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Gulf Coast Energy Outlook: Addendum.

Addendum accompanying whitepaper. See full whitepaper here.

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Gulf Coast Energy Outlook

- The inaugural **Gulf Coast Energy Outlook** seeks to provide a broad overview of the current status of trends guiding energy markets with an emphasis on the Gulf Coast Region.
- The research initiative is a collaborative effort of Louisiana State University's **Center for Energy Studies** and **E.J. Ourso College of Business** and focuses on the energy sector of the gulf Coast Region's economy.
- This document is an **addendum** to the whitepaper that can be found on the LSU Center for Energy Study's website.
- The whitepaper includes a number of graphs and figures and provides readers with a general understanding of the research vision and methodology.
- This addendum provides significantly more detailed figures for reader's wanting a more supporting information.

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Take-Aways

- Lower prices **reduced upstream activity**, but a slow recovery has started given the OPEC-induced price increase.
- Natural gas experience shows that **(crude oil) price recovery will be a long time coming.**
- Recent crude oil drilling/production activity is contributing to a significant rebound in associated gas production that **will likely sink the recent, short-lived natural gas price rebound**.
- U.S. producers are **very efficient** and have reduced costs, increased capital & operating efficiencies, and increased well productivity ("the best solution for low prices is low prices.")
- Crude oil and natural gas prices likely to remain **range-bound** with lower relative **pricing volatility**.
- Continued **positive investment/development activity** in mid-stream, refining, and processing/manufacturing – as well as **energy exports.**

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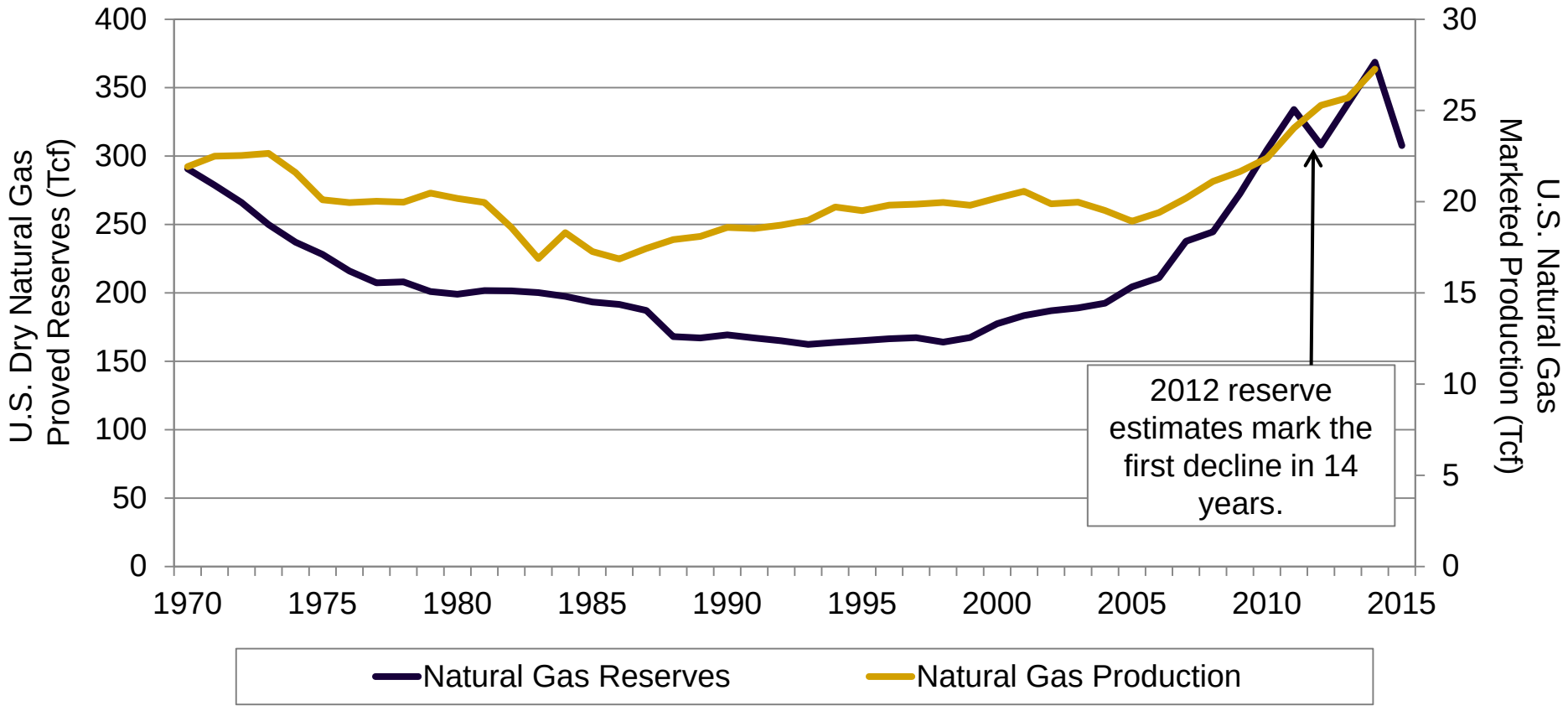
U.S. natural gas reserves and production.

Natural gas production and reserves are at levels not seen since the 1970s and both U.S. natural gas production and reserves are now at an all time recorded peak.



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

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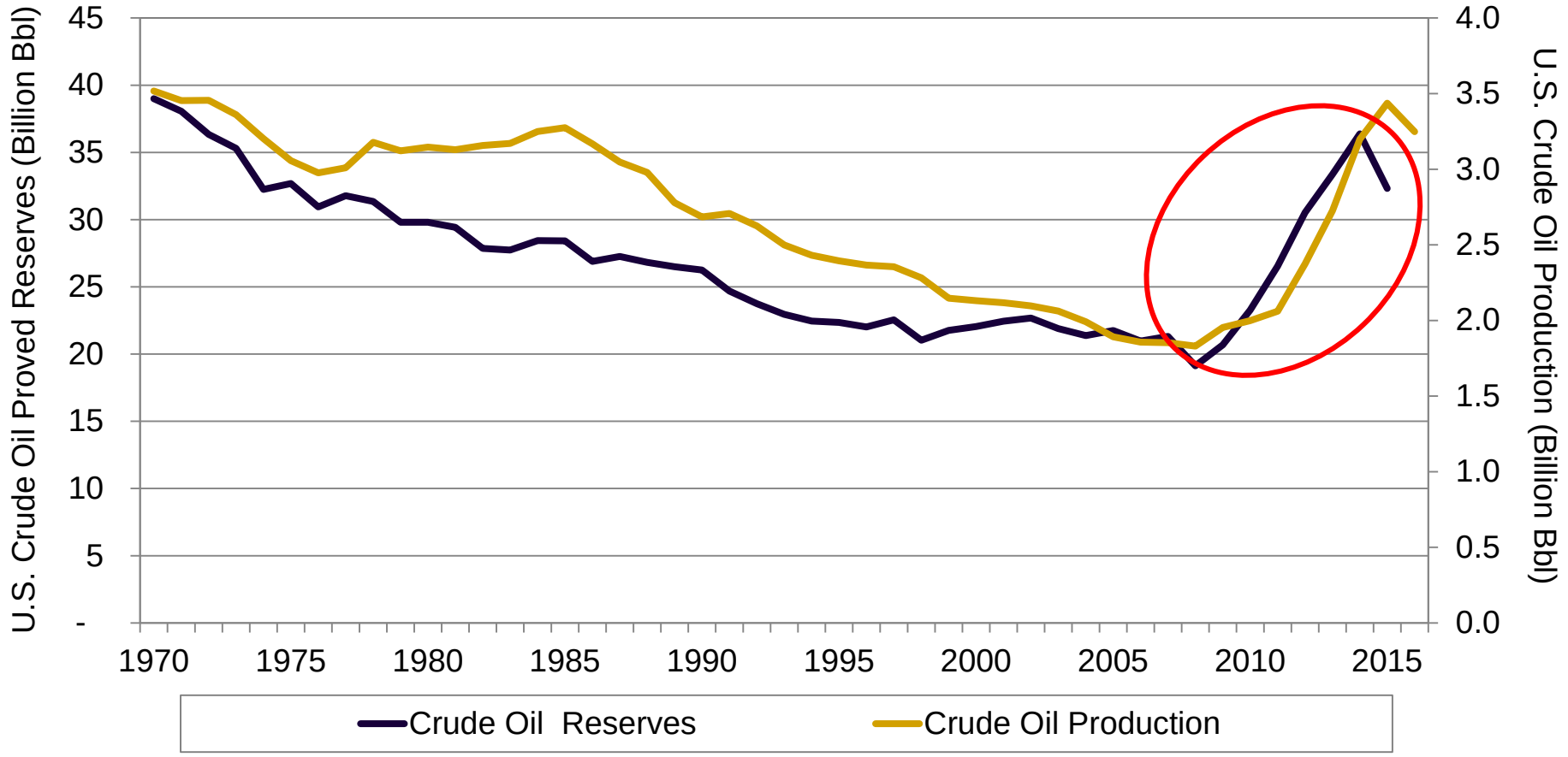
U.S. crude oil reserves and production.

Crude oil production and reserves are climbing back to levels not seen since the early 1980s (reserves).



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

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Recent Market Trends

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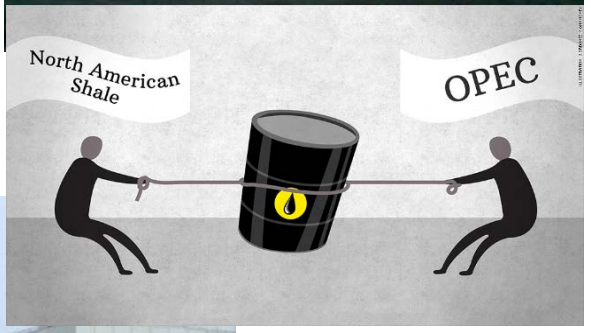
Recent energy market drivers/changes.

Recent market changes:

- Non-OPEC production surge.
- OPEC floods market with predatory production action.
- Post-price-crash industry restructuring and resiliency.
- Recent OPEC production cuts.
- U.S. drilling/production response.



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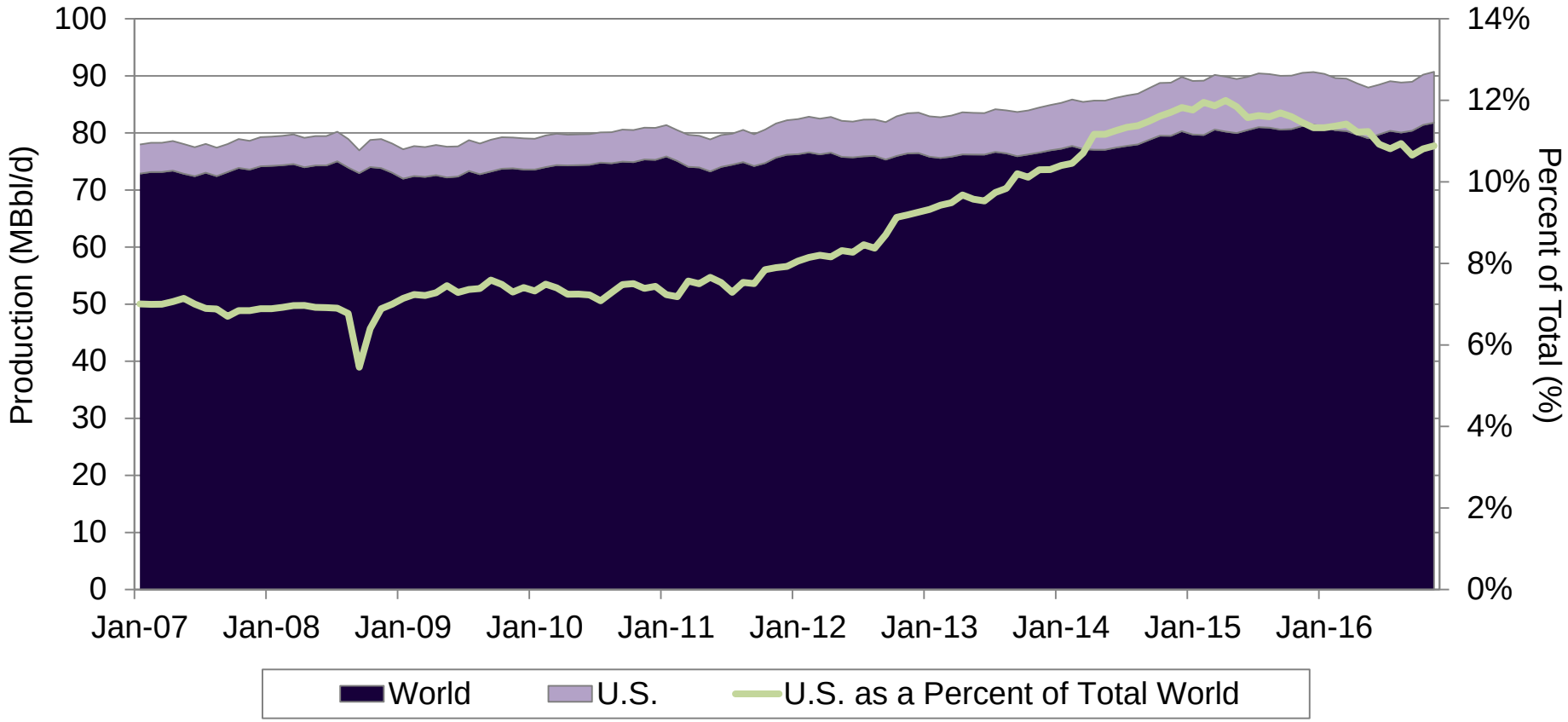
Monthly global and U.S. crude oil production.

In the last ten years, global crude oil production has increased at an average annual rate of 1.2 percent. The U.S. share has increased from seven percent to over 11 percent.



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

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OPEC crude oil production agreements.

The recent OPEC agreements have had the largest most recent impact on supply and prices

Country	Reference Production Level	Adjustment	Production Level Effective January 2017	Estimated Change (%)
		(MBbl/day)		
OPEC Countries				
Algeria	1,089	-50	1,039	4.6%
Angola	1,751	-87	1,664	5.0%
Ecuador	548	-26	522	4.7%
Gabon	202	-9	193	4.5%
Indonesia*				
Iran	3,975	-178	3,797	4.5%
Iraq	4,561	-210	4,351	4.6%
Kuwait	2,838	-131	2,707	4.6%
Libya				
Nigeria				
Qatar	648	-30	618	4.6%
Saudi Arabia	10,544	-486	10,058	4.6%
UAE	3,013	-139	2,874	4.6%
Venezuela	2,067	-95	1,972	4.6%
Total OPEC Adj.	**31,236**	**-1,441**	**29,795**	**4.6%**
Non-OPEC Countries		-558		
Total Adjustment		**-1,999**		

Note: *Indonesia has suspended its OPEC membership. Non-OPEC countries include Azerbaijan, Kingdom of Bahrain, Brunei Darussalam, Equatorial Guinea, Kazakhstan, Malaysia, Mexico, Sultanate of Oman, the Russian Federation, Republic of Sudan, and Republic of South Sudan

Source: http://www.opec.org/opec_web/static_files_project/media/downloads/press_room/OPEC%20agreement.pdf

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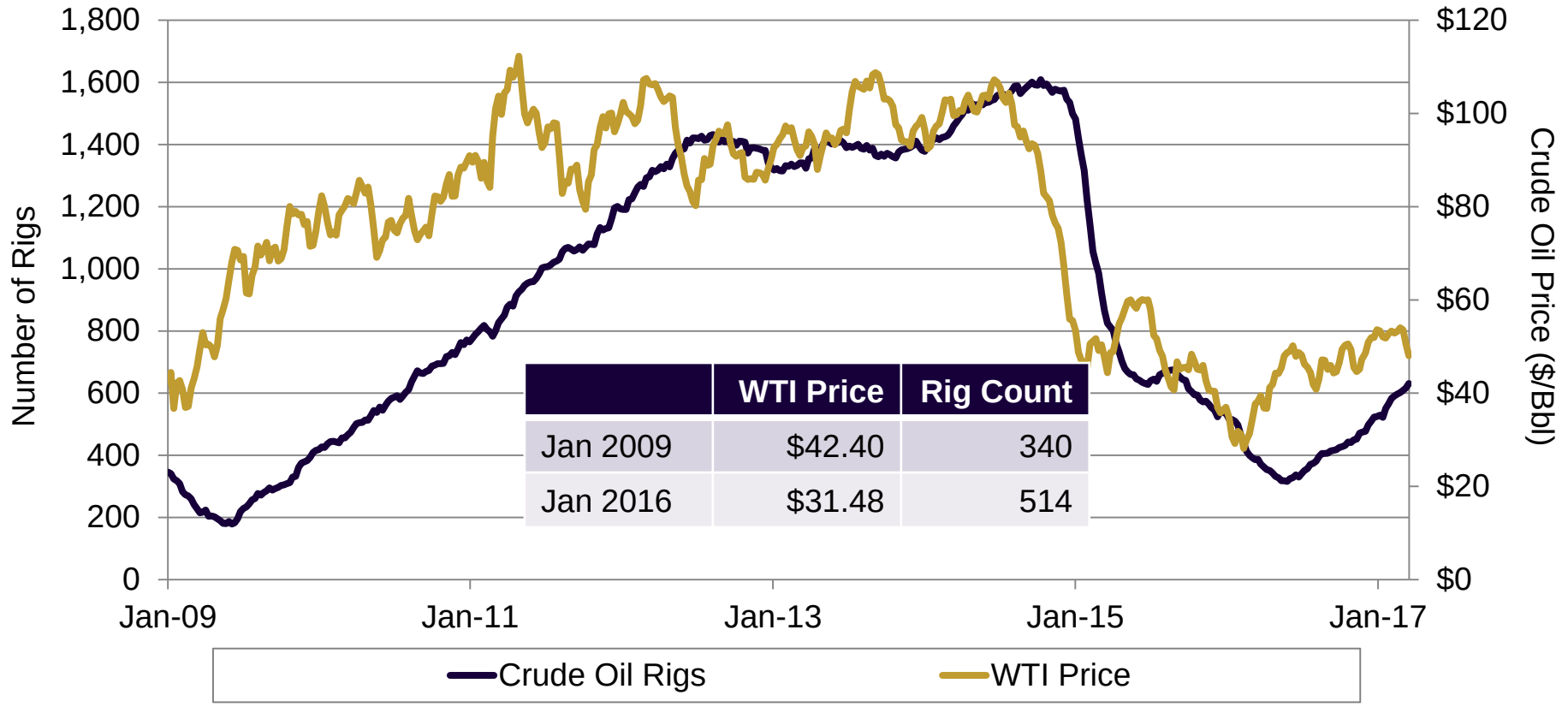
U.S. crude oil prices and rig count.

Rig counts have fallen precipitously, but are back on the rise.



	WTI Price	Rig Count
Jan 2009	$42.40	340
Jan 2016	$31.48	514

Source: Energy Information Administration, U.S. Department of Energy; and Baker Hughes.

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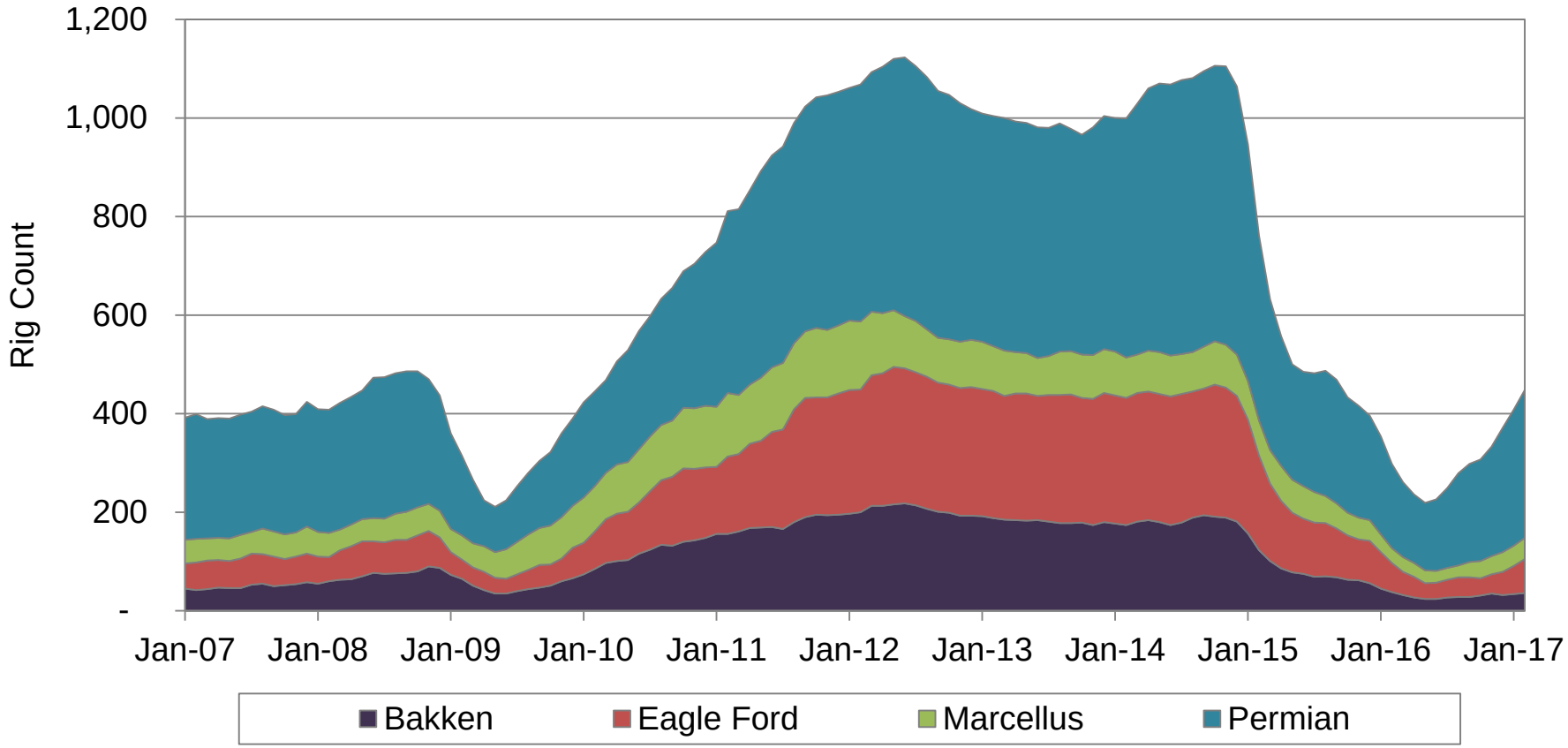
Monthly U.S. horizontal drilling rig activity (per major basin).

