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# API Industry Outlook

## Third Quarter 2019



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**Chief Economist**

American Petroleum Institute

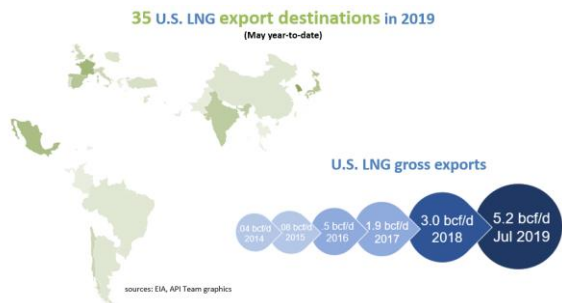
September 19, 2019



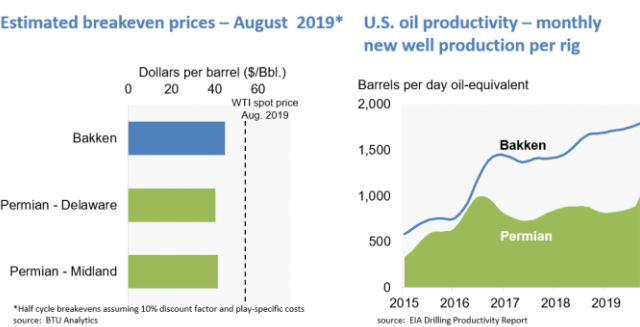
# Key takeaways – Q3 2019

## 1. The U.S. energy revolution has continued to advance economic and environmental progress

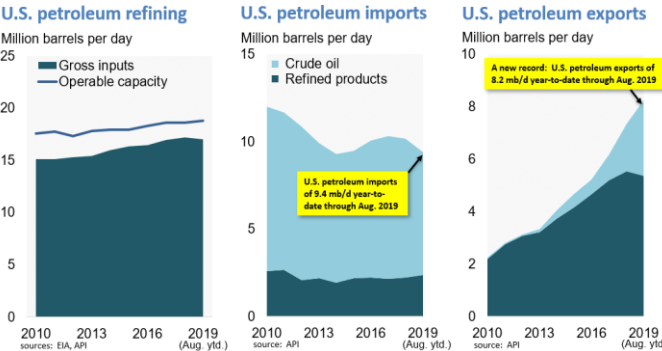
Record U.S. LNG exports have helped reduce global CO<sub>2</sub> emissions



Strong productivity and production have underpinned abundant U.S. oil & gas supplies

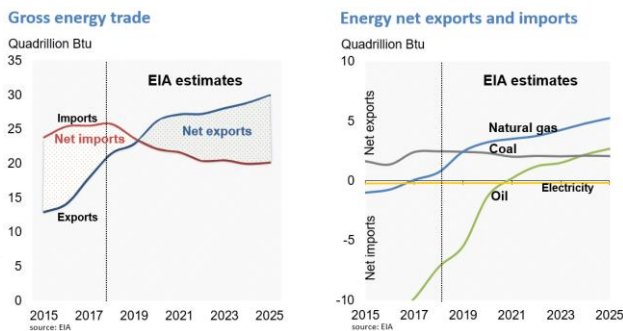


Refinery expansions have enabled the U.S. to become a global supplier of finished products

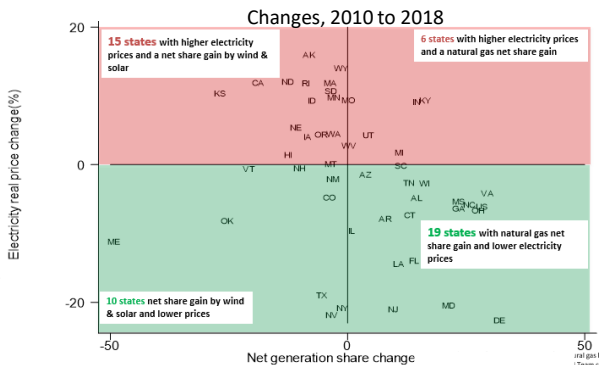


## 2. As the U.S. approaches becoming an energy net exporter and consumers have realized benefits of natural gas, enabling the next wave of major projects is key

U.S. poised to become an energy net exporter in 2019 per EIA



States adding more (less) natural gas generation have seen lower (higher) electricity prices



Active risk mitigation has enabled concentrated development so far



# Global Economy and Oil Markets





# Despite economic uncertainties, the global economy has needed more energy, which has mainly been supplied by the U.S.



## → The global economy is on a knife-edge

The Economist

## → Nobody Likes These Curves as Global Economy's Out of Shape

Bloomberg

## Rebalancing the Global Economy: Some Progress but Challenges Ahead

International Monetary Fund



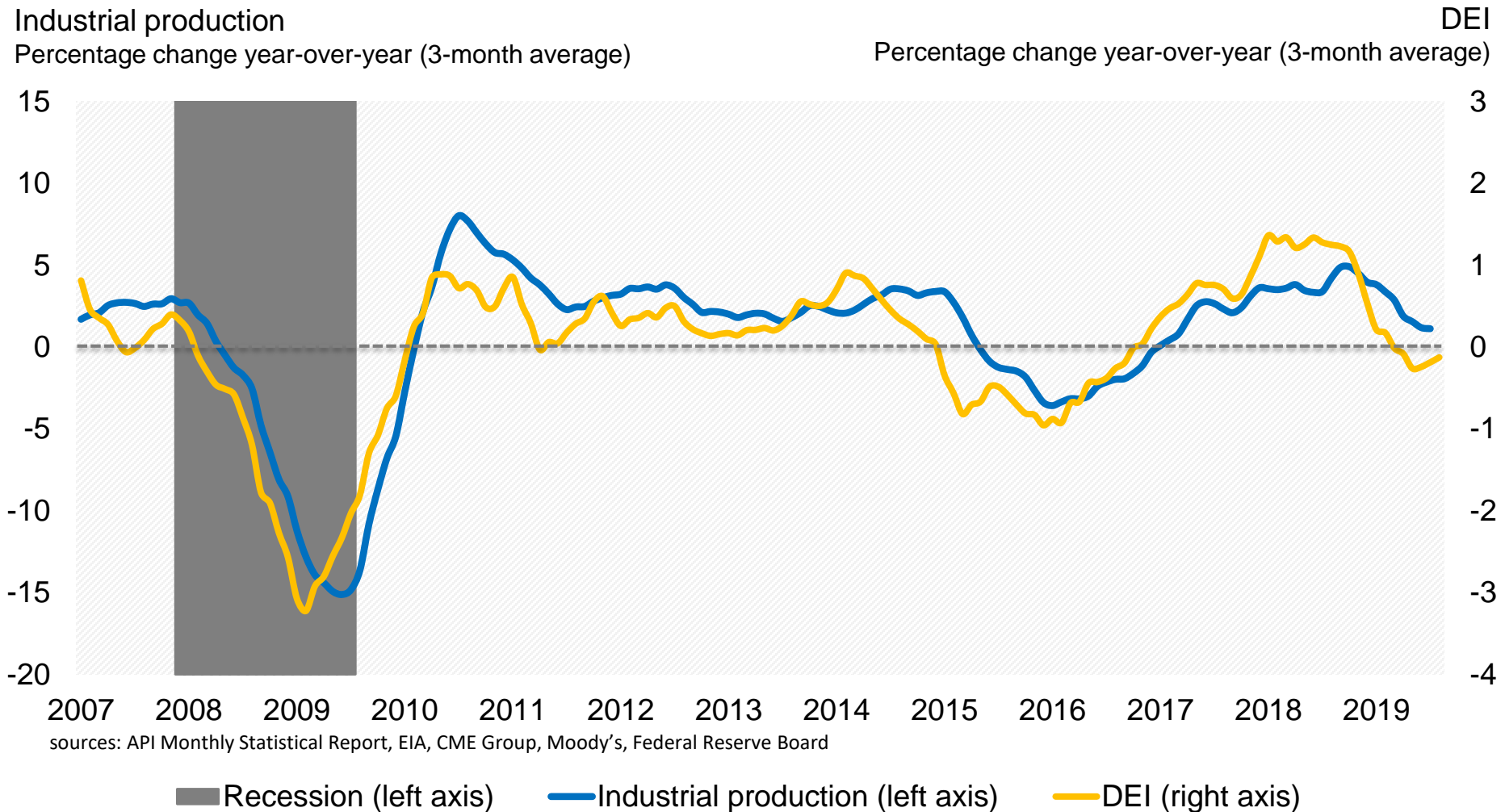
## → US Oil Production Hits New All Time High

Rigzone



# The API D-E-I (Distillate Economic Indicator) – August 2019

- ▶ The DEI value of -0.1 for August and three-month average of -0.1 suggests a continued slowing of industrial production



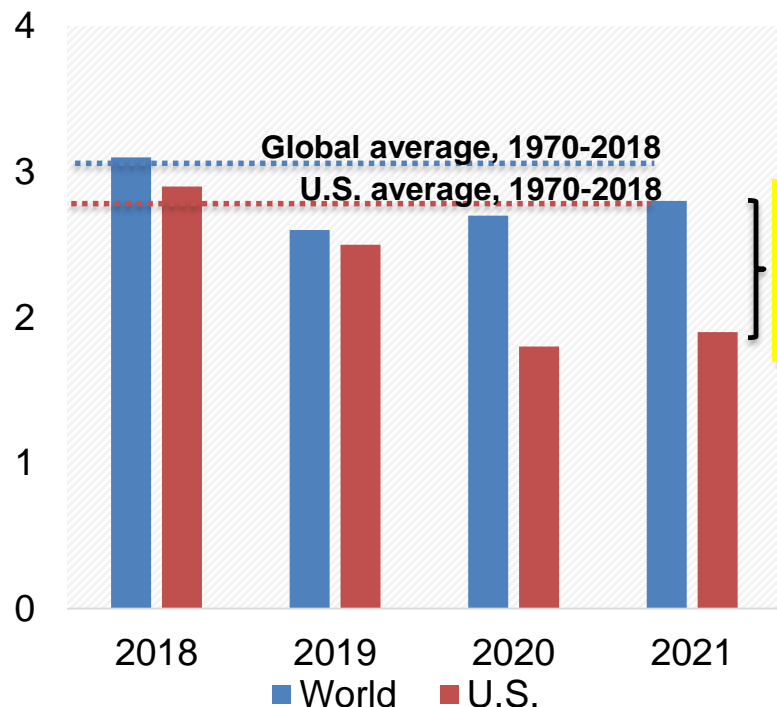
# The consensus expects a divergence between U.S. and global economic growth, which historically has had implications



- ▶ Bloomberg consensus expects U.S. and world GDP growth to diverge, with the U.S. to slow to only 2/3<sup>rds</sup> as fast as the world in 2020 and 2021
- ▶ Historically, relative weakness of U.S. economic growth has corresponded with a weaker U.S. dollar foreign exchange rate and higher crude oil prices

## Real GDP growth\*

y/y%



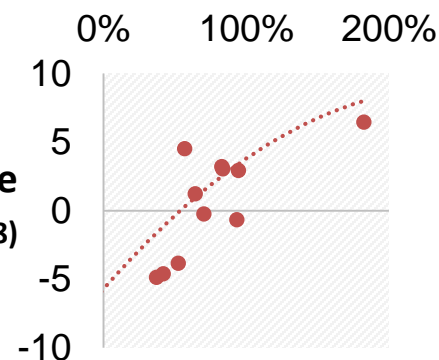
Consensus expects the U.S. cannot keep pace with global growth

