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# Powering America Past Impossible



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# Powering America Past Impossible



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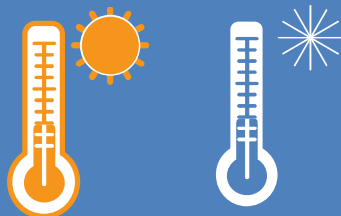
# Total Energy

# Energy is everything, and natural gas and oil are integral

## Transportation



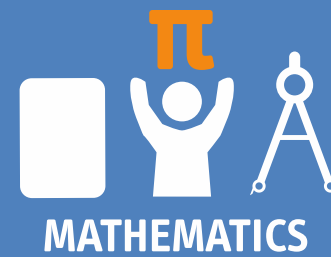
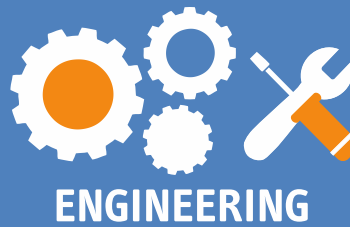
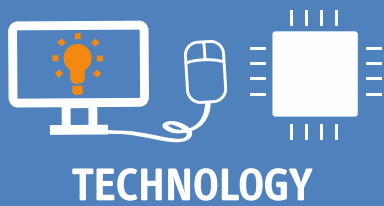
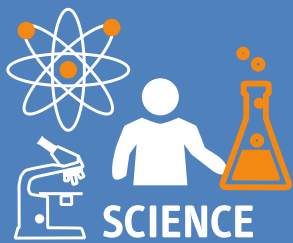
## Heating and Cooling