Horizontal rig activity increased by 400 percent to 2015 but fell by over half during the ensuing price collapse. Current rebound is highly concentrated in the Permian basin.



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

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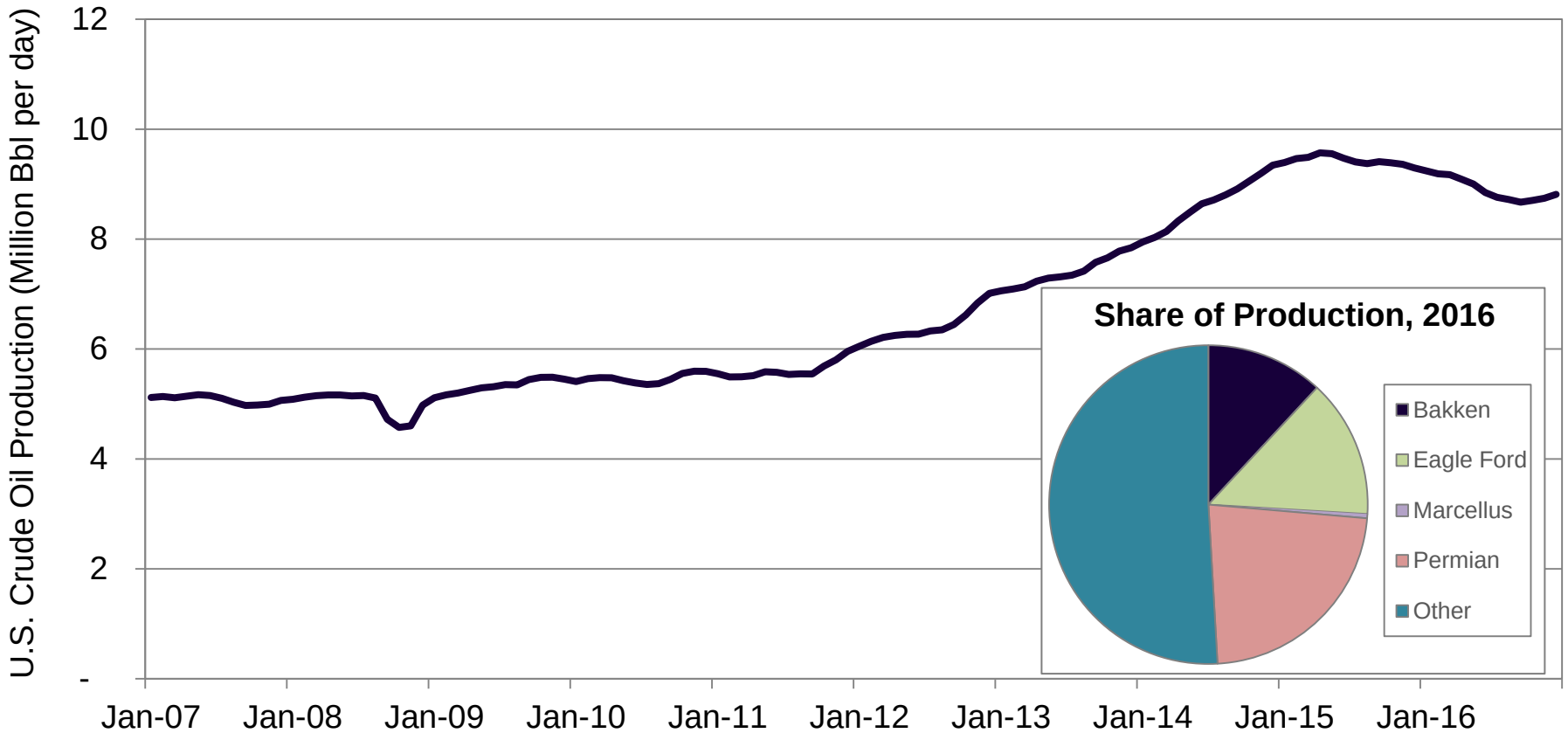
Monthly U.S. crude oil production.

U.S. crude oil production volumes are up by over 75 percent relative to historic trends. While production is down, it is still resilient and relatively strong.



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

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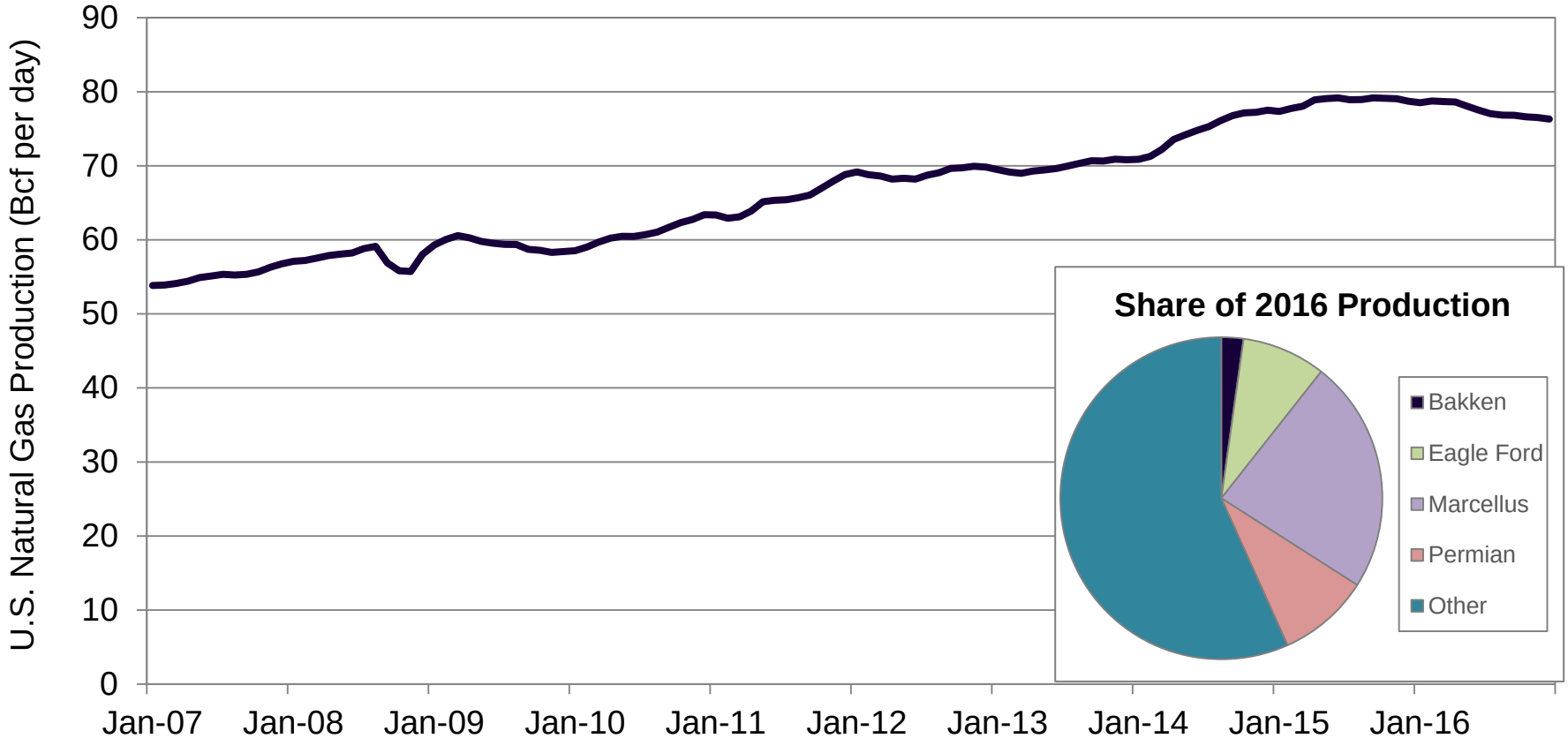
Monthly U.S. natural gas production.

U.S. natural gas production has increased 42 percent in the last 10 years.



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

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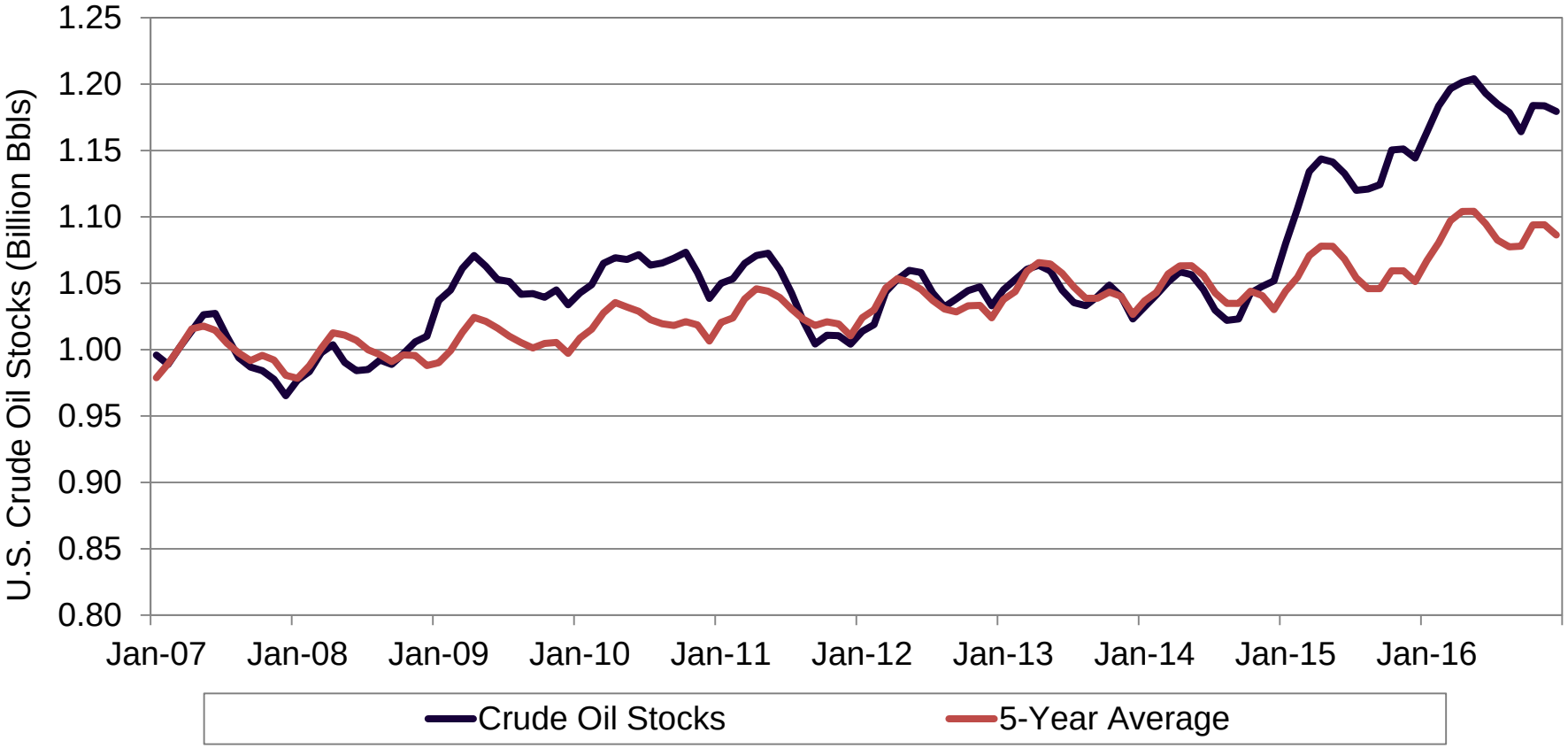
U.S. crude oil stocks.

U.S. crude oil stocks have increased at an average annual rate of two percent. Between 2014 and 2015 stocks increased eight percent; and another five percent in 2016.



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

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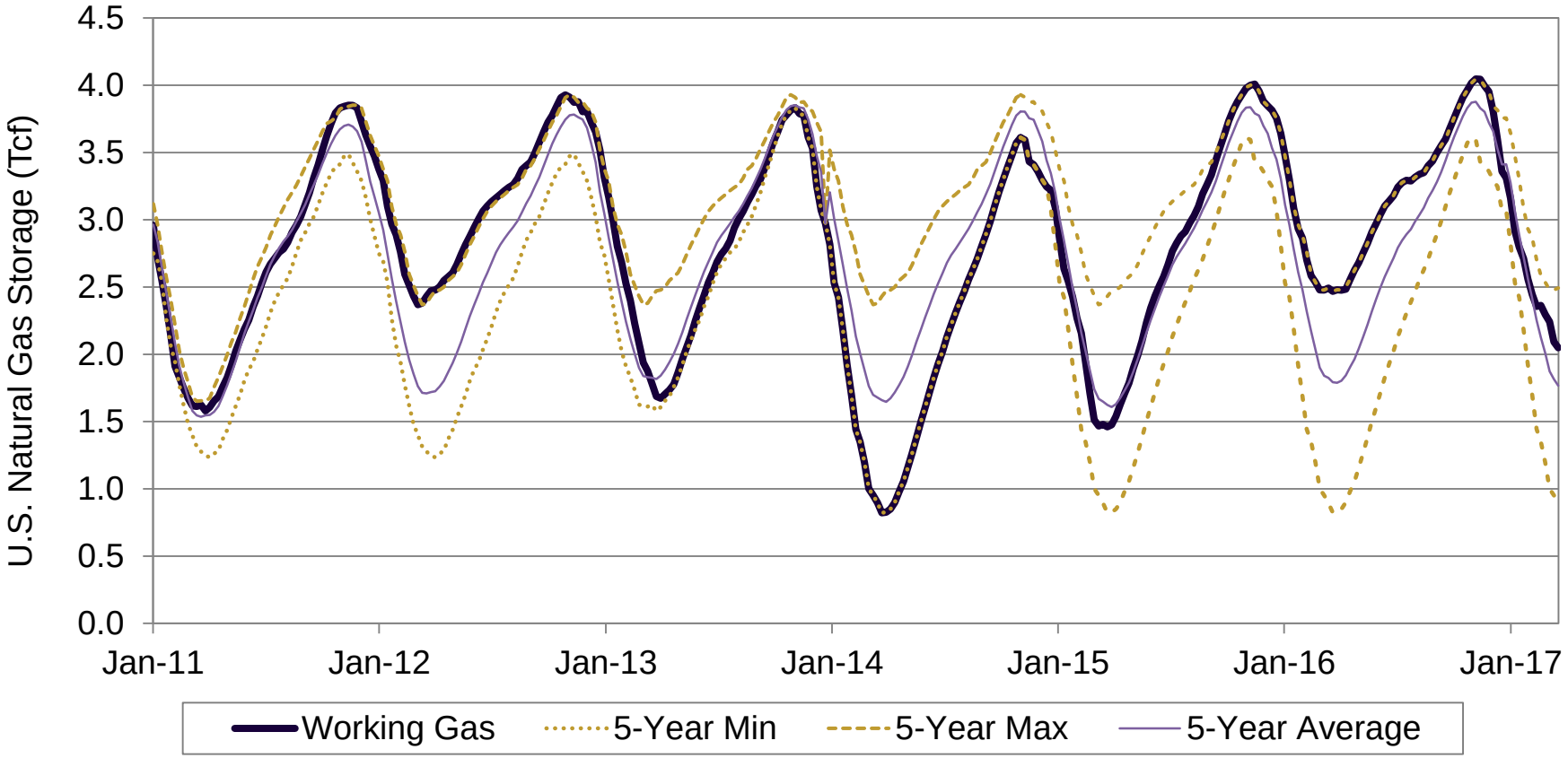
U.S. natural gas storage.

Current natural gas storage levels are 16 percent above five year averages and 18 percent below the recent five year maximum.



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

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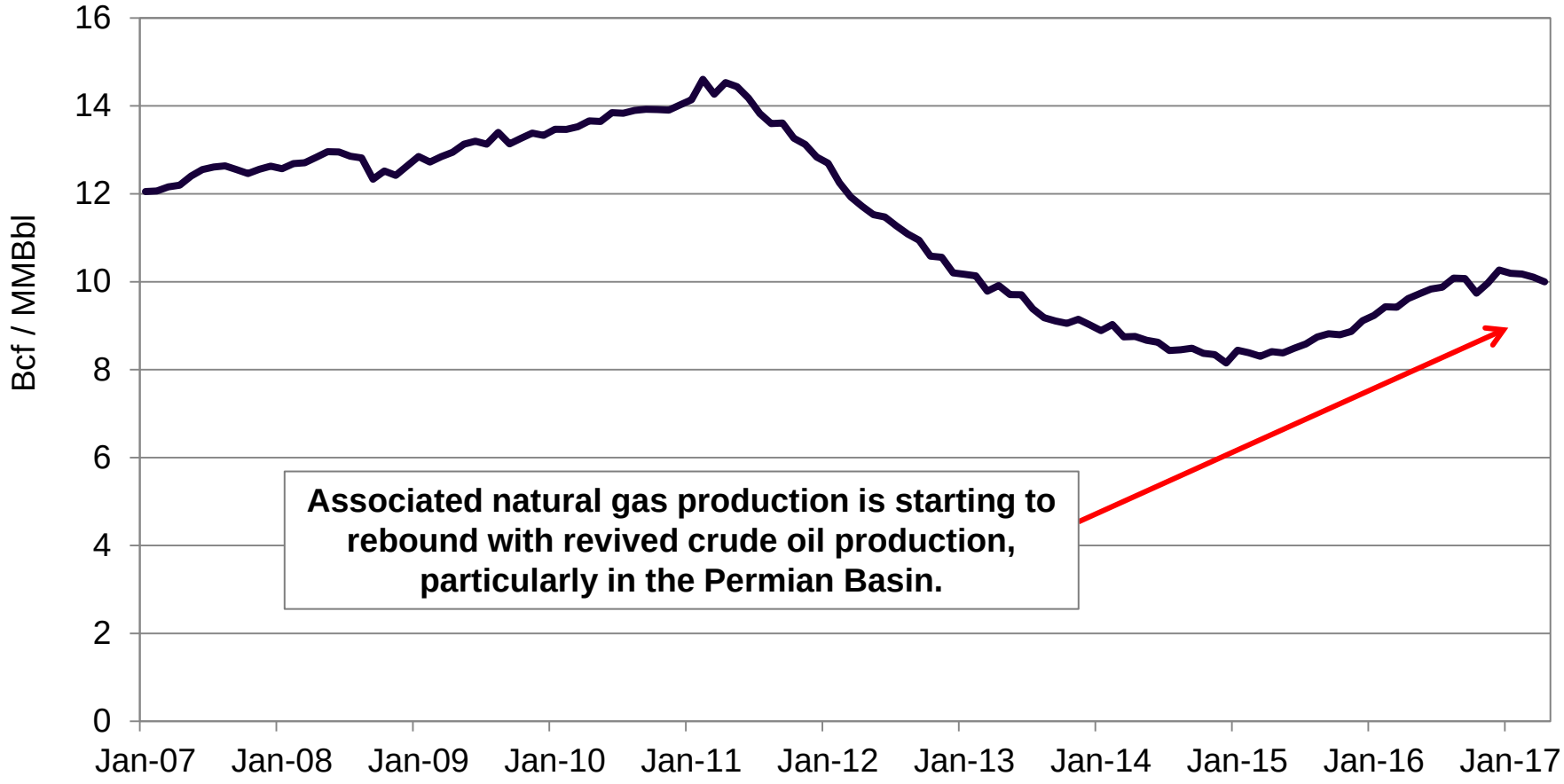
Associated natural gas production (shale production).

Growth in associated natural gas is rebounding quickly and tanking the short-lived rebound in natural gas prices.



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

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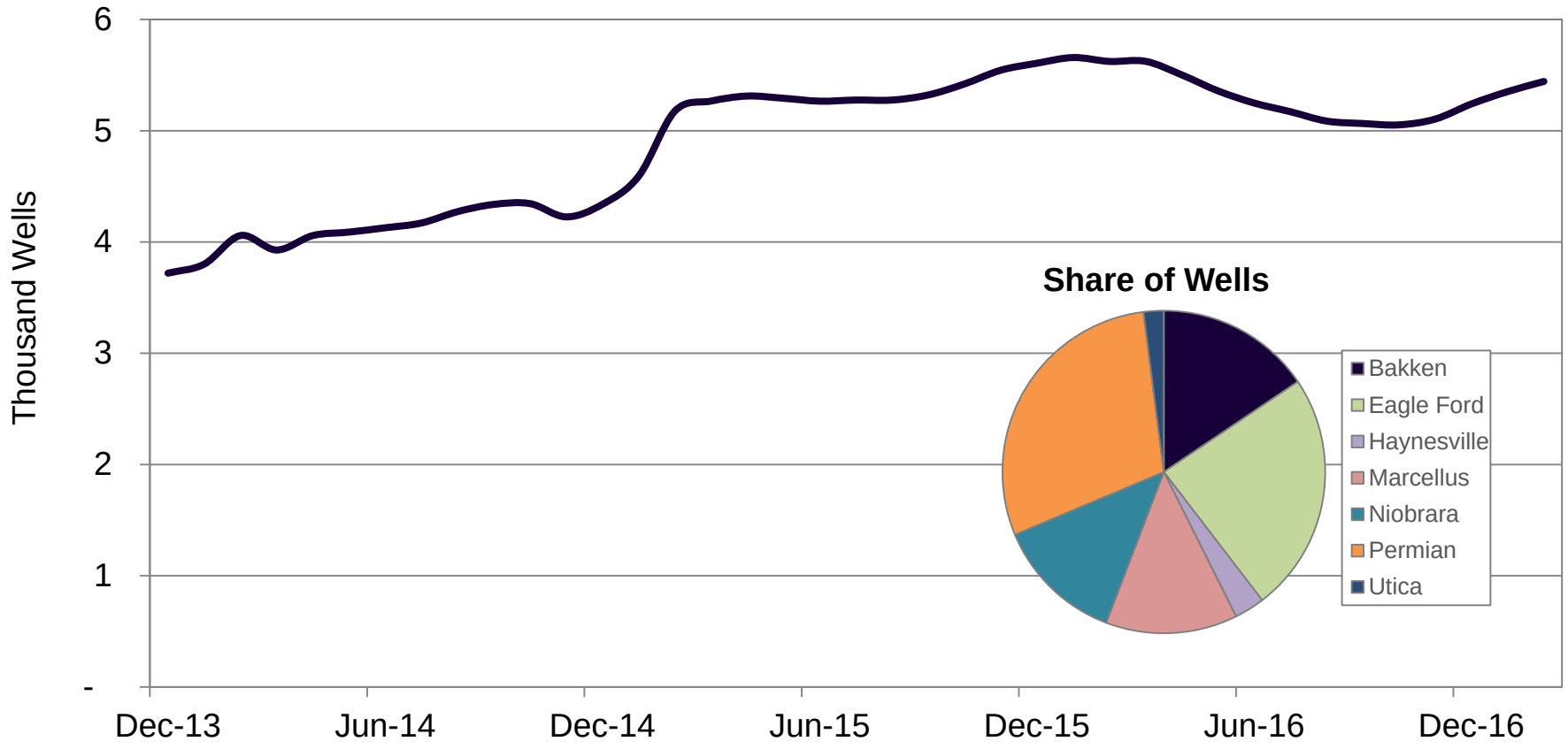
Monthly drilled but uncompleted wells.

