

2024

GULF COAST ENERGY OUTLOOK

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GROUP

Outline

1 Introduction & Uncertainties

2 Oil & Gas Production

3 Mid-stream Constraints

4 Power Sector

5 Energy Exports

6 Energy Manufacturing Activity

7 Employment

8 Conclusions

Outline

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Introduction & Uncertainties



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Oil & Gas Production

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Mid-stream Constraints

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Power Sector

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Energy Exports

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Energy Manufacturing Activity

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Employment

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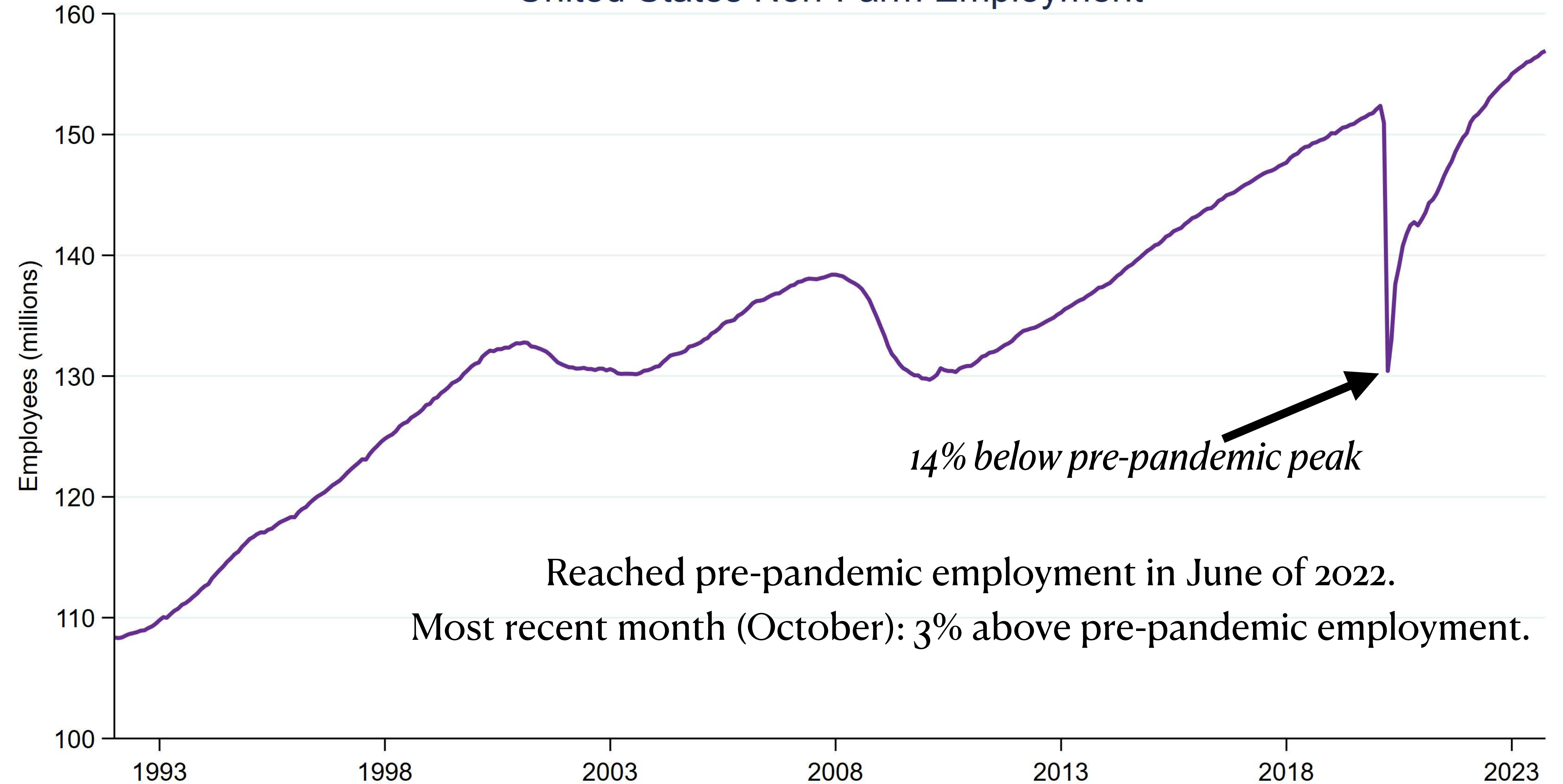
Conclusions

Uncertainties

1. Is a Recession Still on the Horizon?
2. Decarbonization Efforts: Balancing Cost Competitiveness and Emissions Reductions
3. What have we learned from the Russian Invasion of Ukraine?
4. Supply Restrictive Policies
5. Is Permitting the New Bottleneck?



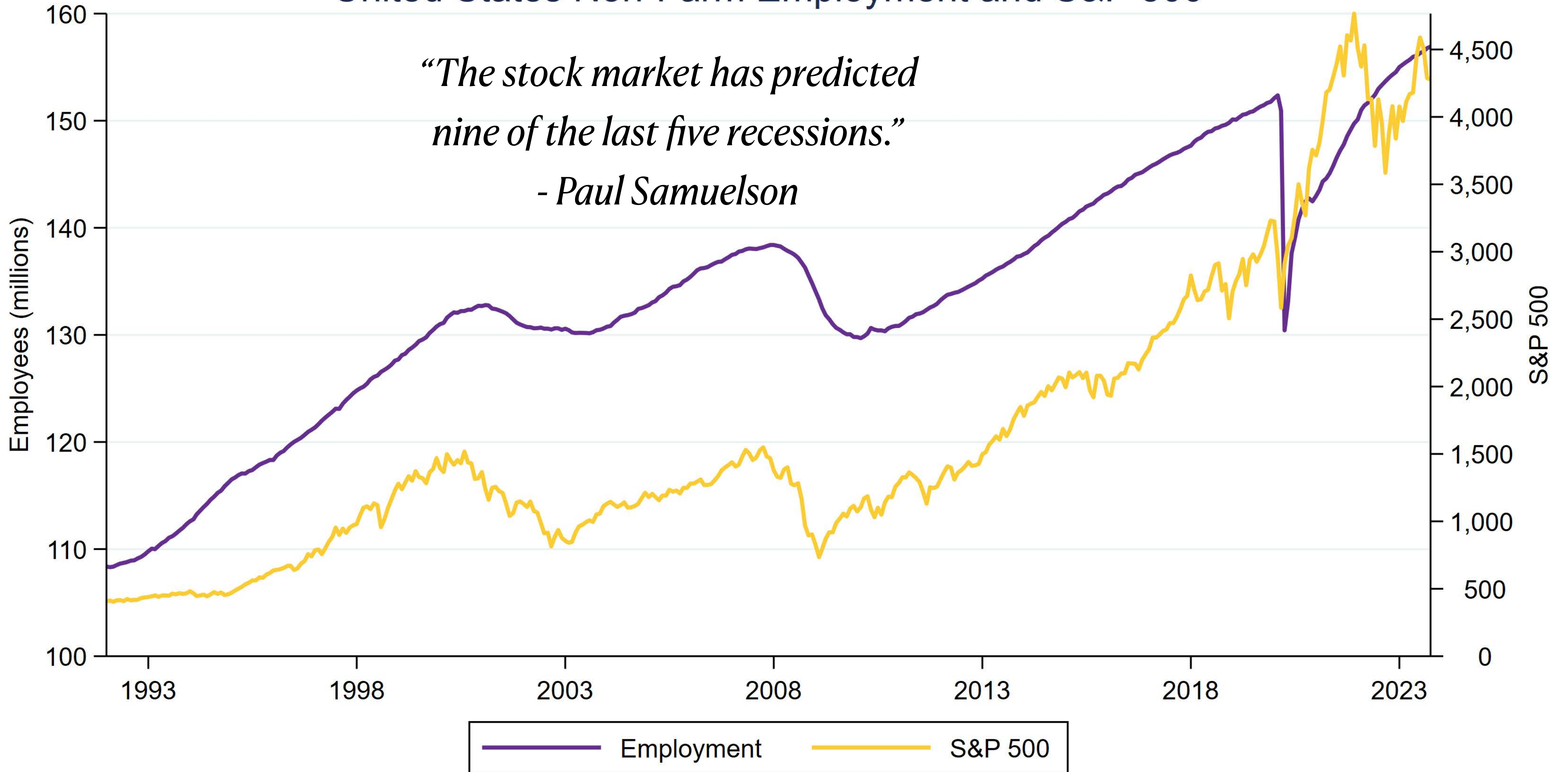
United States Non-Farm Employment



Source: Bureau of Labor Statistics. Current Employment Statistics (CES). Retrieved from FRED.

United States Non-Farm Employment and S&P 500

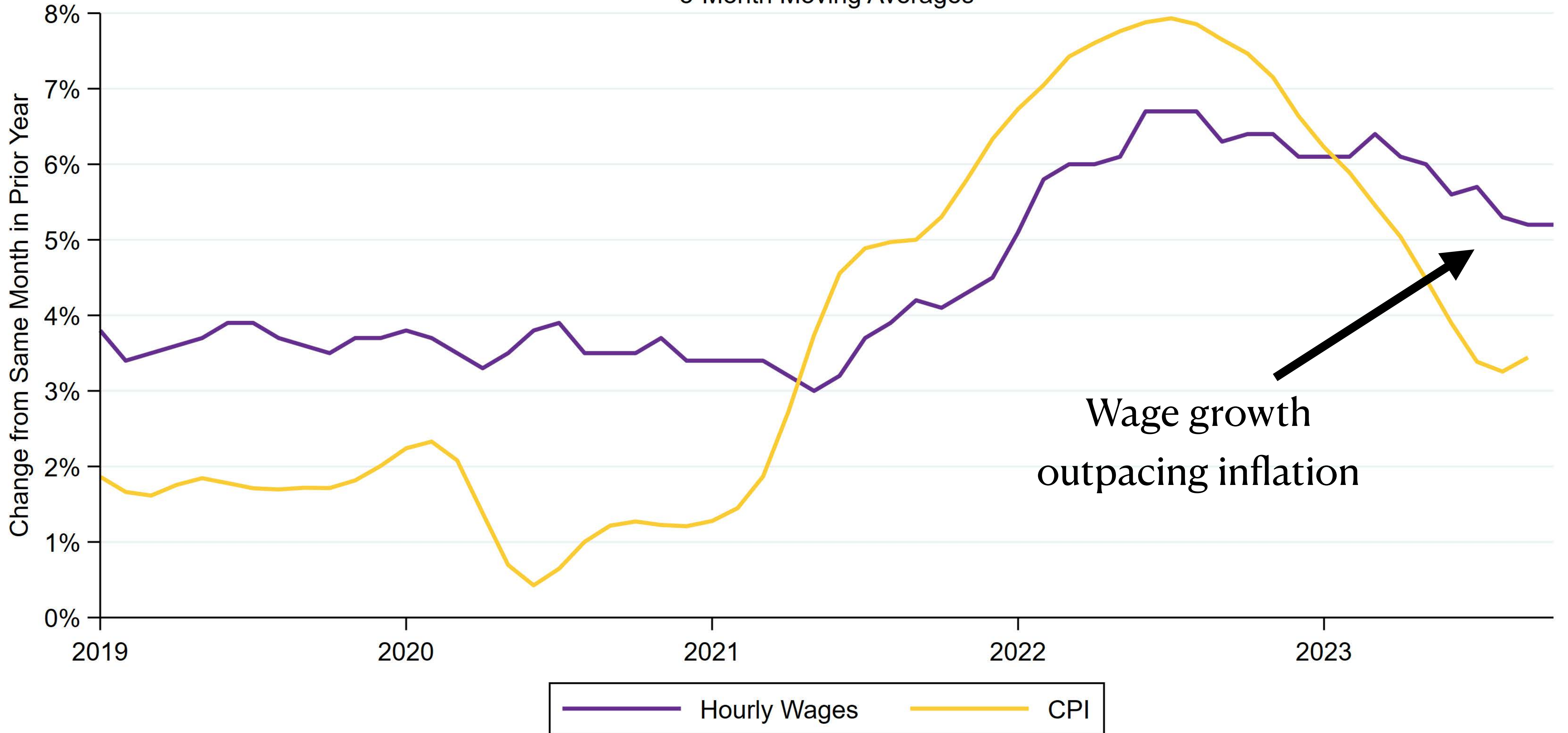
*“The stock market has predicted
nine of the last five recessions.”
- Paul Samuelson*



Source: Bureau of Labor Statistics. Current Employment Statistics (CES). Retrieved from FRED.
S&P 500 from www.investing.com

Wage Growth and Consumer Price Index

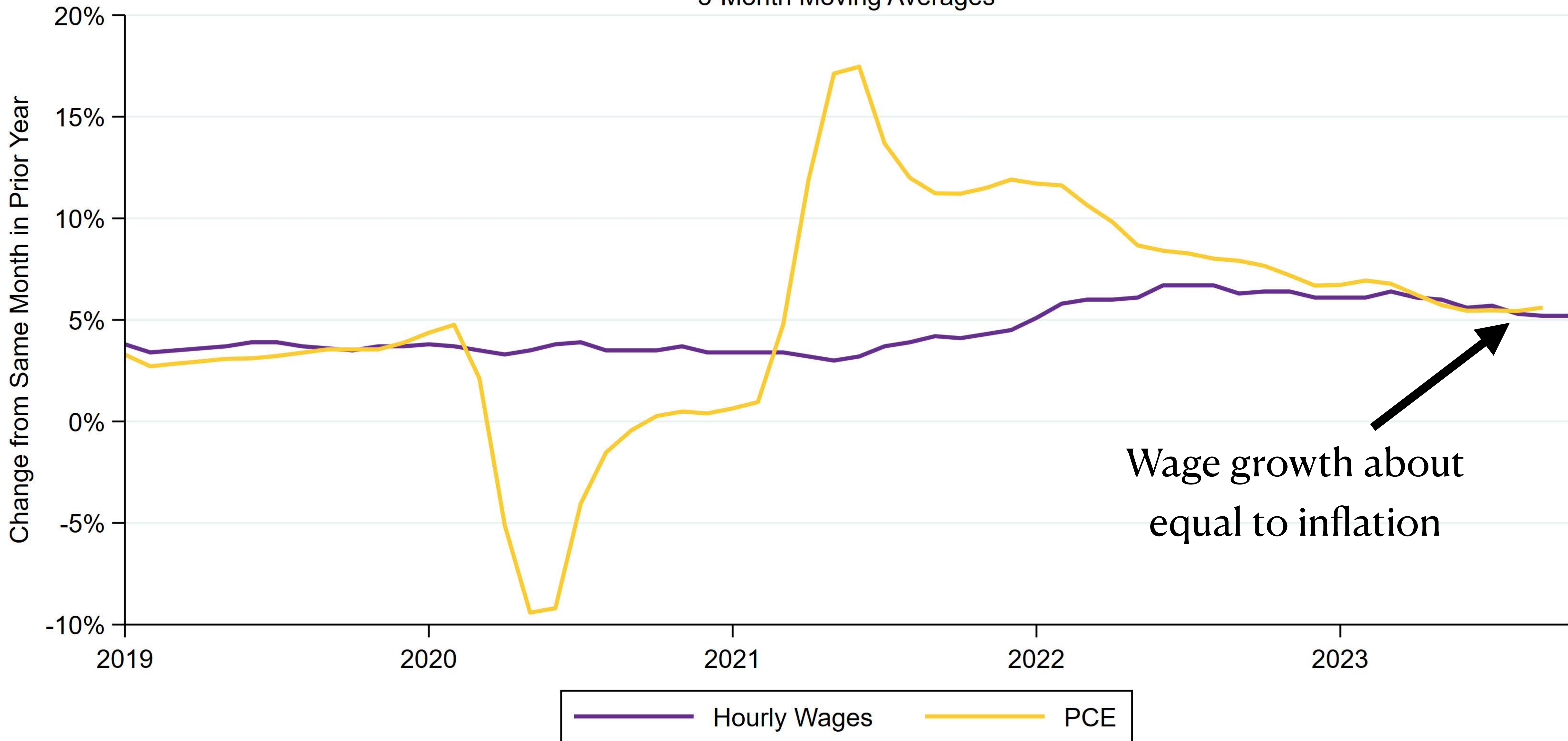
3-Month Moving Averages



Sources: Atlanta Fed Wage Growth Tracker (constructed using the Current Population Survey), retrieved from FRED.
Bureau of Labor Statistics, retrieved from FRED.

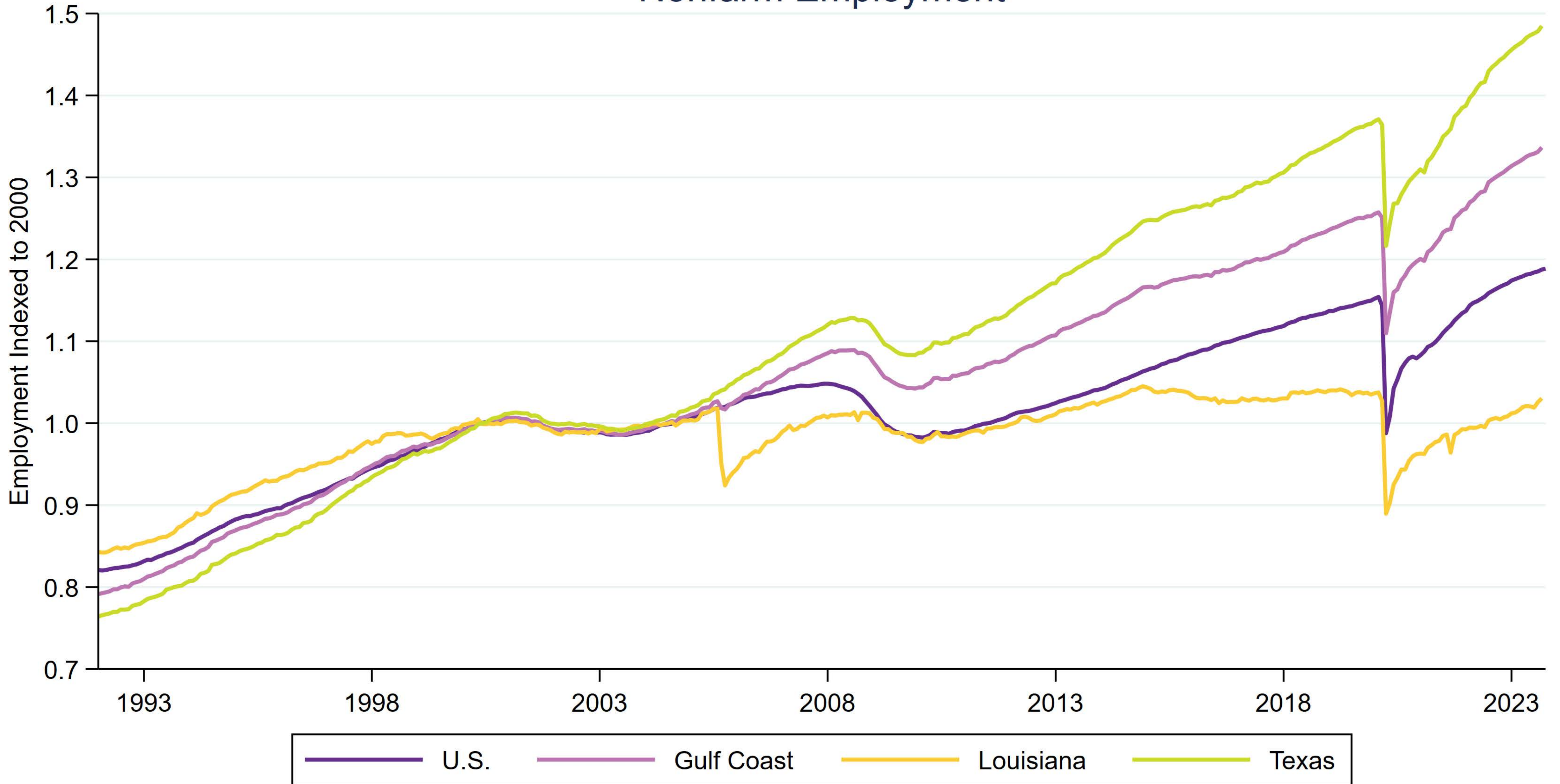
Wage Growth and Personal Consumption Expenditures Index

3-Month Moving Averages



Sources: Atlanta Fed Wage Growth Tracker (constructed using the Current Population Survey), retrieved from FRED. Bureau of Labor Statistics, retrieved from FRED.

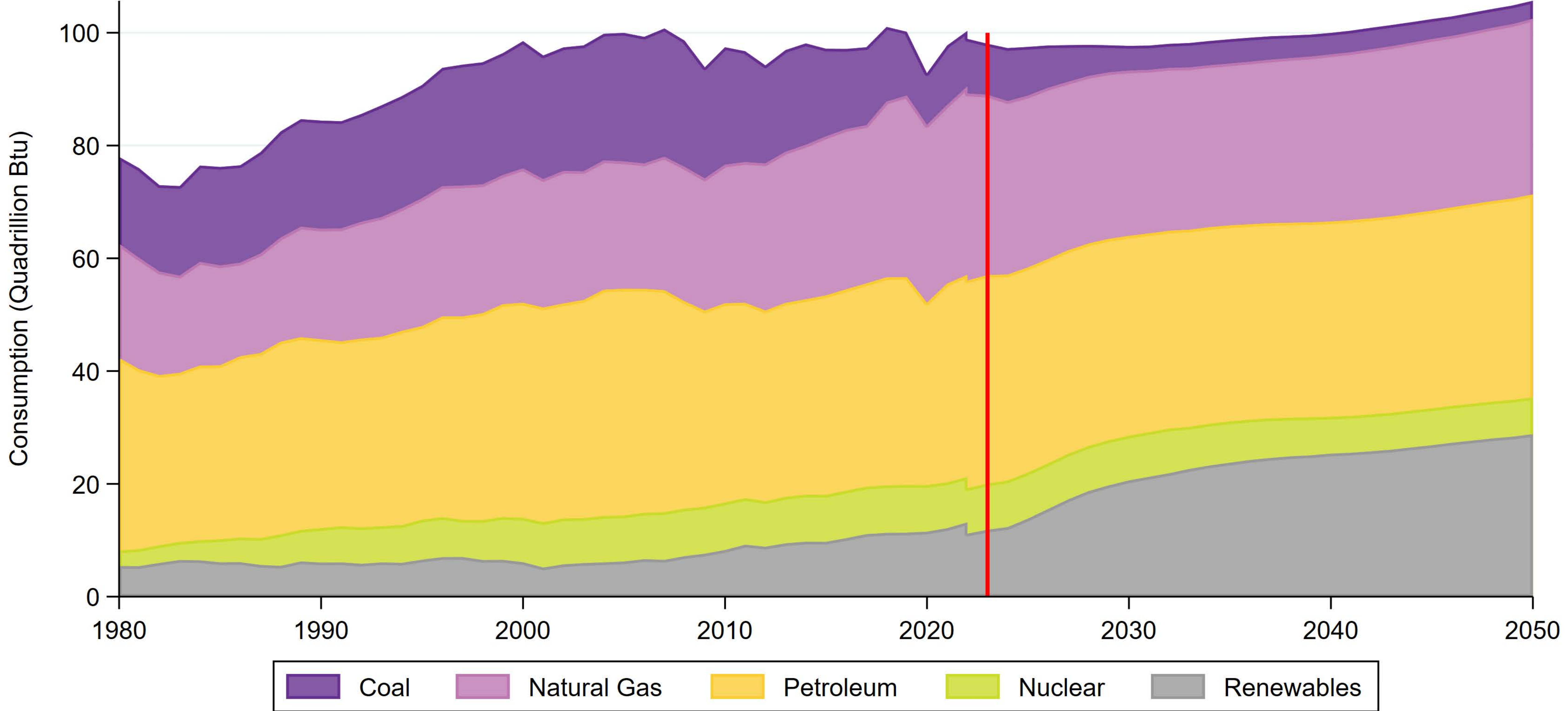
Nonfarm Employment



Source: Bureau of Labor Statistics. Current Employment Statistics (CES). Retrieved from FRED.

U.S. Primary Energy Consumption

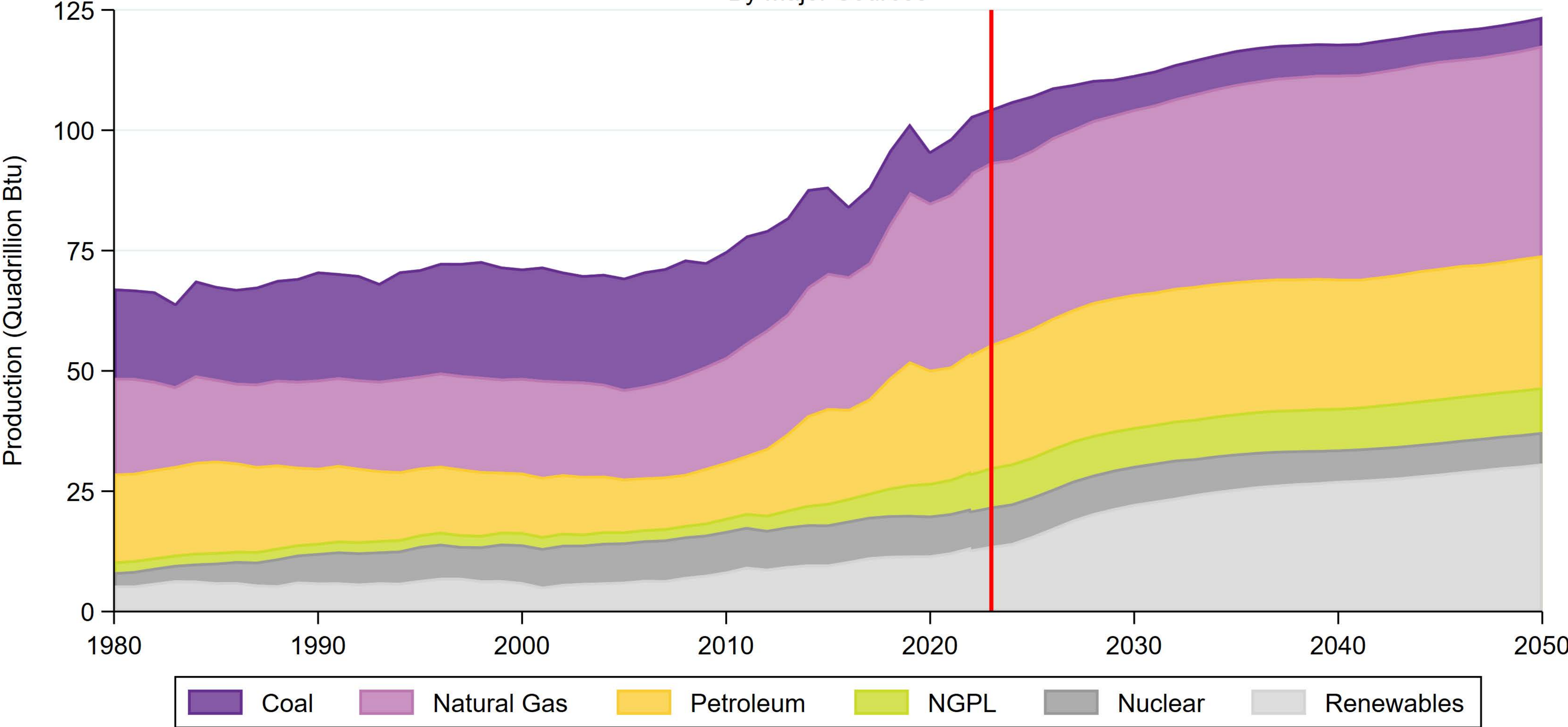
By Major Sources



Source: Energy Information Administration
Future trends are from Annual Energy Outlook 2023 reference scenario

U.S. Primary Energy Production

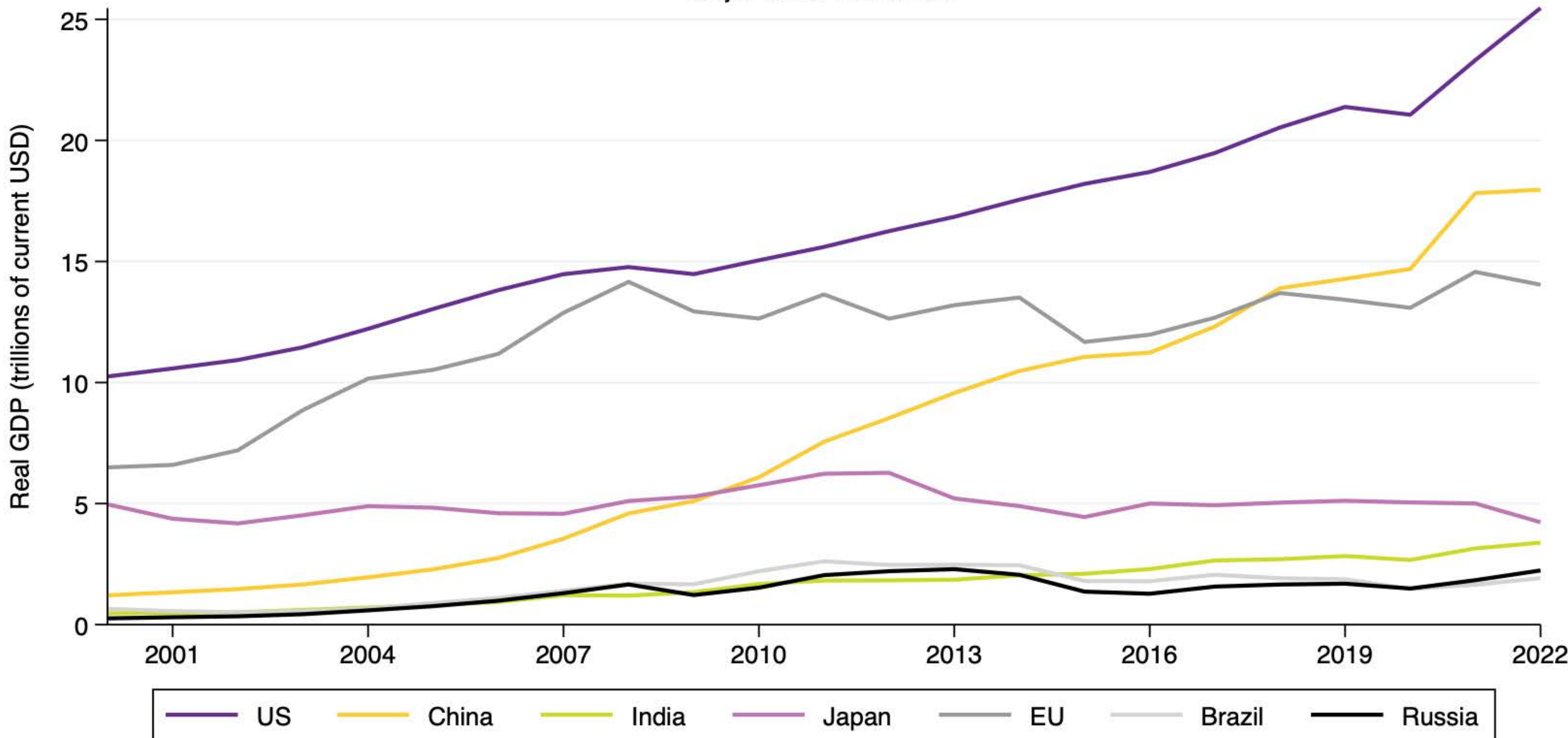
By Major Sources



Source: Energy Information Administration
Future trends are from Annual Energy Outlook 2023 reference scenario

Real Gross Domestic Product

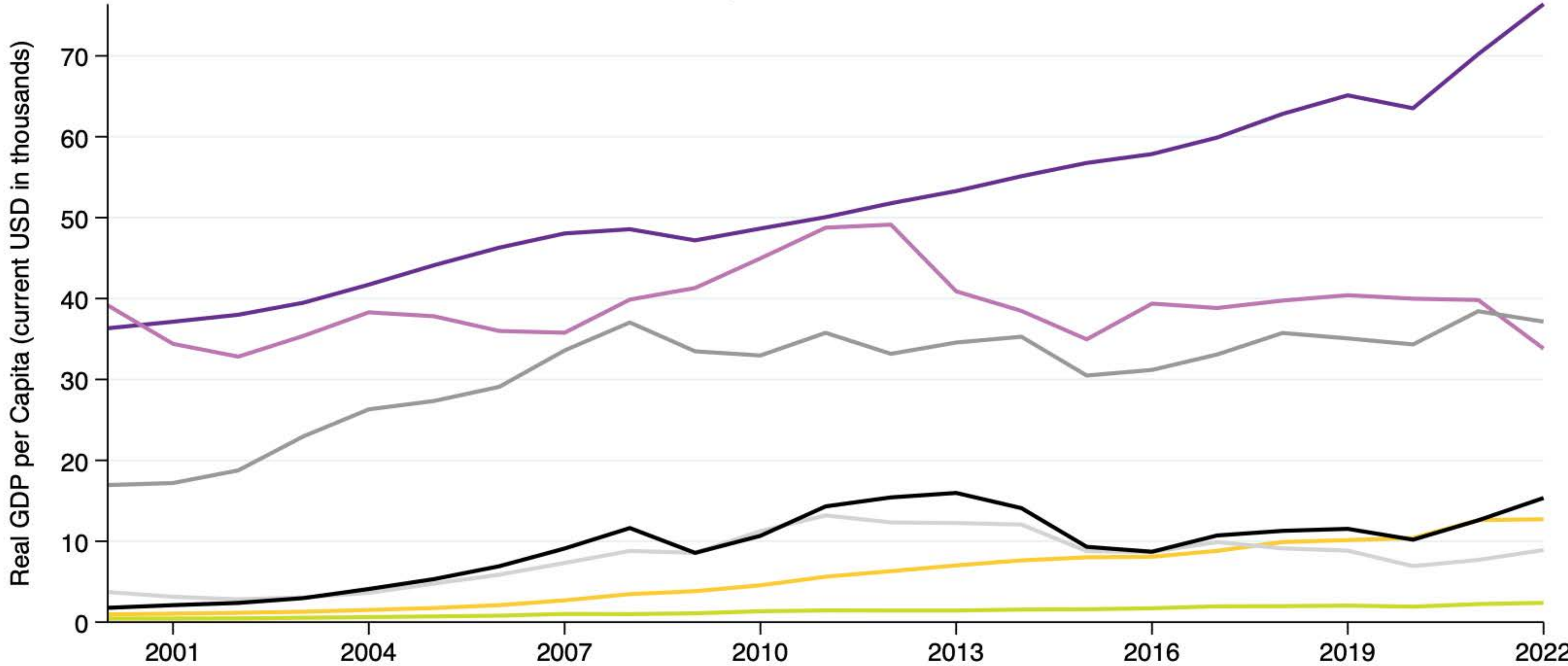
Major World Economies



Source: Bloomberg.

Real Gross Domestic Product per Capita

Major World Economies



Source: Bloomberg.

1.1 Is a Recession Still on the Horizon?

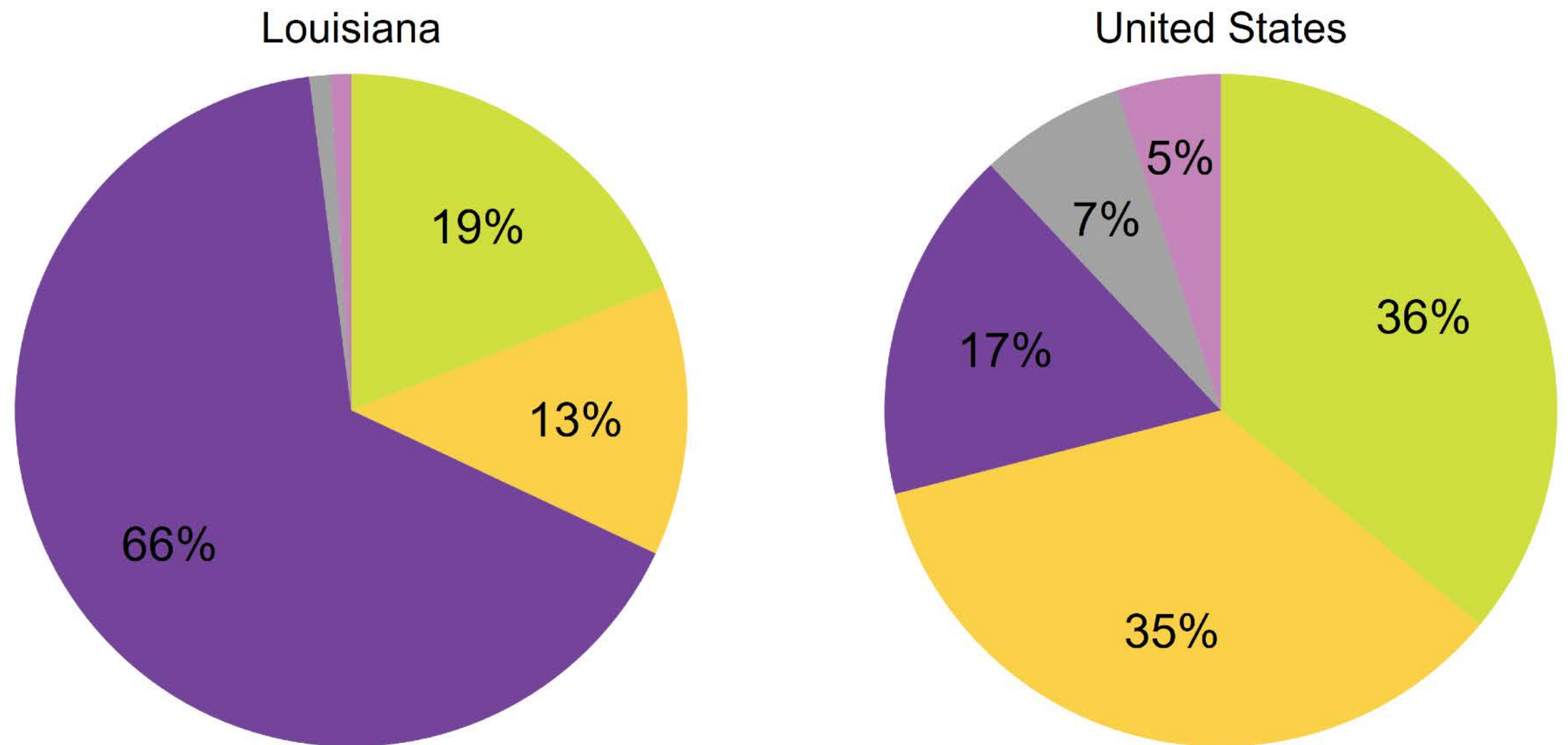
This year's GCEO modeling will assume that inflation continues to gradually slow to the Federal Reserve's target of two to three percent over the next few years. Wage growth will gradually begin to outpace inflation, and demand for energy globally will continue to rise. GCEO, much like years past, anticipates that long-run energy demand growth will lead to increased U.S. energy exports, especially to the growing developing world. If the global economy enters a recession, this will reduce demand for energy products in the short-term, making these forecasts too optimistic.

1.2 Decarbonization Efforts: Balancing Cost Competitiveness and Emissions Reductions

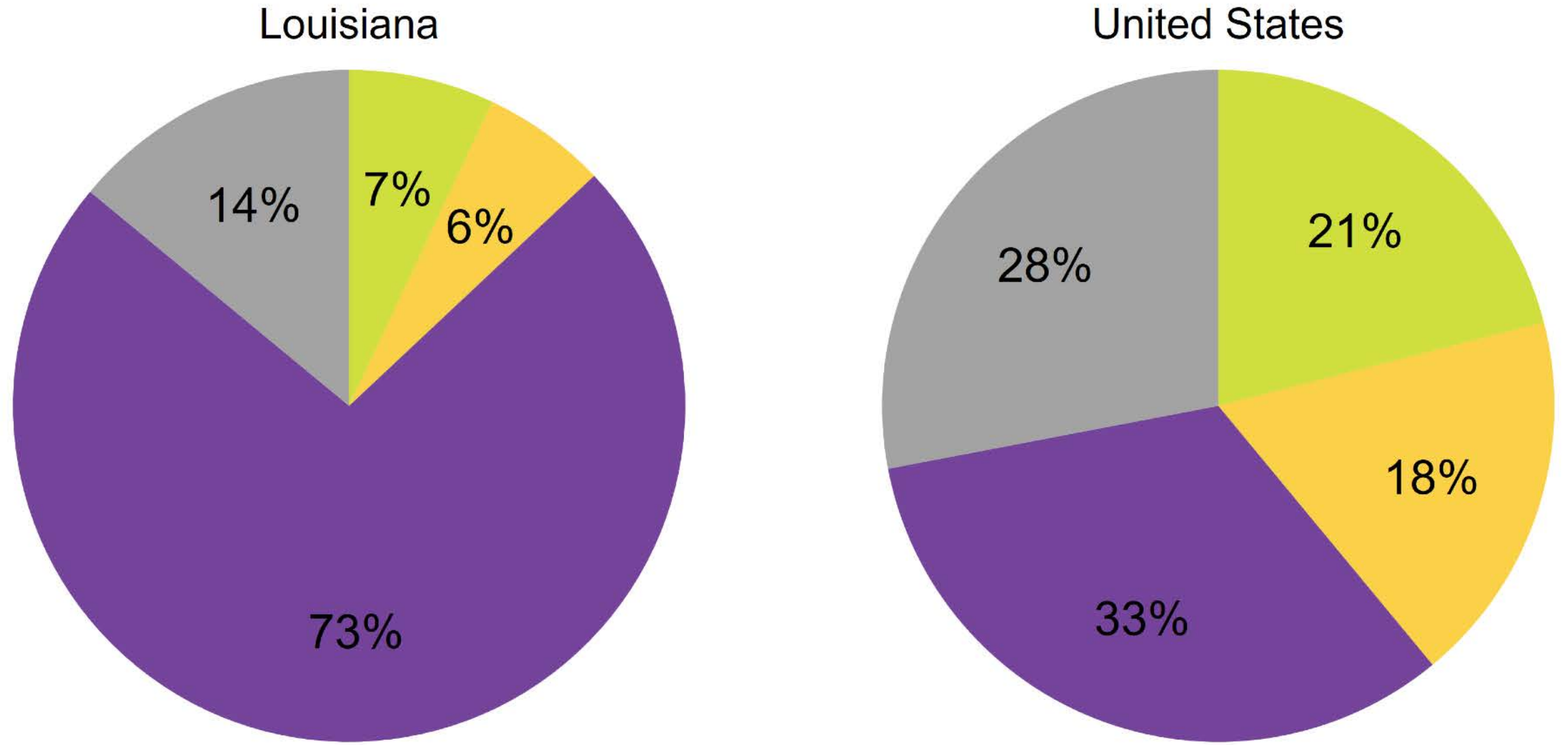
- Decarbonization, particularly industrial decarbonization, continues to take on a new level of importance and urgency each year.
- We are still in the beginning phases of the Inflation Reduction Act's (IRA) 10-years of spending on emissions reductions.
 - IRA signed into law in August of 2022.
 - Energy & climate accounted for 84% of bill's spending.
- Three Stylized Facts:
 1. Energy demand has been flat in the U.S. for a decade, and this is expected to continue.
 2. Energy production has increased over this time period:
 - Oil ↑ 83%; Natural gas ↑ 47%; renewable energy ↑ 51%.
 3. Energy production growth facilitated by exports.

Balancing cost competitiveness and emissions competitiveness at the top of companies minds when making investment decisions.