\* Market exchange rate basis  
sources: IMF, Bloomberg, API Team calculations

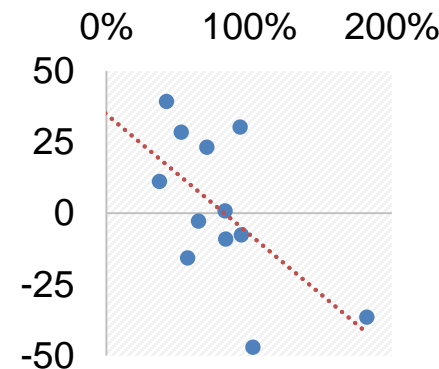
## Relative U.S. economic performance

U.S. dollar exchange value (y/y%, 2006-2018)

Ratio of U.S. to World real GDP growth (y/y%, 2006-2018)



Brent crude oil prices (y/y%, 2006-2018)



sources: IMF, Bloomberg, Federal Reserve



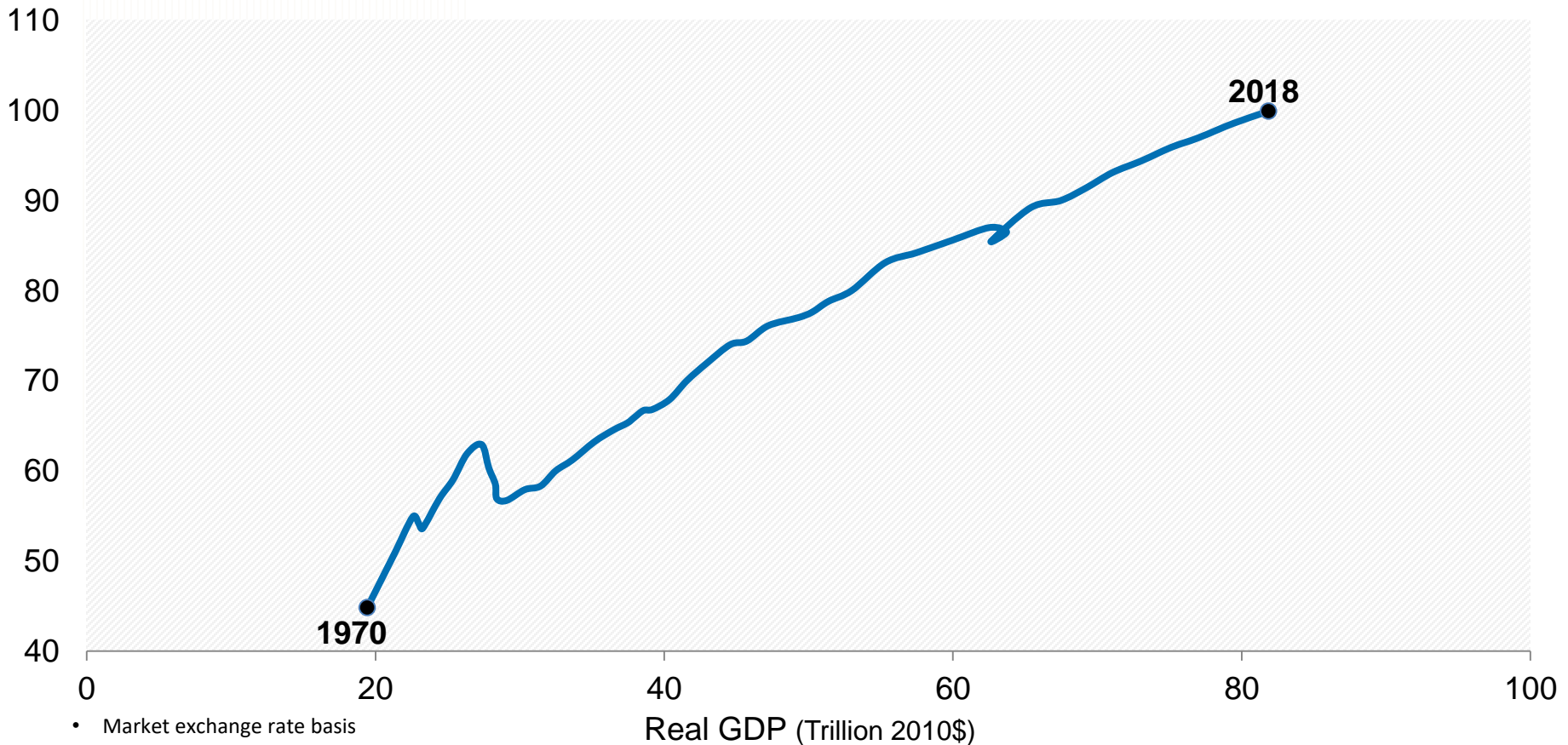
# Global economic growth has consistently required liquid fuels



- Global oil demand has grown consistently with the economy, increasing by an average of 1.3 mb/d since 2010 or roughly half the rate of global GDP growth\*

## Global oil demand versus GDP

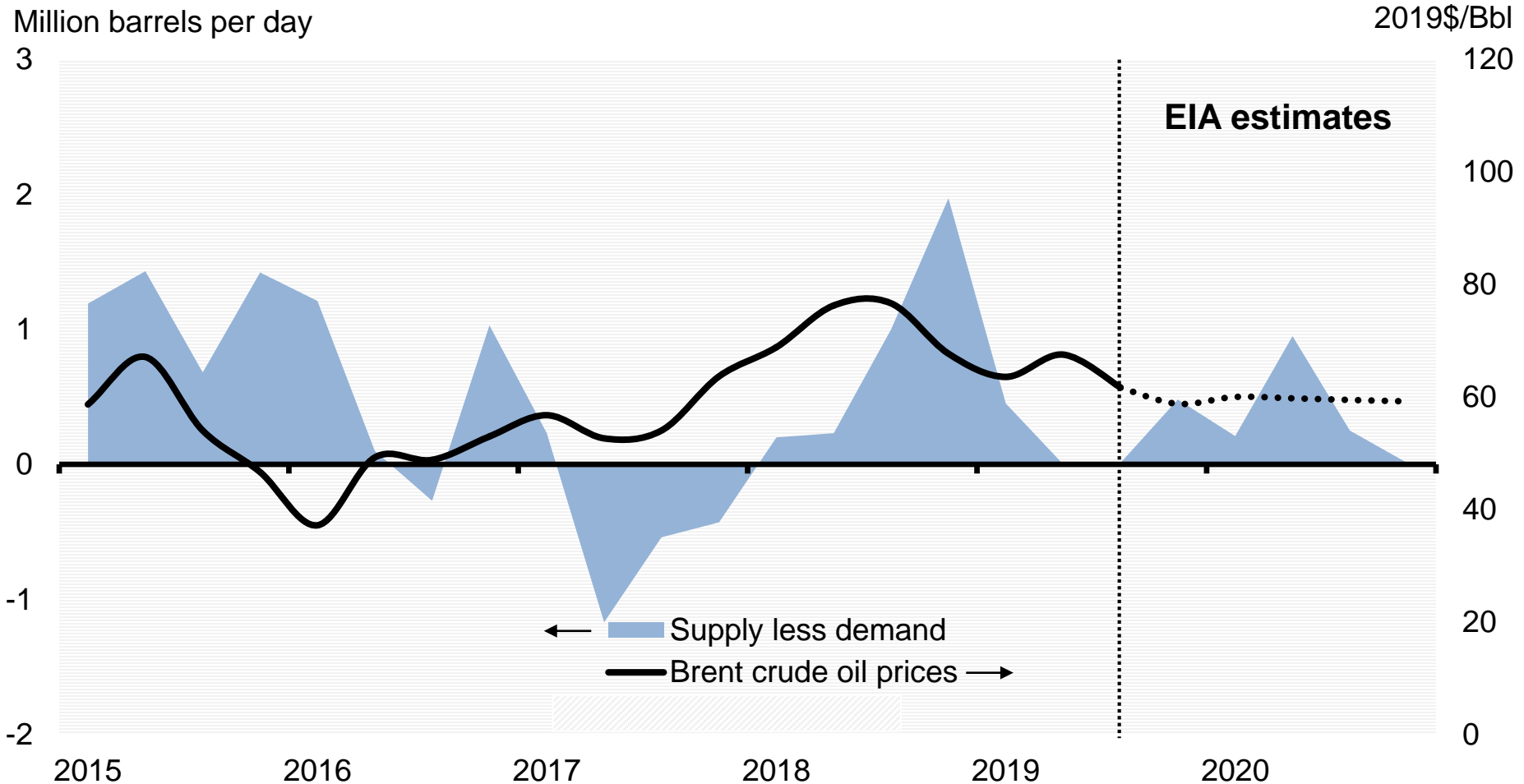
Million barrels per day



# Prior to recent events in Saudi Arabia, EIA expected a balanced global oil market and stable prices



## EIA global supply/demand estimates as of September 2019



sources: EIA STEO (Sep. 2019), Bloomberg

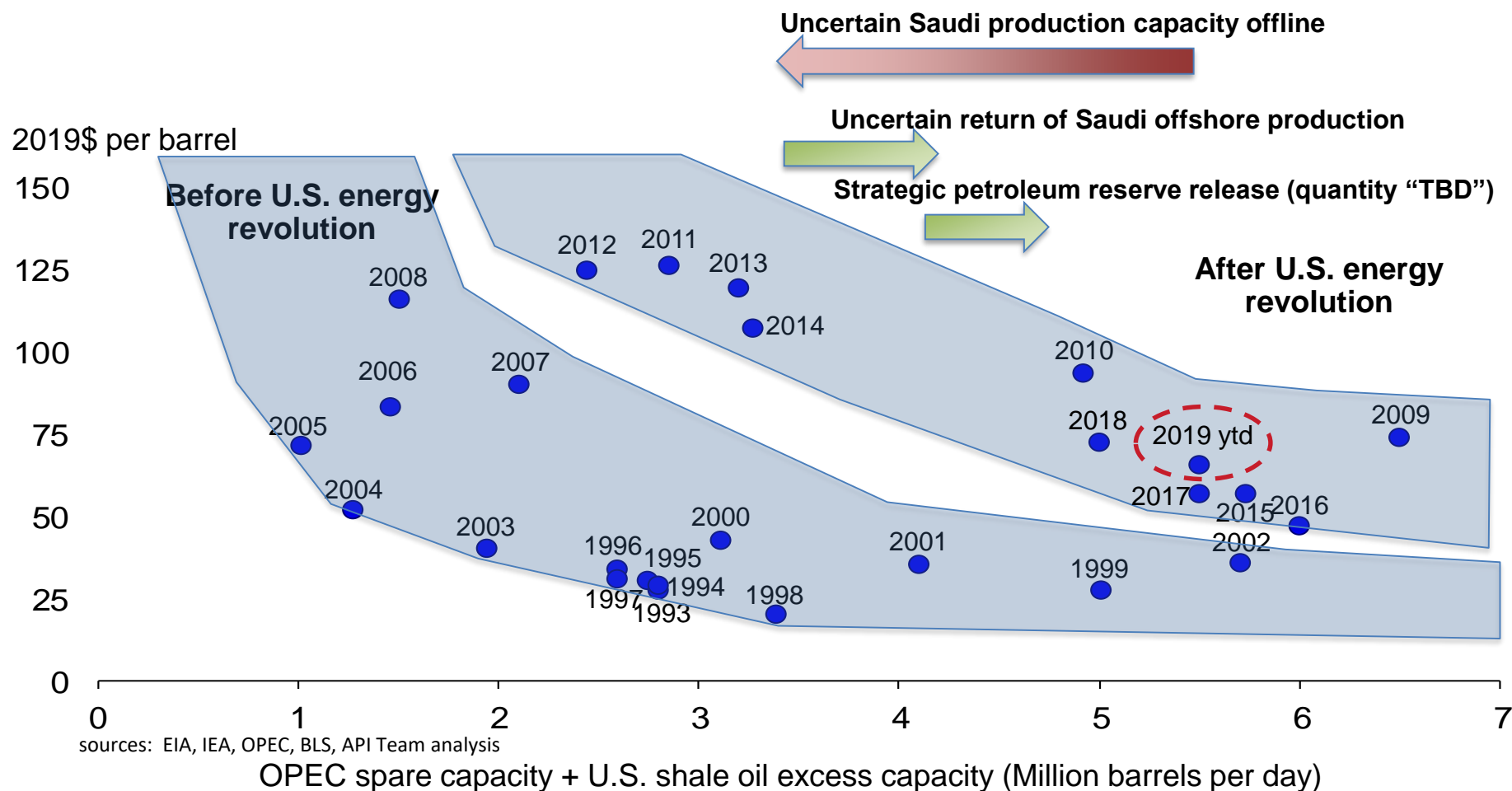


# The U.S. energy revolution has essentially been akin to global spare production capacity and cushioned oil prices



- In general, greater spare production capacity has historically corresponded with lower prices
- Recent events have added uncertainty but directionally lowered production capacity