Drilled but uncompleted wells have increased by almost 50 percent in the last few years.



Note: Share of wells is the average of the last six months, September 2016 through February 2017.
Source: Energy Information Administration, U.S. Department of Energy.

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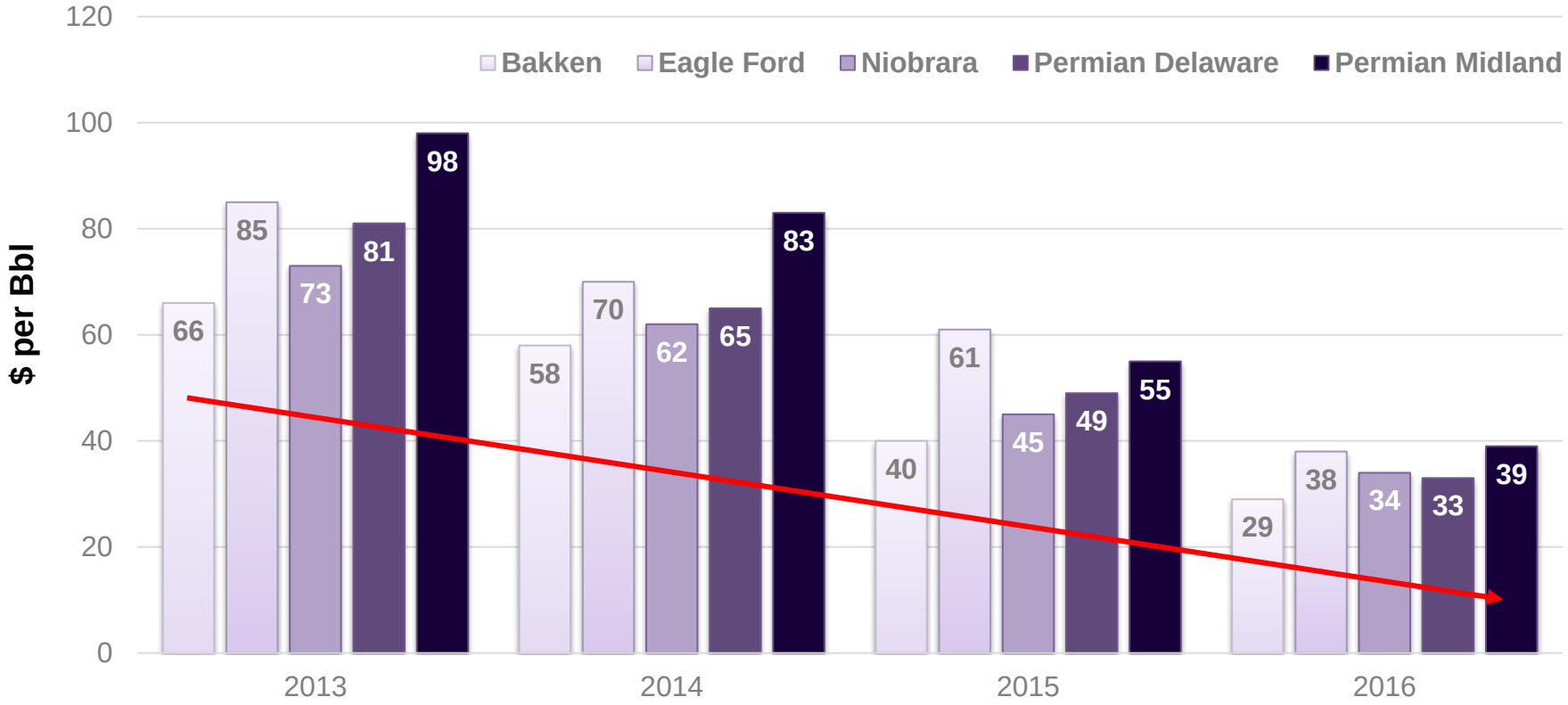
Wellhead breakeven prices for key shale plays.

Since 2013, the average wellhead break-even price for key shale plays has decreased from $80 per barrel to $35 per barrel, representing an average decrease of over 55 percent.



Note: Author's estimate from source.
Source: Rystad Energy NASWellCube.

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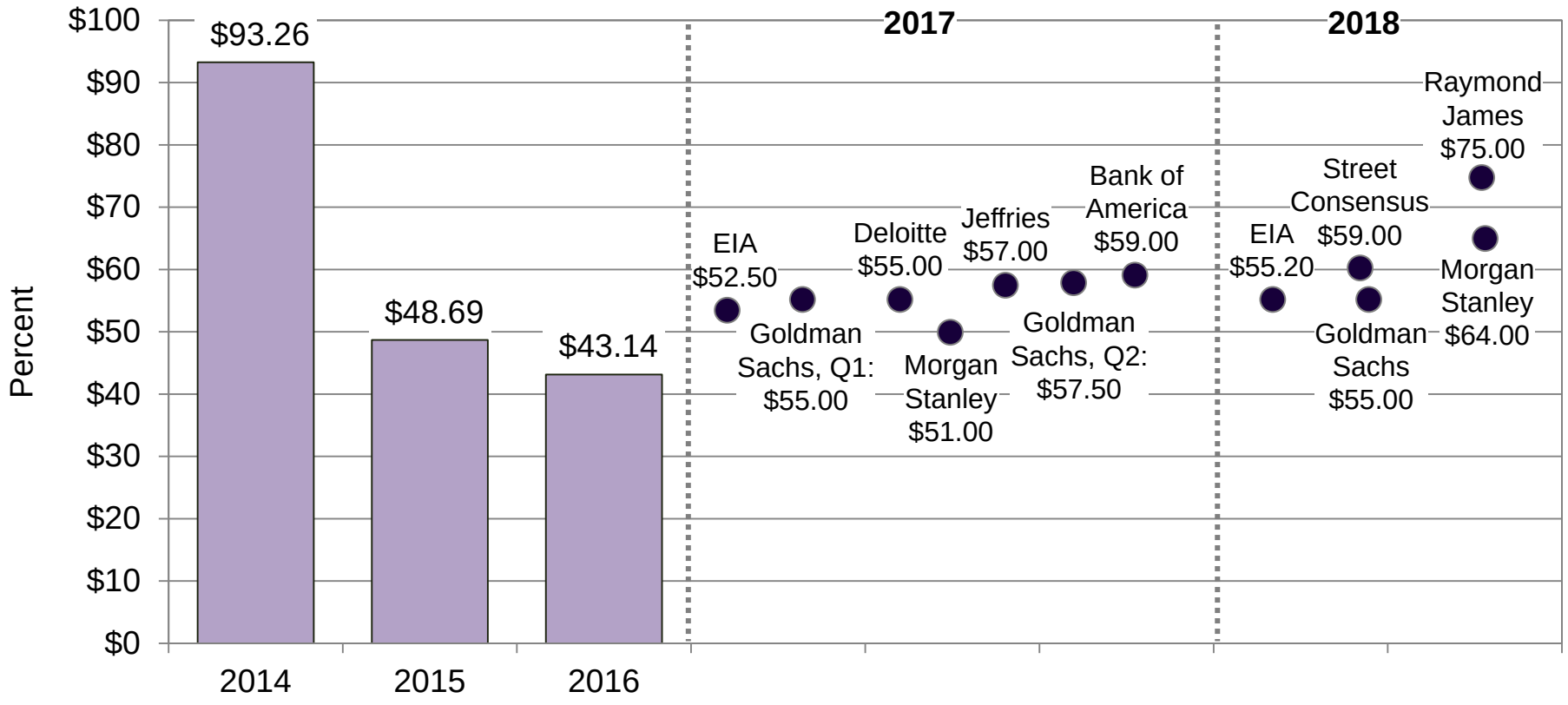
Crude oil price outlook.

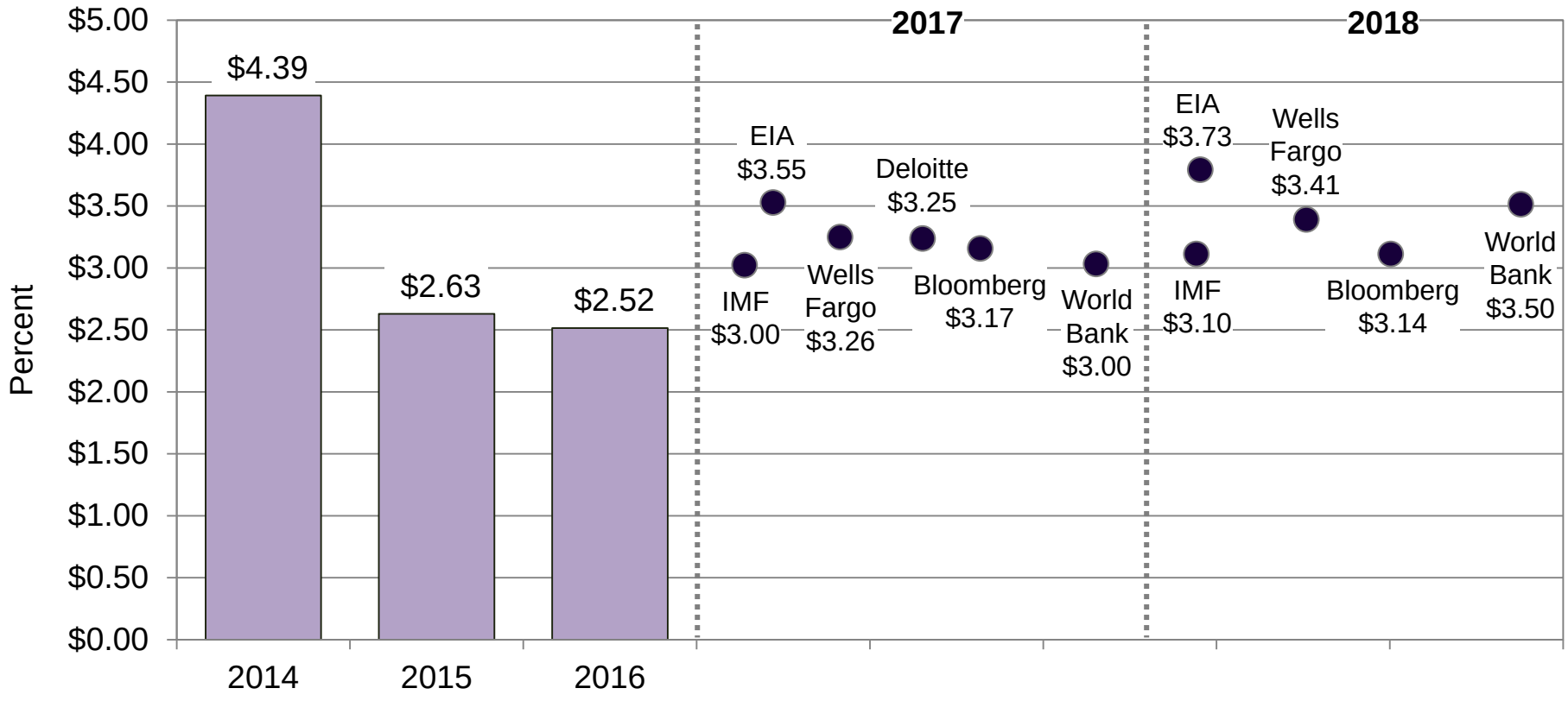
Most crude oil price projections for 2017 are around $55 per barrel. Prices are expected to increase in 2018, but remain below $75 per barrel.



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

Natural gas price outlook.

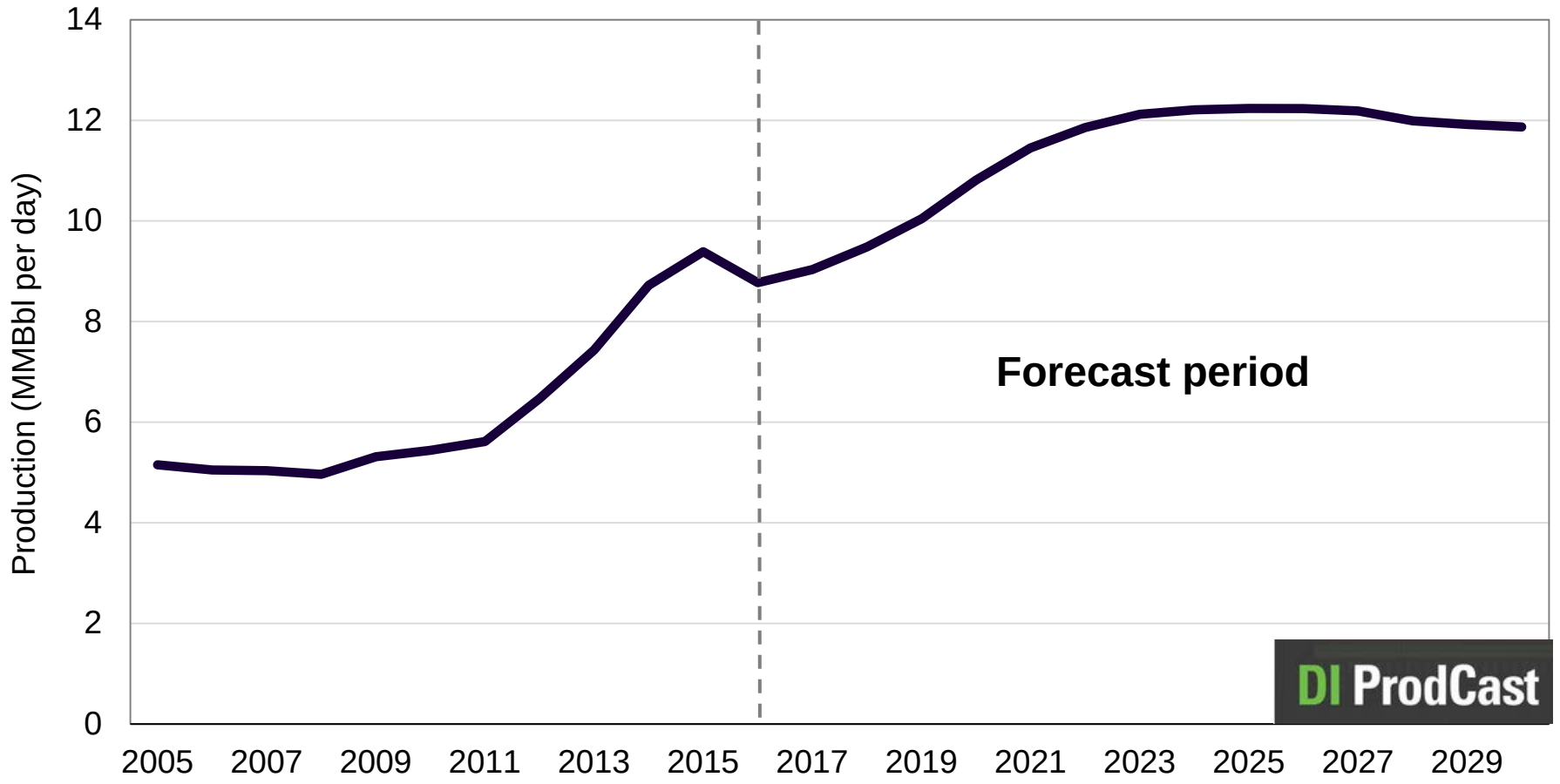
Natural gas prices are expected to stay below $3.55 per MMBtu in 2017 and under $3.75 in 2018.



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

U.S. crude oil production trends and forecast.

US crude production will likely increase to over 10 MMBbls/d by 2020.



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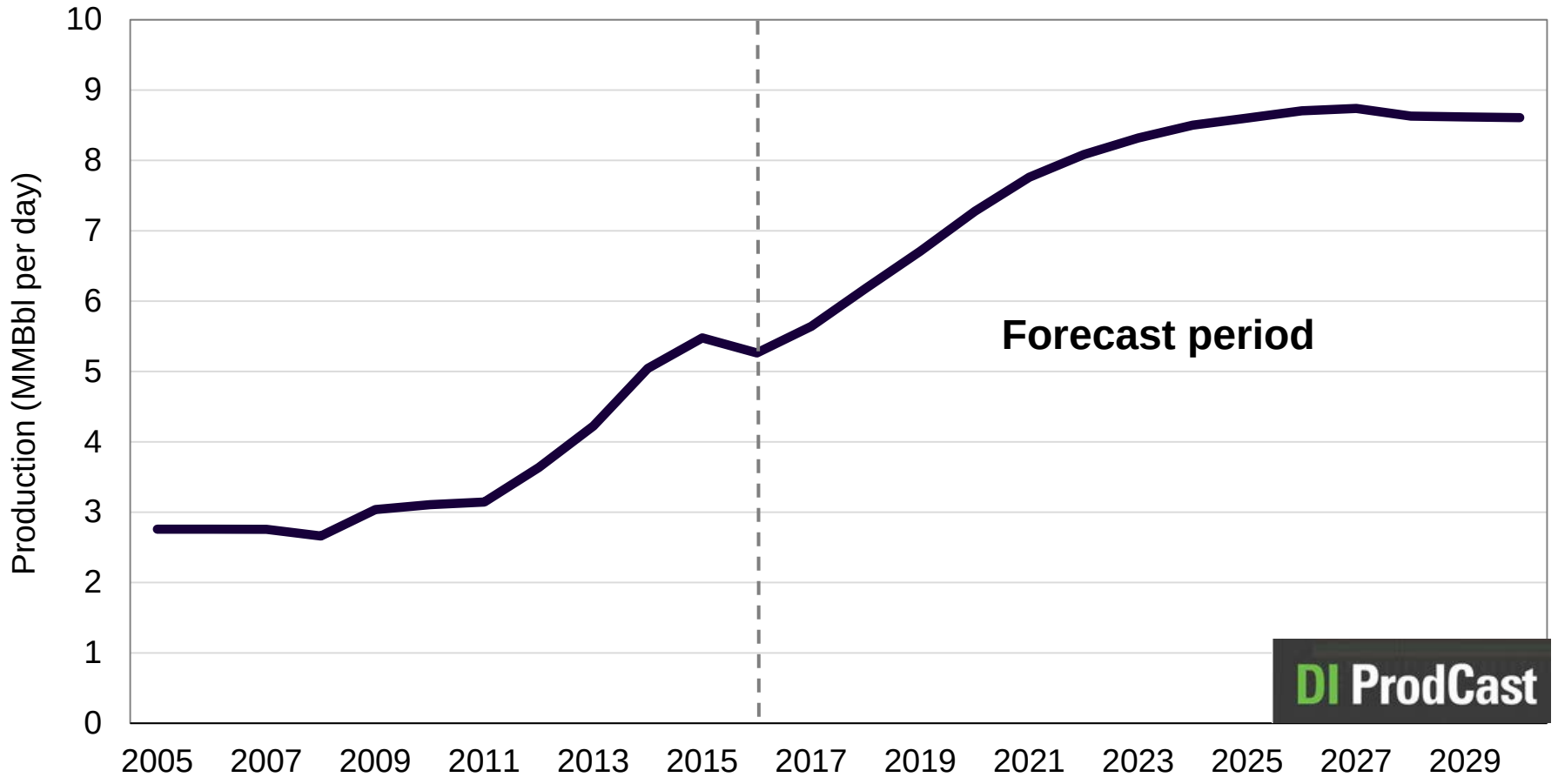
Gulf coast crude oil production trends and forecast.

The Gulf Coast forecast, which includes all Texas Permian production, accounts for a significant share of the gain in U.S. crude oil production.



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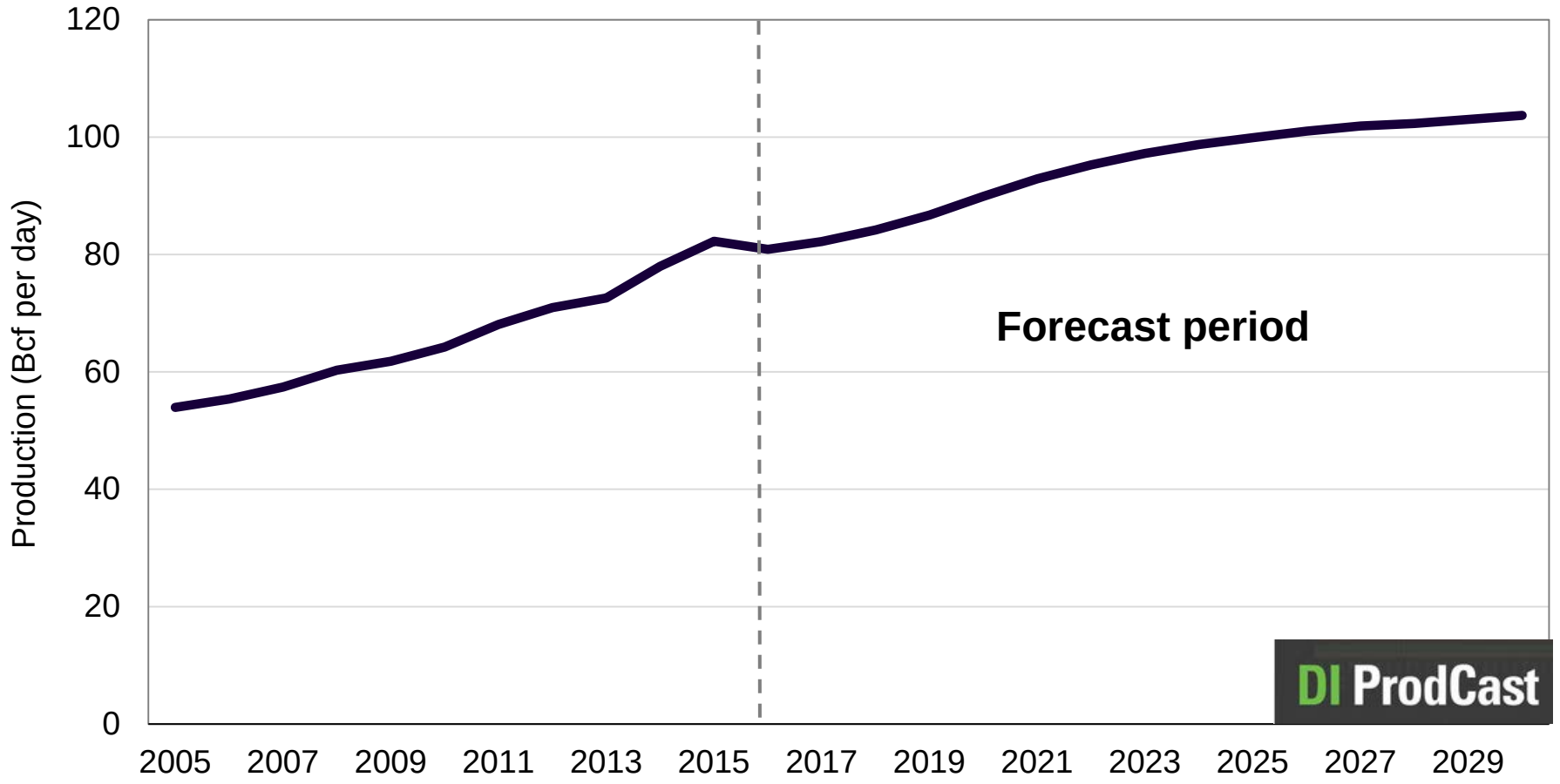
U.S. natural gas production trends and forecast.

