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Gulf Coast Energy Outlook 2019: Production, Trade and Infrastructure Trends.

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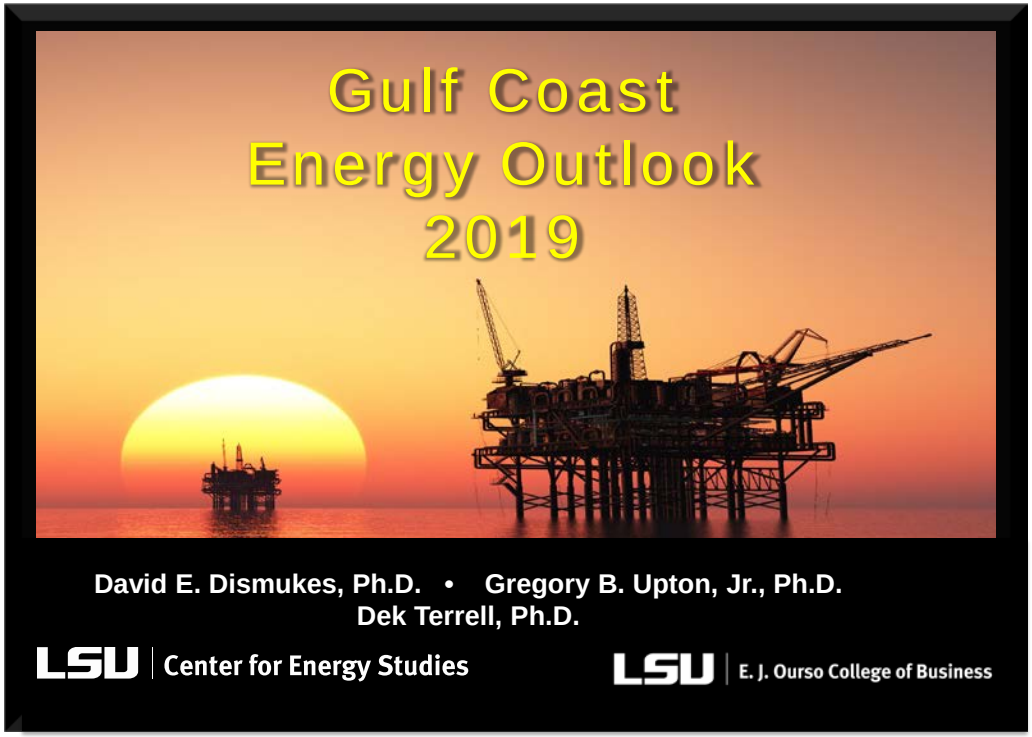
David E. Dismukes, Ph.D.
Center for Energy Studies
Louisiana State University

2019 Gulf Coast Energy Outlook

Presentation is based upon materials from recent 2019 GCEO.



Gold

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Silver

LLOG exploration

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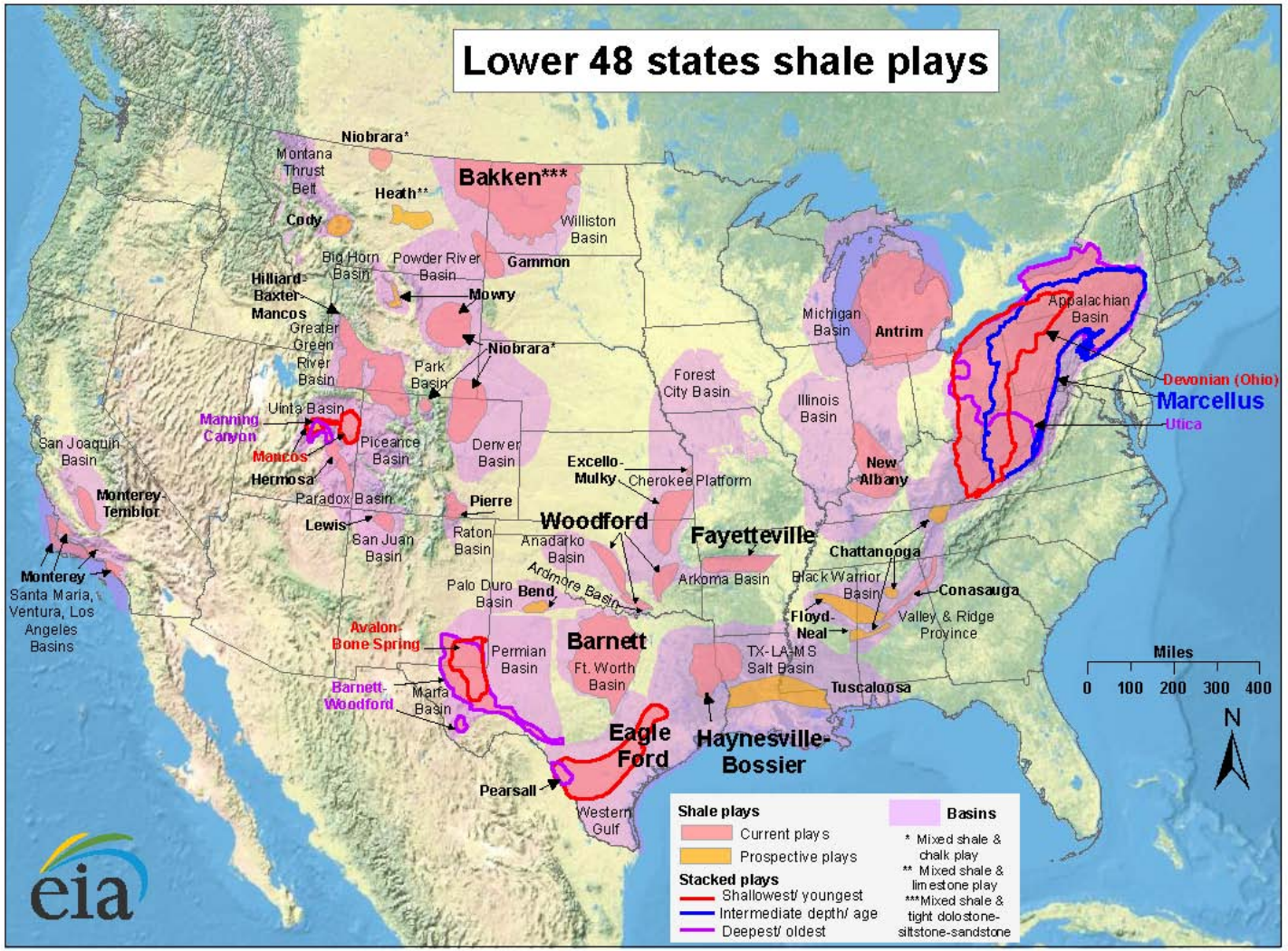
Bronze

Entergy

Crude oil and natural gas

Domestic shale gas basins and plays.

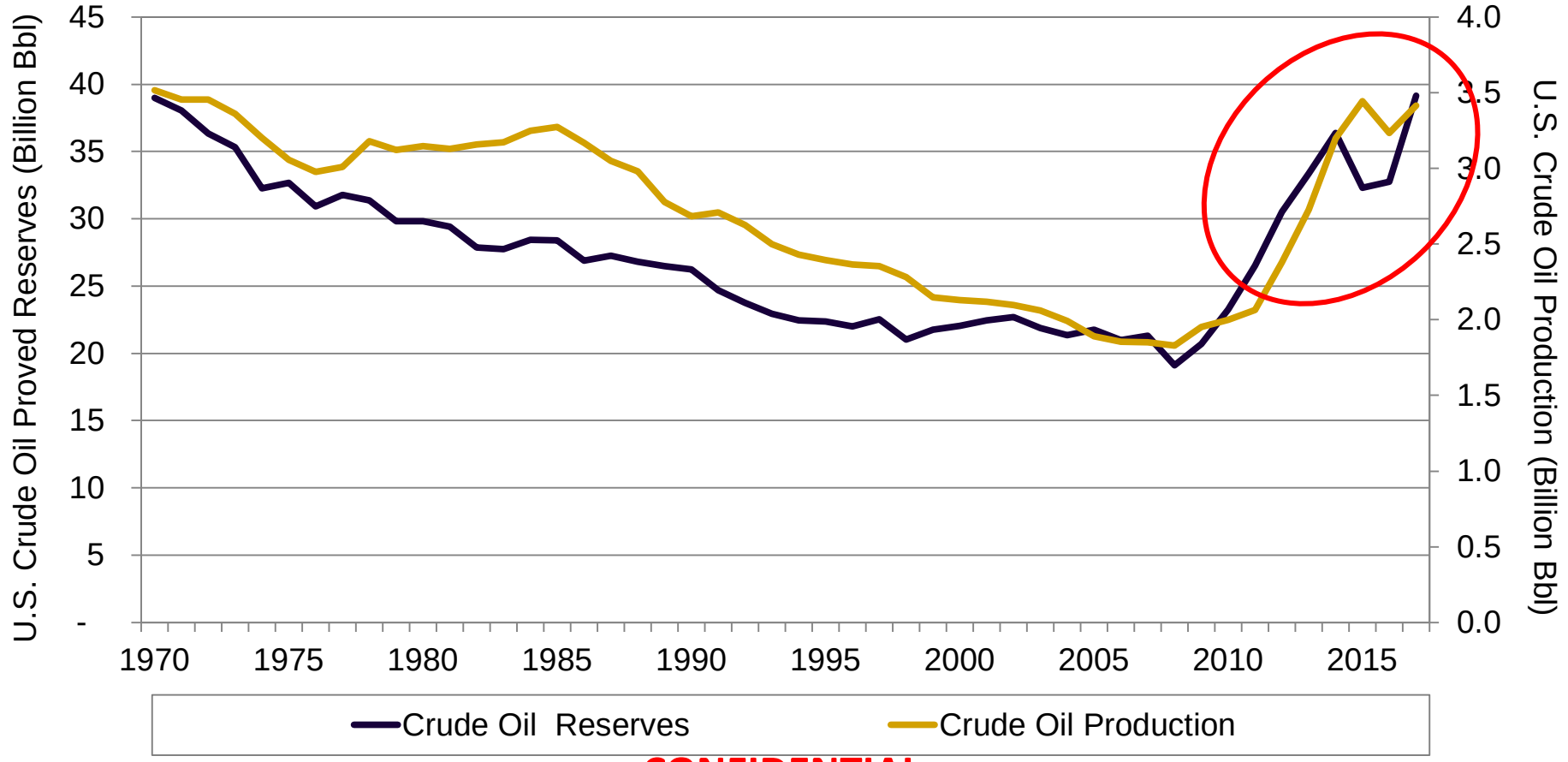
U.S. unconventional production from shale plays has **unleashed a considerable level of domestic energy production.** This production, however, is arising in new areas, leading to a number of **market, infrastructure, and institutional changes**.



Source: U.S. Energy Information Administration.

Changes in crude oil reserves and production.

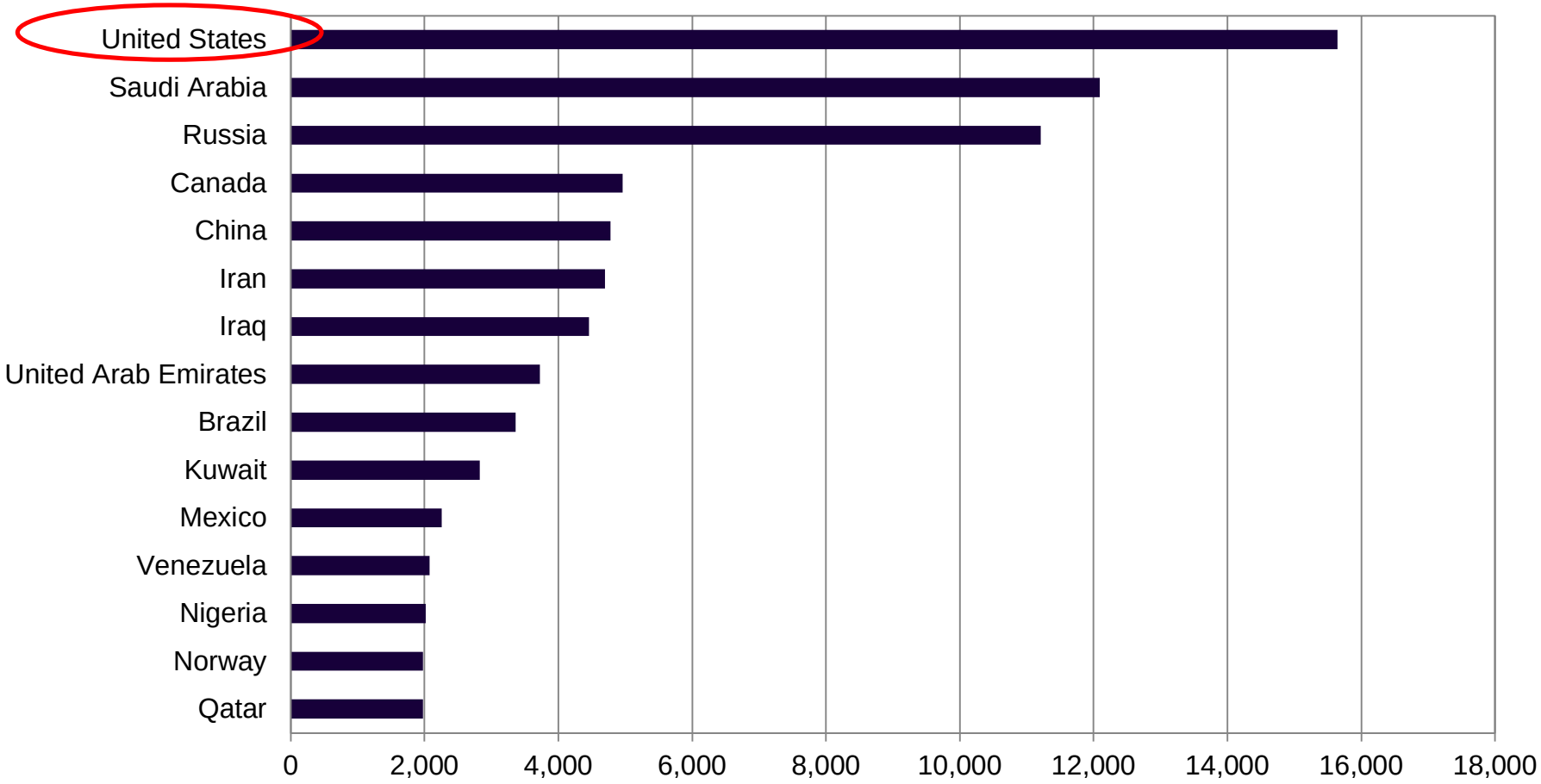
Crude oil production and reserves are climbing back to levels **not seen since the early 1980s (reserves).** Creates **new domestic resource opportunities** for U.S. refineries.



Source: U.S. Energy Information Administration.

World Crude Oil Production (2017)

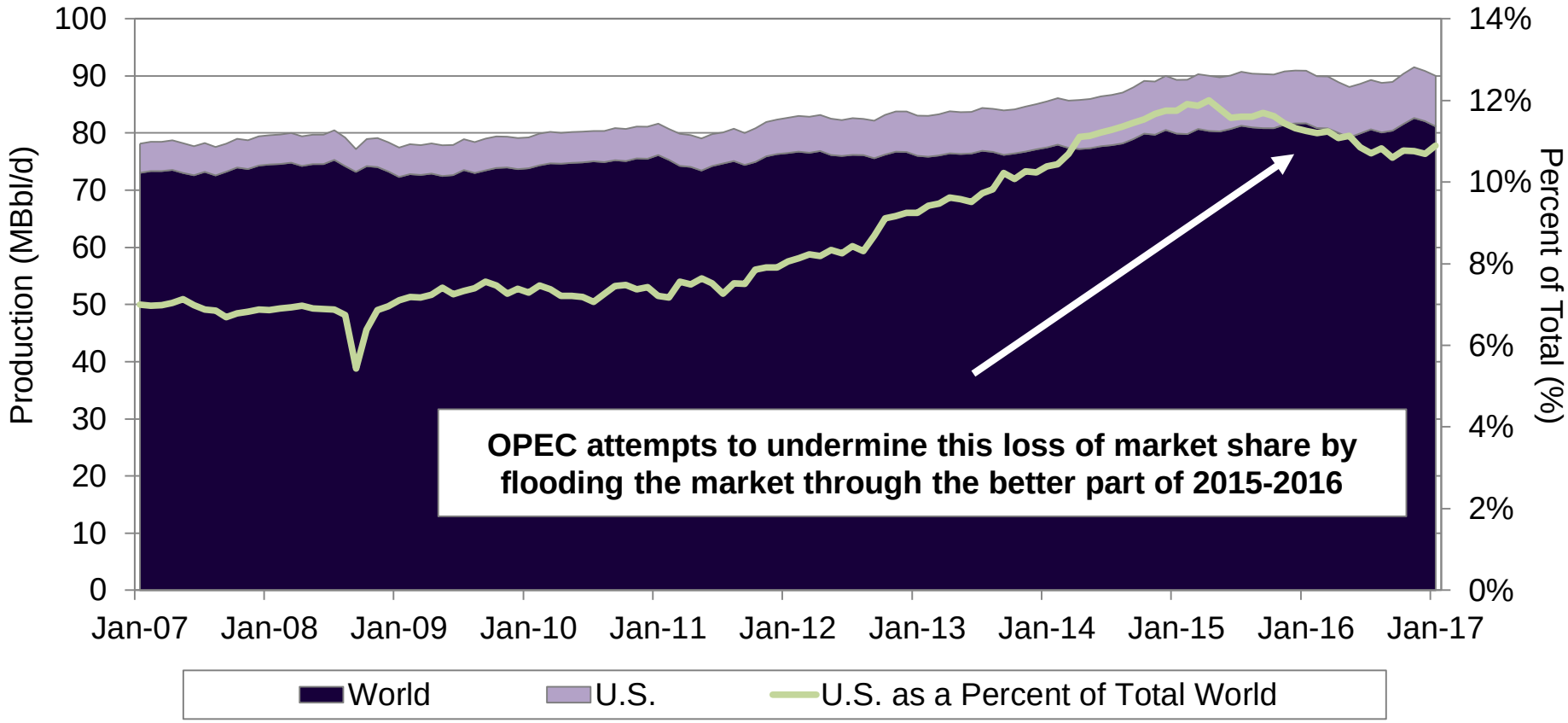
The U.S. is now the largest producer of crude oil (2017).



(In Thousands of Barrels; Includes Condensate)
Source: Energy Information Administration

Monthly global and U.S. crude oil production.

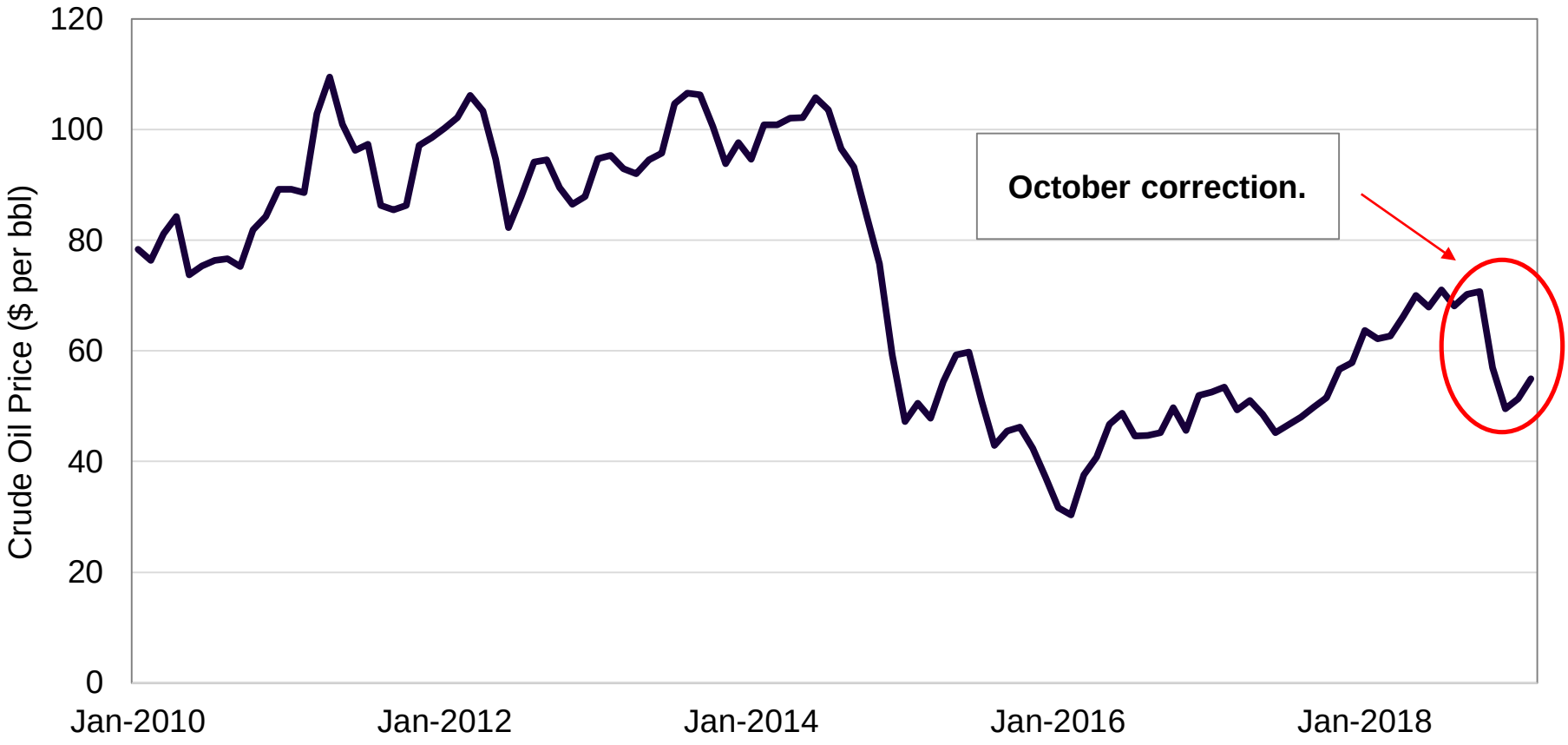
In the last ten years, global crude oil production has increased at an average annual rate of 1.3 percent. The U.S. share has increased from seven percent to around 12 percent.



Source: U.S. Energy Information Administration.