## Comparing historical real Brent crude oil prices with a measure of spare capacity

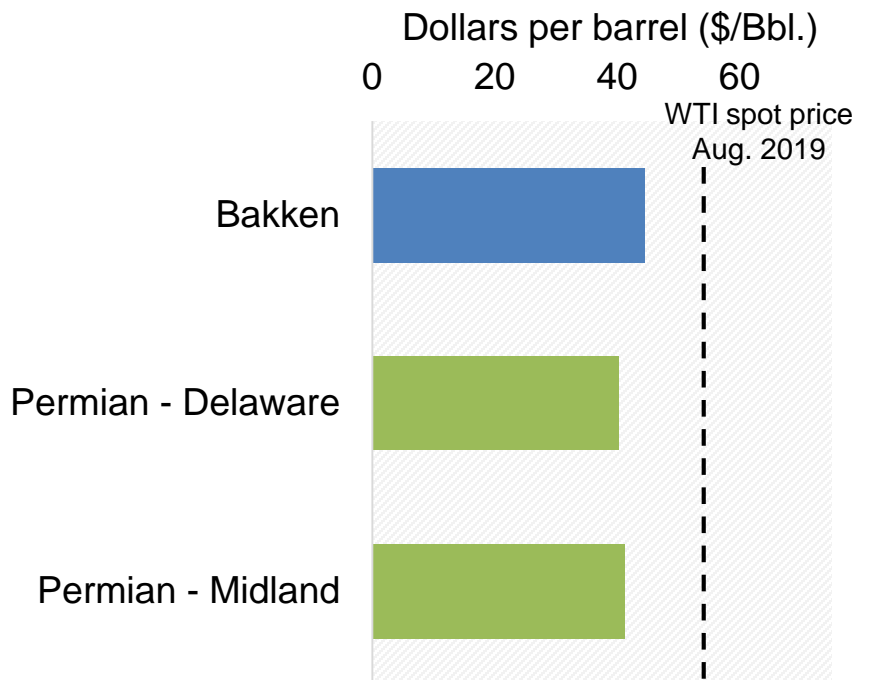


# Strong productivity and cost effectiveness have continued to position the U.S. for oil and natural gas production growth



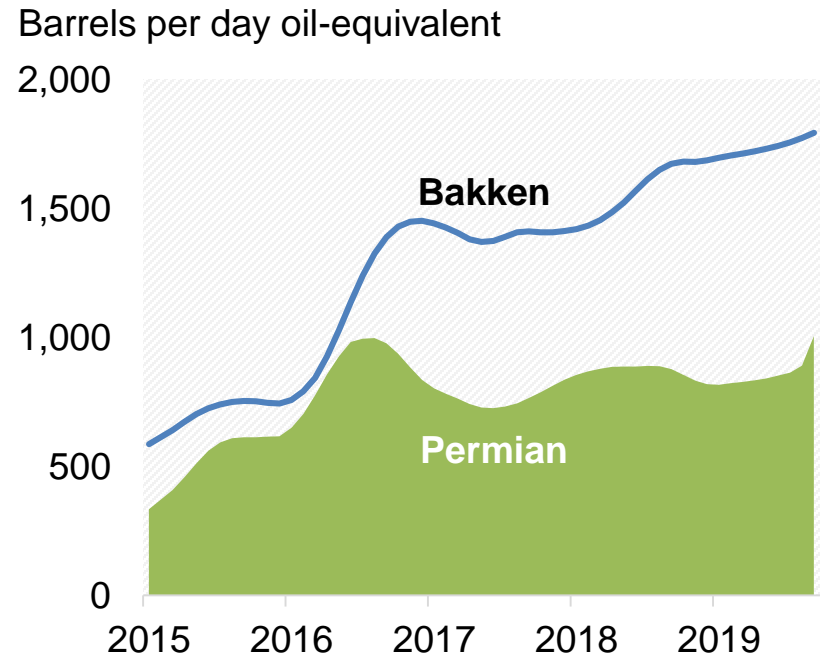
- BTU Analytics' estimated breakeven prices remained below WTI crude oil in major production areas, and EIA productivity estimates rose

## Estimated breakeven prices – August 2019\*



\*Half cycle breakevens assuming 10% discount factor and play-specific costs  
source: BTU Analytics

## U.S. oil productivity – monthly new well production per rig



source: EIA Drilling Productivity Report



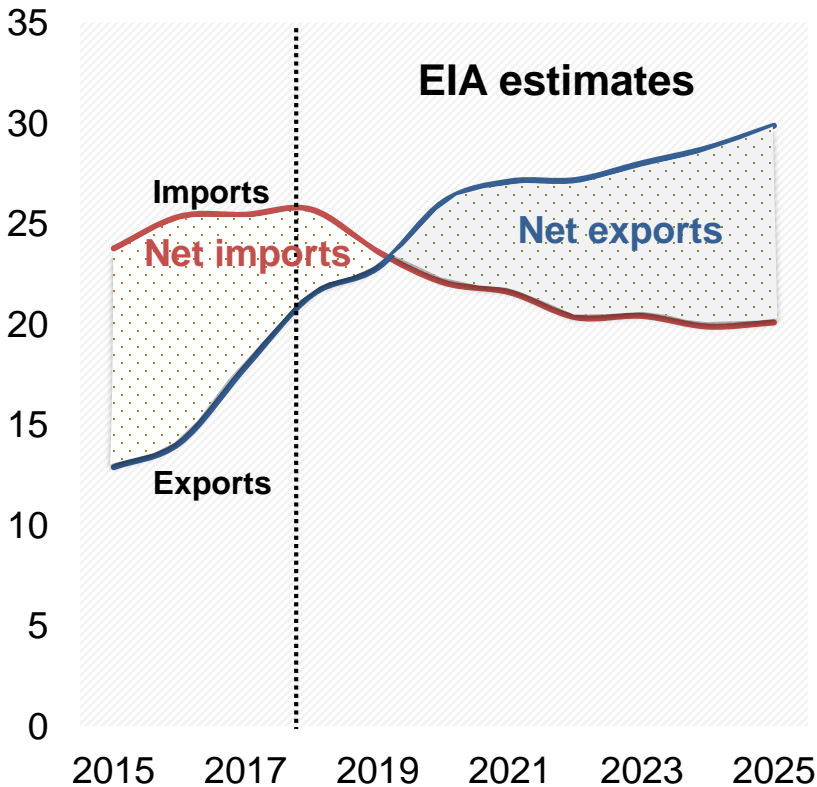
# EIA expects the U.S. to become an energy net exporter this year



- ▶ The U.S. is already a net exporter of coal, natural gas and natural gas liquids, and EIA projects the U.S. will become a net exporter in 2019 of total energy (including oil)
- ▶ The turning point could be a decline in petroleum net imports, which averaged 1.2 mb/d through the first seven months of 2019 (API)

