S. LNG exports by destination

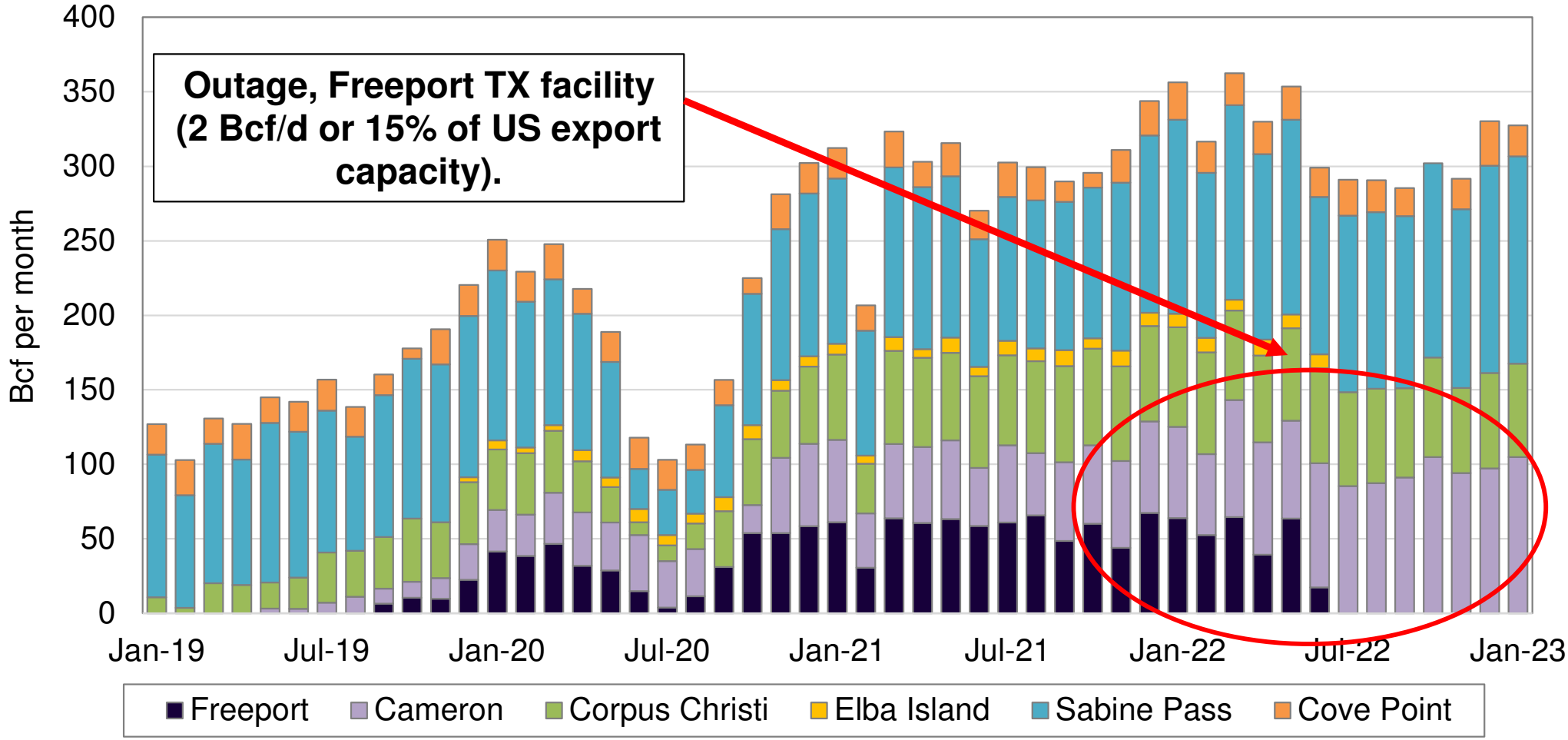
U.S. **LNG exports rebounded quickly and strongly post COVID**. Reaching a high of 8 Bcf per day in the beginning of 2020. (recent decreases due to **Freeport outage**)



Note: Europe includes Belgium, France, Greece, Italy, Netherlands, Poland, Portugal, Spain, Turkey, and the U.K.; South America includes Argentina, Brazil, Chiles, Columbia, and Mexico.
Source: U.S. Energy Information Administration.

U.S. LNG exports by facility

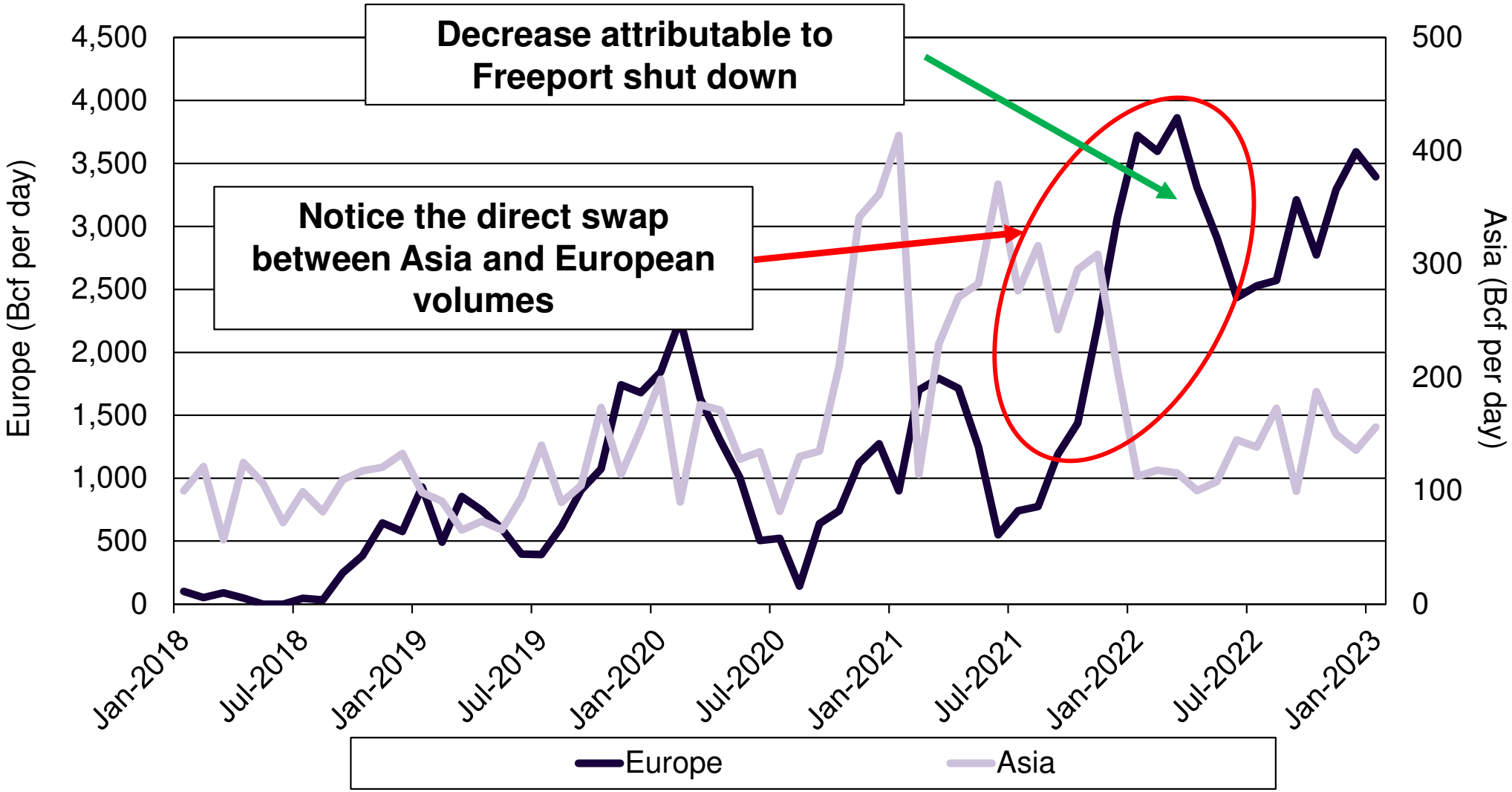
Exports decreased due to Freeport outage, but numbers rebounded to a high of approximately 203 Bcf per month in 2022.



Source: U.S. Energy Information Administration.

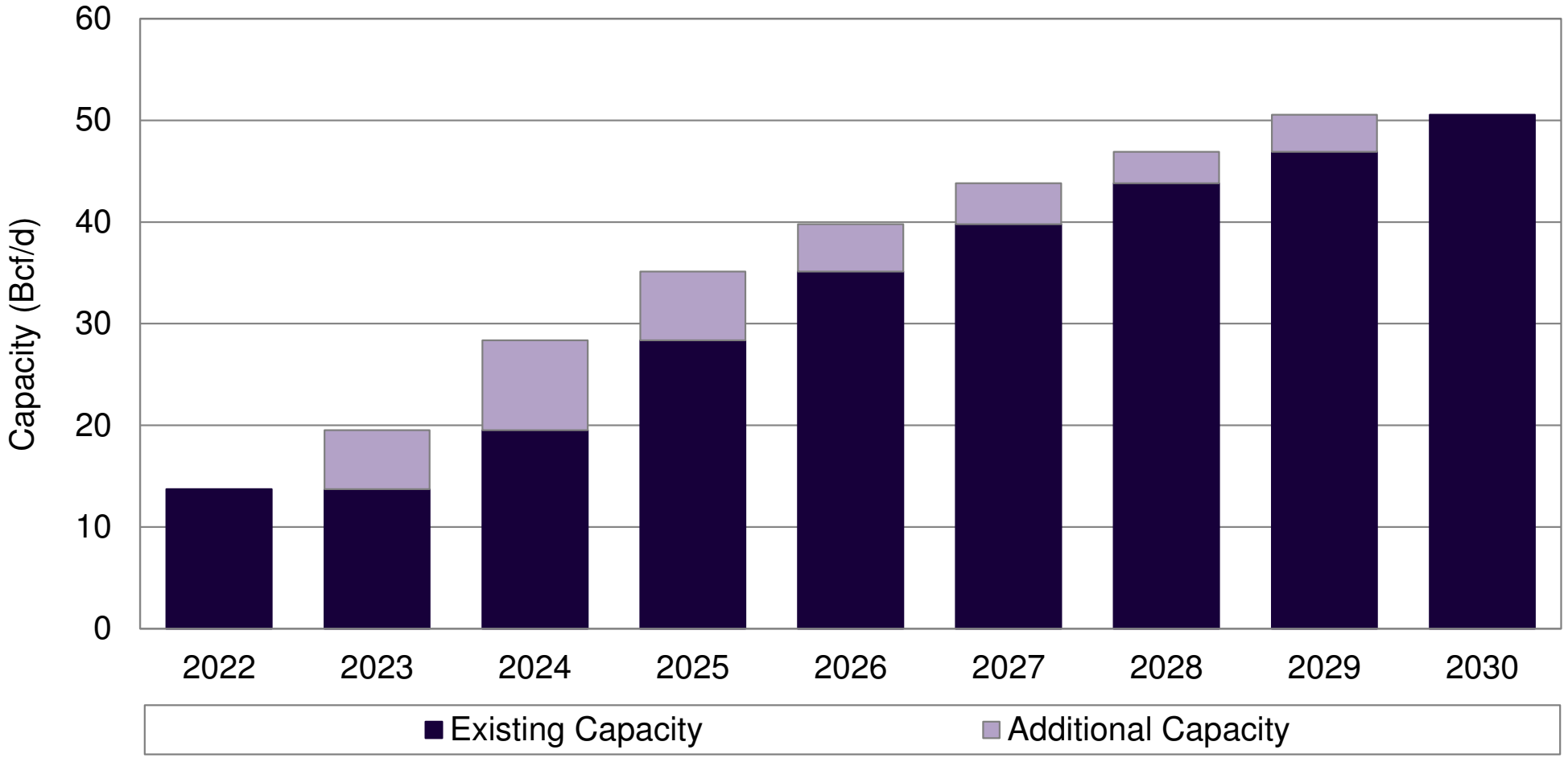
Asian v. European Exports from U.S.