U.S. Crude Oil Prices

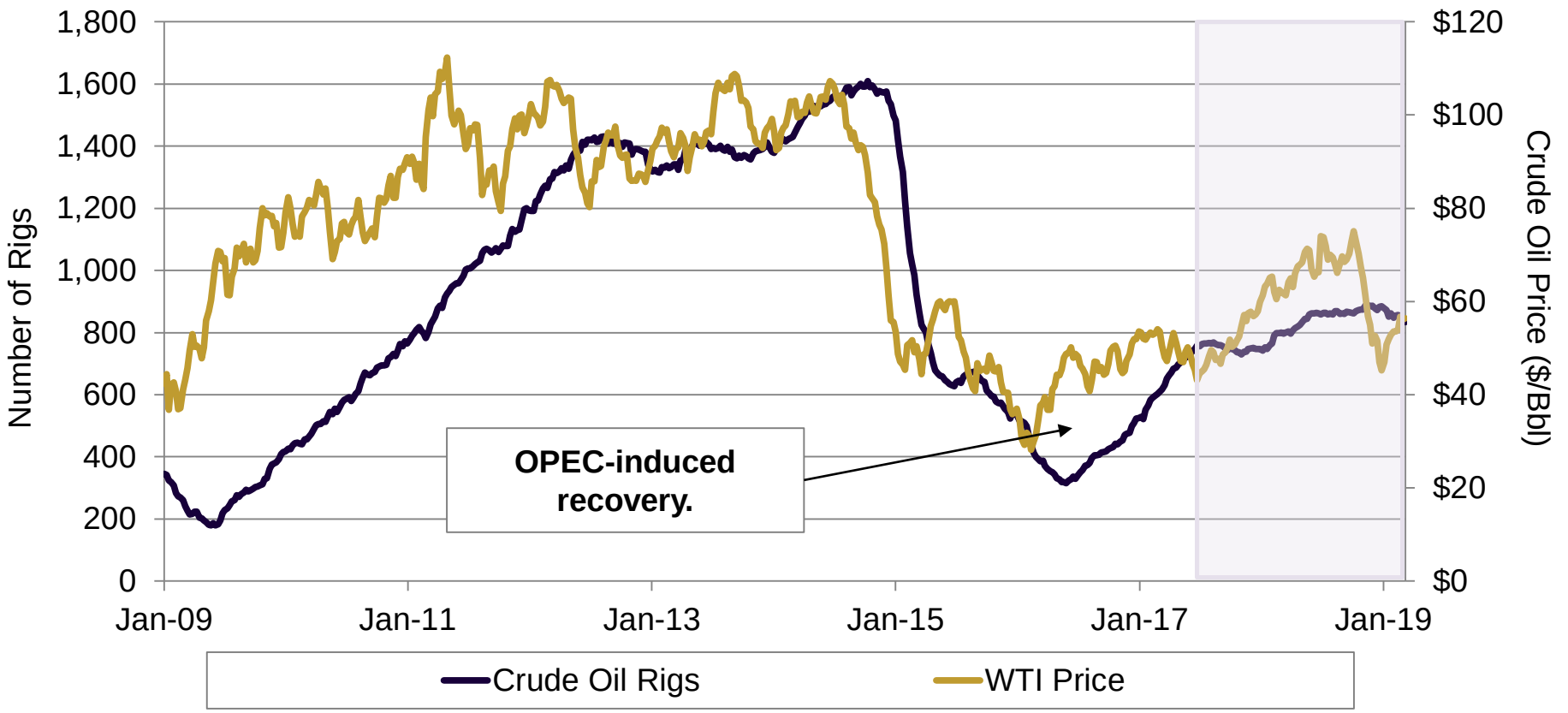
U.S. crude oil prices fell over 70 percent from over $100/bbl to around $35/bbl (June 2014 to February 2016). Recovery cut back about half of that difference.



Source: U.S. Energy Information Administration.

U.S. crude oil prices and rig count

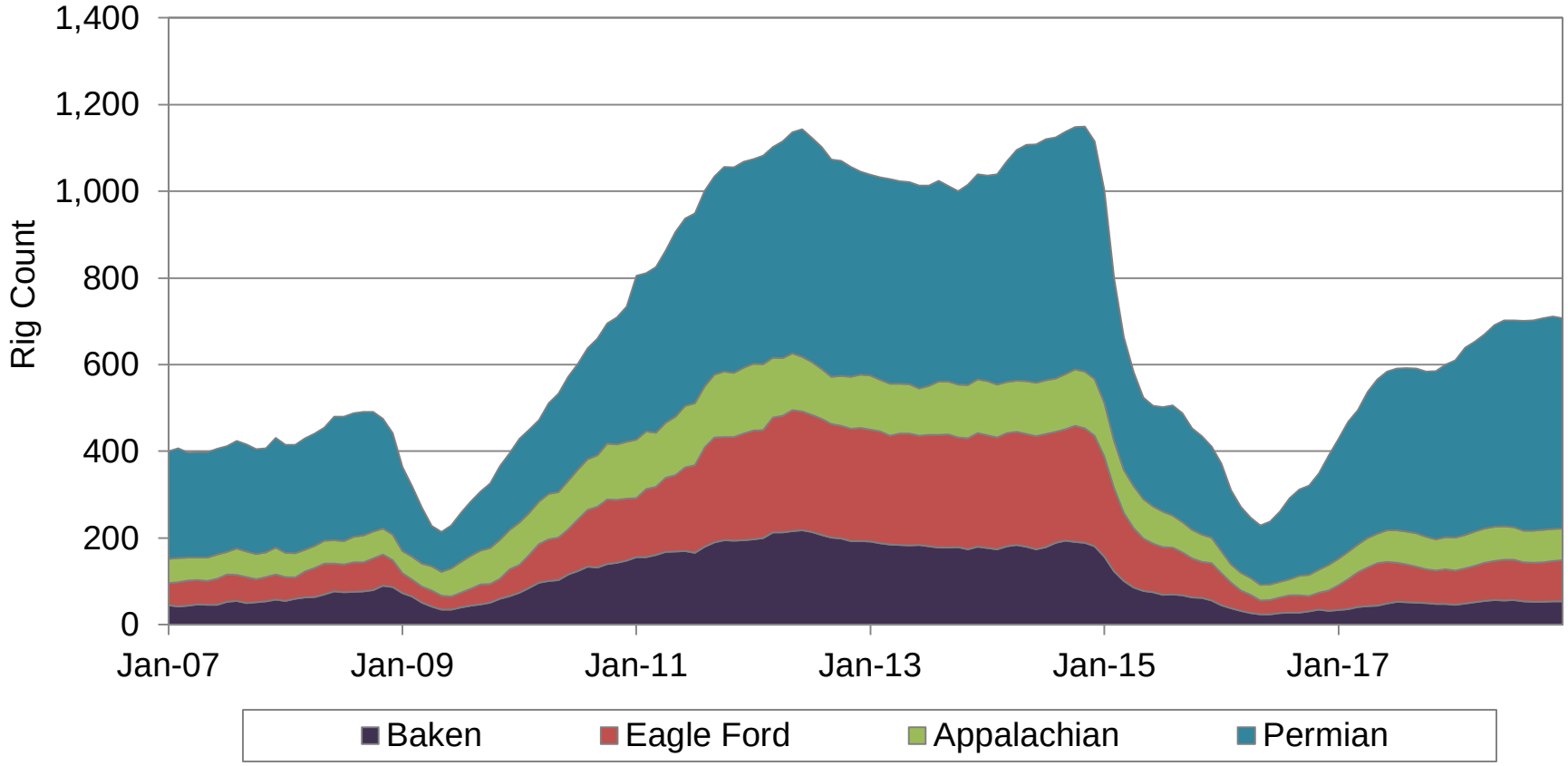
Price/rig price responsiveness is weakening considerably since mid-year 2017 (shaded area).



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

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

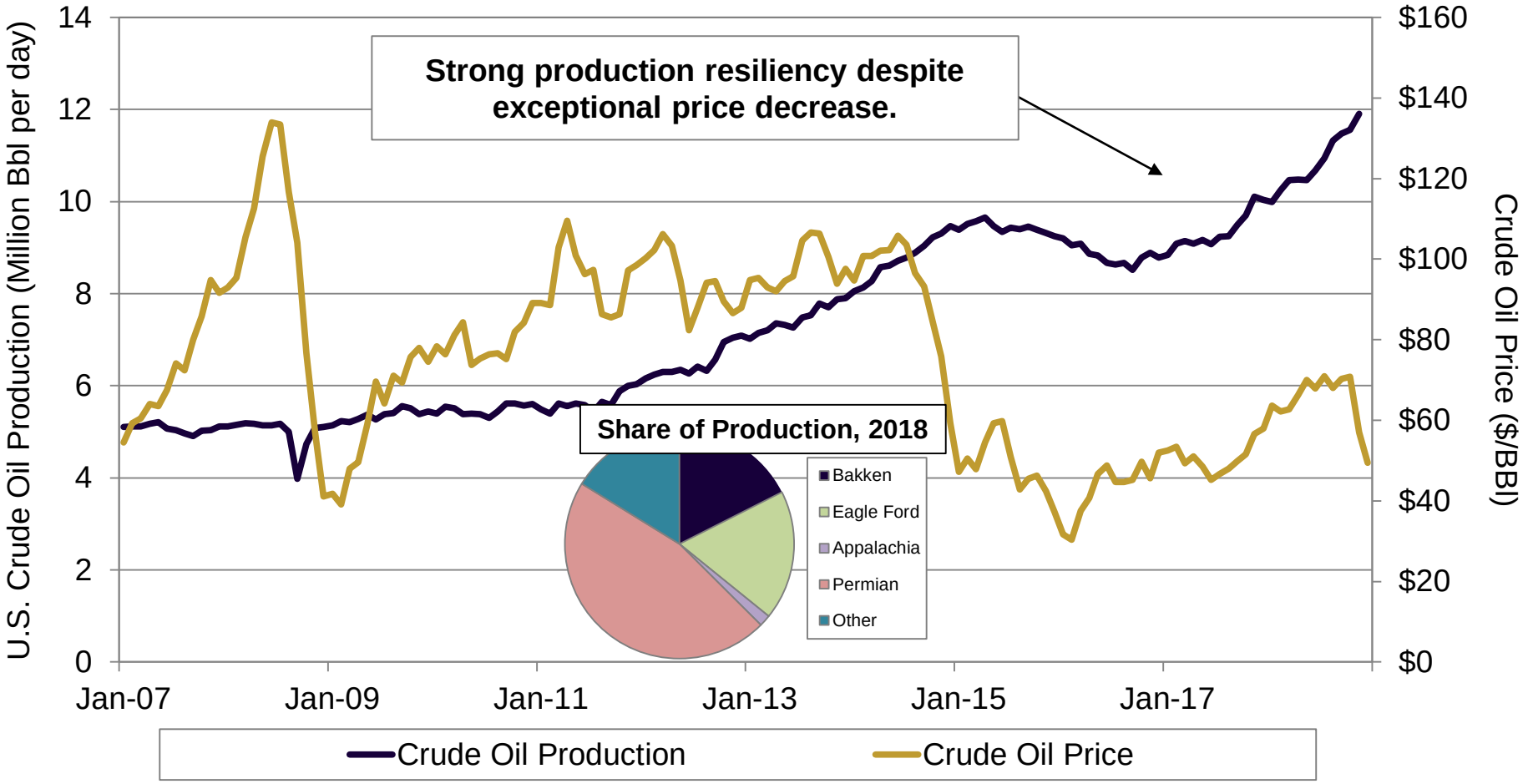
Horizontal rig activity increased by 400 percent to 2015 but fell by over half during the ensuing price collapse. Current rebound is highly concentrated in the Permian basin.



Source: U.S. Energy Information Administration.

Monthly U.S. crude oil production.

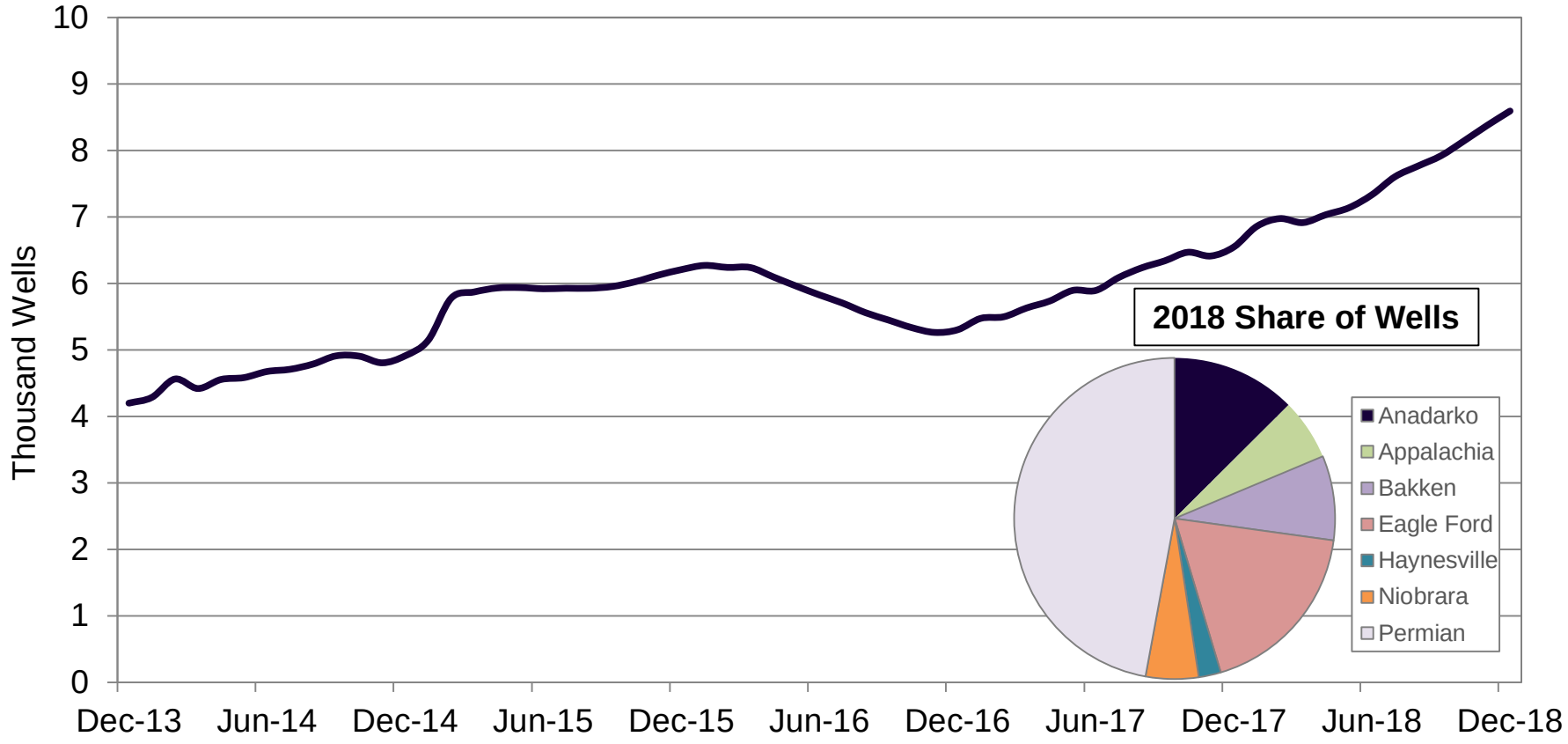
U.S. crude oil production volumes are up by over 100 percent relative to historic trends. While production was down, it is still resilient and strong.



Source: U.S. Energy Information Administration.

Monthly drilled but uncompleted wells.

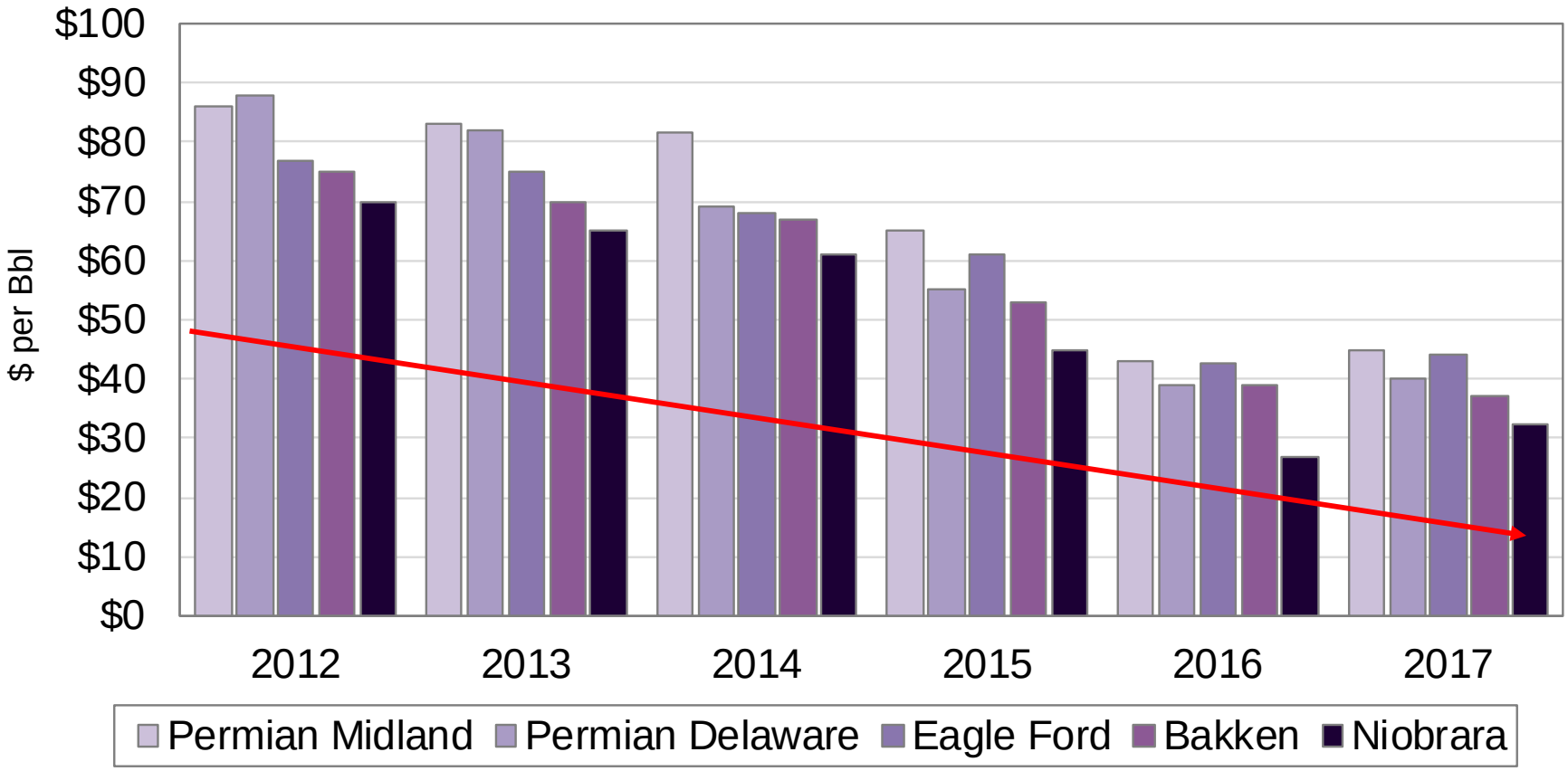
Drilled but uncompleted wells have increased by almost 50 percent in the last few years.



Source: U.S. Energy Information Administration.

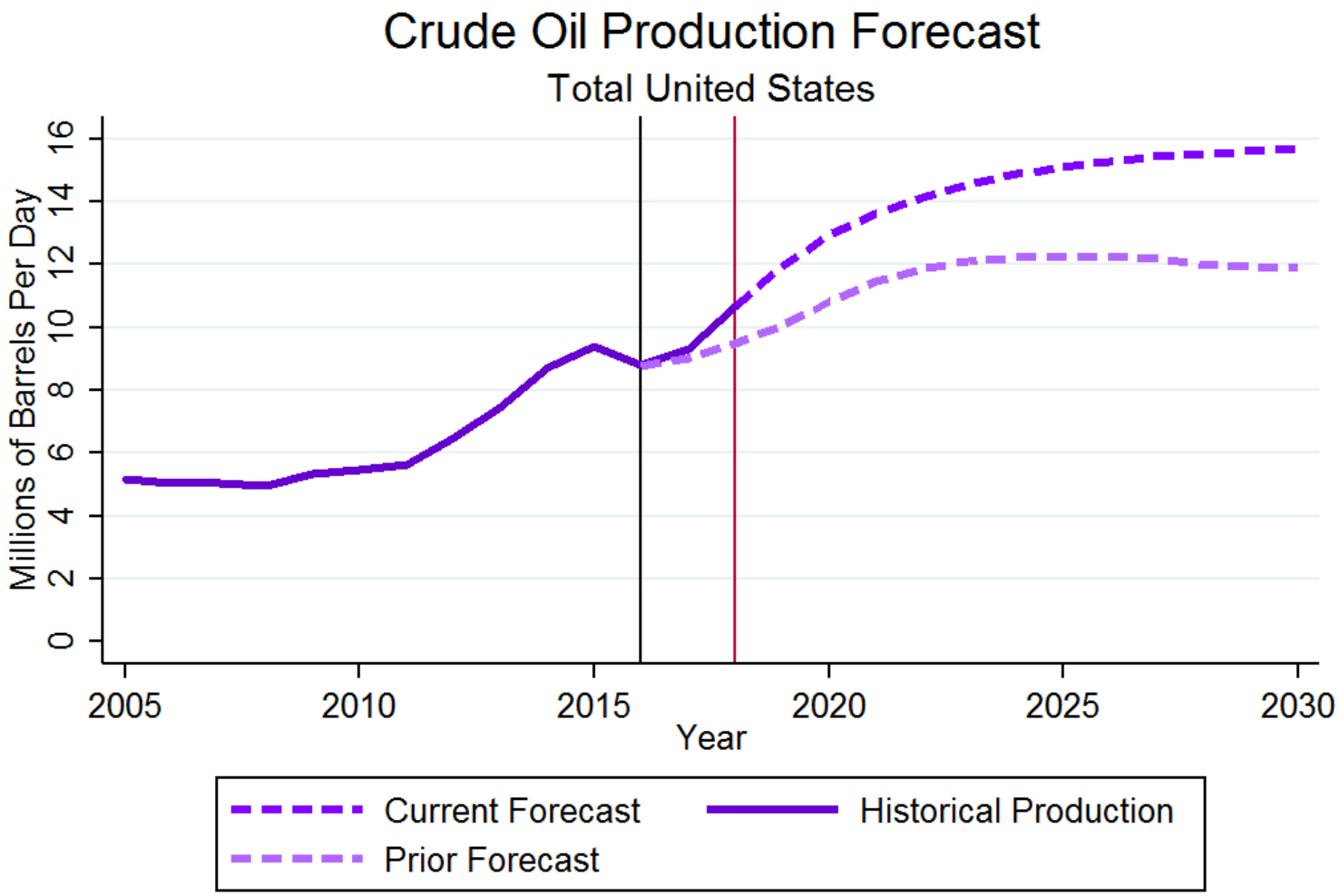
Wellhead breakeven prices for key shale plays.

Since 2012, the average wellhead break-even price for key shale plays has decreased from $79 per barrel to $40 per barrel, representing an average decrease of nearly 50 percent.



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

Forecast Performance



Forecasts based on DrillingInfo Prodcast.