## Electric power

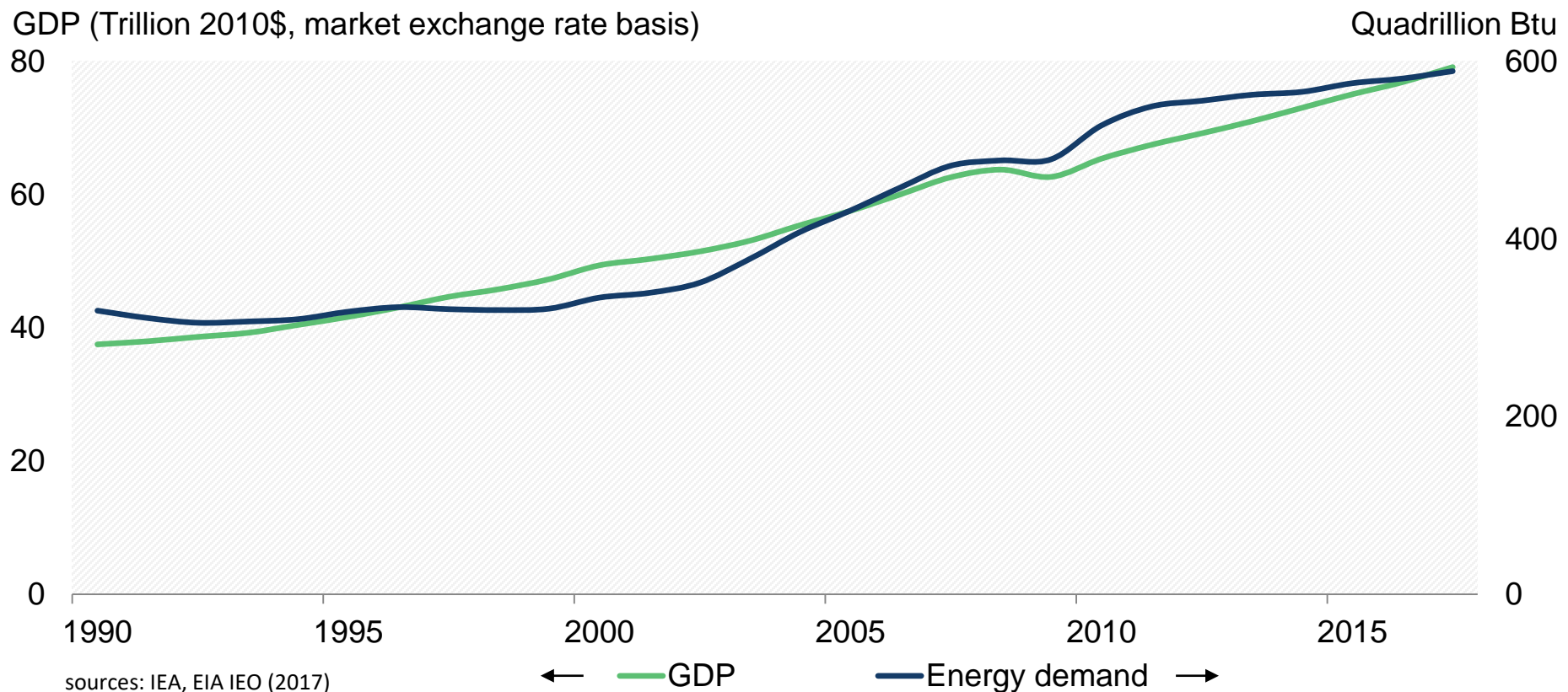


## Materials (Industry & Manufacturing)



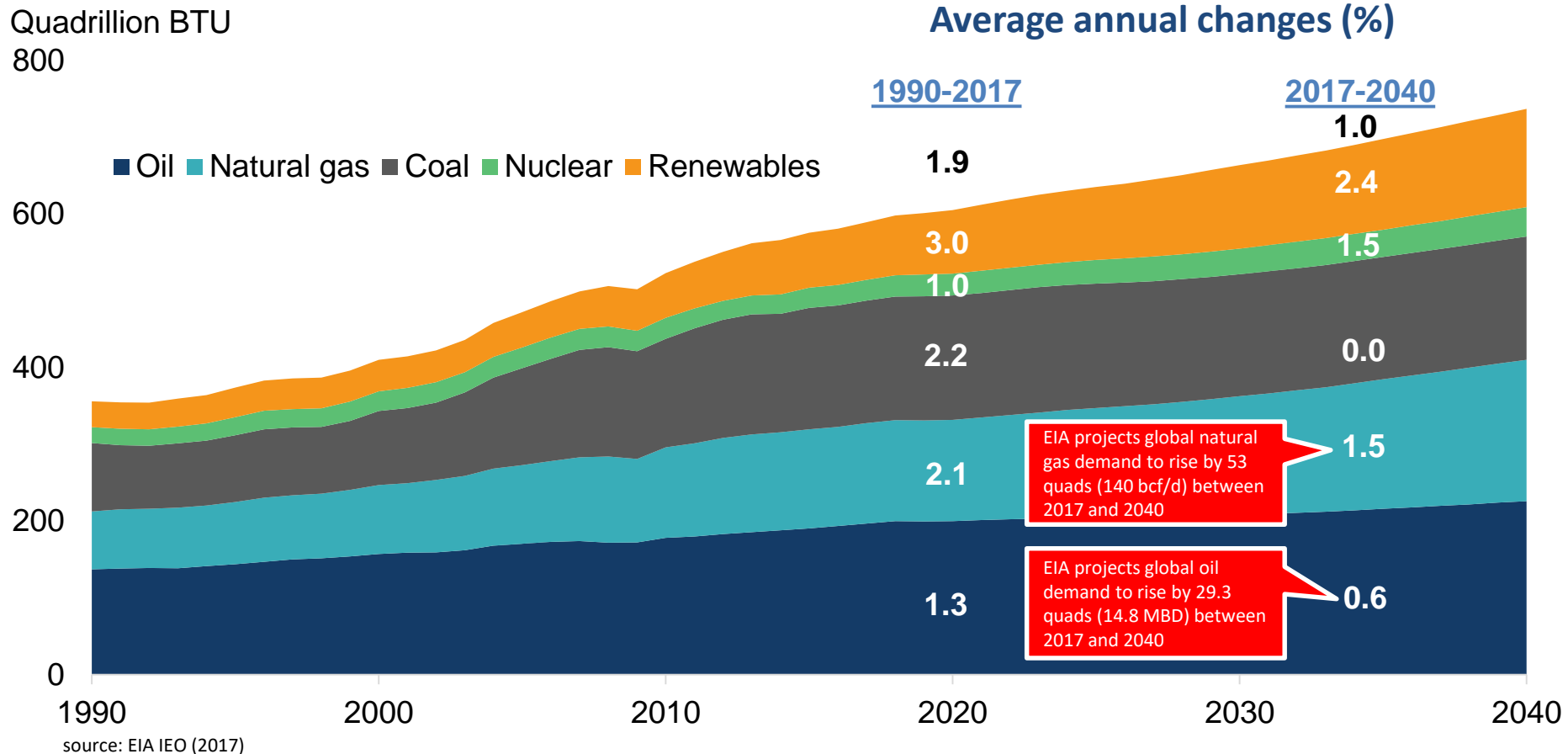
# Global economic and energy demand growth go hand-in-hand