Large recent surge in European exports, decrease in Asian-bound exports.



U.S. LNG export capacity development: announced projects.

If all the LNG applications currently filed with the Department of Energy were to come online, U.S. liquefaction capacity **would exceed 50 Bcf per day by 2030**.



Source: FERC

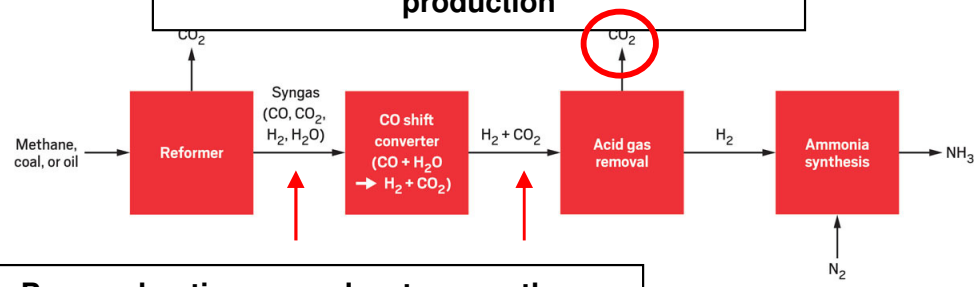
Carbon capture and storage (CCS) and energy transition investments

CCS methods

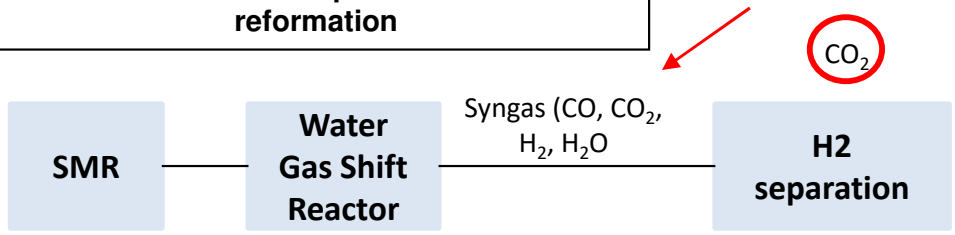
Pre-combustion capture

Precombustion separates CO_2 before combustion. This is usually done in the **reformation of various chemical processes** like steam methane reformation or ammonia production. **Can also include gasification** of solid fuels like petroleum coke or lignite.

Pre-combustion example: ammonia production

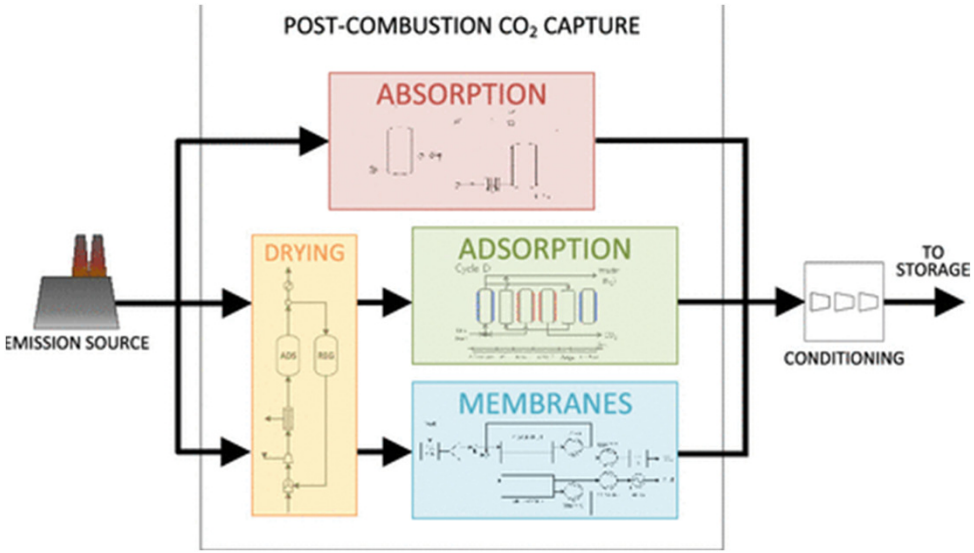


Pre-combustion example: steam methane reformation



Post-combustion capture

Usually involves cleaning flue gases after the combustion process. CO_2 is removed by scrubbing the flue gas with chemical solvent like amine. **Common in power generation** applications.

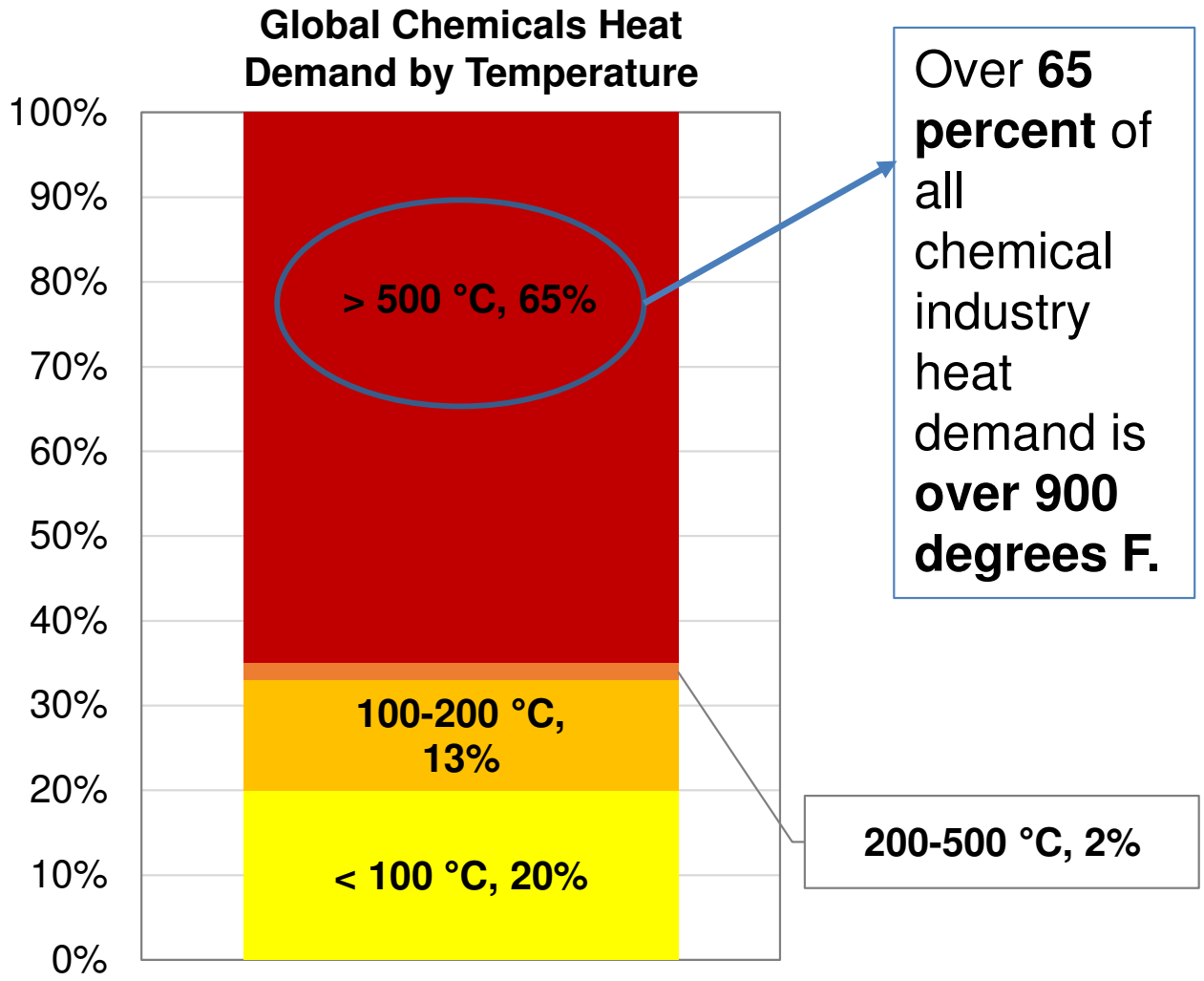


Source: Chemical and engineering news, EIA, Concawe Report 18/20, Linde Engineering.

Chemical industry use

Electrification will be limited in near term since about **60 percent** of chemical industry energy use is for **non-feedstock/non-power generation purposes**.