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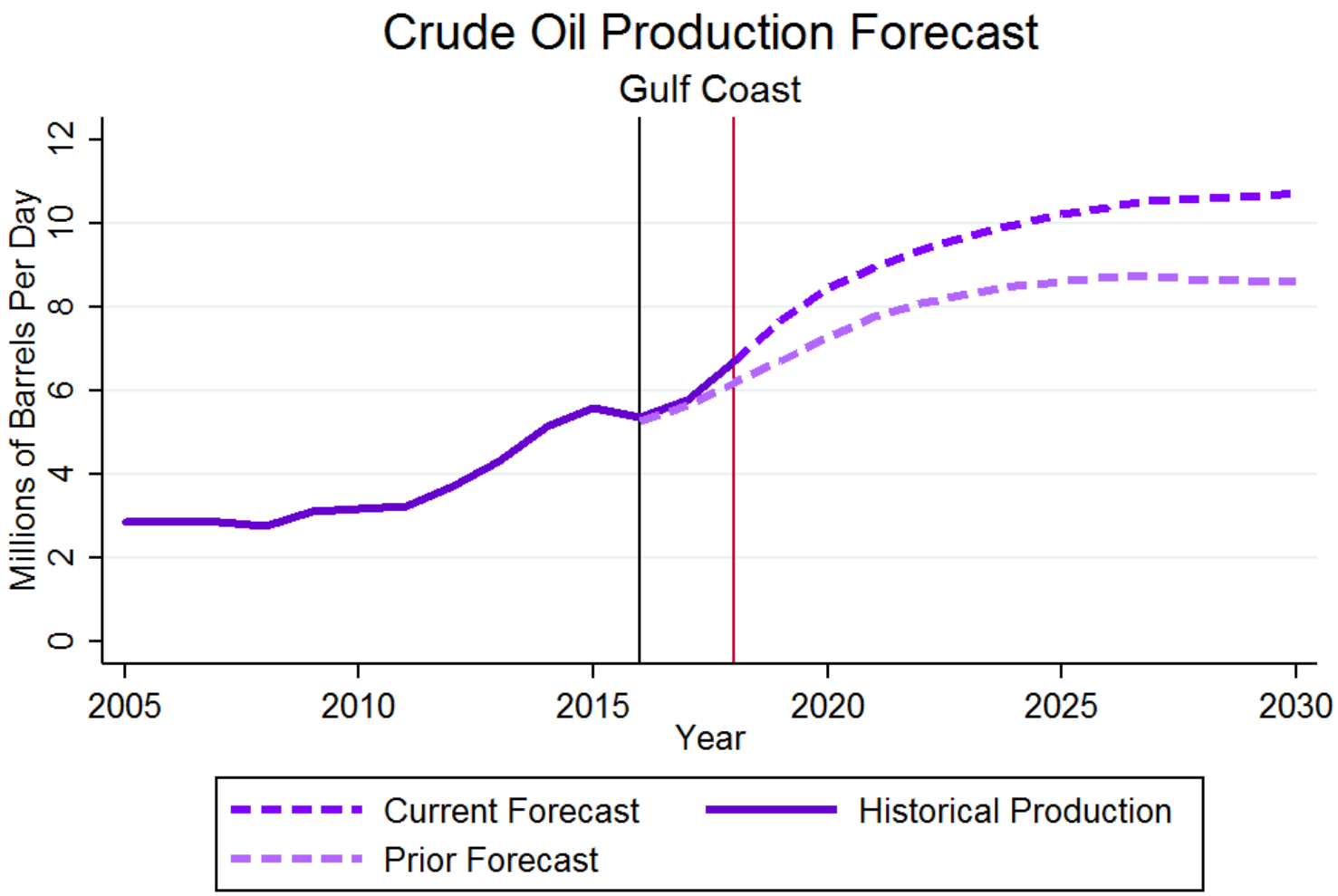
Forecast Performance



Forecasts based on DrillingInfo Prodcast.

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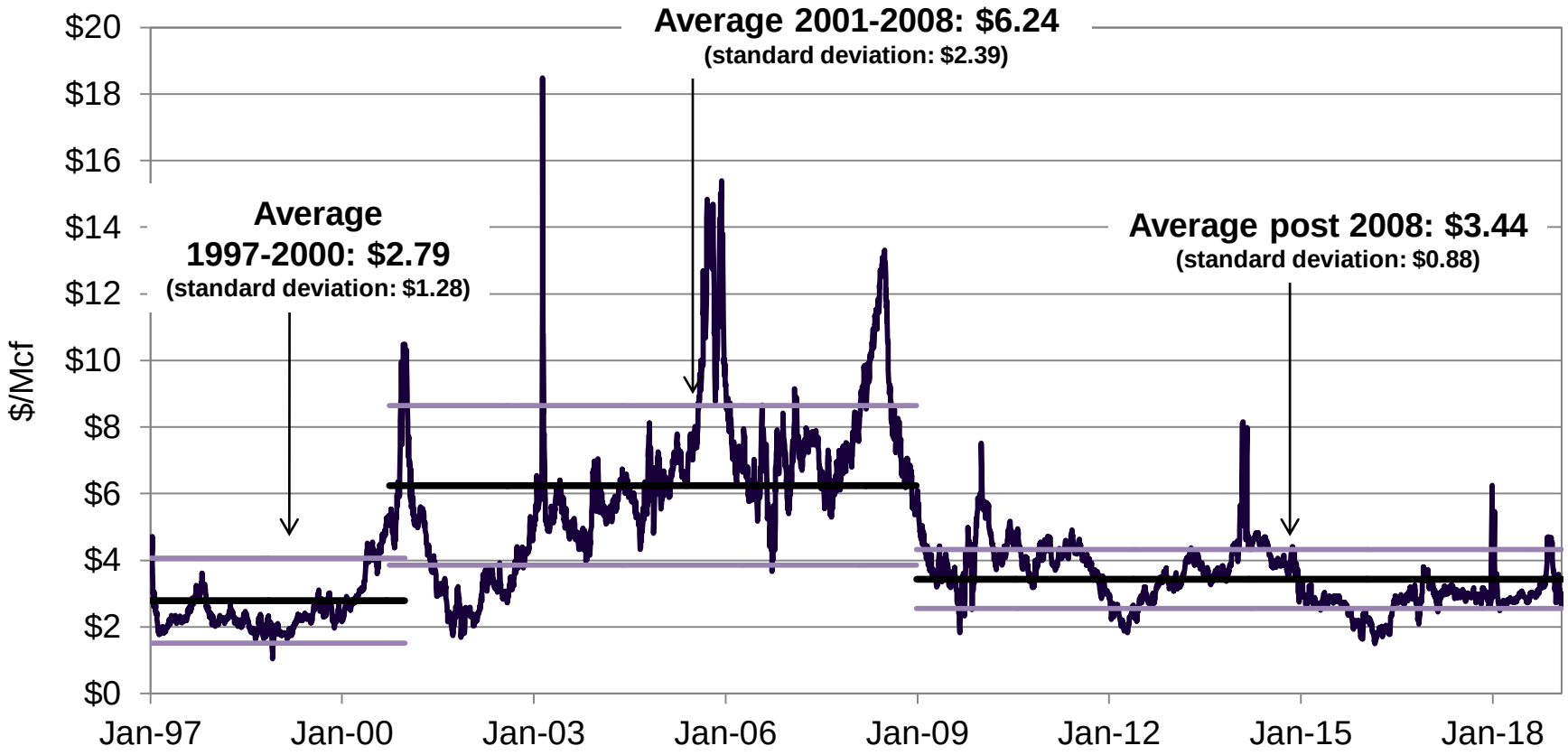
Natural gas price trends

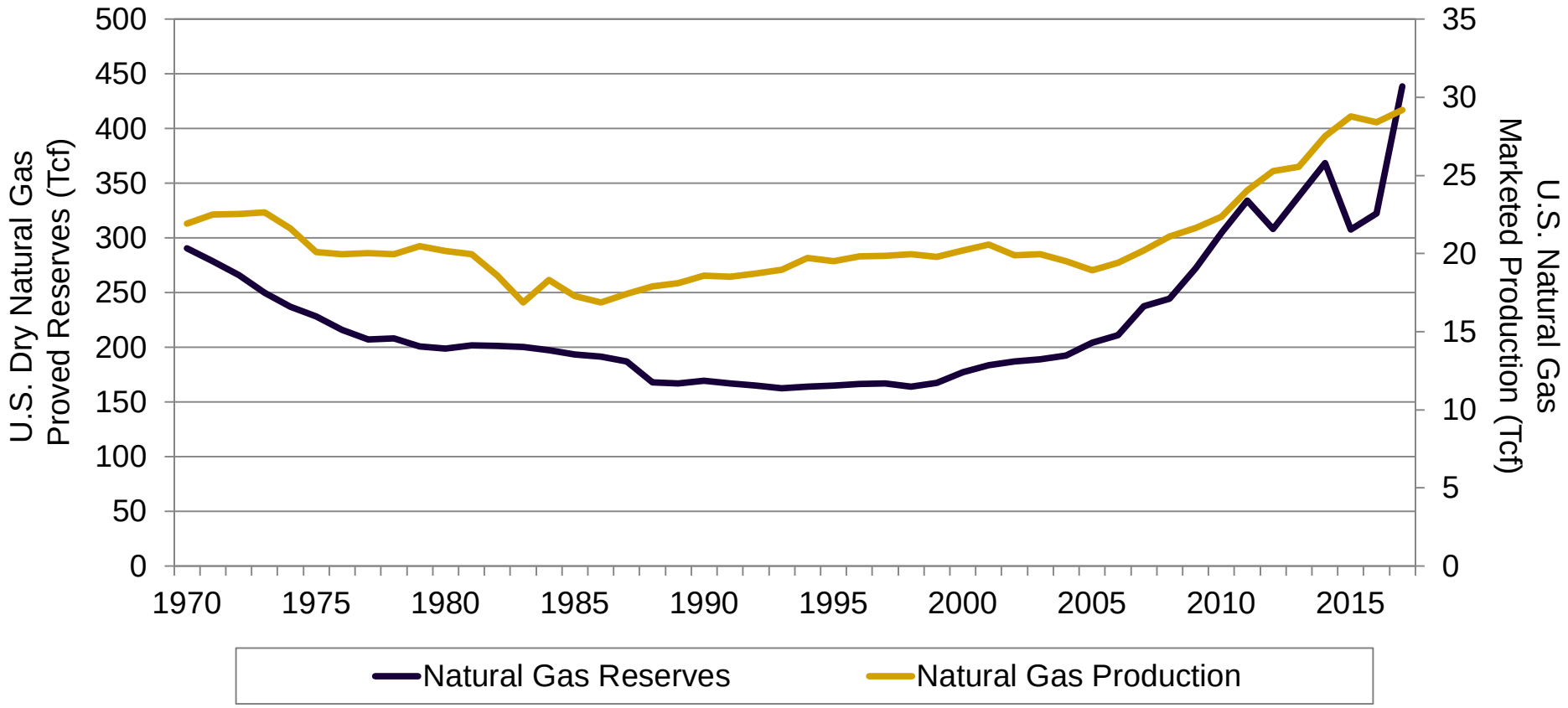
Natural gas price reductions (and reductions in volatility) are the direct result of unconventional oil and gas development.



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

Changes in Reserves and Production

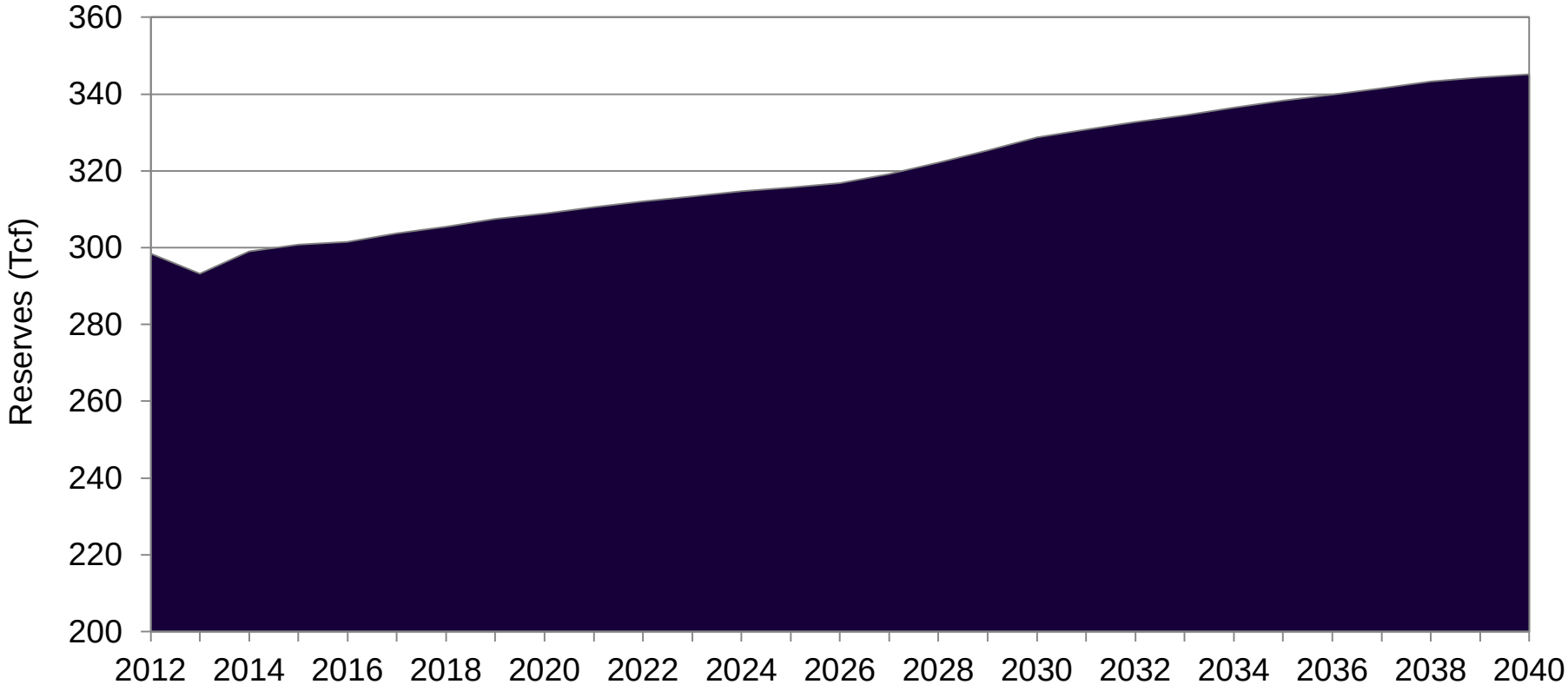
Natural gas production and reserves are at levels not seen since the 1970s and both U.S. natural gas production and reserves are now at an all time recorded peak.



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

Annual Energy Outlook, Natural Gas Reserves

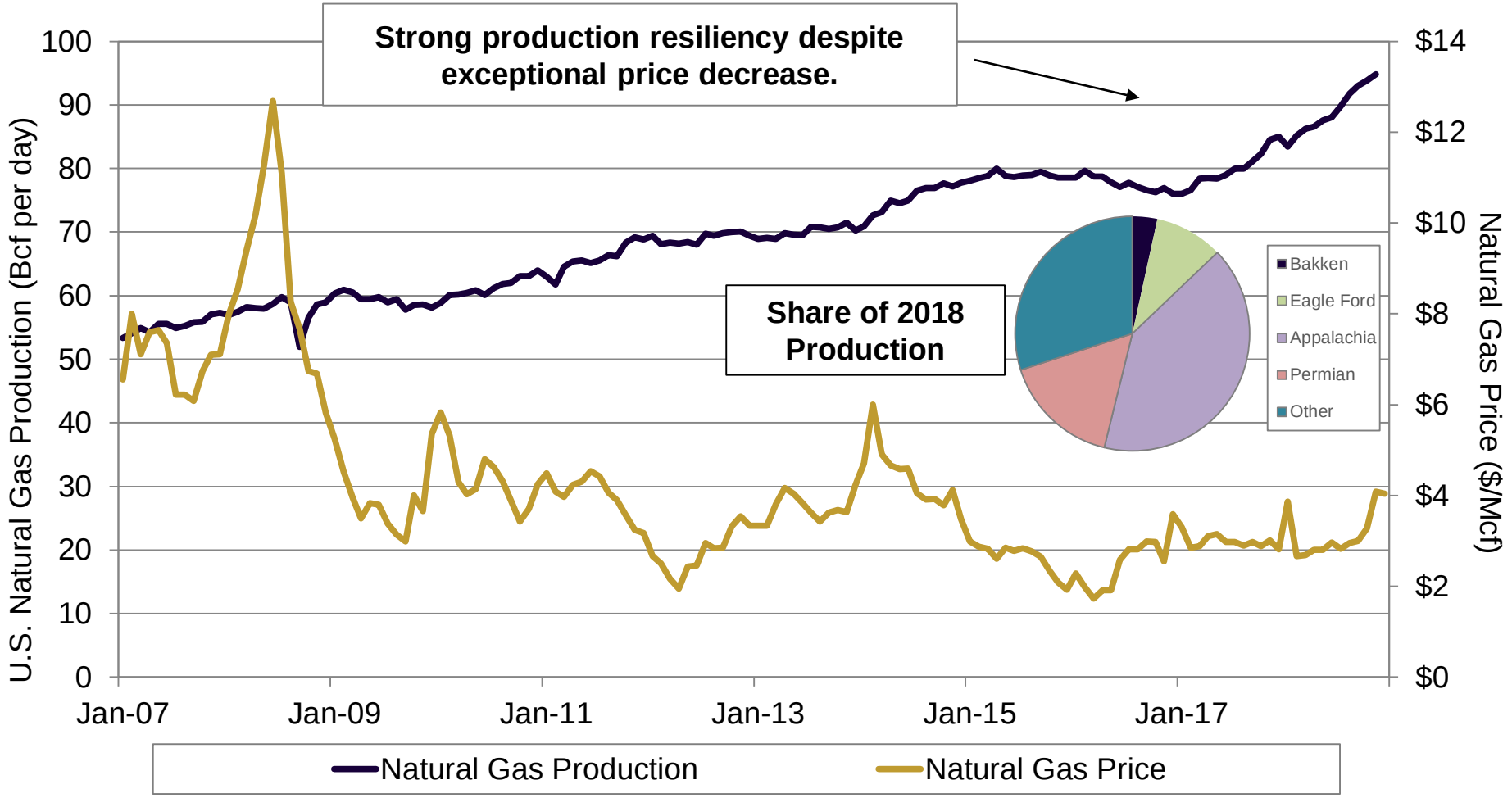
Unconventional resources are not a "flash in the pan" and are anticipated to continue to increase over the next two decades or more.



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

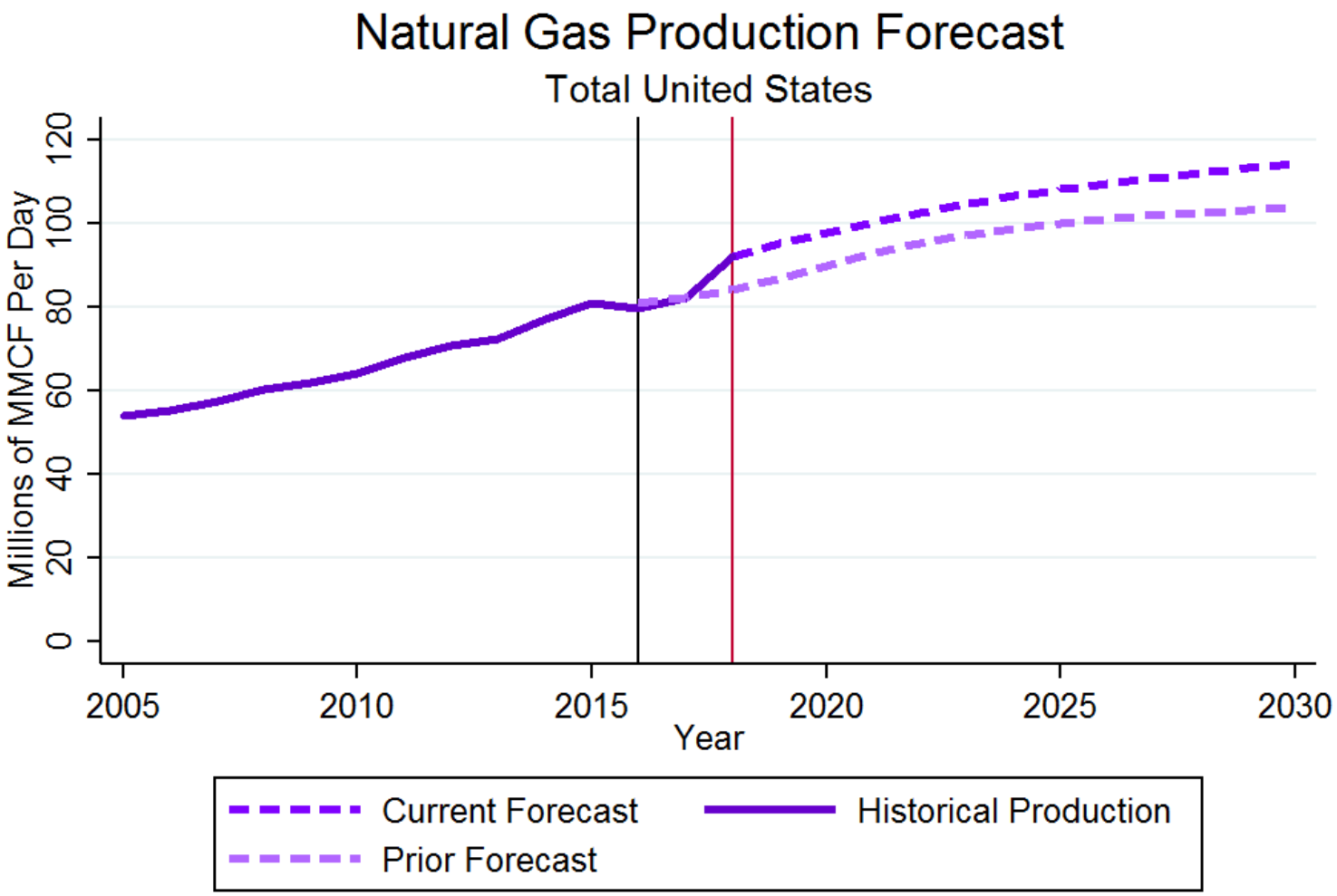
Monthly U.S. natural gas production.

U.S. natural gas production has increased 62 percent in the last 10 years.



Source: U.S. Energy Information Administration.

Forecast Performance



Forecasts based on DrillingInfo Prodcast.

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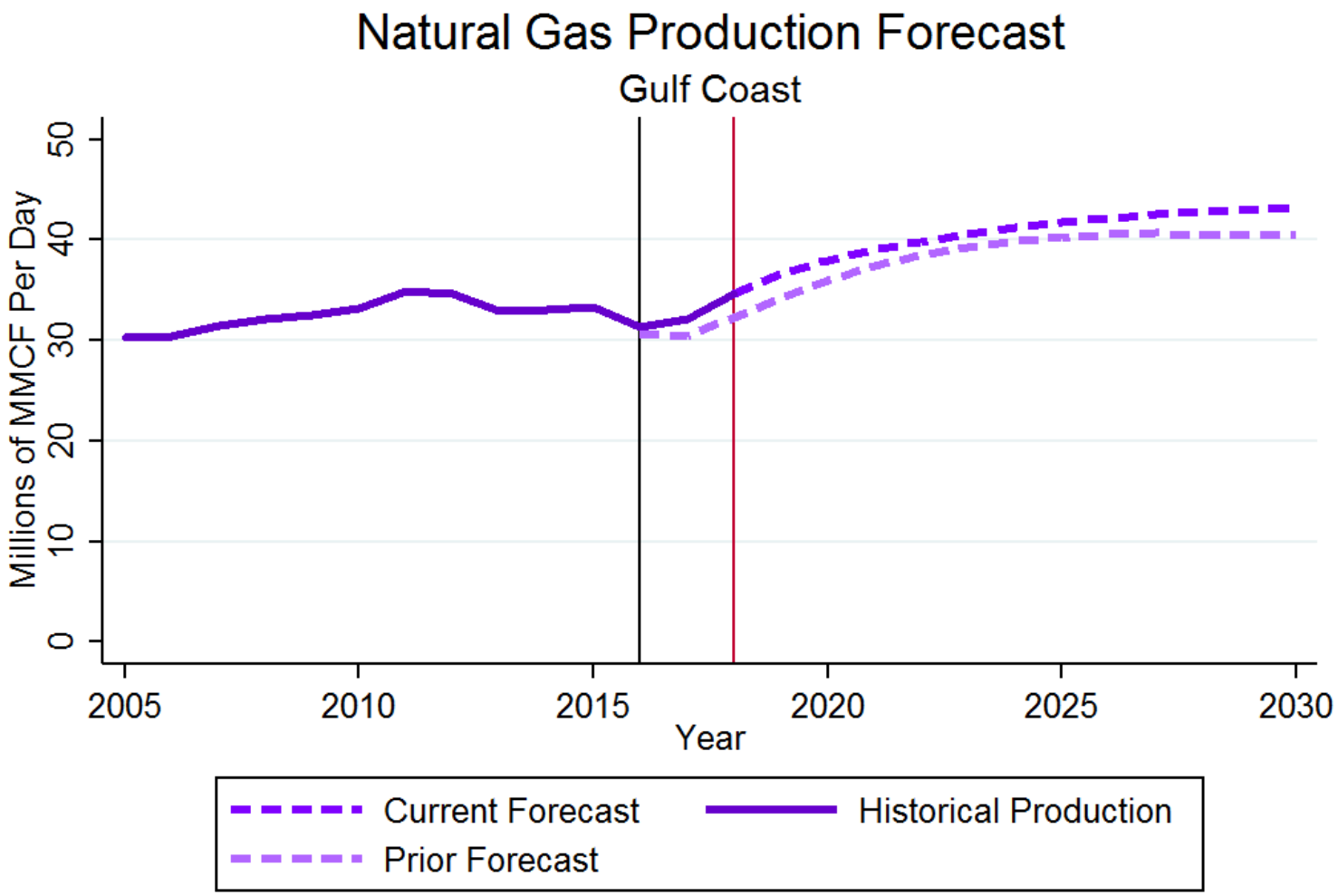
Forecast Performance



Forecasts based on DrillingInfo Prodcast.