- As the global economy grows, so does energy demand
- Since 2010, every one percent rise in global GDP has typically generated a 0.6 percent increase in energy demand



# Natural gas and oil accounted for more than 55% of global energy in 2017. EIA expects this to remain steady in 2040

- Renewables should sustain the highest growth among all fuels, but even so they would represent less than 20% of global energy needs in 2040



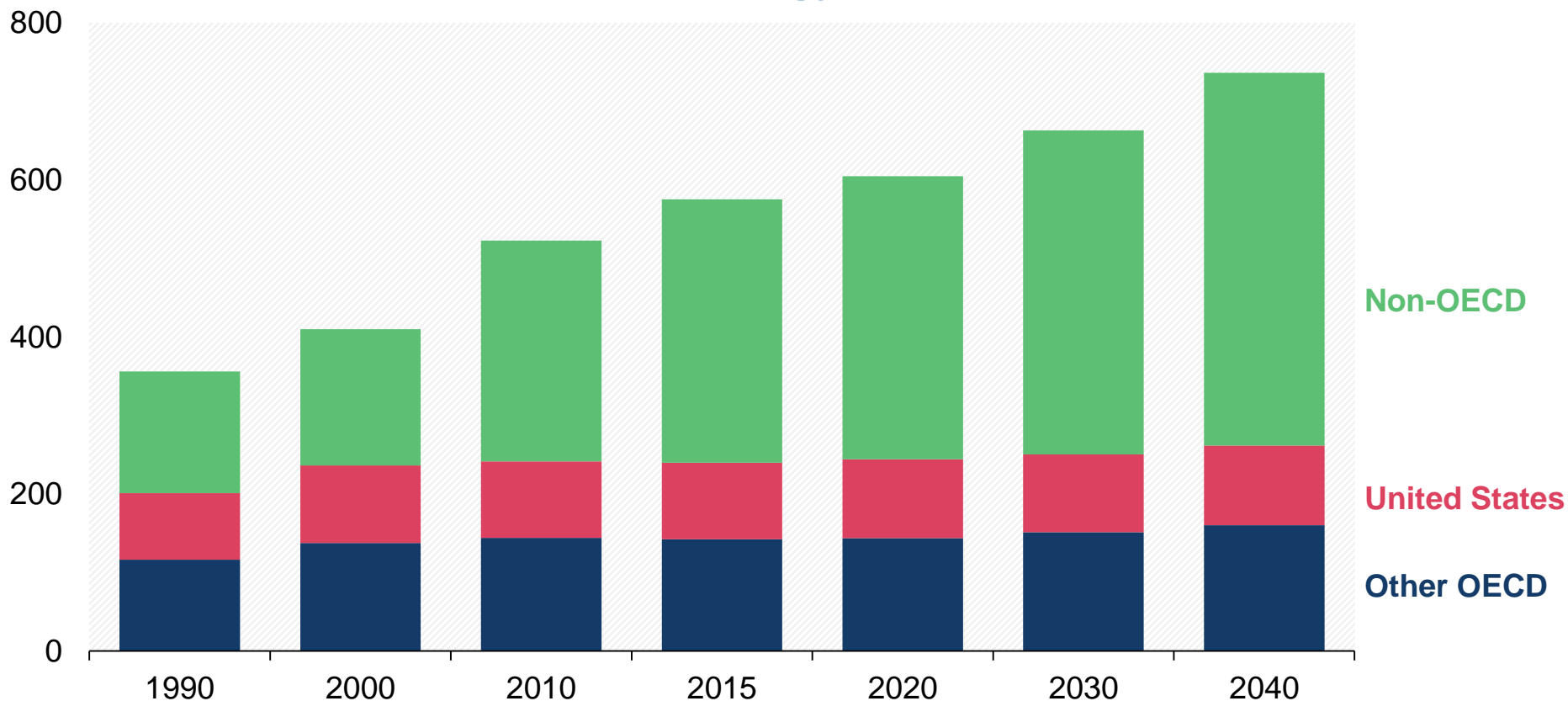


# While EIA expects Non-OECD economies to lead energy growth, U.S. and OECD economies continue with strong demand

- EIA expects Non-OECD economies to lead with energy demand growth of 28% between 2015 and 2040