U.S. natural gas production continues to be resilient and shows continued strong growth through 2020 and beyond.



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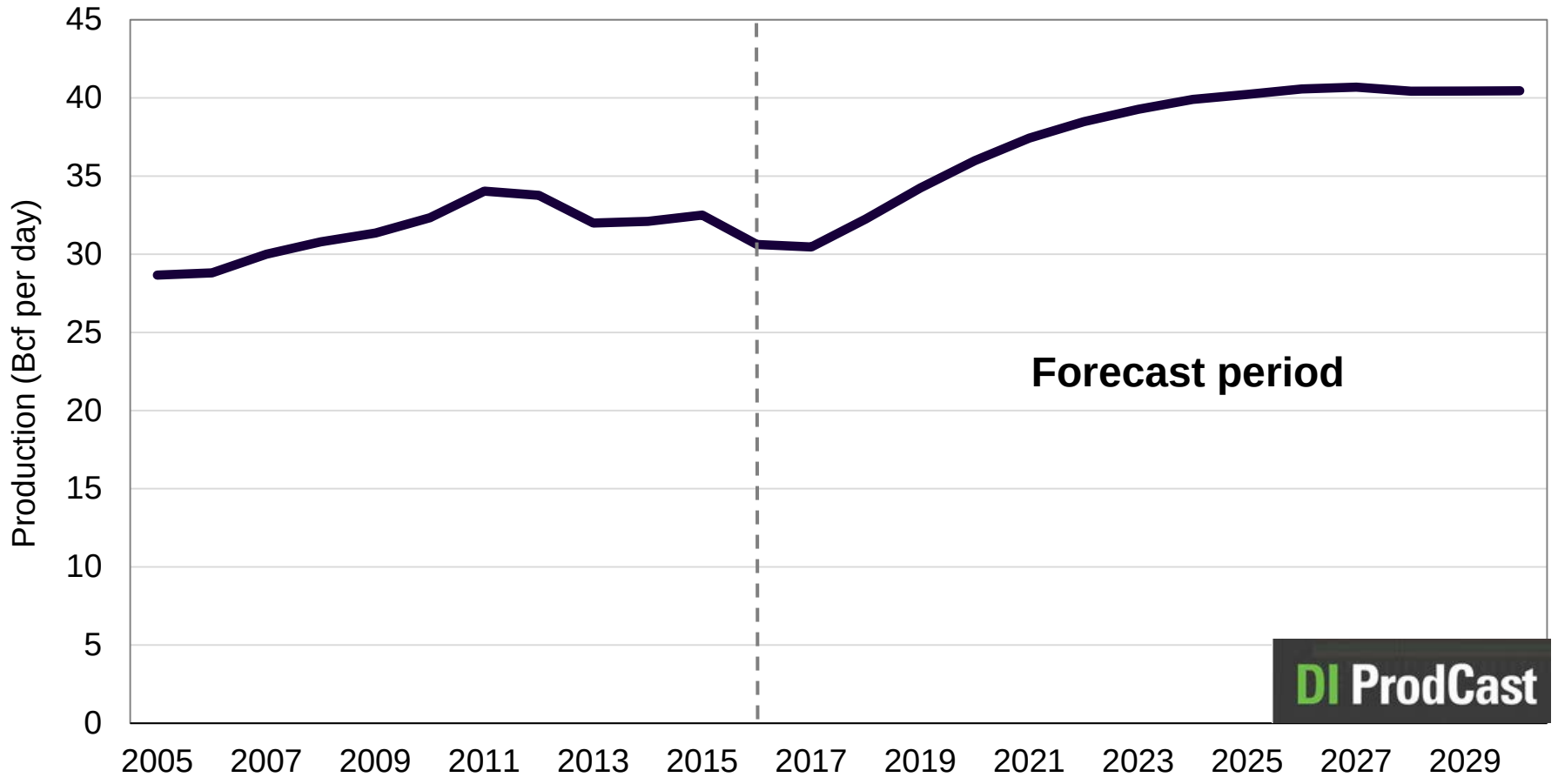
U.S. natural gas production trends and forecast.

The Gulf Coast makes a significant contribution to the 80 Bcf/d U.S. market, but the Marcellus accounts for the largest relative share.



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Industrial outlook

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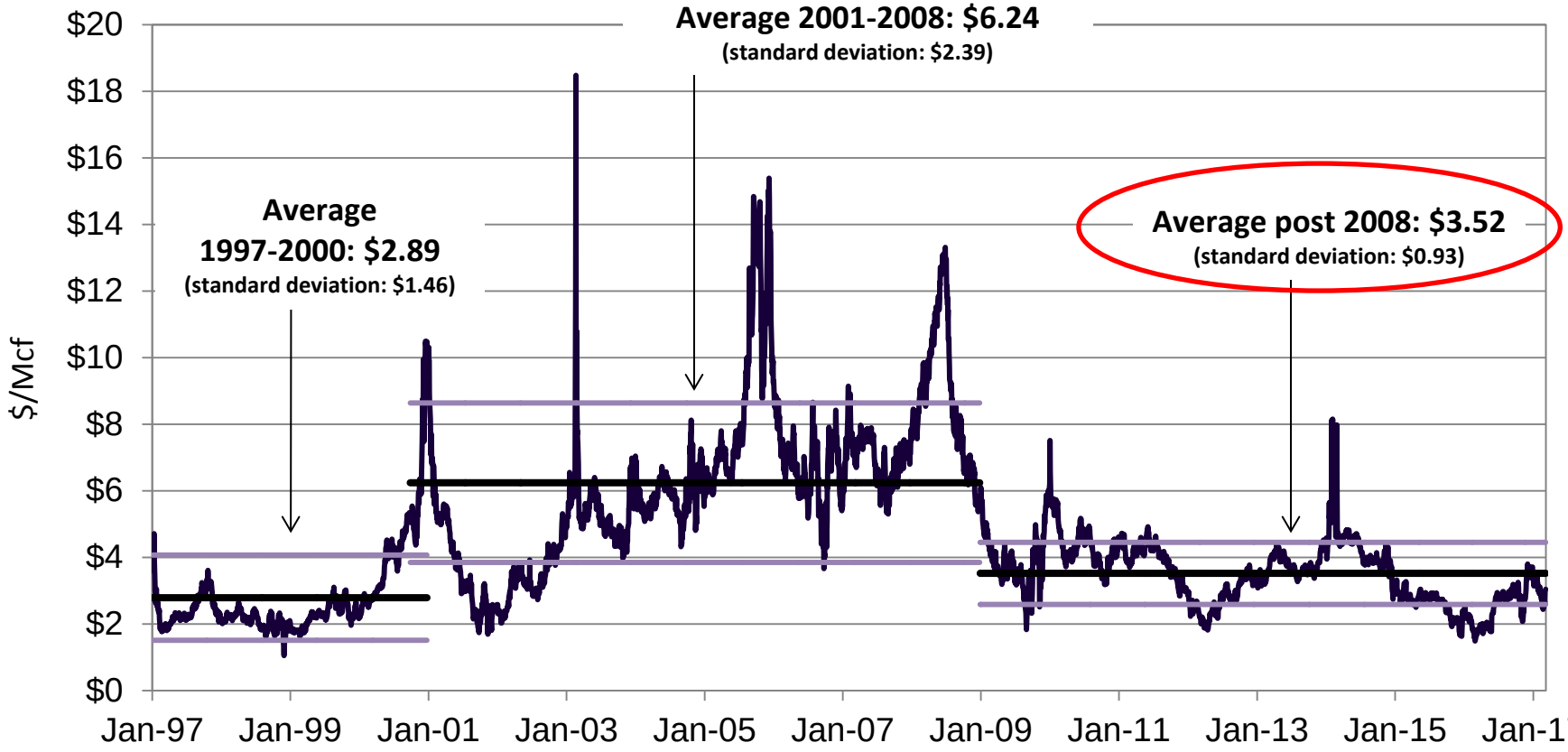
Natural gas pricing trends and volatility.

Shale-based resources have changed natural gas price volatility.



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

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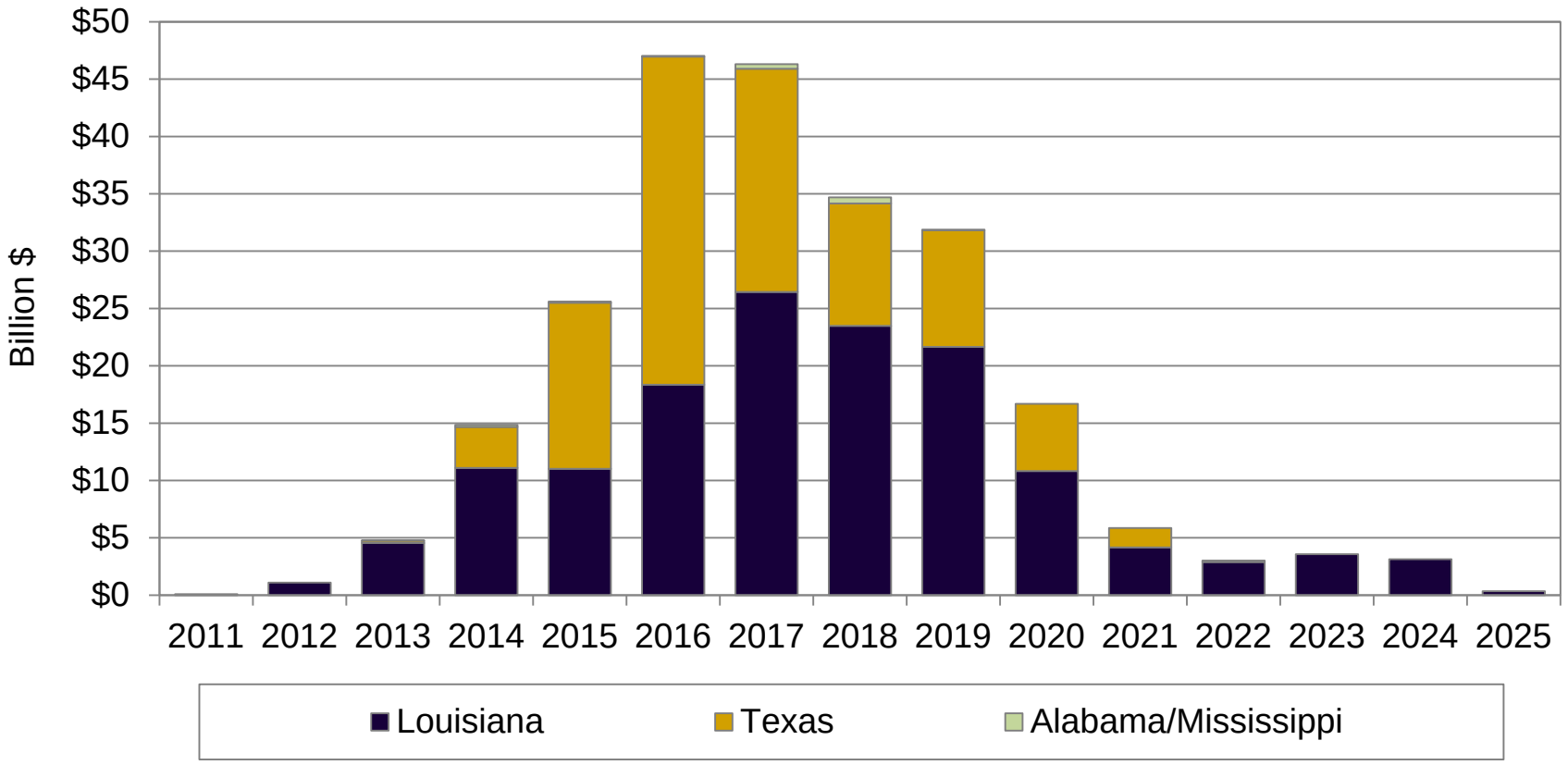
Gulf of Mexico region: energy manufacturing capital expenditures (by state).

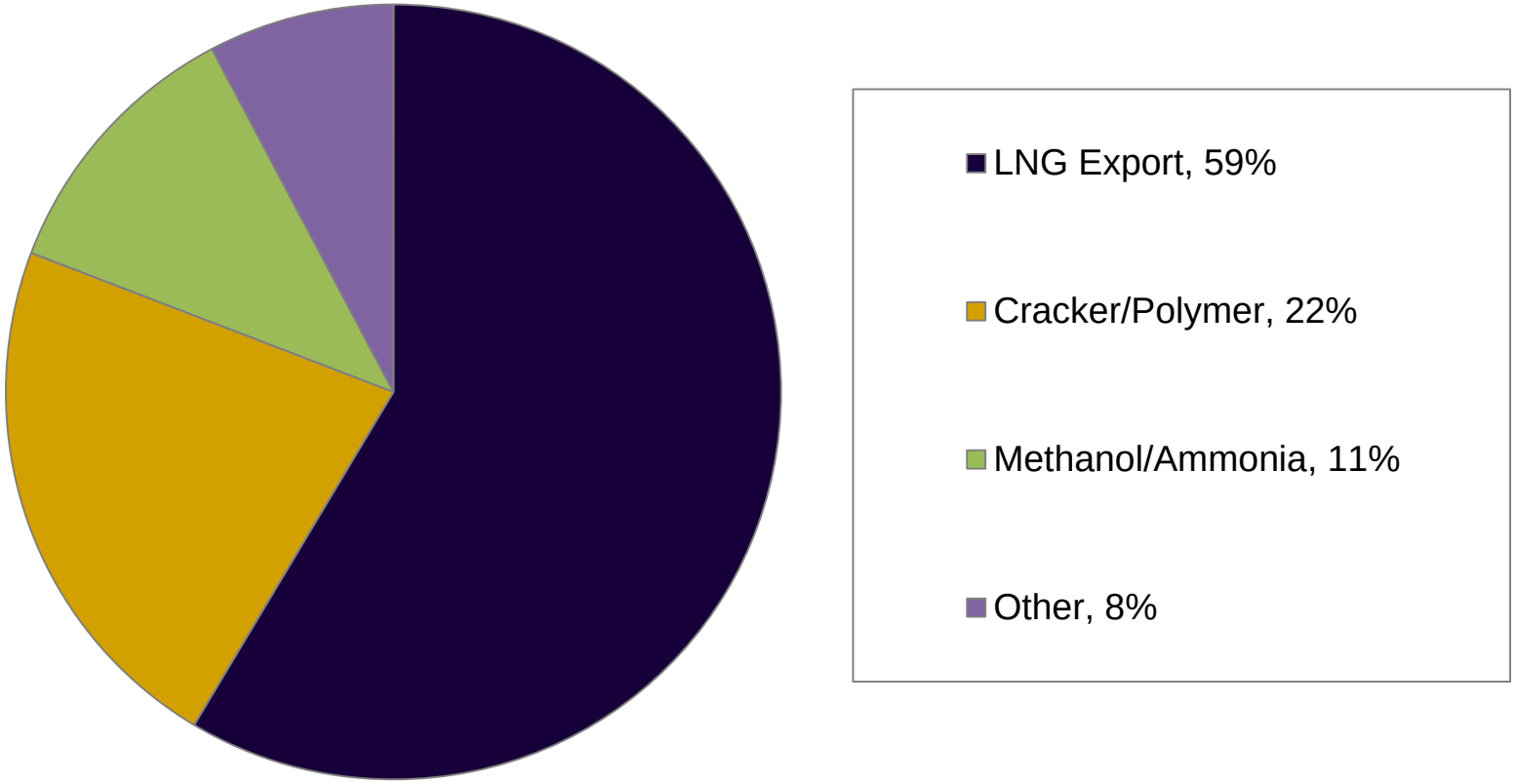
An estimated $240 billion in new energy-based manufacturing development is expected, most of which should occur between 2015 and 2019.



Source: Louisiana State University, Center for Energy Studies.

Gulf of Mexico region: total proposed capital expenditures by sector.

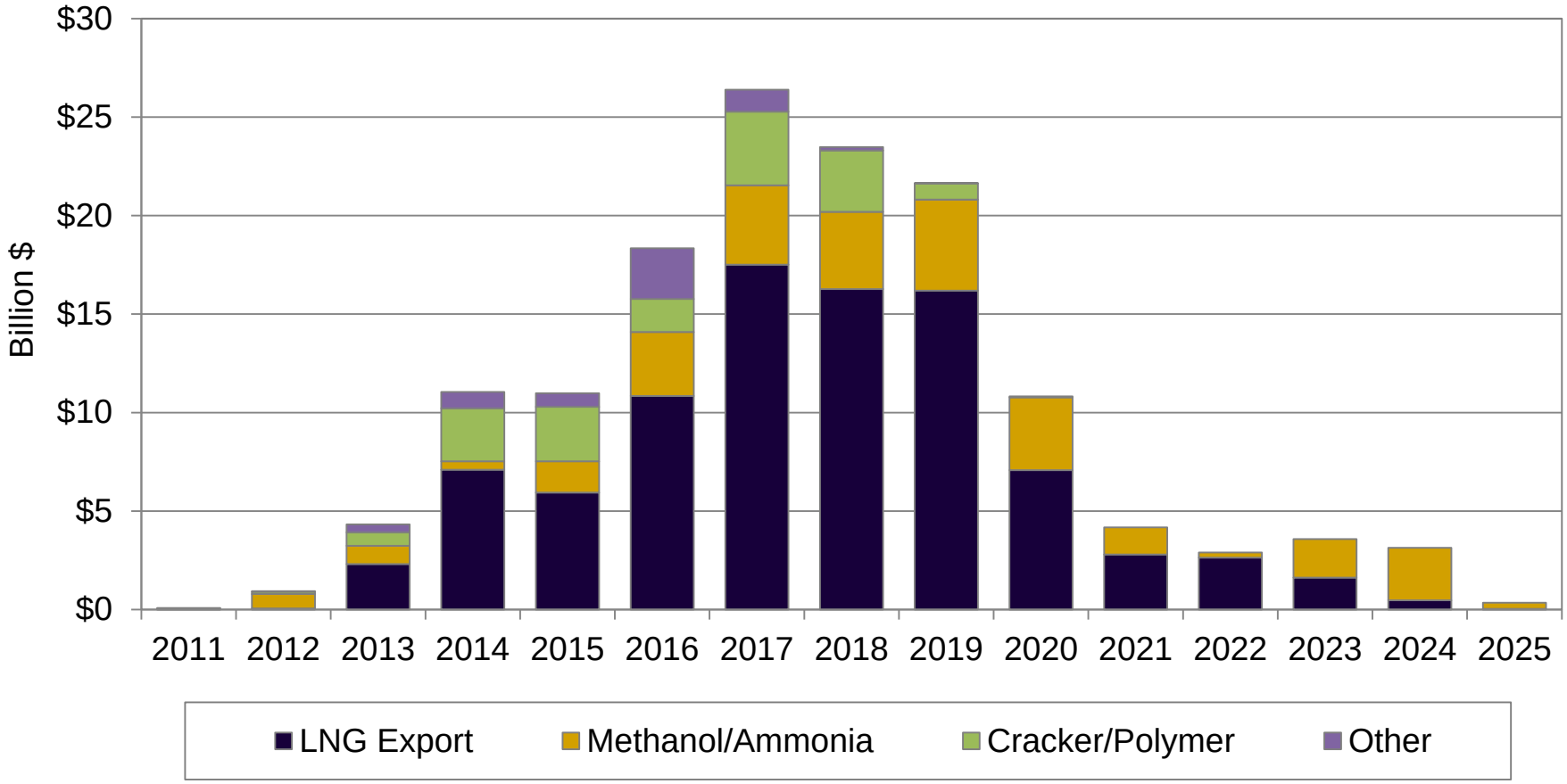
Of the proposed facility expansions in the Gulf of Mexico region, LNG export facilities comprise the majority of proposed capital spending.



Source: Louisiana State University, Center for Energy Studies.

Louisiana energy manufacturing total capital expenditures by sector.

The continued low natural gas price outlook has facilitated considerable development of over $142 billion: $46 billion already completed, $96 billion remaining, but heavily concentrated in LNG export facilities.



Source: David E. Dismukes (2013). *Unconventional Resources and Louisiana's Manufacturing Development Renaissance*. Baton Rouge, LA: Louisiana State University, Center for Energy Studies and author's updates.