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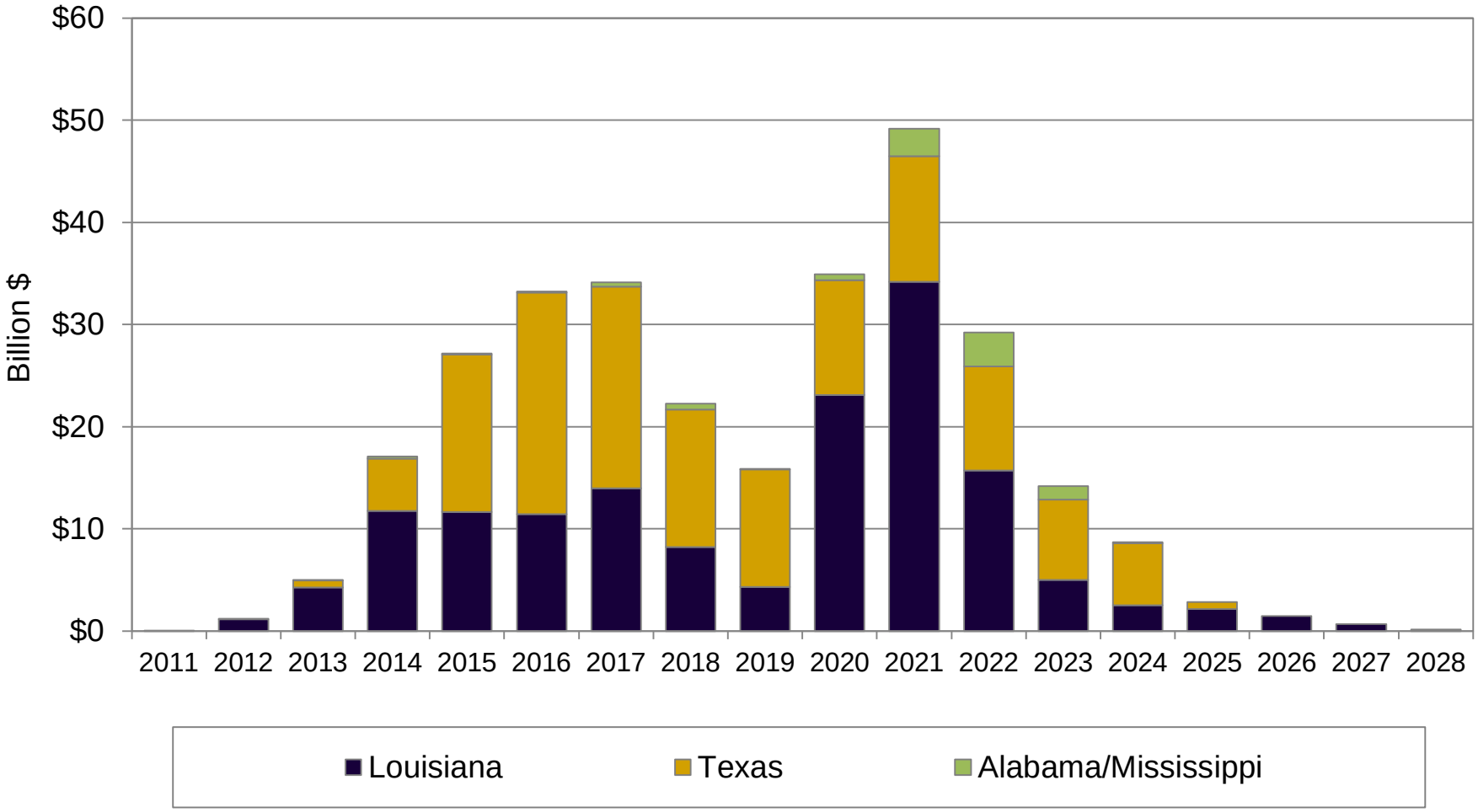
Energy infrastructure

Gulf of Mexico region – energy manufacturing capital expenditures (by State)

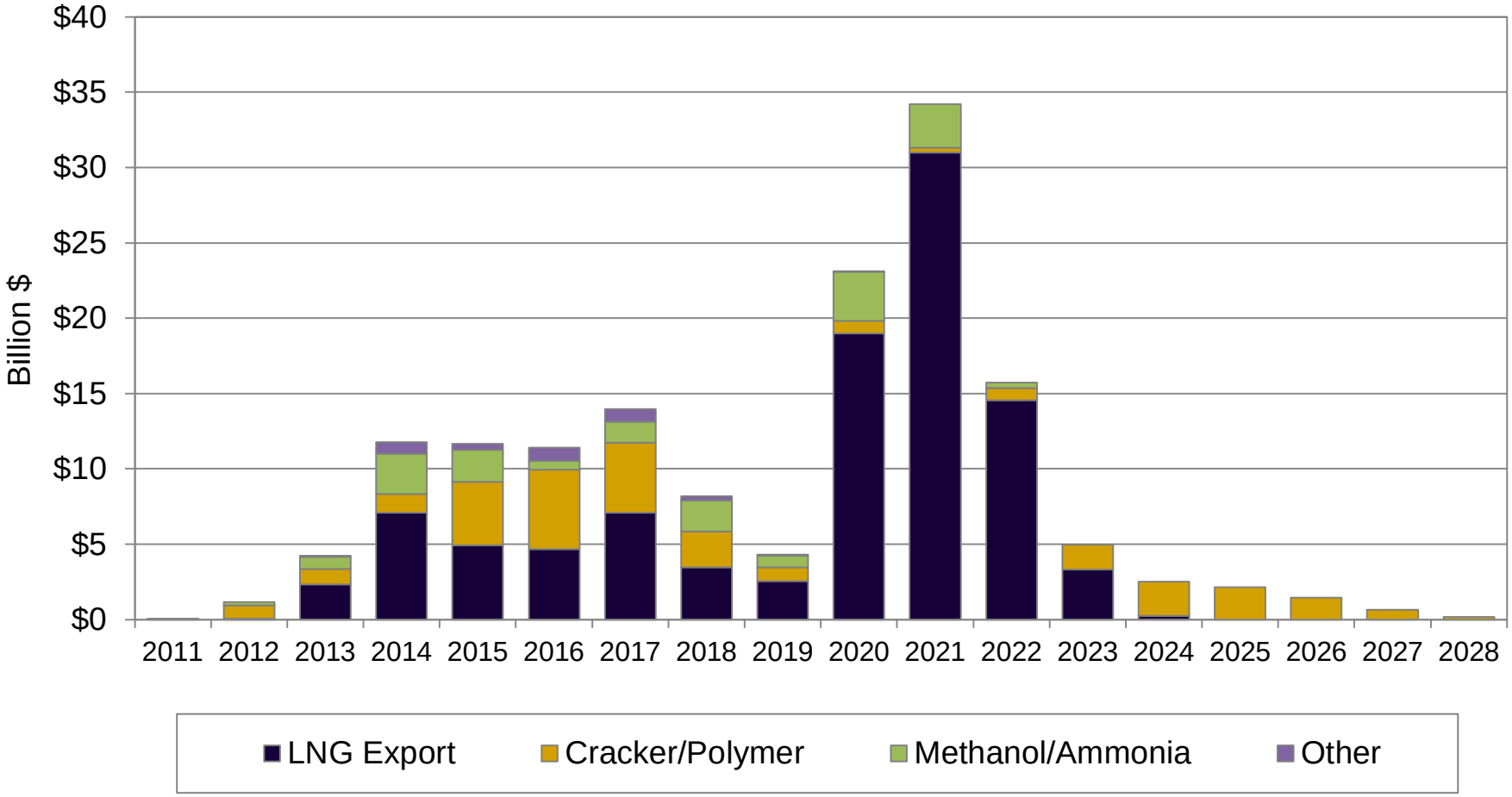
Capital expenditures have been relatively balanced across the two states.



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.

Louisiana total capital expenditures by sector

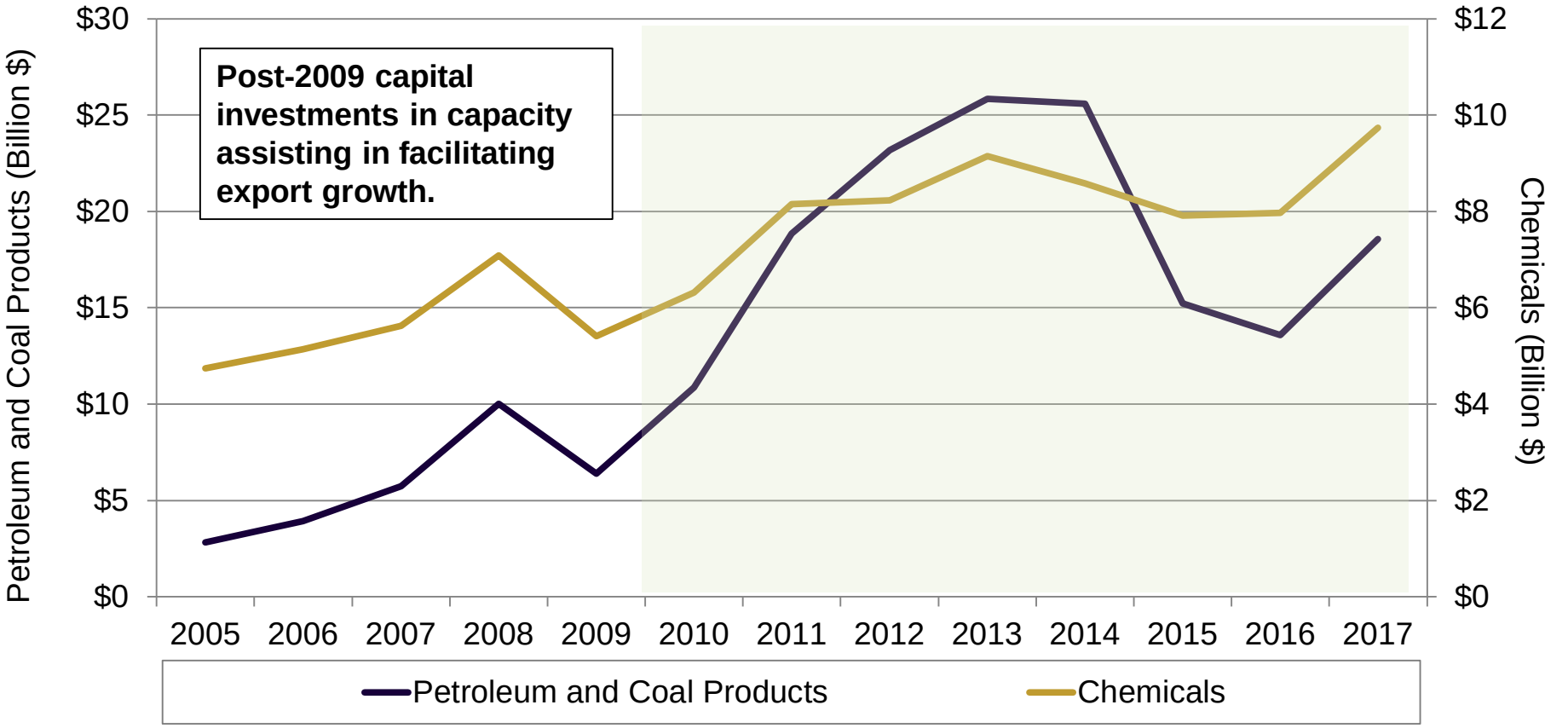
The Louisiana capital expenditures are more heavily weighted to LNG export facilities than in Texas.



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.

Louisiana exports (chemicals and refined product).

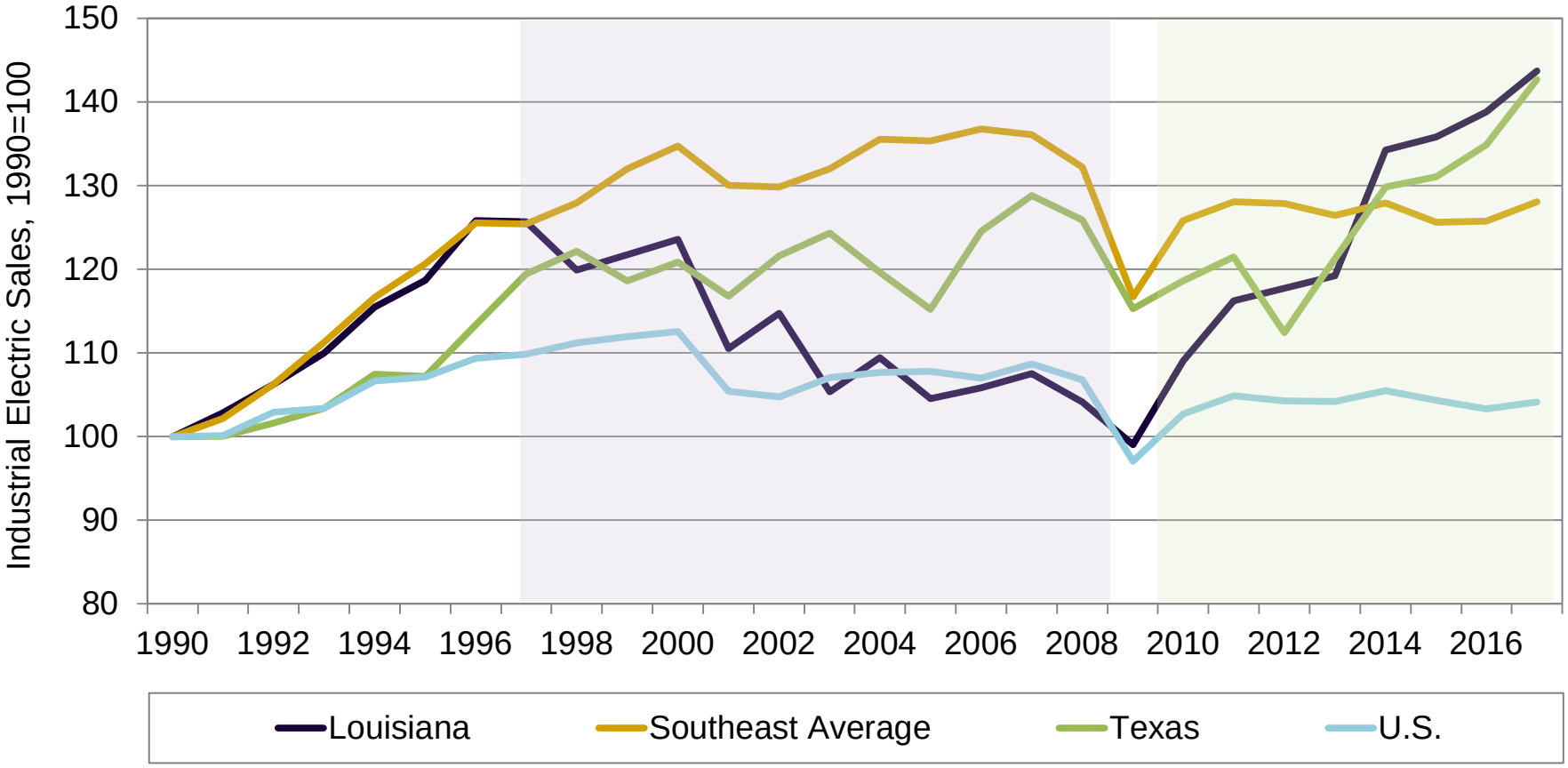
Louisiana exports of petroleum and coal products increased 190 percent between 2009 and 2014 but have fallen in recent years. Chemical exports have increased 301 percent since 2009. All facilitated by new capacity investments.



Source: International Trade Administration

Industrial electric sales comparisons

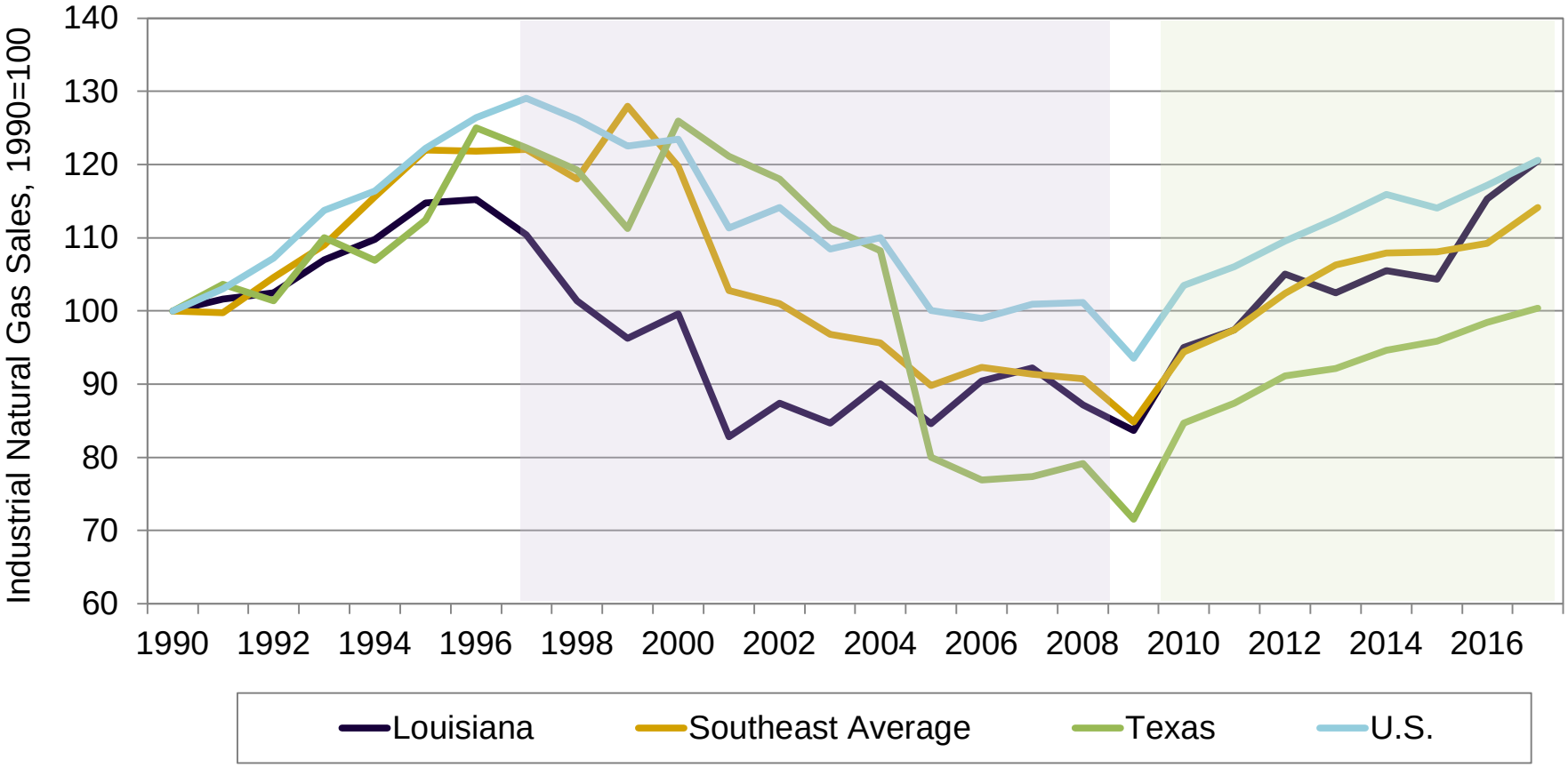
Louisiana's industrial electric sales (proxy for onsite production activity) fell 21 percent between 1996 and 2009. Since then, they have jumped 45 percent.



Note: Southeast states include Alabama, Arkansas, Florida, Mississippi and Georgia.
Source: U.S. Energy Information Administration.

Industrial natural gas sales comparisons

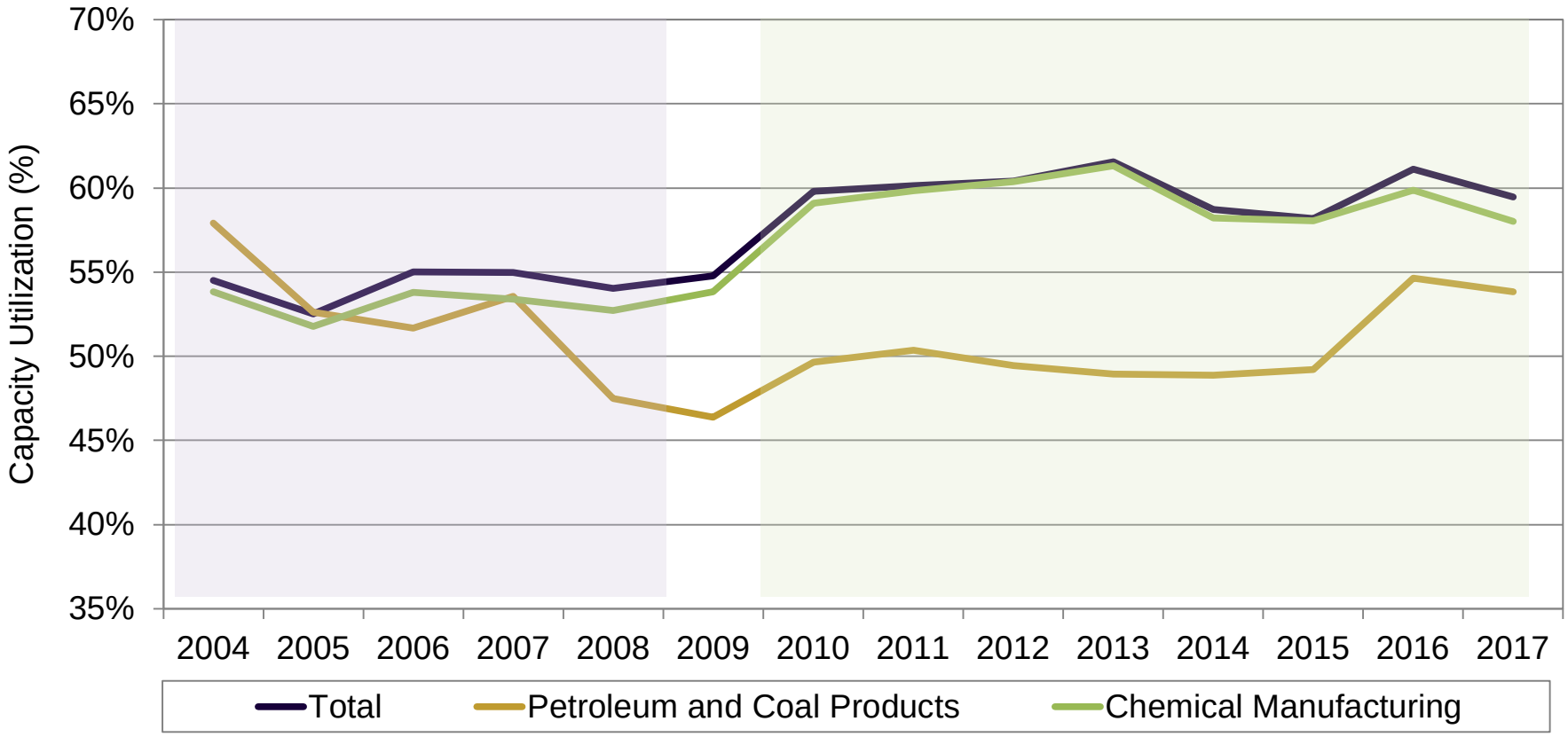
Louisiana's industrial natural gas sales (proxy for onsite production activity) fell 27 percent between 1996 and 2009. Since then, they have increased 44 percent.