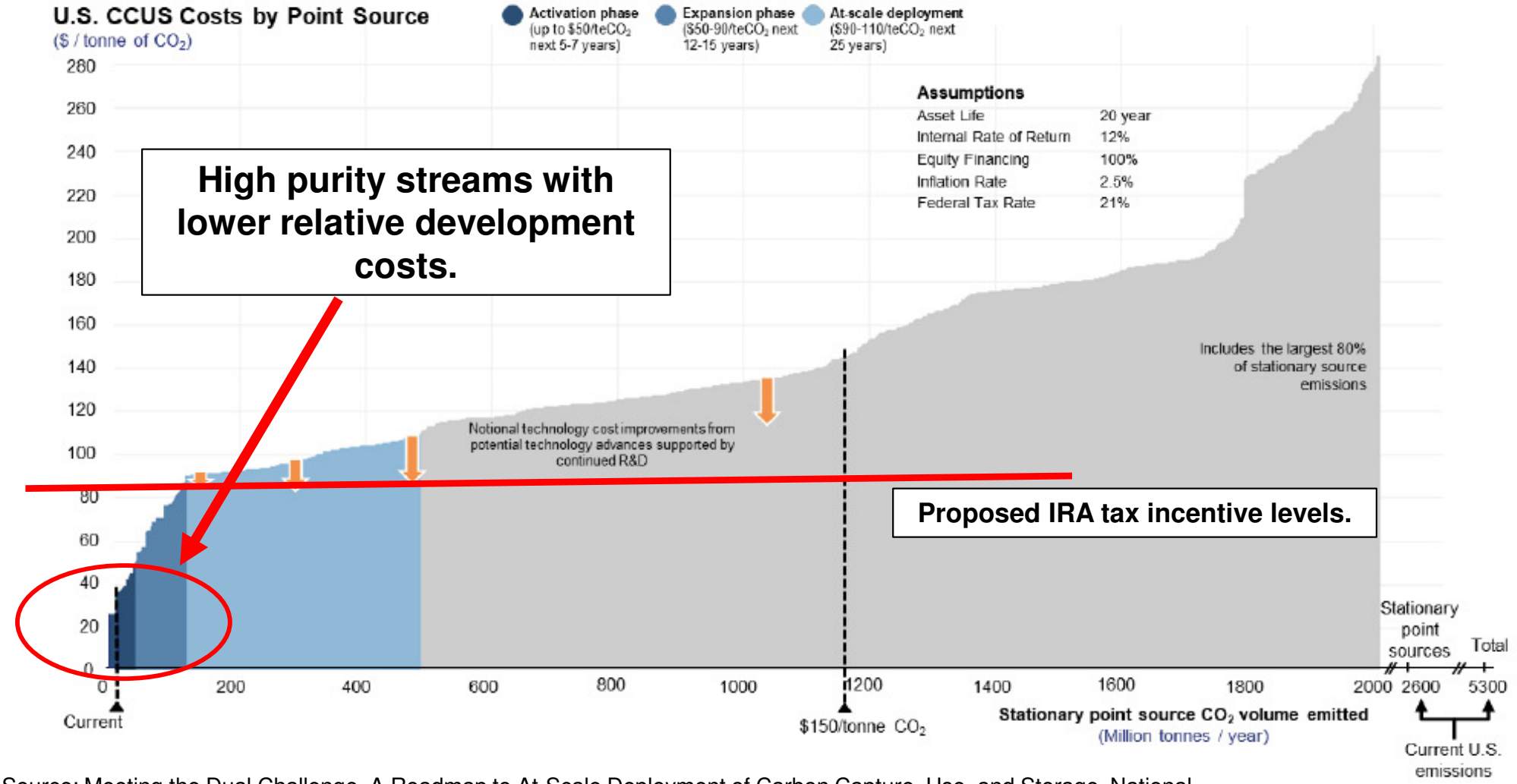
Energy Source	Global Chemical Non-Feedstock Energy Use (%)
Natural Gas	29%
Purchased Electricity	23%
Coal	23%
Petroleum	13%
Purchased Heat / Steam	12%
Bioenergy	>1%



Source: Jeff Rissman. "Decarbonizing Chemicals and other Industries in Louisiana." CCS Presentation. October 8. 2021.

U.S. CCUS cost curve (2019 NPC Study)

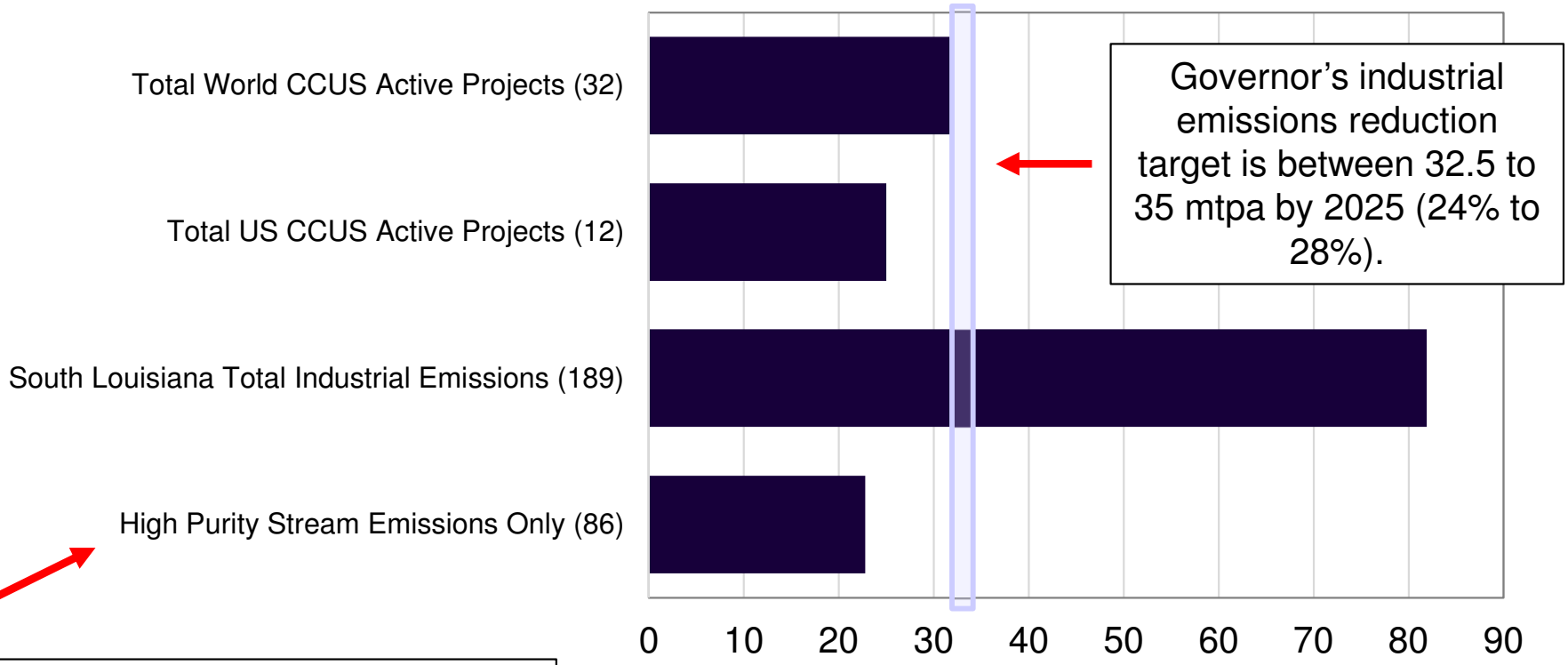
Costs are an important challenge. **High purity streams could be in a relatively economic range, particularly with 45(Q) or other enhanced tax incentives.**



Source: Meeting the Dual Challenge, A Roadmap to At-Scale Deployment of Carbon Capture, Use, and Storage. National Petroleum Council.

Louisiana high purity streams of CO_2

The opportunities for development in Louisiana are rich. There is **in excess of 20 mpta in high quality (90 percent plus) streams** in Louisiana alone: a level comparable to all the active U.S. CCUS facilities.



Close to 6,000 MW of load associated with the high purity streams alone.

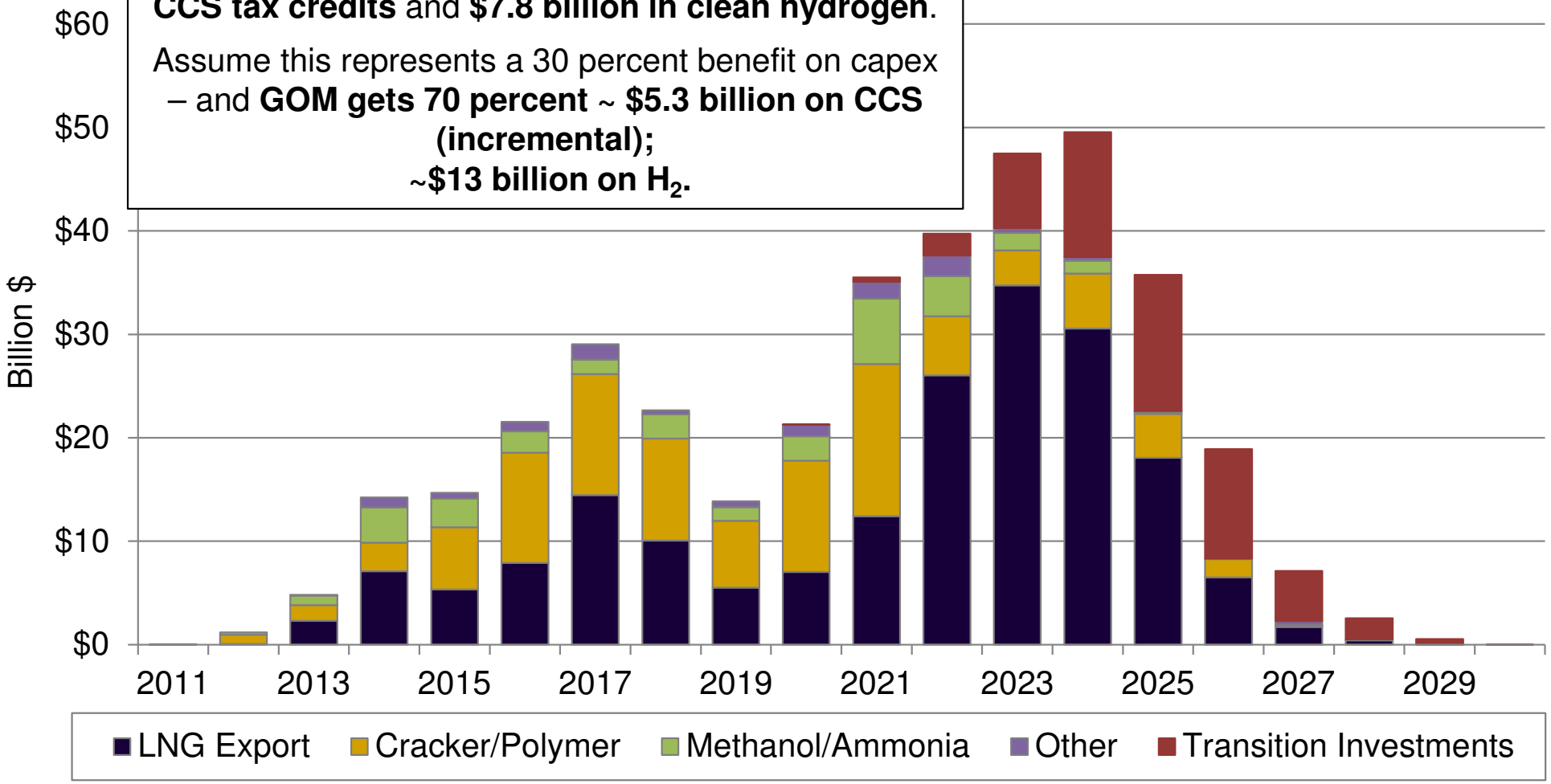
Source: Author's construct and Global CCS Institute.