Emission Shares



Energy End-Use Consumption



Transportation Electric Power Industrial Residential Commercial

Residential Commercial Industrial Transportation

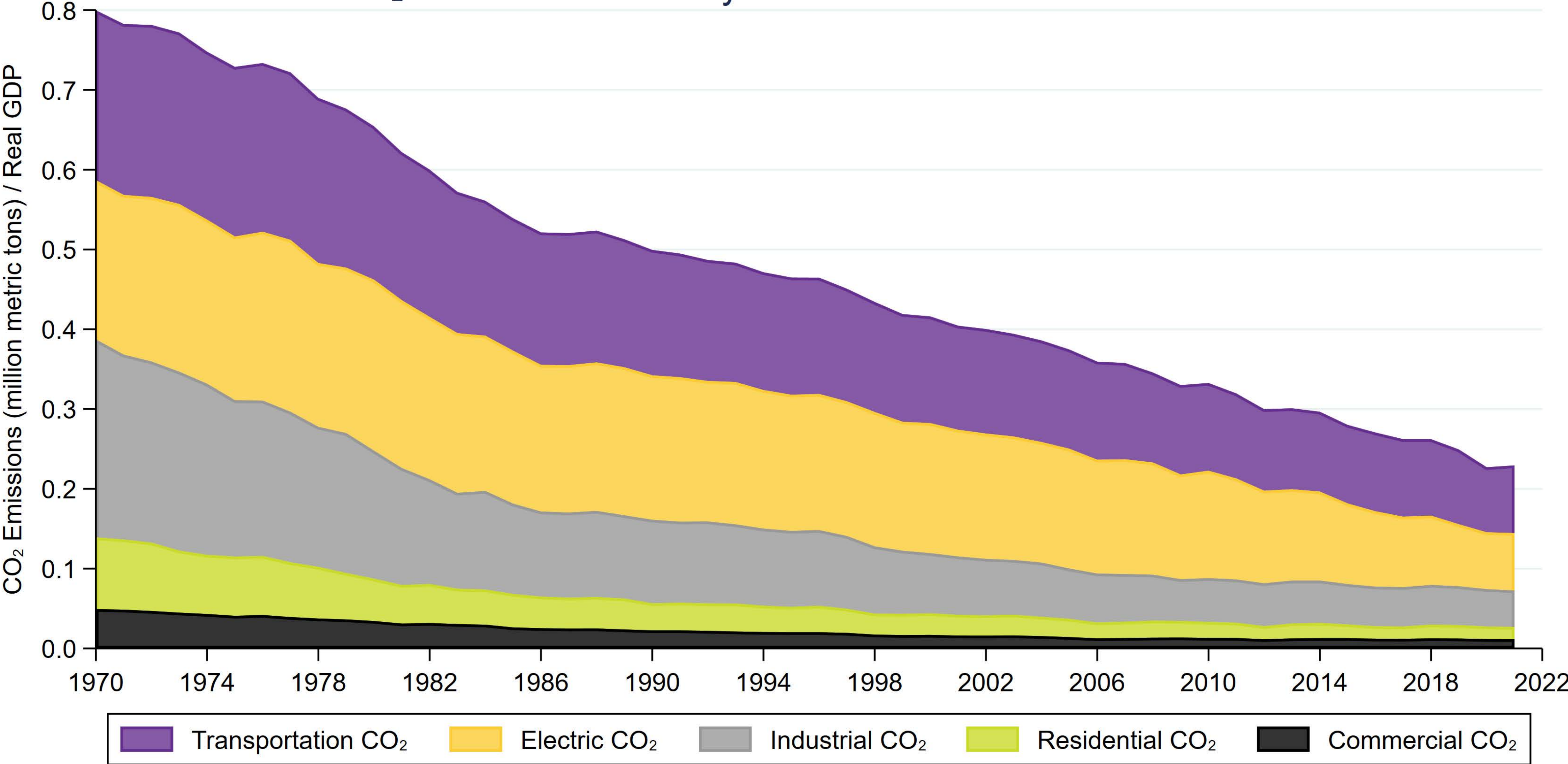
Source: Louisiana 2021 Greenhouse Gas Inventory

Source: Louisiana 2021 Greenhouse Gas Inventory

Industrial emissions make up ~2/3 of Louisiana's GHG emissions, compared to ~17 percent nationally.

Industrial energy usage makes up approximately ~3/4 of energy usage in Louisiana, compared to ~1/3 nationally.

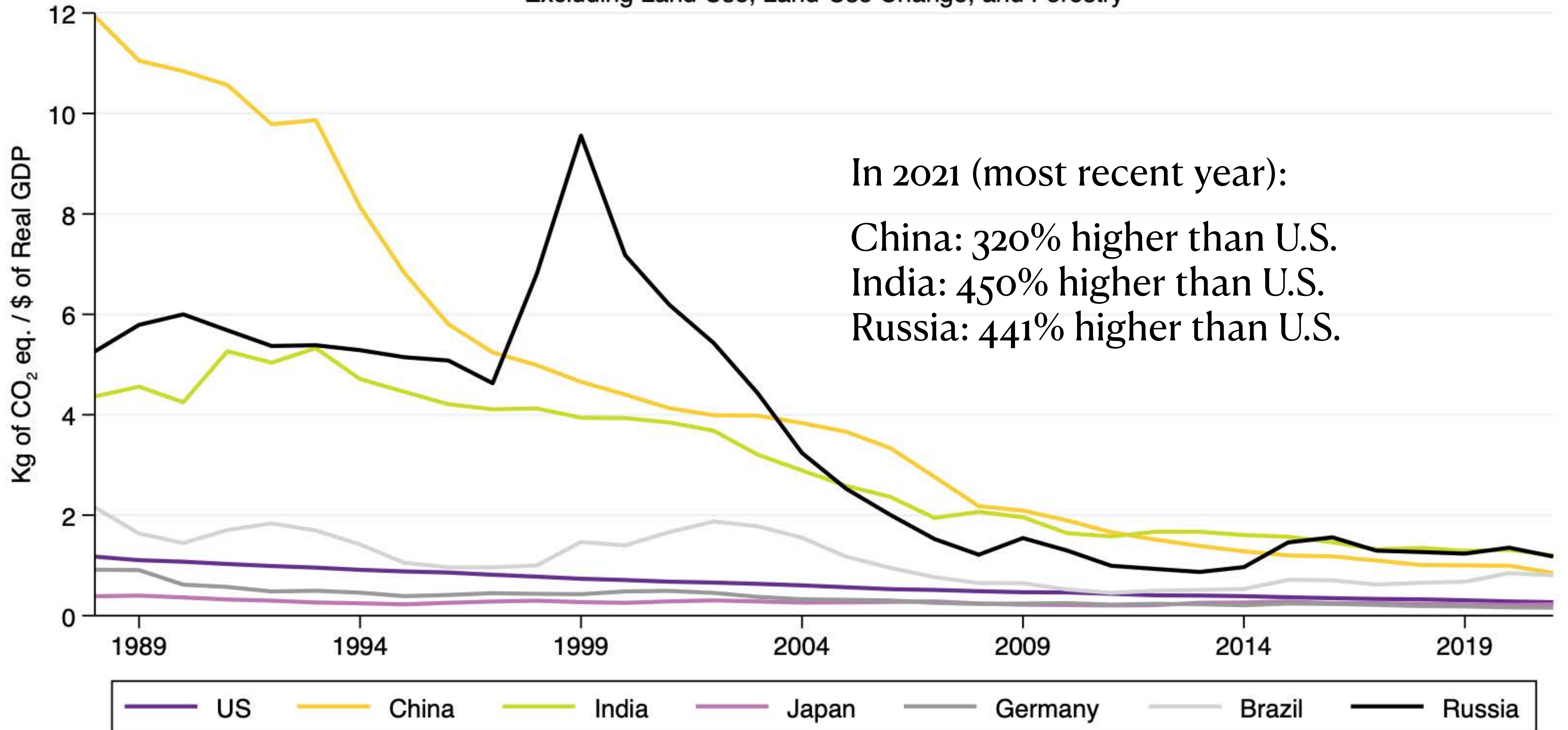
CO₂ Emissions Intensity of Real Gross Domestic Product



Source: U.S. Energy Information Administration
Real GDP is in billions of chained 2017 dollars, not seasonally adjusted

Emissions Intensity of GDP

Excluding Land Use, Land-Use Change, and Forestry

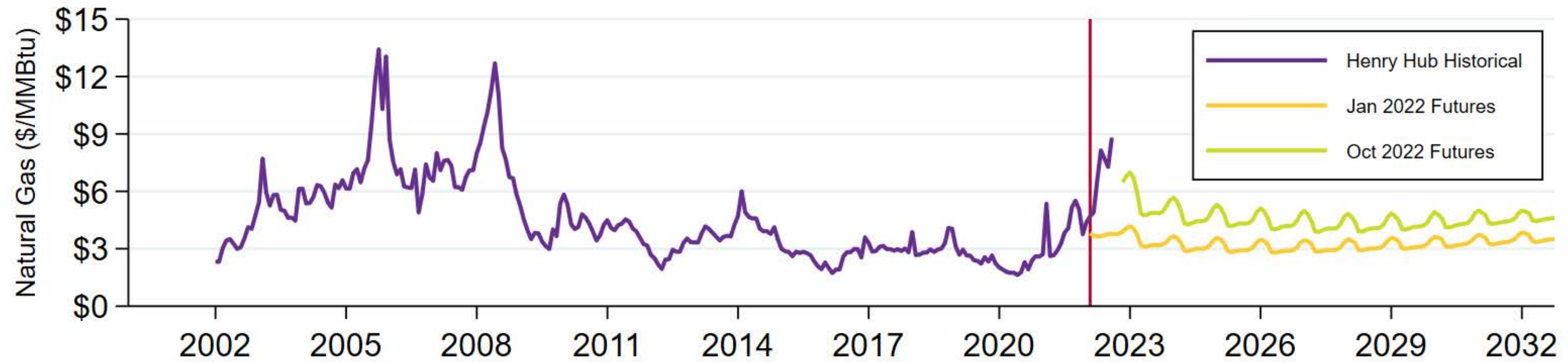
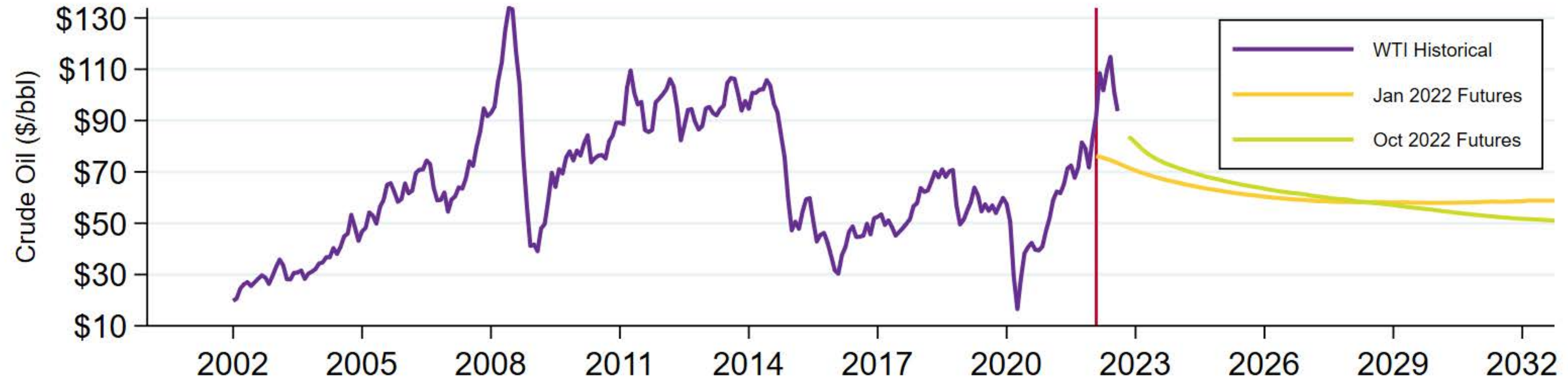


Source: GDP data from Bloomberg.
Emissions data from the IMF.

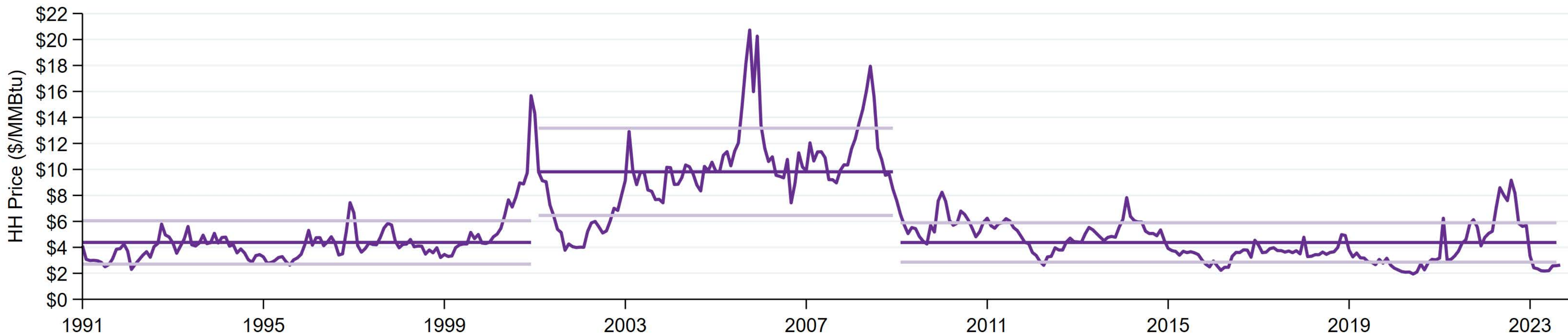
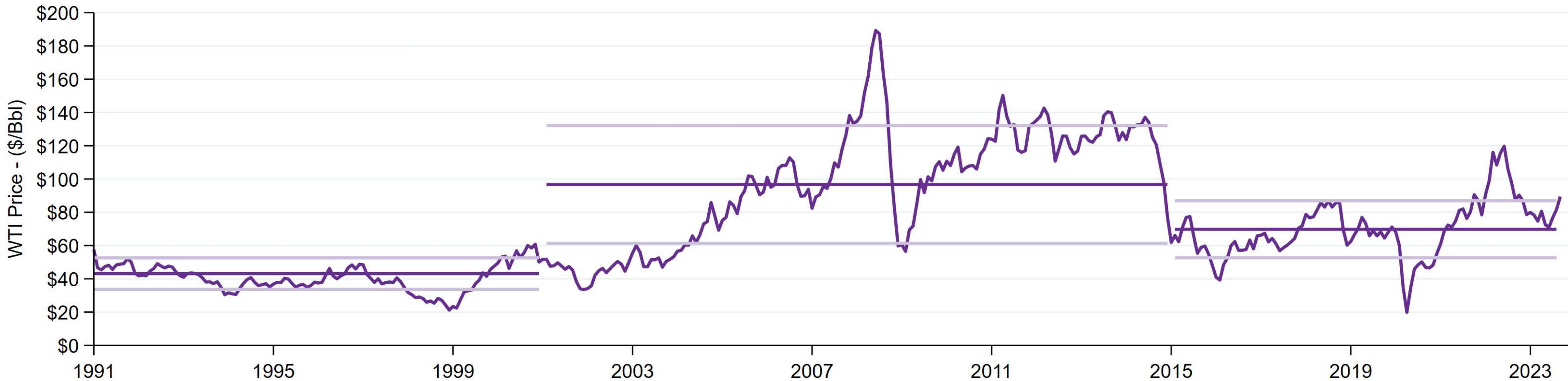
Risk or Opportunity?

Decarbonization will not only challenge existing Gulf Coast energy manufacturing but also create an opportunity for regional leadership in the development of the production capacity for liquid fuels, chemicals, plastics, fertilizers, and other products historically derived from fossil fuels, with lower, or even net zero GHG emissions. Companies are actively considering the most efficient ways to achieve meaningful emissions reductions given the subsidies that are currently available under the IRA. Over the forecast horizon, the GCEO sees decarbonization creating considerable regional capital investment opportunities. Longer-term effects of decarbonization on the region will be determined by the cost to achieve emissions reductions alongside the global market's willingness to pay a premium for lower emission intensive products.

1.3 What Have We Learned from Russia's Invasion of Ukraine?



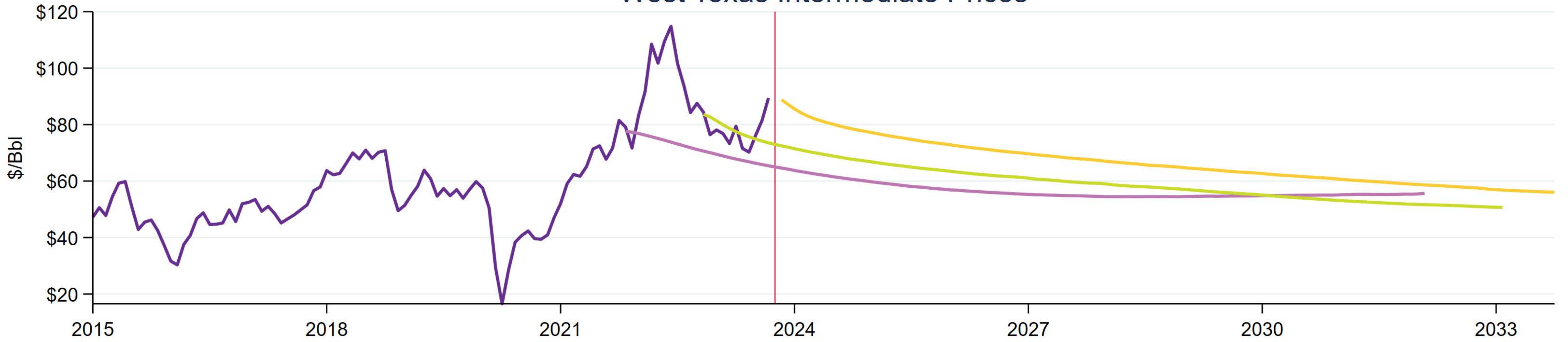
Source: S&P Global Market Intelligence



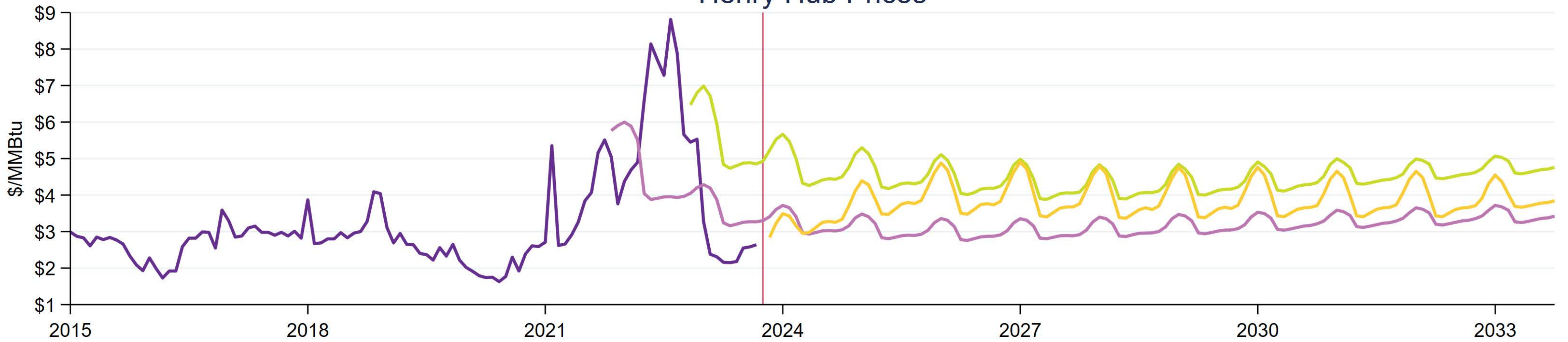
Henry Hub Spot Price adjusted to current Consumer Price Index.
 Source: U.S. Energy Information Administration



West Texas Intermediate Prices



Henry Hub Prices



Historical Inflation Adjusted Crude Oil Prices



WTI Spot Price Adjusted to current Consumer Price Index.
Source: U.S. Energy Information Administration

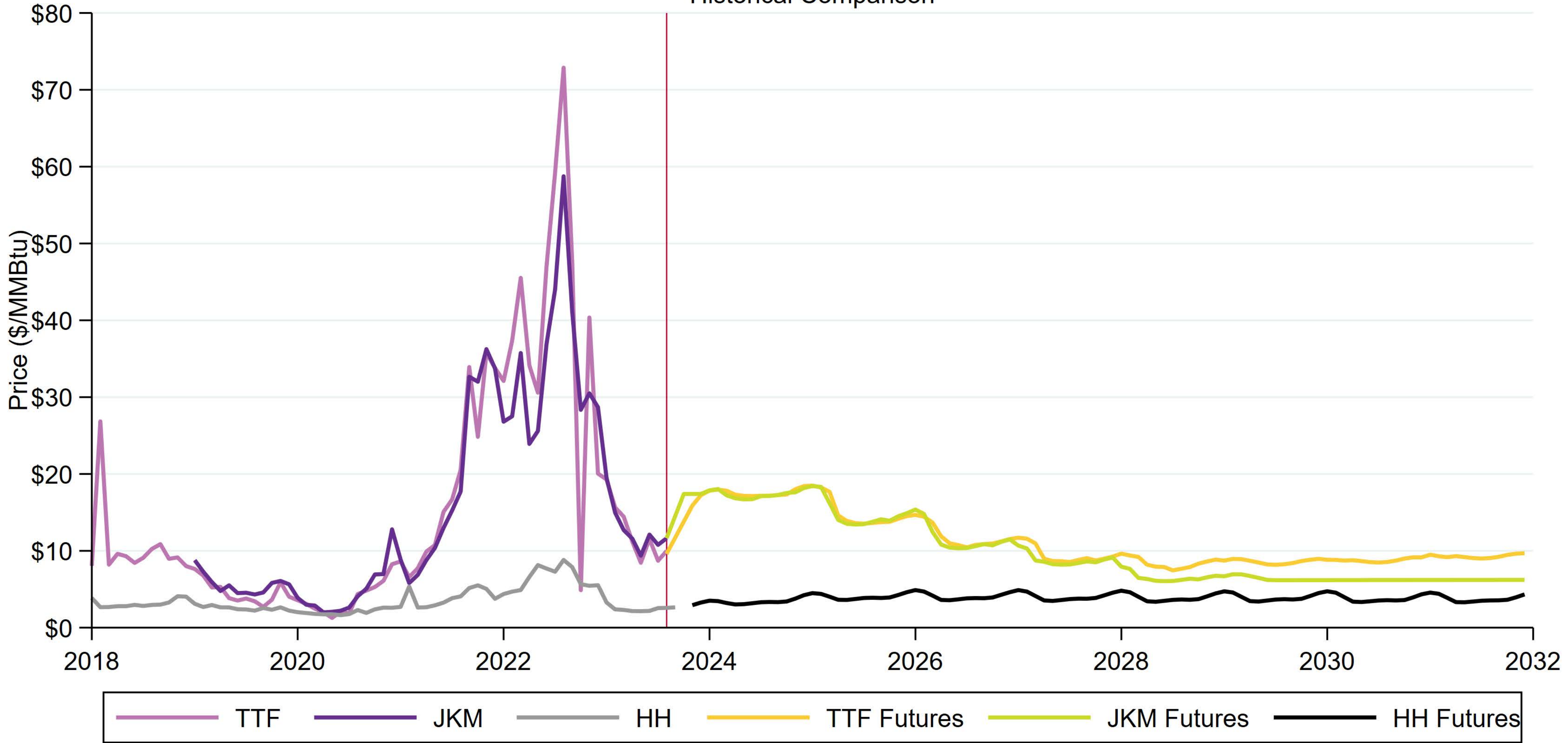
Historical Inflation Adjusted Natural Gas Prices



Henry Hub Spot Price adjusted to current Consumer Price Index.
Source: U.S. Energy Information Administration

Natural Gas Prices

Historical Comparison



Source: Bloomberg

1.3 What Have We Learned from Russia's Invasion of Ukraine?

GCEO modeling will assume that the war in Ukraine continues, as does Western economic sanctions on Russia. Global commodity prices have largely already adjusted to this global supply shock, and any effects will continue to attenuate as time passes. The Russian invasion of Ukraine has increased the international importance of our region as a global energy provider.

1.4 Supply Restrictive Policies

GCEO modeling considers uncertainty around reduced levels of offshore leasing. Over the forecast horizon, three years, effects on employment are likely to be small. But long-term implications on oil and gas supplies and upstream employment are likely to be larger if uncertainty around offshore leasing continues into the future.

Offshore Leasing Timeline

- 2020 campaign trail: Candidate Biden said he would ban “new oil and gas permitting” on public lands and waters.
- January 2021 executive order: “pauses new oil and gas leases” on public lands and waters during “comprehensive review and reconsideration” of leasing practices.
 - March Gulf of Mexico Lease Sale cancelled.
- June 2021: Preliminary injunction granted in Federal court that the Bureau of Land Management (BLM) and Bureau of Ocean Energy Management (BOEM) continue leasing while review is completed.
- November 2021: Gulf of Mexico Lease Sales 257 conducted, with ~81 million acres available for leasing.
 - ~1.7 million acres leased for ~\$192 million.
- January 2022: Washington, D.C. Court vacated results of Lease Sale 257.
- June 2022: Department of the Interior announces that all lease sales remaining in the current five-year program are cancelled.
 - Offshore leasing in the Gulf of Mexico effectively discontinued.
- August 2022: Inflation Reduction Act signed into law.
 - Lease Sale 257 reinstated.
 - Offshore leasing resumed and tied to offshore wind developments.
- February 2023: BOEM announces blocks available for Lease Sale 259 totaling ~73 million acres.
- March 2023: Lease Sale 259 conducted.
 - ~1.6 million acres leased for ~\$264 million.
- August 2023: BOEM announces blocks available for Lease Sale 261 totaling ~67 million acres.
 - IRA had required a minimum of 60 million acres be leased for oil/gas to grant leases for offshore wind.
 - ~6 million acres trimmed from original plan following lawsuit to protect Rice’s whale.
- September 2023: Western District Court of Louisiana issues preliminary injunction reinstating whale-related acreage previously removed from Lease Sale 261.
 - 5th Circuit Court subsequently denies BOEM’s request to stay the injunction but pushes back the sale date to November.
- September 2023: BOEM announces new 5-year leasing plan including 3 sales between 2024-29, fewest in the leasing program’s 70-year history.
 - Comes after substantial delay (previous plan expired in 2022).



1.5 Permitting: The New Bottleneck?

Four sources of supply chain constraints discussed in prior years:

1. Economic recovery from COVID
2. Full employment economy + economic stimulus
3. Russian invasion of Ukraine and resulting sanctions
4. “Deglobalization”

GCEO modeling assumes that **global supply chain constraints continue to attenuate,** while **uncertainty around permitting presents a more immediate bottleneck** in project development.

What is Carbon Capture, Utilization and Storage (CCUS)?

Greg Upton, LSU Center for Energy Studies; Brian Snyder, LSU Department of Environmental Sciences;
John Flake, LSU Cain Department of Chemical Engineering

What is CO₂?

Carbon dioxide (CO₂) is one of the most important gases on the planet. Plants need it to grow, animals exhale it, and many of our most important industrial processes emit it. It is what makes the gas bubbles (fizz) in sodas, beer, and champagne. CO₂ is also the product of burning anything made of carbon.

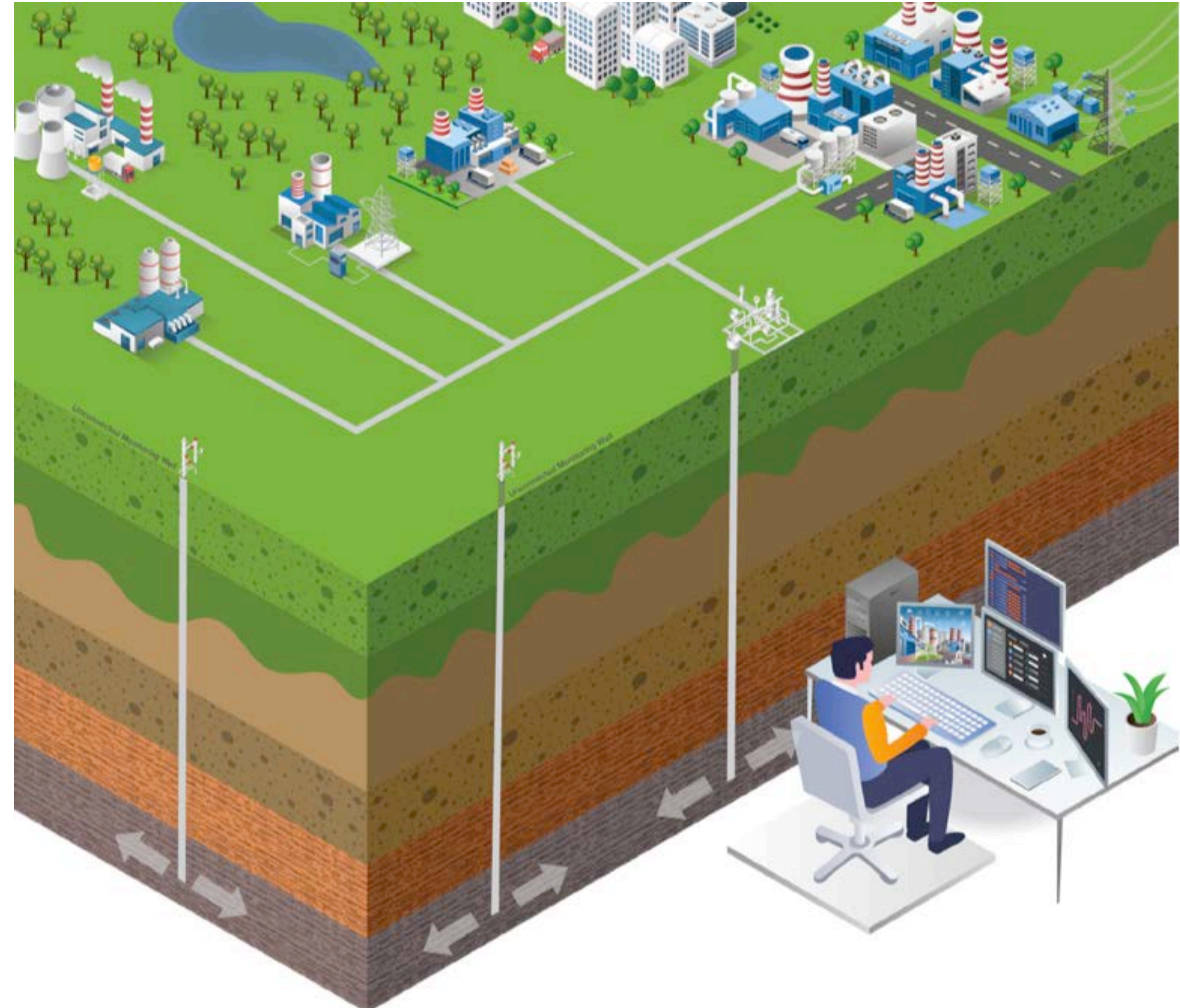
CO₂ is one of the gases that has influenced the climate for millions of years. It's a greenhouse gas (GHG), meaning it traps heat that would normally be radiated back into space. In other words, CO₂ in the atmosphere works like the glass in a greenhouse, warming the planet by preventing heat from escaping.

Over the past 150 years, the concentration of CO₂ in the atmosphere has increased from about 280 parts per million to about 420 parts per million as of 2023. This has already contributed to the planet warming by about 1 degree Celsius, or about 2 degrees Fahrenheit compared to the average of the 20th century. If humanity continues to emit CO₂ at current rates, scientists believe that warming will continue. Continued warming can lead to sea level rise, increased extreme precipitation events, and other effects that will impact humans. The Paris Agreement addressing anthropogenic (human caused) GHG emissions was ratified by over 190 countries, representing 97 percent of the global population. Customers and investors worldwide are telling companies with operations in Louisiana they want the products to be made without emitting so much CO₂.

What is Carbon Capture?

Many of our industrial facilities and processes emit CO₂, including refineries, chemical plants, fertilizer plants, as well as power generation from certain sources like coal and natural gas. Louisiana industrial facilities produce products that make modern life possible and sell these products worldwide. For example, without fertilizer, we could not produce enough food for the world's population. Likewise, polymers produced in Louisiana are used to make the detergents, clothing, tennis shoes, and packaging materials that we use every day.

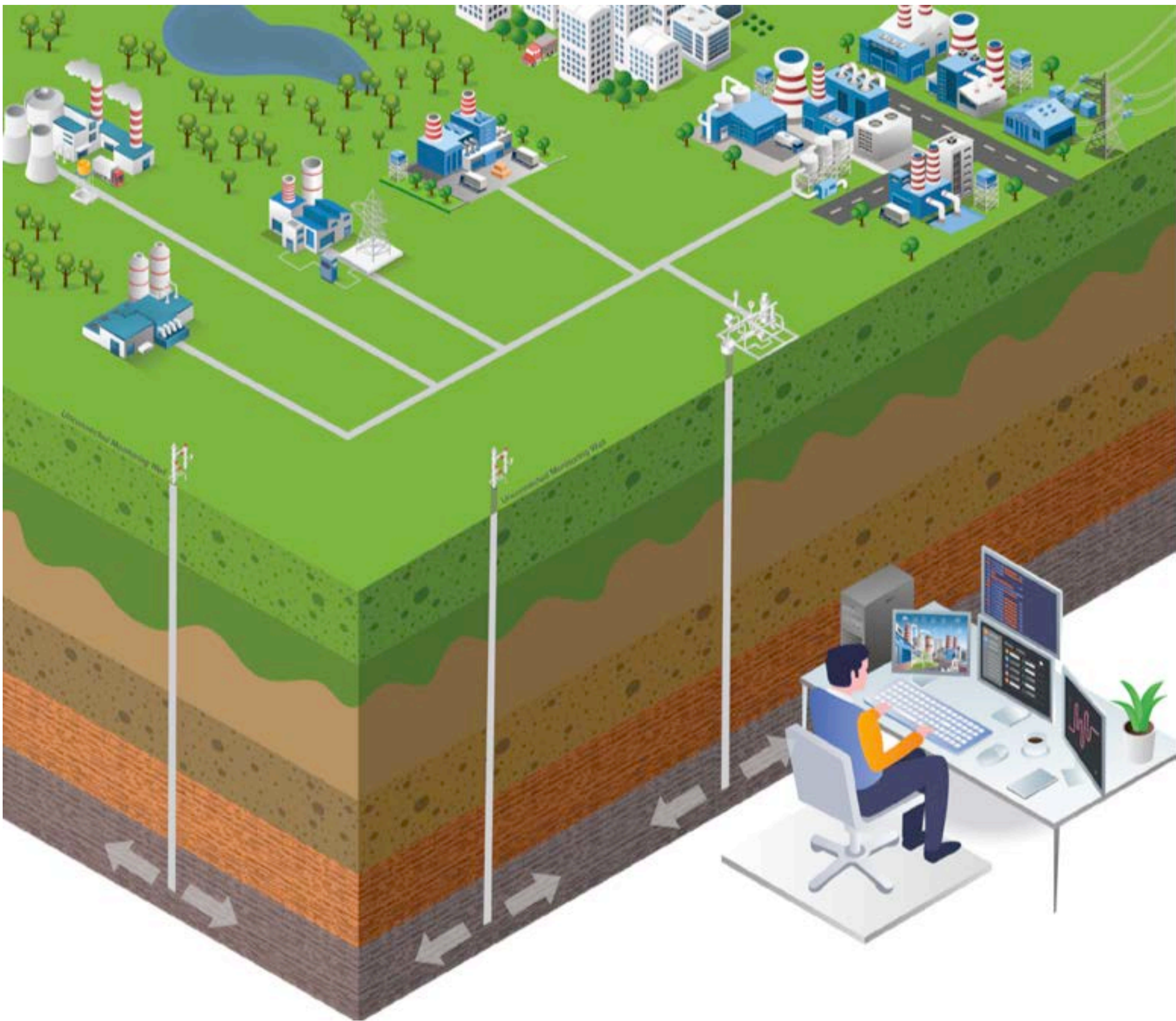
Carbon capture occurs when the CO₂ emissions from an industrial facility or power plant are captured before they can be emitted to the atmosphere. This typically involves an "amine scrubber" that is used to remove CO₂ from chemicals and gasses. Amine scrubbing takes advantage of the fact that some chemicals (amines in the liquid phase) bind or "capture" CO₂. These systems, though, are expensive to install in an industrial facility, and once operational require significant energy to run. The amount of energy required depends on the CO₂ concentration in the emissions stream, among other factors. If the emissions from an industrial facility have a high concentration of CO₂, the energy required to capture the CO₂ decreases. Some industrial processes, especially fertilizer production, already produce very pure streams of CO₂. Capture from these sources is thus relatively low cost and low energy. On the other hand, capturing CO₂





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Outline

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Upstream Activity



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Mid-stream Constraints

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Energy Manufacturing Activity

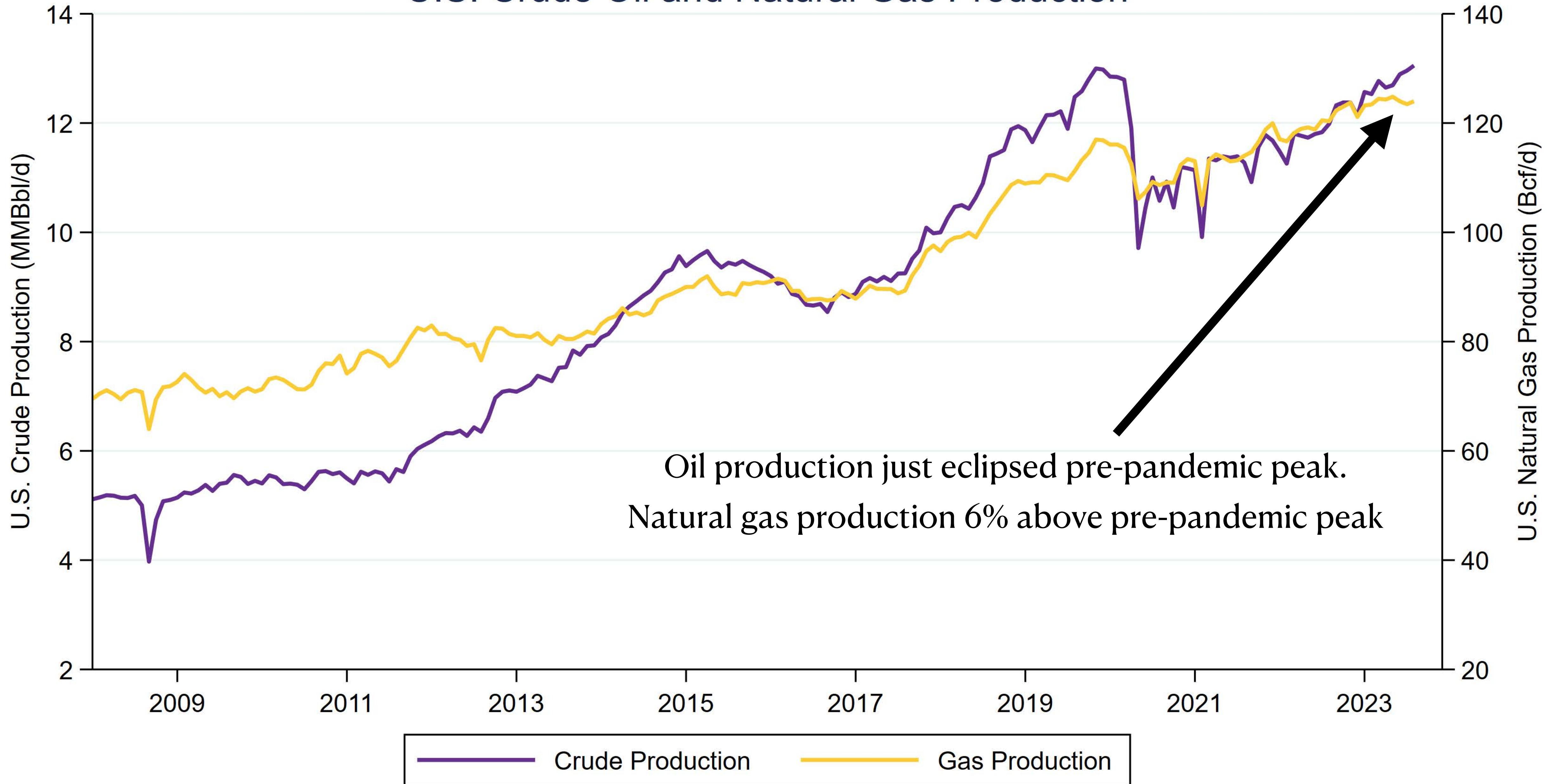
7

Employment

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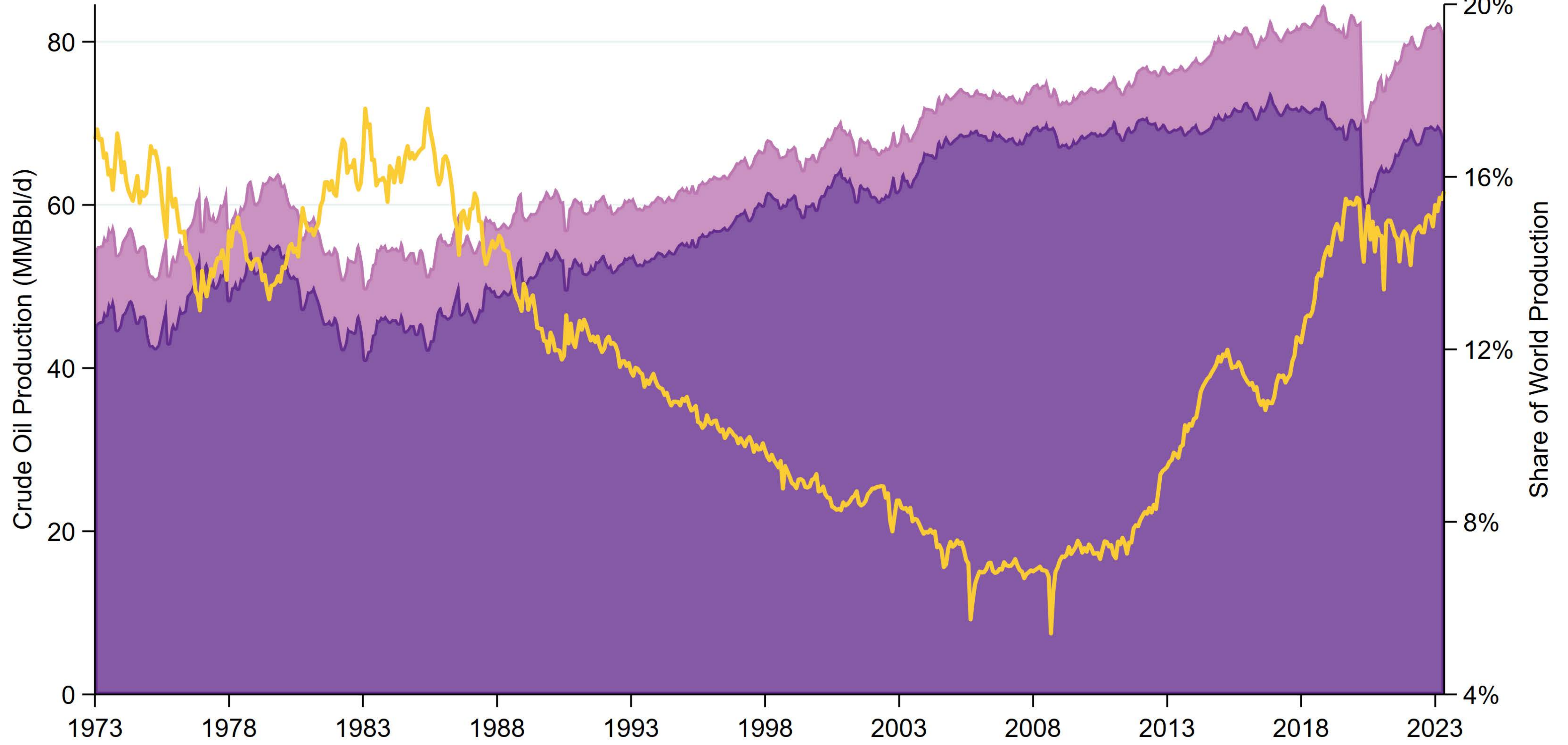
Conclusions

U.S. Crude Oil and Natural Gas Production



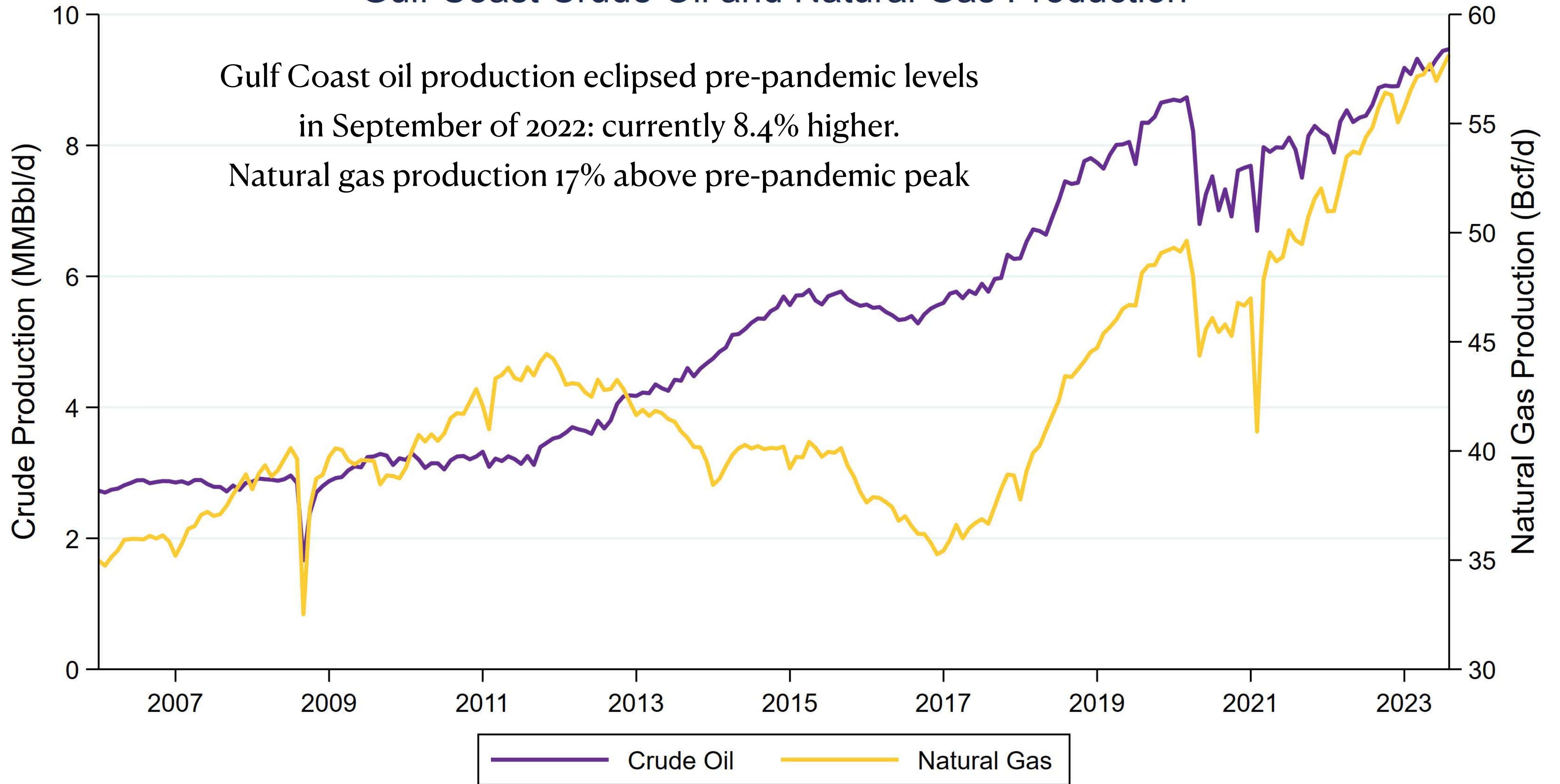
Source: Energy Information Administration, U.S. Department of Energy.