## Gross energy trade

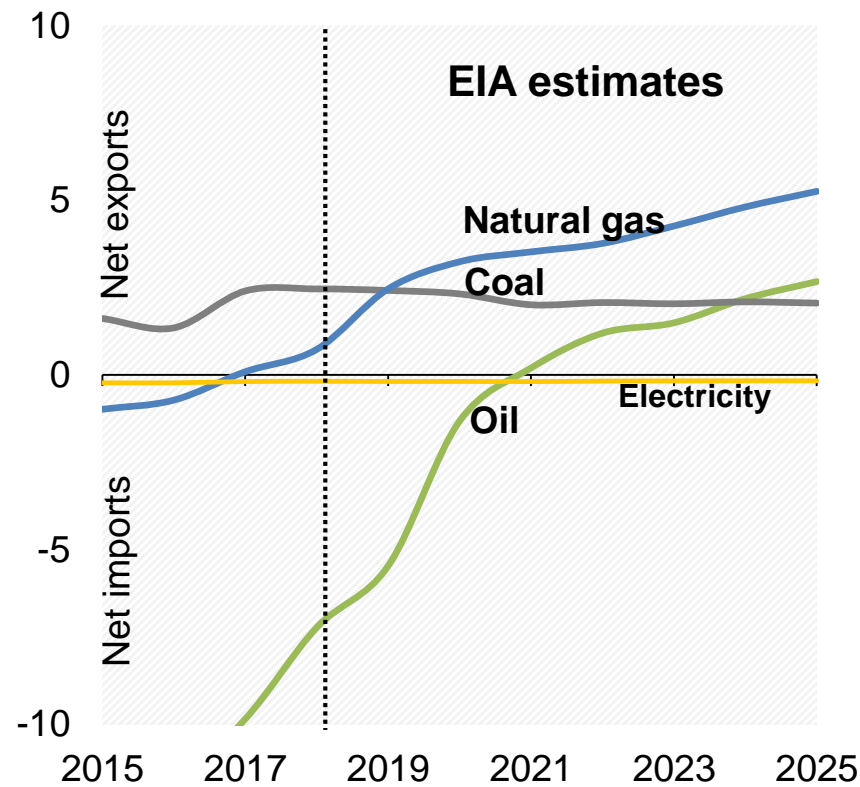
Quadrillion Btu



source: EIA

## Energy net exports and imports

Quadrillion Btu

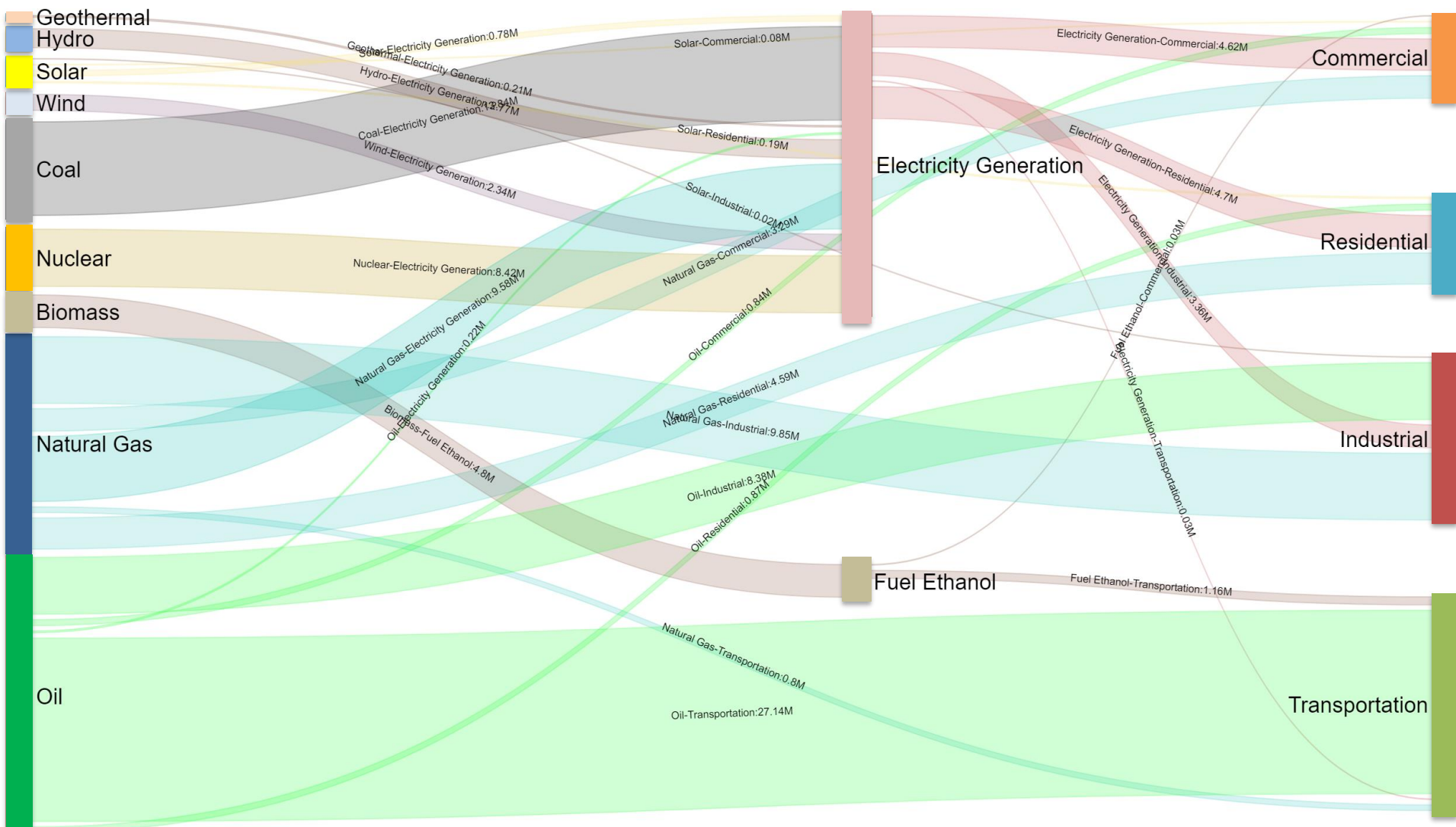


source: EIA

# EIA estimates that oil, natural gas and coal will have supplied more than 80% of U.S. primary energy demand in 2019



U.S. total energy consumption exceeded 100 quadrillion Btu for the first time in 2018 (EIA)



sources: EIA AEO (2019), EIA SEDS (2019), API Team graphics; energy shares based on 2017 consumption

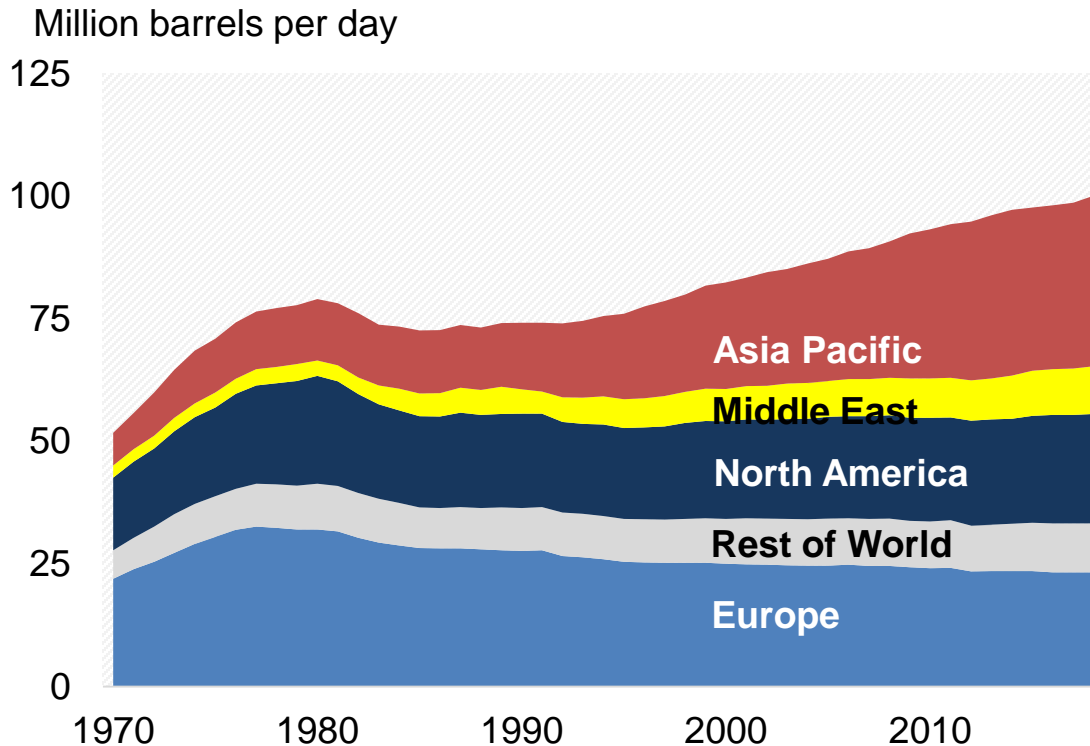


# Global refiners have expanded to meet demand growth

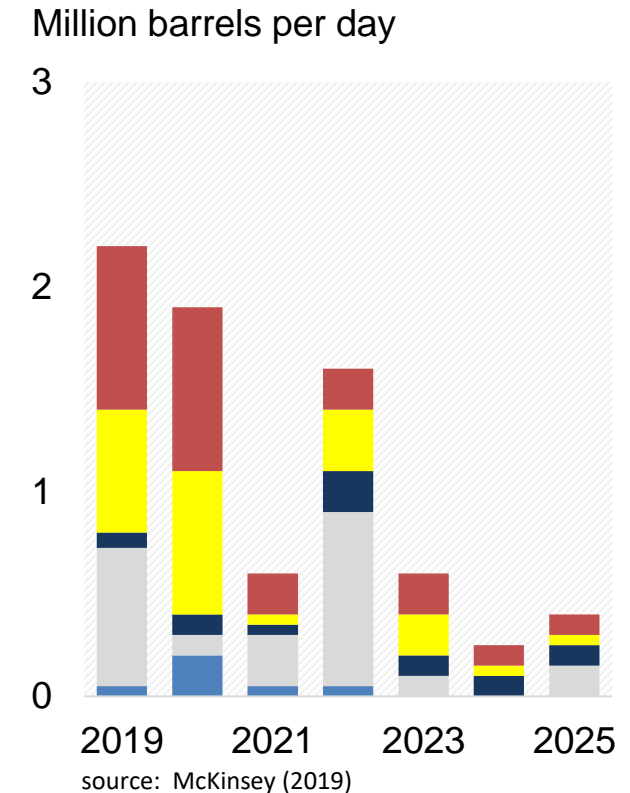


- ▶ Refining capacity has expanded in Asia, the Middle East and North America – and is expected to grow more than 7.0 mb/d by 2025

## Global refinery capacity



## Global planned refinery capacity additions



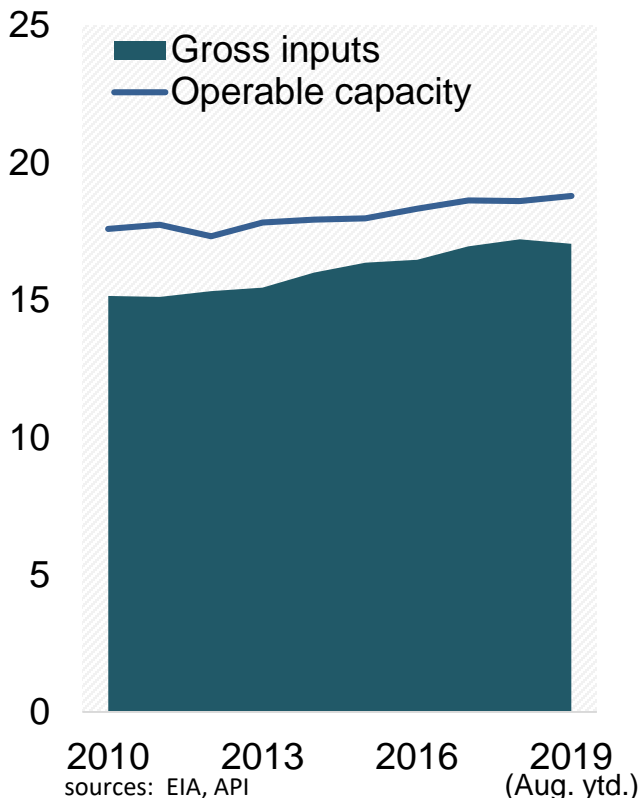
# As refineries have expanded, the U.S. has increasingly become a supplier of finished products to the world



- Since 2010, U.S. refining capacity has increased 6.8% while throughput rose 11.7%, yielding world-leading capacity utilization rates
- This growth has leveraged domestic crude oil – driving imports to 24-year lows and enabling petroleum exports to reach new records