GOM energy manufacturing investments by sector.

Total historic **GOM investment = $178.8 billion**, total **LA investment = $85.6 billion**. Large number of **future investments tied to energy transition**.

Inflation Reduction Act has **$3.2 billion in additional CCS tax credits** and **$7.8 billion in clean hydrogen**.

Assume this represents a 30 percent benefit on capex – and **GOM gets 70 percent ~ $5.3 billion on CCS (incremental); ~$13 billion on H_2.**



Source: Authors Construct; capex for announced projects with missing information were estimated using available data from average/typical facility type/cost.

Total GOM investments (all projects, GCEO update, March 2023).

GOM looking at **$53 billion in total energy transition investments**, most of which are announced to be in Louisiana (~**$37 billion**).

Year	Texas					Louisiana					Other GOM					Total GOM				
	LNG	Non-LNG	Transition	Other	Total	LNG	Non-LNG	Transition	Other	Total	LNG	Non-LNG	Transition	Other	Total	LNG	Non-LNG	Transition	Other	Total
	(million $)																			
2022	$ 5,529	$ 4,699	$ 248	$ 1,762	$ 12,238	$ 20,453	$ 4,916	$ 1,864	$ 225	$ 27,457	$ 33	$ -	$ -	$ -	$ 33	$ 26,014	$ 9,615	$ 2,112	$ 1,987	$ 39,728
2023	5,241	2,376	3,005	232	10,854	28,179	2,685	4,198	136	35,199	1,321	-	-	101	1,422	34,742	5,061	7,203	470	47,475
2024	7,142	4,335	3,792	93	15,363	19,382	2,227	8,268	117	29,993	4,038	-	-	149	4,187	30,562	6,562	12,060	359	49,543
2025	3,825	3,491	4,329	128	11,773	11,836	894	8,859	15	21,604	2,394	-	-	-	2,394	18,055	4,385	13,189	143	35,771
2026	336	1,005	3,618	54	5,014	5,963	745	6,963	-	13,672	213	-	-	-	213	6,513	1,750	10,581	54	18,898
2027	-	68	422	412	902	1,716	88	4,412	-	6,216	-	-	-	-	-	1,716	156	4,834	412	7,118
2028	-	-	187	99	286	412	-	1,846	-	2,259	-	-	-	-	-	412	-	2,034	99	2,545
2029	-	-	45	-	45	29	-	457	-	486	-	-	-	-	-	29	-	502	-	531
2030	-	-	-	-	-	-	-	31	-	31	-	-	-	-	-	-	-	31	-	31
Total	**$ 22,073**	**$ 15,974**	**$ 15,646**	**$ 2,780**	**$ 56,474**	**$ 87,970**	**$ 11,556**	**$ 36,899**	**$ 493**	**$ 136,917**	**$ 8,000**	**$ -**	**$ -**	**$ 250**	**$ 8,250**	**$ 118,043**	**$ 27,530**	**$ 52,545**	**$ 3,523**	**$ 201,640**

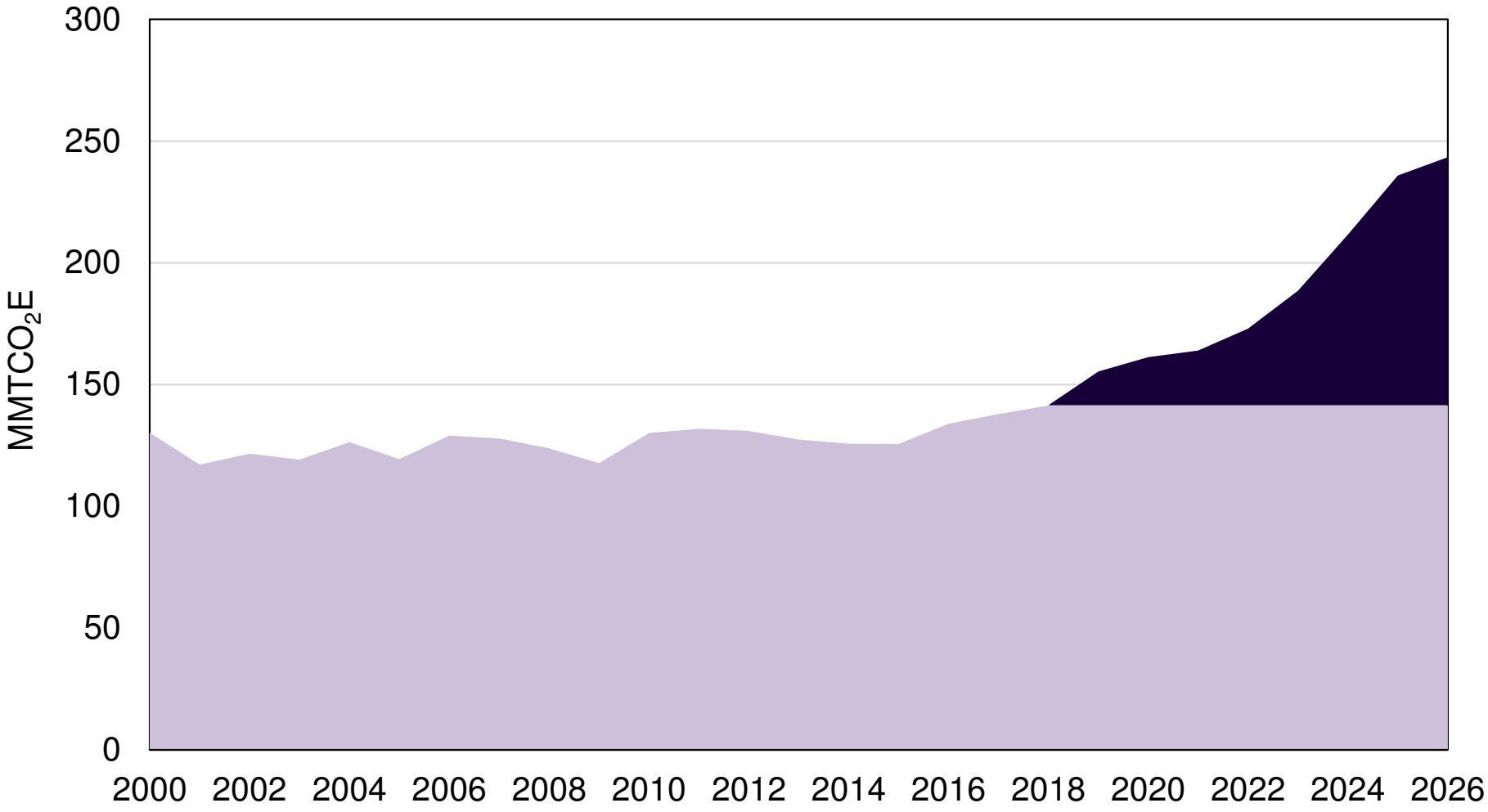
Since November 2022, **LA has seen transition investment announcements increase by ~ $14 billion**, GOM increase by **$23.5 billion**.

LA transition investments increase from ~ **19% of total to ~ 27%**; GOM from **~16 % to 31%**

Source: Authors Construct; capex for announced projects with missing information were estimated using available data from average/typical facility type/cost.

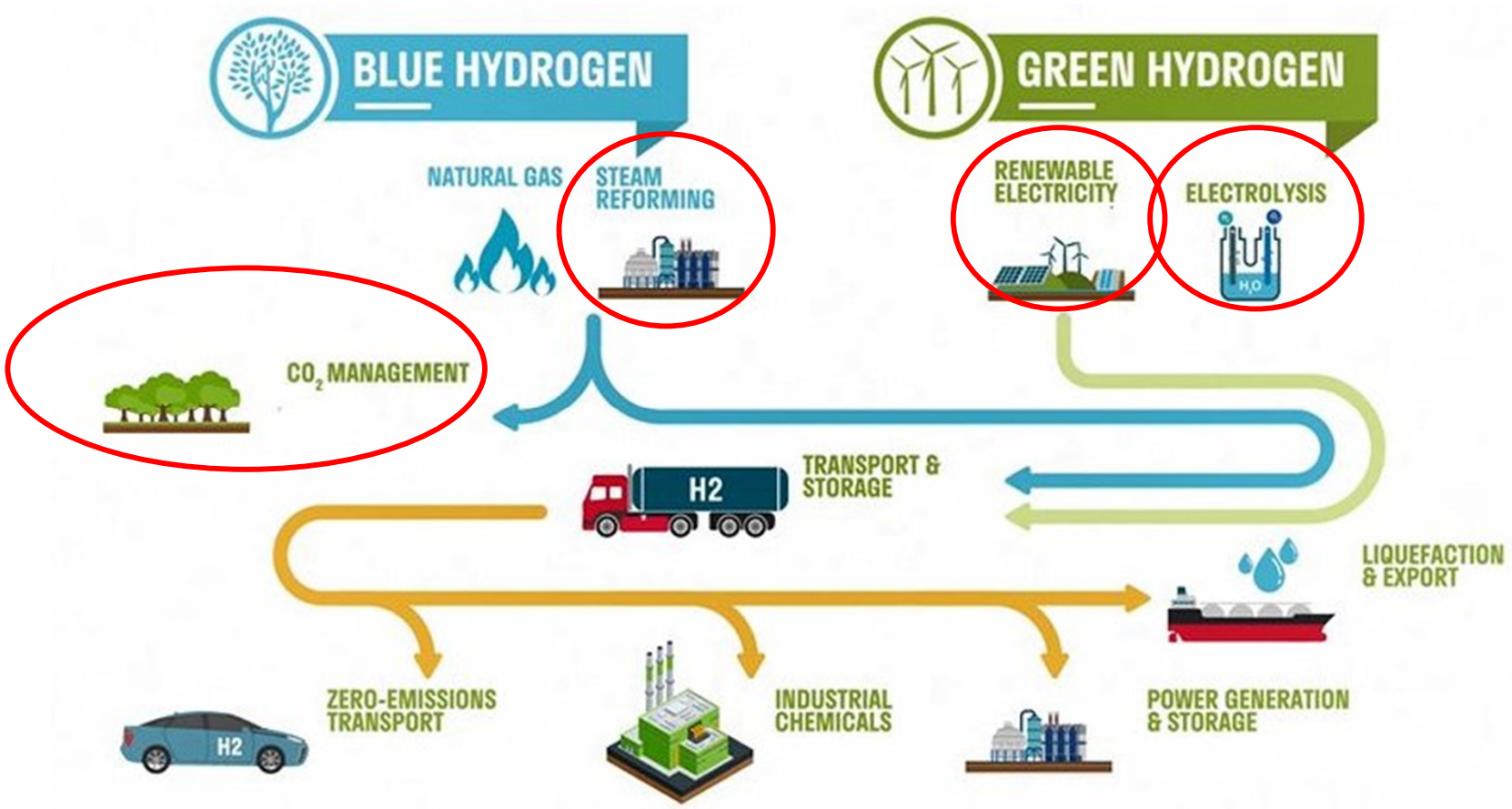
Emissions projections, based on LDEQ air permits (2021)