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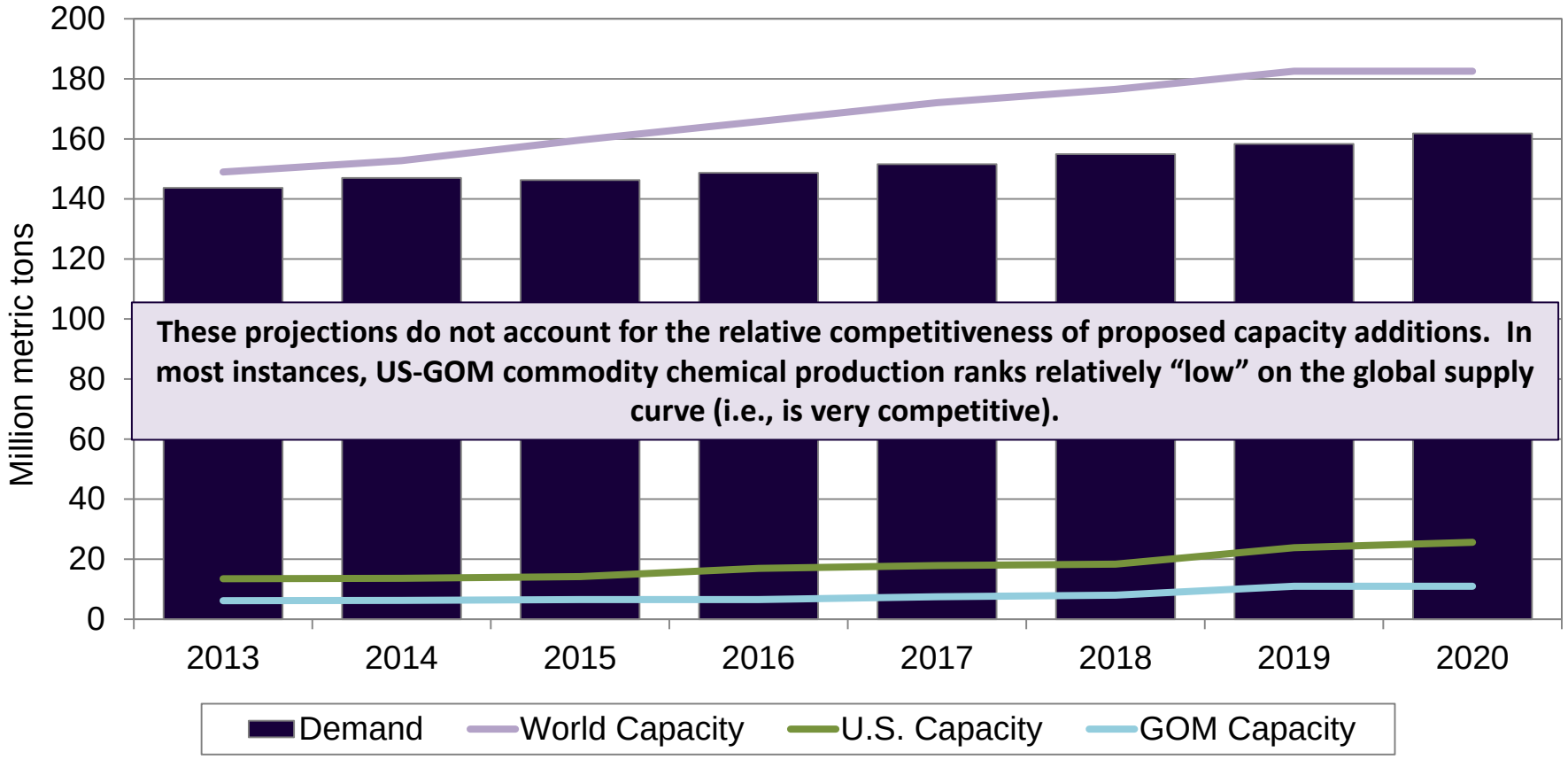
Ammonia demand and capacity outlook.

Excess global supply may start to build through 2020. The degree to which the market potentially becomes over-supplied will be function of project cancellations (if any) and continued growth.

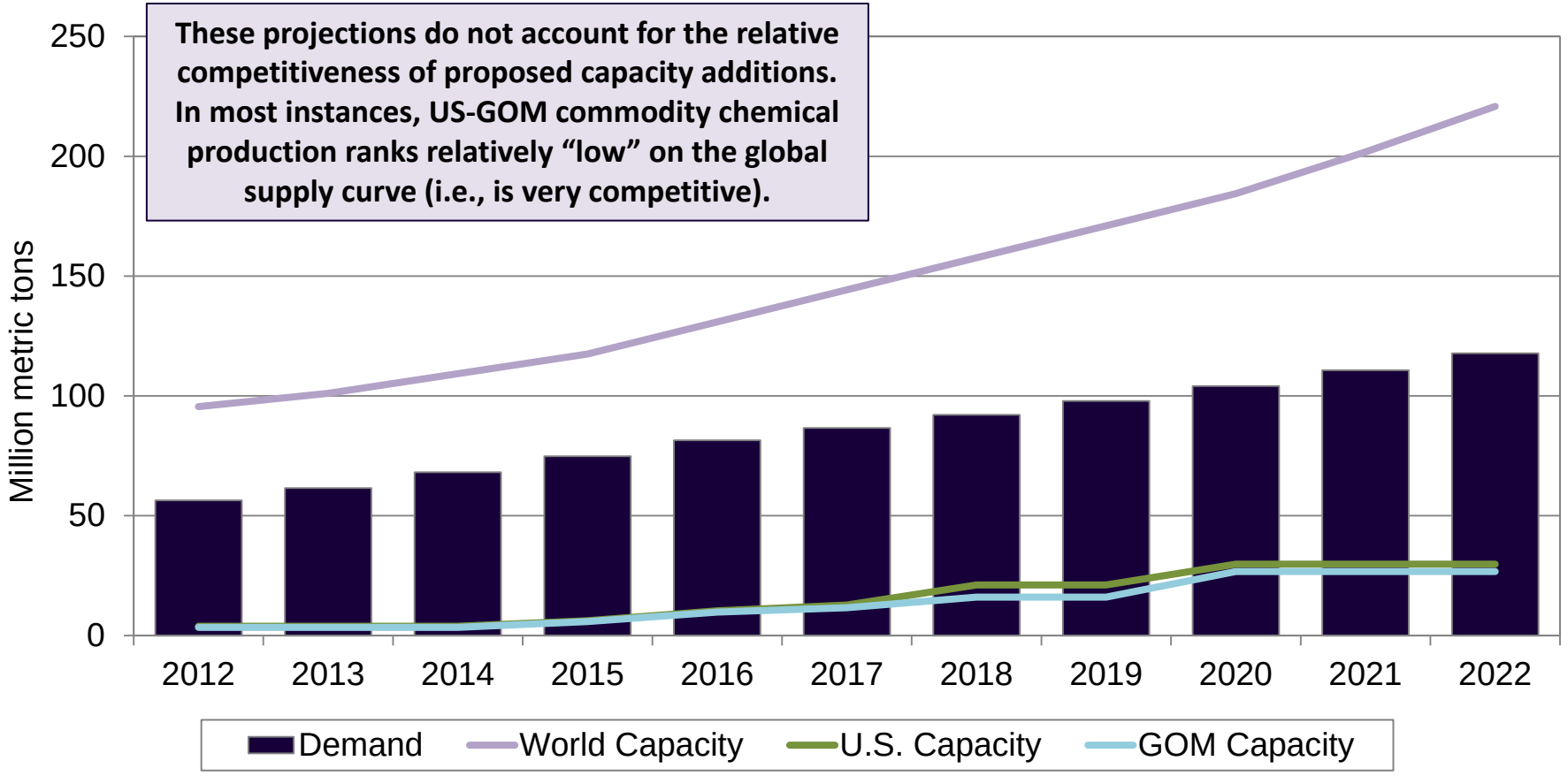


These projections do not account for the relative competitiveness of proposed capacity additions. In most instances, US-GOM commodity chemical production ranks relatively "low" on the global supply curve (i.e., is very competitive).

Source: Author's construct from previous slides.

Methanol demand and capacity outlook.

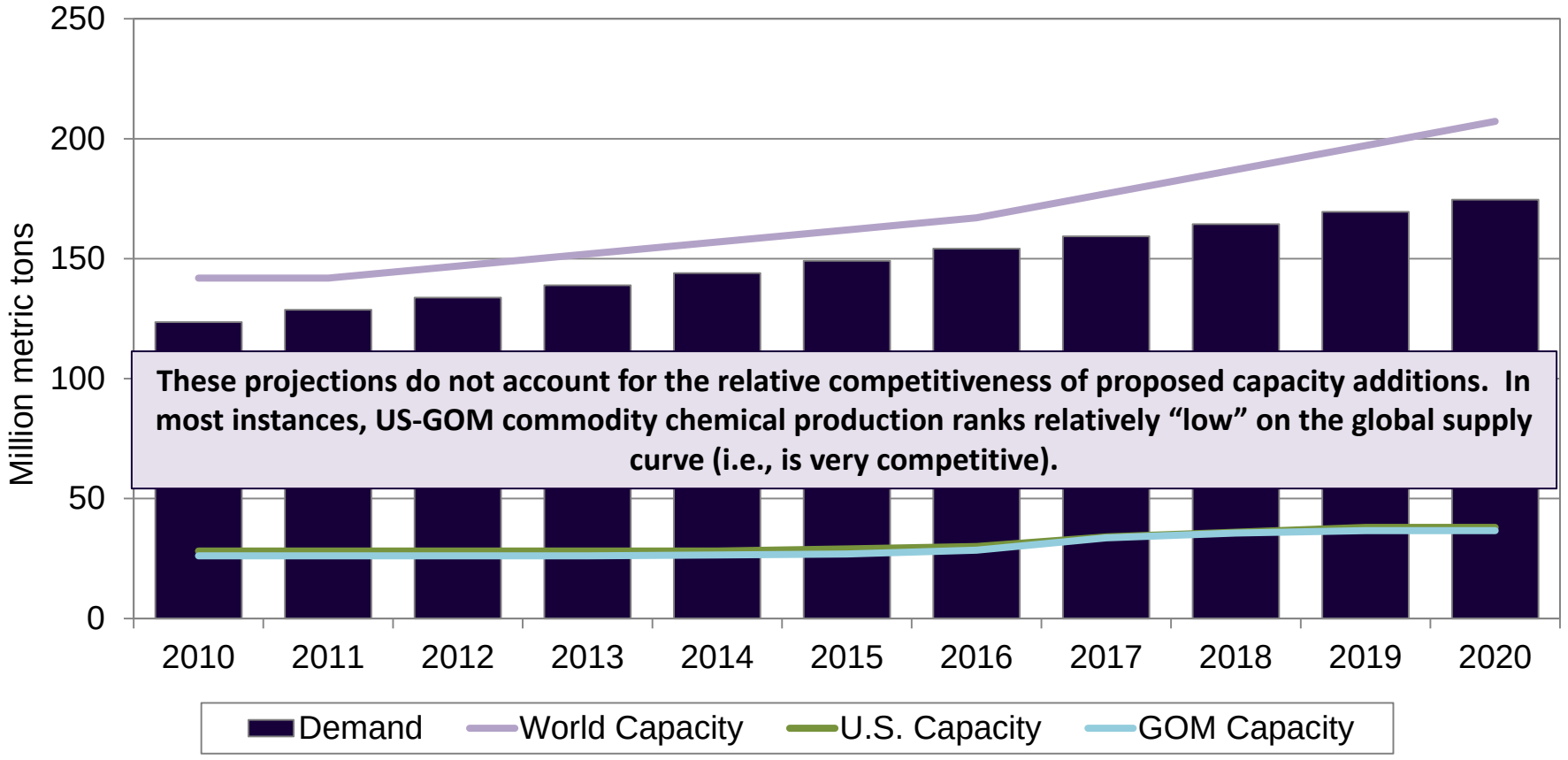
Excess global supply may start to build through 2020. The degree to which the market potentially becomes over-supplied will be function of project cancellations (if any) and continued growth.



Source: Author's construct from previous slides.

Ethylene demand and capacity outlook.

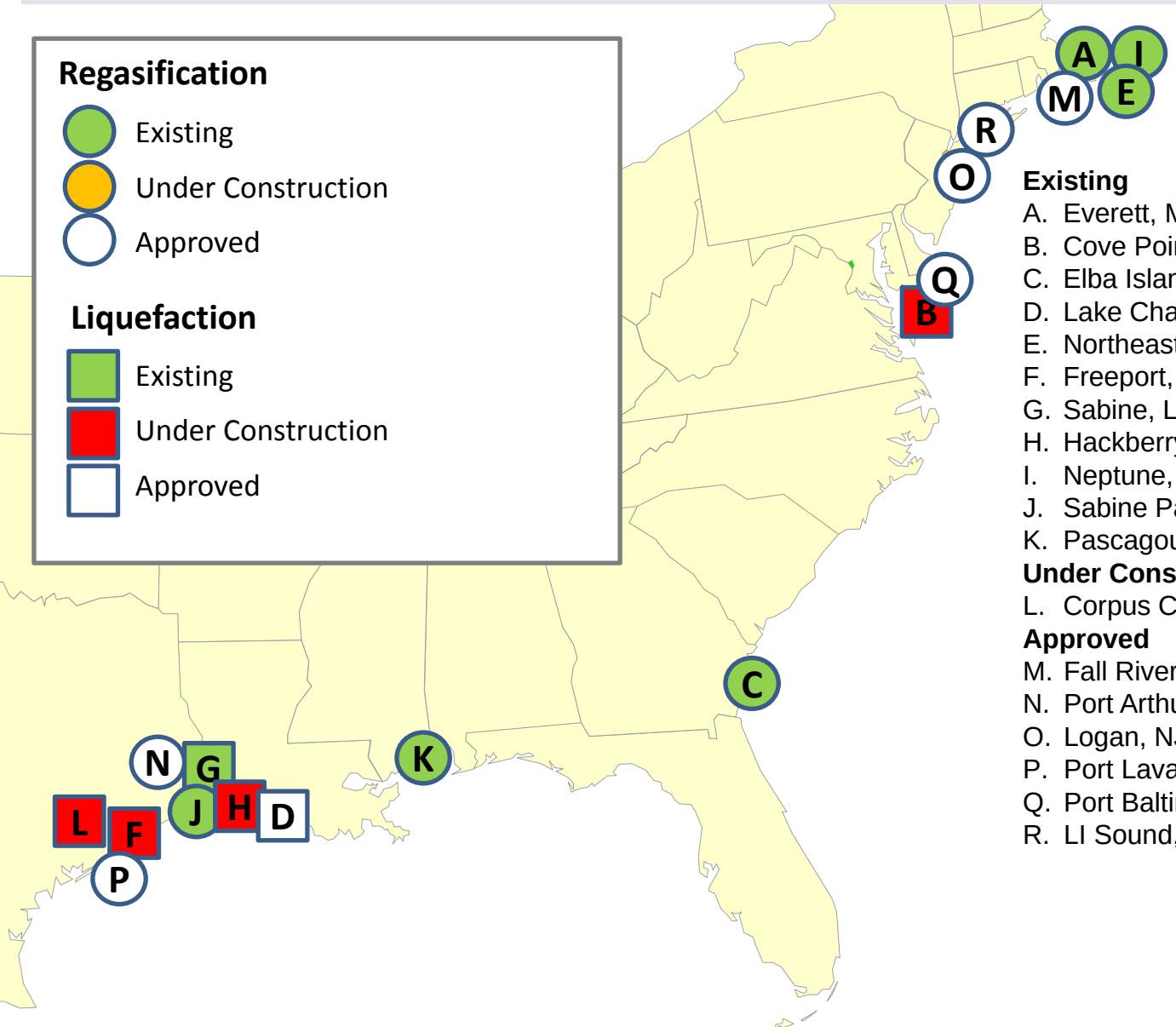
Excess global supply may start to build through 2020. The degree to which the market potentially becomes over-supplied will be function of project cancellations (if any) and continued growth.



These projections do not account for the relative competitiveness of proposed capacity additions. In most instances, US-GOM commodity chemical production ranks relatively "low" on the global supply curve (i.e., is very competitive).

Source: Author's construct from previous slides.

GOM LNG capacity.



Existing

A. Everett, MA: 1.035 Bcfd
B. Cove Point, MD: 1.8 Bcfd
C. Elba Island, GA: 1.6 Bcfd (+0.5 Expansion)
D. Lake Charles, LA: 2.1 Bcfd
E. Northeast Gateway, Offshore MA: 0.8 Bcfd
F. Freeport, TX: 1.5 Bcfd (+2.5 Expansion)
G. Sabine, LA: 4.0 Bcfd
H. Hackberry, LA: 1.8 Bcfd (+0.85 Expansion)
I. Neptune, Offshore MA: 0.4 Bcfd
J. Sabine Pass, TX: 1.0 Bcfd (+ 1.0 Expansion)
K. Pascagoula, MS: 1.5 Bcfd

Under Construction

L. Corpus Christi, TX: 2.14 Bcfd

Approved

M. Fall River, MA: 0.8 Bcfd
N. Port Arthur, TX: 3.0 Bcfd
O. Logan, NJ: 1.2 Bcfd
P. Port Lavaca, TX: 1.0 Bcfd
Q. Port Baltimore, MD: 1.5 Bcfd
R. LI Sound, NY: 1.0 Bcfd

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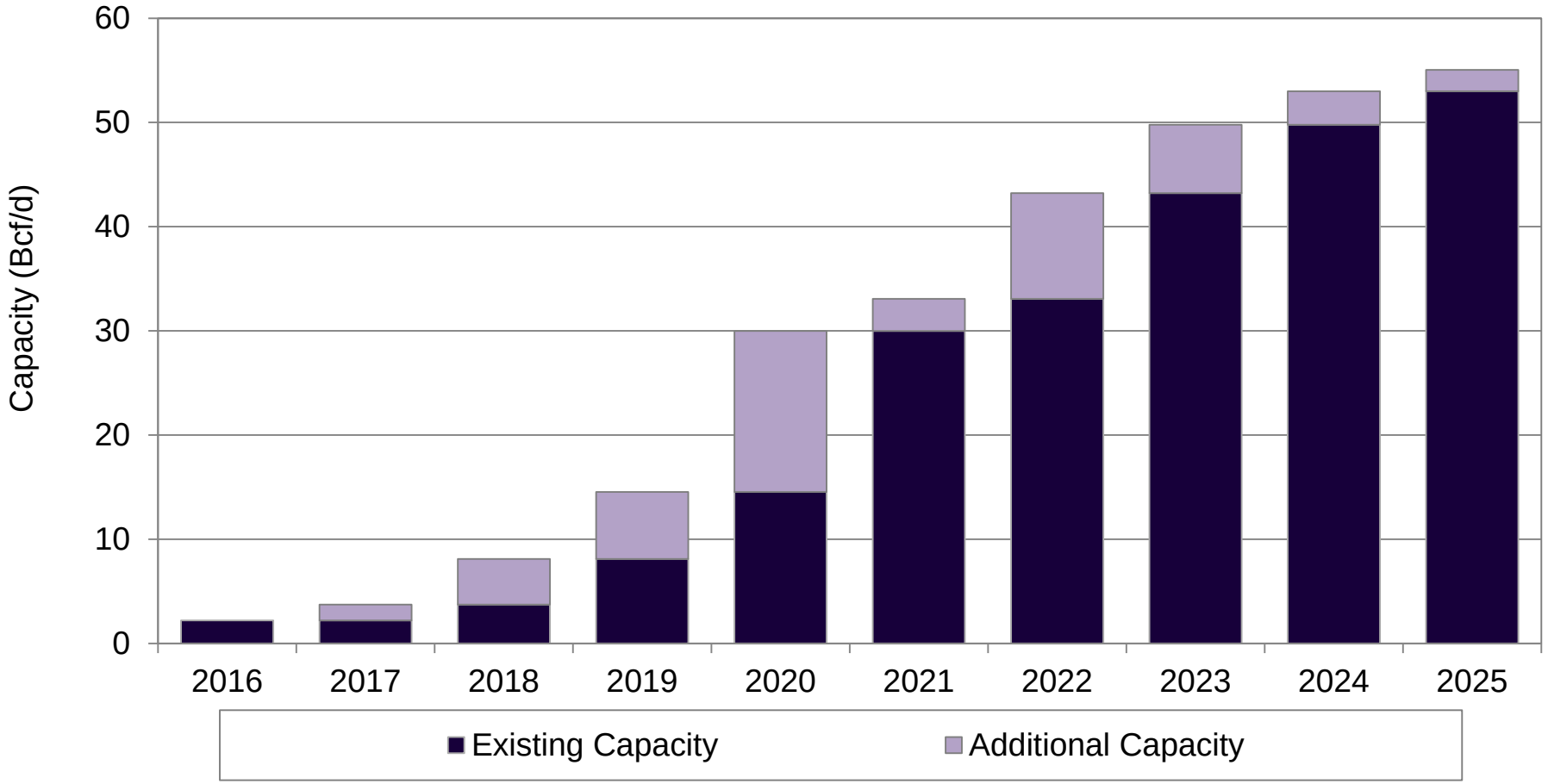
U.S. LNG capacity development outlook.