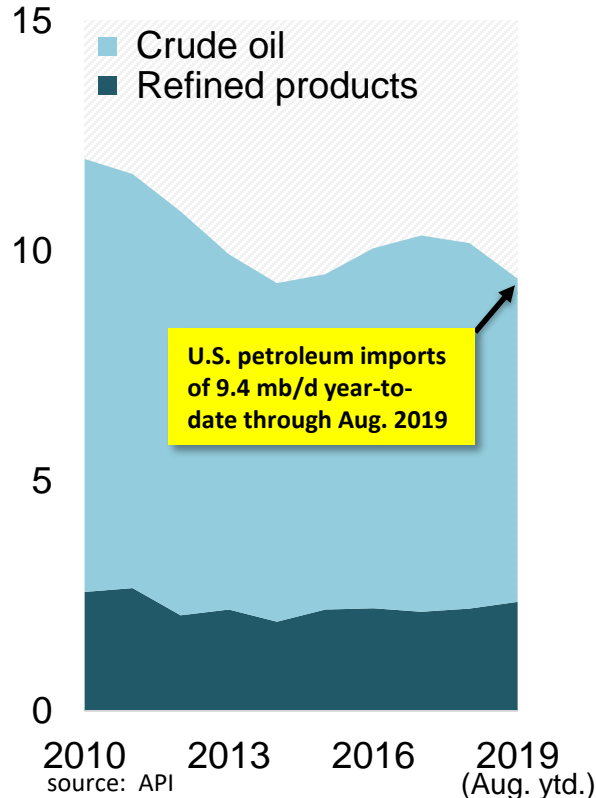
## U.S. petroleum refining

Million barrels per day



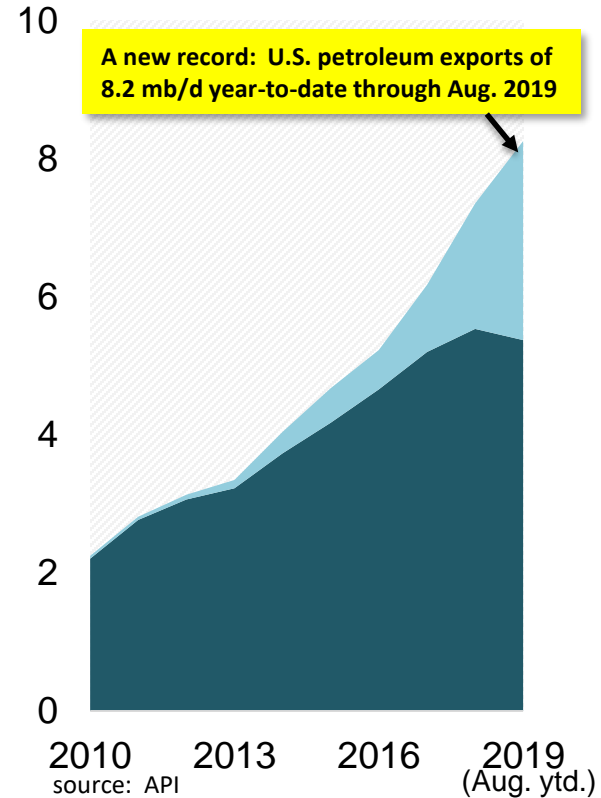
## U.S. petroleum imports

Million barrels per day



## U.S. petroleum exports

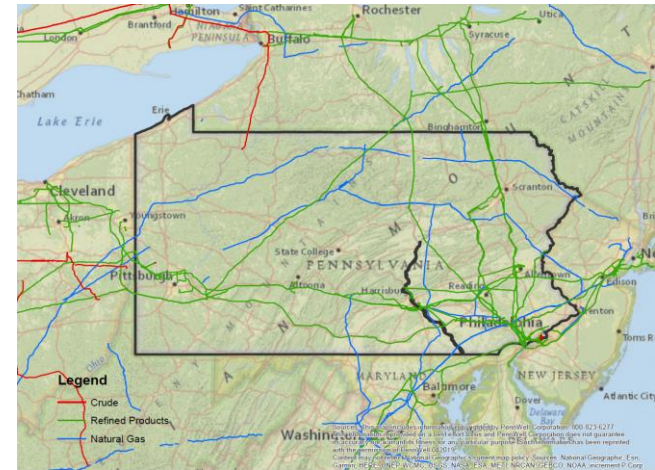
Million barrels per day





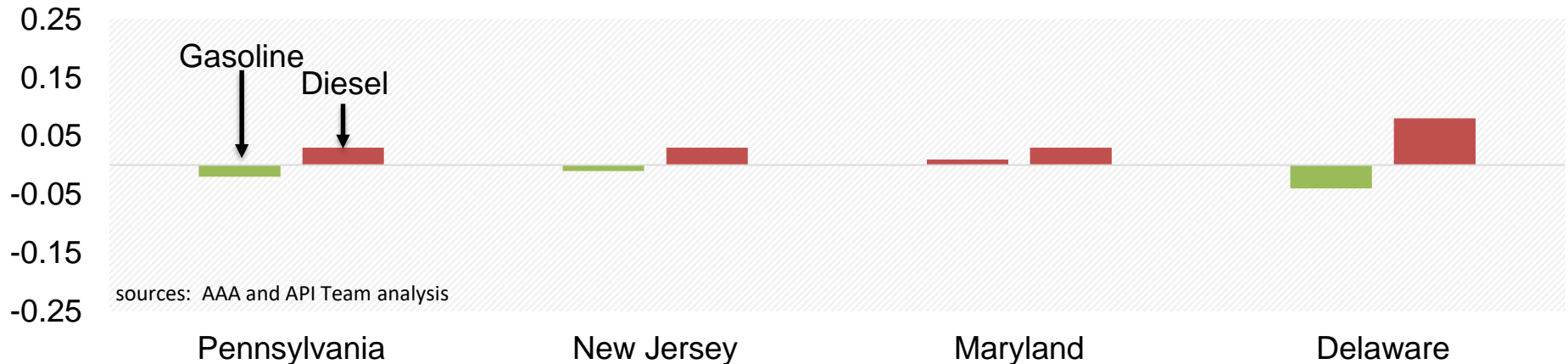
# Philadelphia Energy Solutions' refinery shutdown had negligible consumer price impact

- As Philadelphia Energy Solutions' 300,000 barrel per day refinery closed in late June, the resilient U.S. petroleum sector, infrastructure and market forces ensured products moved to serve the regional market
- Subsequently, the differences in state fuel prices from the U.S. average changed very little – and gasoline prices in PA, NJ and DE fell further below the U.S. average



## Average fuel price differences in June and July, compared with the U.S. average

Cents per gallon



# Potential demand responses to IMO 2020 from residual fuel oil to distillates have past precedents



- For decades, global demand for distillates has grown while that for residual fuel decreased
- Market demand changes similar in magnitude to IMO 2020 have precedents where, over three-year periods, residual fuel oil demand decreased by more than 4.0 mb/d and distillate demand rose by more than 2.0 mb/d

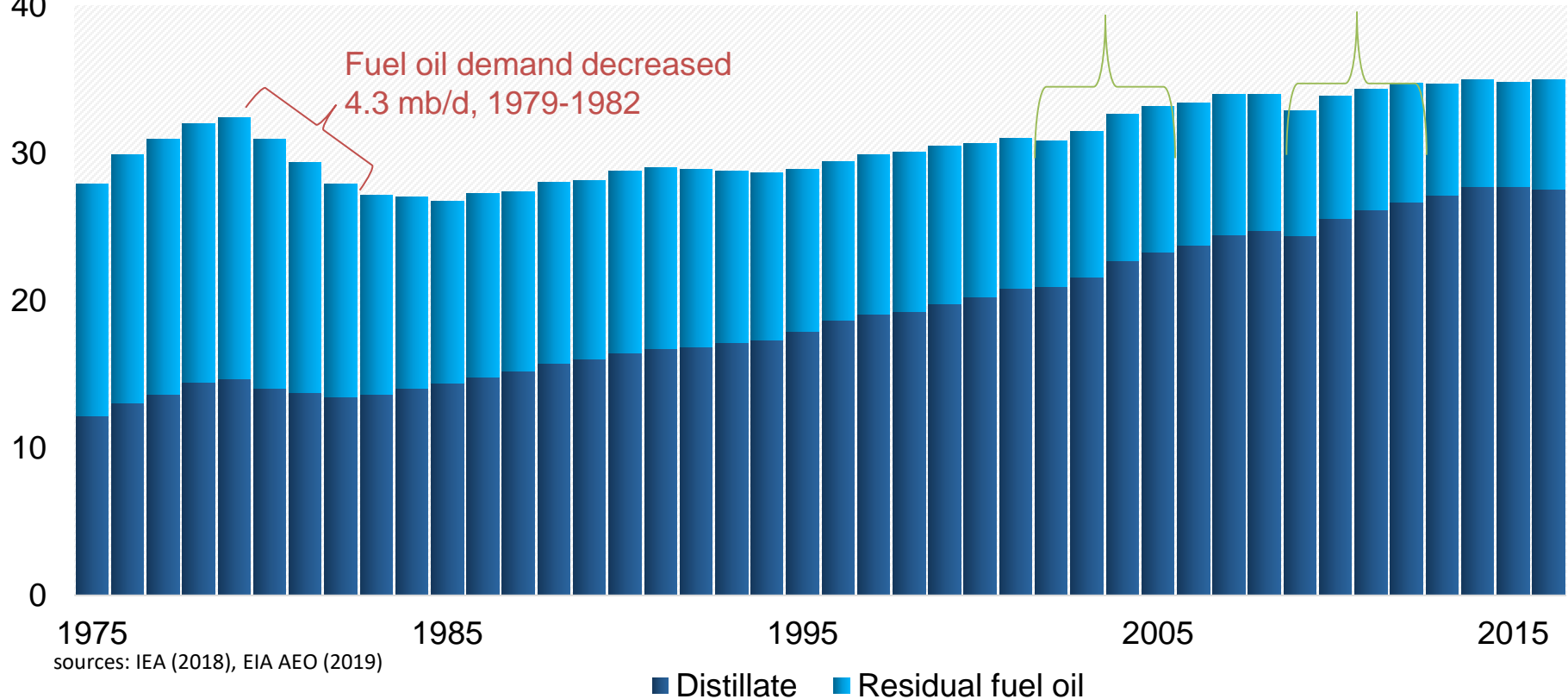
## Global fuel switching precedents

Million barrels per day (mb/d)

40

Fuel oil demand decreased  
4.3 mb/d, 1979-1982

Gas/diesel oil demand increased by 2.3  
mb/d in 2002-2005 and 2009-2012



# U.S. refineries have put their plans into action for IMO 2020



- U.S. refining system is well-positioned for IMO 2020 due to our:
  - Relatively complex refineries;
  - Access to attractive crude oils;
  - Abundant and inexpensive natural gas; and,
  - The best workers in the global industry

This combination makes the U.S. refining system flexible and resilient in competing to place its products globally

**Economic variables** that are likely to affect IMO 2020 outcomes

1. Regional crack spreads
2. Heavy crude price differential, especially the WTI-WCS spread for U.S. refiners
3. Coker economics

Refinery capabilities/capacities that influence refiner optionality

1. Residual fuel oil **upgrading capability**
2. Capacities for **sulfur treating** and **hydrotreating**







## Operations

- Shift to **hydrocracking** instead of **cat cracking** to emphasize distillate production over gasoline production
- **Hydrocracking** of residual fuel oil can produce greater yields (rather than simply processing residual fuel oil)
- Much distillate can be supplied by **hydro-treating** gas oil in a refinery or de-converting jet fuel, but these entail **economic tradeoffs** among fuels
- Importance of **product placement options** that enable refineries to run at high utilization rates
- Importance of **reliability**, which is affected by investment

## Storage, export capacities, and global markets

- On the margin, residual fuel oil could flow into the power sector globally
- The capacity to trade high-sulfur fuels depends in part on U.S. tank storage and export infrastructure capacities

# Motor gasoline and diesel fuel prices have generally moved with crude oil, and EIA expects some impact from IMO 2020



- Prior to recent events in Saudi Arabia, EIA projected stable prices to 2020 with a wider difference between diesel, gasoline and crude oil prices, mainly due to IMO 2020

## Crude oil, gasoline and diesel fuel prices, adjusted for consumer price inflation

2019\$ per gallon

4

3

2

1

0

EIA estimates

sources: EIA, AAA, Bloomberg, BLS

2015

2016

2017

2018

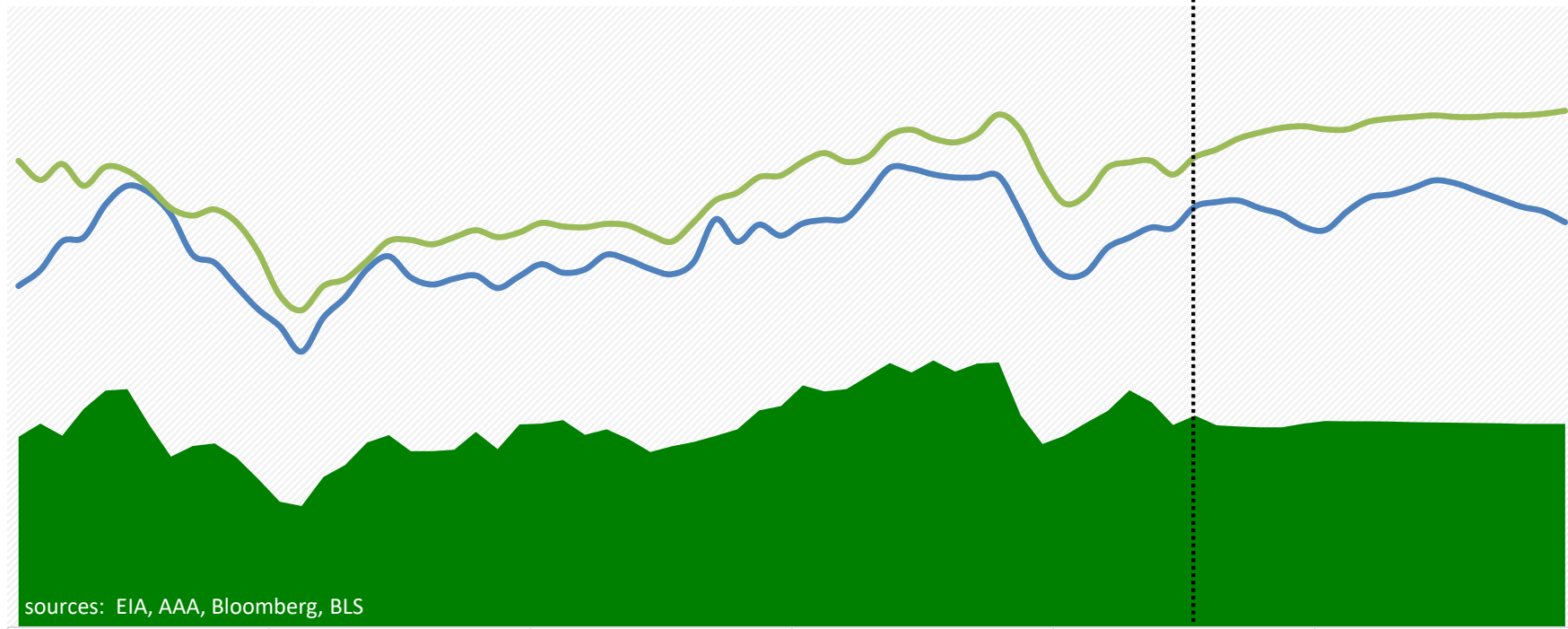
2019

2020

West Texas Intermediate crude oil

Gasoline - U.S. average

Diesel - U.S. average



The image features a close-up of a gas stove burner with several blue flames. The background is a dark, starry night sky with a city skyline visible on the horizon. A horizontal bar with segments of blue, red, green, orange, and purple is positioned above the burner. The text "Natural Gas" is written in white, bold, sans-serif font on the left side of the burner.