United States Share of Global Crude Oil Production



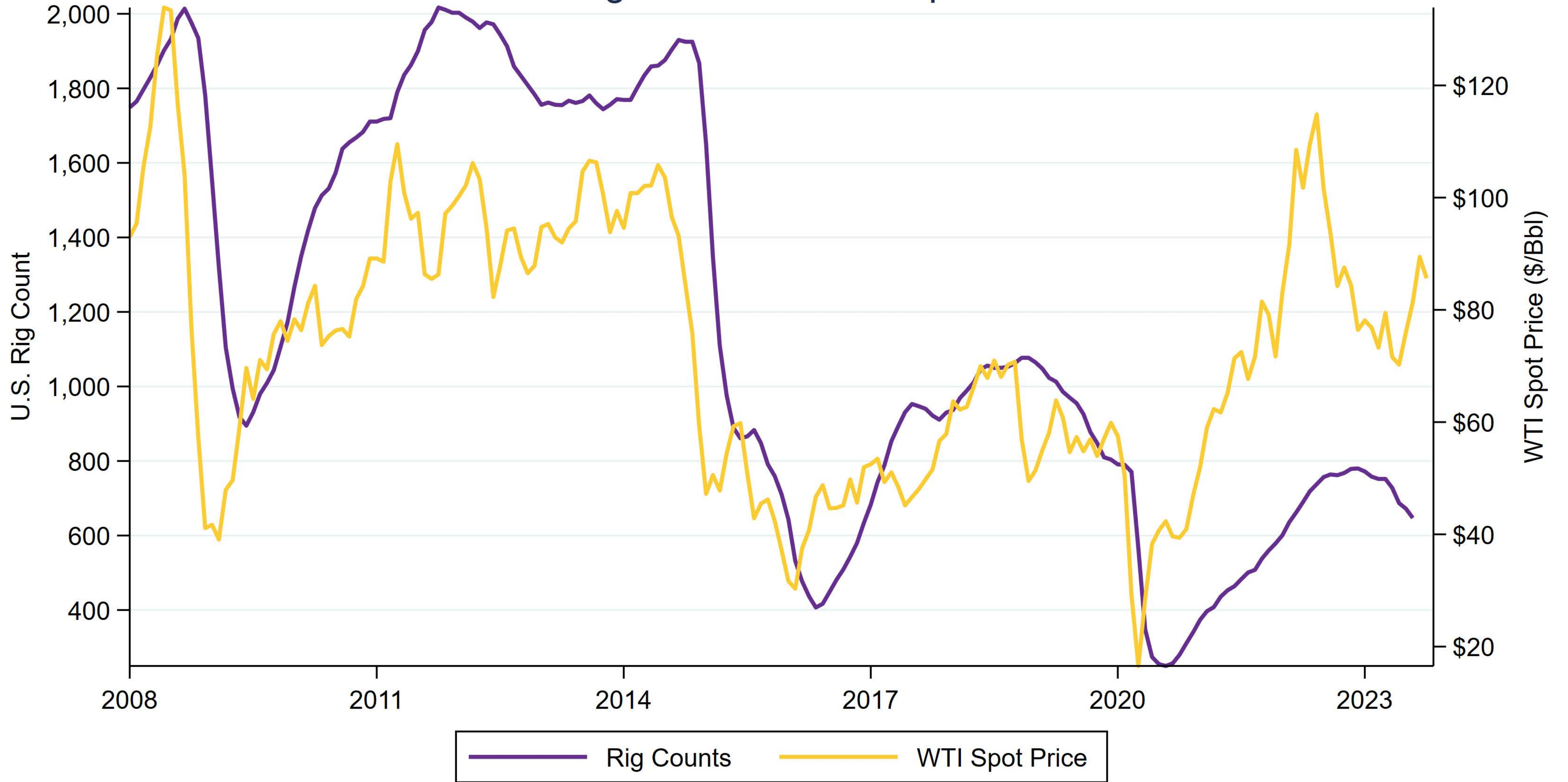
Gulf Coast Crude Oil and Natural Gas Production

Gulf Coast oil production eclipsed pre-pandemic levels
in September of 2022: currently 8.4% higher.
Natural gas production 17% above pre-pandemic peak



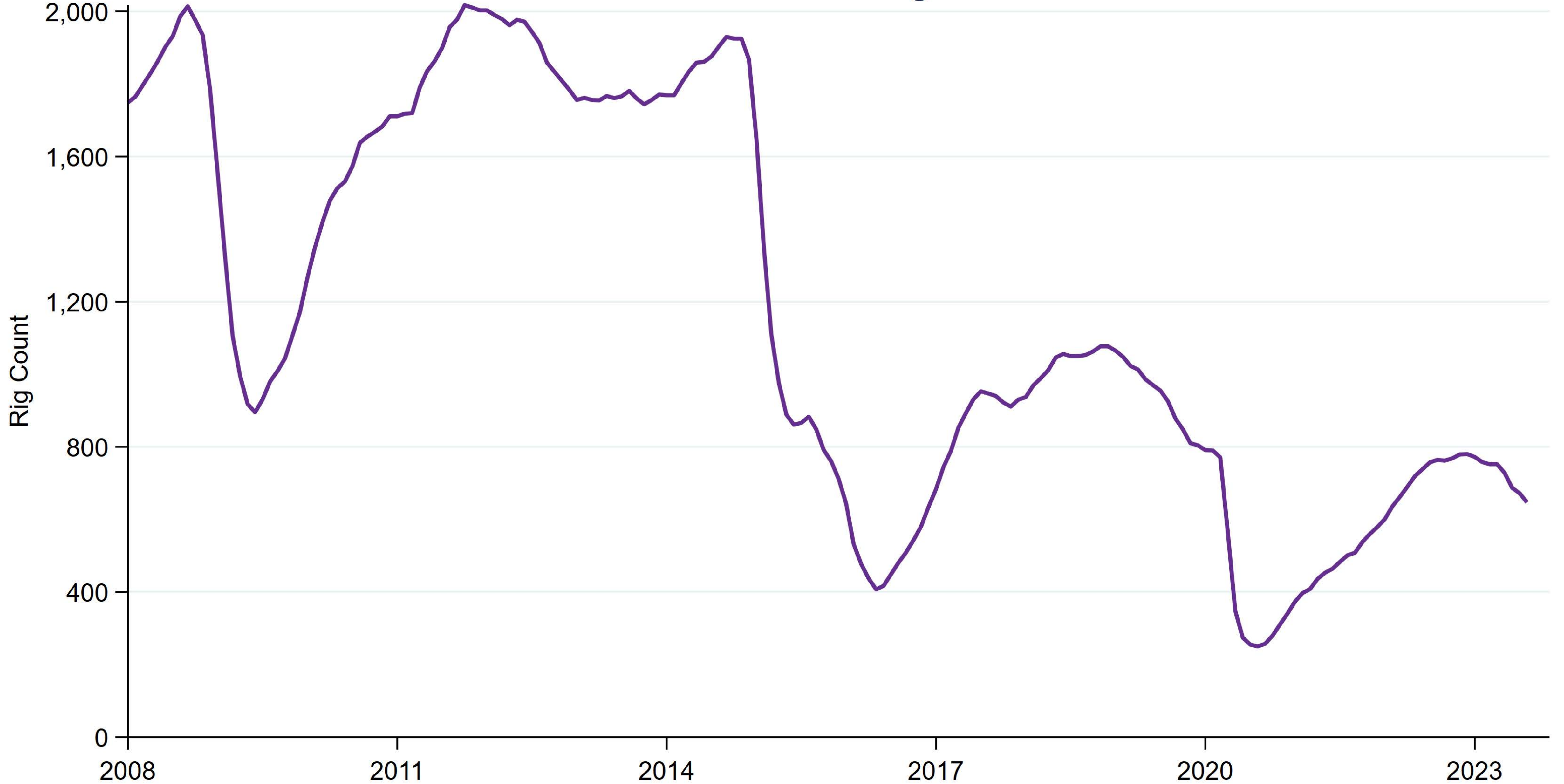
Source: Energy Information Administration. U.S. Department of Energy.

U.S. Rig Count and WTI Spot Price



Source: U.S. Energy Information Administration, Baker Hughes Rig Count Overview

United States Rig Count



Source: Baker Hughes Rig Count Overview

Texas Rig Count



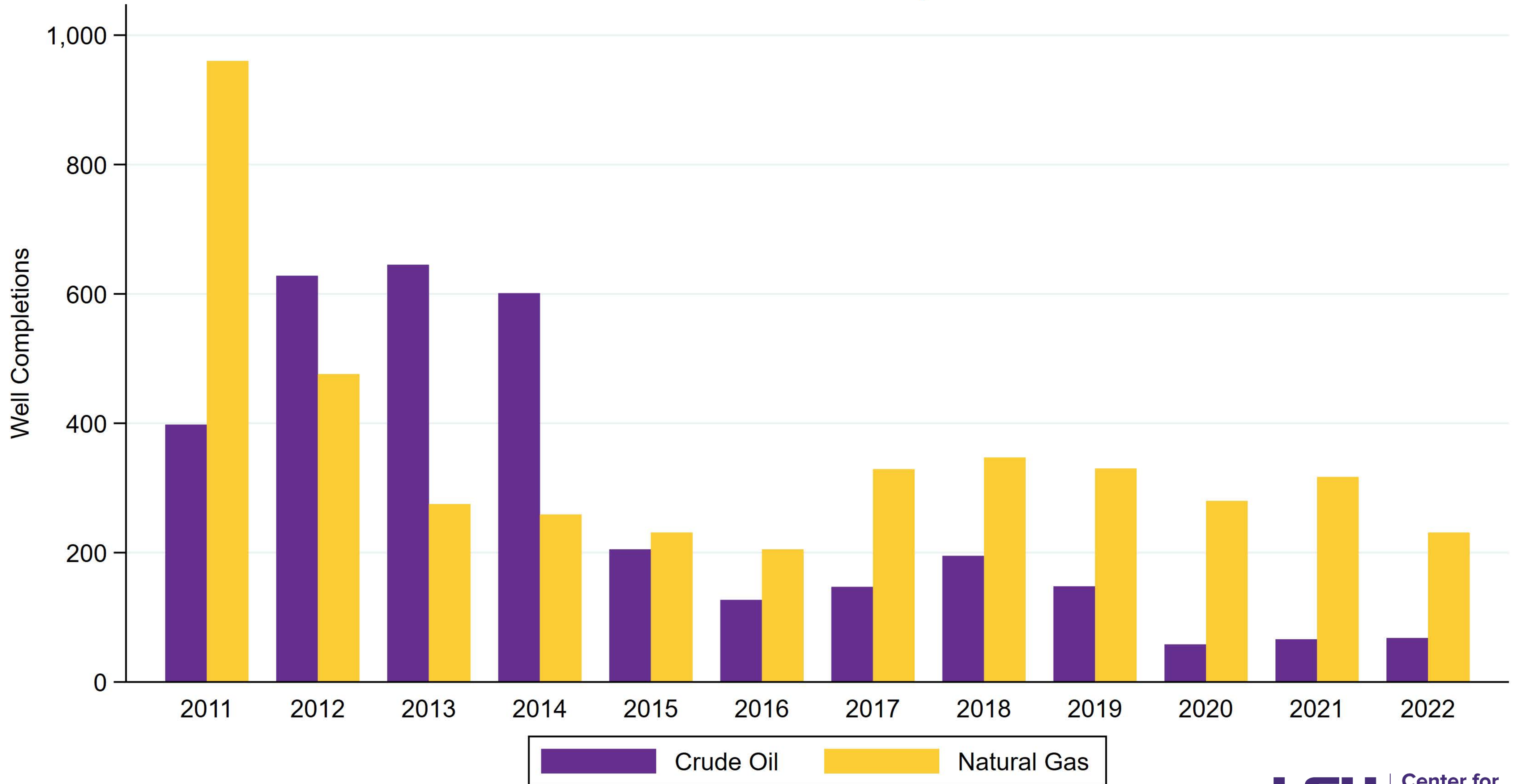
Source: Baker Hughes Rig Count Overview

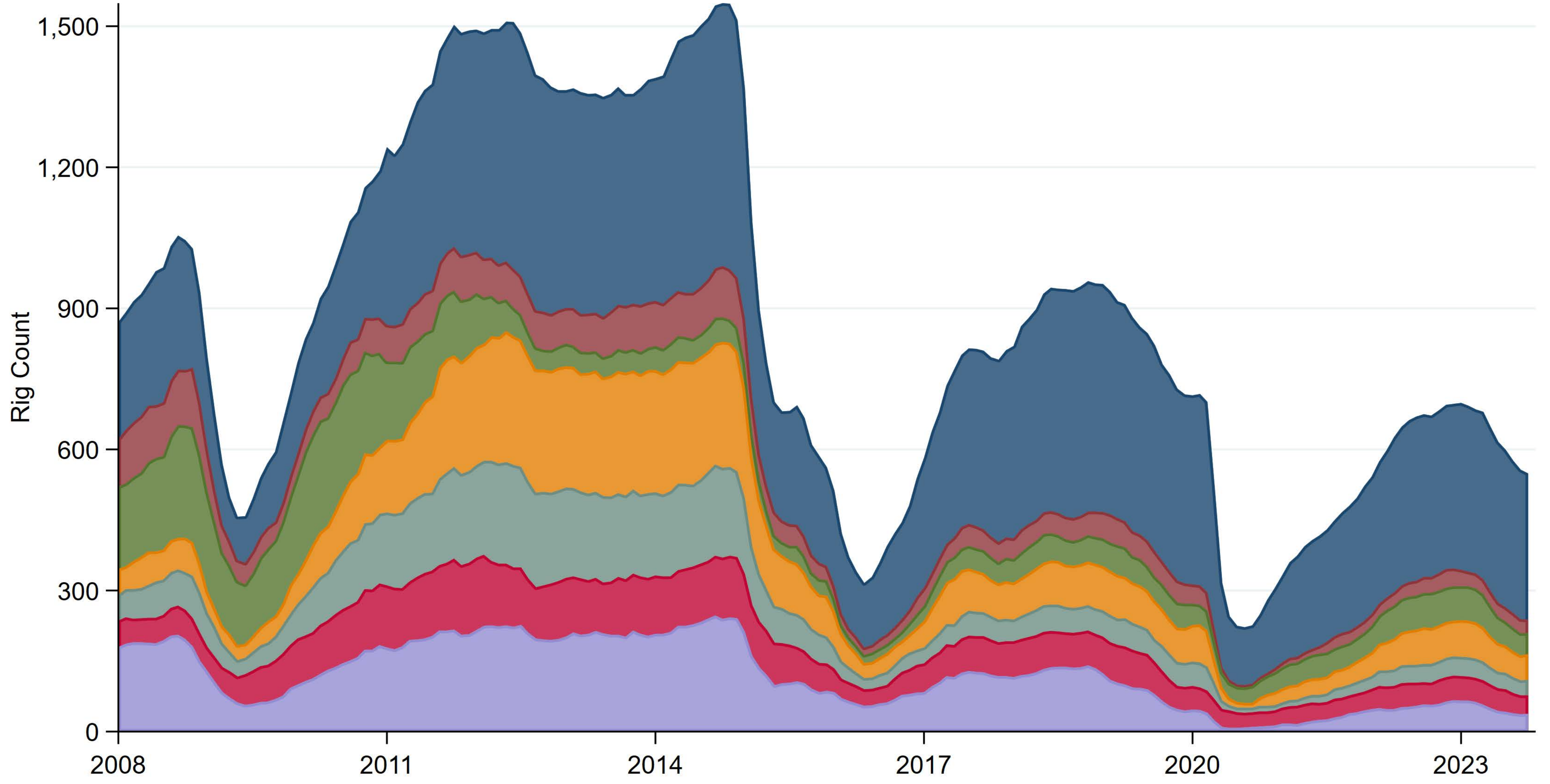
Louisiana Rig Count



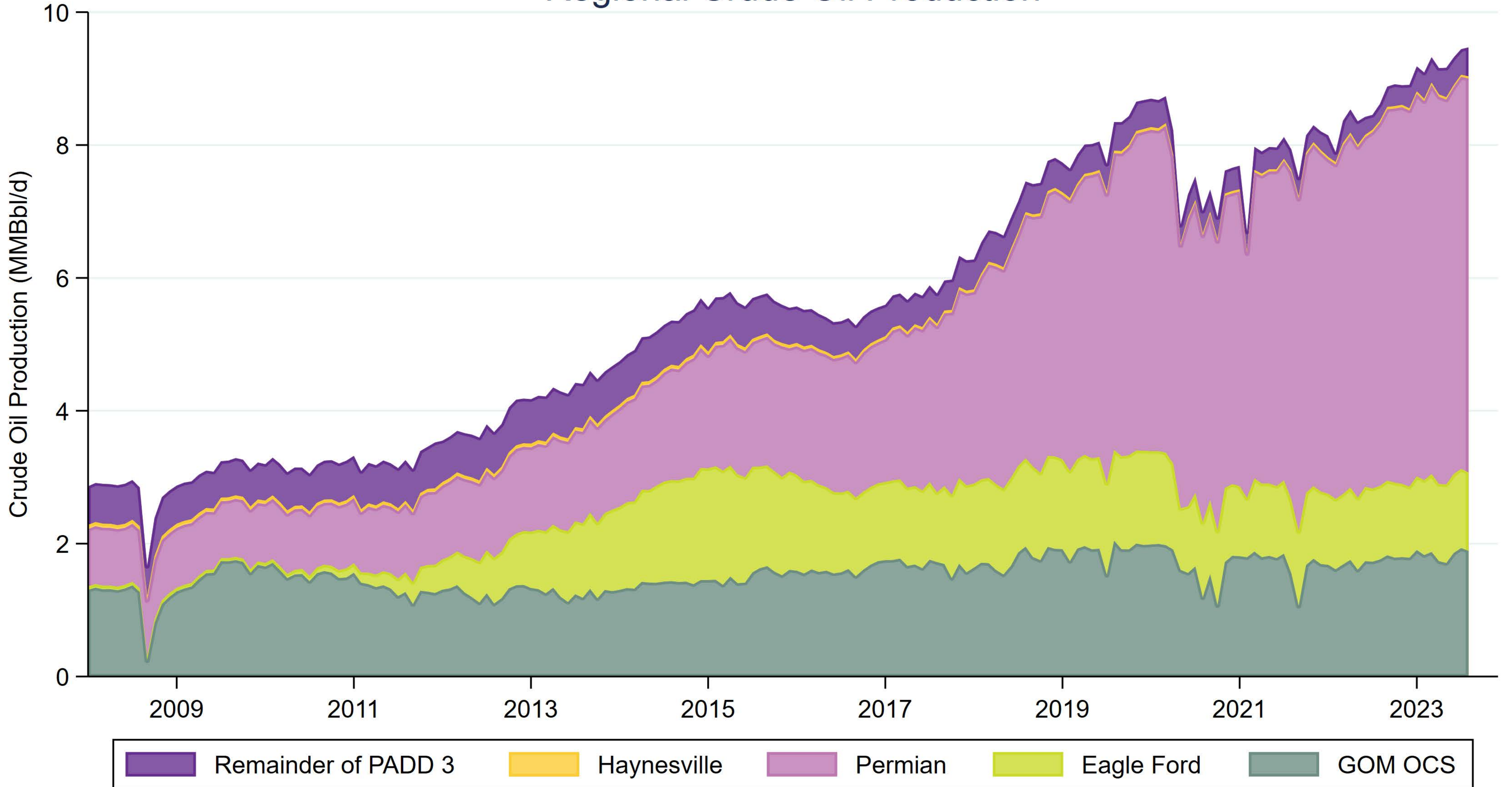
Source: Baker Hughes Rig Count Overview

Louisiana Well Completions

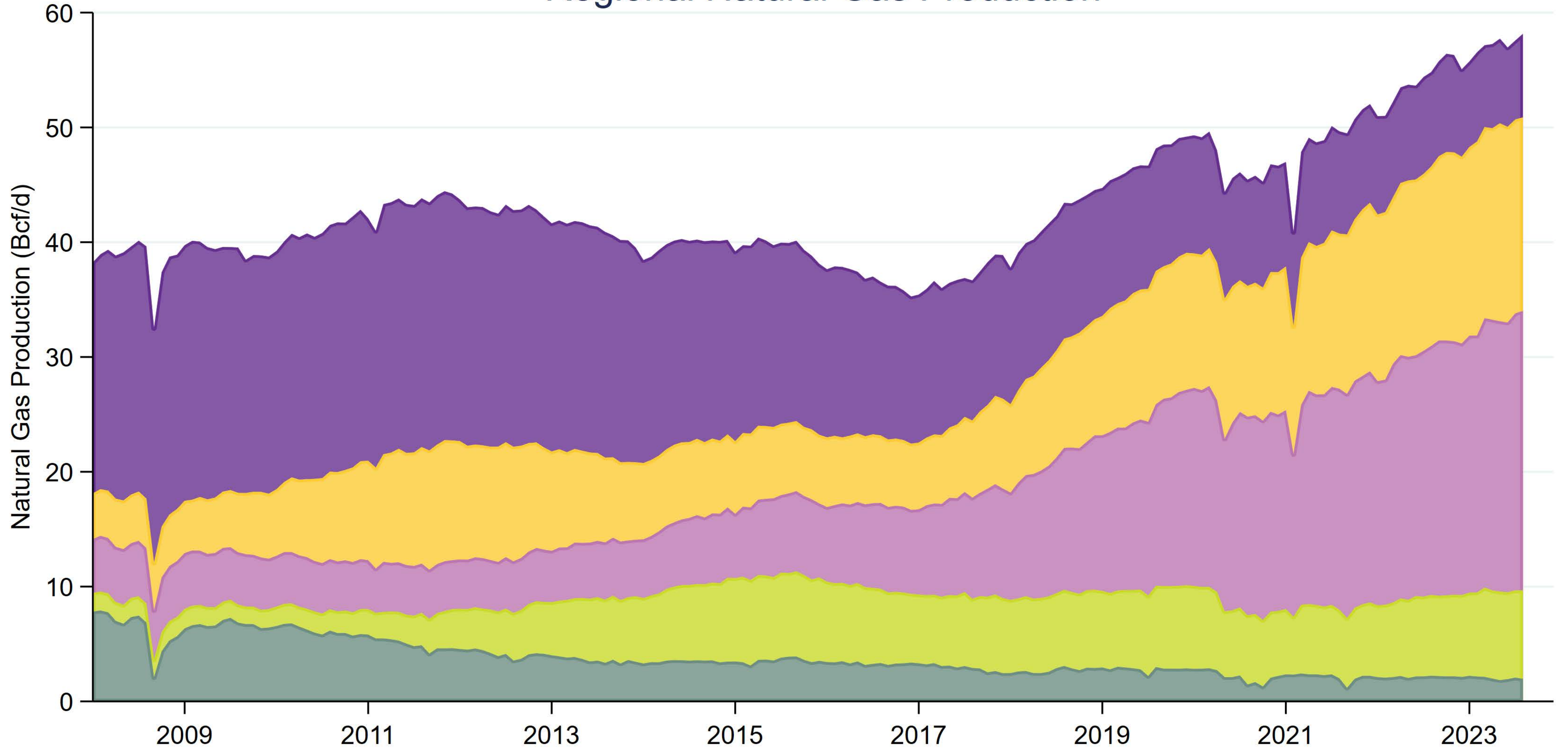




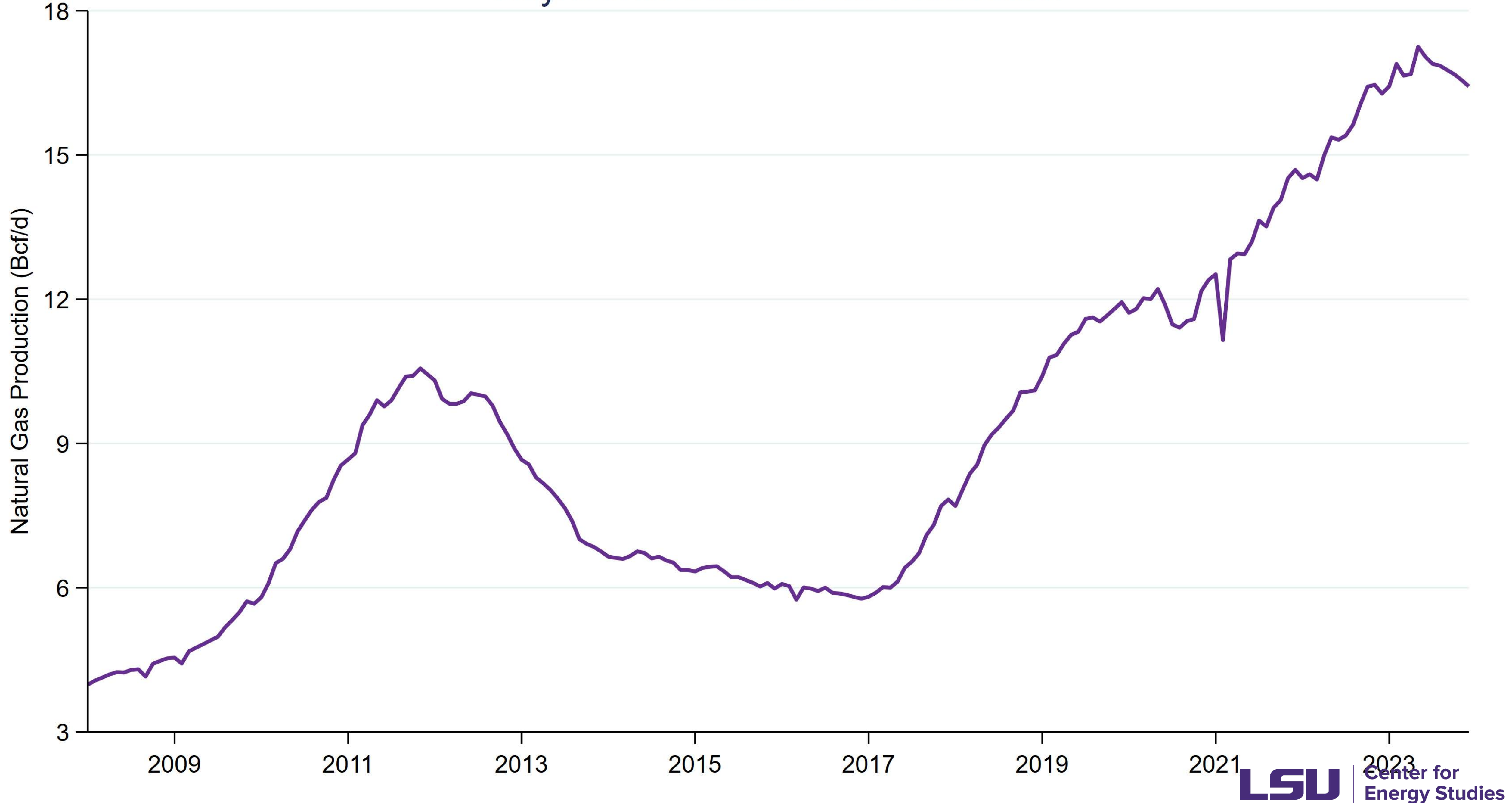
Regional Crude Oil Production



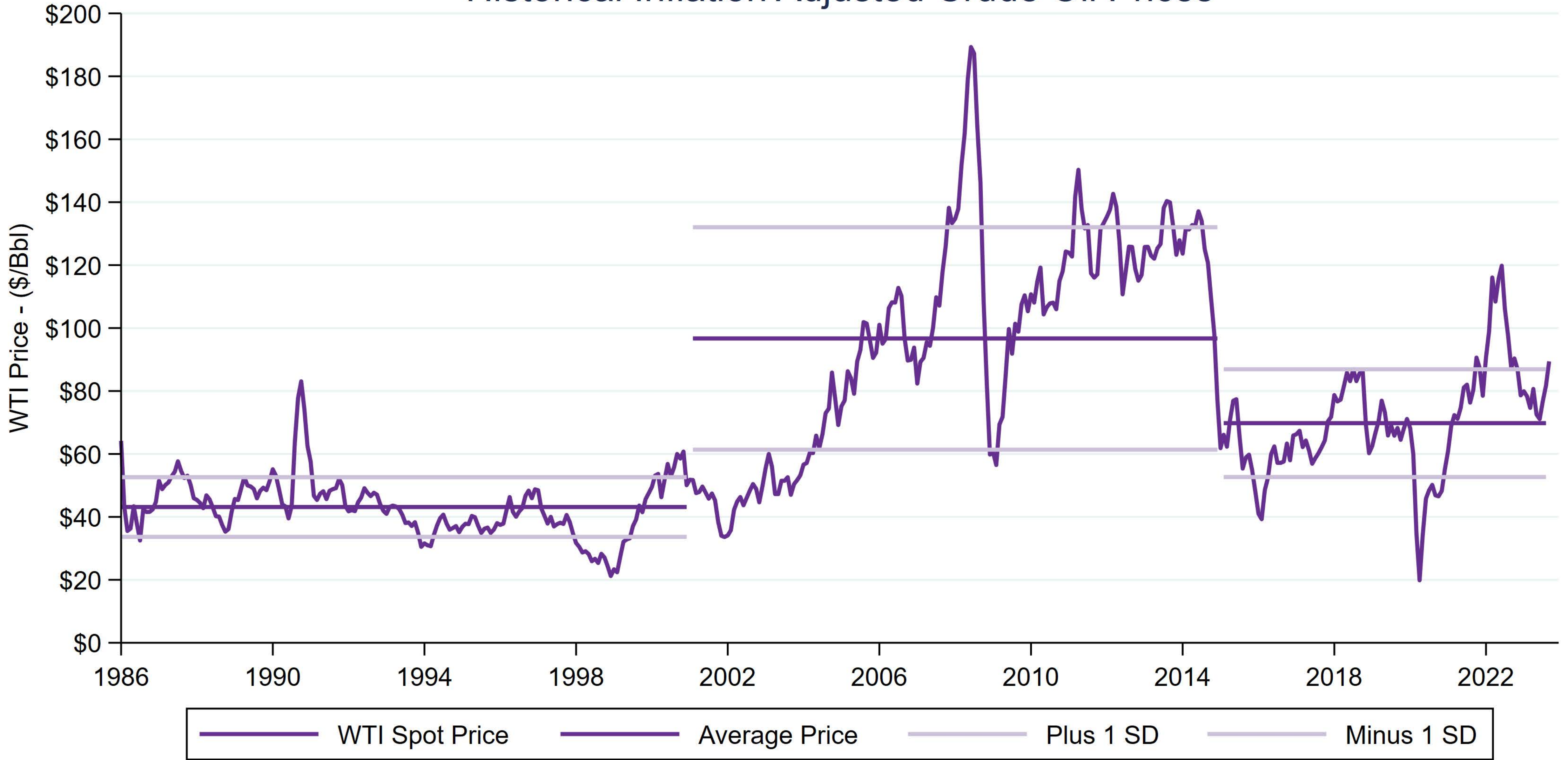
Regional Natural Gas Production



Haynesville Natural Gas Production

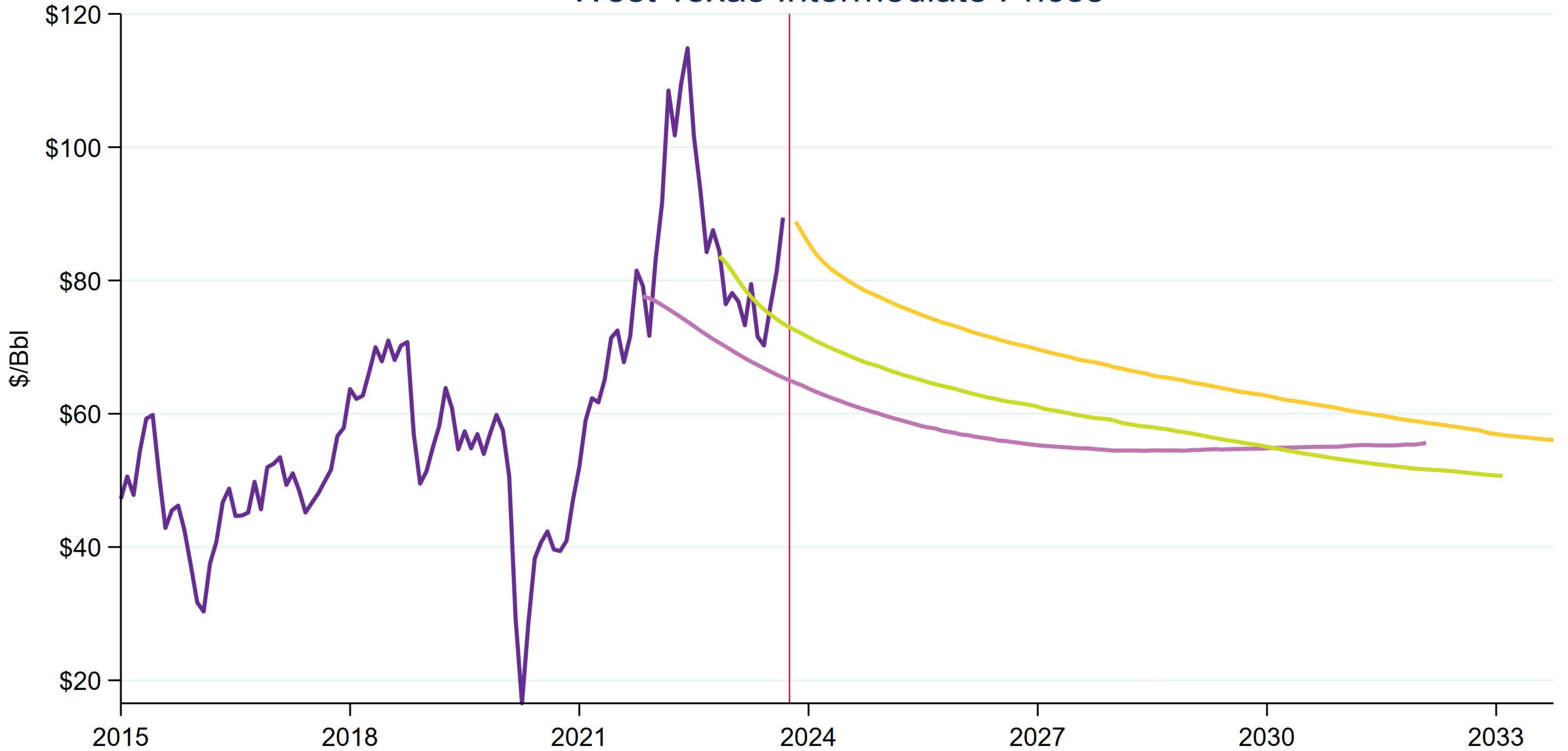


Historical Inflation Adjusted Crude Oil Prices

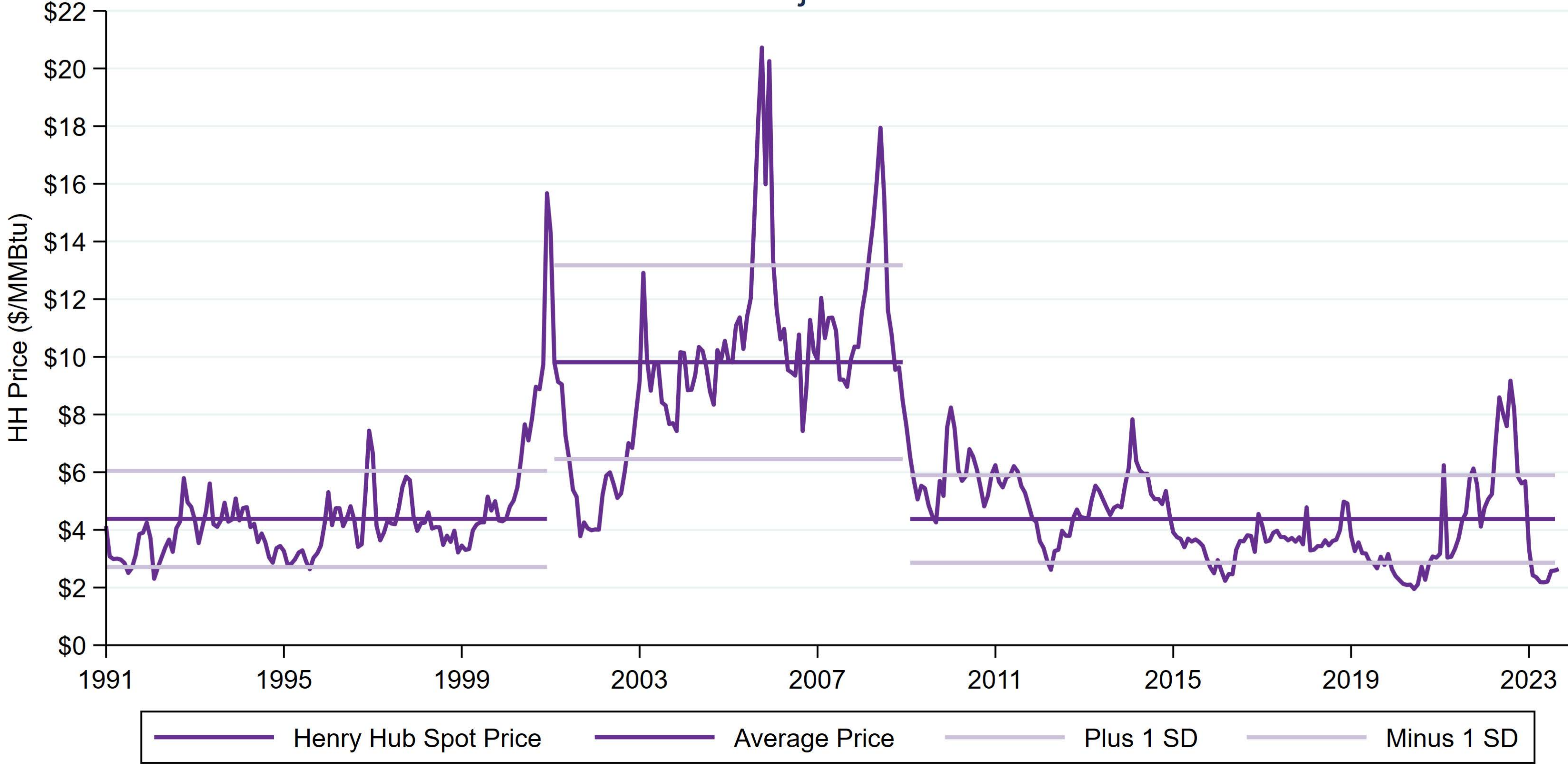


WTI Spot Price Adjusted to current Consumer Price Index.
Source: U.S. Energy Information Administration