LDEQ air permitting trends suggests continued industrial growth in CO_2 emissions. This is **not necessarily a forecast** but does give an indication of how the cumulative total could impact future Louisiana emissions levels (**from ~141 MMTCO2E to ~250 MMTCO2E**).



Blue v. green hydrogen

How the hydrogen is made, matters.
Blue uses SMR and CCS;
Green uses RE and electrolysis



Source: Energy Tracker Asia.https://energytracker.asia/hydrogen-oil-green-vs-blue-whats-the-difference

Louisiana's hydrogen economy

Louisiana already has a **substantial hydrogen economy with a large number of buyers, sellers, and infrastructure (direct and supporting).**

Buyers

Sellers

Marketers

Other Institutions

Supporting infrastructure (H2 and CCUS; pipe & storage)

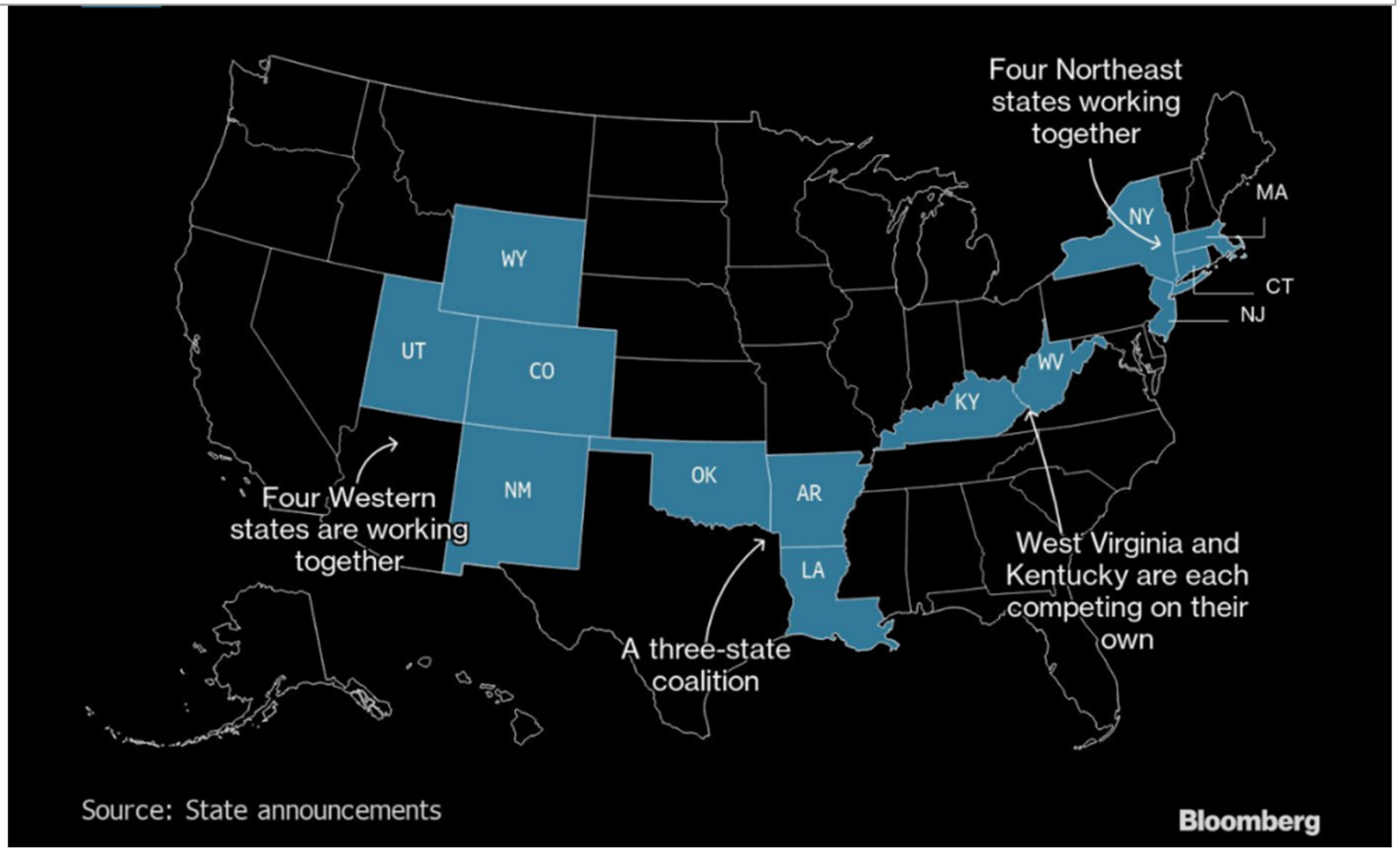
Source: https://esgreview.net/2021/11/03/louisiana-selected-for-hydrogen-megaproject/.

Hydrogen hub funding support

As much as **$8 billion in funding** (Infrastructure Investment and Jobs Act or "IIJA") to support hydrogen hubs. **Louisiana is part of three-state coalition (project "HALO").**

Project HALO

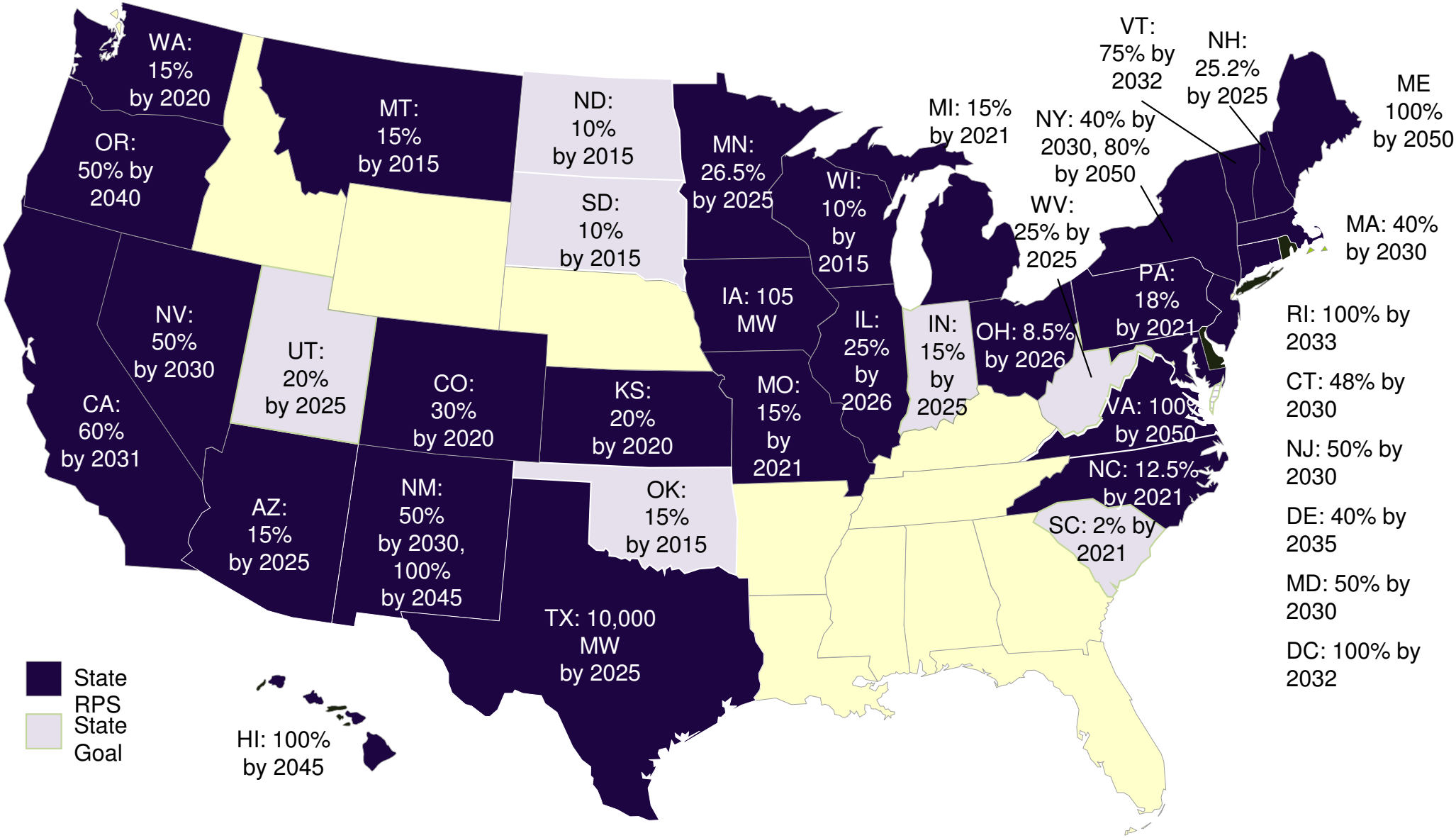
- Concept paper submitted on Nov 5, 2022.
- DOE is currently reviewing concept paper.
- Subset of proposals will be selected by DOE by Dec. 2022
- Ongoing work on full proposal due April 7, 2023.