Quadrillion Btu

## Global energy demand

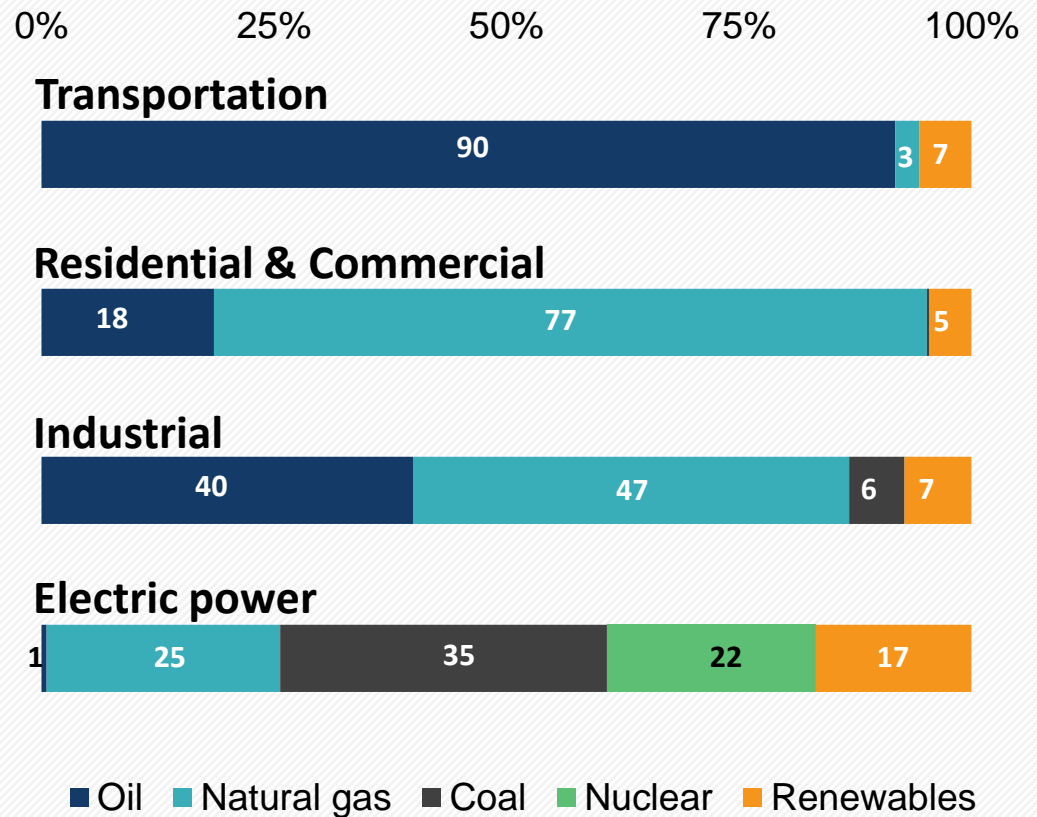
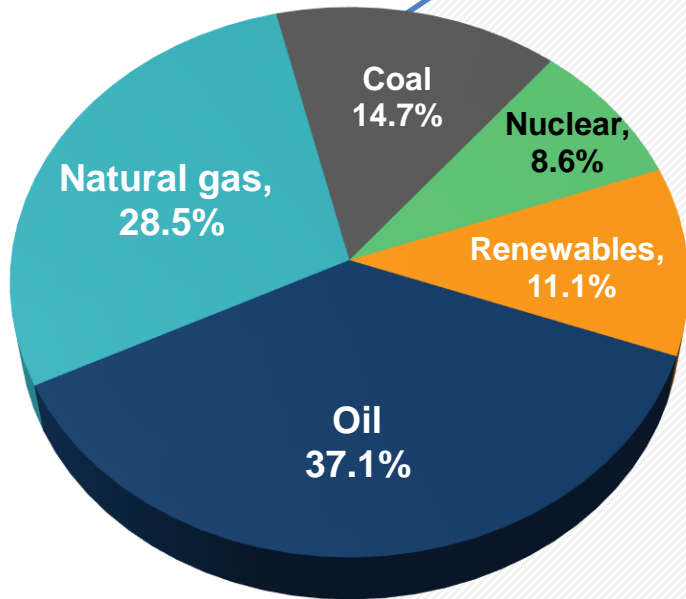