West Texas Intermediate Prices

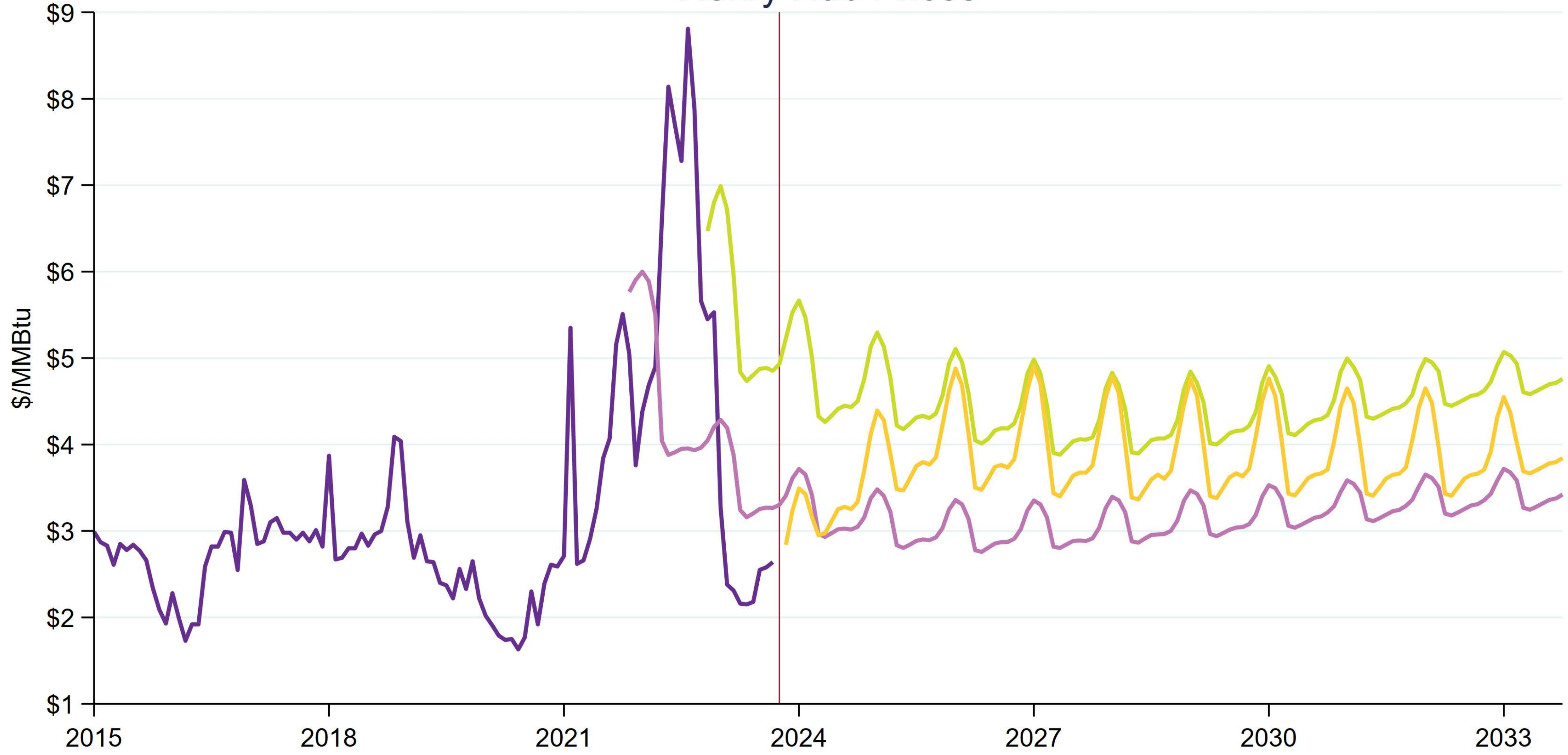


Historical Inflation Adjusted Natural Gas Prices



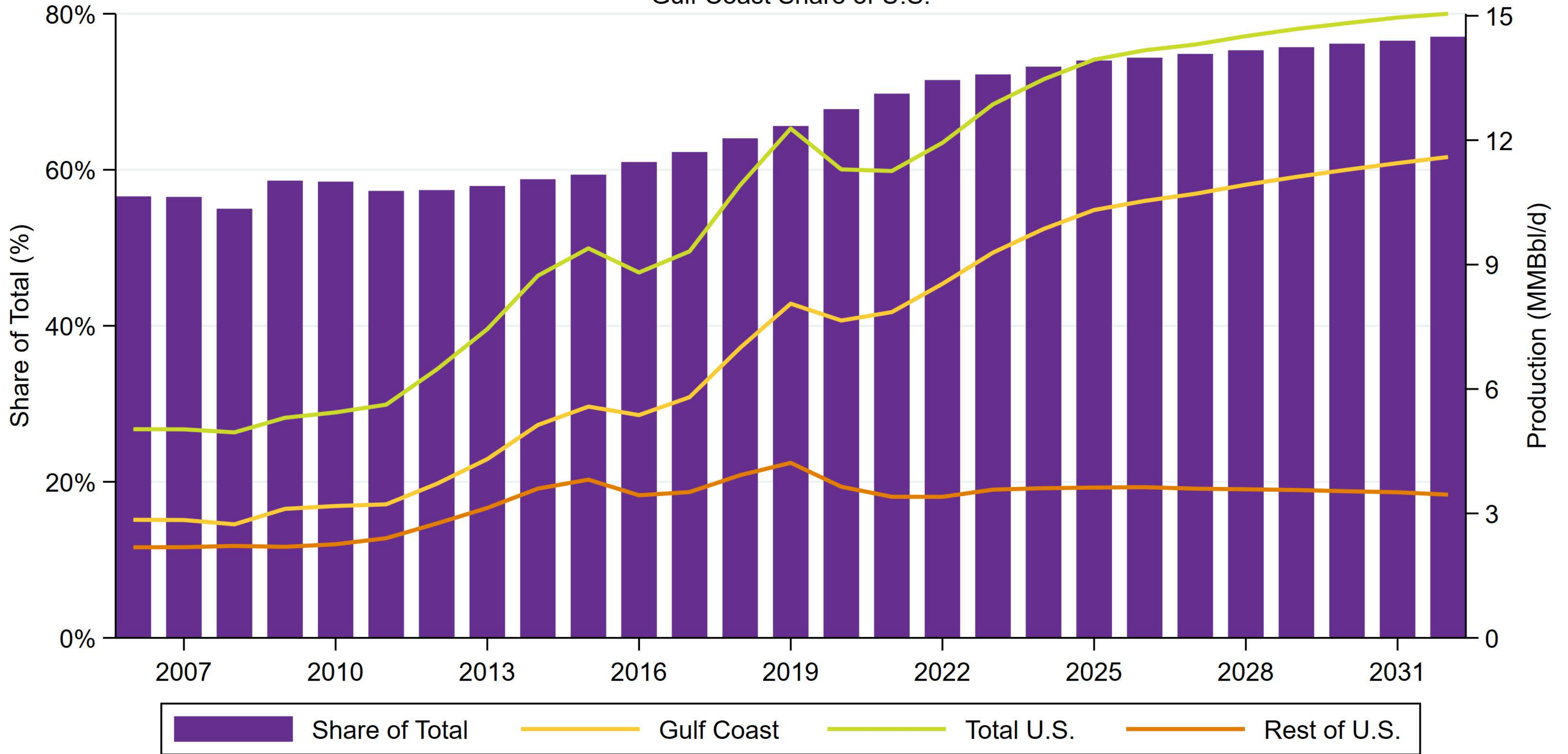
Henry Hub Spot Price adjusted to current Consumer Price Index.
Source: U.S. Energy Information Administration

Henry Hub Prices



Crude Oil Production Forecast

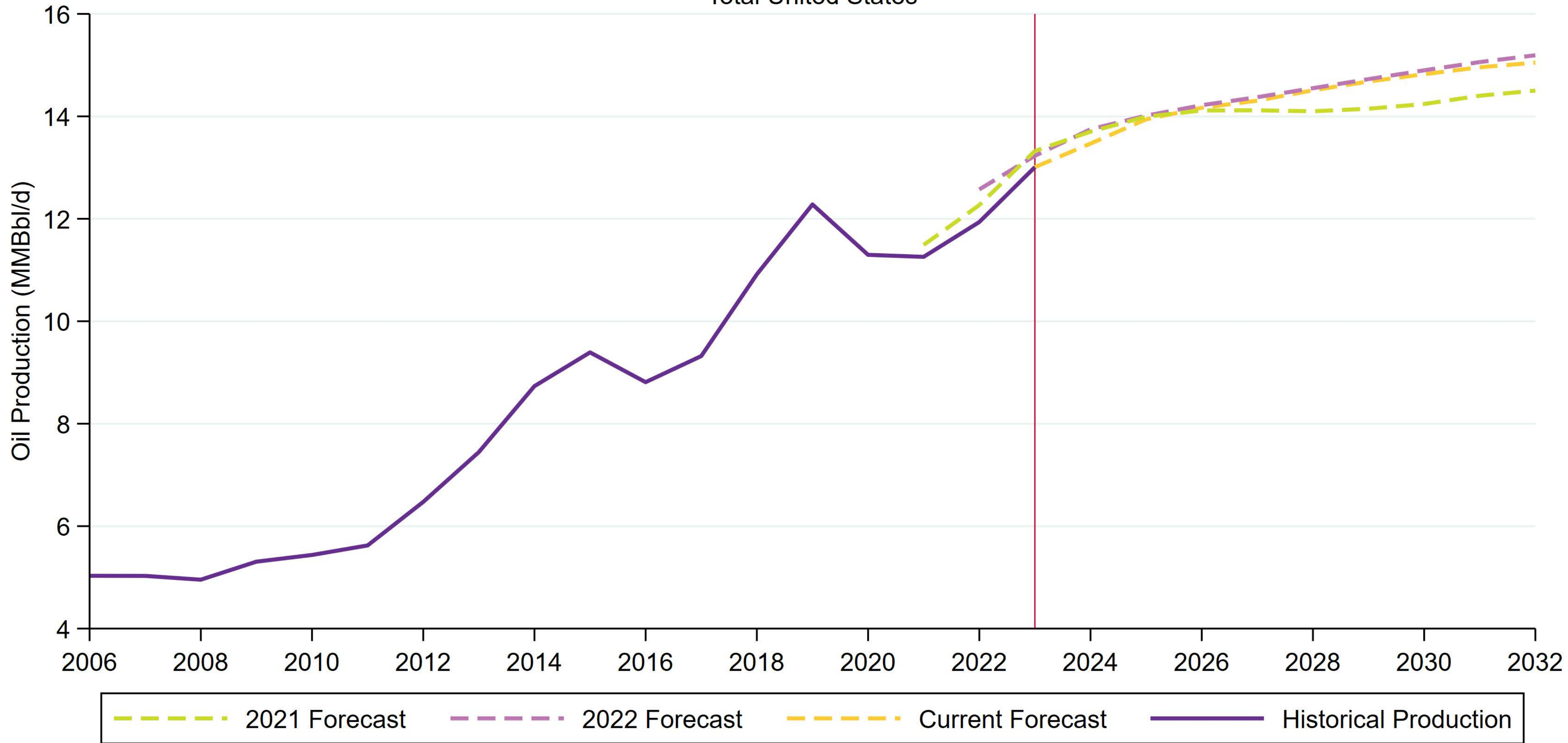
Gulf Coast Share of U.S.



Source: Enverus. DrillingInfo Prodcast.

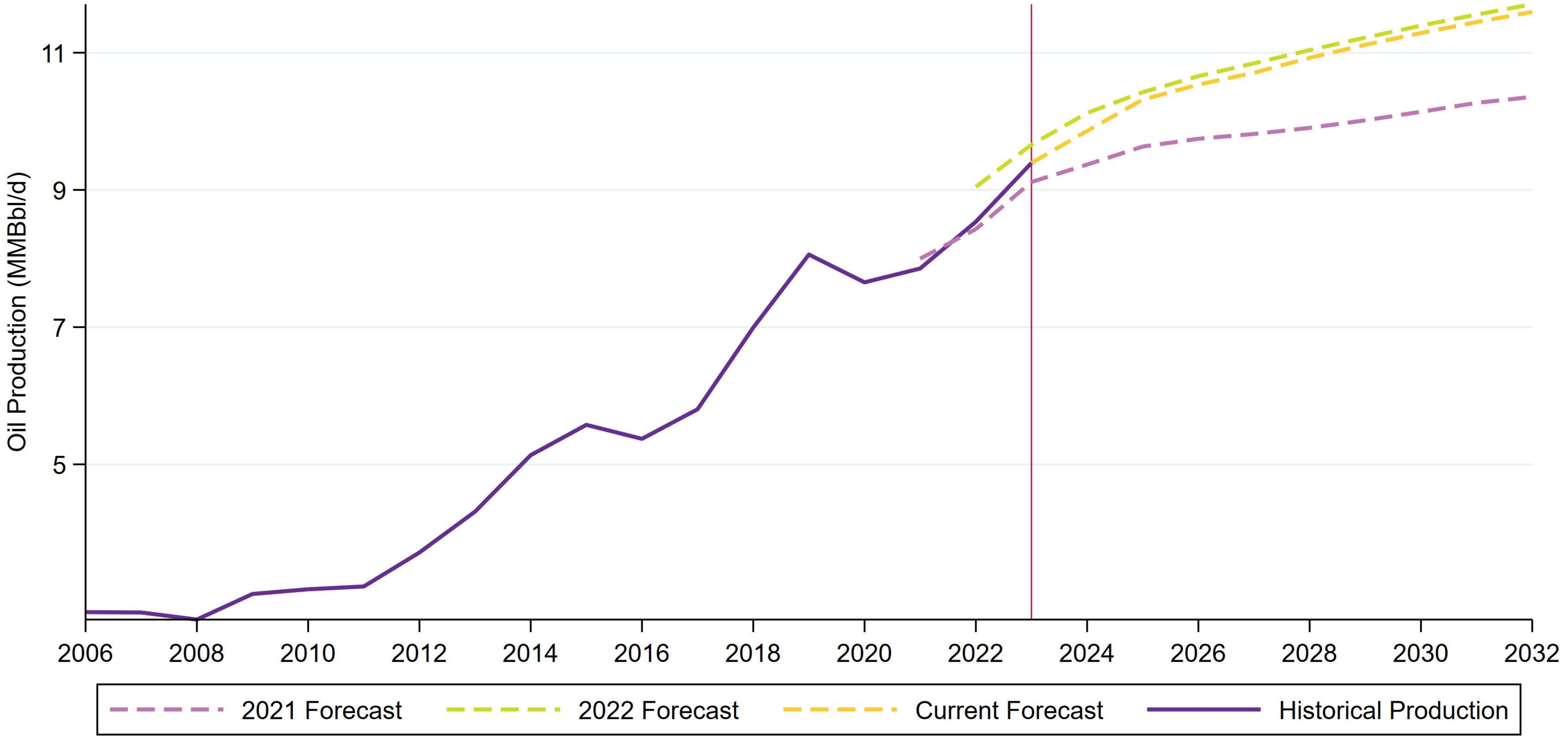
Crude Oil Production Forecast

Total United States



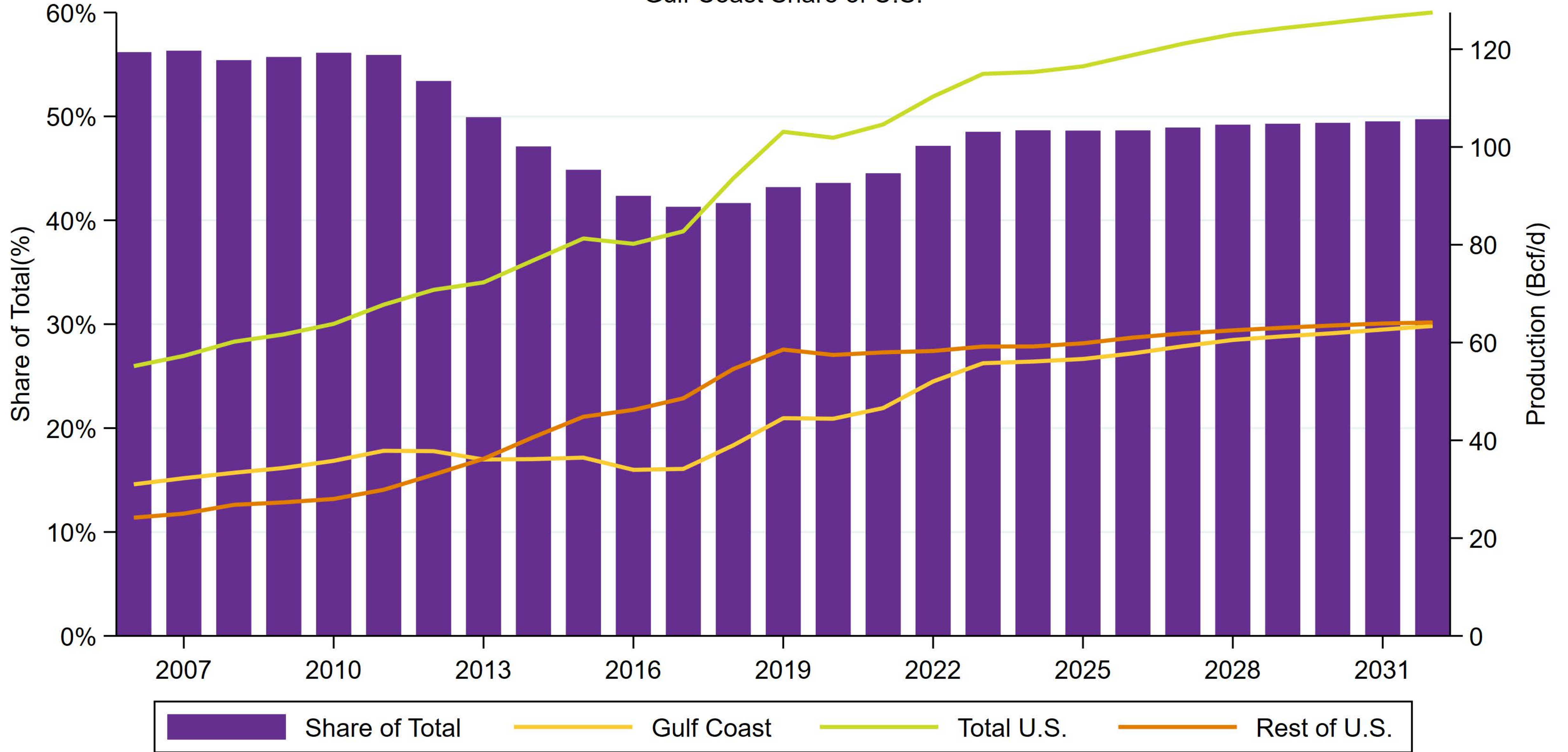
Crude Oil Production Forecast

Gulf Coast



Natural Gas Production Forecast

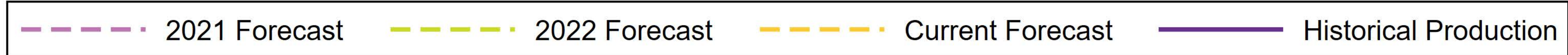
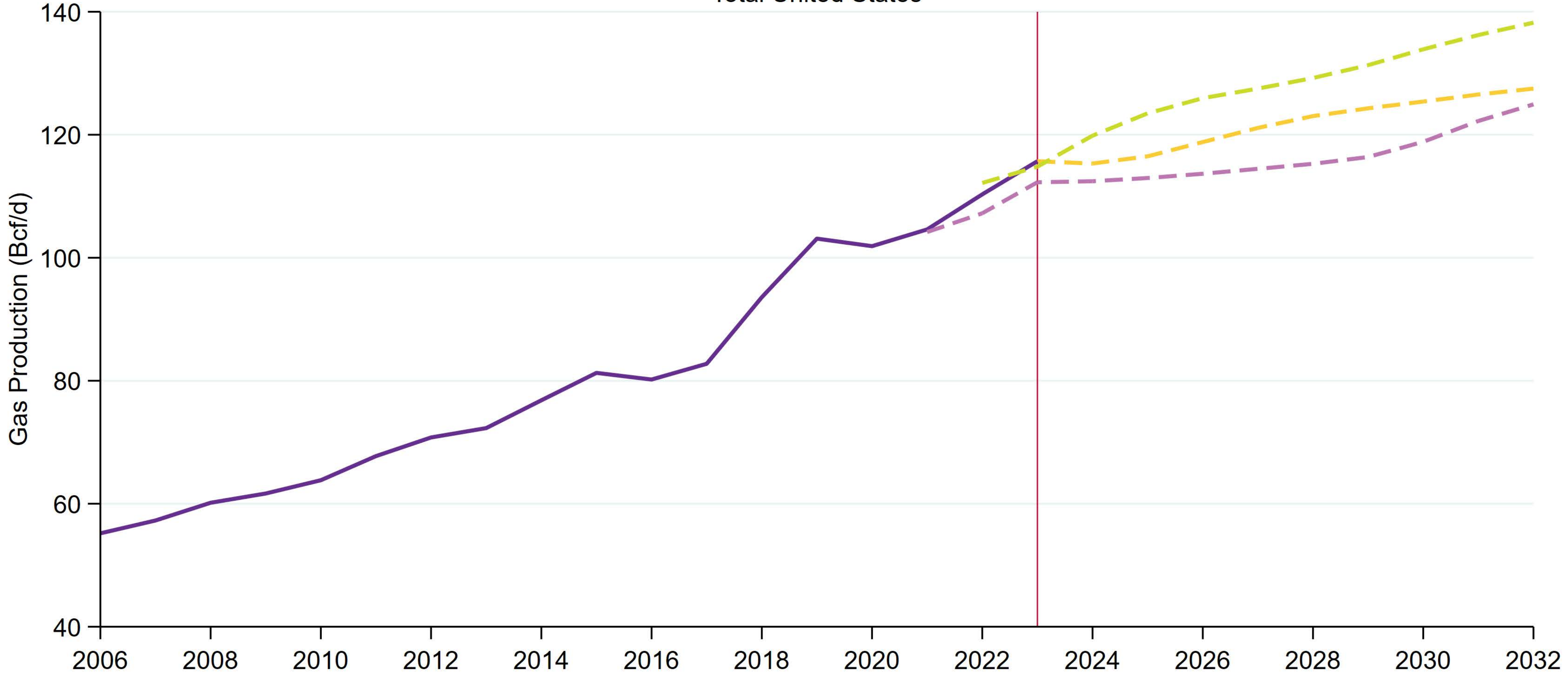
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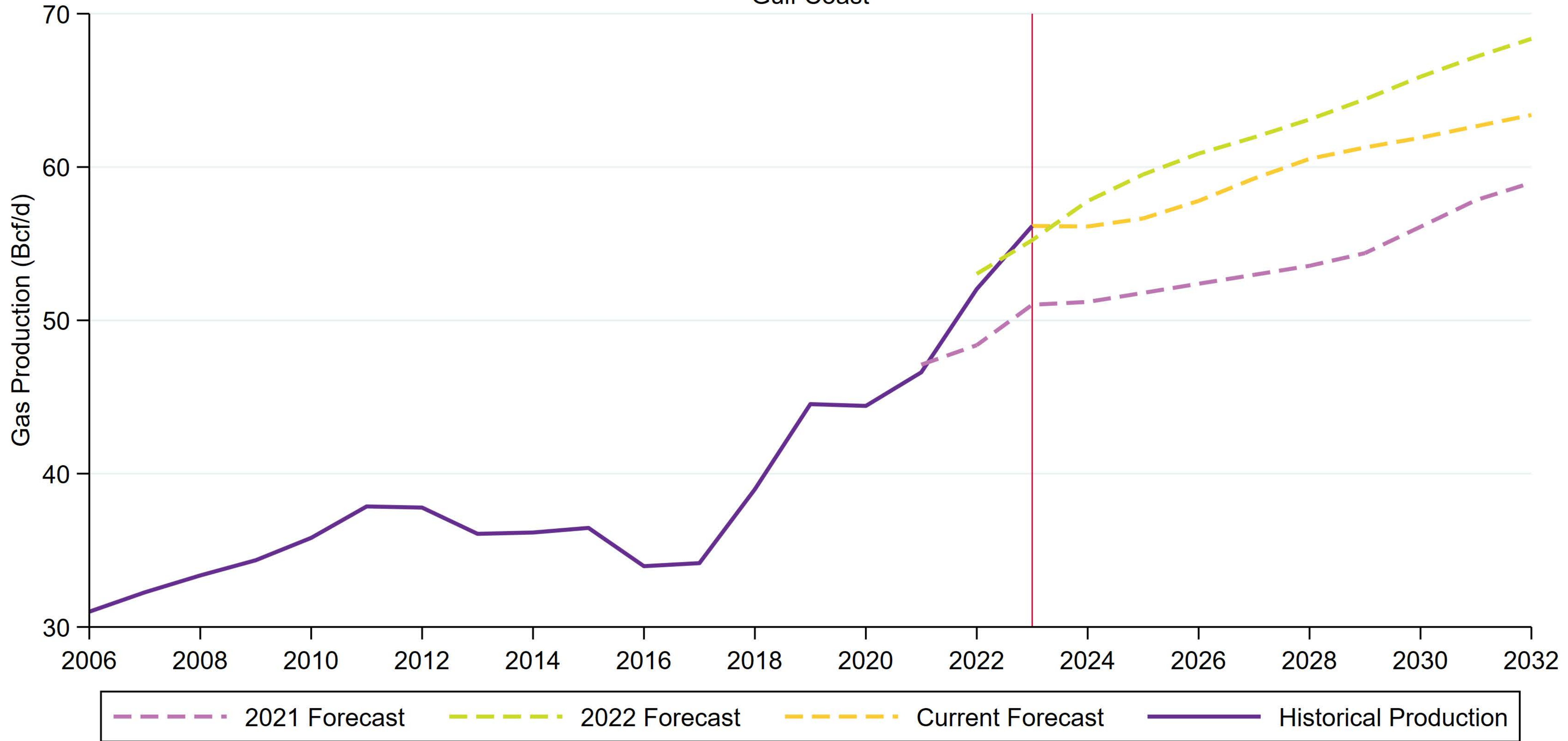
Natural Gas Production Forecast

Total United States



Natural Gas Production Forecast

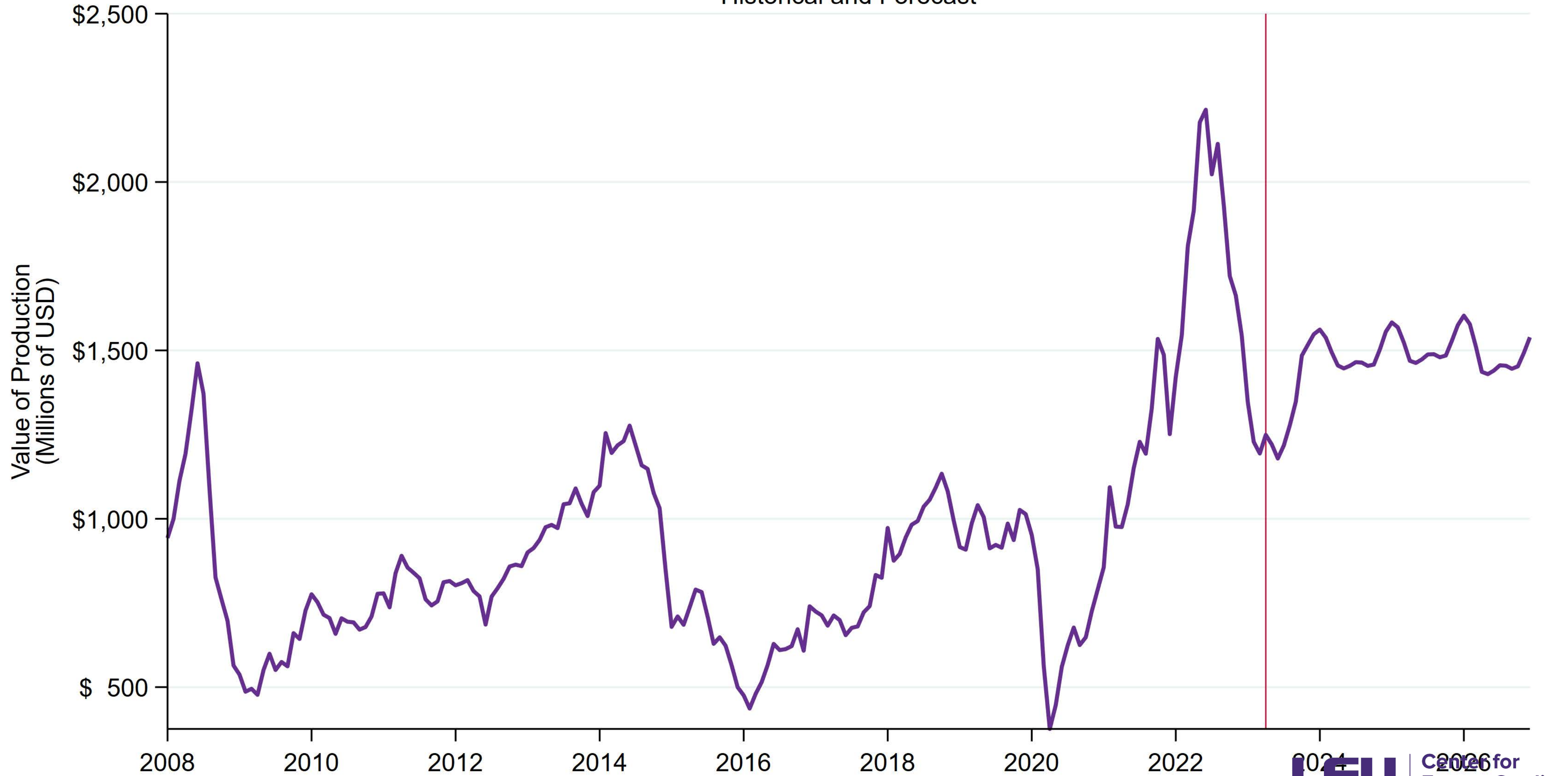
Gulf Coast



Source: Enverus. DrillingInfo Prodcast.

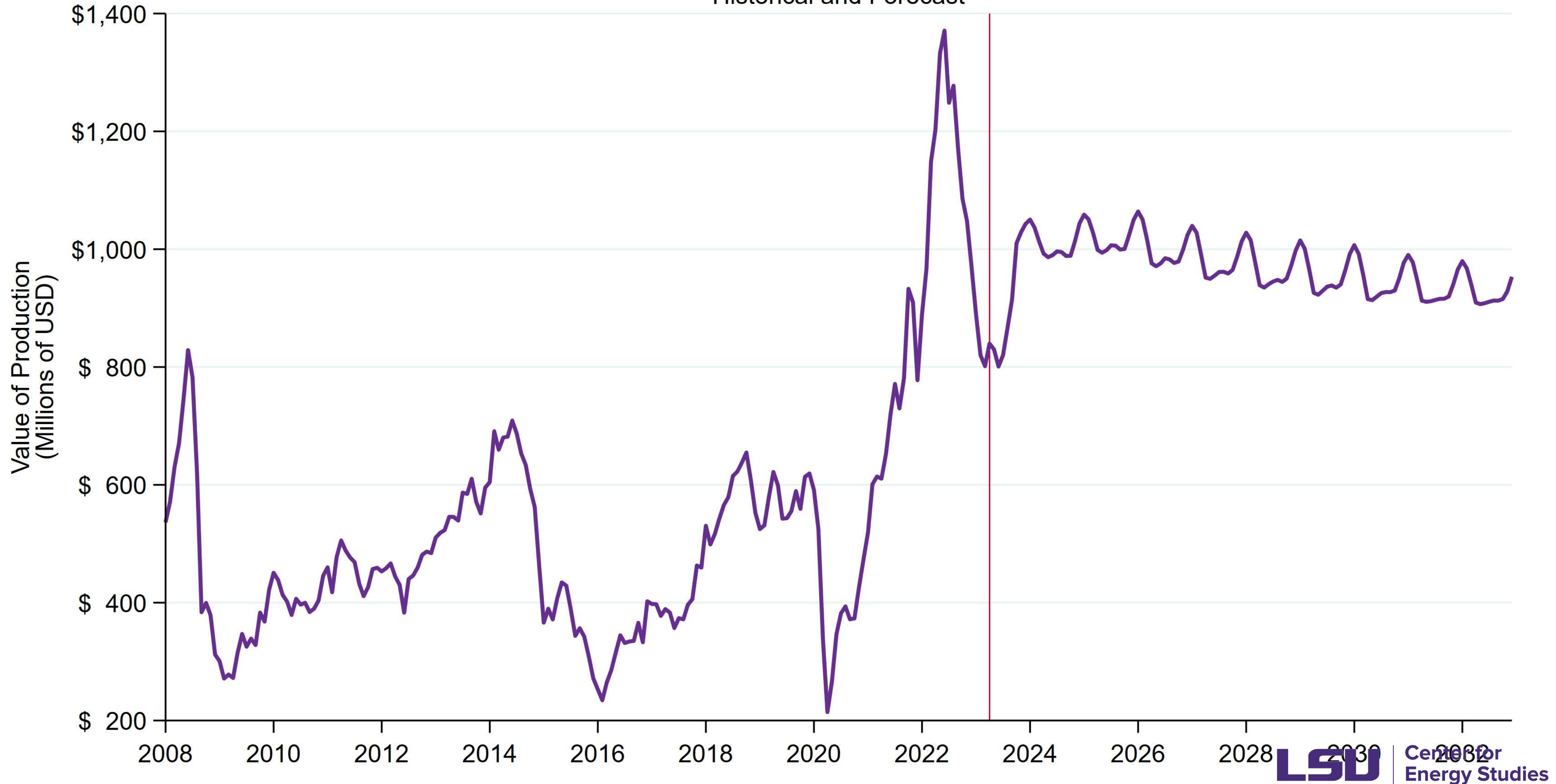
U.S. Value of Production

Historical and Forecast



Gulf Coast Value of Production

Historical and Forecast



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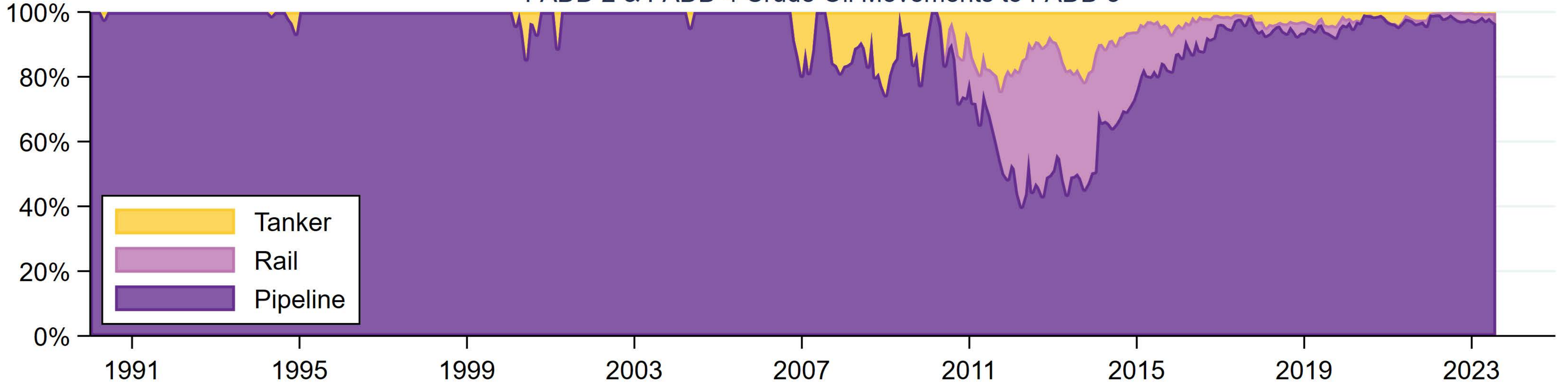
5 Energy Exports

6 Energy Manufacturing Activity

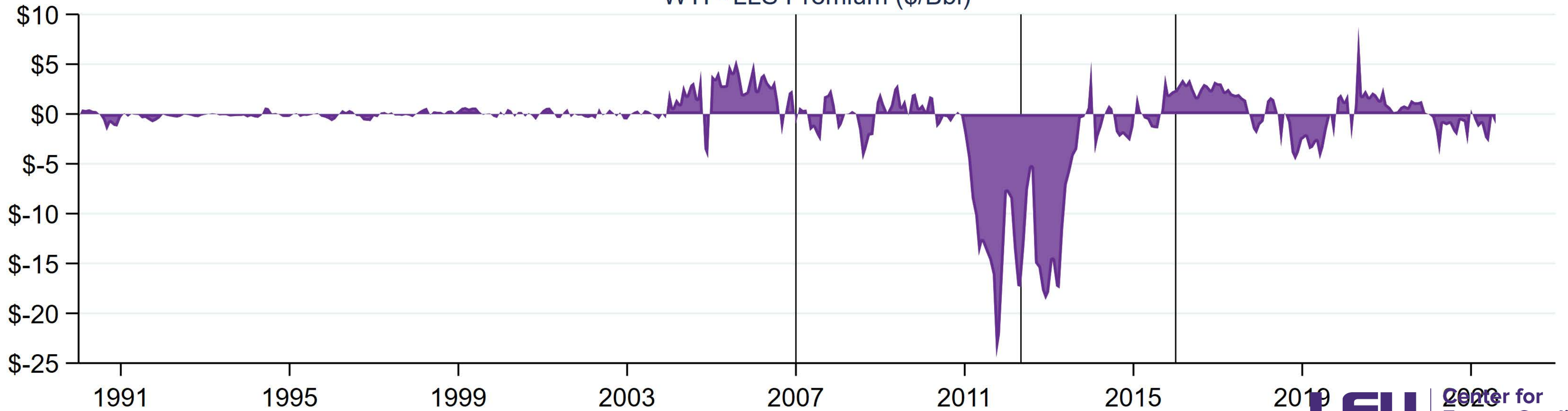
7 Employment

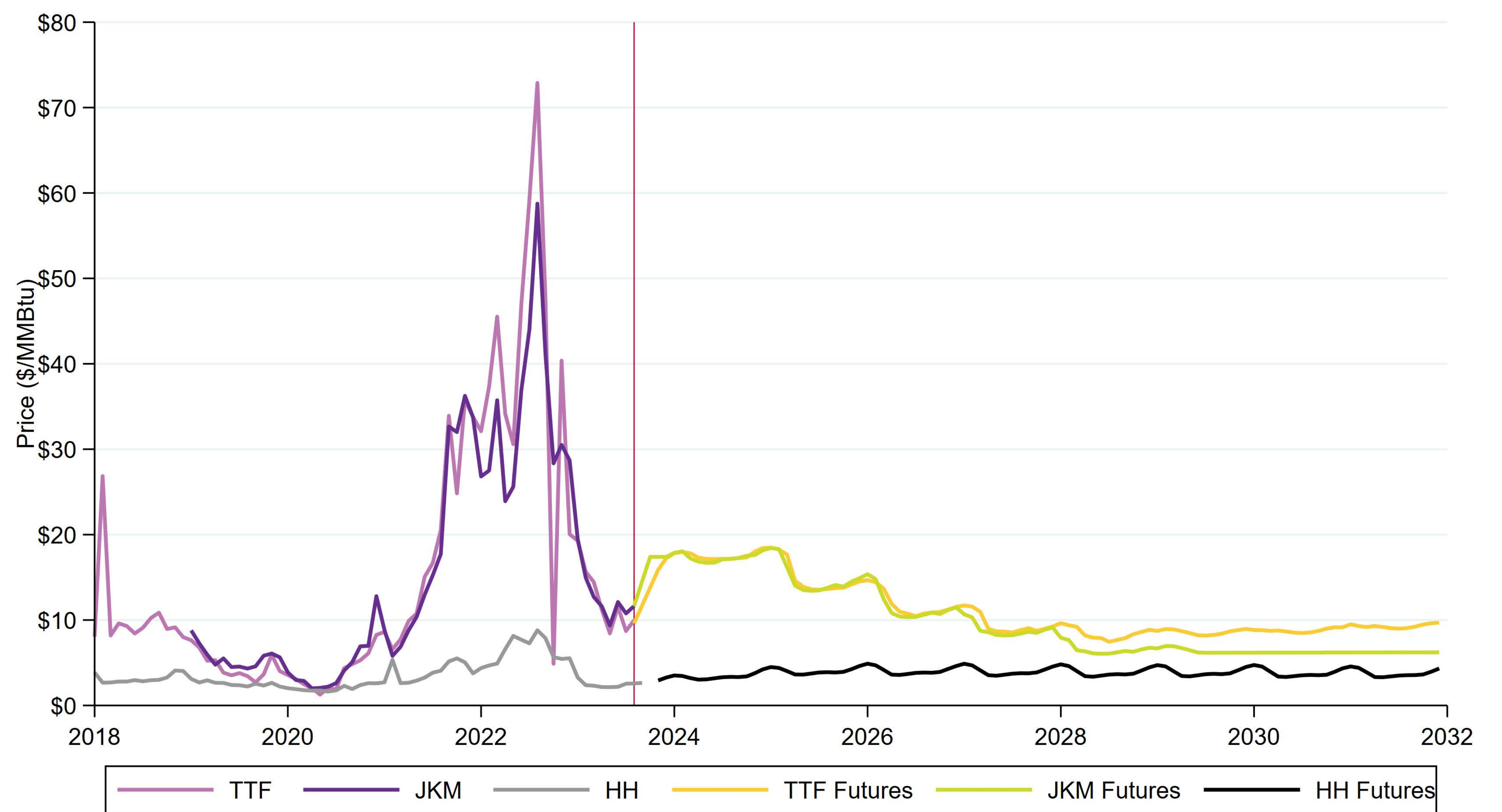
8 Conclusions

PADD 2 & PADD 4 Crude Oil Movements to PADD 3



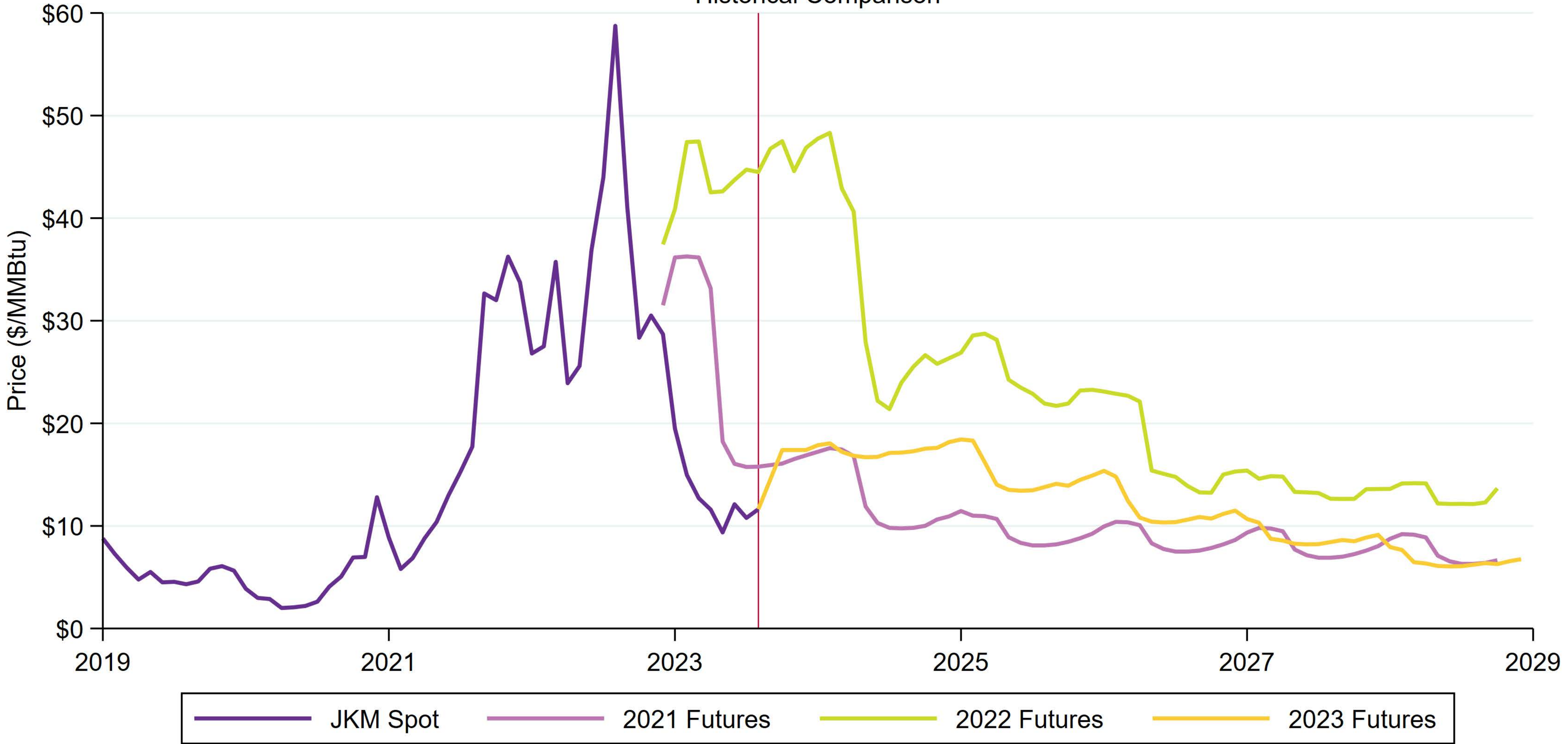
WTI - LLS Premium (\$/Bbl)