Note: Southeast states include Alabama, Arkansas, Florida, Mississippi and Georgia.
Source: U.S. Energy Information Administration.

Estimated Louisiana CHP utilization

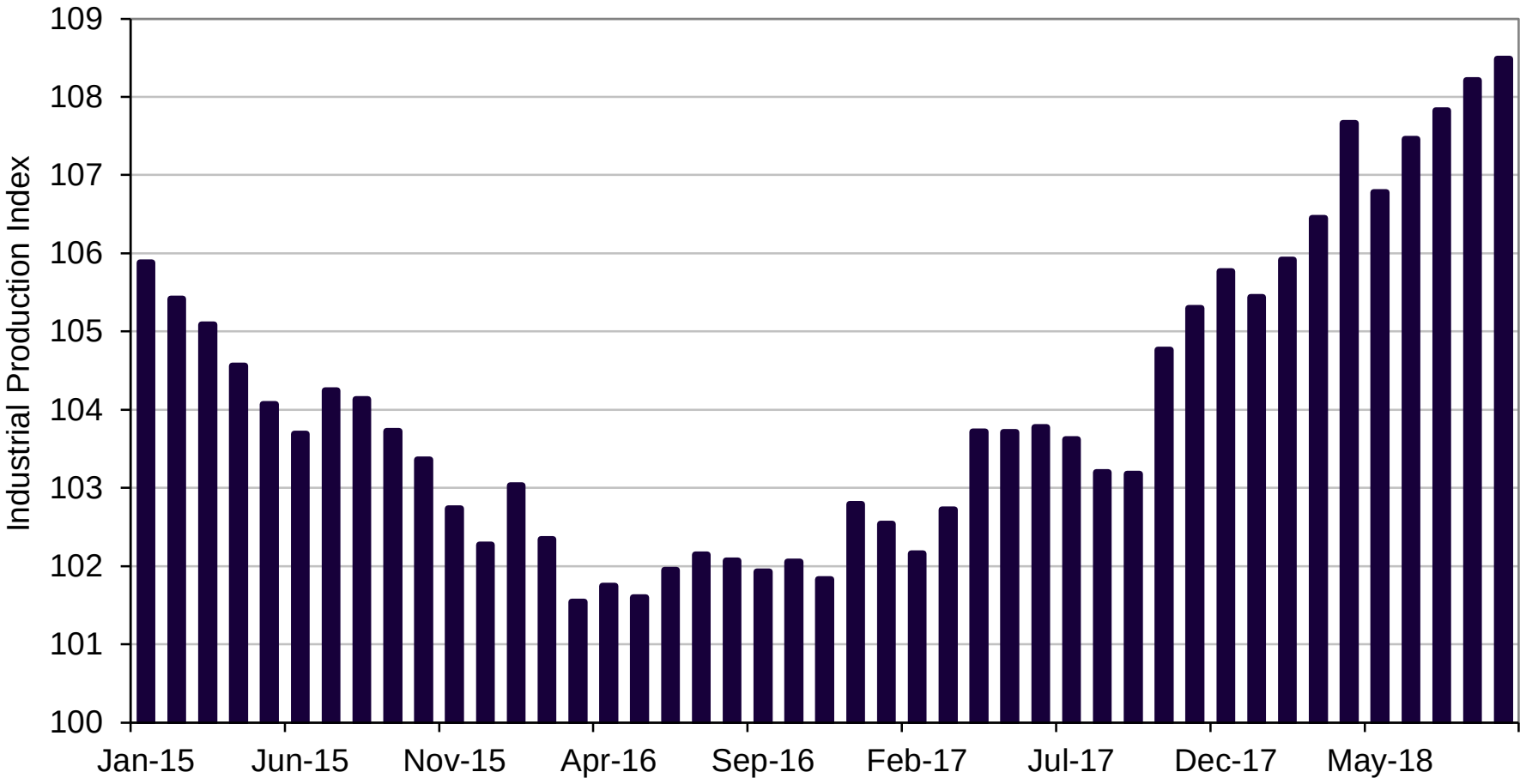
Cogeneration utilization (proxy for onsite production activity) at existing facilities has been stable, increasing slightly in 2015 and 2016.



Source: U.S. Energy Information Administration.

U.S. Industrial Production Index

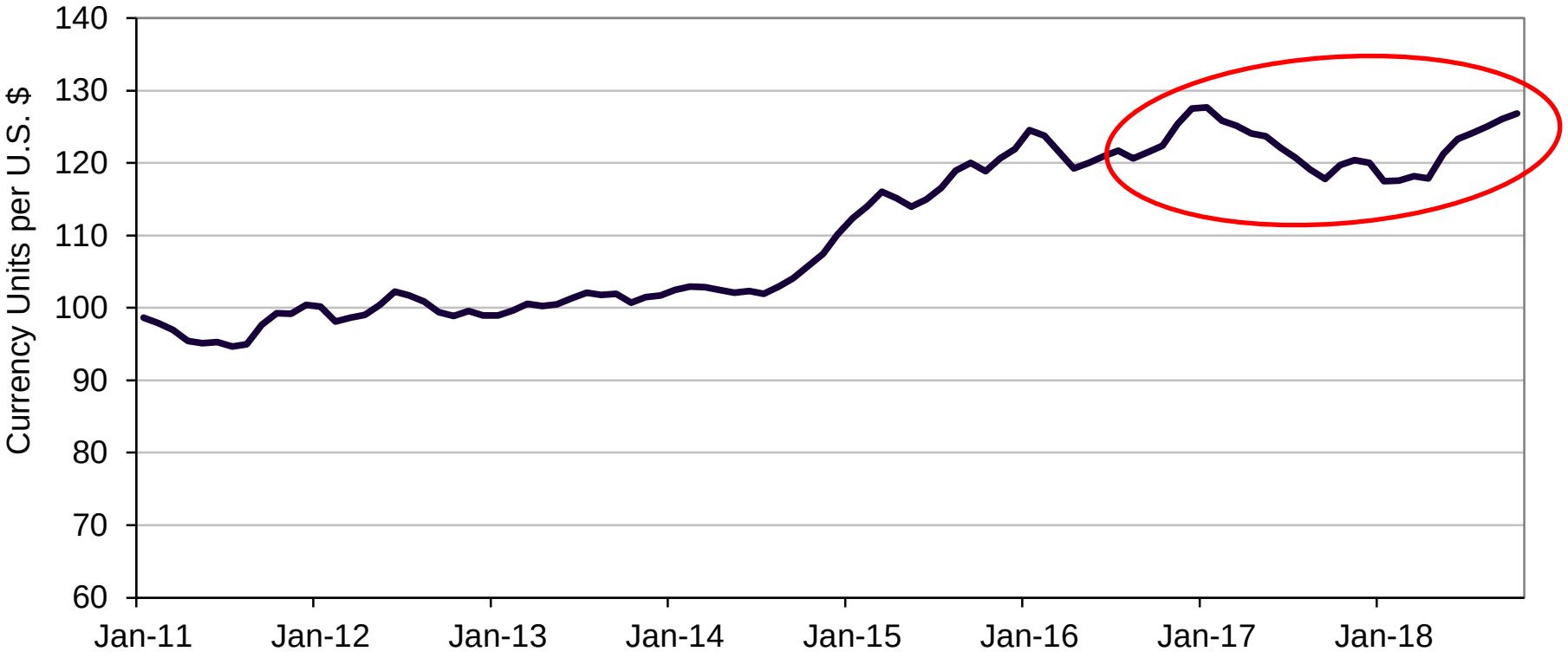
Industrial production consistently increasing since the lows of 2016.



Source: Federal Reserve Bank of St. Louis.

Dollar Valuations (Federal Reserve Broad Index)

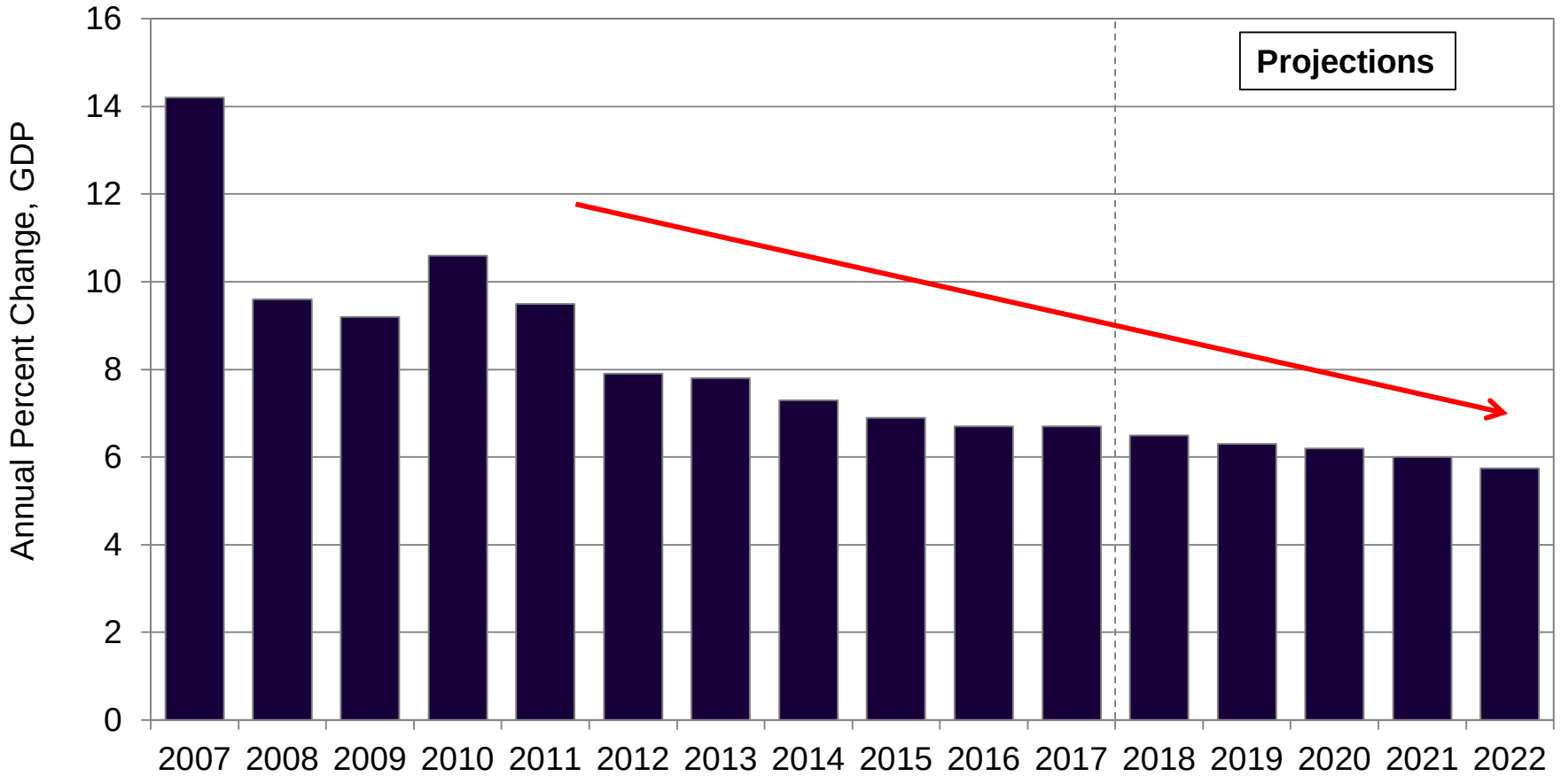
The dollar is up relative to the currencies: 25 percent appreciation over last five years, and six percent in the last 12 months.



Note: The Broad Index is a weighted average of the foreign exchange values of the U.S. dollar against the currencies of a large group of major U.S. trading partners. Base year is 2002.
Source: Federal Reserve Bank of St. Louis.

Changes in Chinese GDP

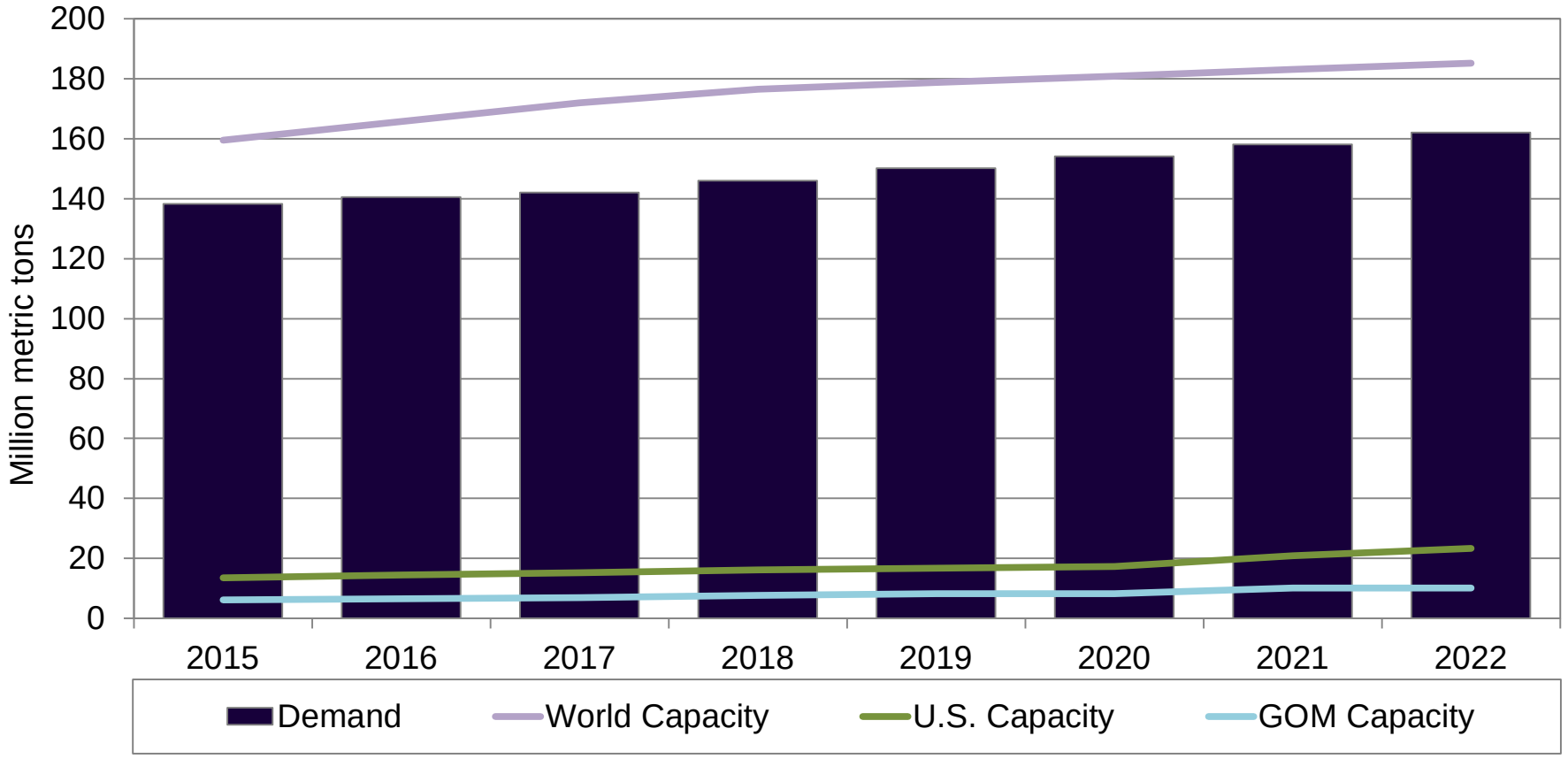
Chinese economic growth officially reported at 6.8 percent, reflecting expectations of expansionary policy mix and a goal of doubling real GDP between 2010 and 2020



Source: International Monetary Fund.

Ammonia demand and capacity outlook

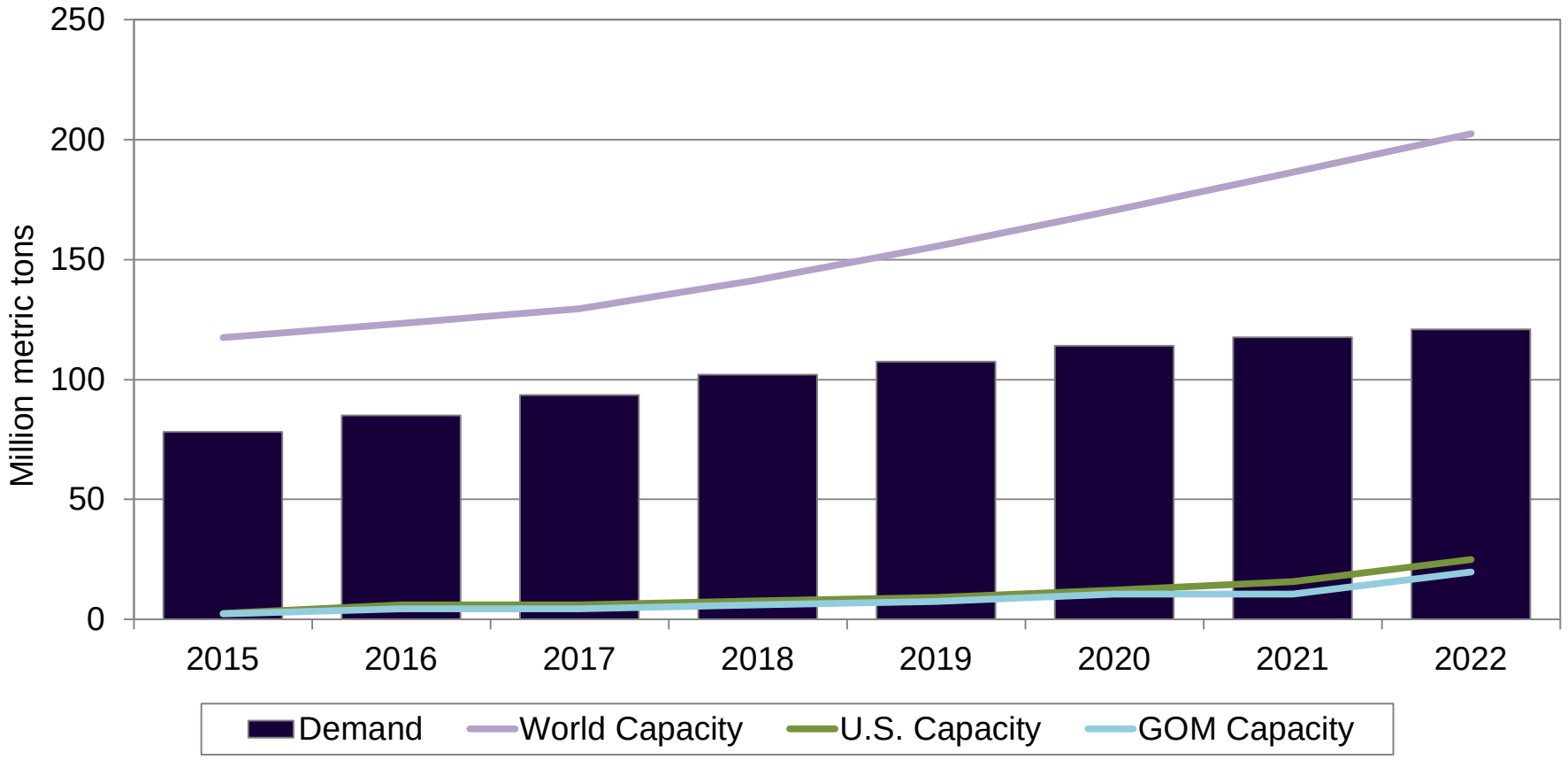
Excess global ammonia supply continues to 2022. This excess is comparable to last year's GCEO forecast. Likely one of the reasons for a slow down in new project announcements.



Source: Author's construct from previous slides and company annual reports and other press releases.

Methanol demand and capacity outlook

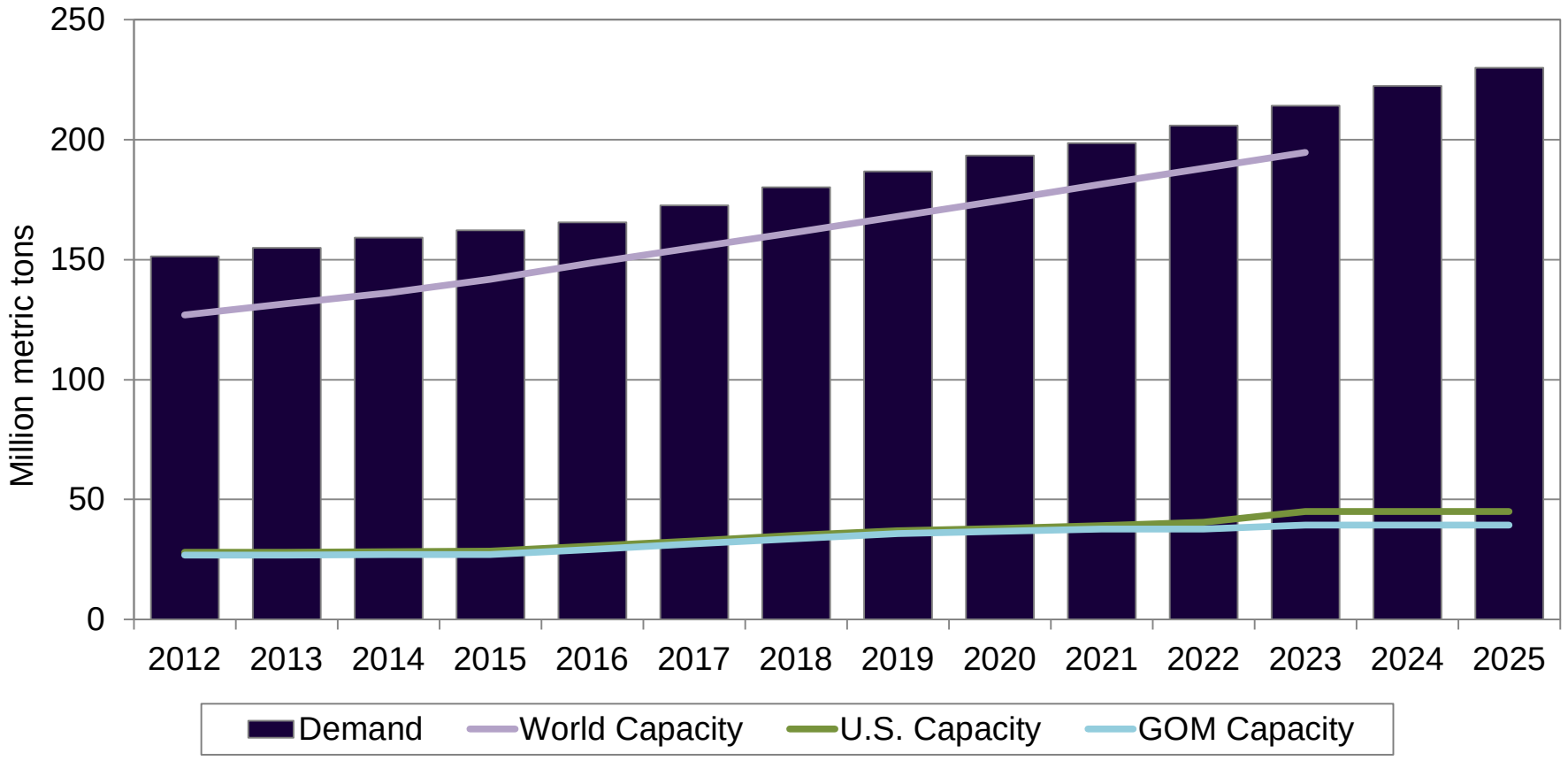
Methanol market is way over supplied – this is important change from last year's GCEO.