# Natural Gas

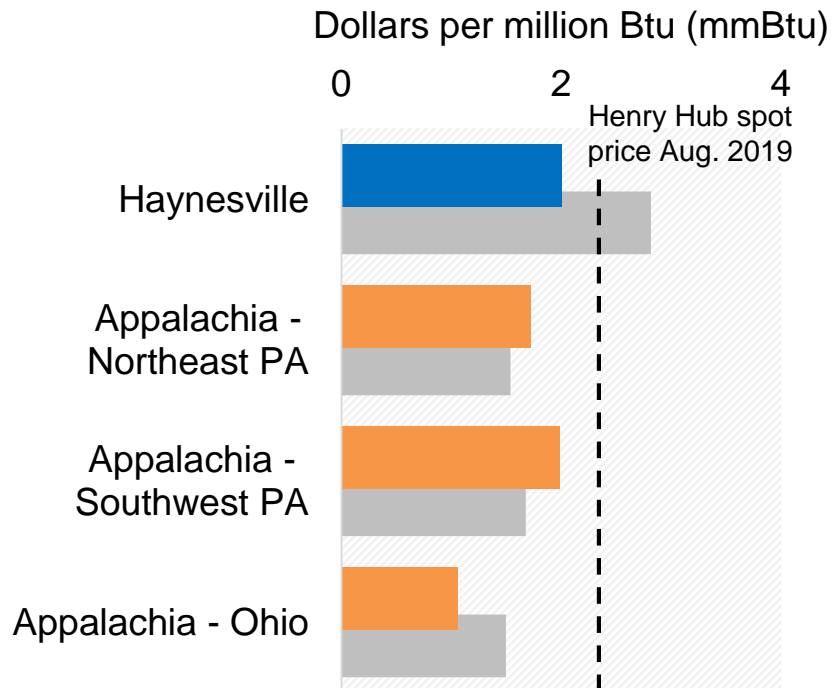


# Solid productivity and cost-effective production support continued U.S. natural gas production growth



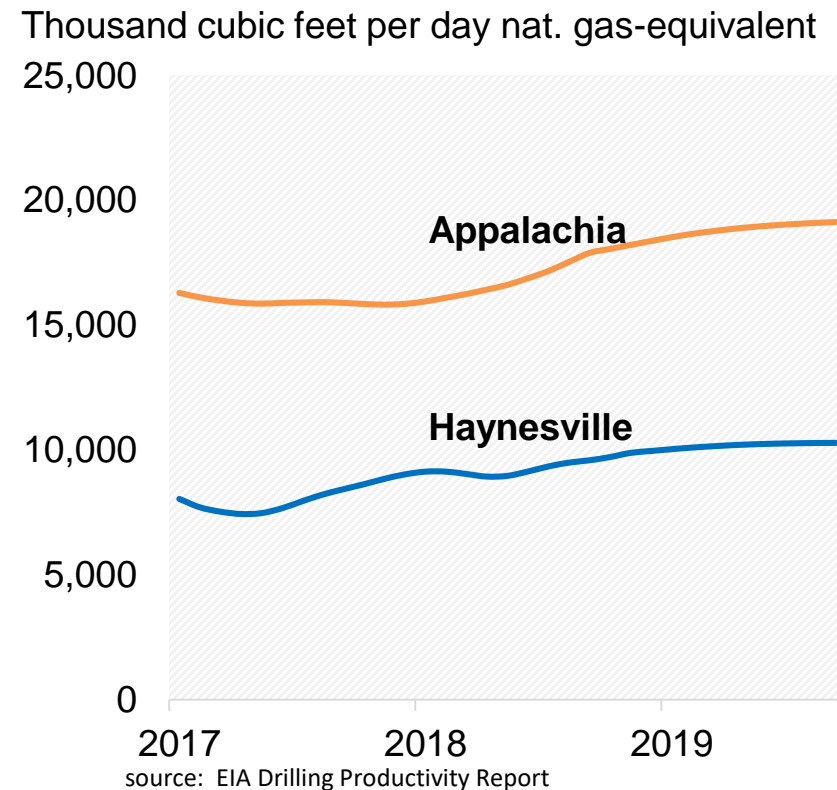
- BTU Analytics estimates breakeven prices among major producing regions range from \$1.06 per million Btu (mmBtu) to \$2.01 per mmBtu

## Breakeven prices for selected gas plays – August 2019\*



\*Half cycle breakevens assuming 10% discount factor and play-specific costs  
source: BTU Analytics

## U.S. natural gas productivity – new production per rig



# Global LNG prices dropped to roughly half of historical levels...



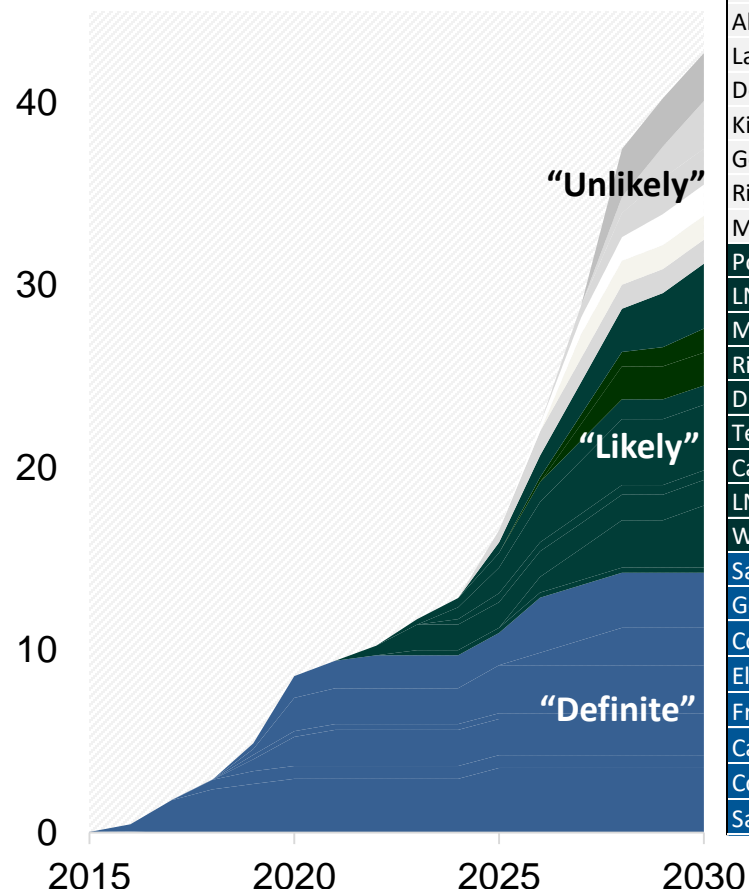
## Global natural gas landed prices (\$ per million Btu) – June 2019



# Bloomberg anticipates about 25 Bcf/d of new North American export capacity by 2030

## North American LNG projects

Billion cubic feet per day (Bcf/d)



Plant name	Bloomberg view of likelihood	Final Investment Decision (FID) Status	2030 capacity (Bcf/d)
Corpus Christi Mod. 1-7	Unlikely	Under regulatory review	3.0
Plaquemines Mod. 1-20	Unlikely	Planning FID	2.6
Freeport LNG Train 4	Unlikely	Planning FID	0.7
Alaska LNG	Unlikely	Planning FID	2.6
Lake Charles	Unlikely	Planning FID	2.0
Delfin FLNG	Unlikely	Planning FID	1.7
Kitimat LNG	Unlikely	Planning FID	1.3
Goldboro LNG	Unlikely	Planning FID	1.3
Rio Grande LNG Tr. 3-6	Unlikely	Under regulatory review	2.4
Monkey Island (SCT&E)	Unlikely	Under regulatory review	1.6
Port Arthur LNG	Likely	Planning FID	1.8
LNG Canada Tr. 3-4	Likely	Planning FID	1.6
Magnolia LNG	Likely	Planning FID	1.1
Rio Grande LNG Tr. 1-2	Likely	Planning FID	1.2
Driftwood	Likely	Planning FID	3.6
Texas LNG	Likely	Planning FID	0.5
Calcasieu Pass	Highly Likely	Planning FID	1.4
LNG Canada Tr. 1-2	Likely	FID taken	1.6
Woodfibre LNG	Likely	FID taken	0.3
Sabine Pass Tr. 6	Likely	Under construction	0.6
Golden Pass	Likely	Under construction	2.1
Corpus Christi Tr. 1-3	In operation/definite	Under construction	1.8
Elba Island	In operation/definite	Under construction	0.3
Freeport LNG Tr. 1-3	In operation/definite	Operational (T1); Under construction (T2-3)	2.0
Cameron LNG	In operation/definite	Operational (T1); Under construction (T2-3)	2.0
Cove Point	In operation/definite	Operational	0.7
Sabine Pass Tr. 1-5	In operation/definite	Operational (Tr. 1-4); Construction (Tr. 5)	3.6

source: Bloomberg New Energy Finance (June 2019), amended for Sabine Pass T6 FID; Golden Pass construction; Port Arthur regulatory approval and commercial HOA with Saudi Aramco; and, Cameron and Freeport T1 completions