JKM Natural Gas Prices

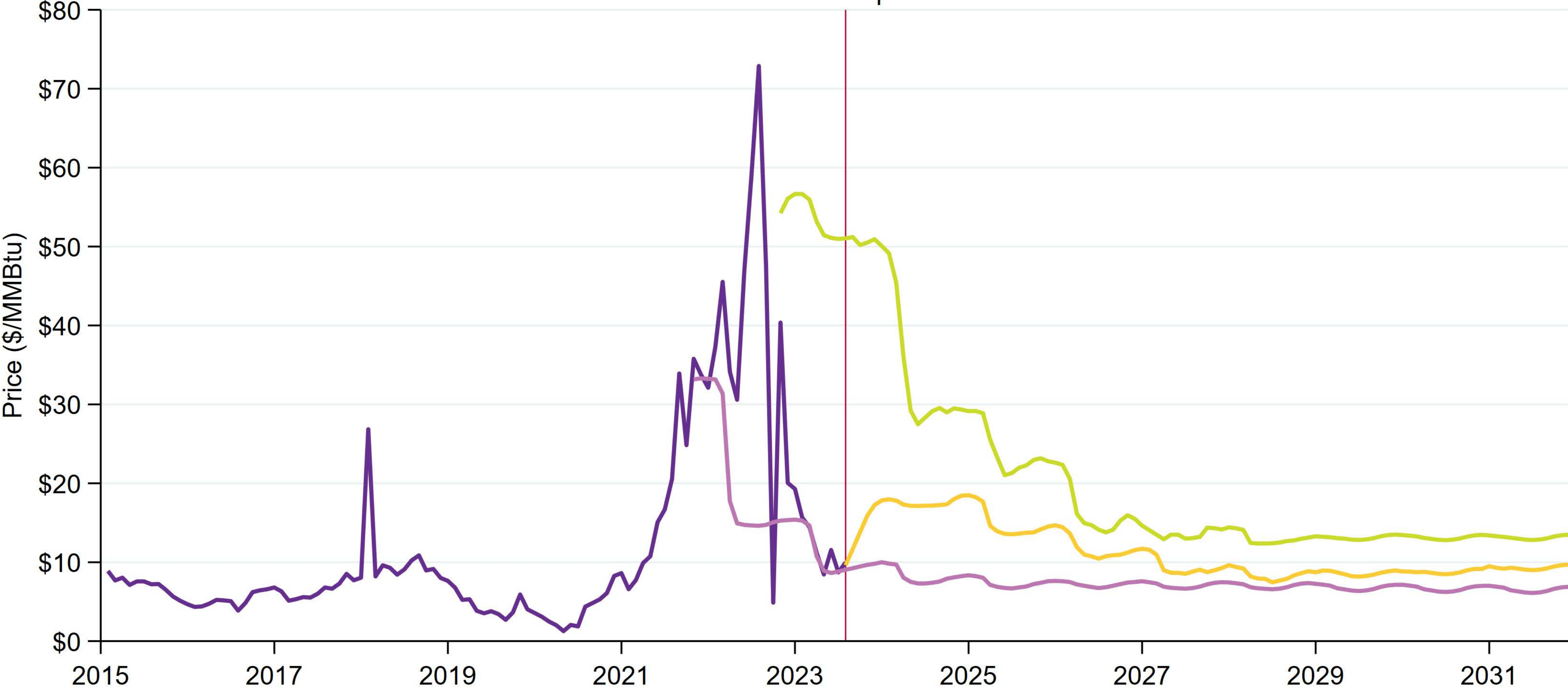
Historical Comparison



Source: Bloomberg

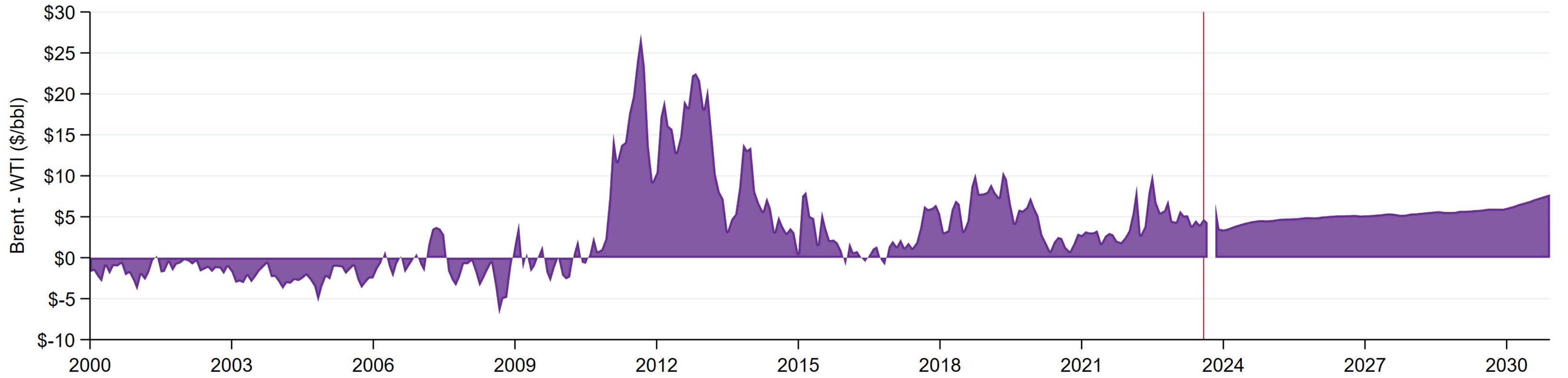
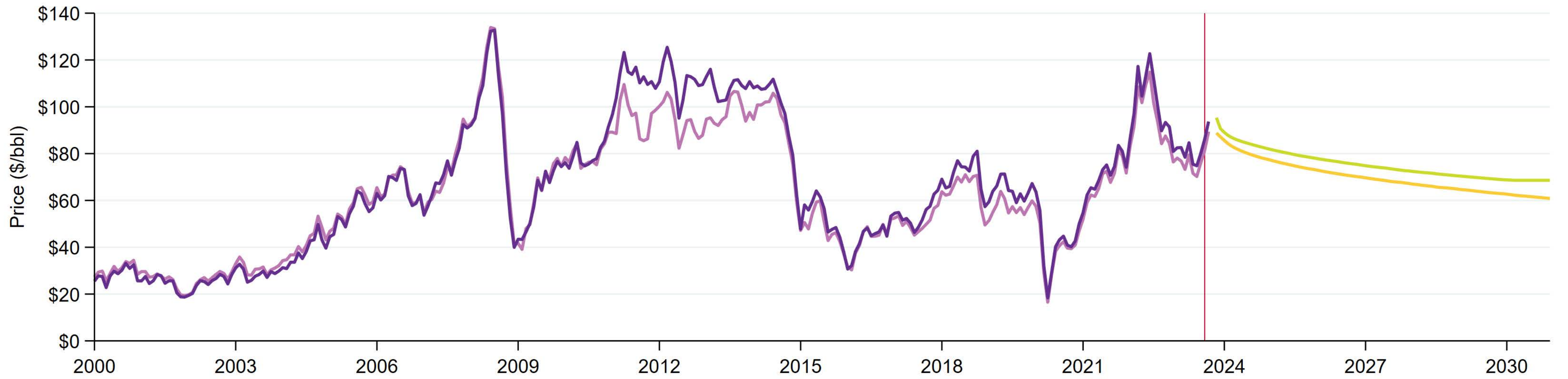
Dutch TTF Natural Gas Price

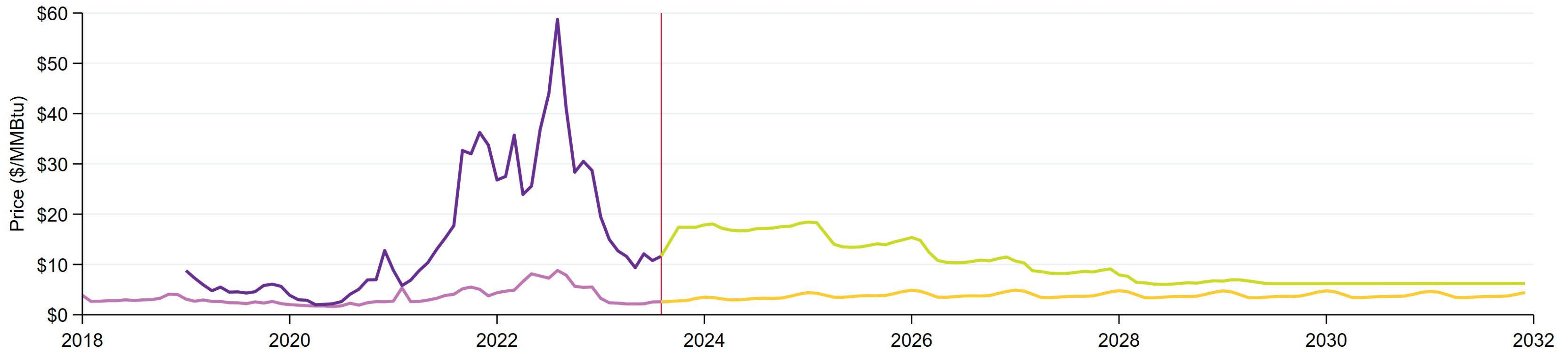
Historical Comparison



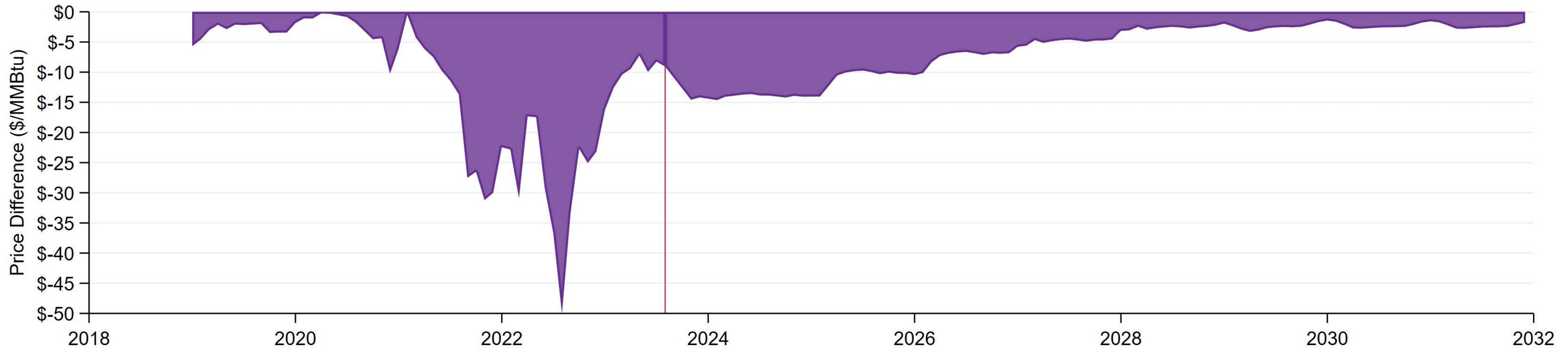
Dutch TTF Spot 2021 Futures 2022 Futures 2023 Futures

Source: Bloomberg



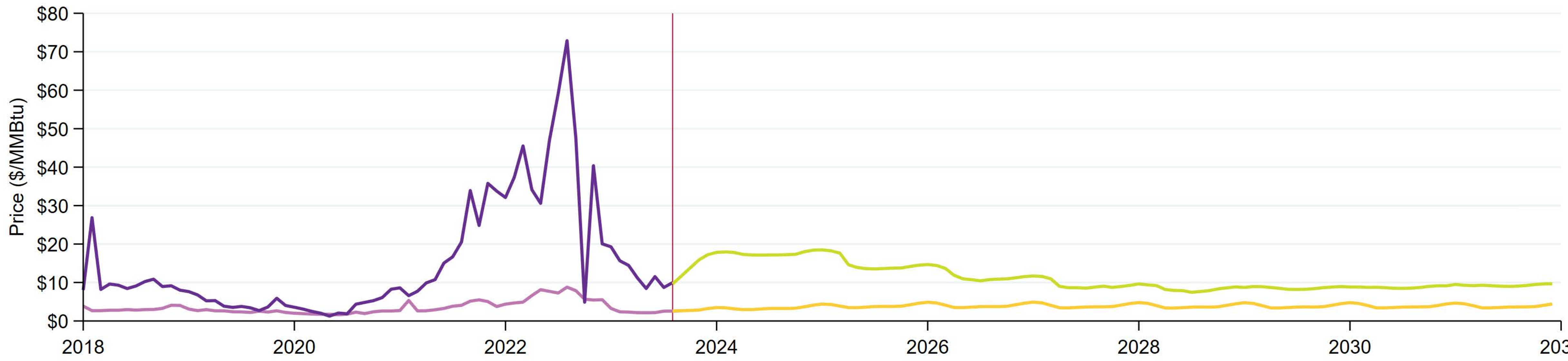


Source: Bloomberg

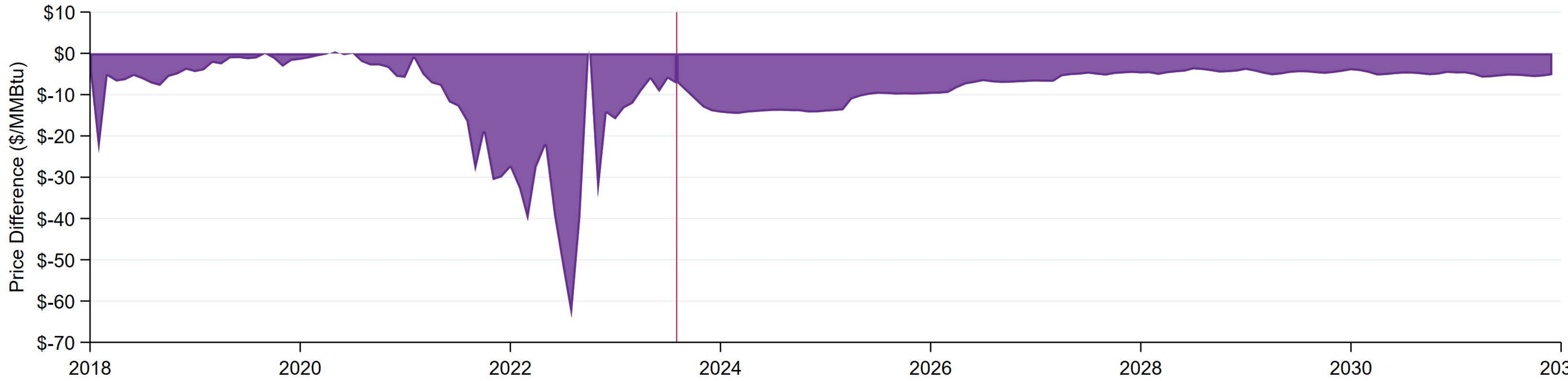


Source: Bloomberg



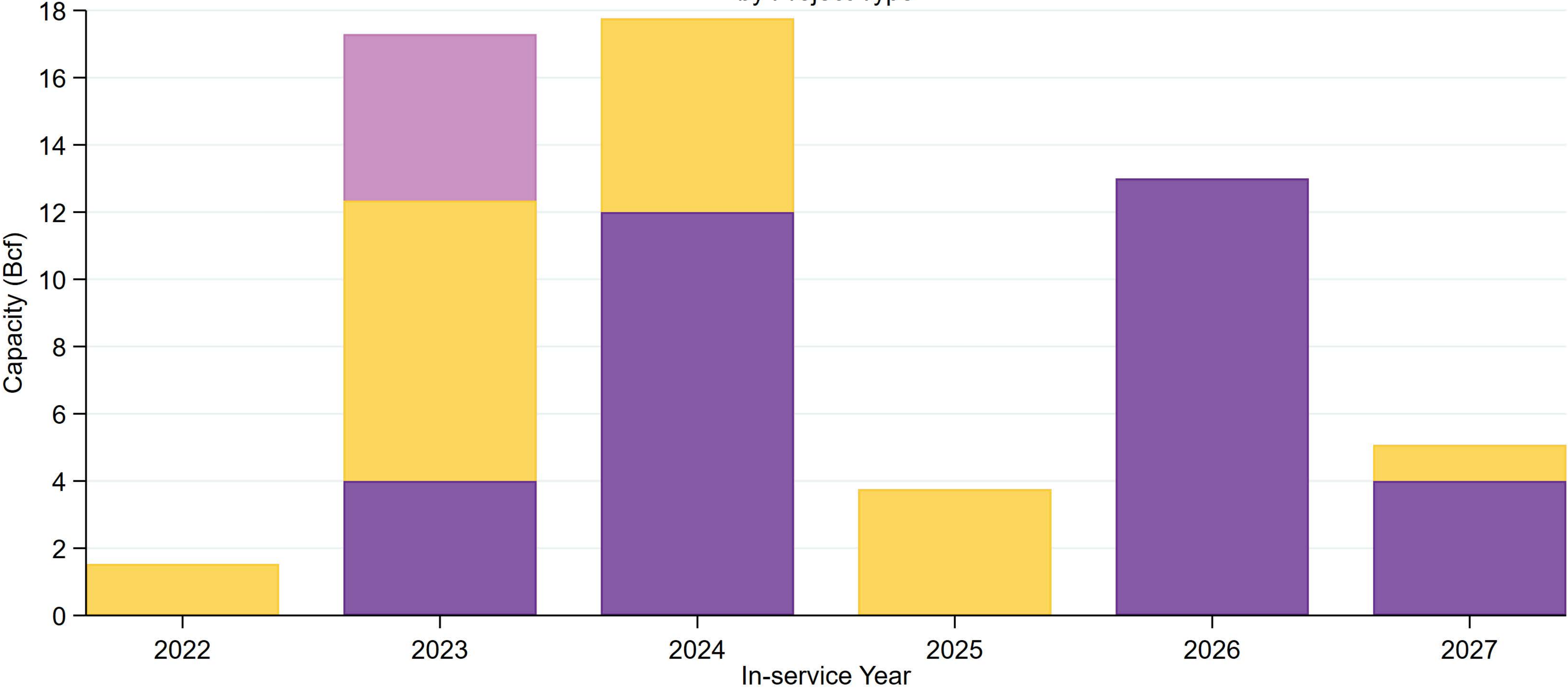


Source: Bloomberg



Natural Gas Pipeline Capacity Additions

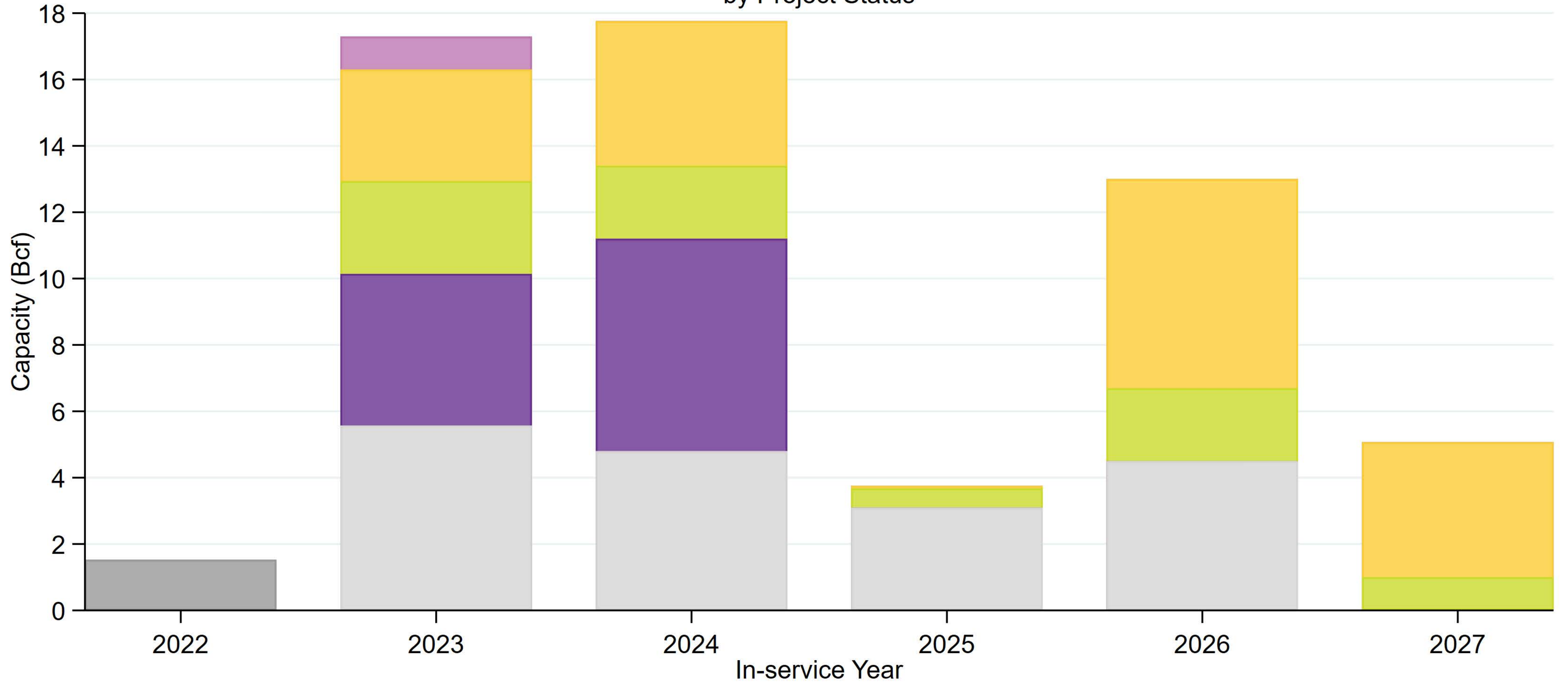
by Project Type



Source: U.S. Energy Information Administration, U.S. Natural Gas Pipeline Projects

Natural Gas Pipeline Capacity Additions

by Project Status



Source: U.S. Energy Information Administration, U.S. Natural Gas Pipeline Projects

Outline

1

Introduction & Uncertainties

2

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6

Energy Manufacturing Activity

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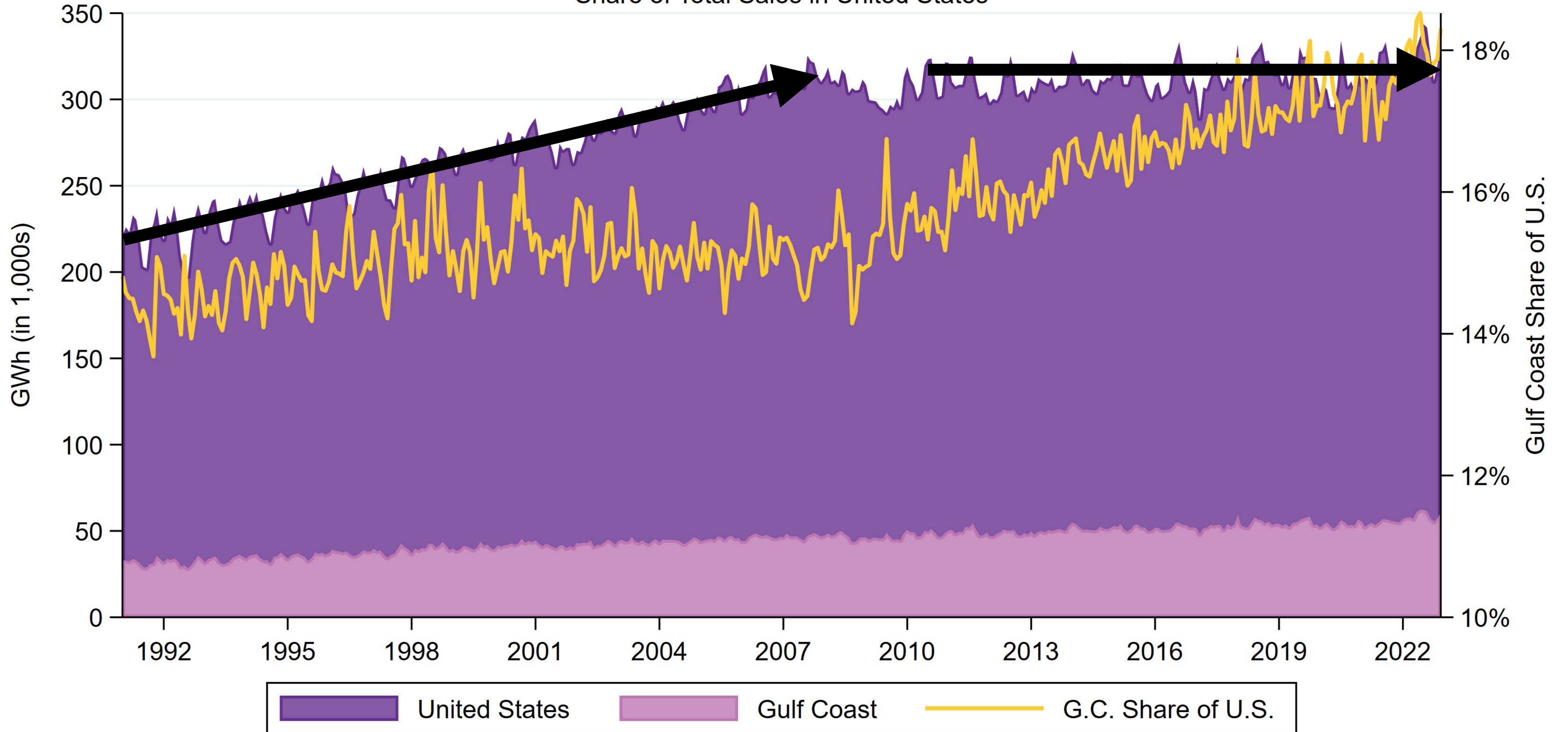
Employment

8

Conclusions

Gulf Coast Total Electricity Sales

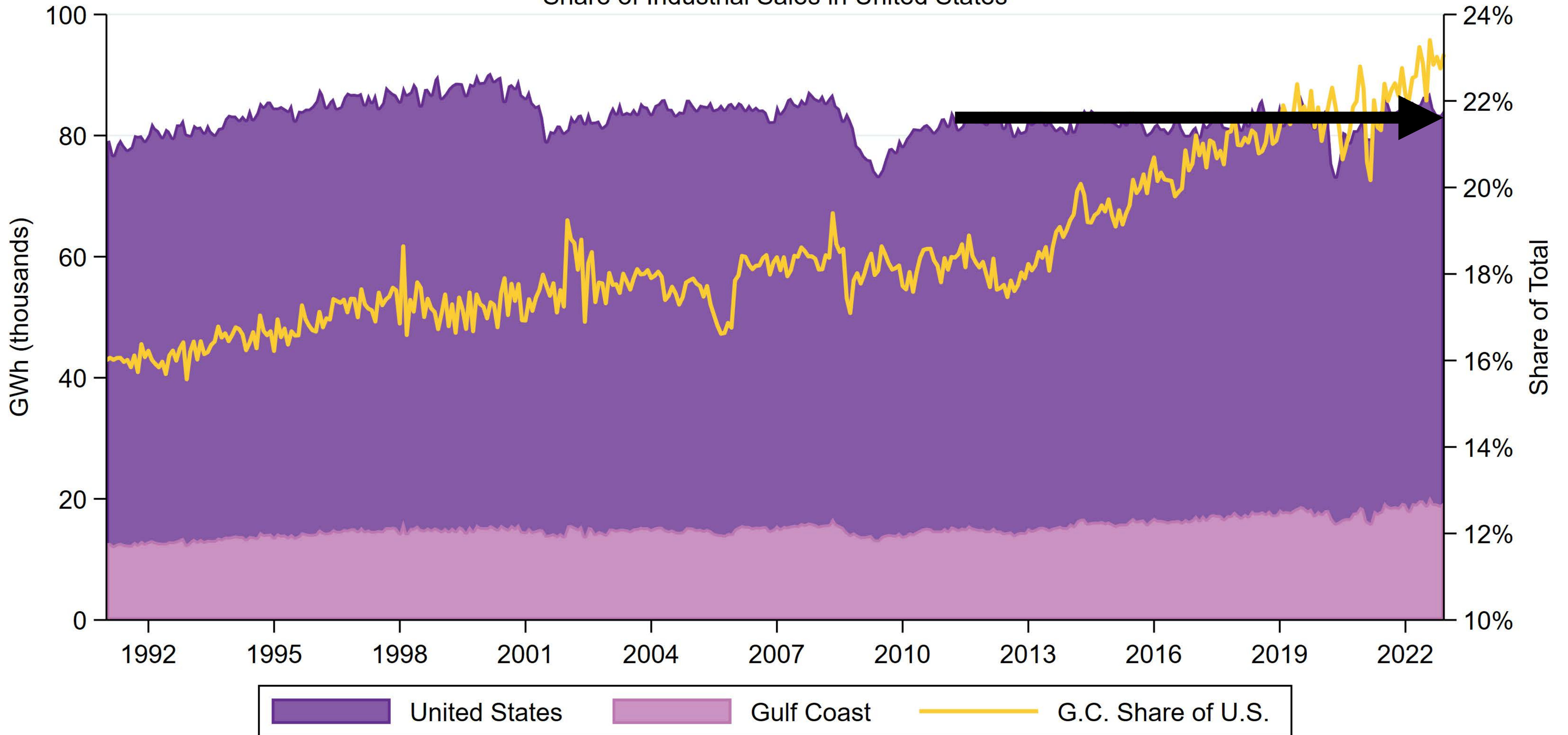
Share of Total Sales in United States



Source: U.S. Energy Information Administration
Only full year data available through 2022 is included.

Gulf Coast Industrial Electricity Sales

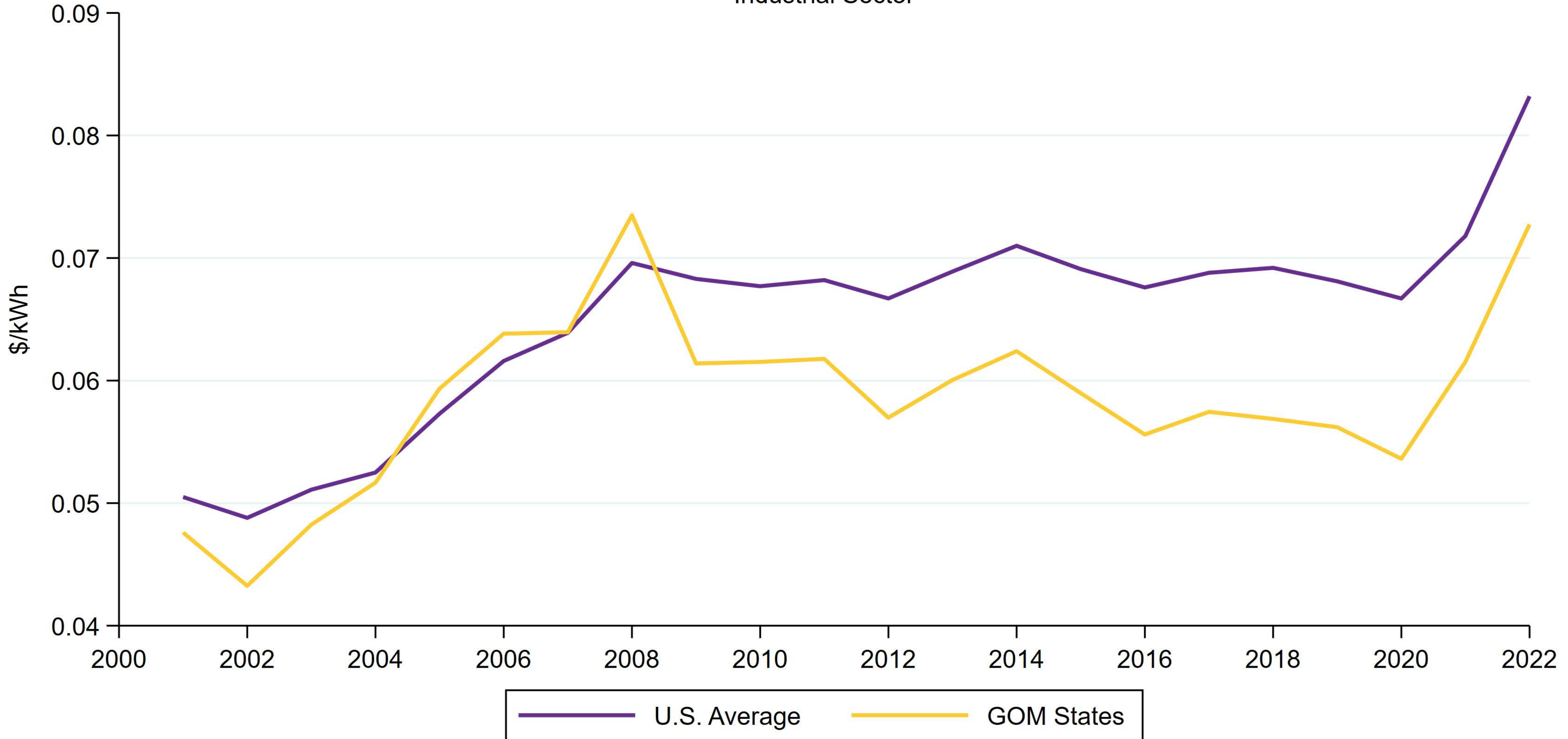
Share of Industrial Sales in United States



Source: U.S. Energy Information Administration
Only full year data available through 2022 is included.

Electricity Rates

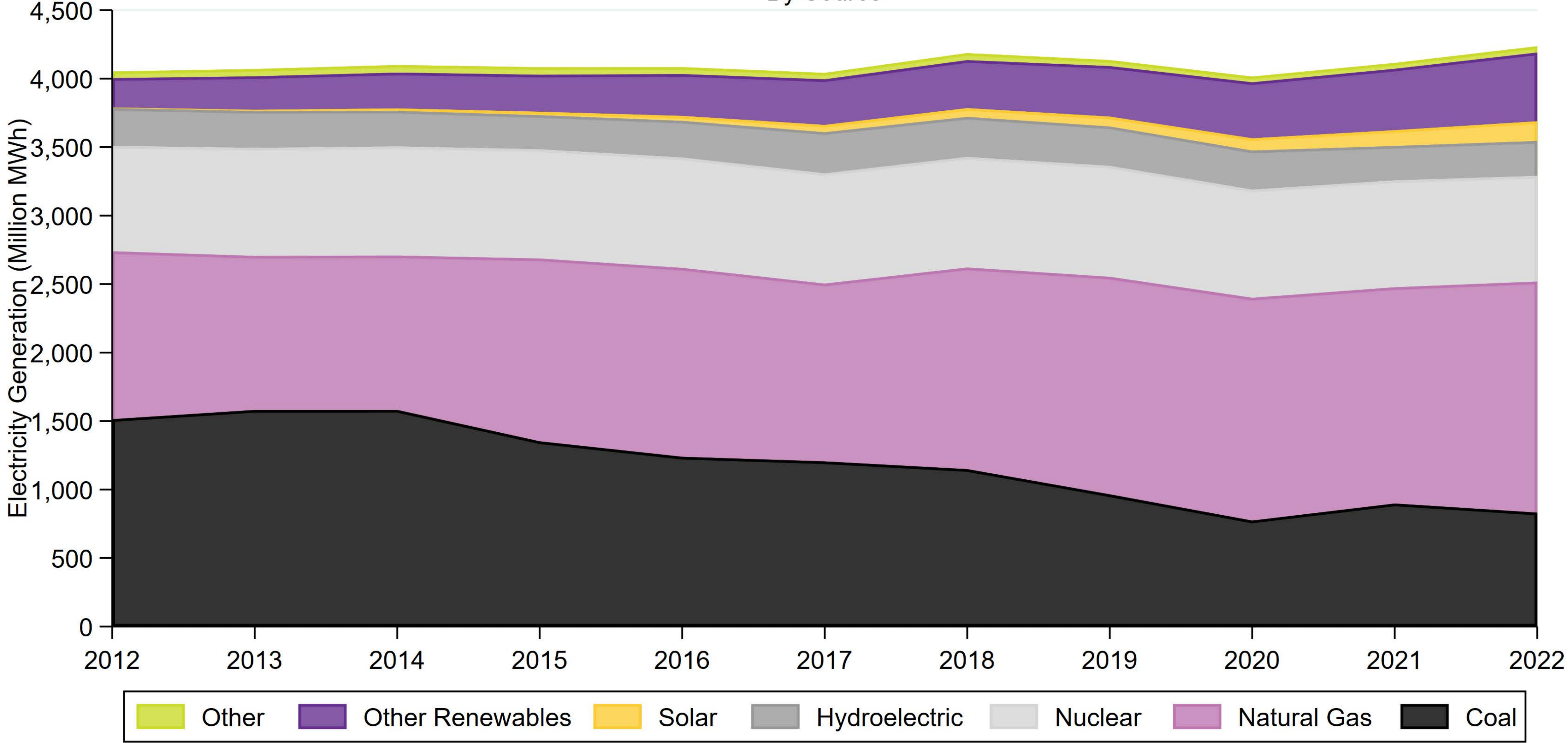
Industrial Sector



Source: U.S. Energy Information Administration

Utility Scale Electricity Generation

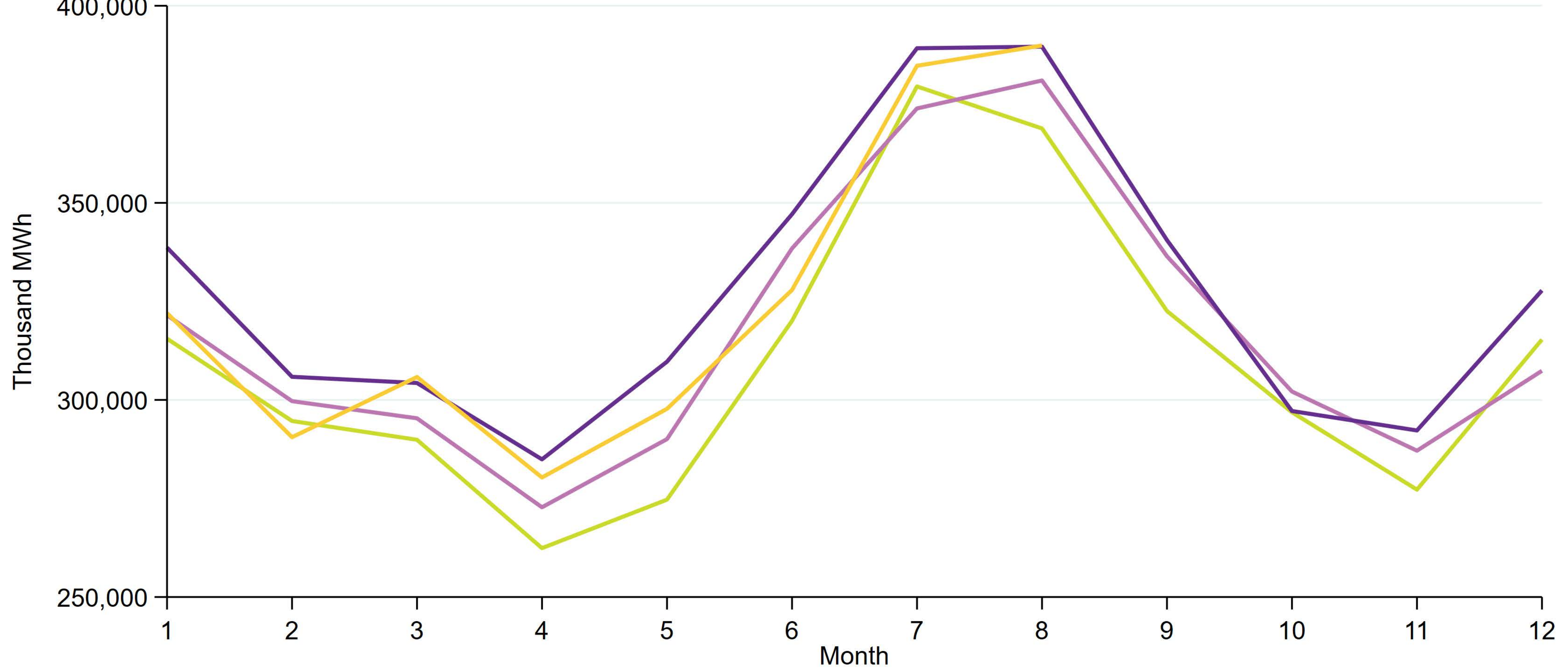
By Source



Source: U.S. Energy Information Administration

Sales of Electricity to Ultimate Consumers

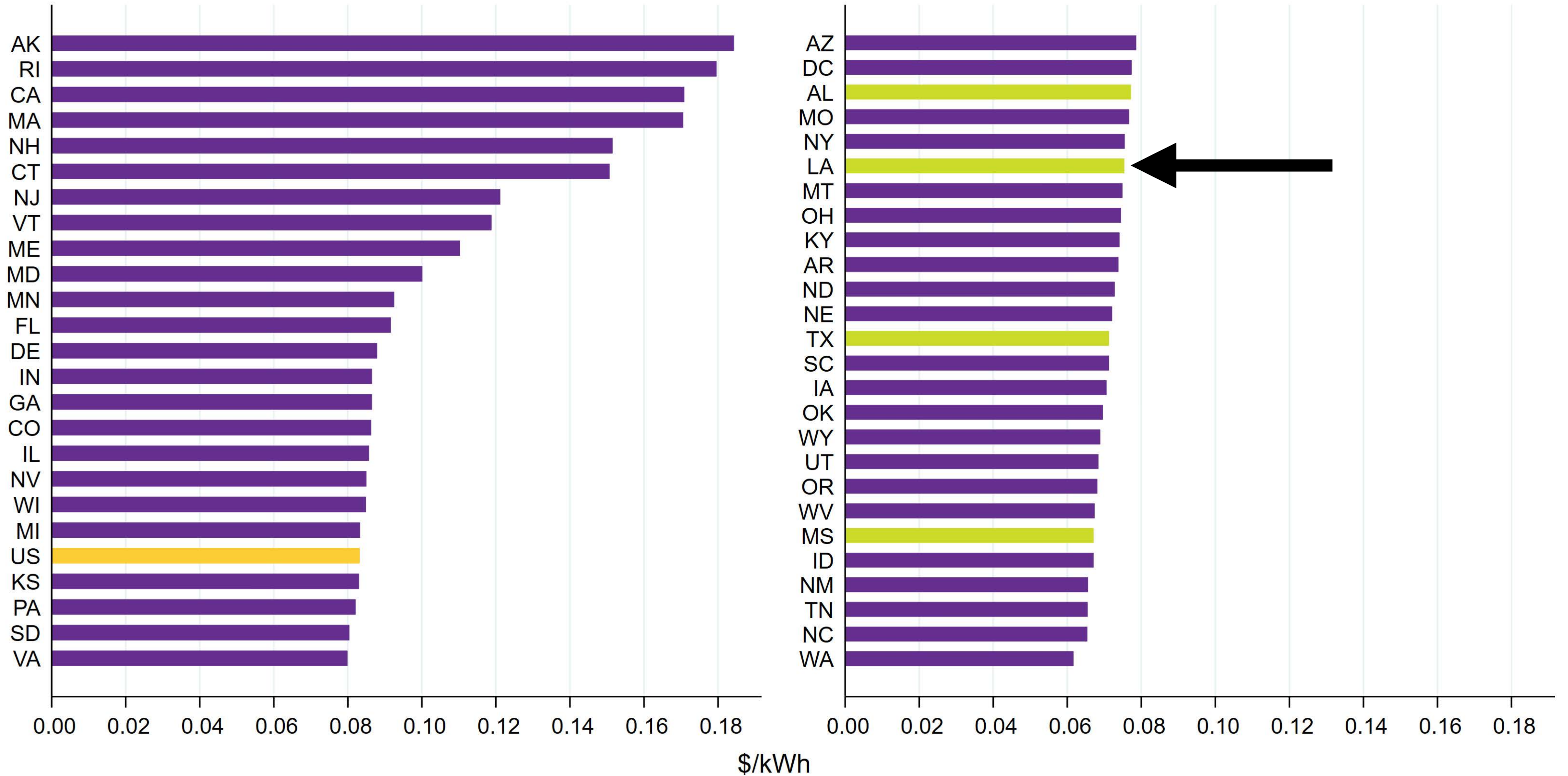
All Sectors



2020 All Sectors 2021 All Sectors 2022 All Sectors 2023 All Sectors

Source: U.S. Energy Information Administration

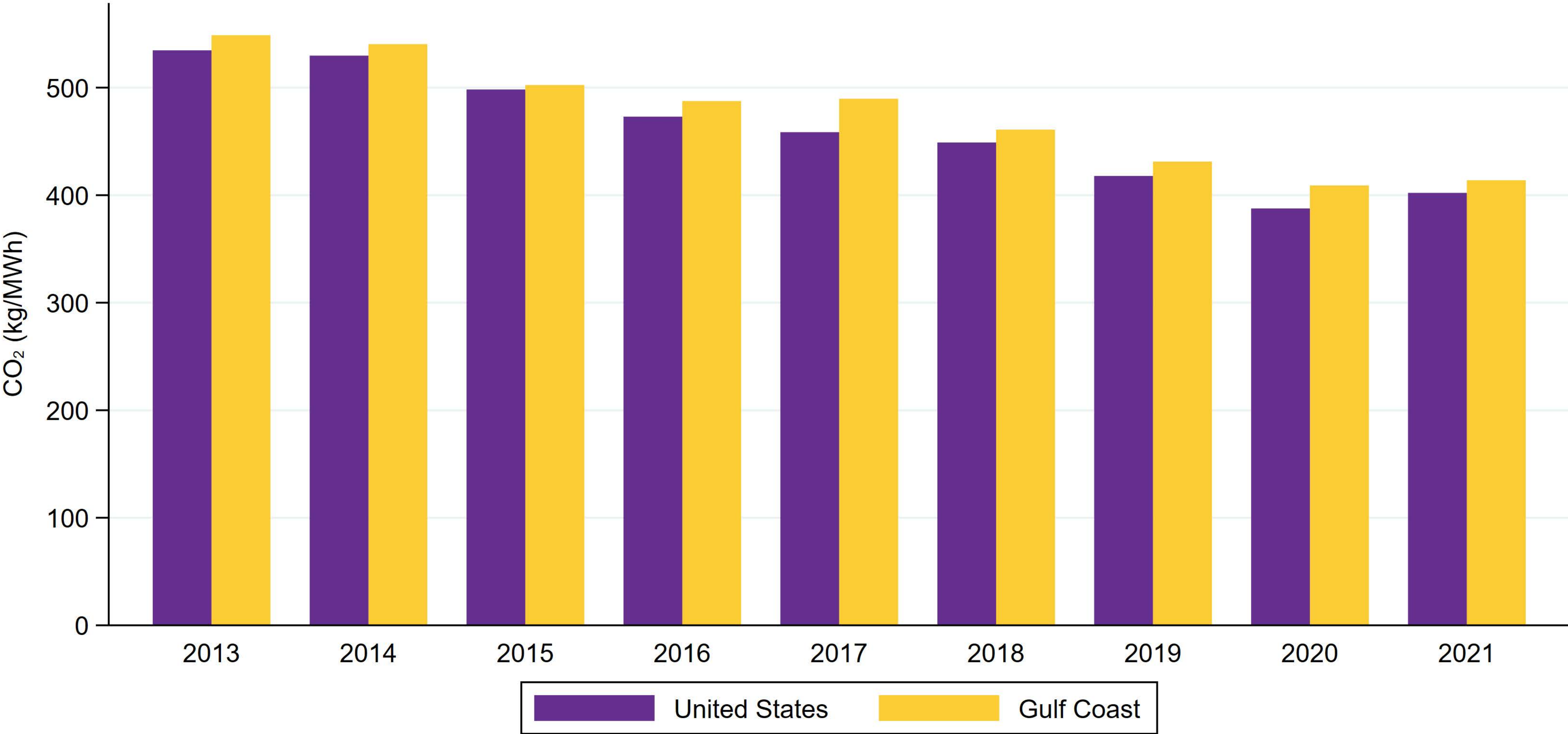
2022 Average Industrial Electricity Rates



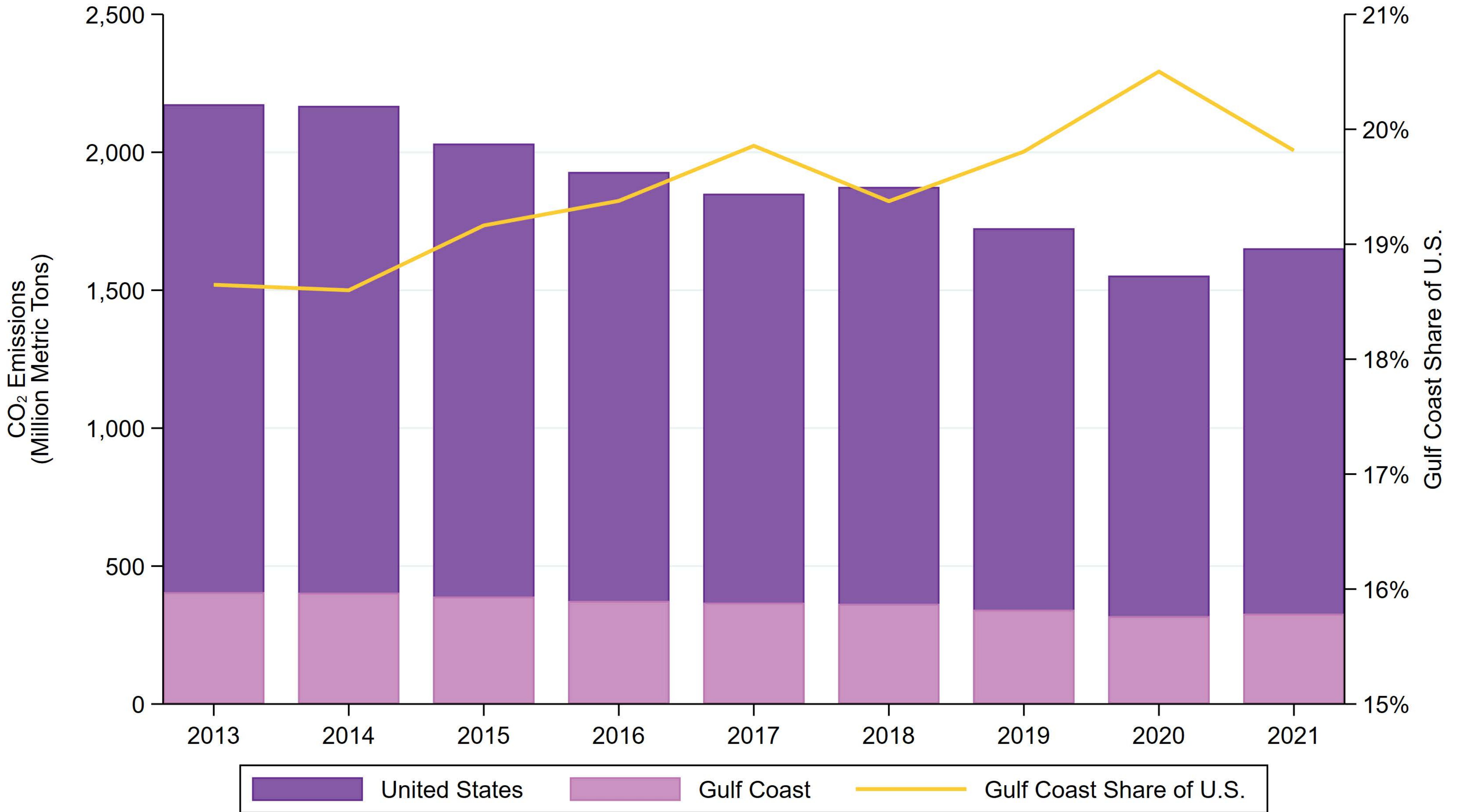
Source: Energy Information Administration
Hawaii (\$0.36/kWh) is excluded from the figure.