Source: https://www.supplychainbrain.com/articles/34882-bidens-hydrogen-hub-plan-sparks-8-billion-race-among-us-states

Renewables

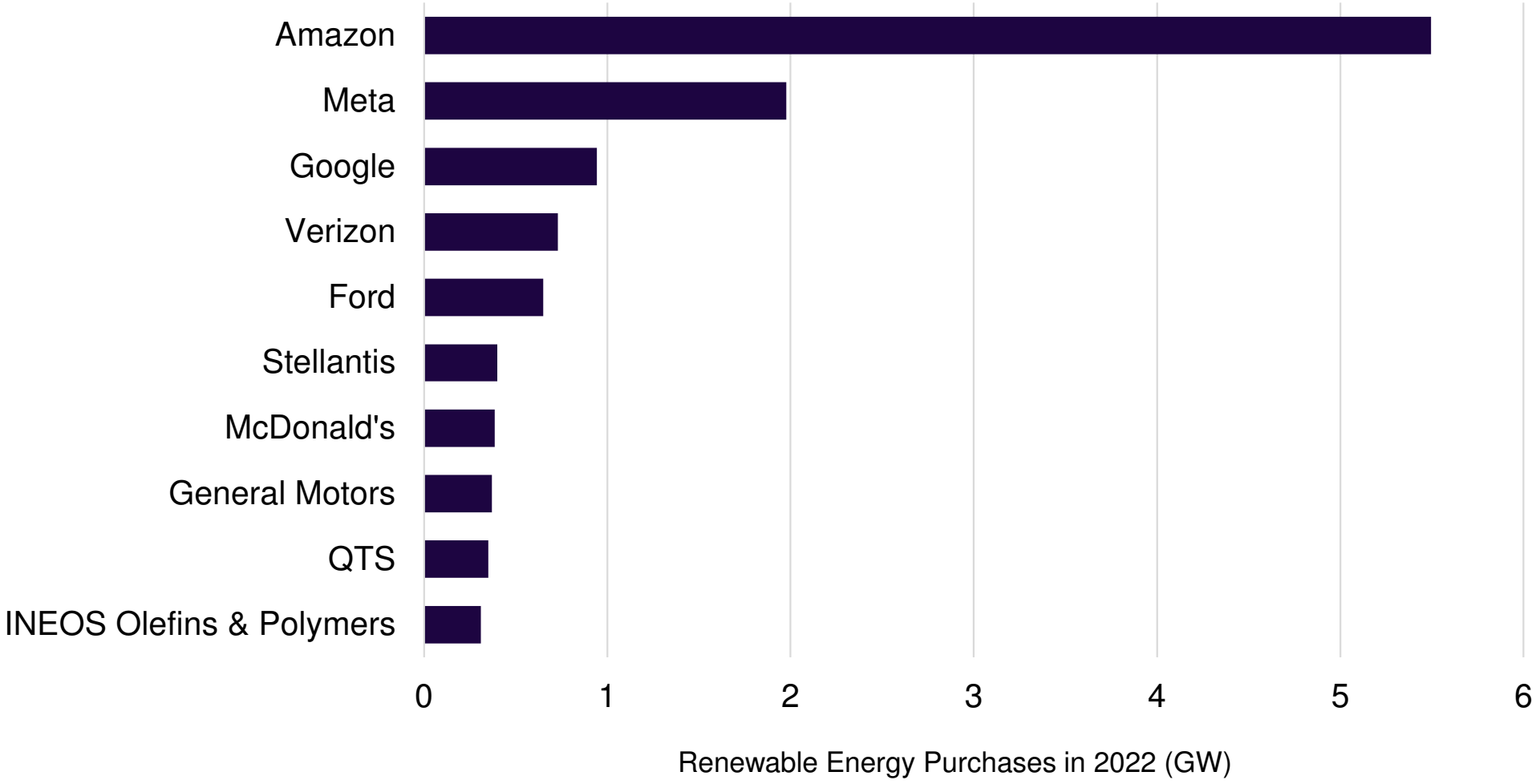
States with formal renewable portfolio standard



Source: Database of State Incentives for Renewable Standards.

Top 10 U.S. corporate renewable energy buyers (2022)

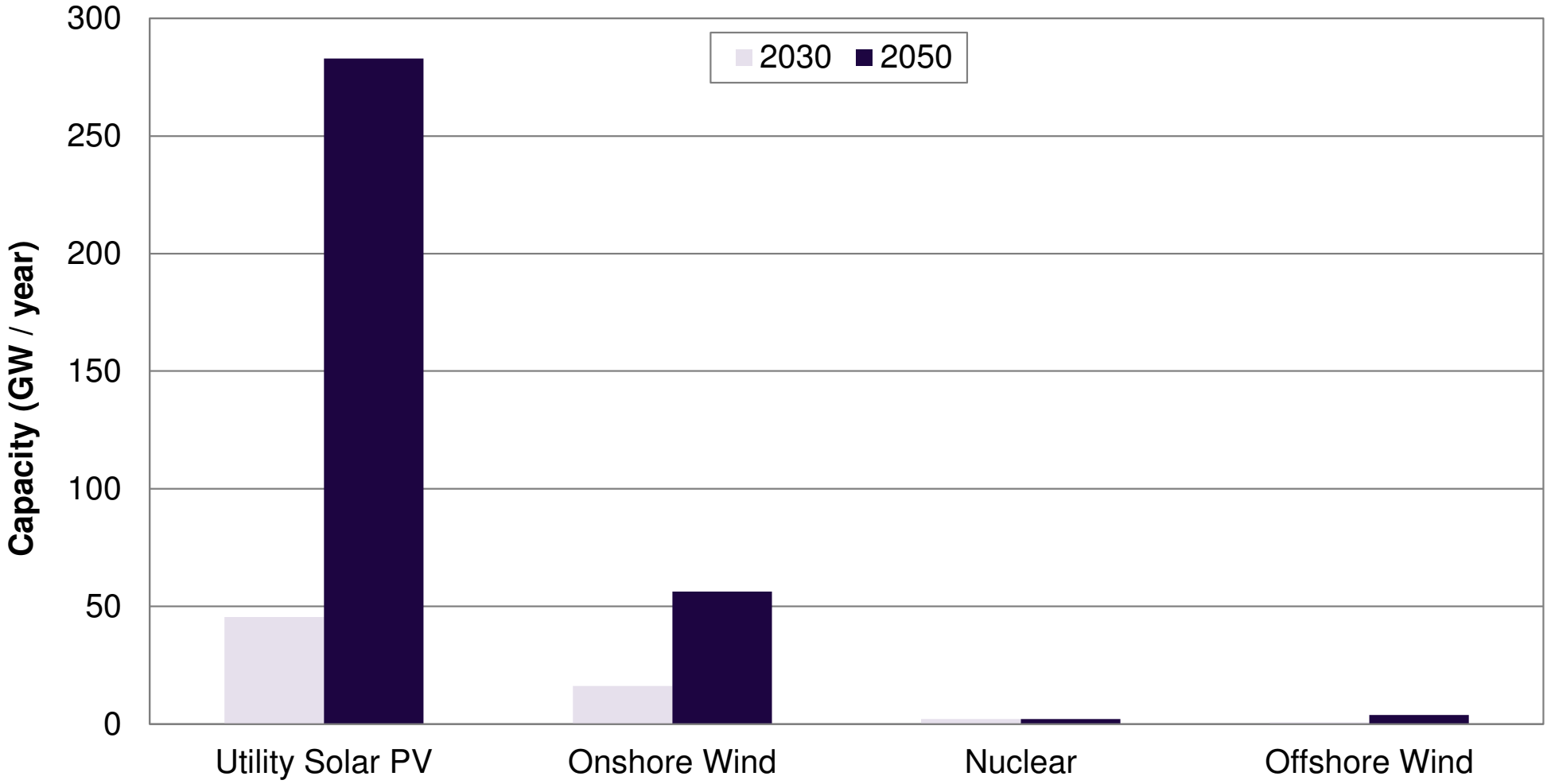
Numerous corporations, across all industries, are now making **large voluntary renewable energy purchases** to meet their internal corporate climate goals.



Source: Clean Energy Buyers Association.

Louisiana electric capacity requirements (Governor's Climate Plan)

Over **350 GW of new generating resources** (mostly renewable) will be needed to meet the Governor's electrification goals.



Source: Louisiana Energy Policy Solutions tool.