Source: Author's construct from previous slides and company annual reports and other press releases.

Ethylene demand and capacity outlook

Ethylene moves to becoming tighter than other chemical commodity markets and represents a big and important shift from last year's GCEO.

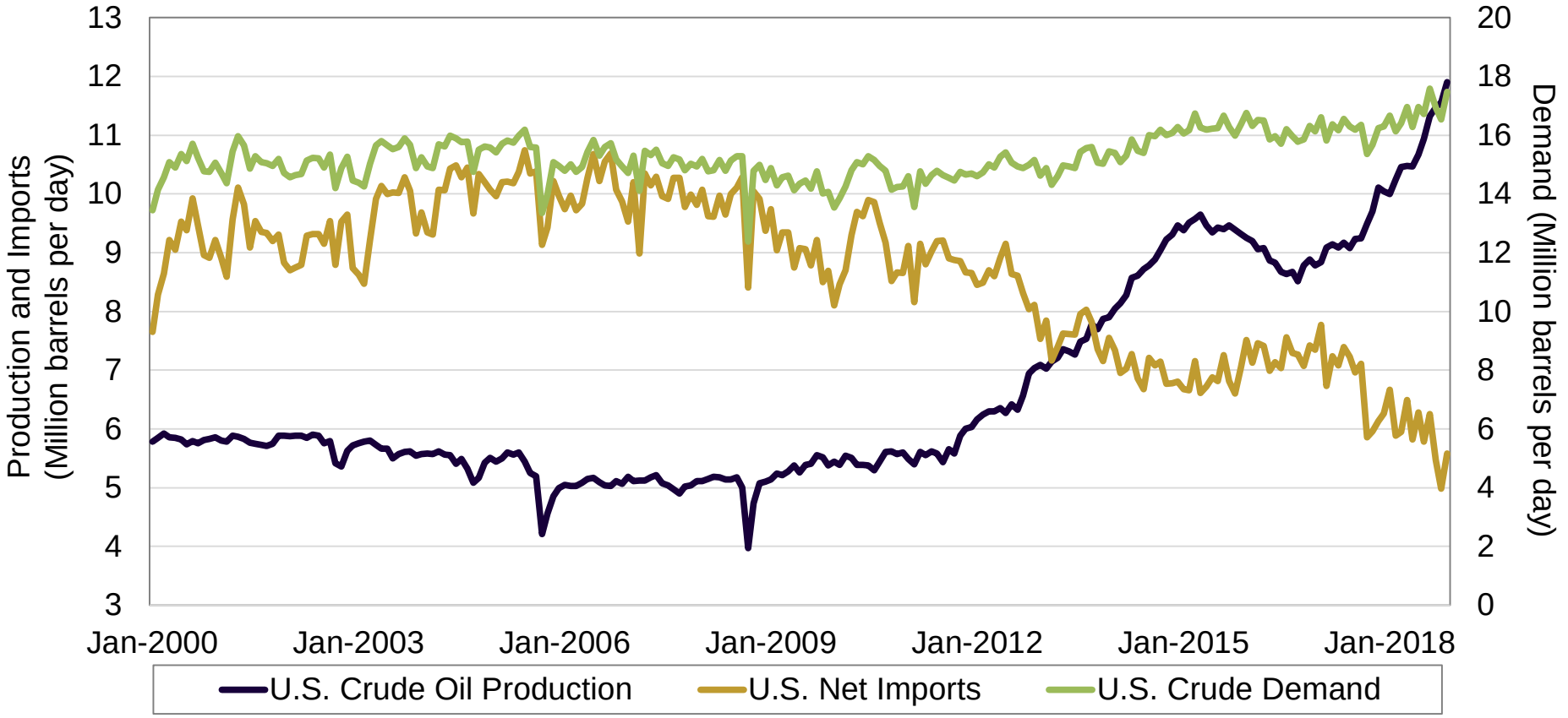


Source: Author's construct from previous slides and company annual reports and other press releases.

Energy trade

U.S. crude oil production and imports.

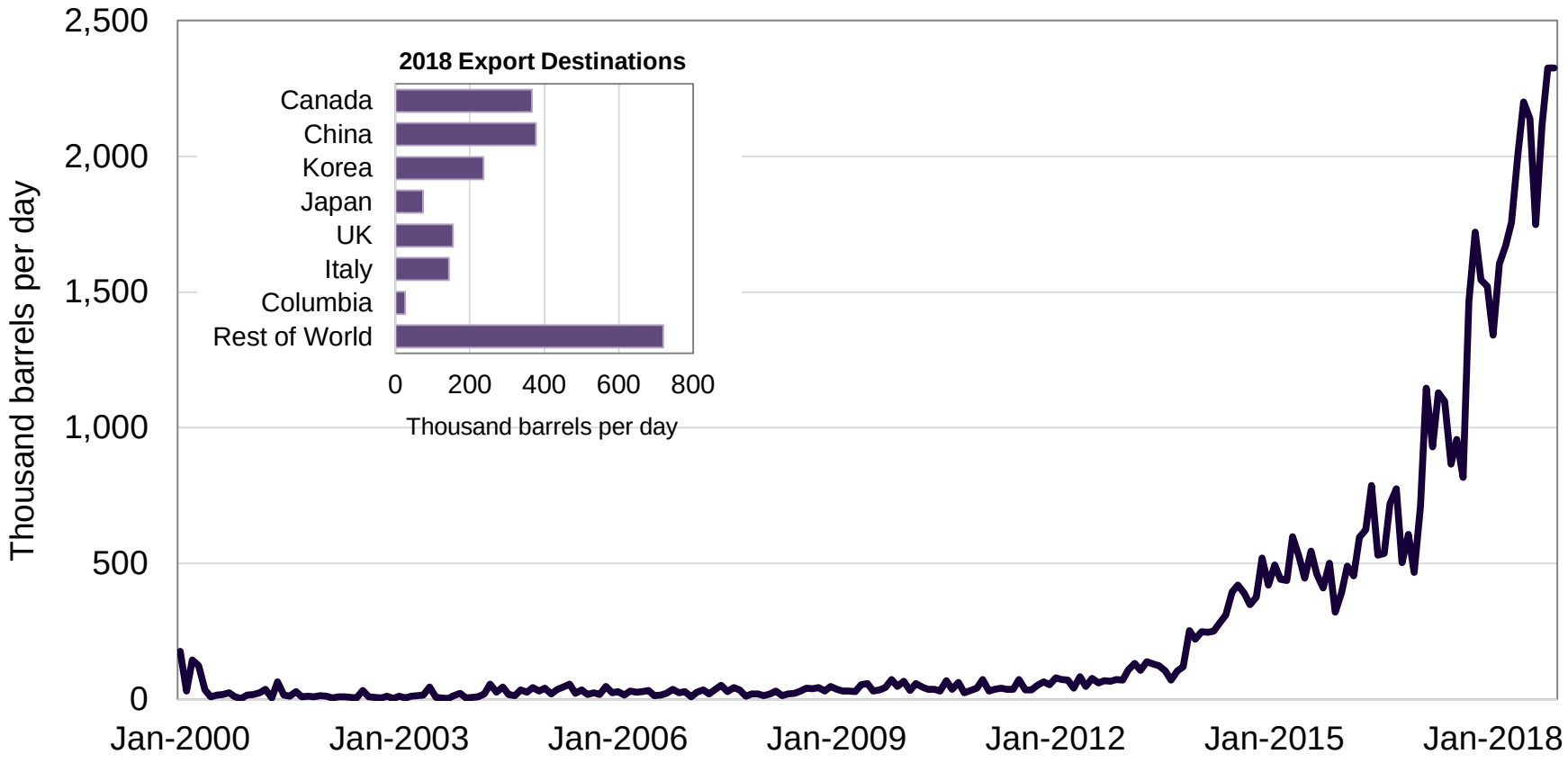
U.S. **crude oil production surged** in 2012 through 2015. Production did fall during the first nine months of 2016, but increased at the end of the year and has continued to increase since. Meanwhile, **U.S. imports of crude oil have fallen** as U.S. demand for crude oil has remained constant.



Source: U.S. Energy Information Administration.

U.S. crude oil exports.

In December 2015, **restrictions on exporting U.S. produced crude oil were lifted**. In 2016, the **U.S. exported an average of 520,000 barrels per day** reaching **1.1 million barrels per day in 2017**. Opportunities for the U.S. to participate further in global crude oil exports are considerable, and the Gulf Coast will be the beneficiaries of these opportunities.



Source: U.S. Energy Information Administration.

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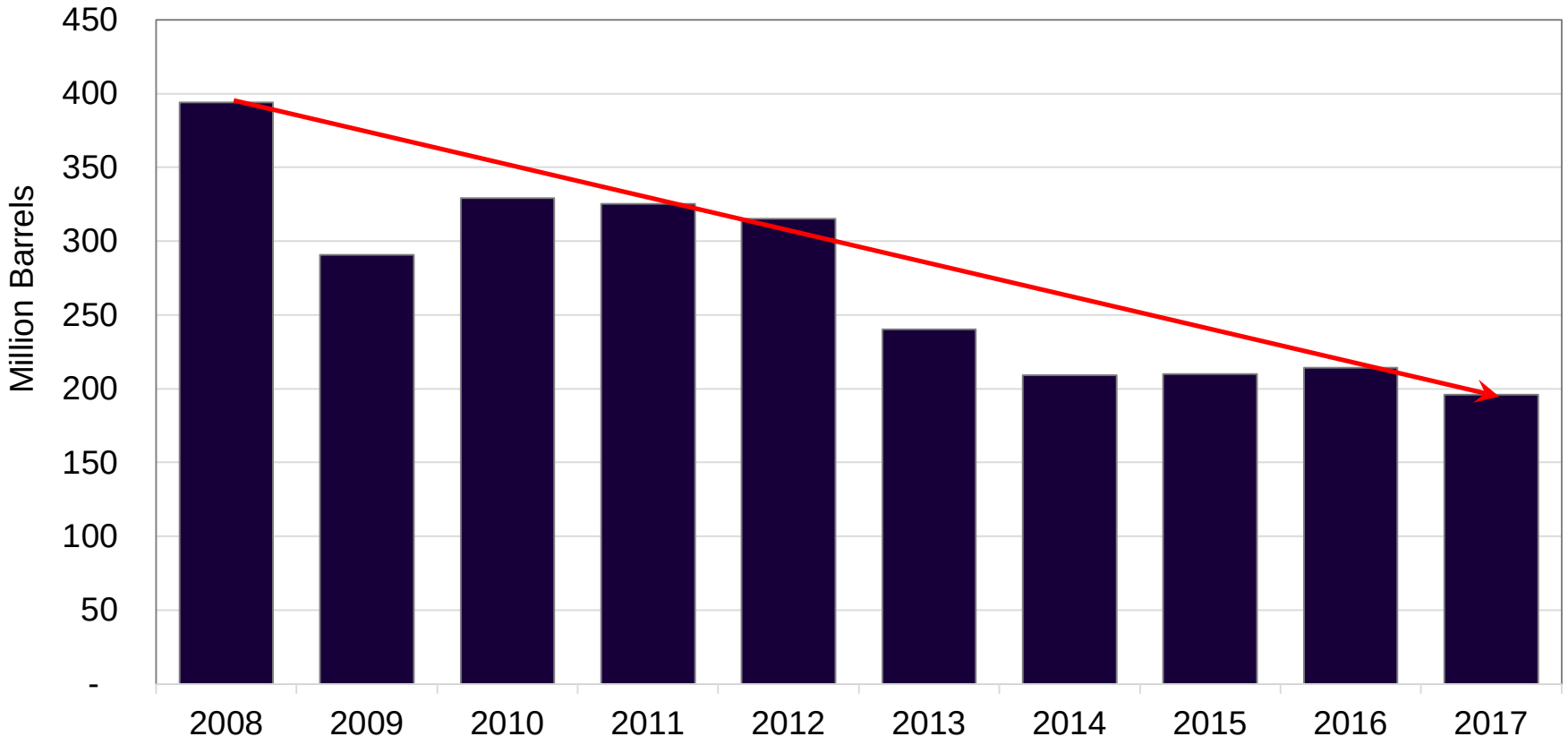
LOOP crude oil imports.

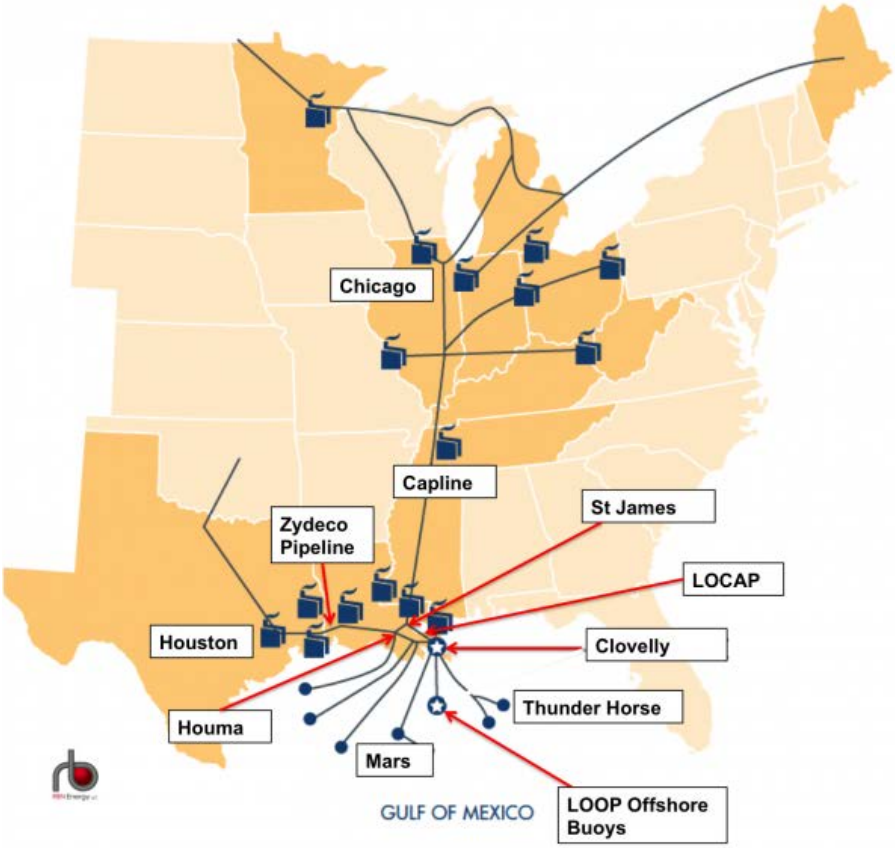
Imports of crude oil through LOOP have **fallen 50 percent in the last ten years**, and **38 percent since 2012**, or an average annual rate of 6.7 percent - due to increased production of **competitive U.S. crude oil from unconventional plays**.



Source: Louisiana Department of Natural Resources.

St. James, Louisiana.

- The **St. James, Louisiana crude oil trading hub** is located on the Mississippi River, about 45 miles west of New Orleans and 160 miles upstream from the GOM.
- Serves as a **distribution hub for crude oil from North Dakota, Texas, the GOM and imports through Louisiana.**
- Location allows for **barge or tanker receipts** as well as capacity for **300 railcars**.
- Total crude **storage capacity of ~32 million barrels.** Capacity has increased significantly in recent years to **accommodate shale production from North Dakota and Texas.**
- Crude oil can be **dispatched to local Louisiana refineries providing feedstock to 2.6 million barrels per day of capacity.**



- Crude oil can also be **dispatched from St. James to other pipeline systems connected to more than 50 percent of U.S. refining capacity throughout the Midwest** and as far north as Canada.

Source: LOOP LLC, available at: https://www.loopllc.com/Information-Central/Distribution-Information/LoCap-Connectivity; RBN Energy, available at: https://rbnenergy.com/i-got-storage-i-feel-good-storage-operators-at-the-st-james-crude-hub.

A two-way LOOP: facilitating an Louisiana energy export economy.

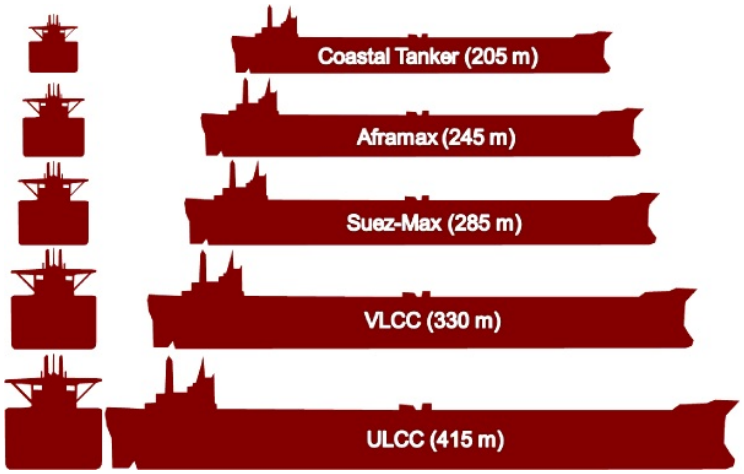
In July 2017 LOOP announced it was pursuing contracts to **start exporting crude oil**.

The **"two-way LOOP"** would provide connecting logistics from the Clovely Hub to the deepwater port.

The facility would require **minor modifications** to pump oil in both directions and service could be available in early 2018.

Most U.S. crude exports are **shipped from Houston or Corpus Christi.** However, these Texas facilities **cannot accommodate the largest tankers carrying full loads**. Smaller vessels are being used to transfer cargoes to large tankers elsewhere.

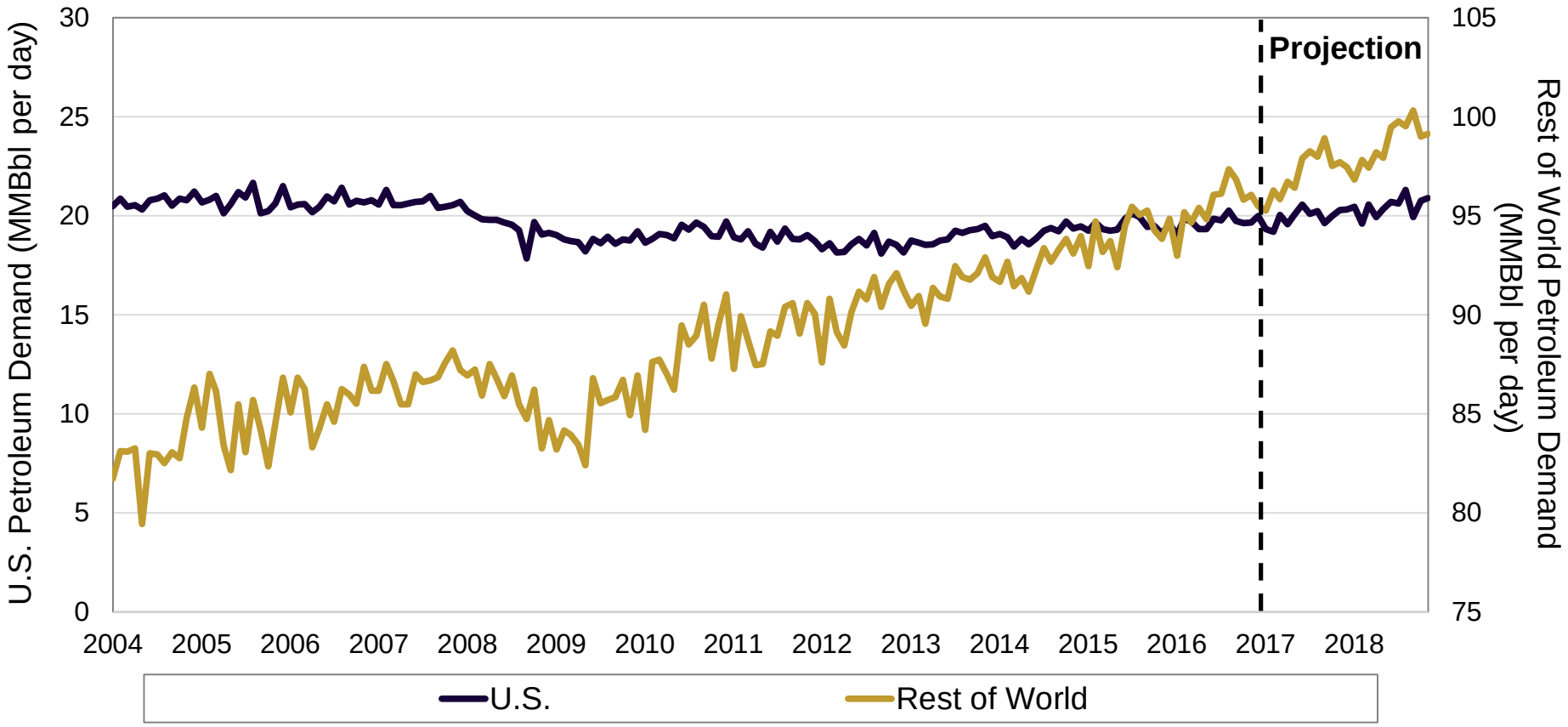
Exporting from LOOP would lower freight costs. And, LOOP's multi-tank storage hub would allow for customer-specific blending of different crude grades.



Note: [1]2017 is 6-month average, January through June.

Petroleum and liquid fuels demand.