CO₂ Emissions per MWh of Generation

Gulf Coast & United States

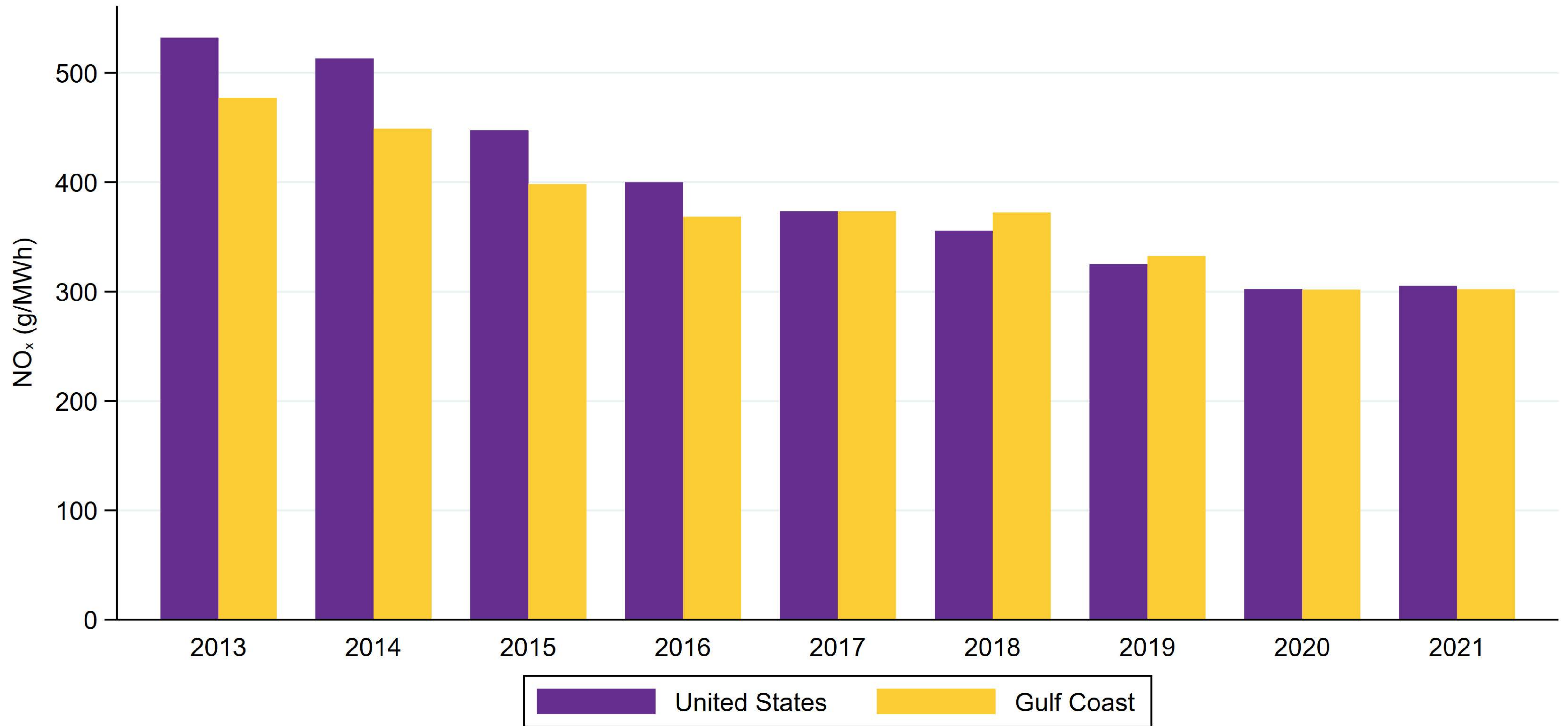


Note: The emissions data presented include total emissions from both electricity generation and the production of useful thermal output
Source: U.S. Energy Information Administration, Form EIA-923 Power Plant Operations Report, Form EIA-860 Annual Electric Generator Report



NO_x Emissions per MWh of Generation

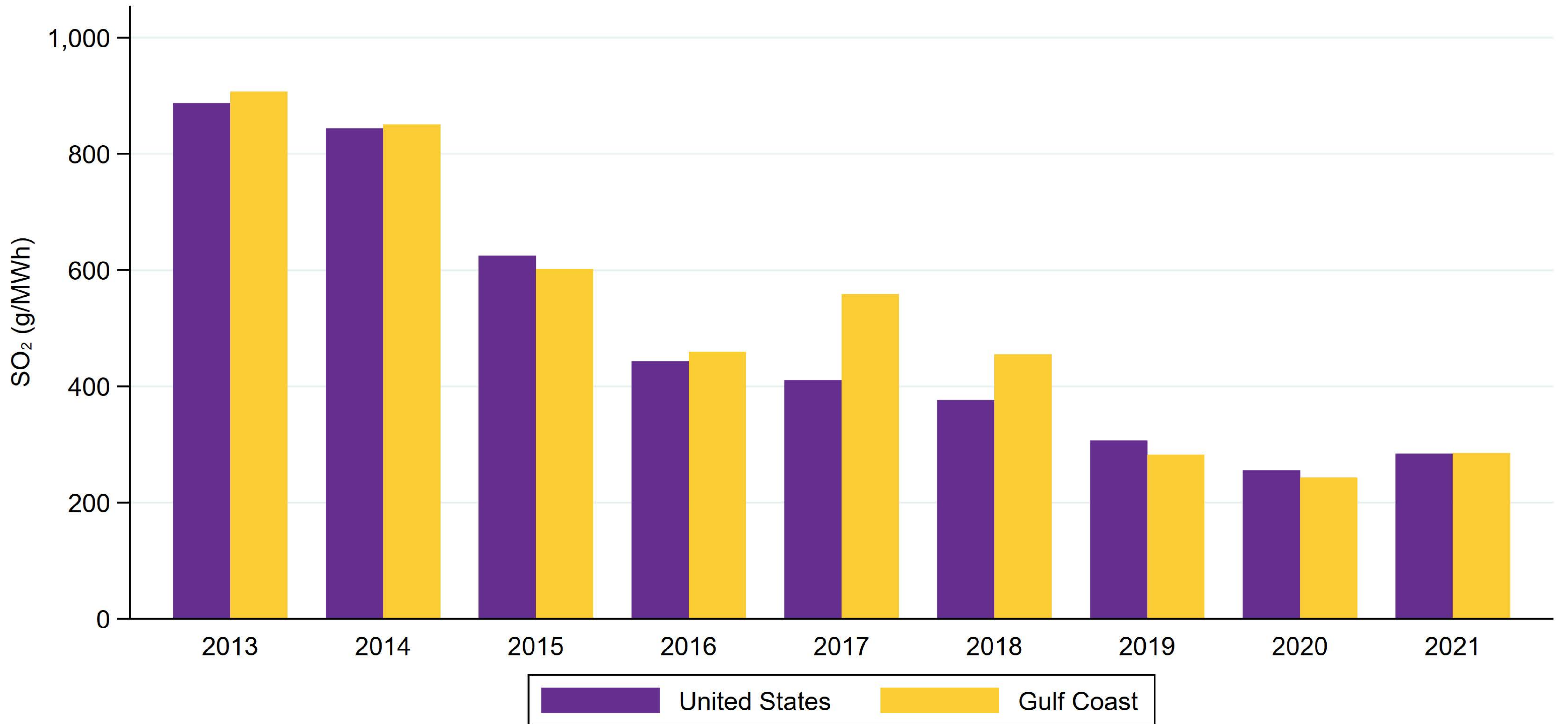
Gulf Coast & United States



Note: The emissions data presented include total emissions from both electricity generation and the production of useful thermal output
Source: U.S. Energy Information Administration, Form EIA-923 Power Plant Operations Report, Form EIA-860 Annual Electric Generator Report

SO₂ Emissions per MWh of Generation

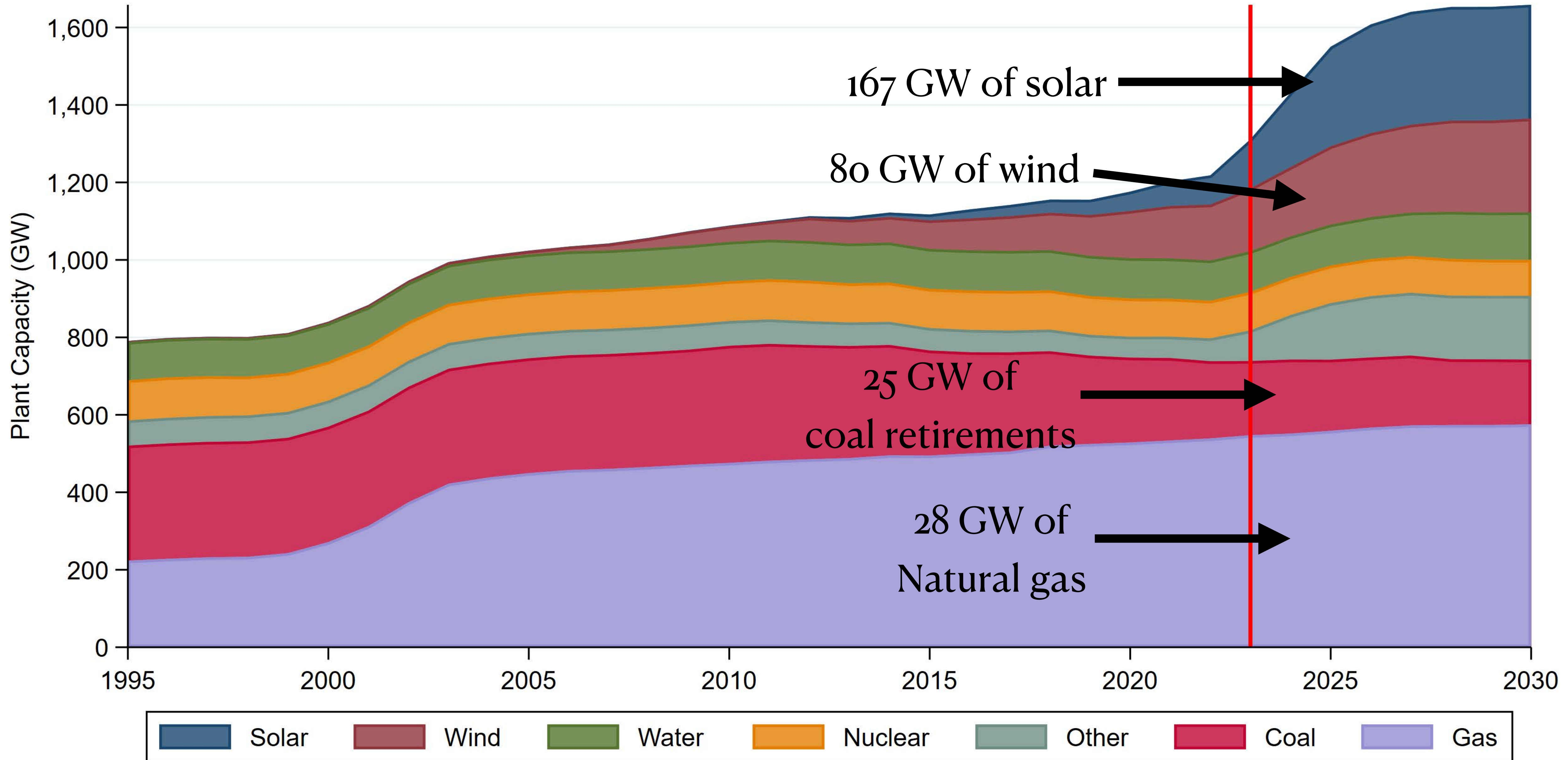
Gulf Coast & United States



Note: The emissions data presented include total emissions from both electricity generation and the production of useful thermal output
Source: U.S. Energy Information Administration, Form EIA-923 Power Plant Operations Report, Form EIA-860 Annual Electric Generator Report

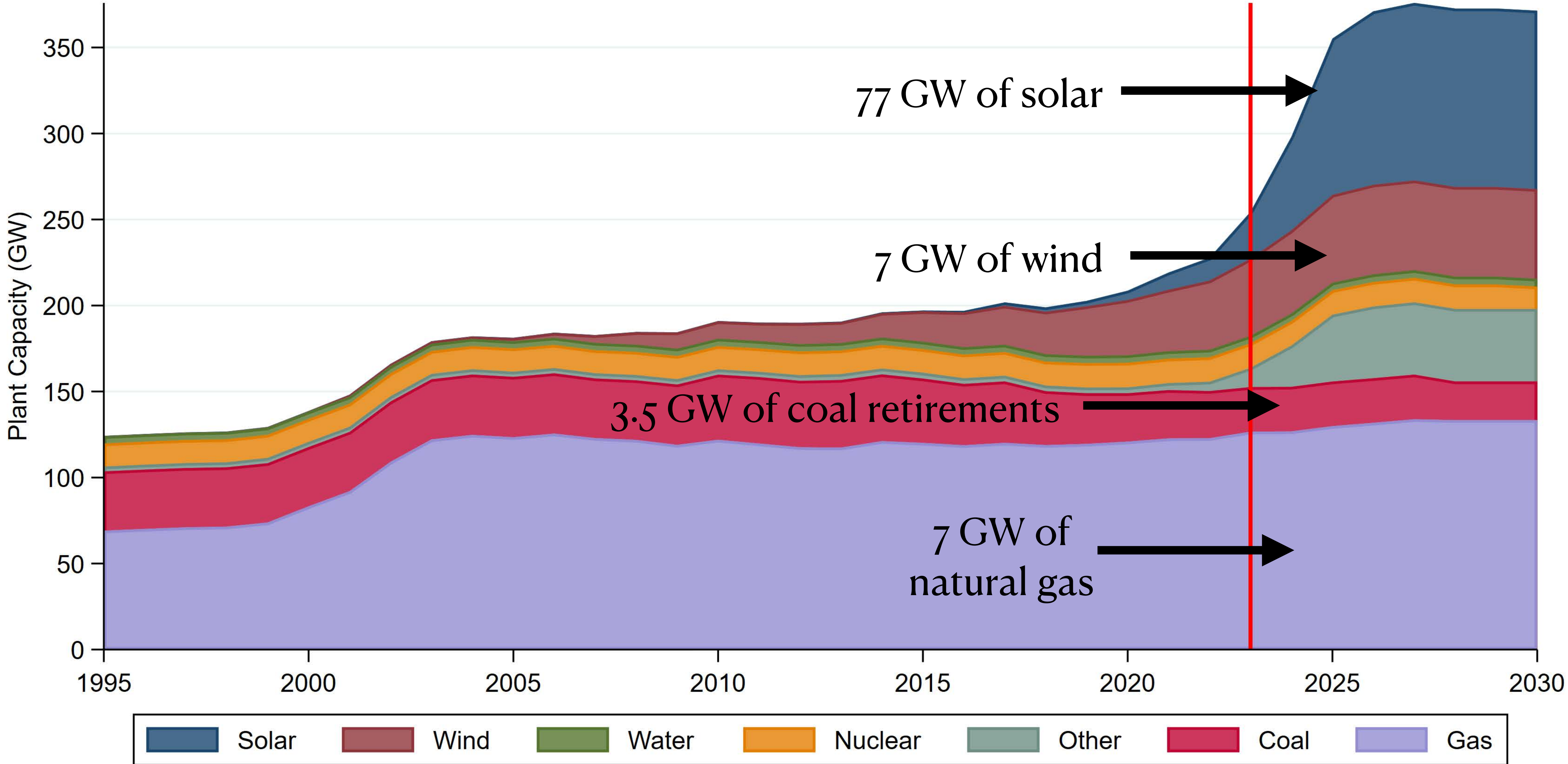
Historical & Future Power Plant Capacity

United States

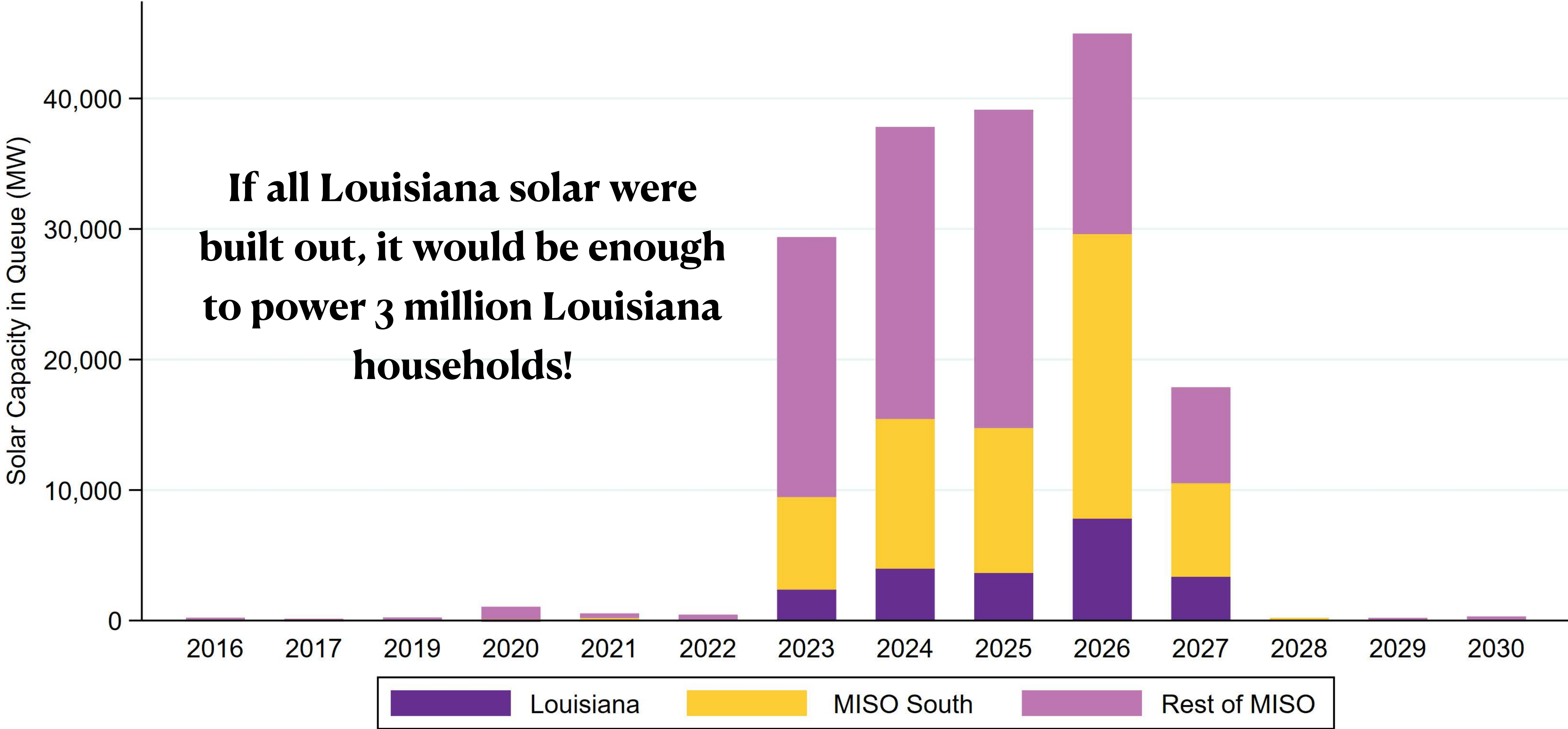


Historical & Future Power Plant Capacity

Gulf Coast



Historical and Future Solar Capacity in Interconnection Queue in MISO States



Note: 2022 includes both completed projects and projects in interconnection queue. Projects listed by expected completion year.

Outline

1 Introduction & Uncertainties

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5 Energy Exports

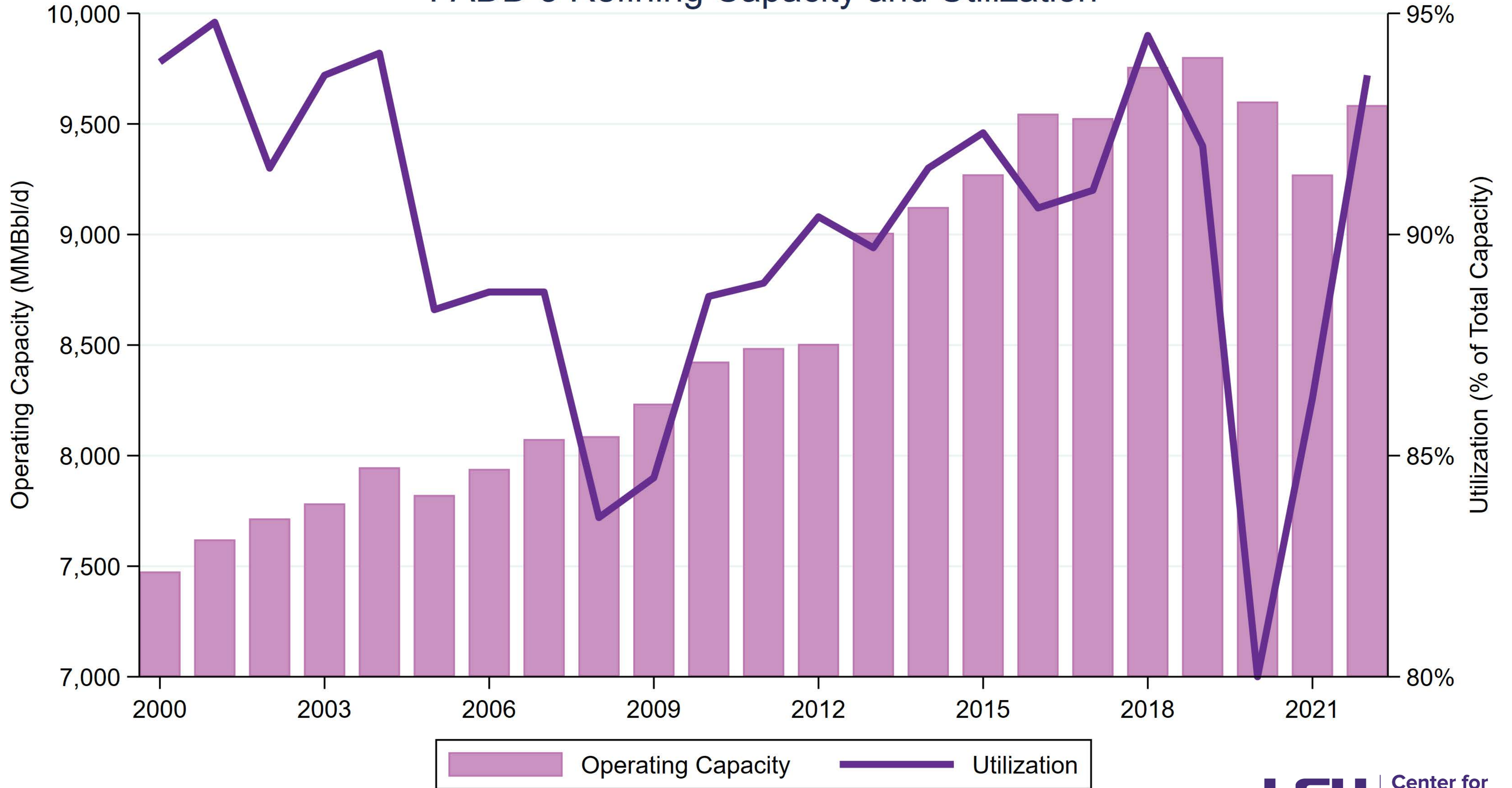


6 Energy Manufacturing Activity

7 Employment

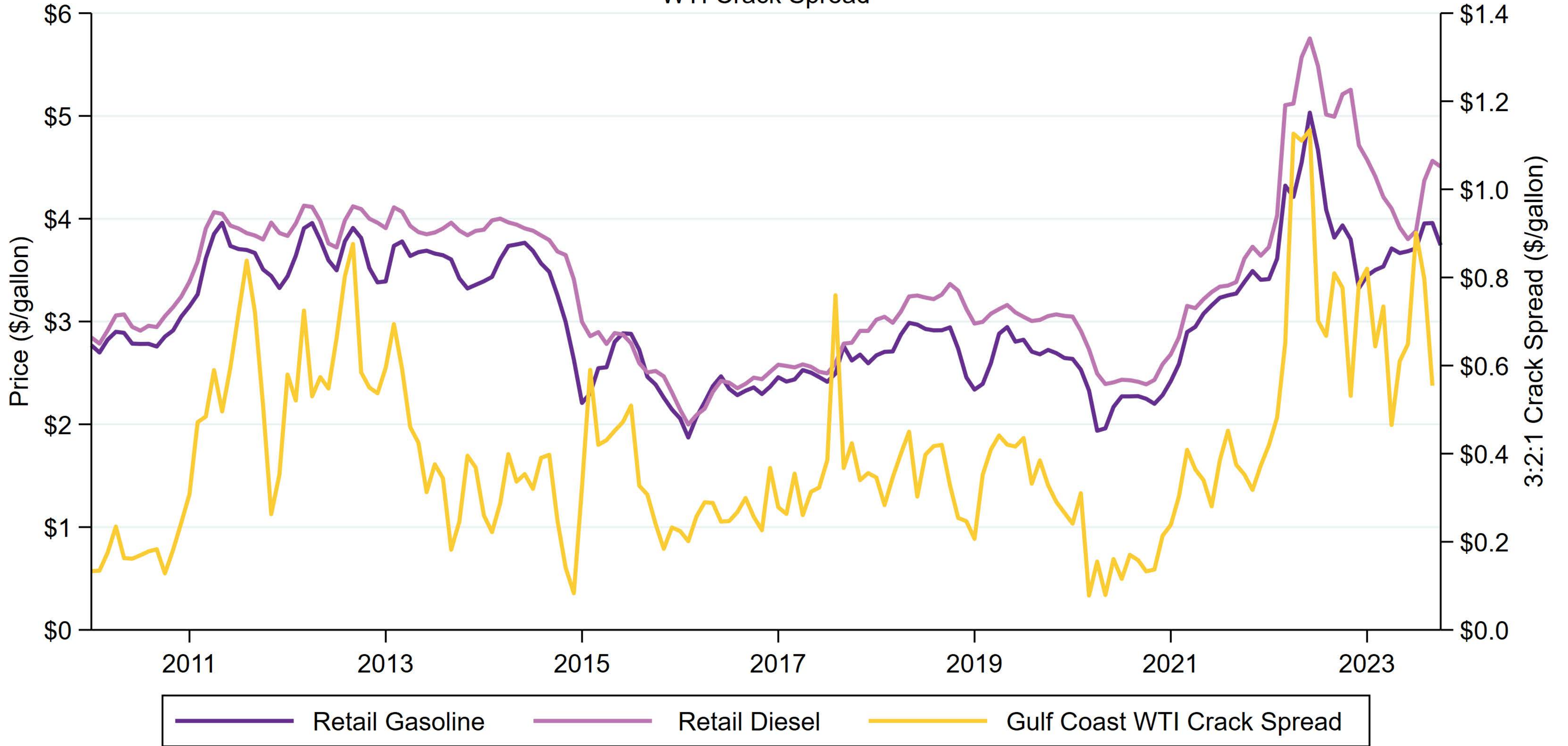
8 Conclusions

PADD 3 Refining Capacity and Utilization



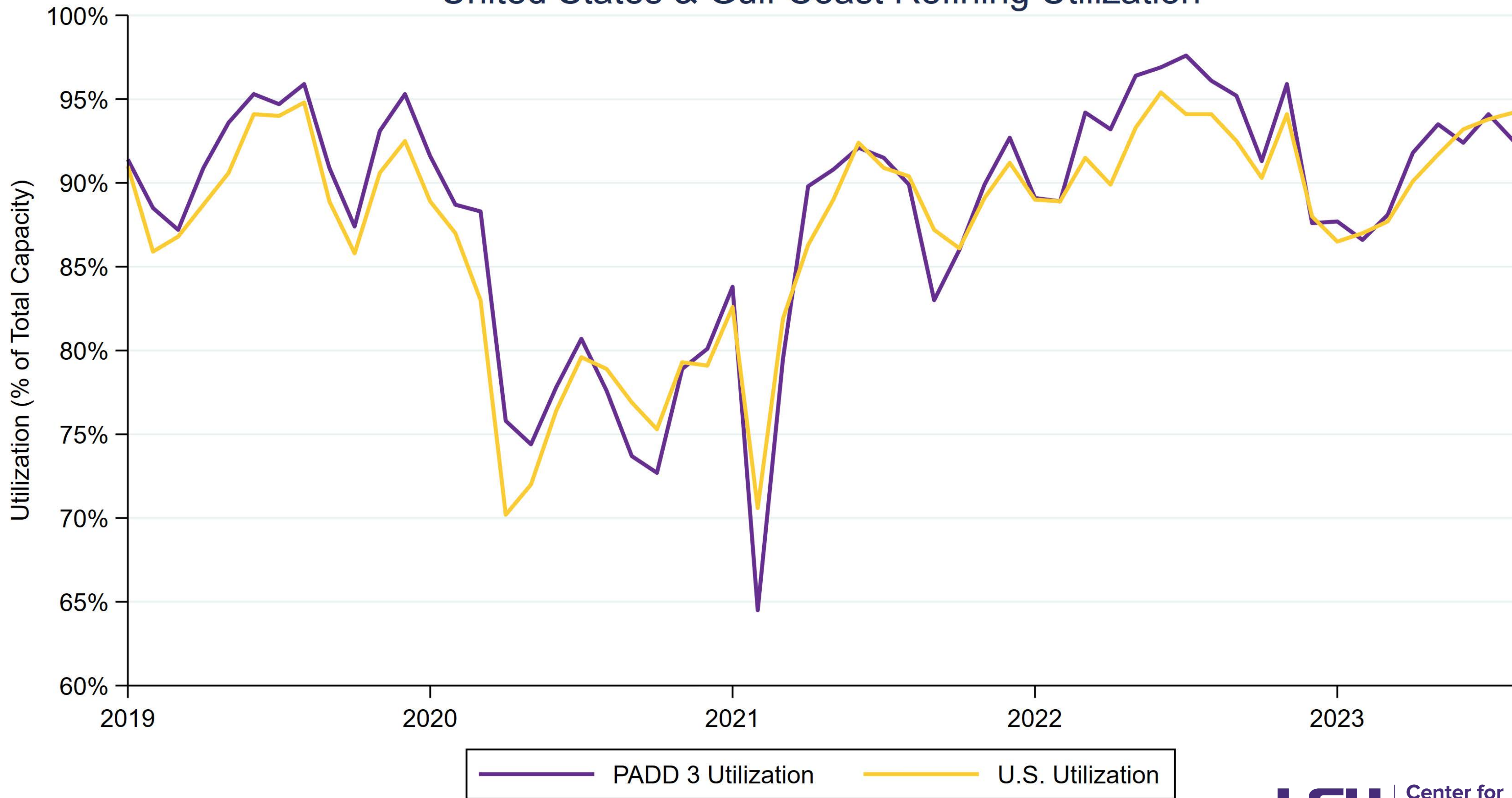
US Gulf Coast Gasoline

WTI Crack Spread

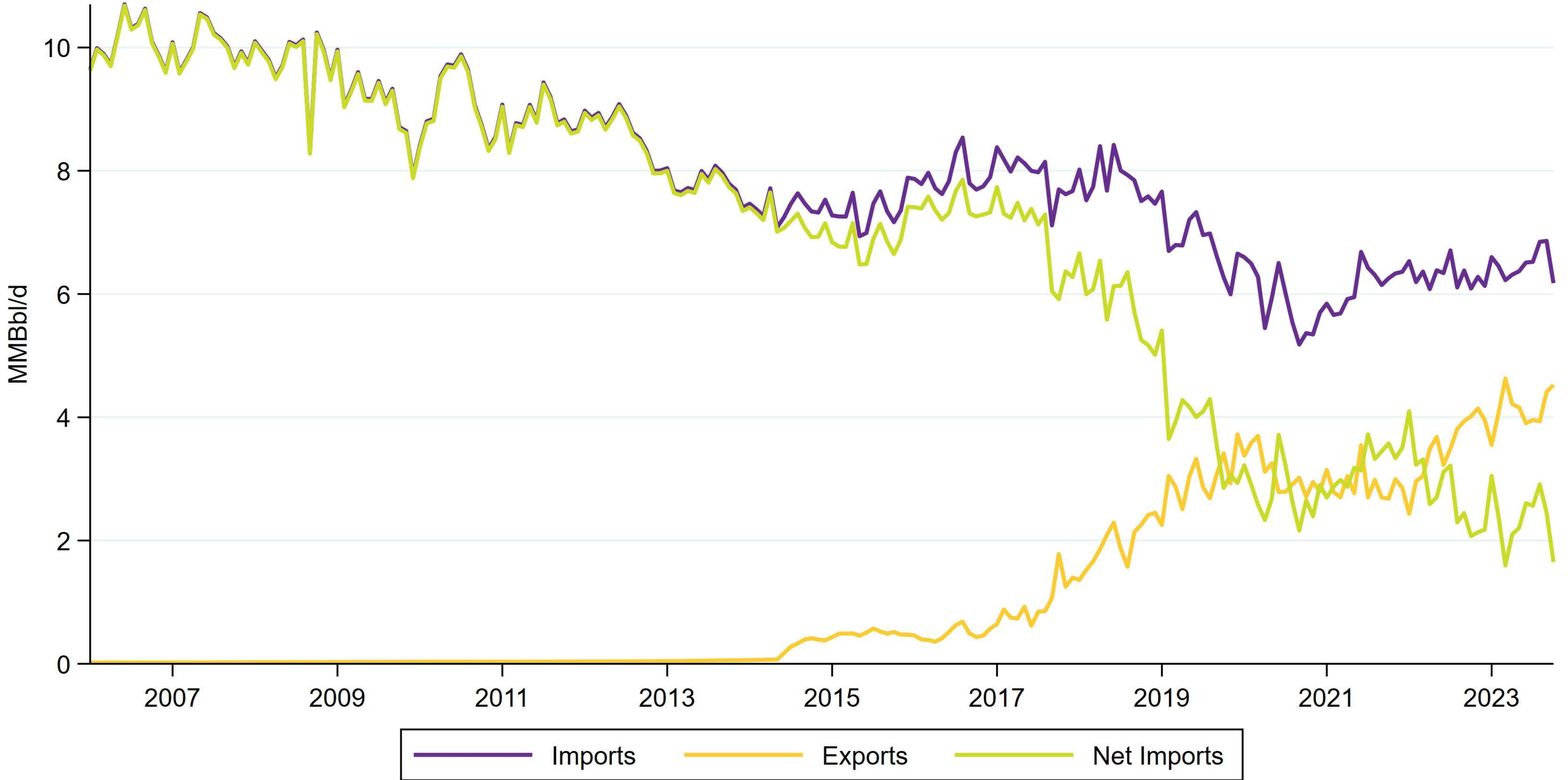


Source: EIA and Bloomberg.