Announced power generation projects, MISO

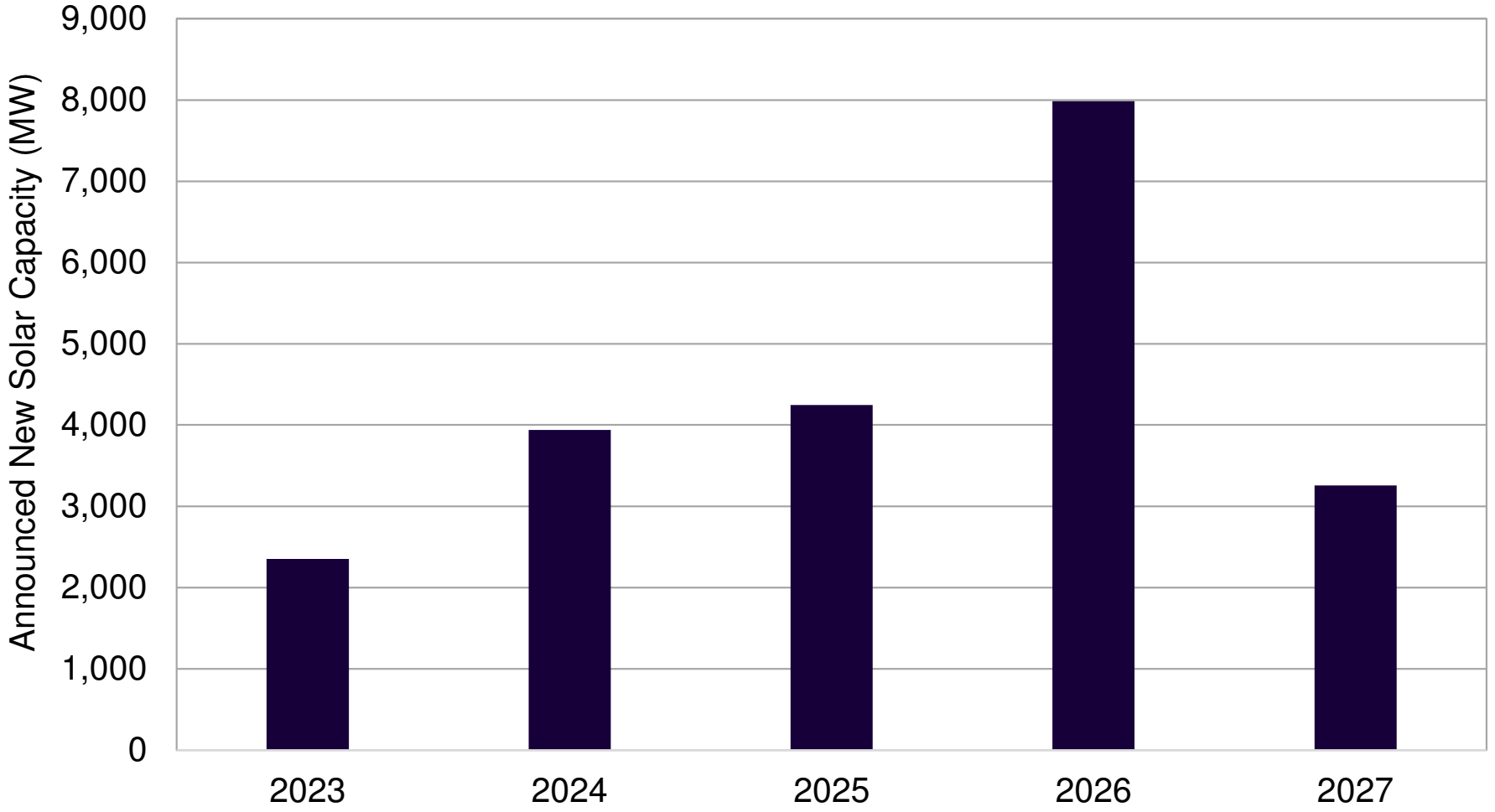
Louisiana announced **solar capacity**/projects is **close to 22 GW (~ 38 percent of MISO-S).** Louisiana is second most active state in MISO (all) in solar capacity announcements.

State	Coal	Natural Gas	Diesel	Hydro	Wind	Solar	Battery storage	Total capacity
MISO South								
Arkansas	20	0	0	0	1,645	24,113	1,960	27,738
Louisiana	0	0	0	36	230	21,775	2,632	24,673
Mississippi	0	0	0	0	397	8,319	749	9,464
Texas	0	0	0	0	-	3,831	300	4,131
Total MISO South	**20**	**0**	**0**	**36**	**2,272**	**58,038**	**5,641**	**66,007**
MISO North								
Iowa	0	0	11	0	7,154	4,734	2,102	14,000
Minnesota	0	0	19	8	2,381	7,218	3,072	12,698
North Dakota	0	0	0	0	3,844	985	851	5,680
South Dakota	0	0	0	0	1,685	400	275	2,360
Total MISO North	**0**	**0**	**30**	**8**	**9,535**	**11,952**	**5,174**	**26,698**
MISO Central								
Illinois	550	0	0	0	5,978	18,719	6,023	31,270
Indiana	0	0	0	0	2,582	21,930	8,039	32,550
Michigan	0	0	0	70	1,184	18,943	6,645	26,842
Missouri	0	0	0	60	1,169	6,273	715	8,217
Kentucky	348	0	0	0	200	3,125	825	4,498
Wisconsin	0	0	0	0	1,516	11,992	4,347	17,855
Total MISO Central	**898**	**0**	**0**	**130**	**12,629**	**80,982**	**26,594**	**121,232**
Total	**918**	**0**	**30**	**174**	**24,435**	**150,972**	**37,408**	**213,937**

Source: MISO Generator Interconnection Queue

Announced Louisiana solar energy projects by anticipated COD

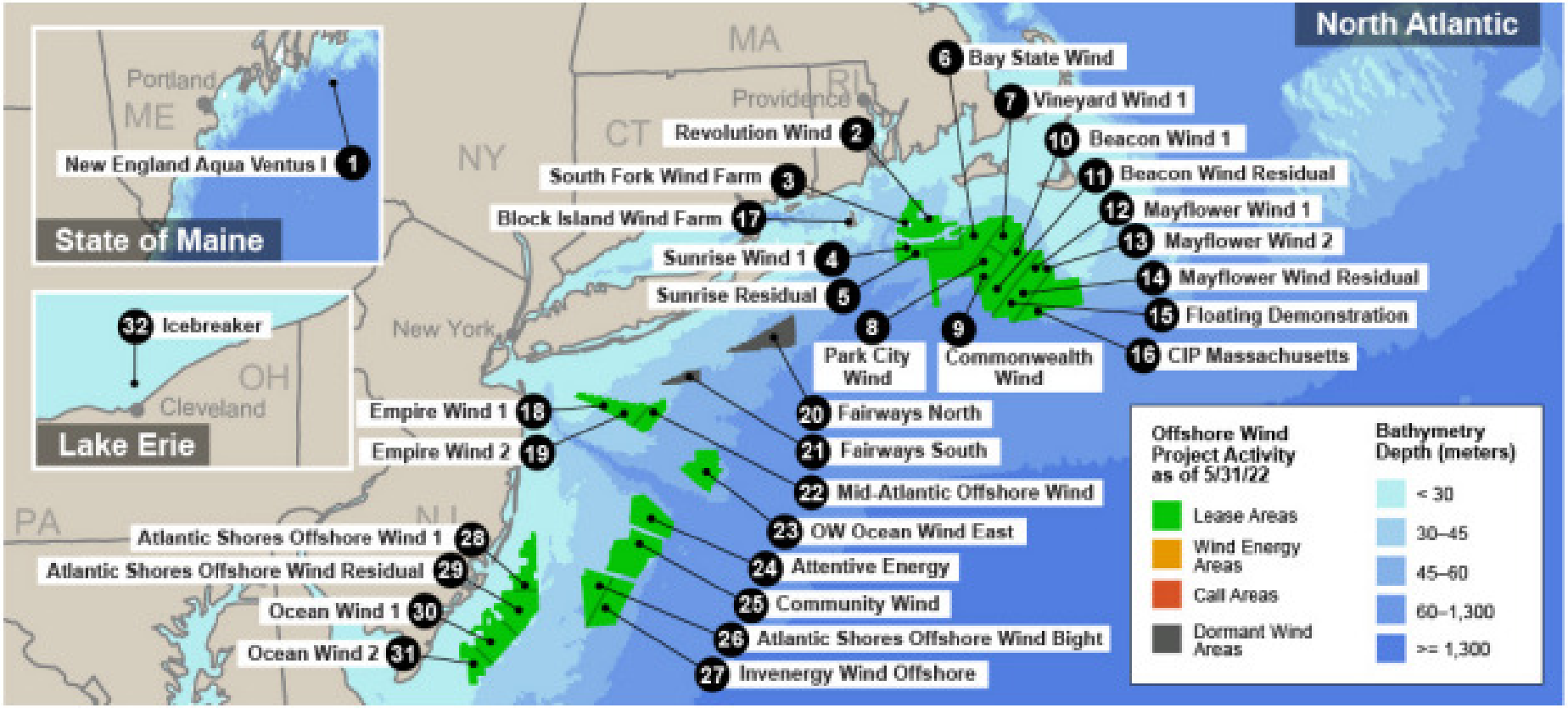
Bulk of the Louisiana solar capacity is anticipated to be on-line in 2026.



Source: MISO Generator Interconnection Queue

OSW Geographic Info

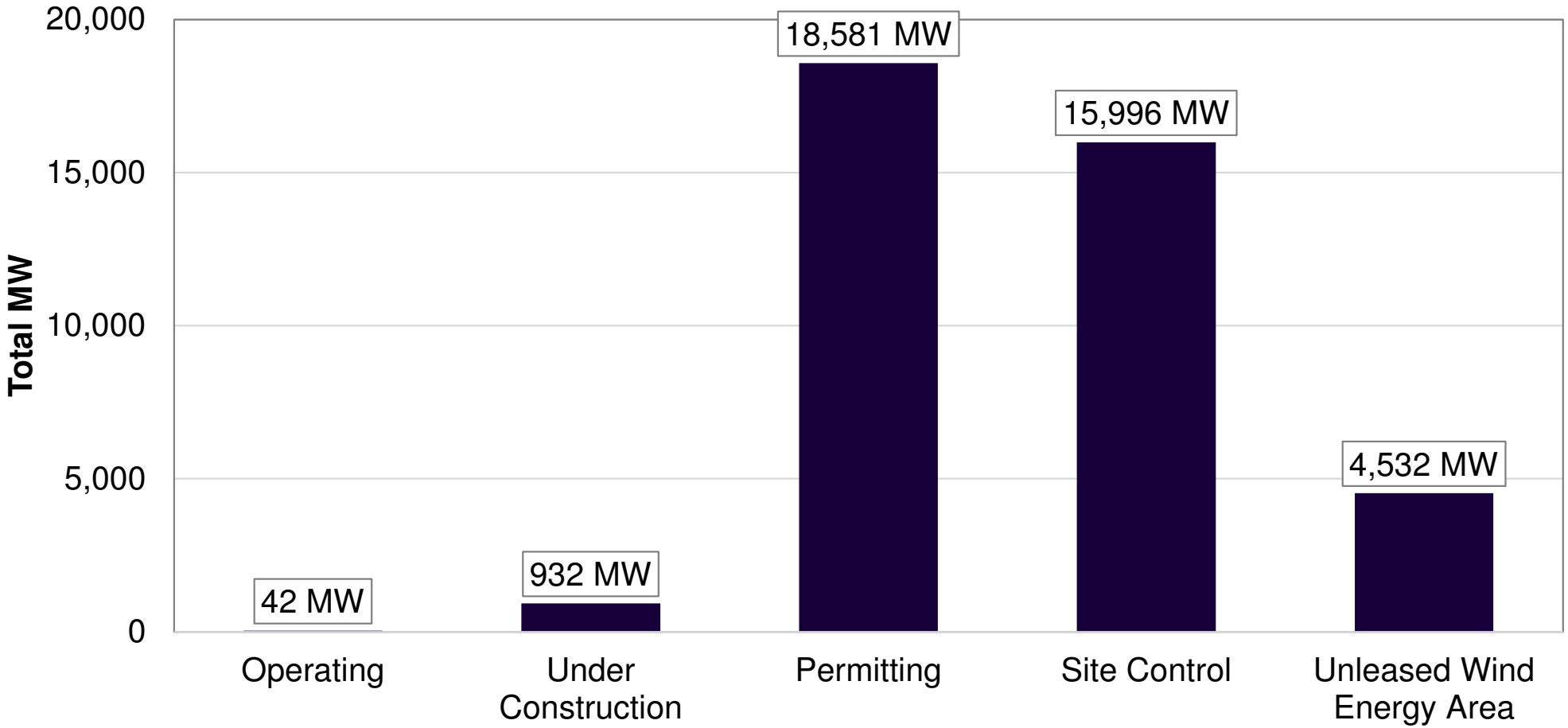
Much of the U.S. offshore wind pipeline **(40.1 GW) is attributable to the Atlantic** Region, where there has been a surge in lease sales, particularly along the coast of **New York and New Jersey**.