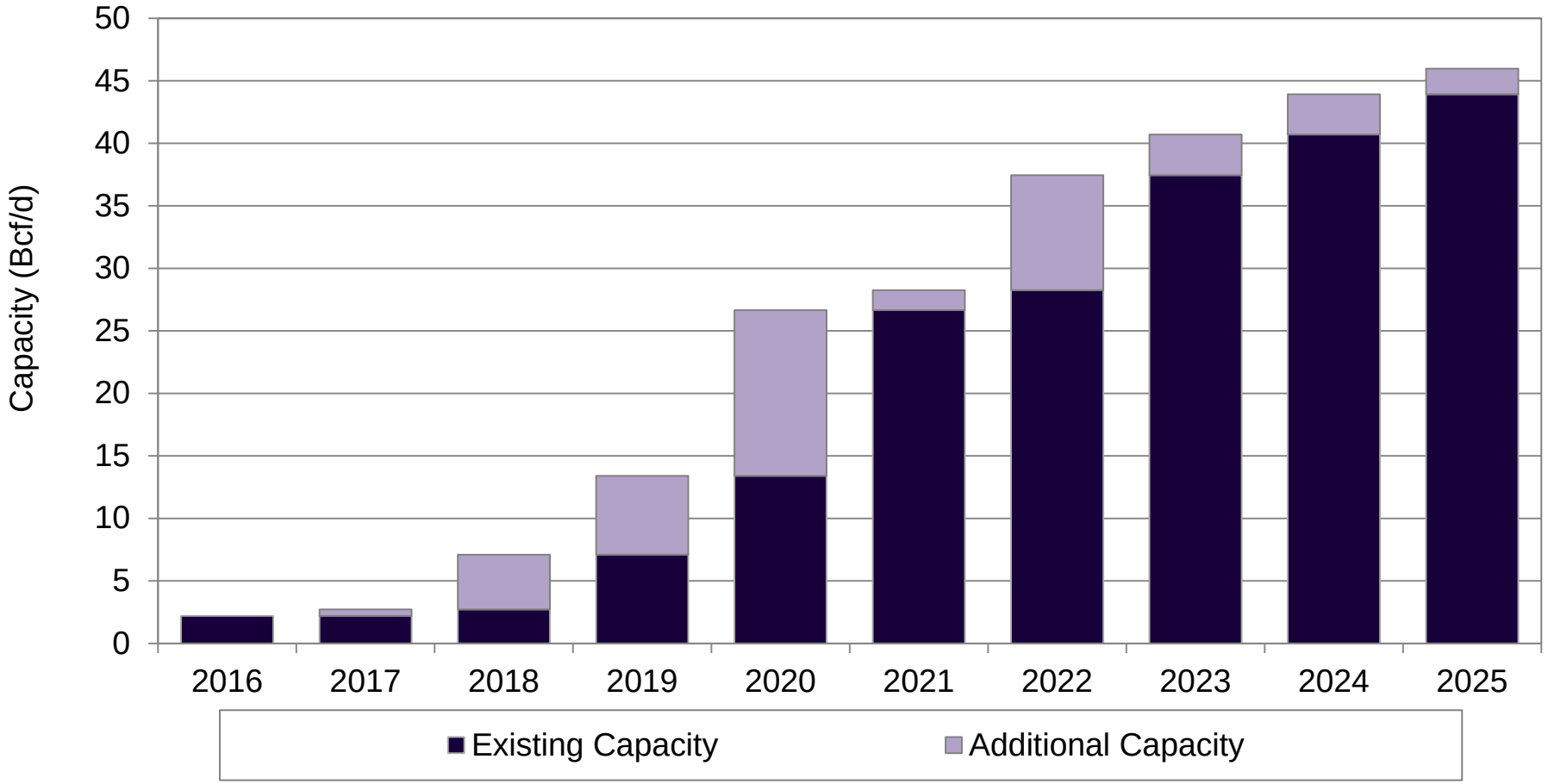
If all of the LNG export applications currently filed with the Department of Energy were to come online, U.S. liquefaction capacity would exceed 50 Bcf per day by 2025. Most of this capacity would come online in 2020.



Source: U.S. Department of Energy.

GOM LNG capacity development outlook.

If all of the LNG export applications currently filed with the Department of Energy were to come online, the GOM liquefaction capacity would exceed 45 Bcf per day by 2025. Most of this capacity would come online in 2020.



Source: U.S. Department of Energy.

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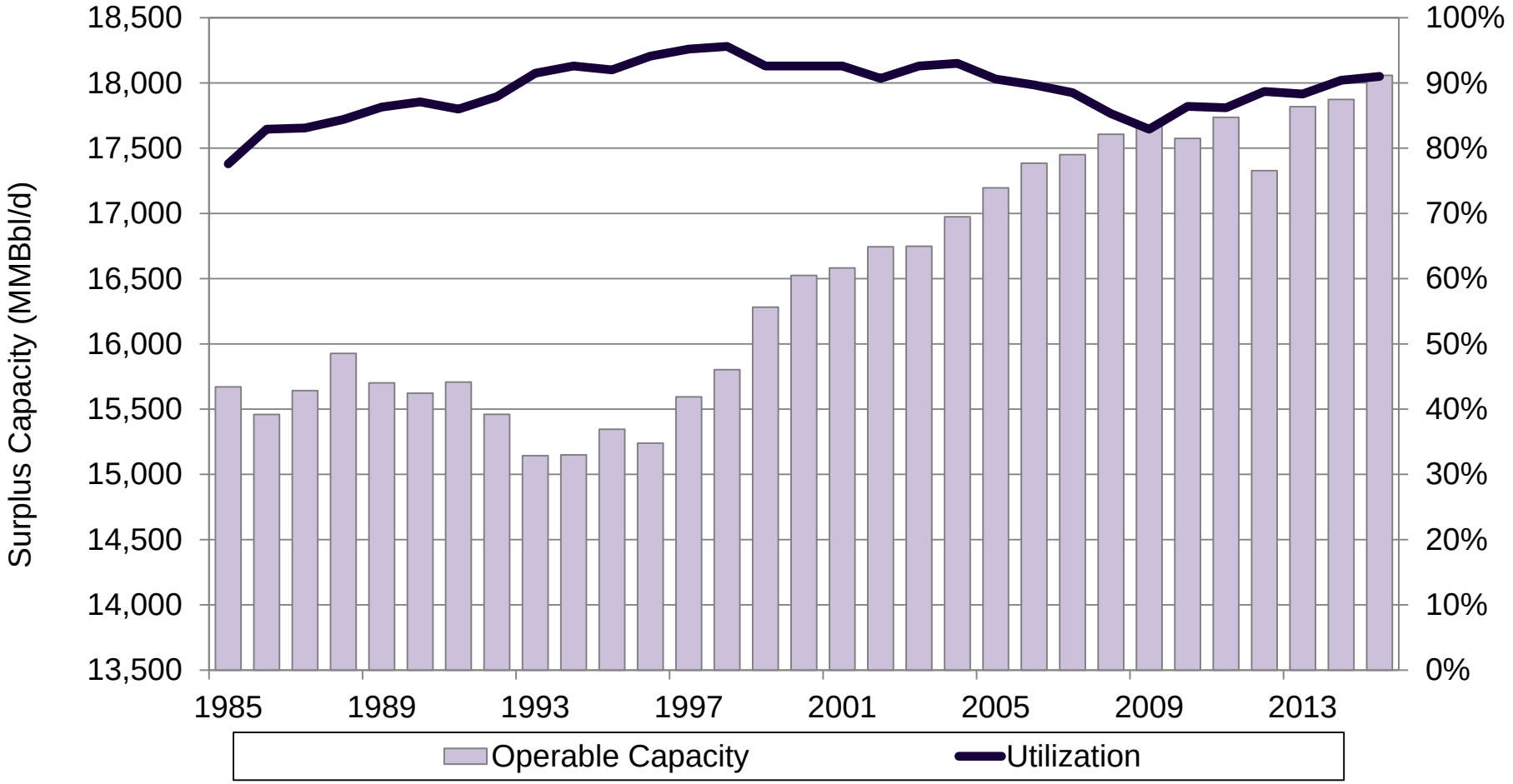
U.S. refining capacity and utilization.

Operable capacity at U.S. refineries has increased nearly 20 percent since 1995 while utilization has remained stable at 90 percent.



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

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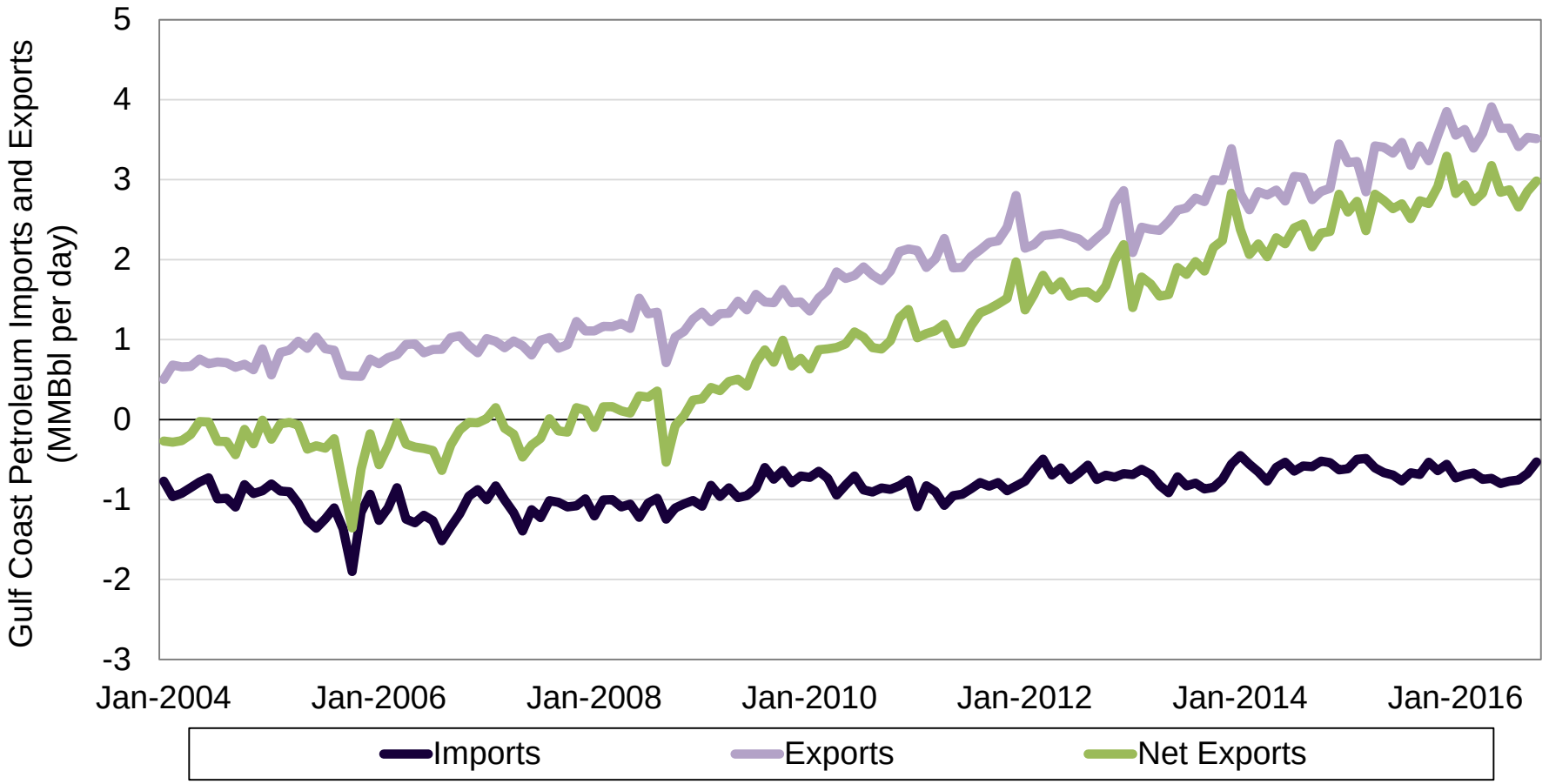
Gulf Coast petroleum net exports.

The Gulf Coast region became a net exporter of petroleum products at the end of 2008. Since then net exports have increased at an average annual rate of 40 percent.



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

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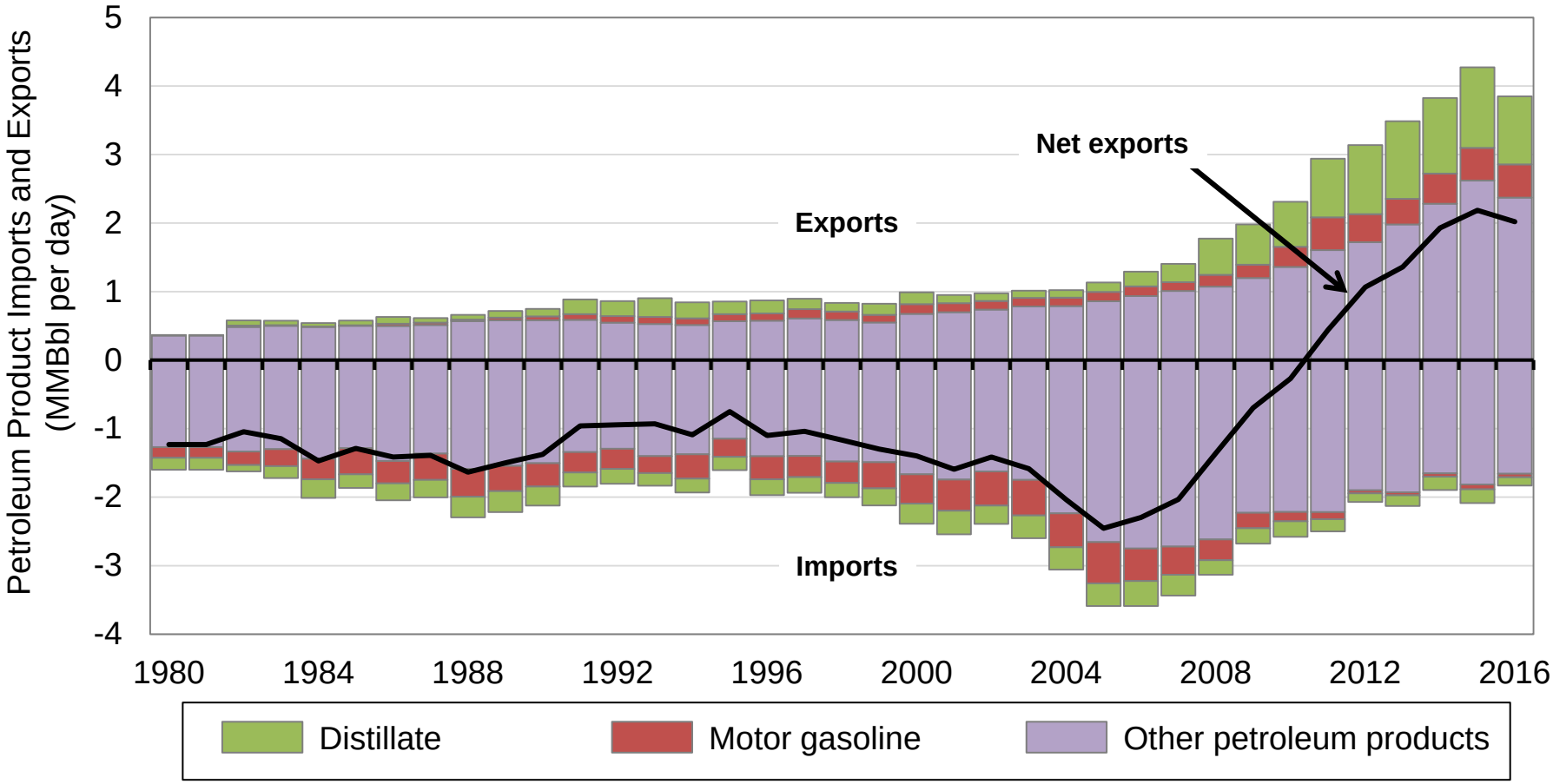
U.S. petroleum product imports and exports.

In 2011, the U.S. became a net exporter of petroleum products. Net exports have increased 360 percent since then.



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

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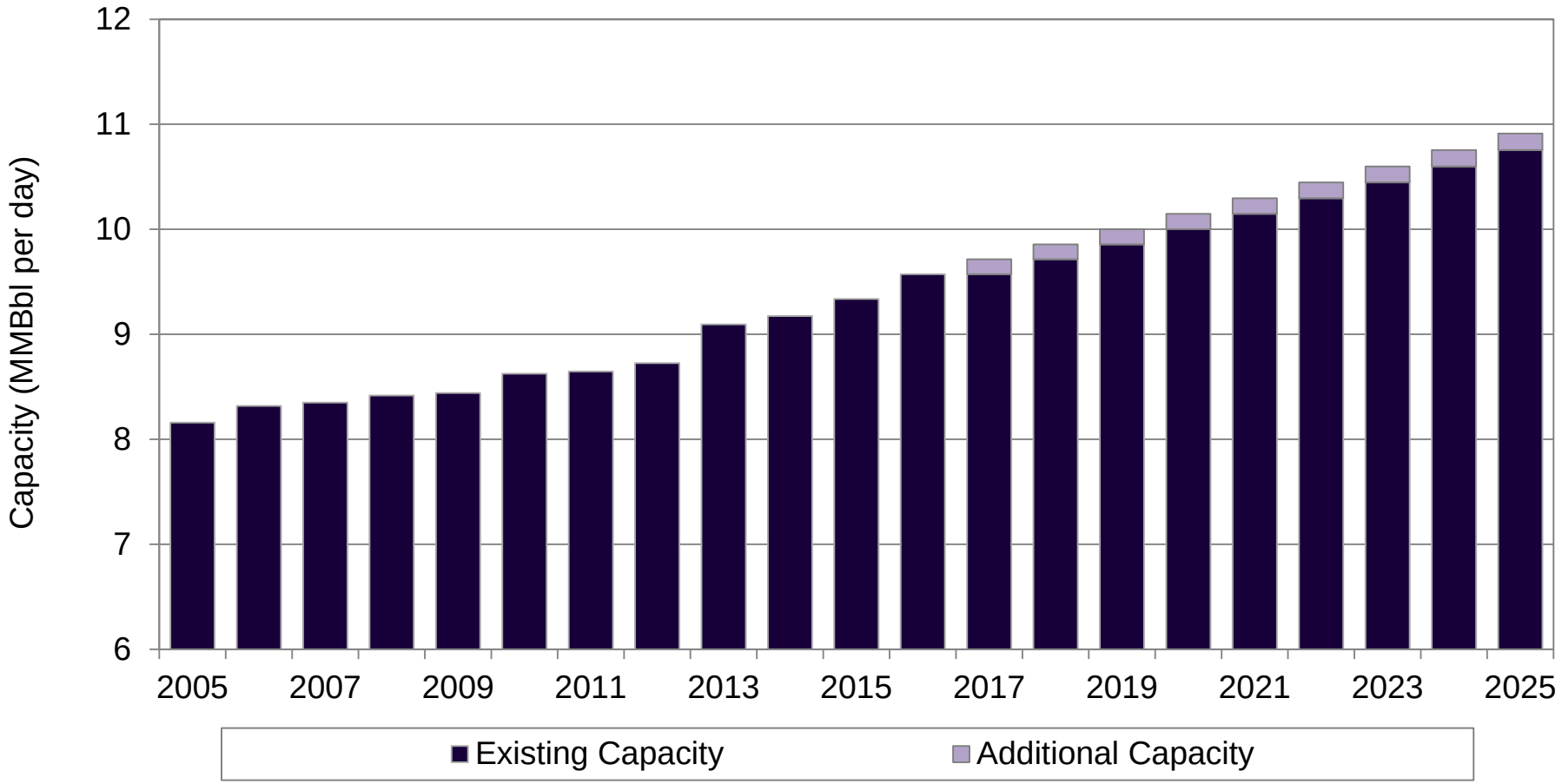
GOM refinery capacity outlook.

GOM refinery capacity has been increasing annually at an average rate of 1.5 percent per year.



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Energy Employment Outlook

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Key Industries

- Oil and Gas
  - NAICS 211: Oil and Gas Extraction
  - NAICS 213: Support Activities for Mining

- Refinery and Chemical Manufacturing
  - NAICS 324: Petroleum and Coal Products Manufacturing (refineries)
  - NAICS 325: Chemical Manufacturing

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Relative energy sector sizes as measured by employment.

	Percent of State Total Employment		Percent of Industry Employment in US	
Region	Oil and Gas	Refining and Chemical Manufacturing	Oil and Gas	Refining and Chemical Manufacturing
Alabama	0.1%	0.7%	0.2%	1.4%
Florida	0.0%	0.3%	0.1%	2.3%
Louisiana	2.3%	1.9%	7.9%	4.0%
Mississippi	0.4%	0.8%	0.8%	0.9%
Texas	2.2%	0.9%	46.7%	11.1%
Gulf Total	1.3%	0.7%	55.7%	19.8%
US Total	0.4%	0.7%	100.0%	100.0%

Source: U.S. Bureau of Labor Statistics, 2015 annual Quarterly Census of Employment and Wages data.

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Relative energy sector sizes as measured by GSP.

	Percent of State Total Employment		Percent of Industry Employment in US	
Region	Oil and Gas	Refining and Chemical Manufacturing	Oil and Gas	Refining and Chemical Manufacturing
Alabama	**0.5%**	**3.1%**	**0.2%**	**1.1%**
Florida	0.0%	0.9%	0.0%	1.4%
Louisiana	7.7%	16.7%	4.6%	7.7%
Mississippi	1.5%	3.5%	0.4%	0.7%
Texas	14.3%	6.0%	56.7%	18.4%
Gulf Total	8.4%	5.1%	61.9%	29.4%
US Total	2.4%	3.0%	100.0%	100.0%

Source: U.S. Bureau of Economic Analysis.