United States & Gulf Coast Refining Utilization

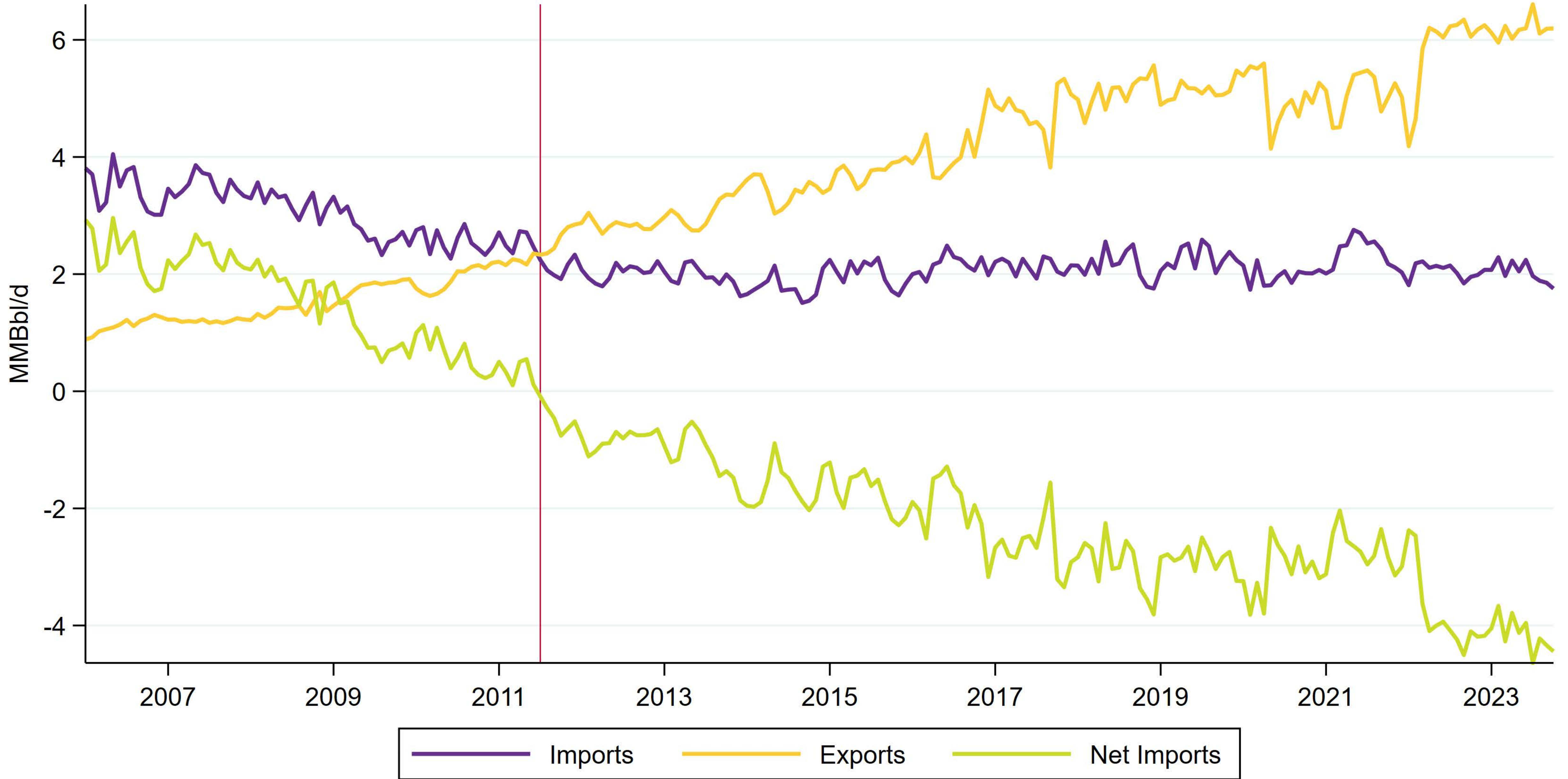


U.S. Crude Oil Trade



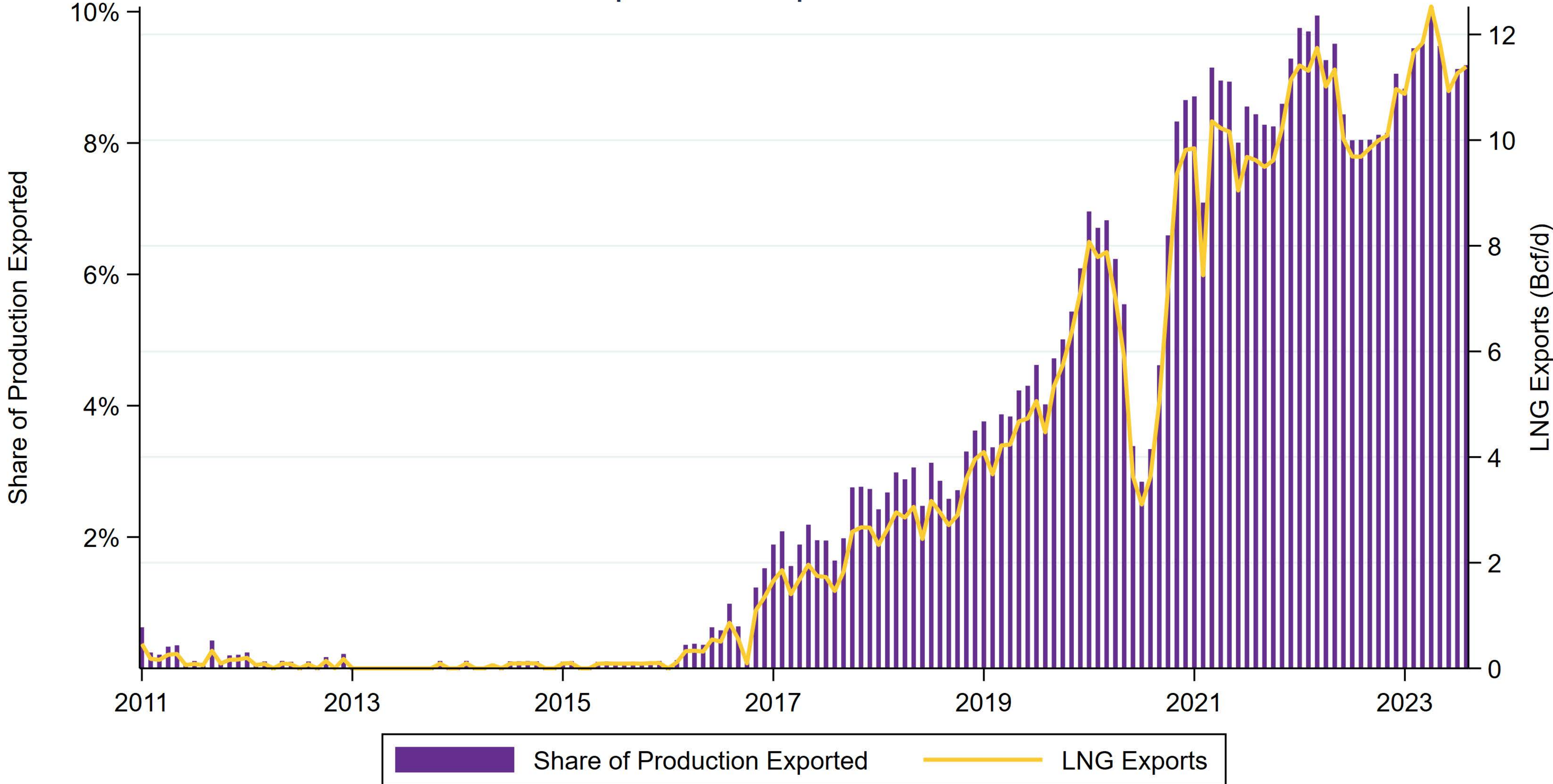
Source: U.S. Energy Information Administration

U.S. Refined Product Trade



Source: U.S. Energy Information Administration

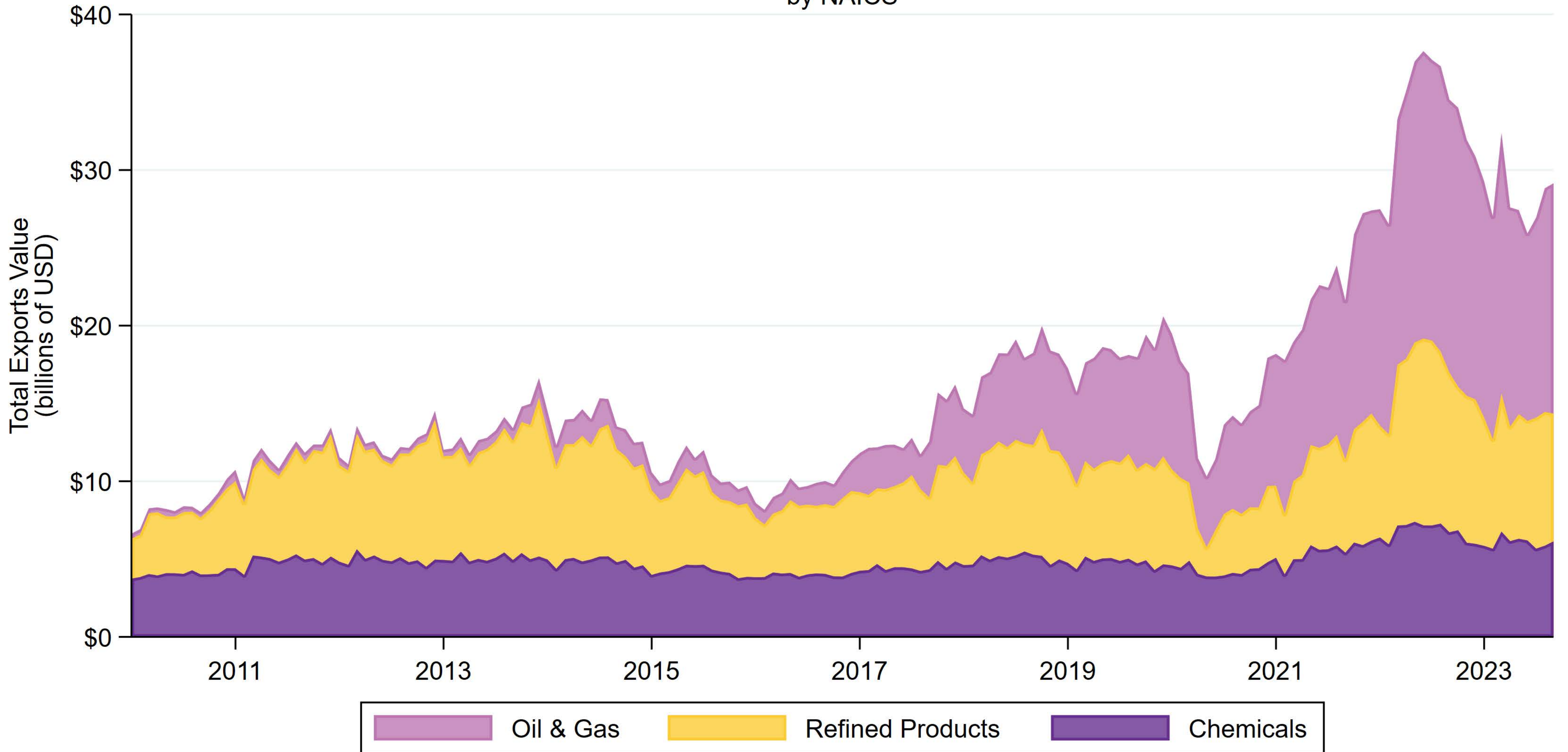
U.S. Exports of Liquefied Natural Gas



Source: U.S. Energy Information Administration

Gulf Coast Exports to World

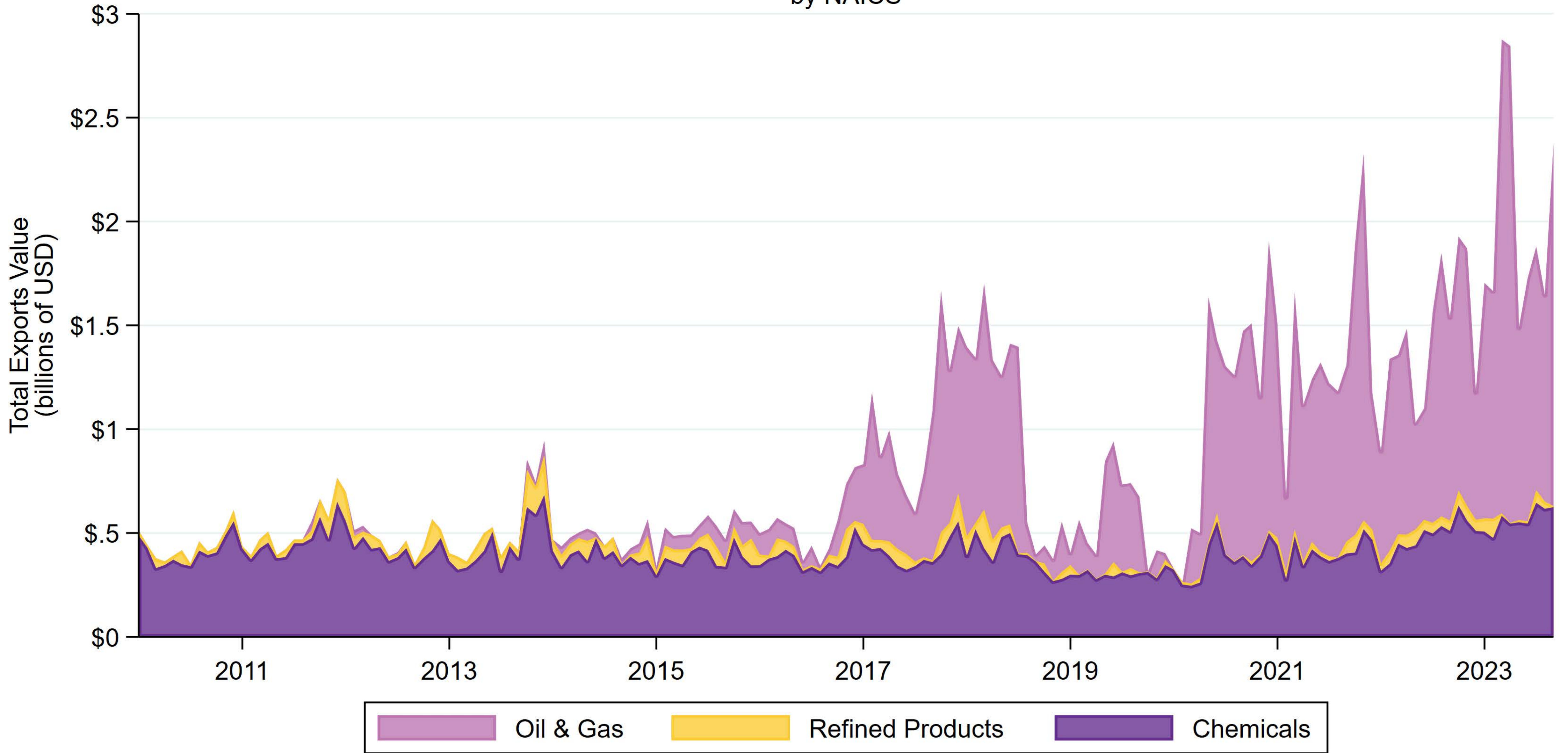
by NAICS



Source: U.S. Census Bureau: Economic Indicators Division USA Trade Online

Gulf Coast Exports to China

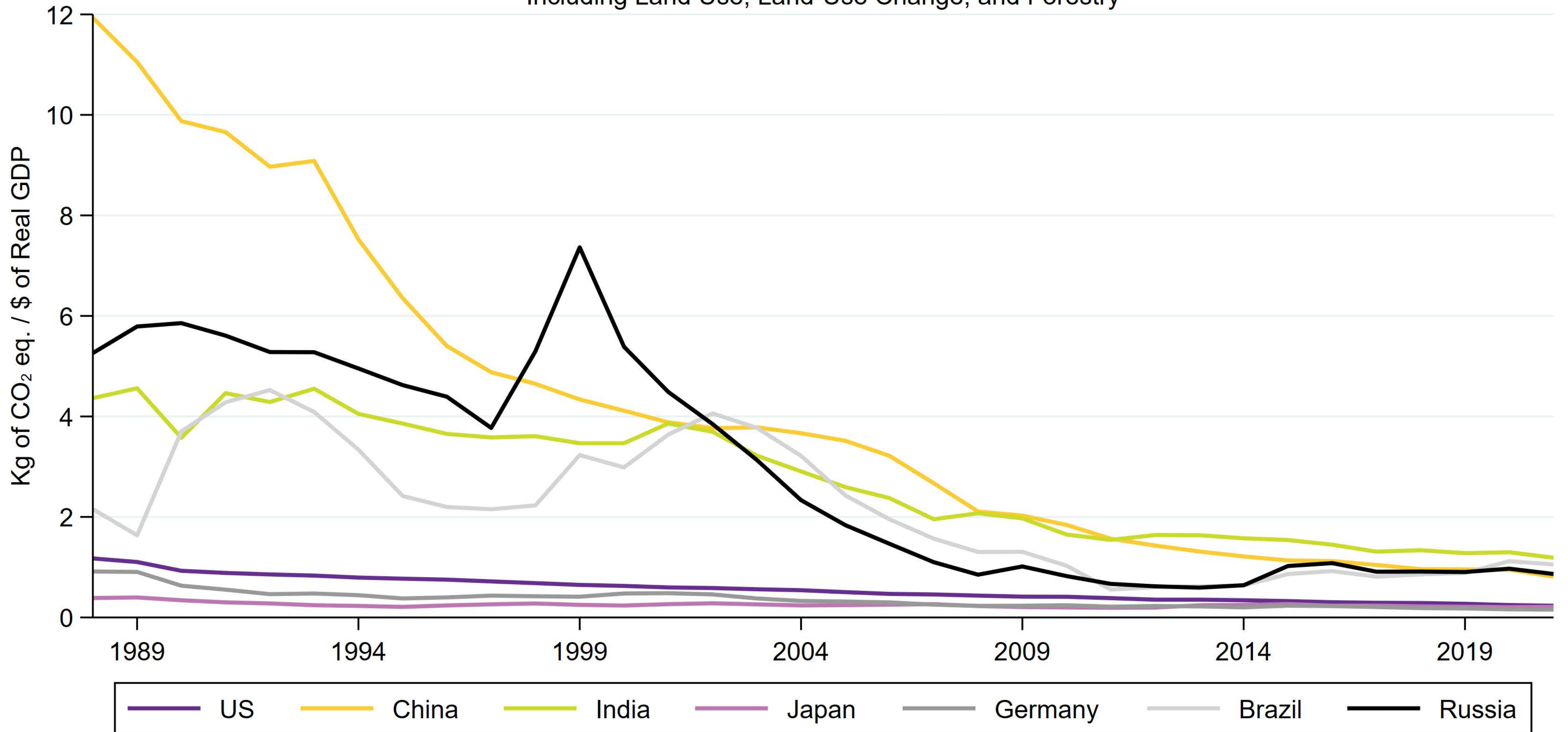
by NAICS



Source: U.S. Census Bureau: Economic Indicators Division USA Trade Online

Emissions Intensity of GDP

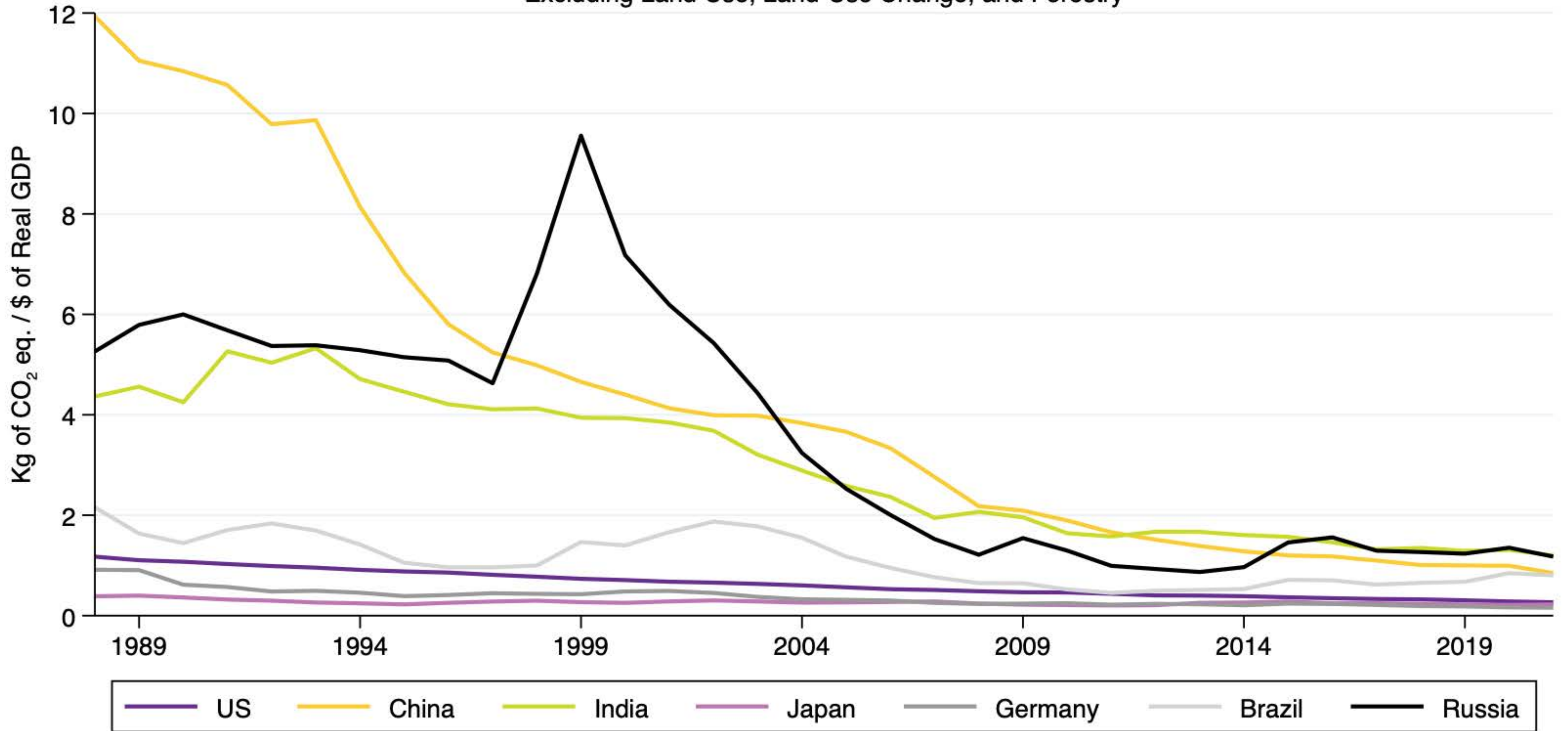
Including Land Use, Land-Use Change, and Forestry



Source: GDP data from Bloomberg.
Emissions data from the IMF.

Emissions Intensity of GDP

Excluding Land Use, Land-Use Change, and Forestry



Source: GDP data from Bloomberg.
Emissions data from the IMF.

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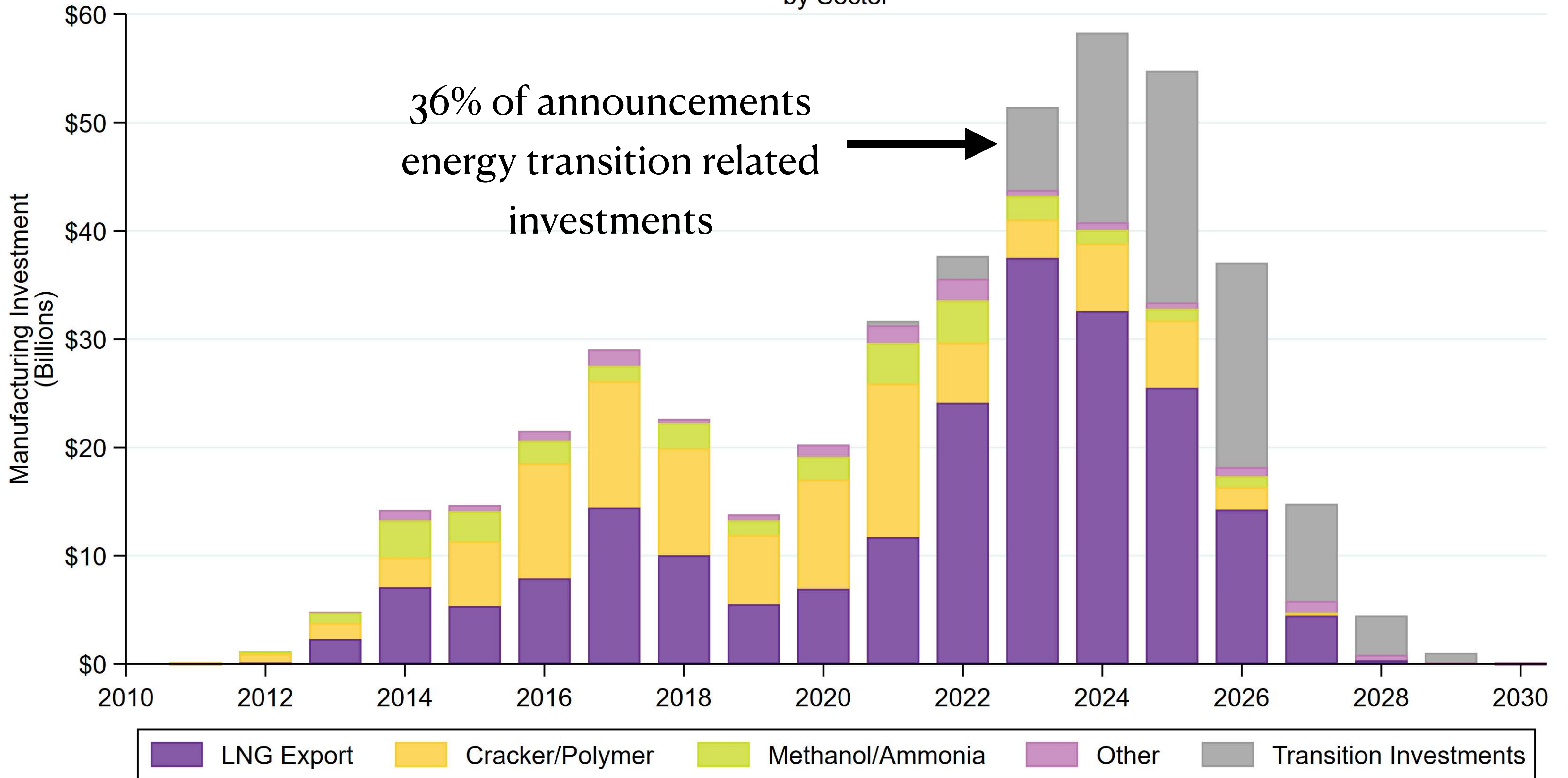


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Gulf Coast Energy Manufacturing Investments

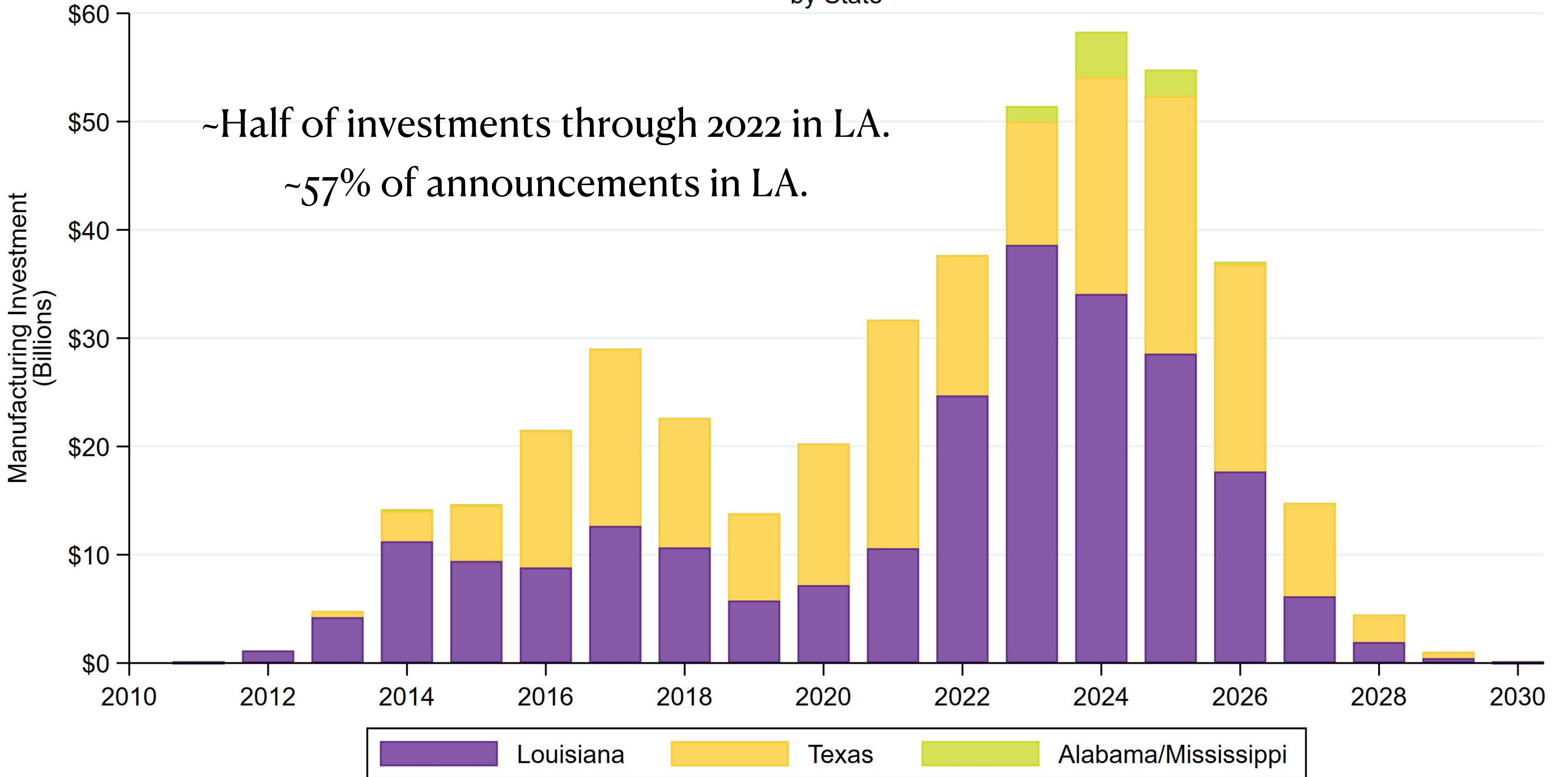
by Sector



Gulf Coast Energy Manufacturing Investments

by State

~Half of investments through 2022 in LA.
~57% of announcements in LA.



Gulf Coast Manufacturing

- Between 2011 and 2022, there was approximately \$212 billion of investment in refining, chemicals, and hydrocarbon export across the Gulf Coast region.
- Approximately \$106.5 billion, or 50 percent is within Louisiana.
- Currently, there are an additional \$170.5 billion in announcements, with approximately 52 percent of these announcements in Louisiana.

Table 1: Total GOM investments

Year	Texas			Louisiana			Other GOM			Total GOM						
	LNG	Non-LNG	Transition	Total	LNG	Non-LNG	Transition	Total	LNG	Non-LNG	Transition	Total				
----- (million \$) -----																
2023	5,274	2,986	3,133	11,393	30,910	3,190	4,513	38,613	1,321	-	1	1,322	37,506	6,277	7,646	51,429
2024	8,517	5,413	6,066	19,997	20,049	2,609	11,426	34,085	4,038	-	21	4,060	32,604	8,171	17,514	58,290
2025	10,010	4,941	8,851	23,803	13,113	2,946	12,507	28,566	2,394	-	29	2,423	25,517	7,887	21,387	54,791
2026	9,292	1,742	8,116	19,151	4,750	2,200	10,735	17,684	213	-	3	217	14,255	3,942	18,854	37,052
2027	4,103	1,139	3,387	8,629	373	232	5,558	6,163	-	-	-	-	4,477	1,371	8,945	14,792
2028	347	505	1,698	2,550	-	-	1,935	1,935	-	-	-	-	347	505	3,633	4,484
2029	-	118	473	591	-	-	457	457	-	-	-	-	-	118	930	1,048
2030	-	8	30	38	-	-	31	31	-	-	-	-	-	8	61	69
Total	\$37,544	\$16,852	\$ 31,754	\$86,151	\$69,195	\$11,177	\$ 47,161	\$127,533	\$7,967	\$ -	\$ 55	\$8,022	\$114,706	\$28,279	\$ 78,970	\$221,955

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

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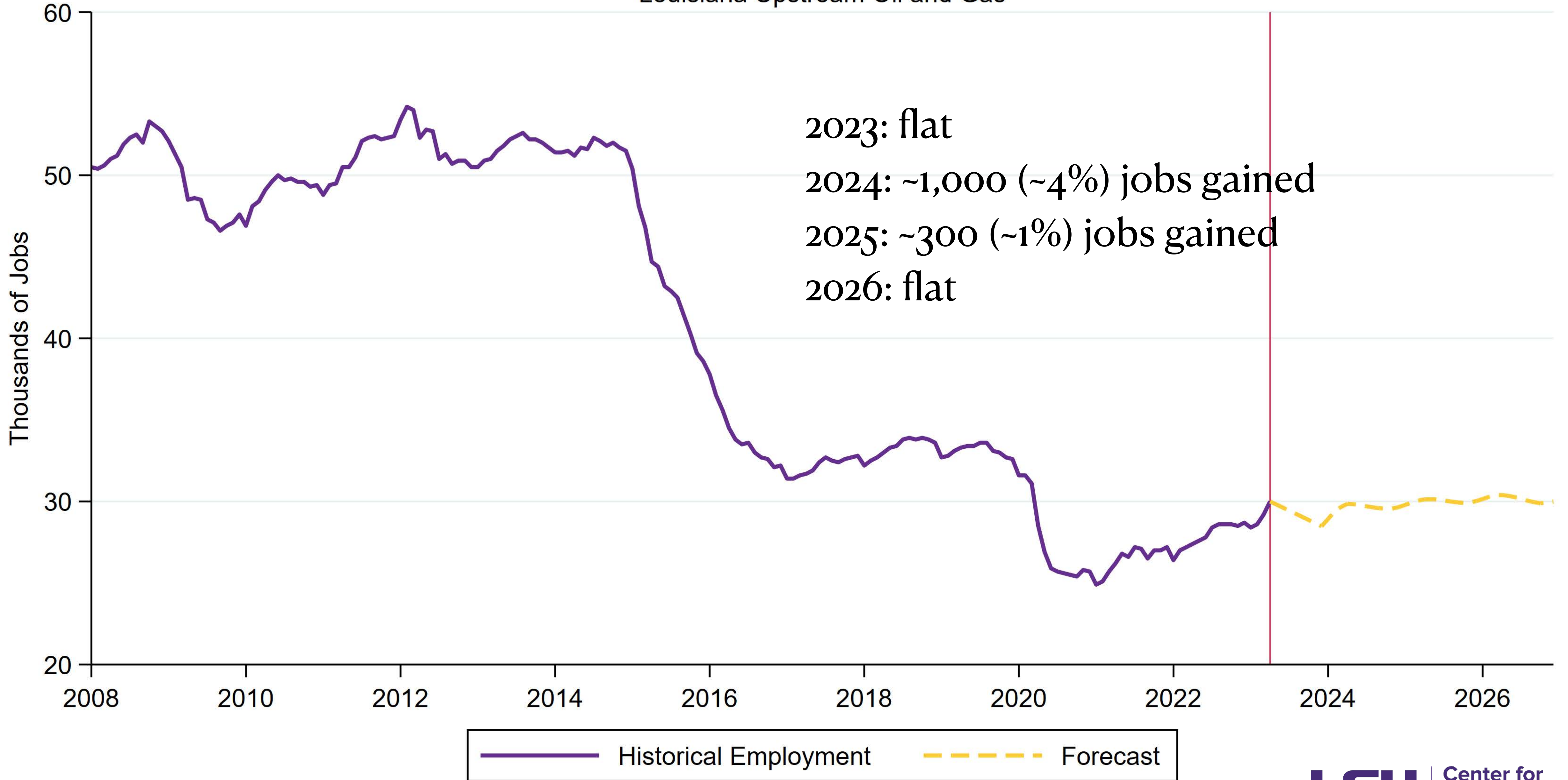
7 Employment