Source: U.S. Department of Energy.

OSW Current Status and Pipeline

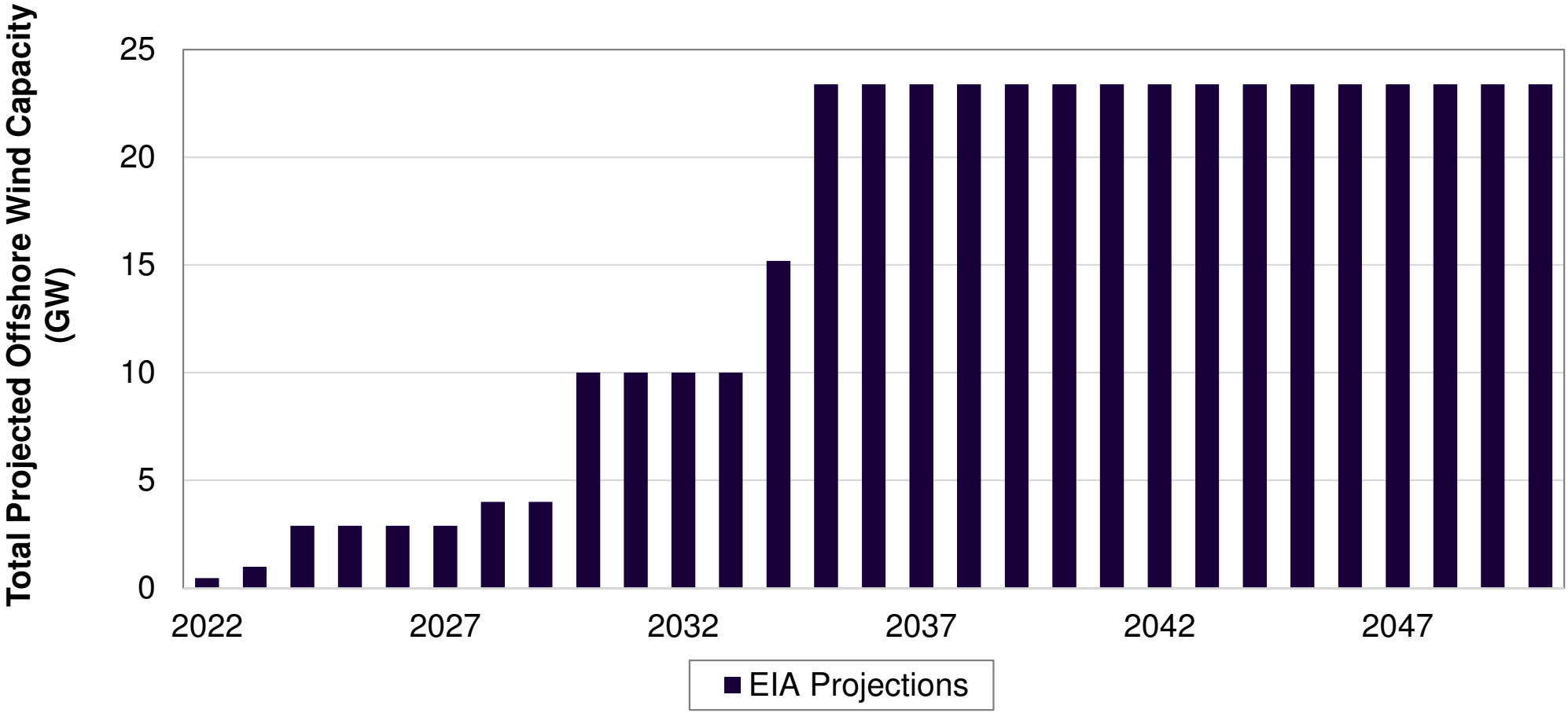
There are only **two operational U.S. windfarms**, representing **42 MW** of capacity. However, **the pipeline is robust (40,083 MW)** and has experienced a **13.5% increase year-over-year.**



Source: U.S. Department of Energy.

Projected Growth

EIA projects the U.S. to reach **nearly 25 GW of total offshore wind capacity by 2035**. However, this projection seems **conservative due to various state procurement targets, which collectively strive for 39.3 GW of capacity by 2040**.



Source: EIA; U.S. Department of Energy.

Lease Activity

In February 2022, **BOEM auctioned six lease areas in the New York area**. These auctions represented the first in the U.S. since 2018. Bids for this lease sale totaled $4.37 billion or $8,955 per acre.

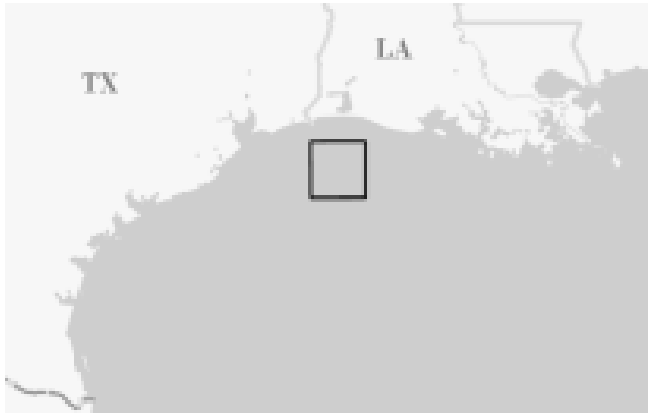
Lease or Grant Number	Date	Lessee or Grantee	Lease Sale ($ Billion)	Acres	Average per Acre ($)	Expected Capacity (MW)	Average per MW ($)
OCS-A 0537	5/1/2022	Bluepoint Wind, LLC	$ 0.77	71,522	$ 10,696	868	$ 881,336
OCS-A 0538	5/1/2022	Attentive Energy LLC	0.80	84,332	9,427	964	824,689
OCS-A 0539	5/1/2022	Community Offshore Wind, LLC	1.10	125,964	8,733	1,387	793,079
OCS-A 0541	5/1/2022	Atlantic Shores Offshore Wind Bight, LLC	0.78	79,351	9,830	924	844,156
OCS-A 0542	5/1/2022	Invenergy Wind Offshore LLC	0.65	83,796	7,697	934	690,578
OCS-A 0544	5/1/2022	Vineyard Mid-Atlantic LLC	0.29	43,056	6,619	523	544,933
Totals:			**$ 4.37**	**488,021**	**$ 8,955**	**5,600**	**$ 763,128**

Source: U.S. Department of Energy.

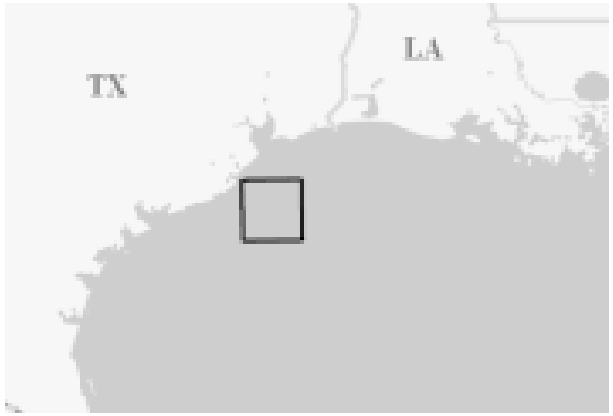
Lease Activity: Gulf of Mexico

In February 2023, the Department of the Interior announced three proposed lease areas (**across 301,746 acres**) in the Gulf of Mexico off the coasts of **Galveston, TX** and **Lake Charles, LA.**

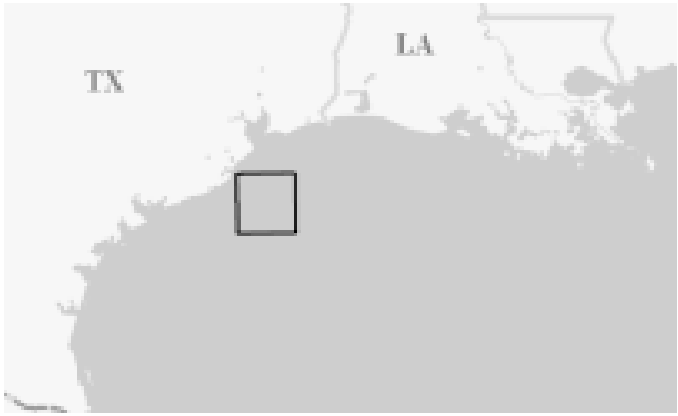
OCS-G 37334: 102,480 acres



OCS-G 37335: 102,480 acres



OCS-G 37336: 96,786 acres



At the price of the 2022 lease sales in New York ($8,955 per acre), **these lease areas represent $2.7 billion in potential lease sales.**

Source: BOEM.

Conclusions

Conclusions.

- Three factors highly influencing gulf coast energy: **globalization; decarbonization; and politicization**.
- Crude oil and natural gas markets continuing to **"run sideways"** and are range-bound. **Considerable economic, financial and political uncertainty**.
- Unconventional basins are still productive, but **significant "pull-back" on upstream investment**. Continued work on **balance sheet improvement and ESG concerns**.
- Capital investments continue but increasingly tied to **energy transition activities.**
- **Regional renewable capacity development is surging** and will likely continue to advance.

Questions, comments and discussion.

David E. Dismukes
Professor Emeritus
Center for Energy Studies
Email: dismukes@lsu.edu

Phone: 225-578-4343

URL: www.enrg.lsu.edu