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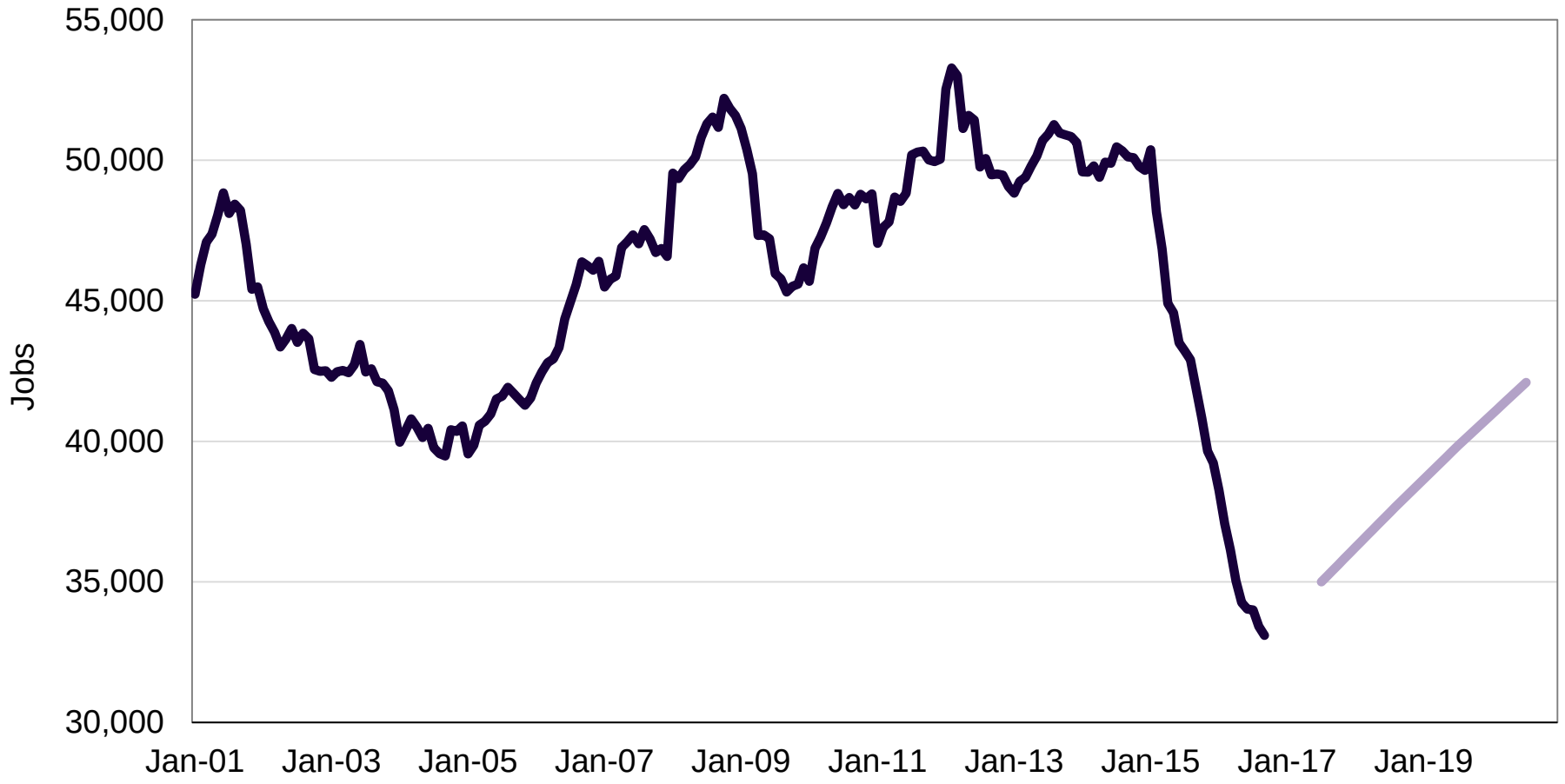
Louisiana oil and gas employment forecast



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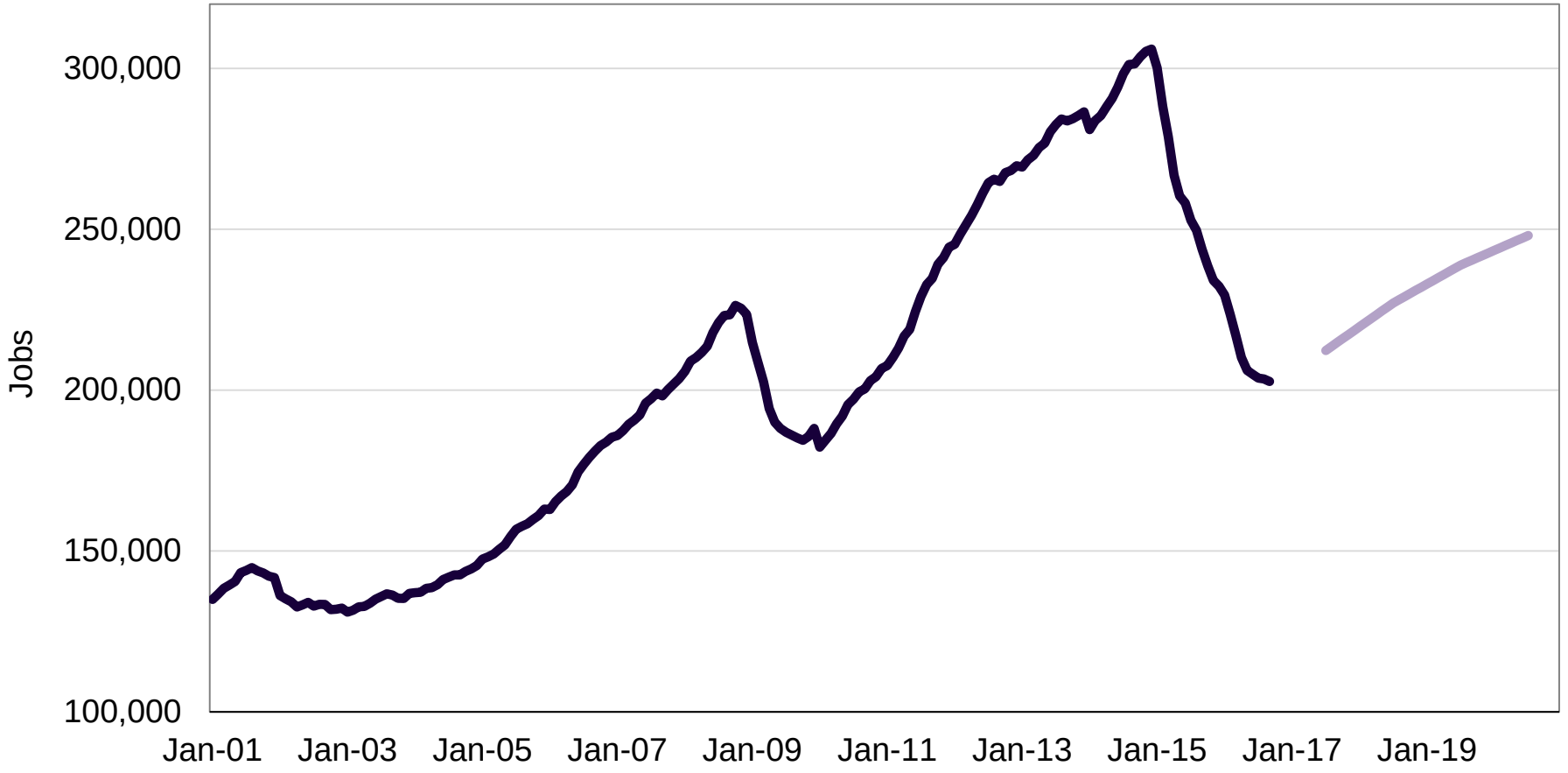
Texas oil and gas employment forecast



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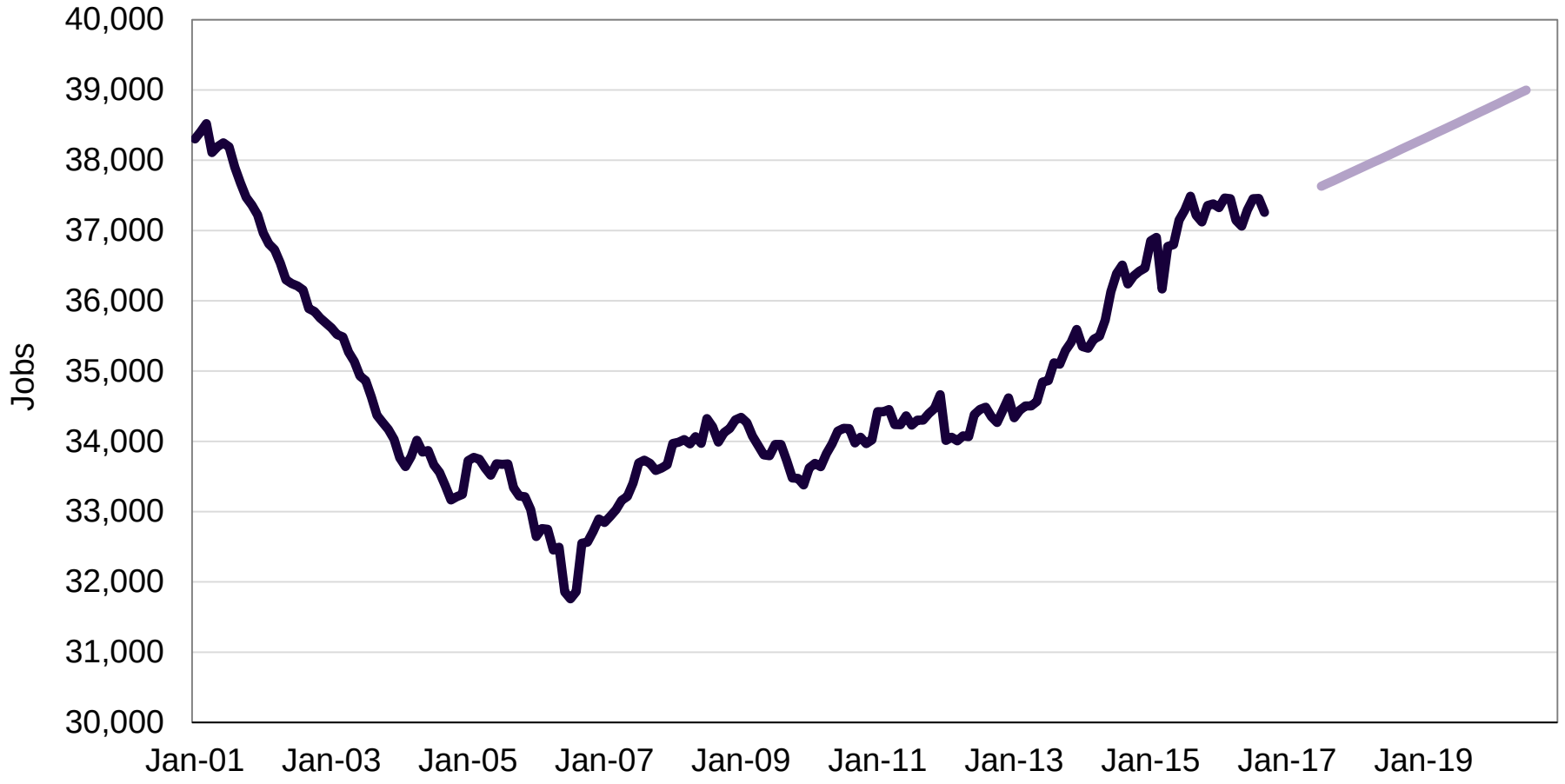
Louisiana refinery and chemical sector employment forecast



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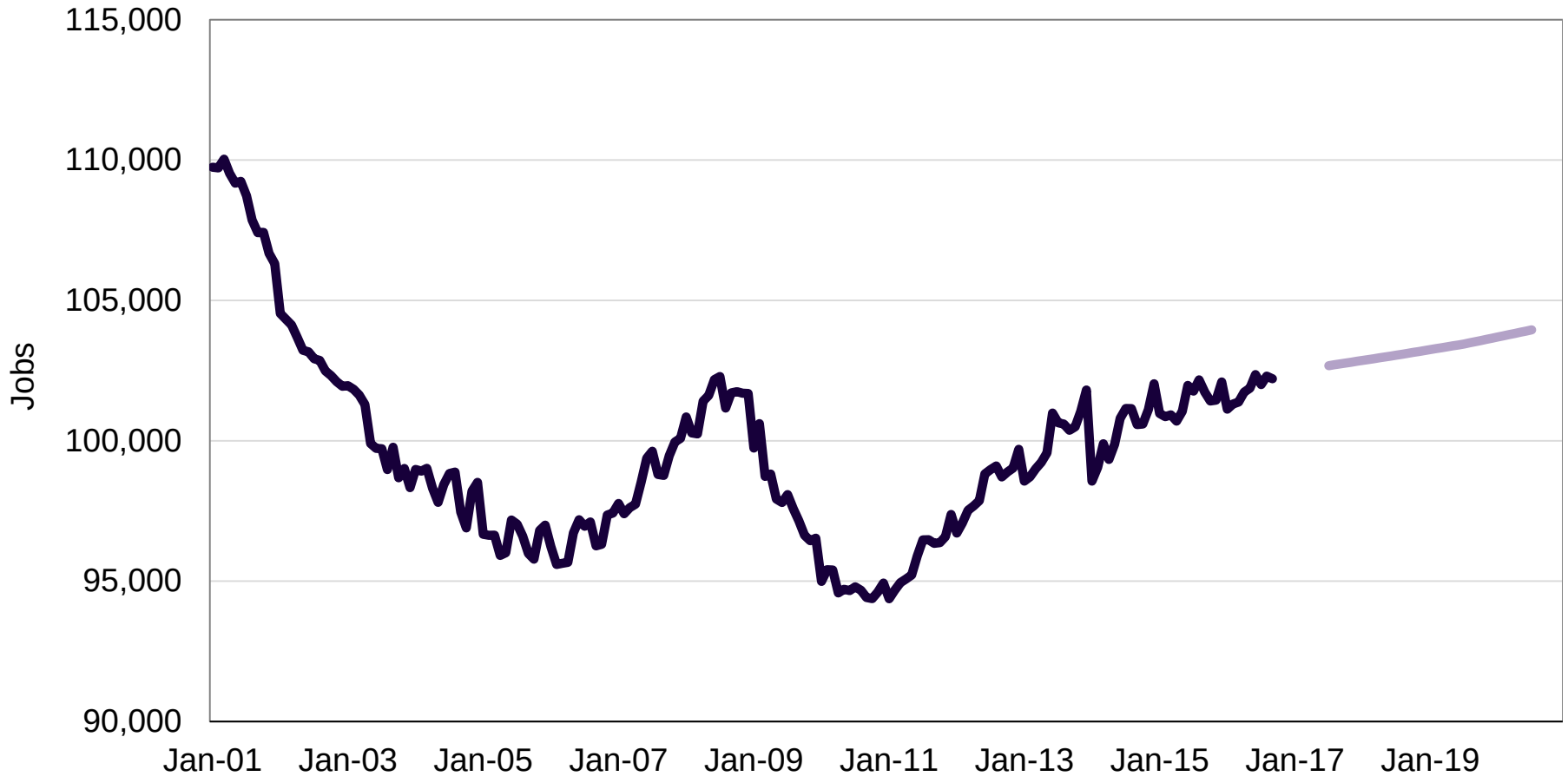
Texas refinery and chemical sector employment forecast



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Conclusions

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Conclusions

- Crude oil and natural gas **markets continue to be resilient**. Prices anticipated to remain affordable and less volatile.
- Natural gas supply growth increasingly driven by **"associated" natural gas** – a byproduct of increasing production coming from higher hydrocarbon-based production (Permian, Eagle Ford, Bakken). Crude production developments will continue to have implications for natural gas markets.
- **Economic growth** is likely the only near-term factor that will **burn-off excessive commodity storage levels**. Likely to continue to crude oil and natural gas prices to be **range-bound** with likely lower relative **pricing volatility**.
- Continued **positive investment/development activity** in mid-stream, refining, and processing/manufacturing – as well as energy exports.

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Acknowledgements

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Addition Employment Forecasts

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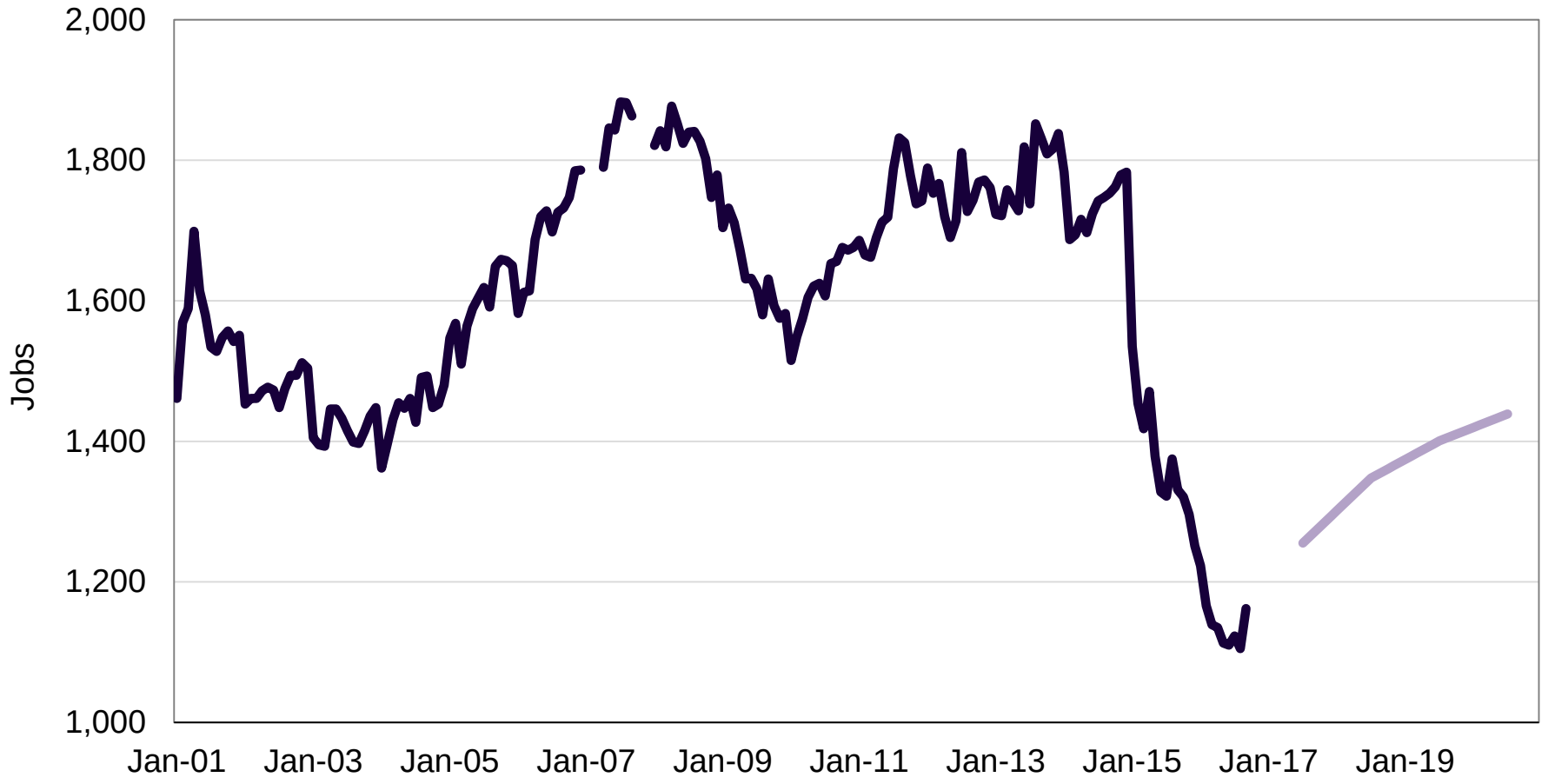
Alabama Oil and Gas Employment Forecast



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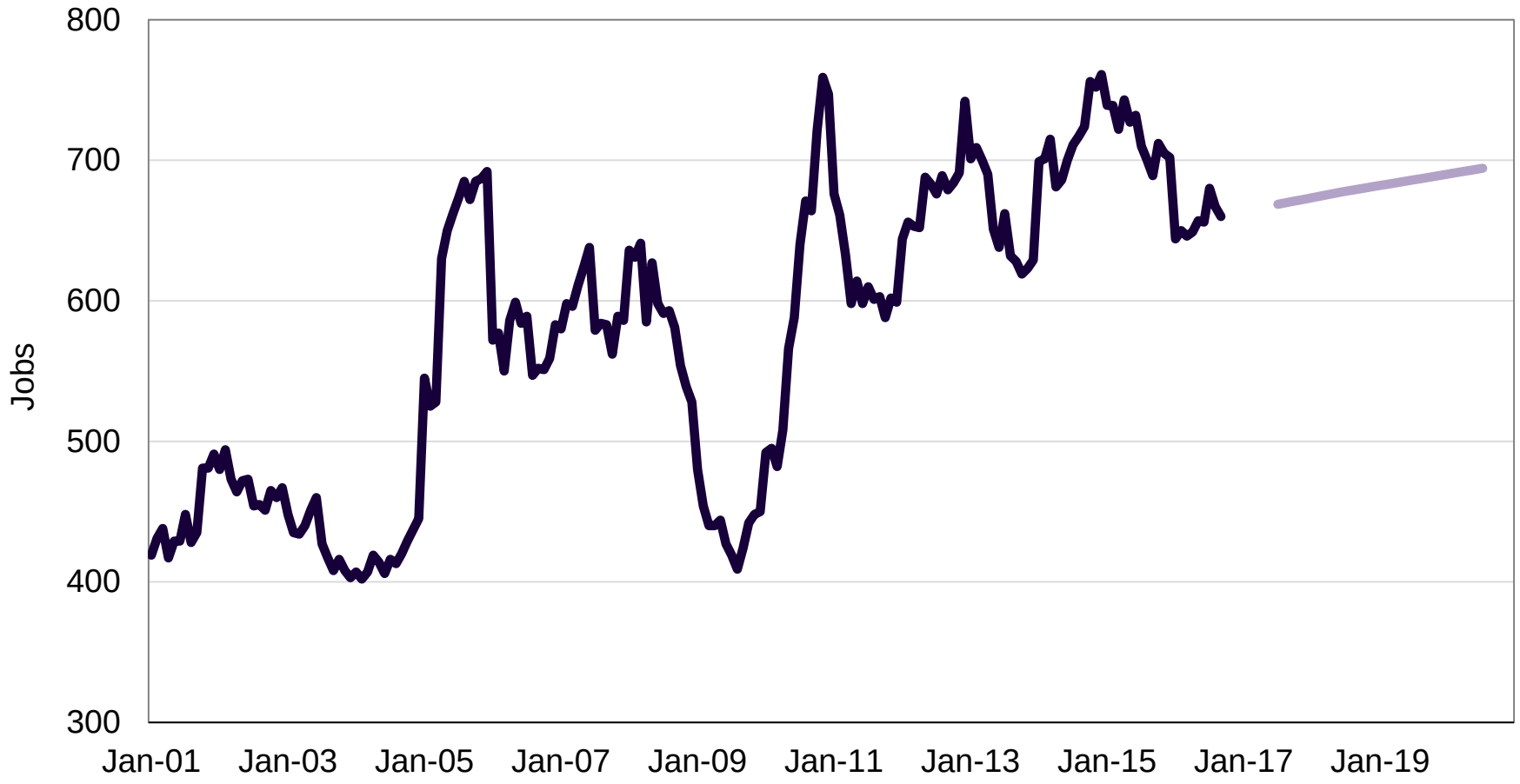
Florida Oil and Gas Employment Forecast