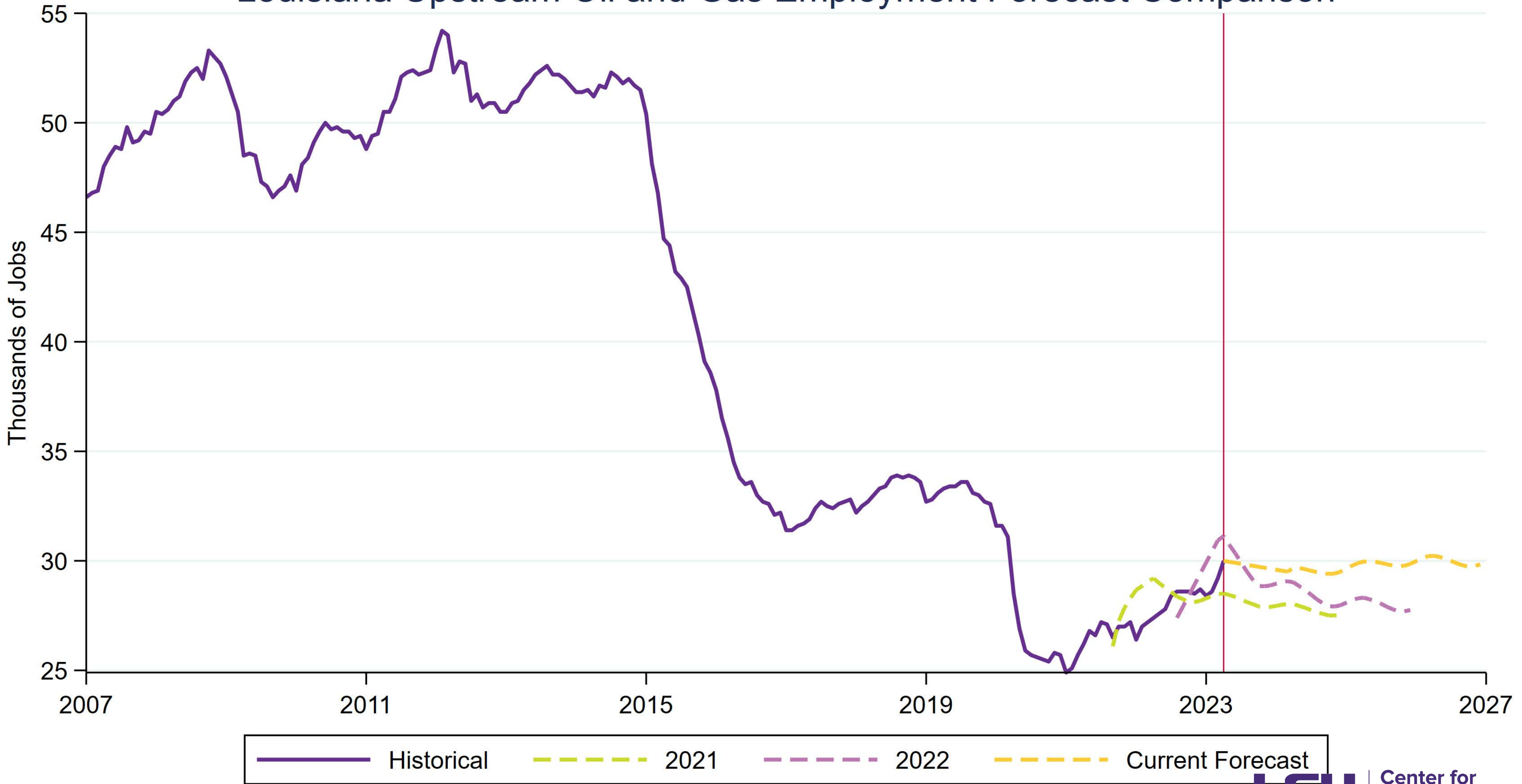
8 Conclusions

Employment Forecast

Louisiana Upstream Oil and Gas

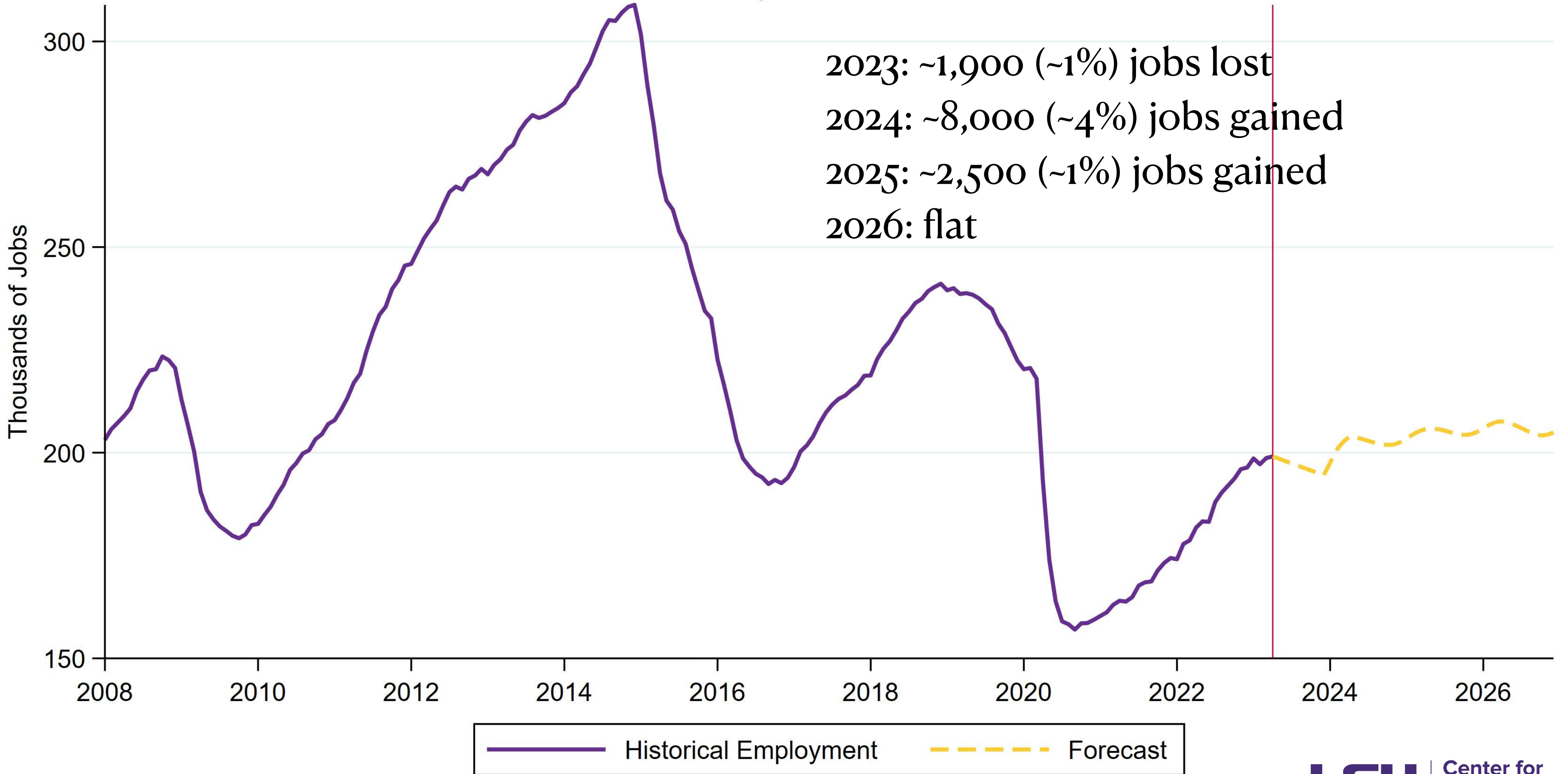


Louisiana Upstream Oil and Gas Employment Forecast Comparison

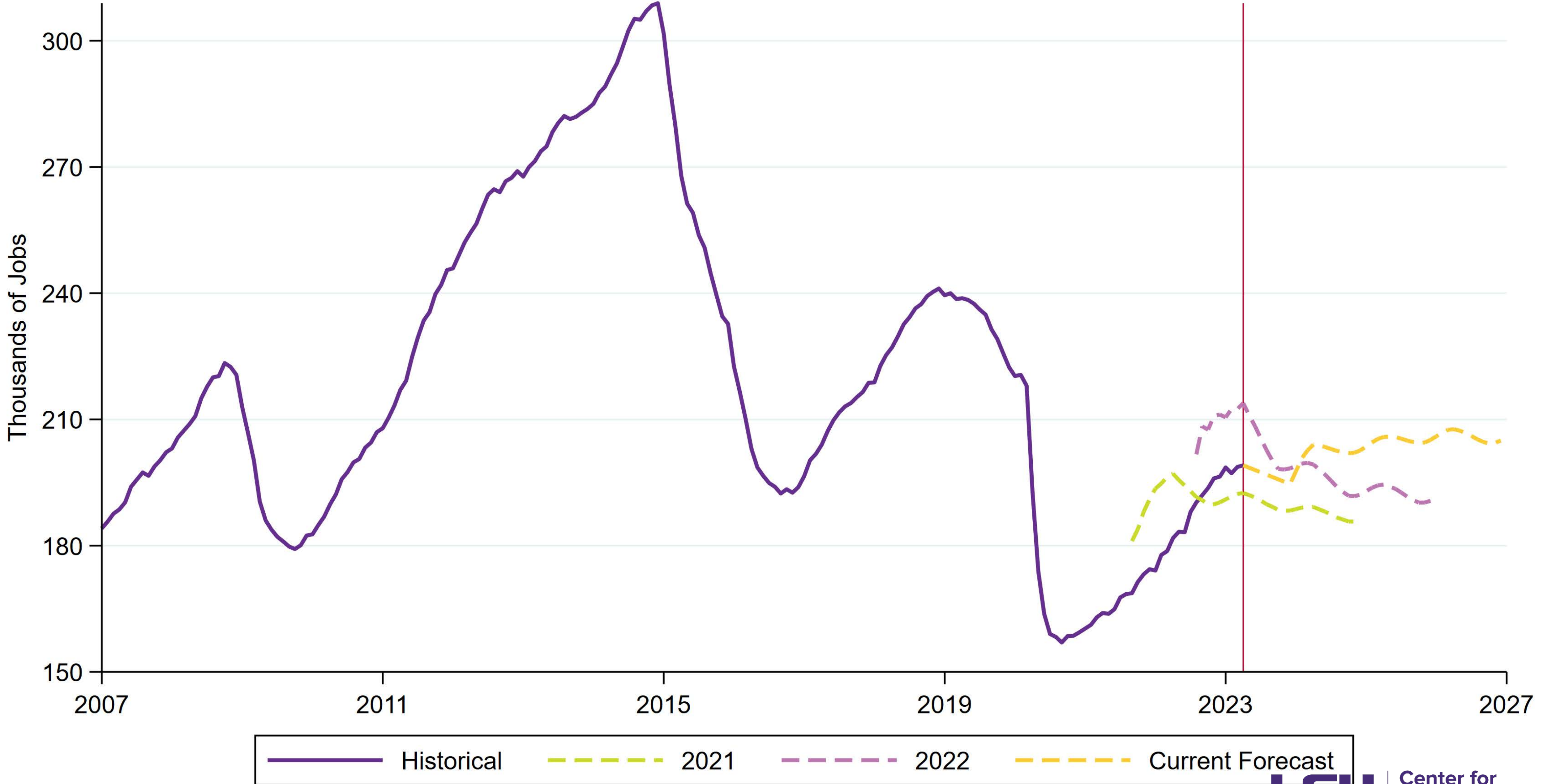


Employment Forecast

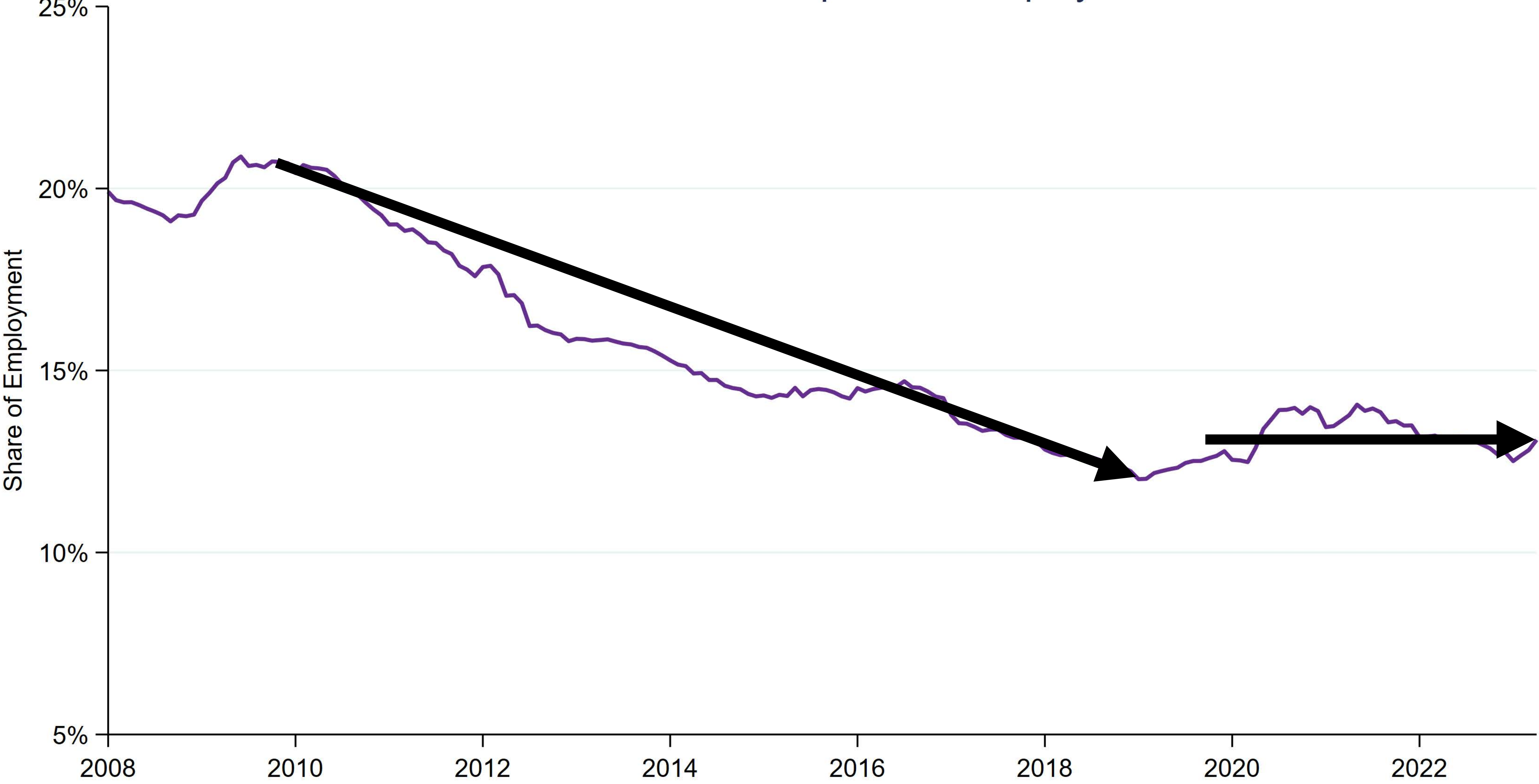
Texas Upstream Oil and Gas



Texas Upstream Oil and Gas Employment Forecast Comparison

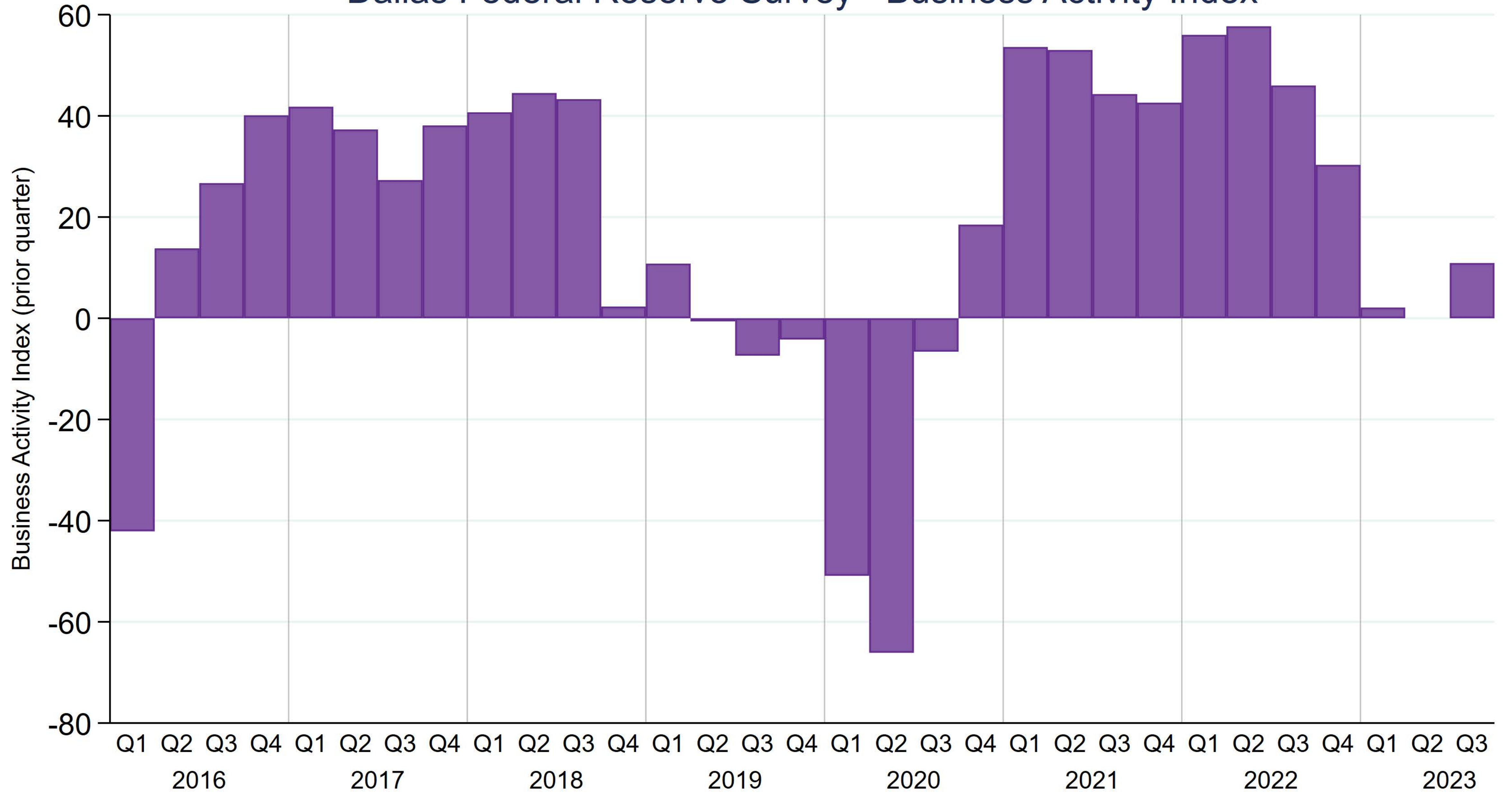


Louisiana Share of Upstream Employment

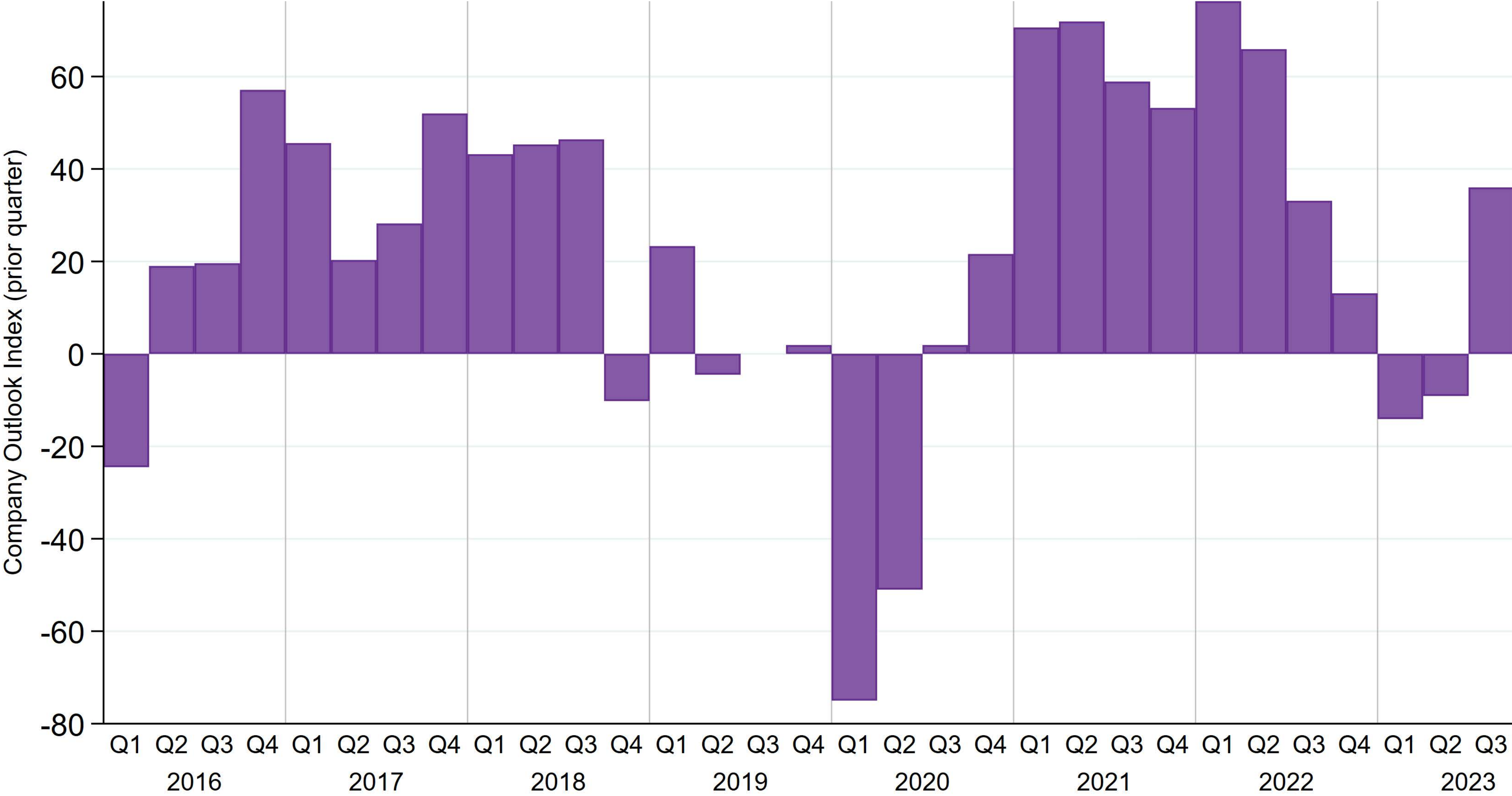


Source: Bureau of Labor Statistics. Current Employment Statistics (CES). Retrieved from FRED.

Dallas Federal Reserve Survey - Business Activity Index



Dallas Federal Reserve Survey - Company Outlook Index



Employment Forecast

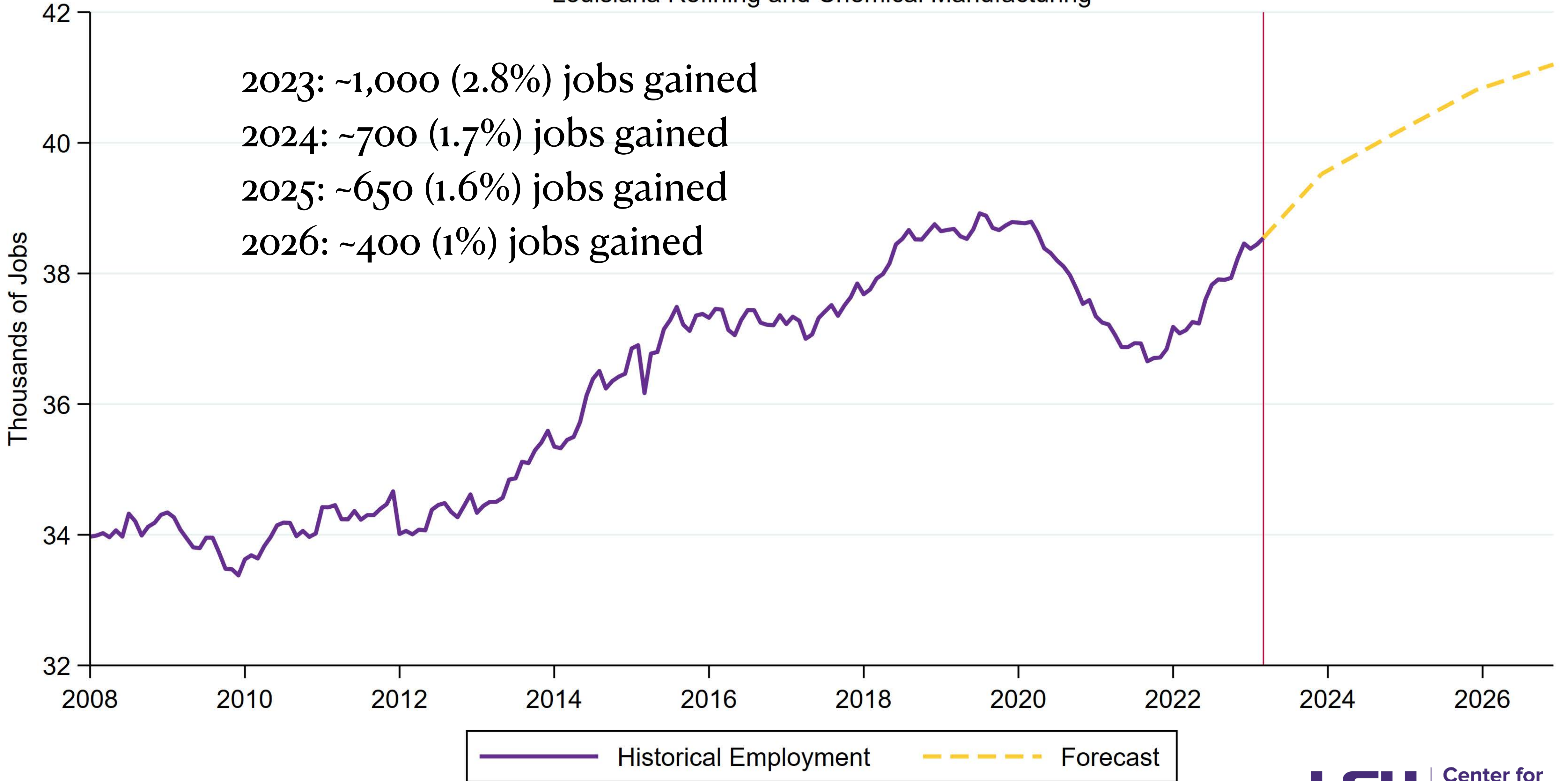
Louisiana Refining and Chemical Manufacturing

2023: ~1,000 (2.8%) jobs gained

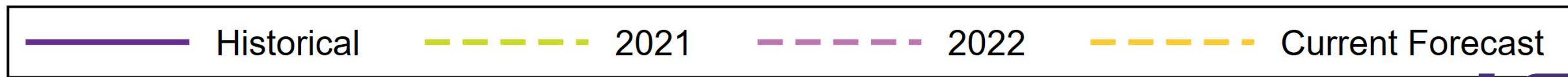
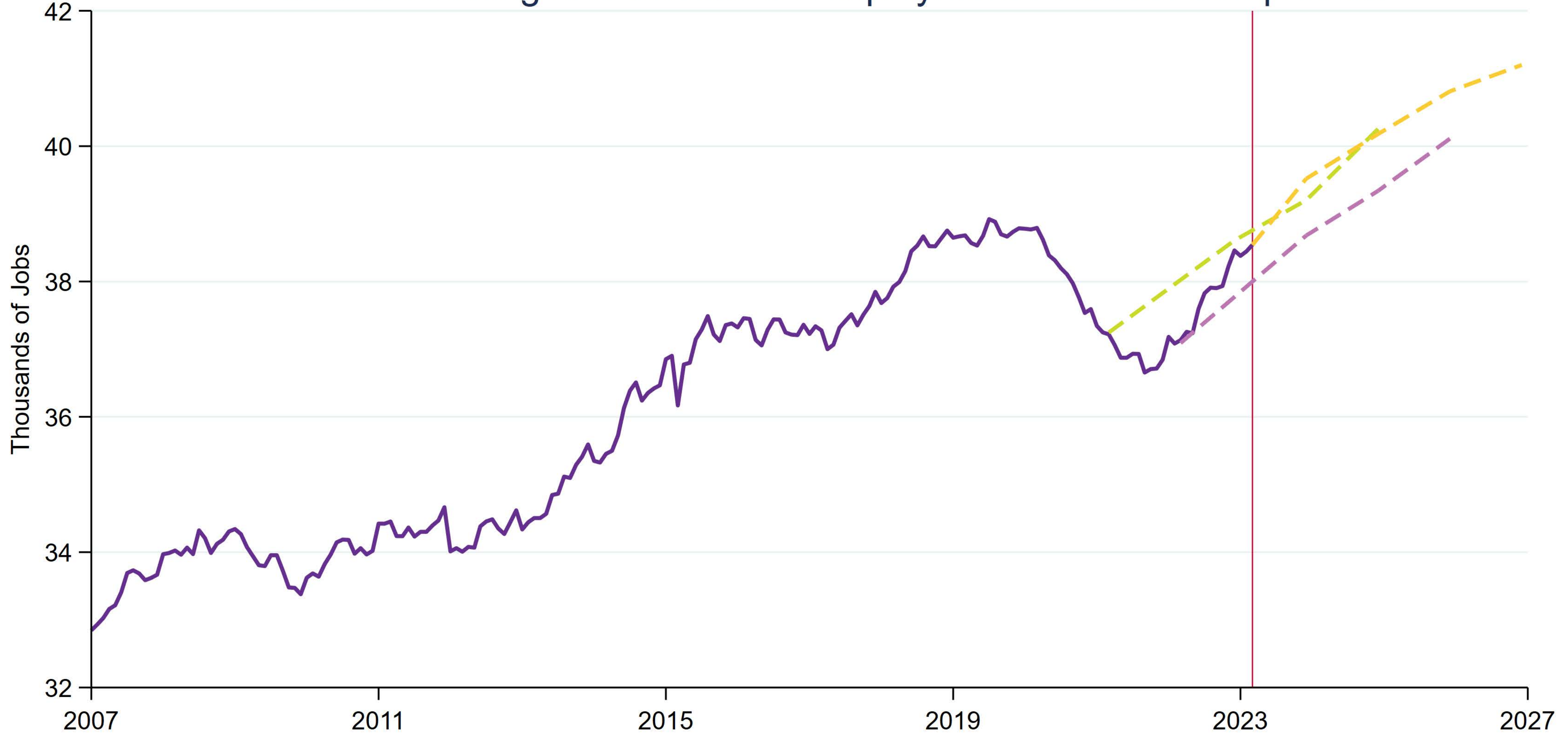
2024: ~700 (1.7%) jobs gained

2025: ~650 (1.6%) jobs gained

2026: ~400 (1%) jobs gained



Louisiana Refining and Chemicals Employment Forecast Comparison



Employment Forecast

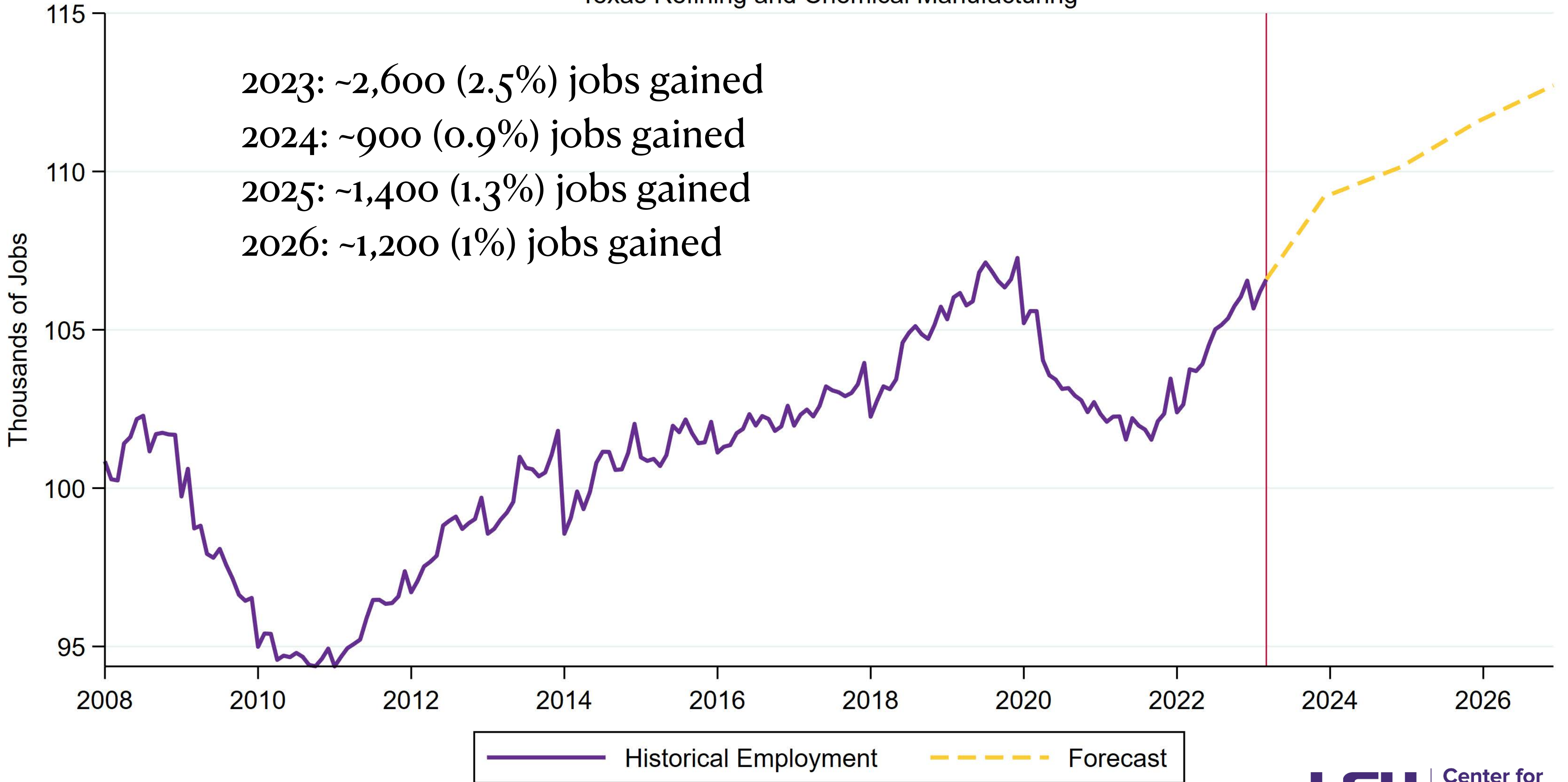
Texas Refining and Chemical Manufacturing

2023: ~2,600 (2.5%) jobs gained

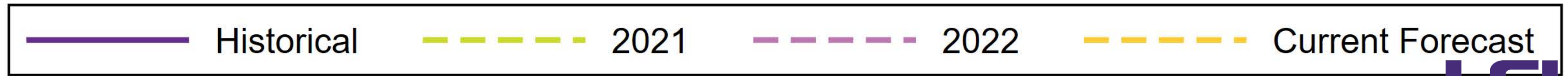
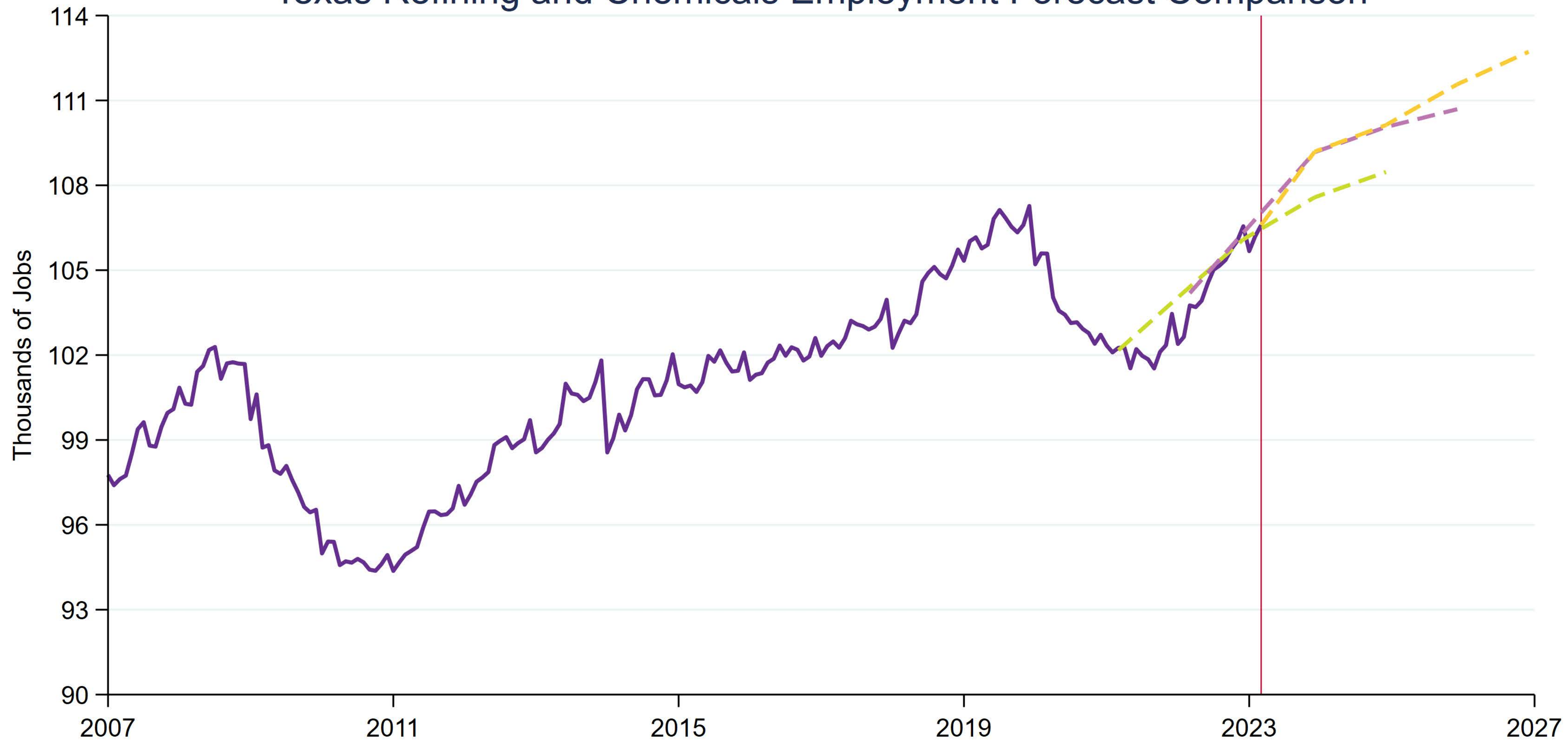
2024: ~900 (0.9%) jobs gained

2025: ~1,400 (1.3%) jobs gained

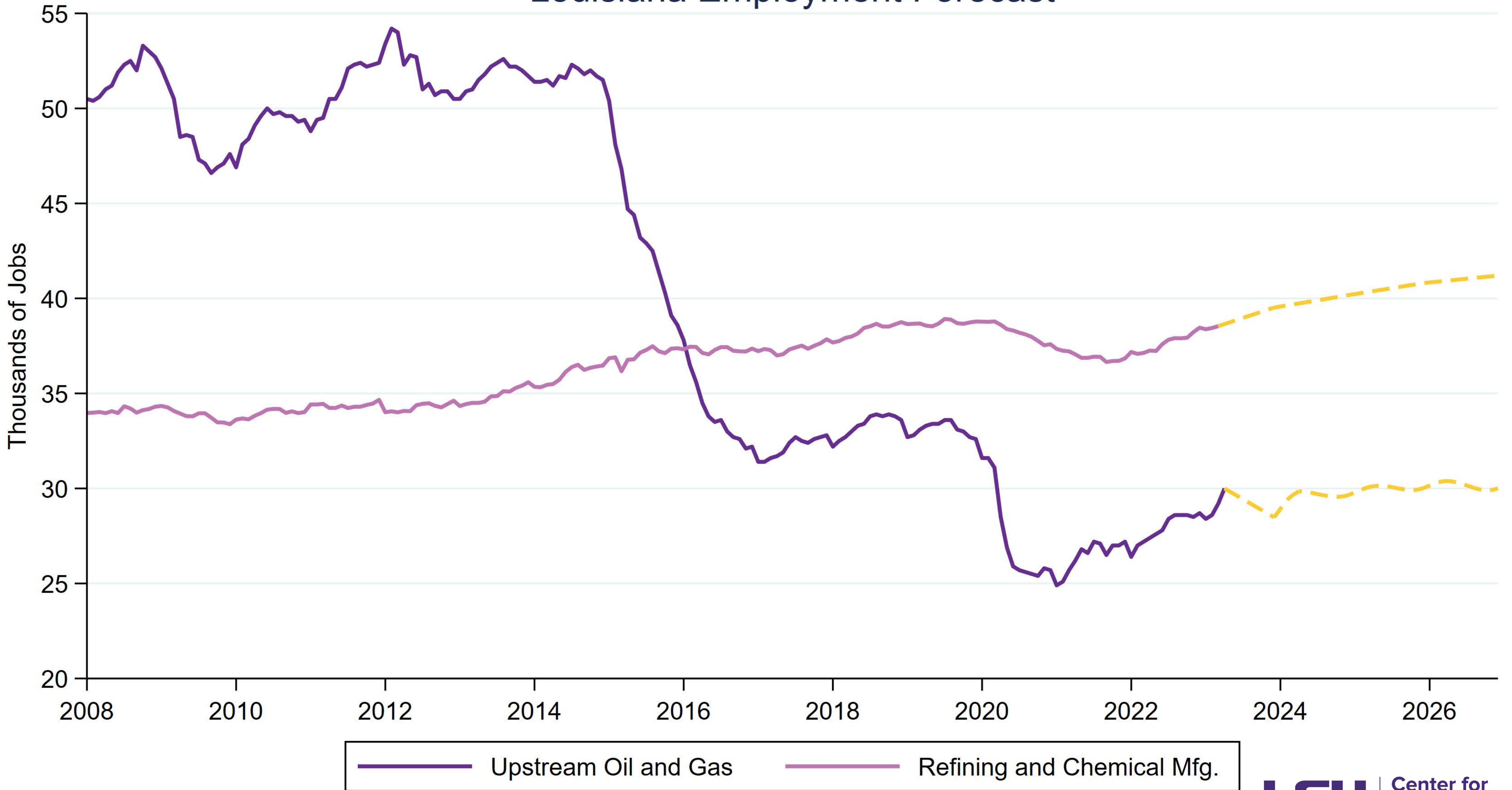
2026: ~1,200 (1%) jobs gained



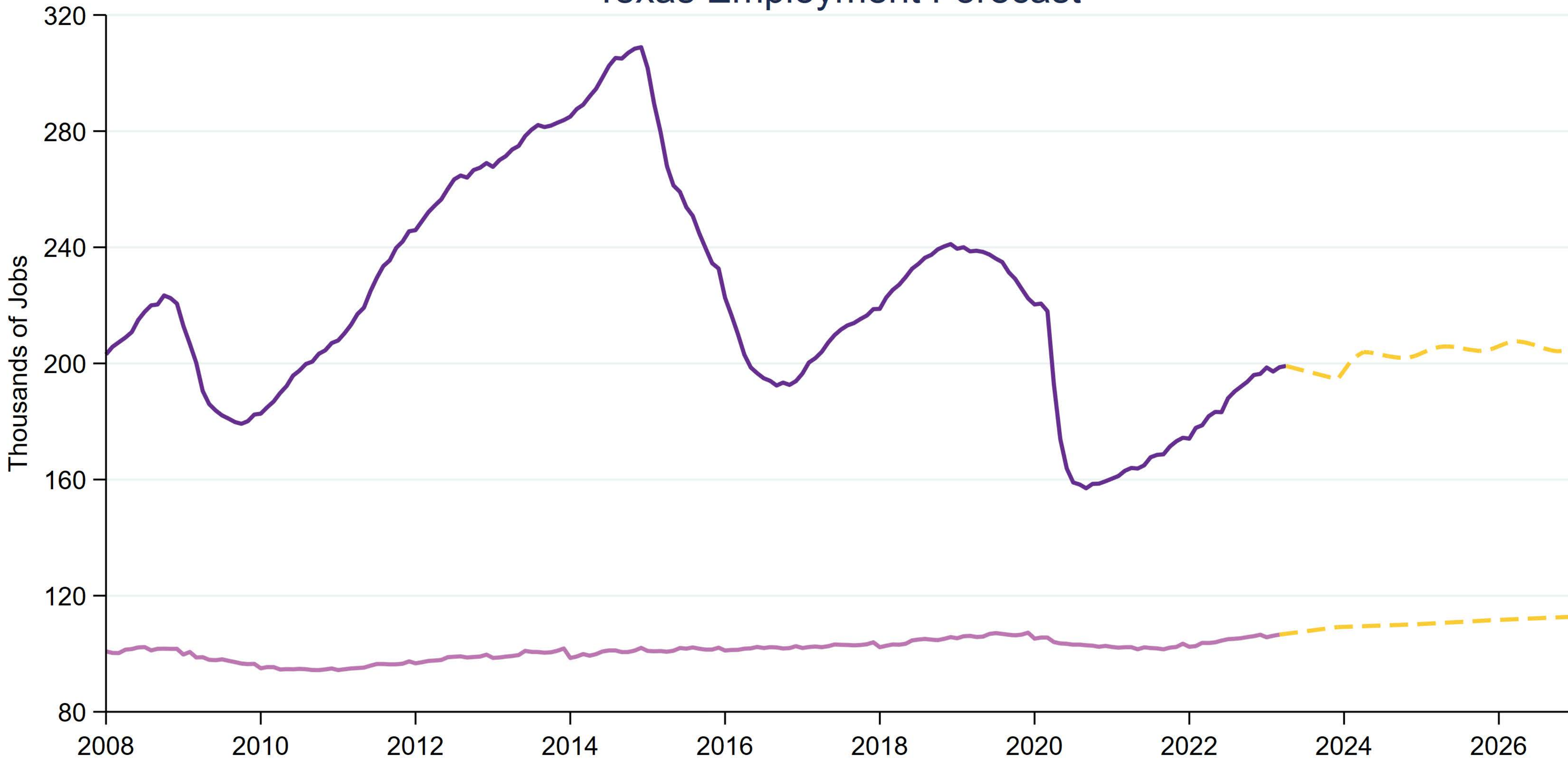
Texas Refining and Chemicals Employment Forecast Comparison



Louisiana Employment Forecast



Texas Employment Forecast



— Upstream Oil and Gas — Refining and Chemical Mfg.

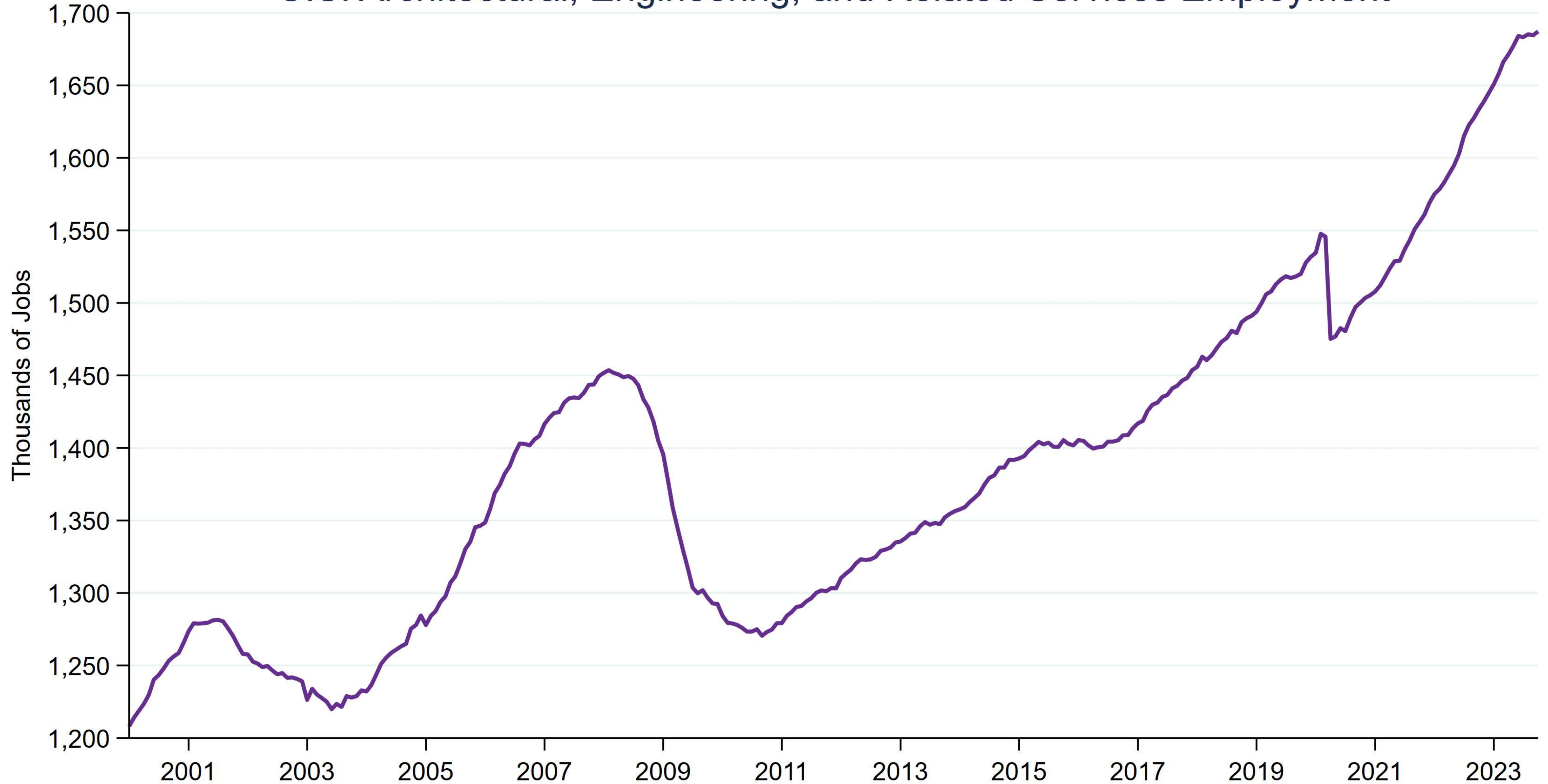
Broader Economic Implications

<u>Industry</u>	<u>Multiplier</u>
Upstream Oil and Gas	
Oil and Gas Extraction	2.3
Support Activities for Mining	3.1
Oil and Gas Manufacturing	
Petroleum and Coal Products Manufacturing	4.4
Chemical Manufacturing	4.8

Source: RIMS II Multipliers

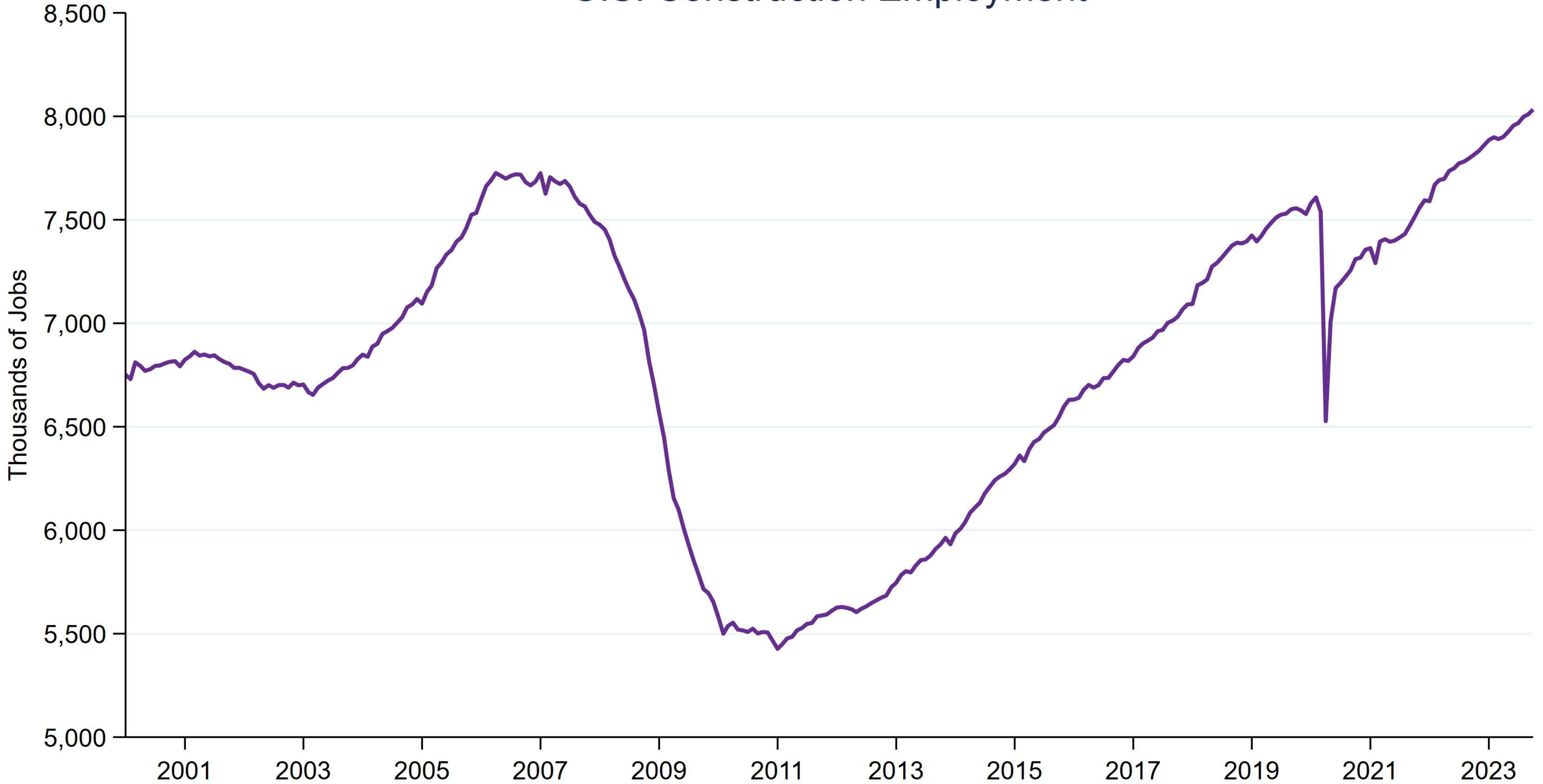
Note: Multipliers represent the total change in number of jobs in all industries for each additional job in the industry corresponding to the entry

U.S. Architectural, Engineering, and Related Services Employment



Source: Bureau of Labor Statistics. Current Employment Statistics (CES). Retrieved from FRED.

U.S. Construction Employment



Source: Bureau of Labor Statistics. Current Employment Statistics (CES). Retrieved from FRED.

2024

GULF COAST ENERGY OUTLOOK

LSU

Center for
Energy Studies