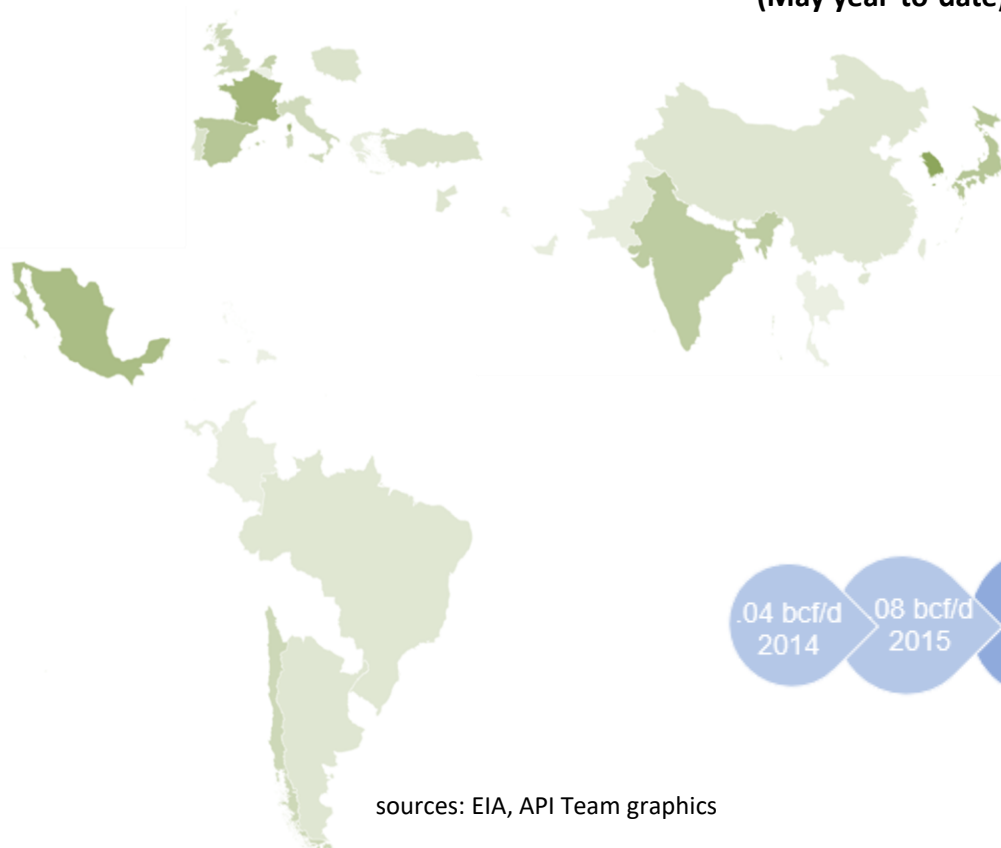


# U.S. LNG exports have helped reduce global CO<sub>2</sub> emissions while bolstering global gas market depth and liquidity

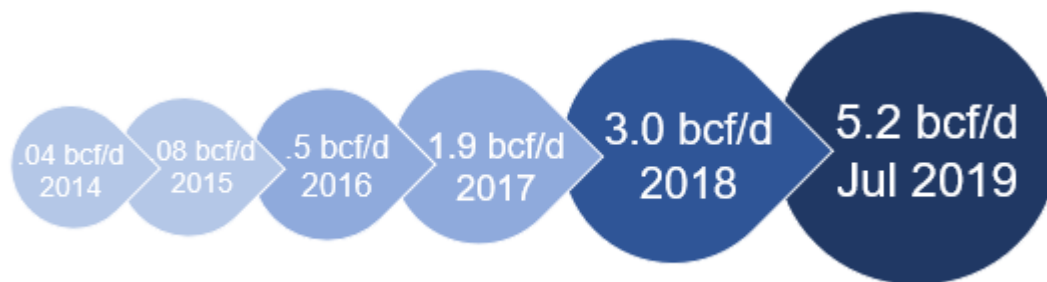
- » Between 2014 and 2018, about 50% of U.S. LNG exports went to Asia and another 20% to Mexico
- » In 2019 so far, U.S. LNG exports have served 35 countries with roughly 40% going to Europe and another 35% to Asia despite China trade frictions

## 35 U.S. LNG export destinations in 2019

(May year-to-date)



## U.S. LNG gross exports



sources: EIA, API Team graphics

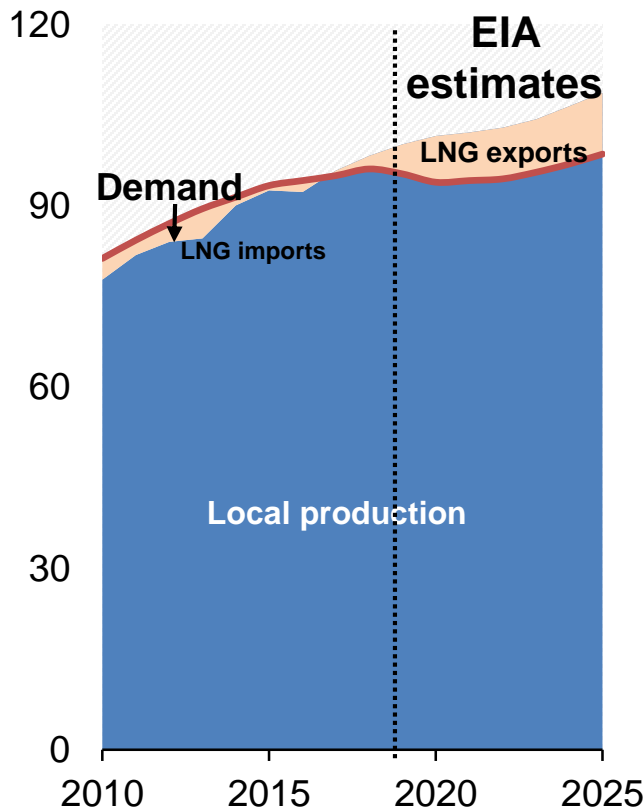
# With their contestable gas markets, Europe and Asia have been successful destinations for U.S. LNG



- EIA's regional natural gas demand projections depend first from the market share gas wins versus other fuels and second on the outcome of gas-on-gas competition
- LNG so far in 2019 has shown an ability to win versus the other gas sources

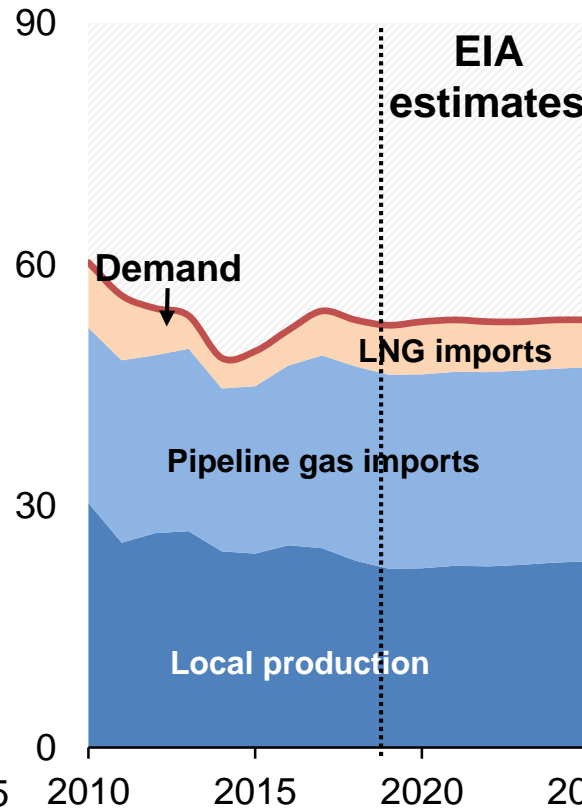
## North America

Billion cubic feet per day (Bcf/d)



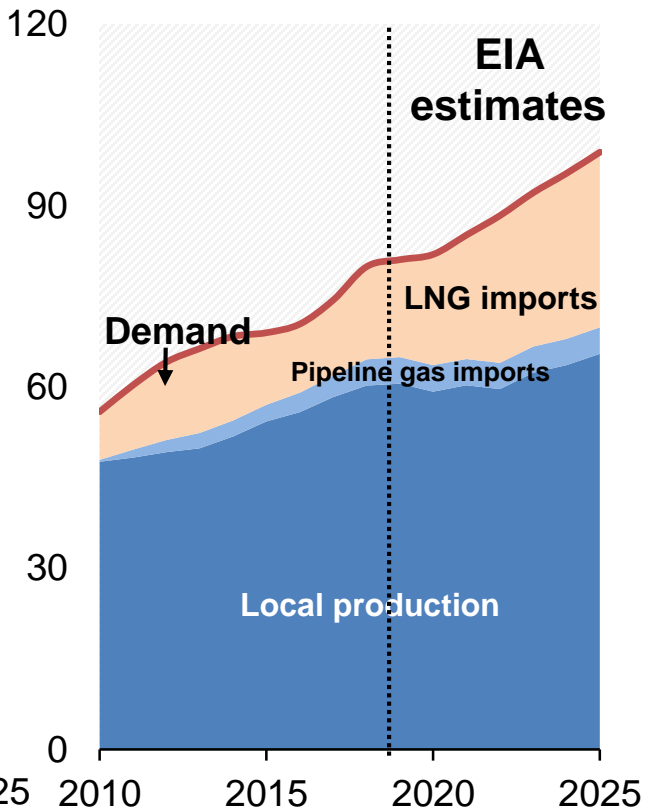
## Europe

Billion cubic feet per day (Bcf/d)



## Asia Pacific

Billion cubic feet per day (Bcf/d)



# Furthering the U.S. energy revolution will require industry leadership to achieve unprecedented mega-project execution



- Outside of steel tariffs, cost escalation has been modest with the first wave of mega-projects
- With a mounting project queue, active cost containment measures will be key to execute the next wave of projects which are critical to advance the U.S. energy revolution

## U.S. existing and proposed LNG export projects



## Cost containment measures

- Advance workforce planning/training
- Contracting strategy to promote competition, including
  - Well-defined work packages
  - Global project management
  - Diverse sourcing/procurement
  - Yard selection/supervision
  - Construction management
  - Flexible contract types (reimbursable, lump-sum, or hybrid)
- Consideration of alternate delivery models, including modularization, mid-scale LNG, Floating LNG



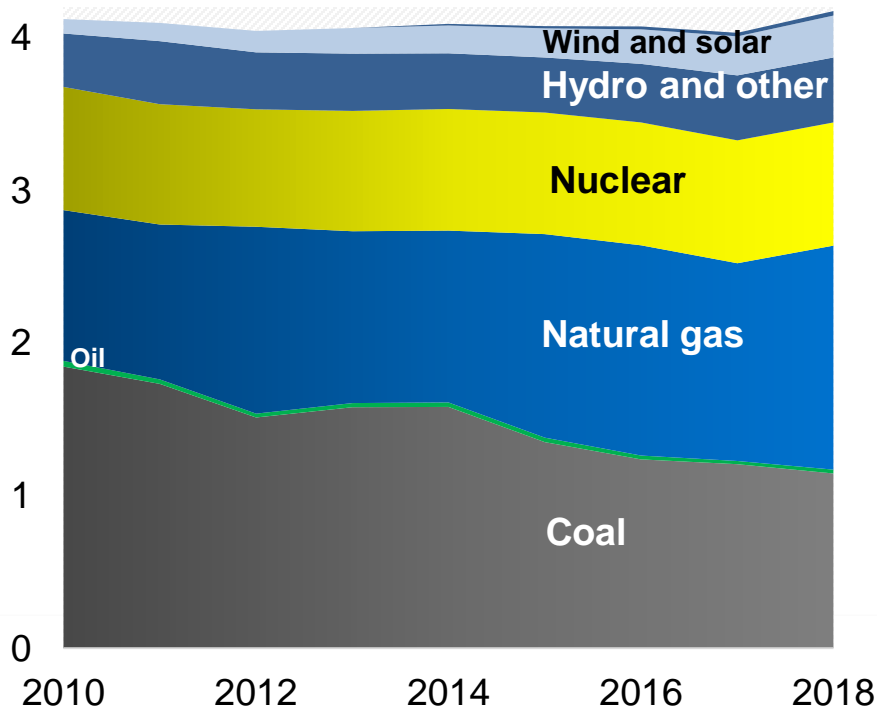
# Increased natural gas and renewables in electricity generation corresponded with lower rates



- Between 2010 and 2018, U.S. coal-fired electricity generation fell by 38%, while that of natural gas increased by 49% and renewables by 64%
- National average U.S. electricity rate decreased by 6.5% over the same period