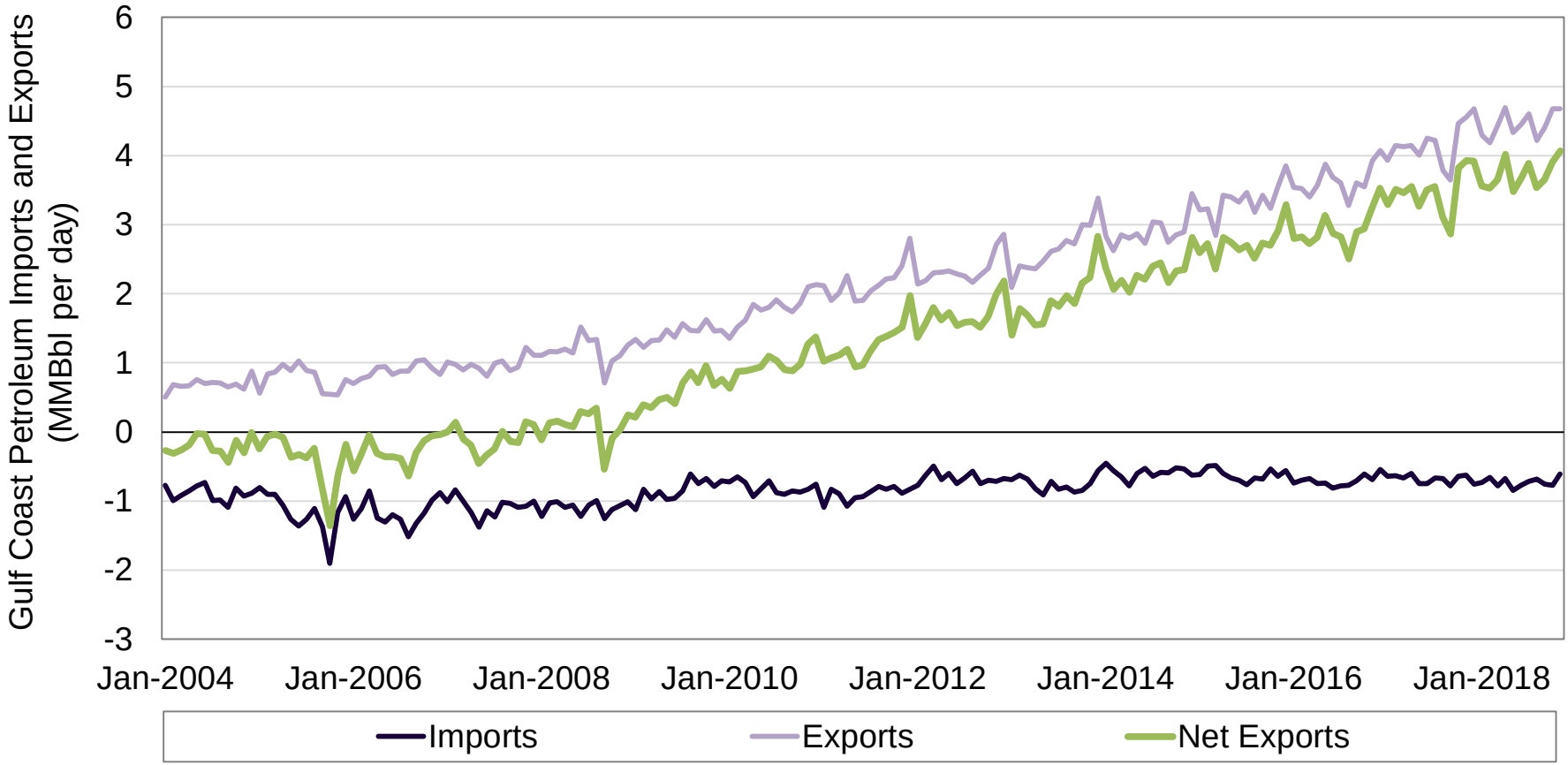
U.S. demand for liquid fuels has been relatively flat, while **demand in the rest of the world has been increasing** underscoring the opportunities for new **Louisiana-based energy exports**.



Source: U.S. Energy Information Administration.

Gulf Coast petroleum net exports.

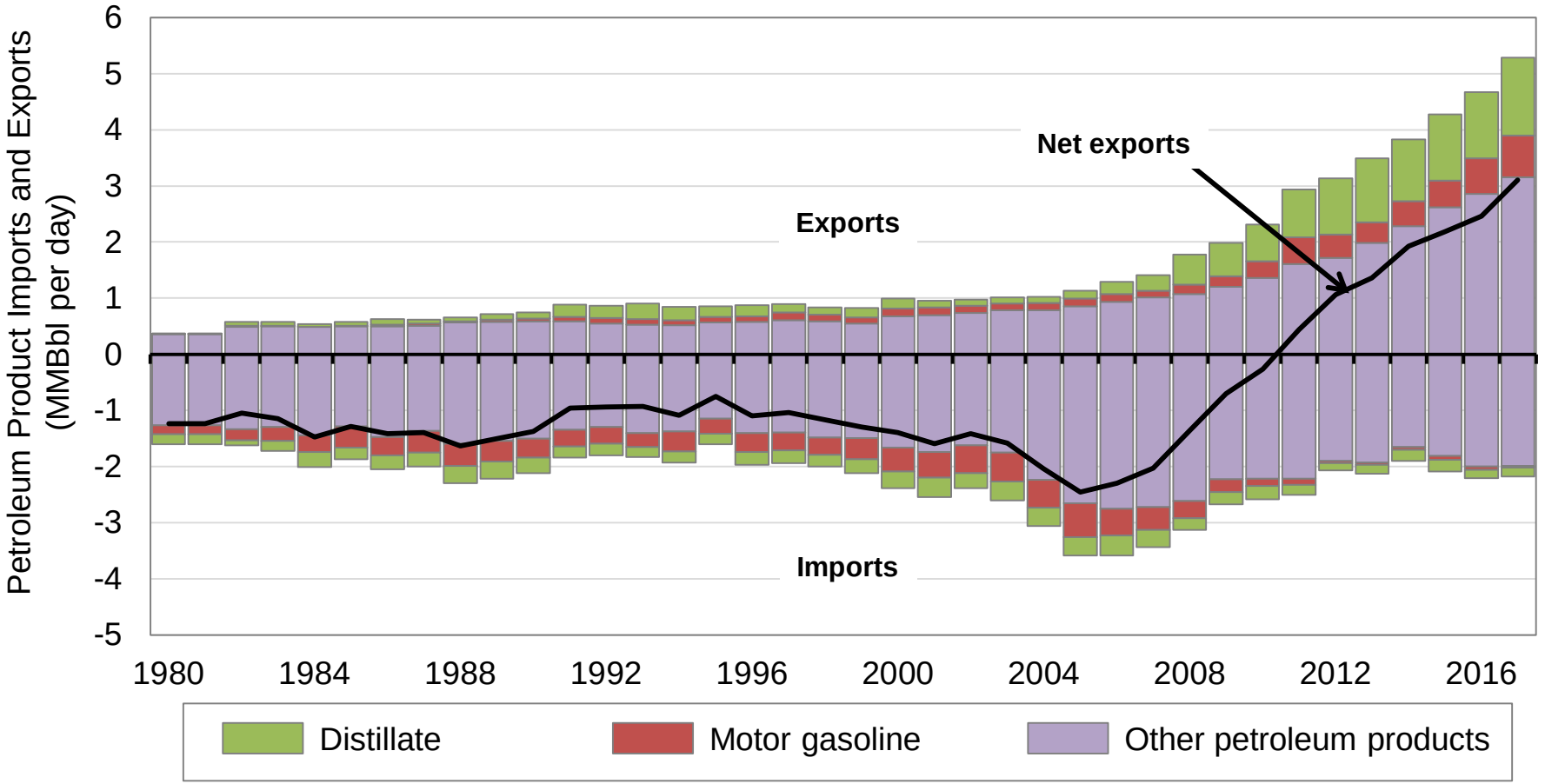
The Gulf Coast region became a net exporter of petroleum products at the end of 2008. Since then net exports have increased at an average annual rate of 38 percent.



Source: U.S. Energy Information Administration.

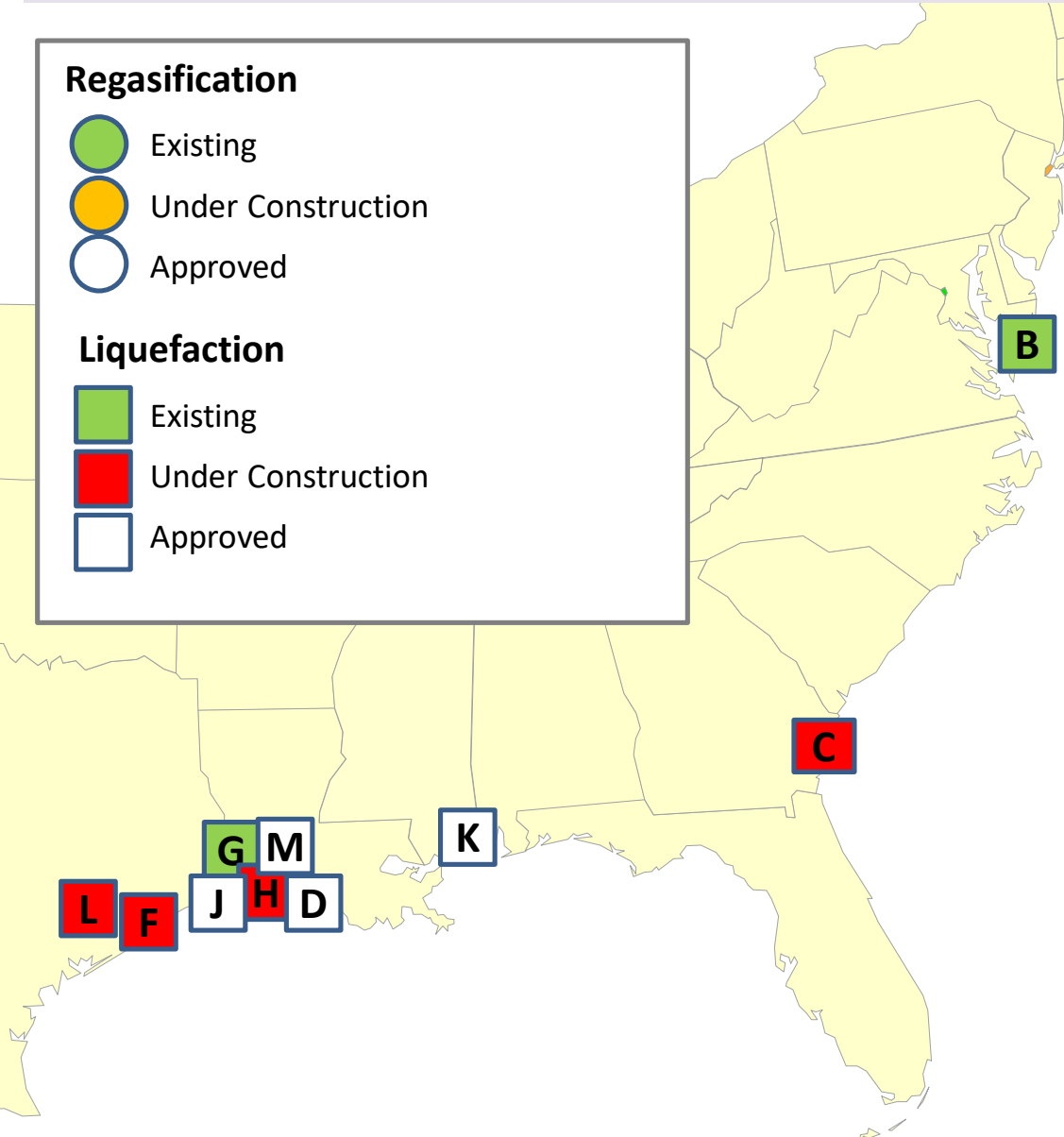
U.S. petroleum product imports and exports.

In 2011, the U.S. **became a net exporter of petroleum products**. Net exports have **increased over 600 percent** since then.



Source: U.S. Energy Information Administration.

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: 2.1 Bcfd
I. Neptune, Offshore MA: 0.4 Bcfd
J. Sabine Pass, TX: 2.0 Bcfd
K. Pascagoula, MS: 1.5 Bcfd

Under Construction

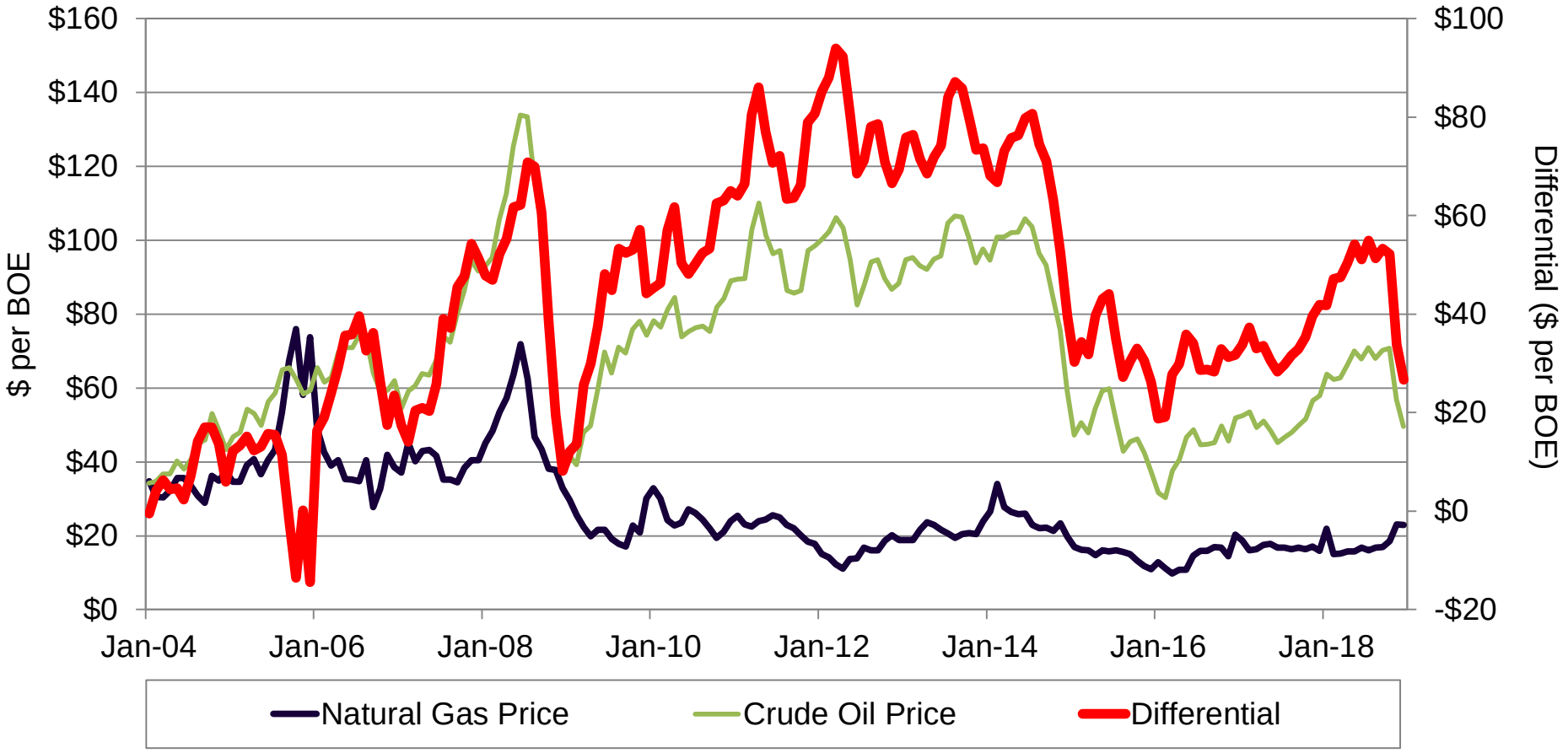
L. Corpus Christi, TX: 2.14 Bcfd

Approved

M. Lake Charles (Magnolia): 1.08 Bcfd

Natural gas and crude oil prices

Natural gas/crude oil price spreads well in excess of $60 per Bbl and as high as $90 per Bbl. These differentials have collapsed by about half.



Source: U.S. Energy Information Administration.

Example: Changes in competitiveness of US-sourced LNG

Economics of LNG development are important, but there are additional factors that can influence development such as geopolitical and supply stability concerns that could sustain continued projects.



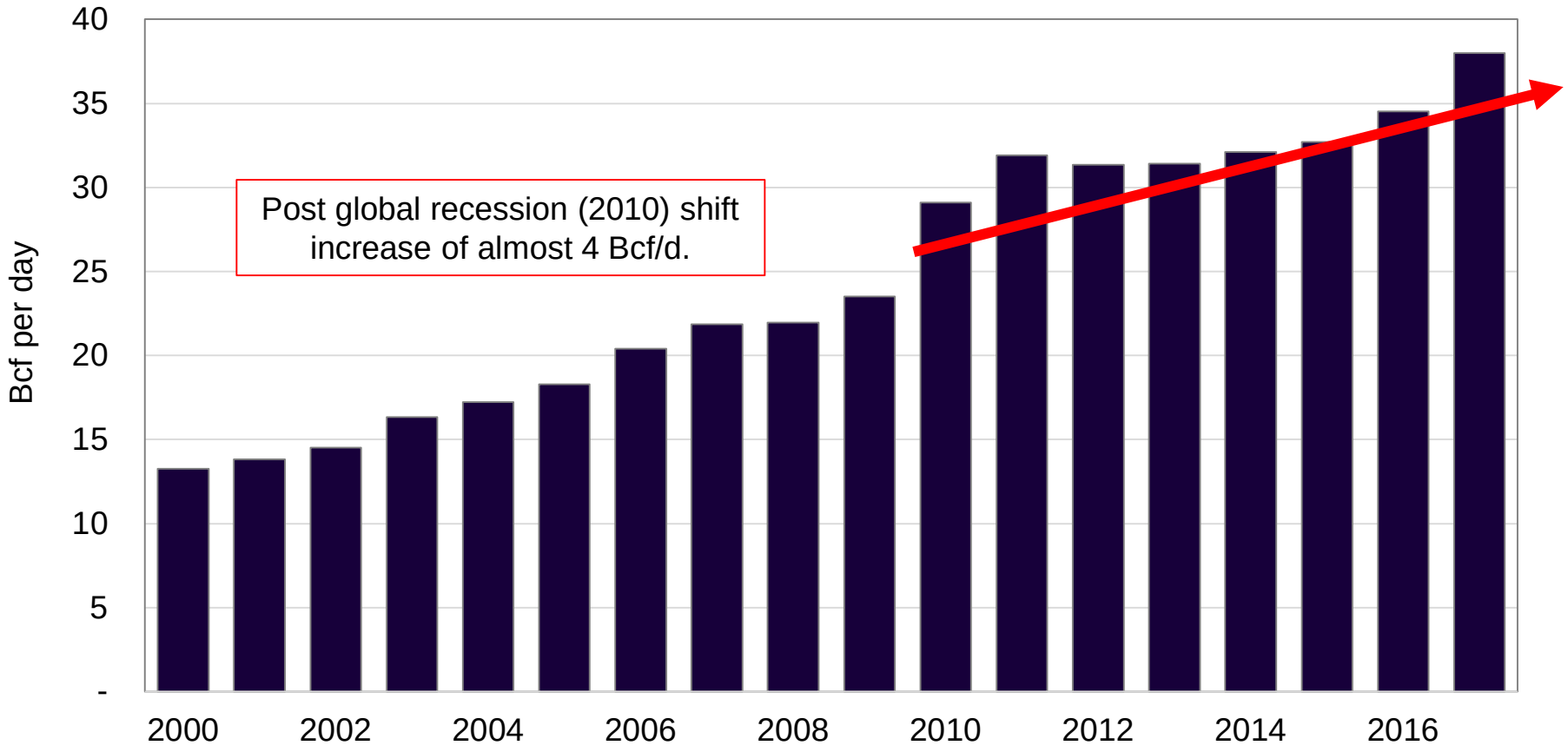

	Feedgas 40-60% ($/MMBtu)	Liquefaction 12%-20% ($/MMBtu)	Shipping & Fuel 20%-40% ($/MMBtu)	Regas 5%-8% ($/MMBtu)	Delivered Cost ($/MMBtu)	Equivalent Oil Price* ($/BOE)
Europe:						
Low	$3.00	$1.25	$1.40	$0.50	$6.15	$35.65
High	$5.00	$1.25	$1.65	$0.50	$8.40	$48.72
Asia:						
Low	$3.00	$1.25	$2.50	$0.50	$7.25	$42.05
High	$5.00	$1.25	$3.00	$0.50	$9.75	$56.55
Caribbean:						
Low	$3.00	$1.25	$0.75	$0.50	$5.50	$31.90
High	$5.00	$1.25	$1.00	$0.50	$7.75	$44.95

Henry Hub (Feb-2019):	WTI (Feb-2019):	Brent (Feb-2019):
$2.90	$53.63	$61.38

Note: *uses a BOE conversion of 5.8 Mcf/BOE.
Source: Various sources

World LNG trade volumes.

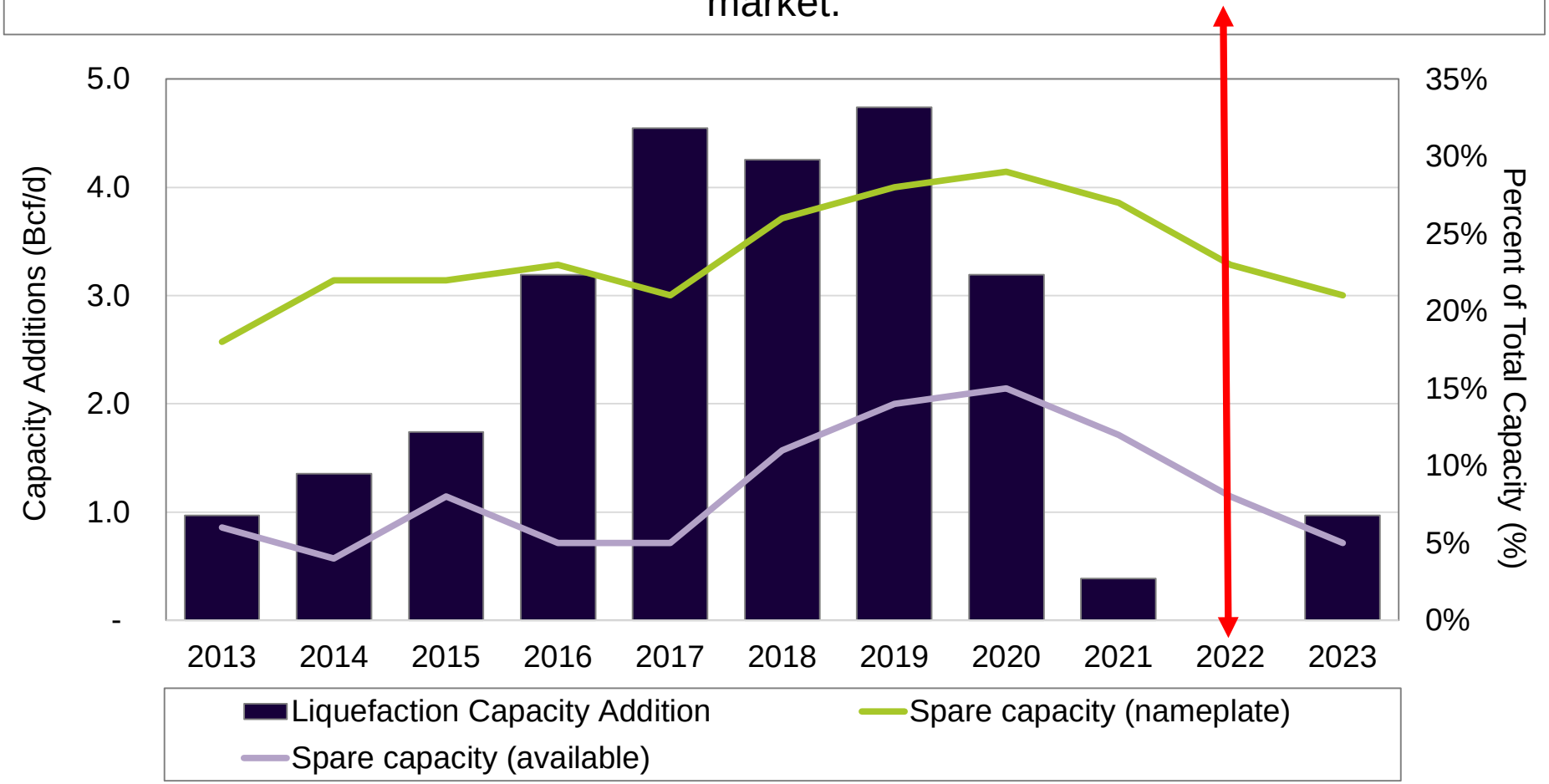
World LNG trade volumes have increased at an **average annual rate of seven percent over the last 18 years** and have increased **73 percent over the last 10 years.**



Source: BP Statistical Review of World Energy.