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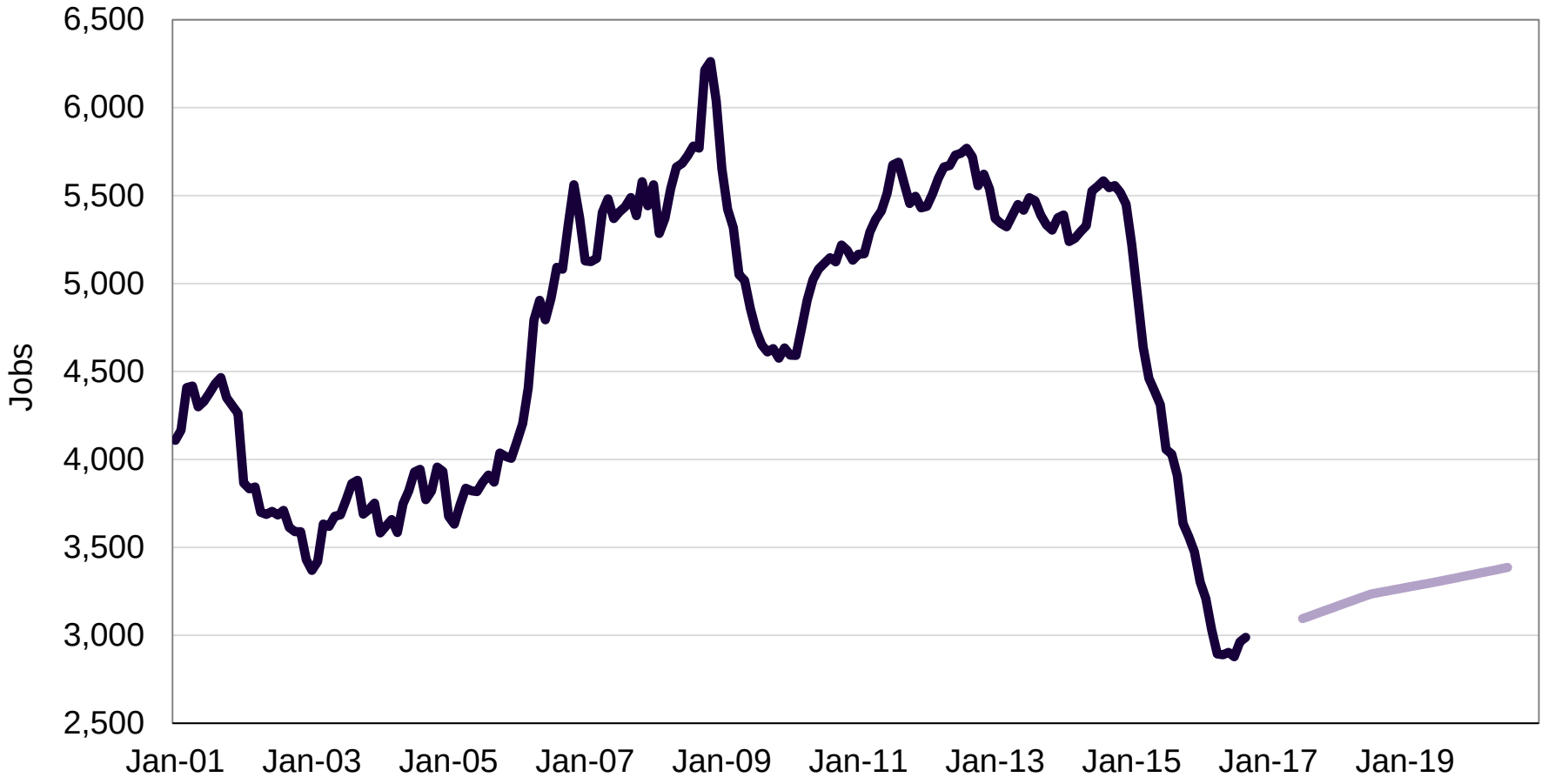
Mississippi Oil and Gas Employment Forecast



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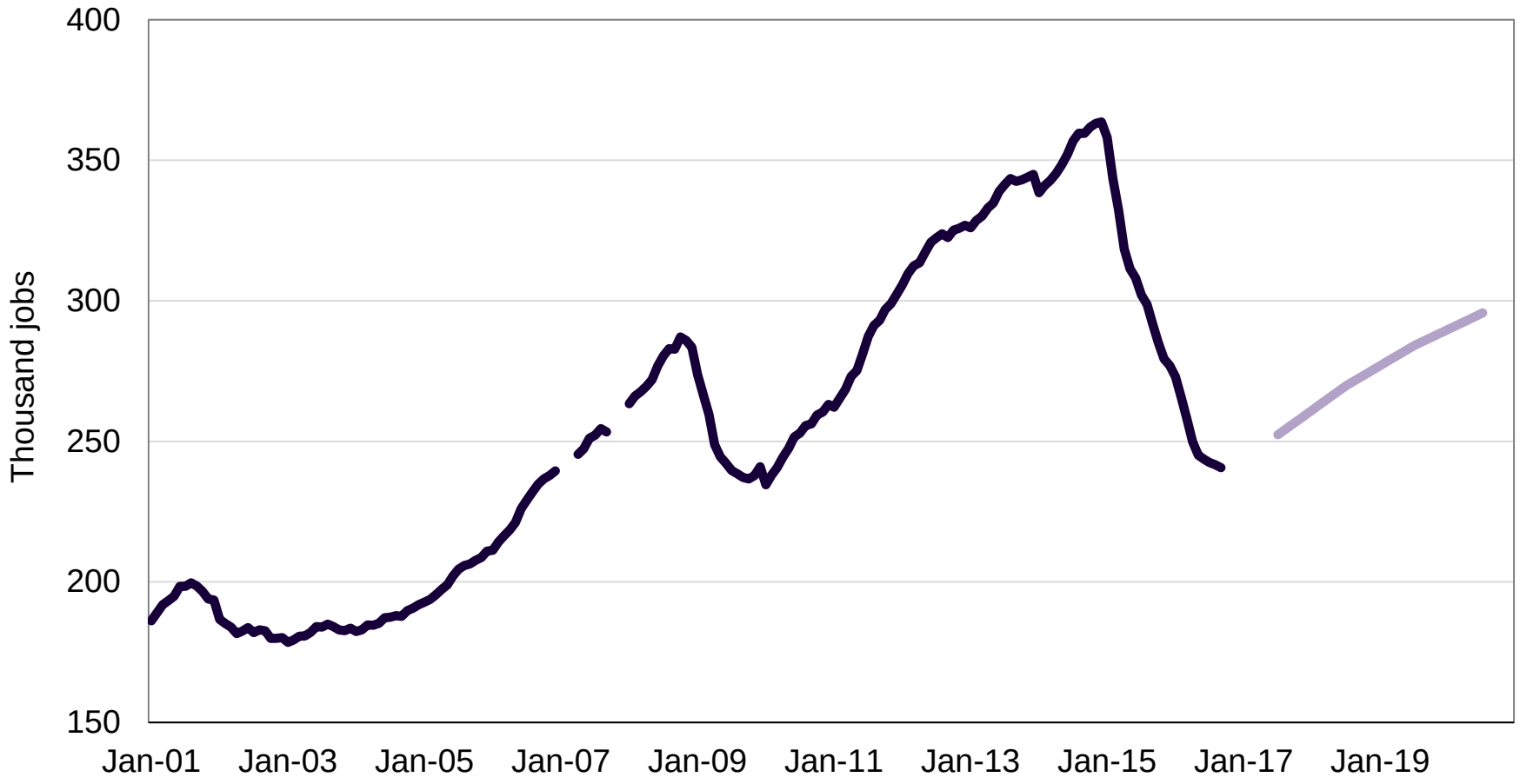
Gulf Total Oil and Gas Employment Forecast



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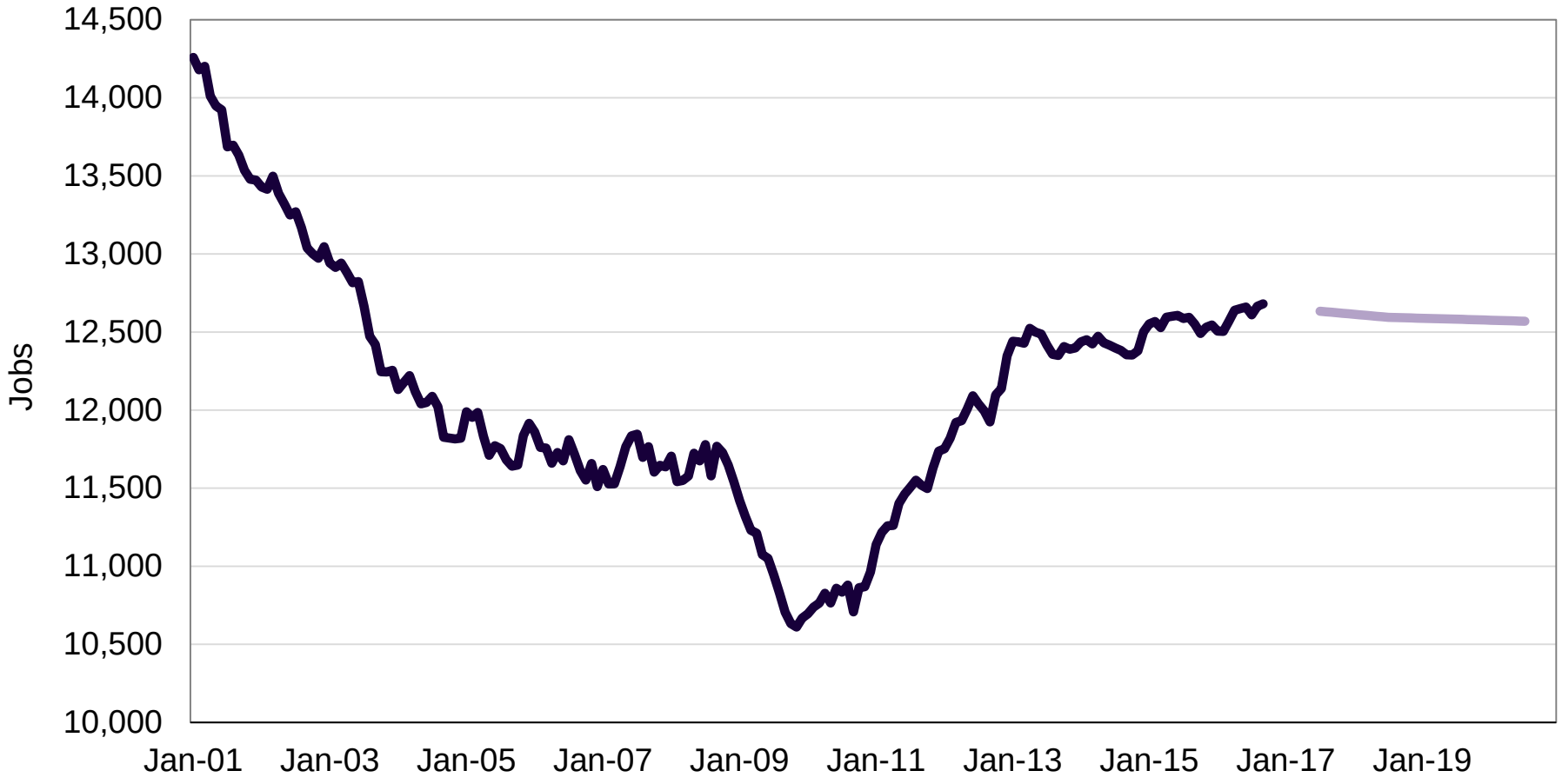
Alabama Refinery and Chemical Manufacturing Employment Forecast



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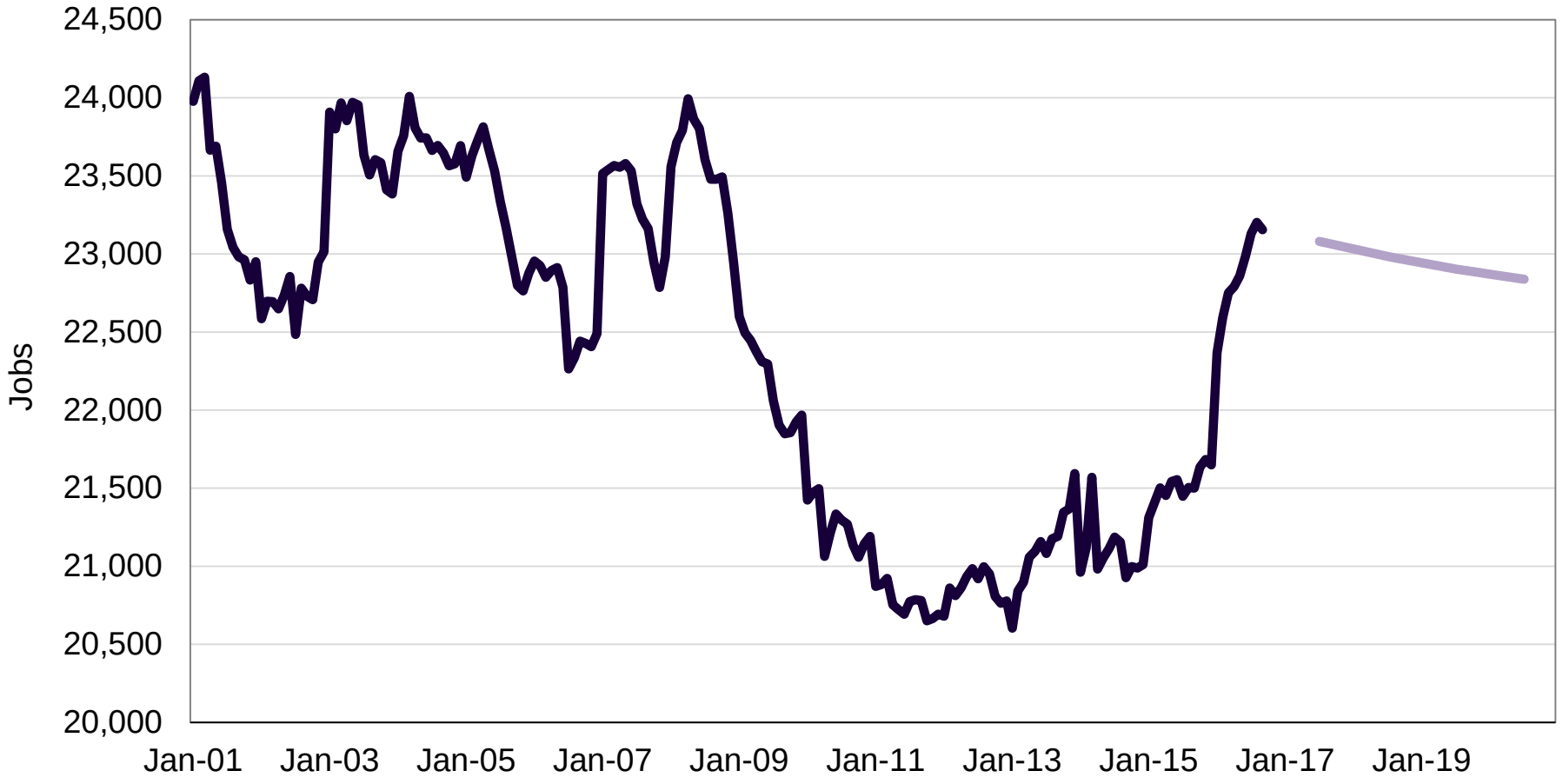
Florida Refinery and Chemical Manufacturing Employment Forecast



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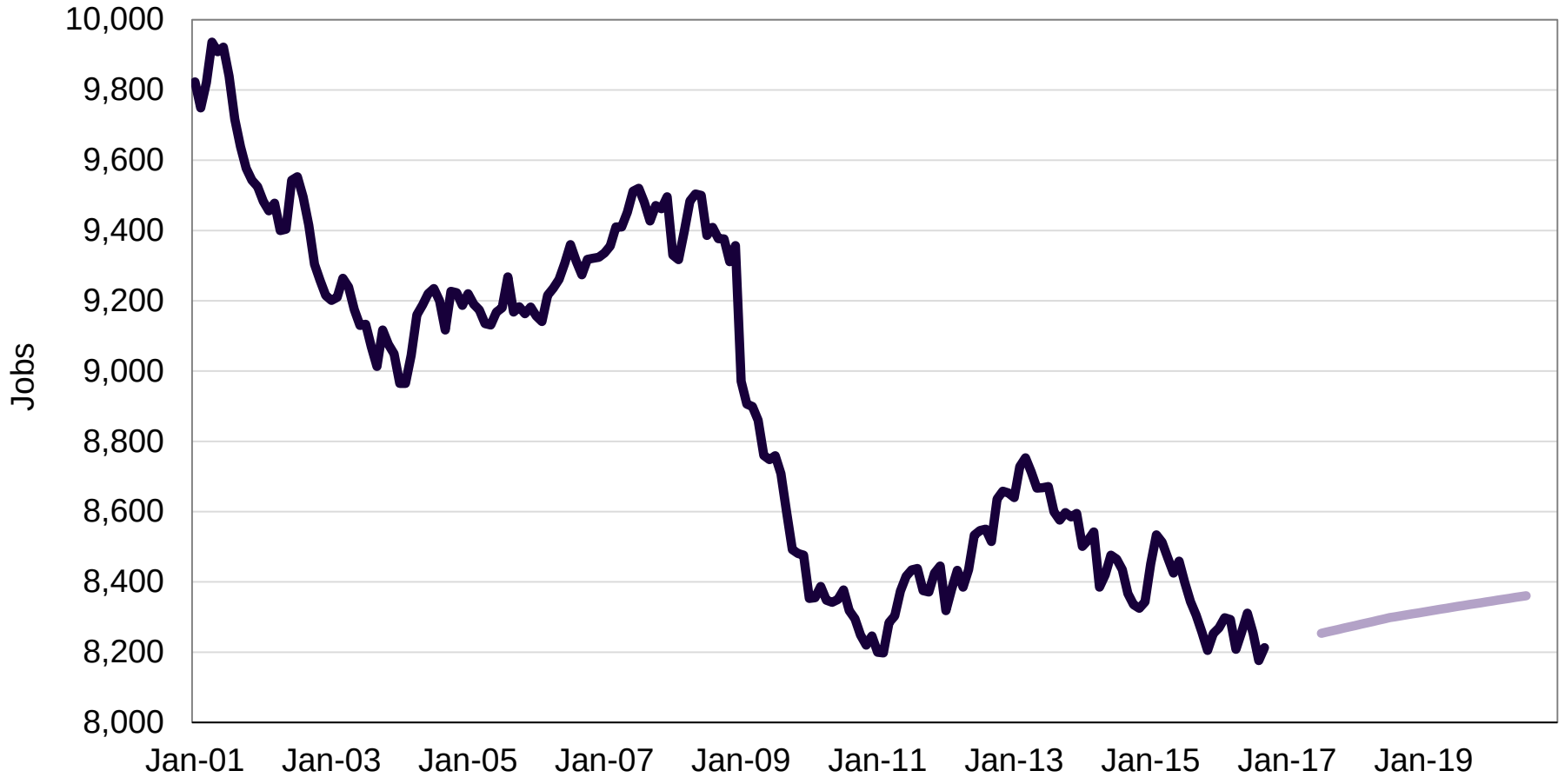
Mississippi Refinery and Chemical Manufacturing Employment Forecast



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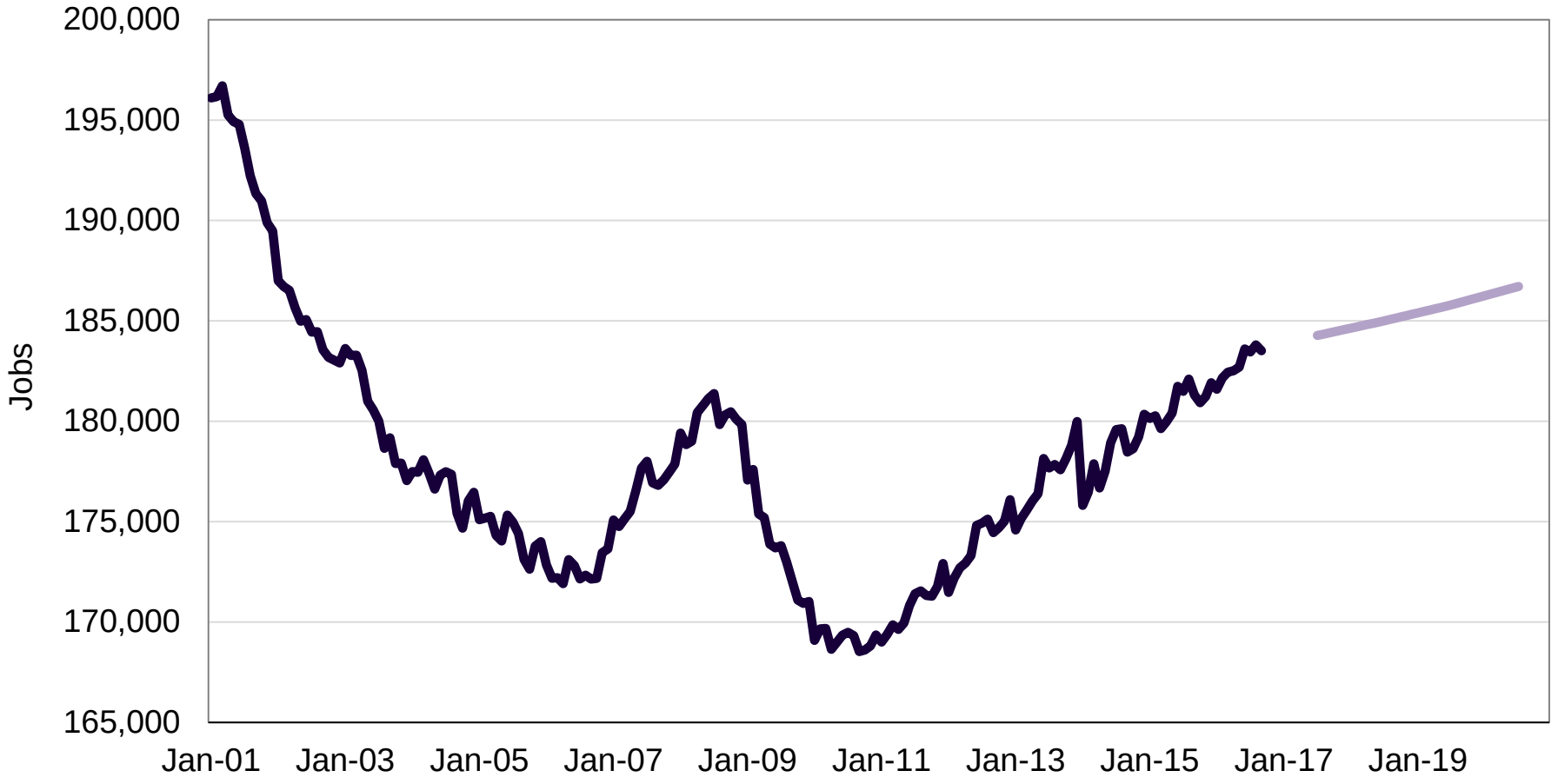

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