## U.S. electricity net generation

Billion megawatt hours

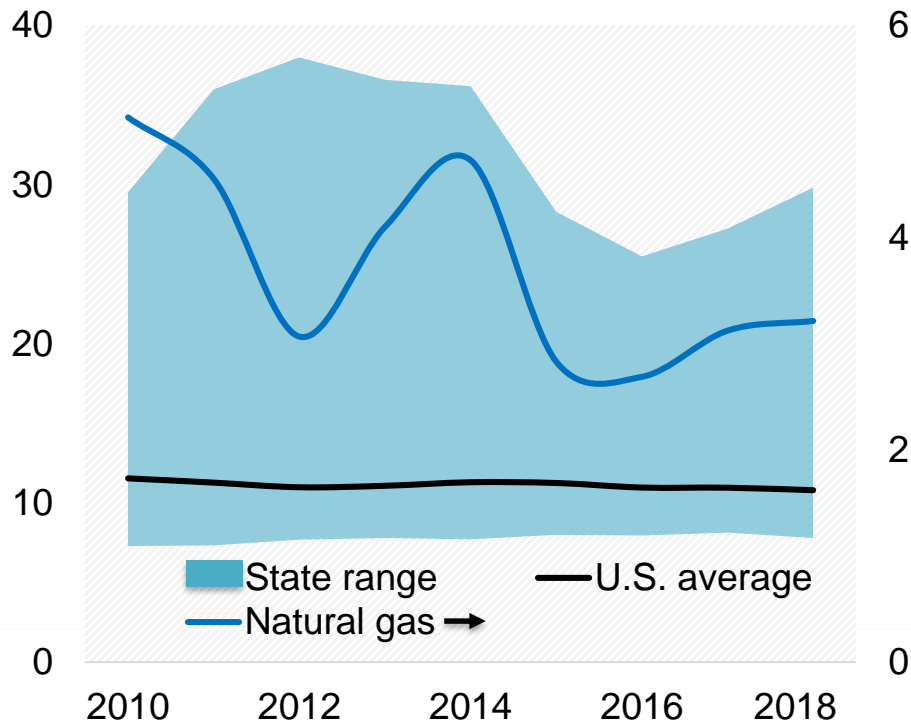


source: EIA

## Real electricity prices versus natural gas prices - all sectors

2019 cents per kWh

2019 dollars per million Btu



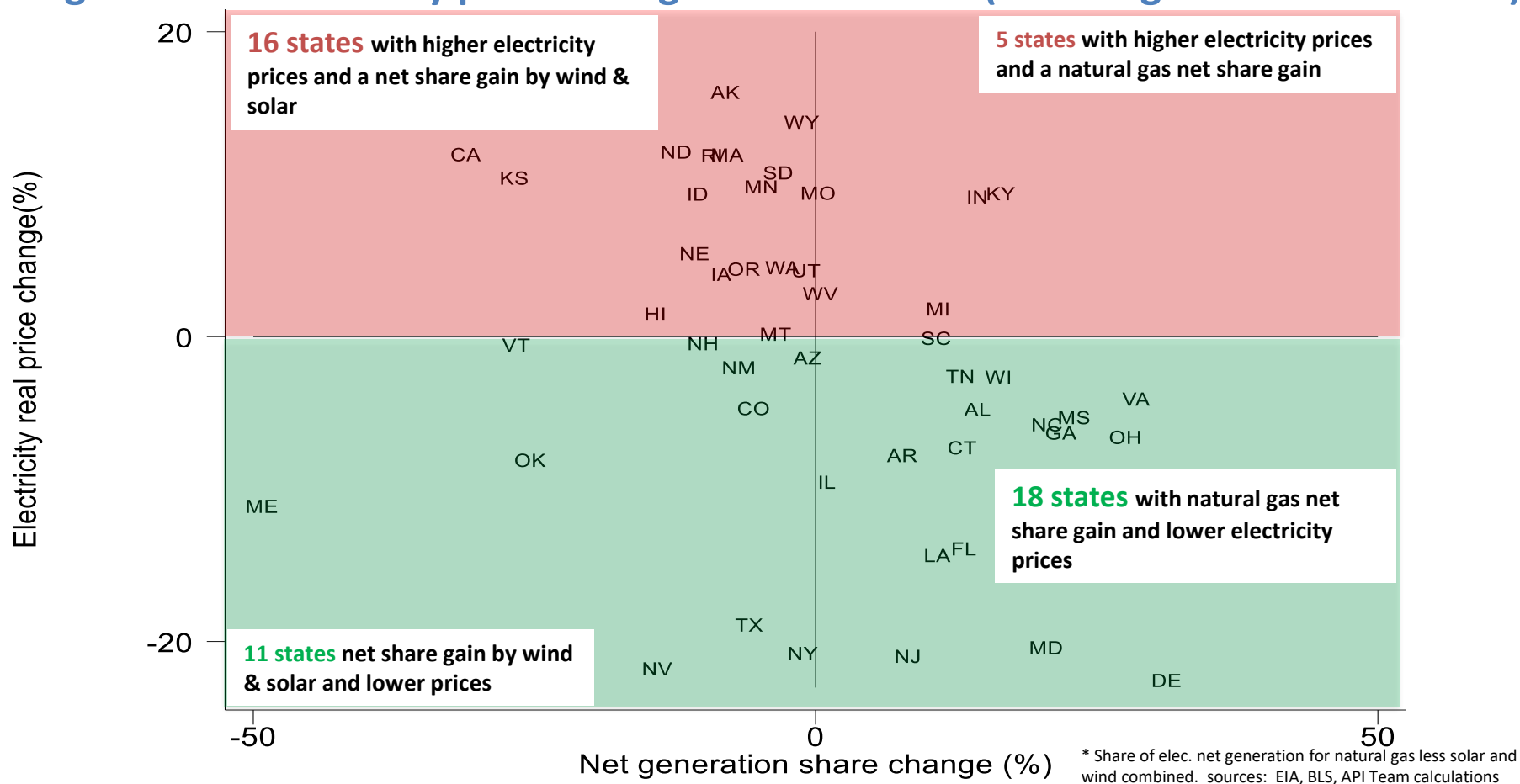
source: EIA

# States that added relatively more natural gas-fired electricity generation have tended to see lower electricity prices



- U.S. real electricity prices decreased among 78% of states that added more natural gas than solar & wind between 2010 and 2018
- Among states where real electricity prices increased between 2010 and 2018, 76% added more wind & solar than natural gas into their generation mix

## Changes in real electricity prices and generation share (natural gas vs. wind & solar)\*

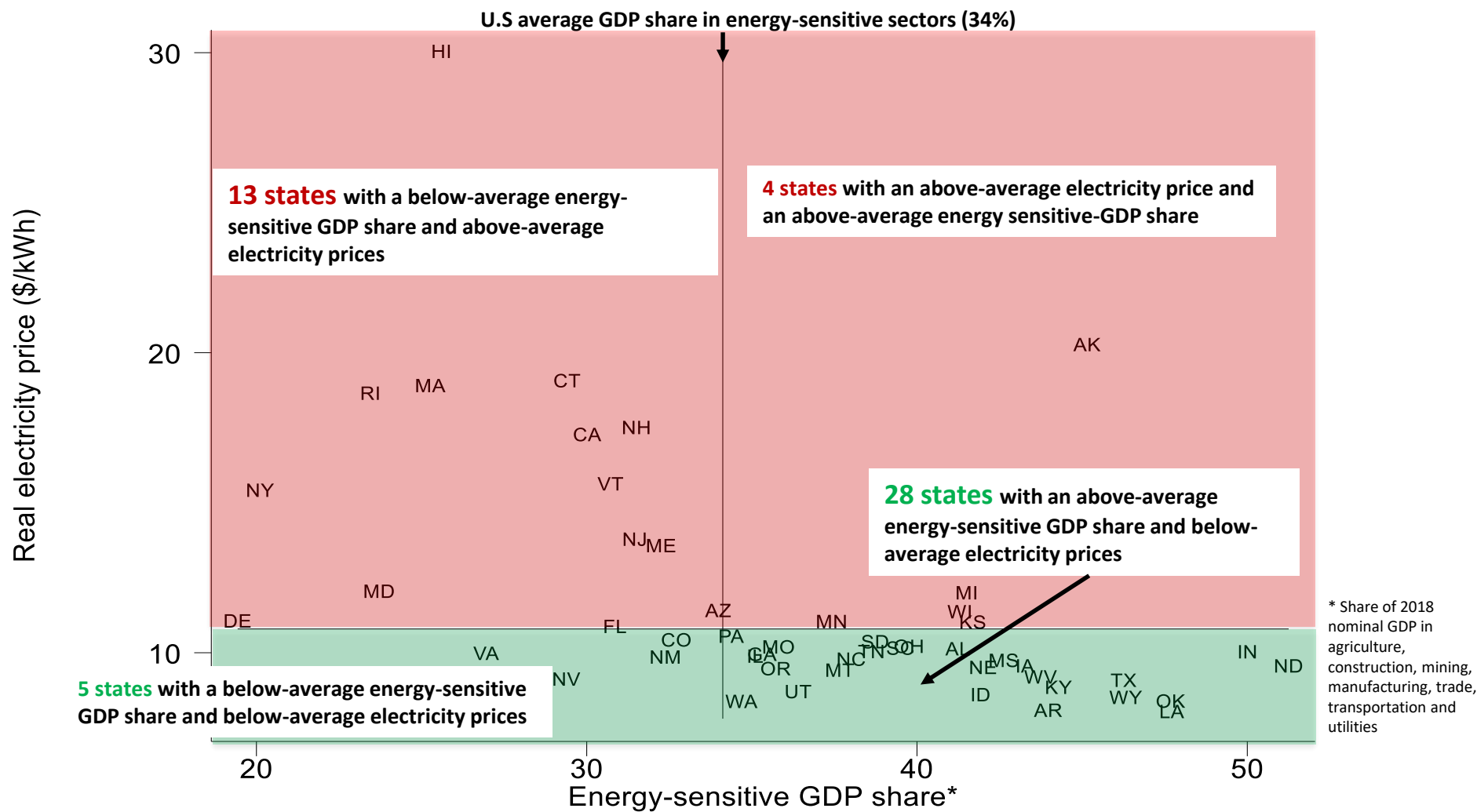


# States with relatively greater economic exposure to energy tended to have relatively lower electricity prices, and vice versa



- Cost-effective and reliable energy affects consumers and state competitiveness. In 2018, 41 of the 50 states lined up into the expected upper left and lower right quadrants

## 2018 electricity prices and state GDP share in energy-sensitive sectors\*





# Resources: Chief Economist's section at [www.api.org](http://www.api.org)

The screenshot shows the API website's navigation bar with the 'Chief Economist' link circled in red. A red arrow points from this link down to the 'DOWNLOADS' section at the bottom of the page, which is also circled in red. The 'DOWNLOADS' section lists two files: 'Monthly Statistical Report' (5 MB) and 'API Quarterly Industry Outlook (June 2019)' (2 MB).

energy **API** 100 YEARS EST. 1919

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## API'S ECONOMIC INDUSTRY OUTLOOK

Reports & Surveys

Weekly Statistical Bulletin

Monthly Statistical Report

**Economic Outlook**

Dean Foreman (left) and podcast hosts

The API Industry Outlook, developed by API's Chief Economist, Dr. R. Dean Foreman, is a quarterly report that provides an overview of the natural gas and oil industry as it relates to the U.S. and global economies.

### READ THE BLOG:

Chief Economist's Posts on the Energy Tomorrow blog

### READ THE NEWS RELEASES:

Chief Economist's News Releases, 2017

Chief Economist's News Releases, 2018

Chief Economist's News Releases, 2019

### DOWNLOADS

\* Monthly Statistical Report  
File Size: 5 MB

\* API Quarterly Industry Outlook (June 2019)  
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