LNG liquefaction capacity additions.

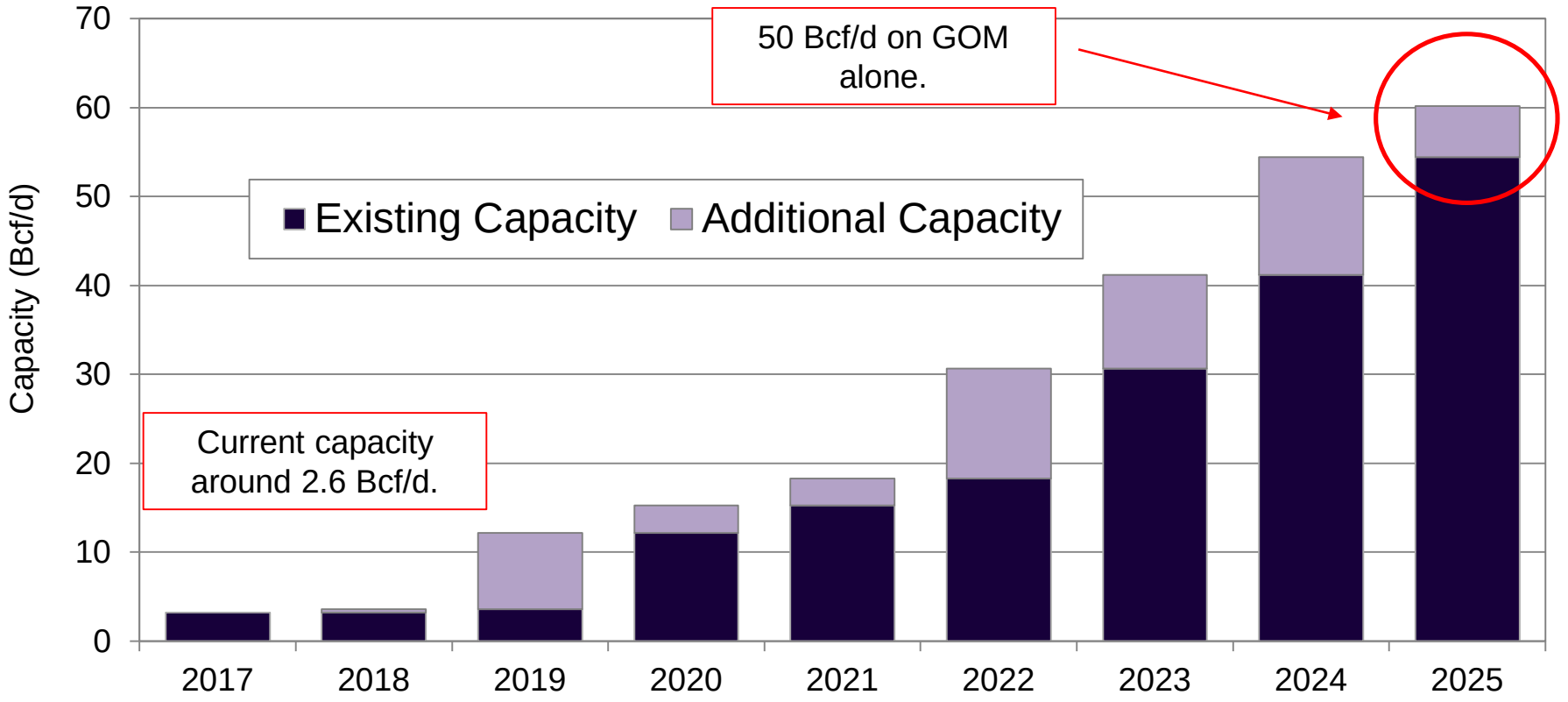
Excess capacity facilitating considerable competition – "nirvana" (for developers) is anticipated to arrive around **2021-2022** as capacity tightens and it becomes sellers' market.



Source: International Energy Agency, Gas 2018.

U.S. LNG capacity development outlook.

If all of the LNG applications currently filed with the Department of Energy were to come online, U.S. liquefaction capacity would exceed 60 Bcf per day by 2025.

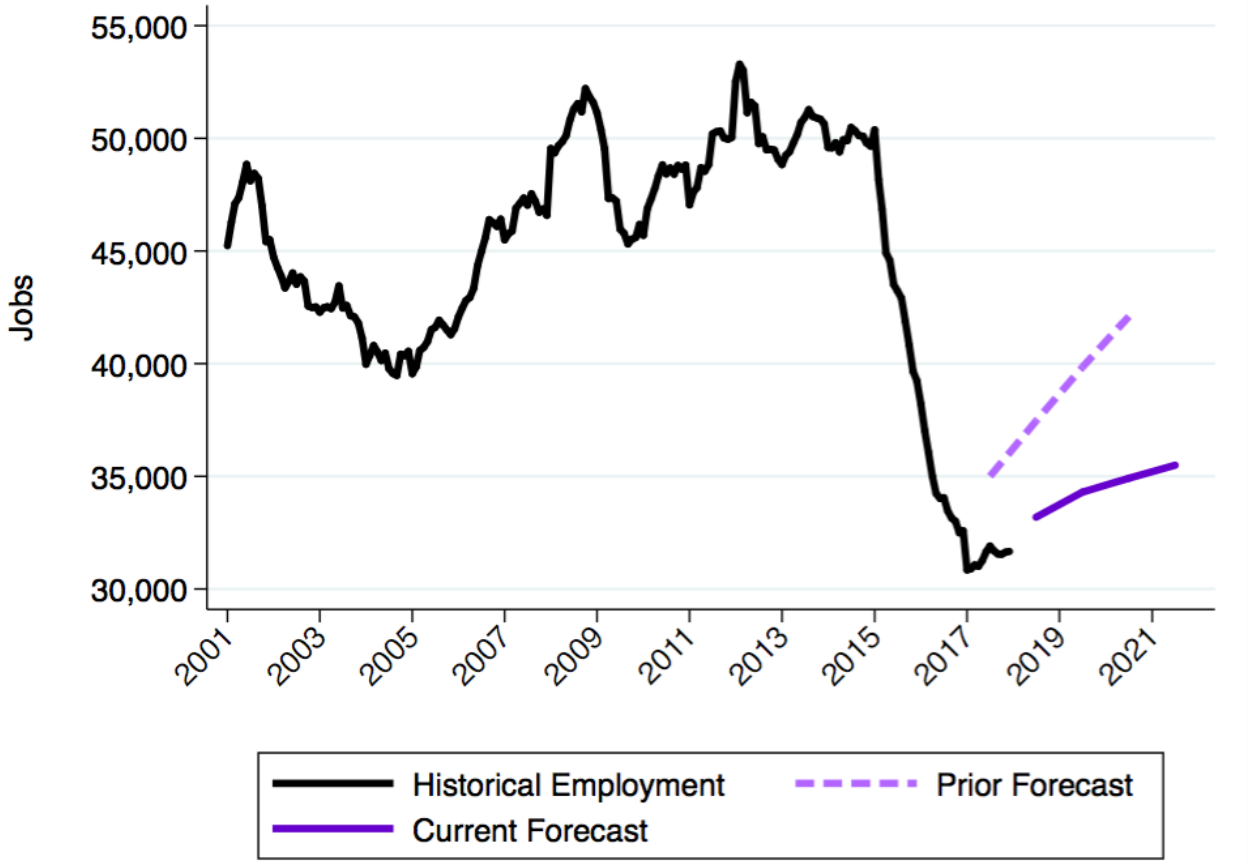


Source: U.S. Department of Energy.

Employment Forecast

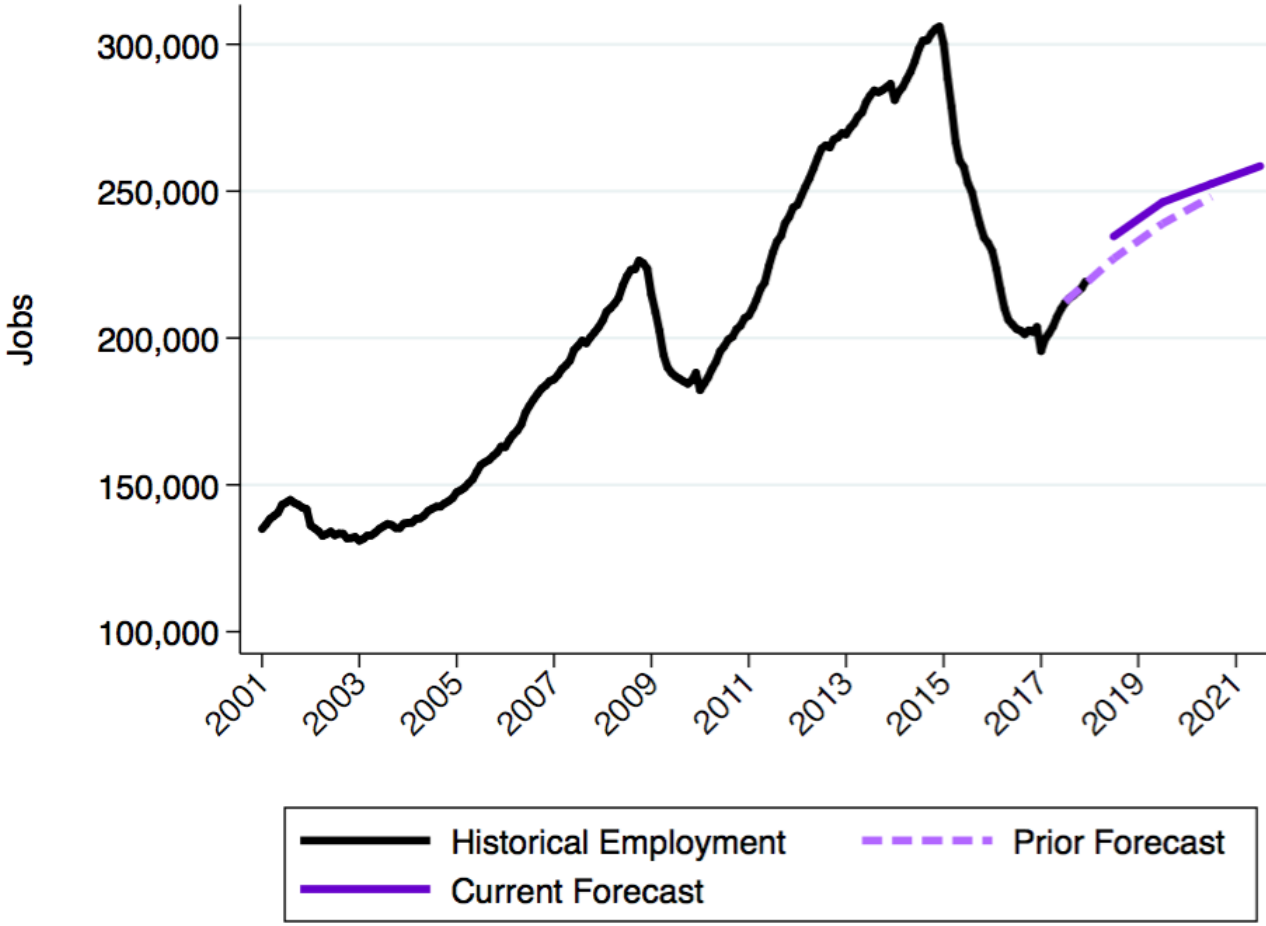
Louisiana Upstream

2018 GCEO did not predict the continued lackluster gains in Louisiana upstream employment. Still forecasting increases, but much smaller than last year's forecast.



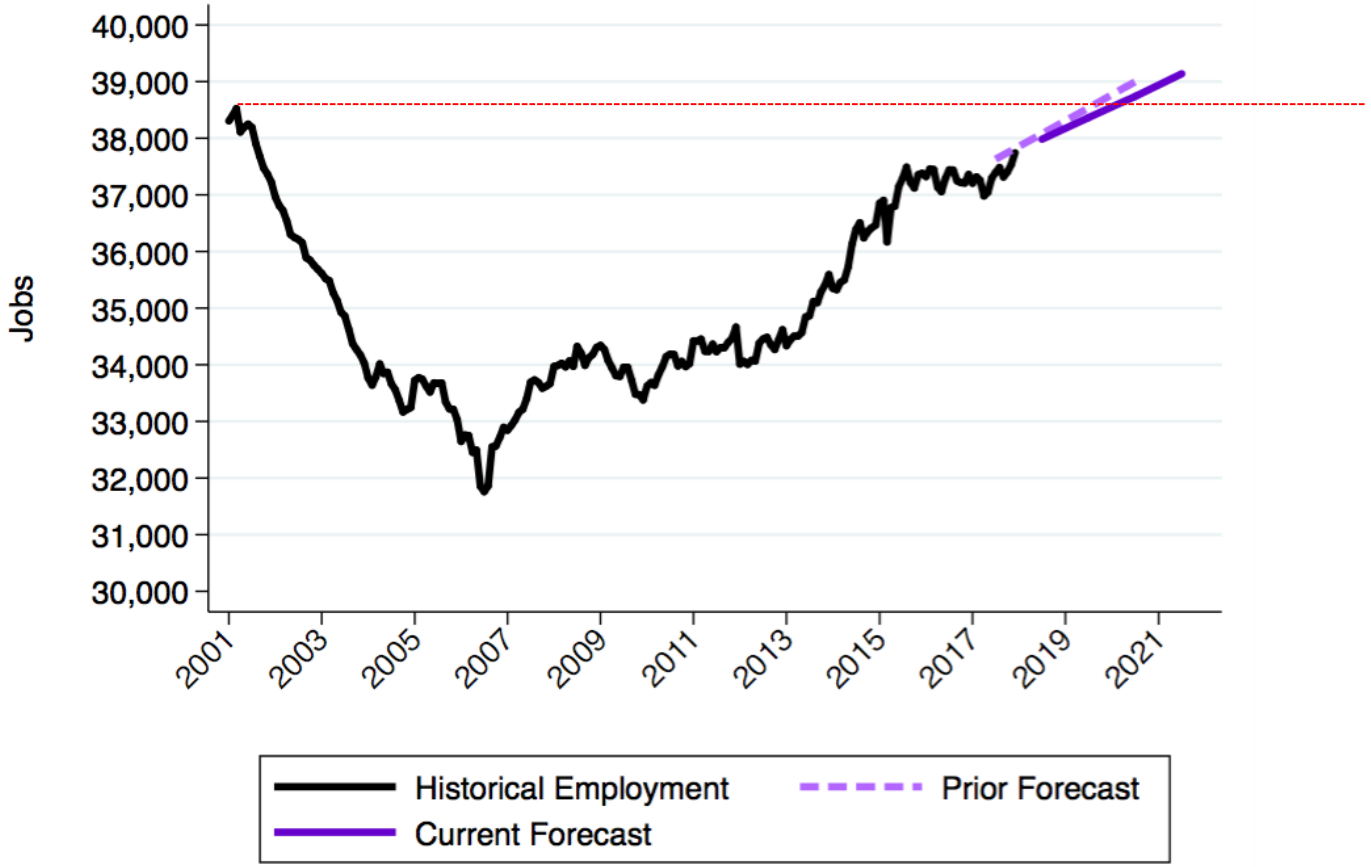
Texas Upstream

Texas forecasts were much more in line with outcomes. Continued, moderate employment growth anticipated: employment rebound continues.



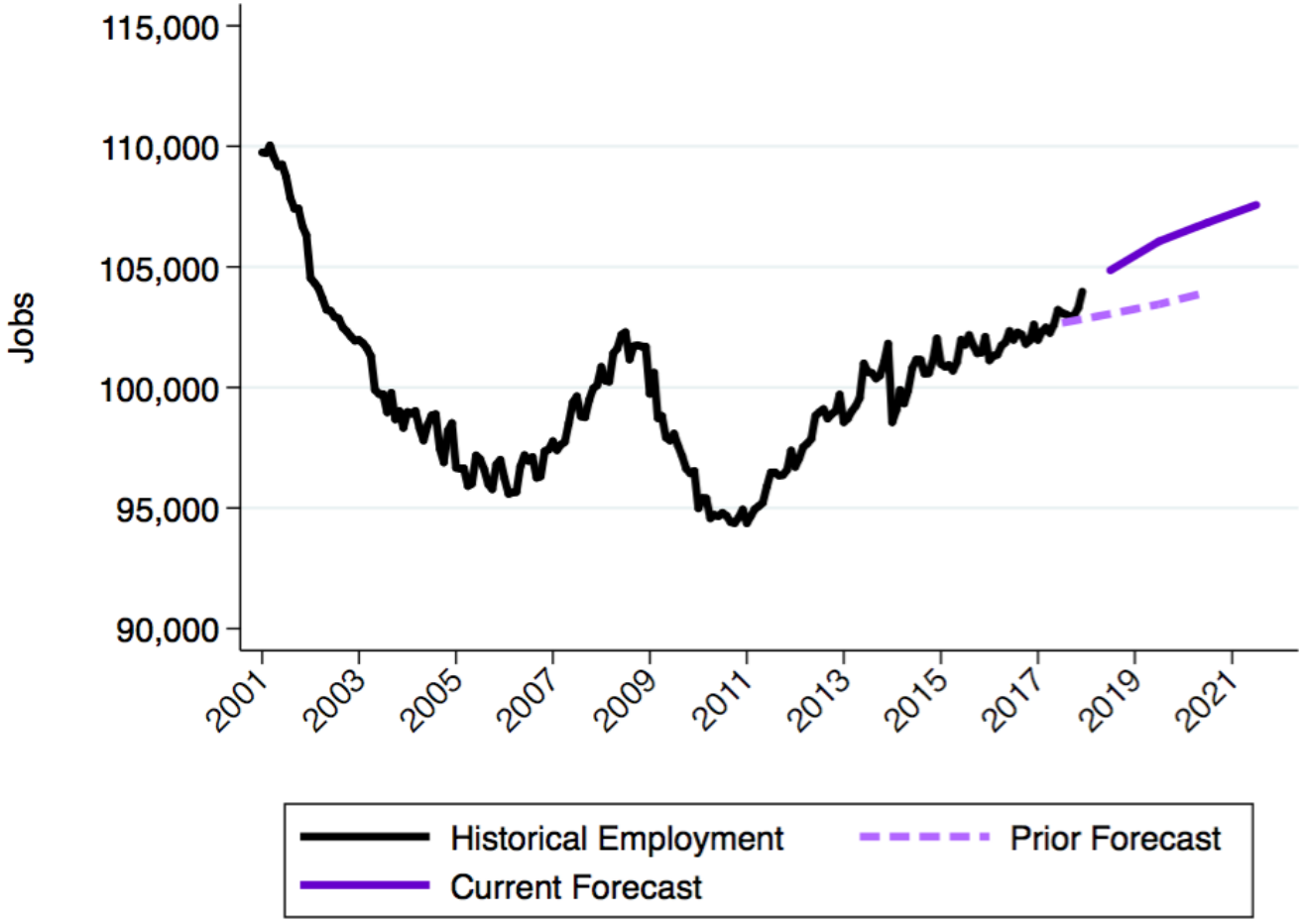
Louisiana Refining and Chemicals

2018 GCEO did a good job in looking at Louisiana mid-stream employment, continued moderate growth anticipated for 2019 to 2022: could surpass 2001 highs.



Texas Refining and Chemicals

Texas midstream employment expected to continue to grow: significant revision to projects for 2019 forecast.



Conclusions

Conclusions – Oil and natural gas.

- Domestic **crude oil and natural gas** production should **continue to be strong**.
  - The nation and region will build upon existing productivity gains.
  - **Drilling activity** may start to geographically **diversify**, but not enough to knock the Permian basin off its perch as being the premier U.S. unconventional basin.
  - The overall **"cool-down" in crude oil demand** should allow infrastructure development to catch up with production requirements.
  - **"Quality over quantity"** mentality by larger companies. Drilling responsiveness has changed in the last recovery period, being more tepid given investor expectations about balance sheet improvement versus drilling (capital budgets are flat).
- The **price outlook** (crude oil, natural gas) is a little **more complicated** than last year.
  - 2017 saw crude prices rise (natural gas flat). Market has now shifted to **correction mode** (crude oil) given changing expectations.
  - **Crude prices likely range-bound at current levels**.
  - Over the next year, the issue will be **economic growth** and the corresponding issues of Fed tightening, exchange rates, inflation, and fiscal stimulus and geopolitical impacts.

Conclusions– Petrochemical/Refining

- The 2019 GCEO **petrochemical industry outlook is flat**.
  - The **capacity utilization outlook for existing and recent investments will likely not increase in any measurable fashion** given a number of global headwinds that include: (a) a slow-down in Asian demand; (b) increased dollar valuations; and (c) continued trade policy uncertainties.
  - The GCEO does not anticipate any chemical industry or LNG project cancellations, but it is not implausible to see that many **currently-announced projects move out** their anticipated project commercial **operation dates** in order to account for the current global market and geo-political uncertainties.
- The 2019 GCEO sees a **continued positive, yet limited growth outlook for U.S. refining**. Refineries will benefit from continued growth of U.S. crude oil supplies and the geographic diversity of those supplies. The sector will also benefit from **continued pipeline infrastructure** moving into and within the region. Product demand growth and storage will be the top issues to watch.

Conclusions -- Employment

- Thus, on an overall basis, the GCEO anticipates, on average, that the region will **build upon its economic gains of the last year**, although those gains will likely be **slower due to concerns about economic growth** and several geopolitical tensions that create uncertainties that are not conducive for capital formation and growth in this industry.
- The region will continue to become a **more integrated part of the overall world energy market** and will likely place itself in a favorable position for future growth once some of these uncertainties start to evaporate.
- The GCEO sees **regional employment continuing to grow** over the next year in both the upstream and downstream sectors for both Louisiana and Texas.
  - Louisiana **upstream growth has been tempered** considerably from last year's projections.
  - For Louisiana, there is more **employment in refining and chemicals** than upstream and we anticipate this to continue but on slower basis.
  - In contrast, **Texas still employs approximately two workers in the upstream sector for every downstream employee** whereas **in Louisiana this is more like a one-to-one relationship.**

Questions, comments and discussion.

David E. Dismukes
Professor and Executive Director
Center for Energy Studies
Email: dismukes@lsu.edu

Phone: 225-578-4343

URL: www.enrg.lsu.edu