# U.S. primary energy demand in 2017 was led by natural gas & oil

- Natural gas and oil fulfill energy needs across every end use sector

## Energy consumption by fuel

96.8 Quadrillion Btu

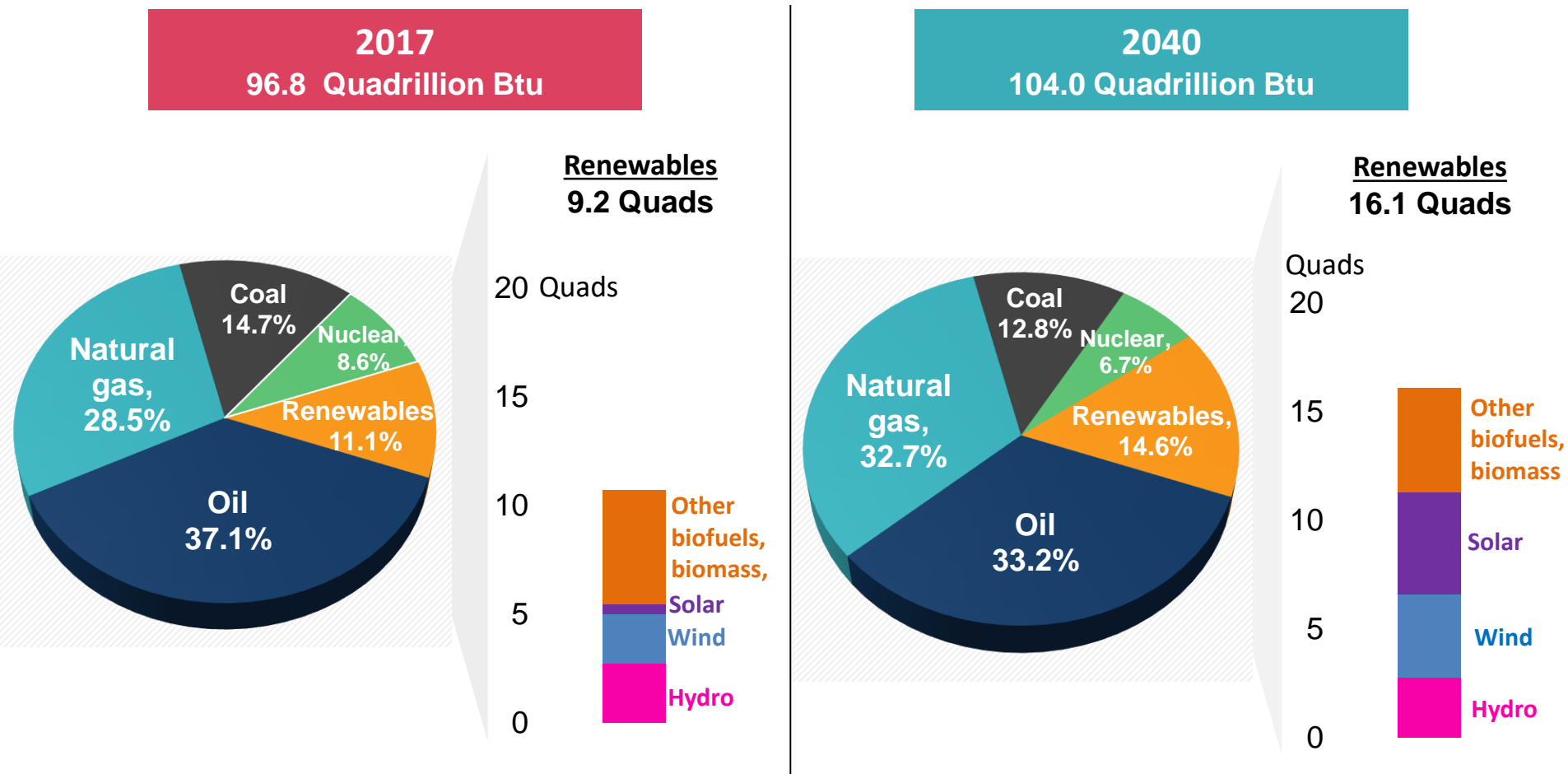


source: U.S. EIA AEO (2018)



# EIA expects natural gas and oil to supply nearly 2/3<sup>rd</sup>s of U.S. primary energy in 2040

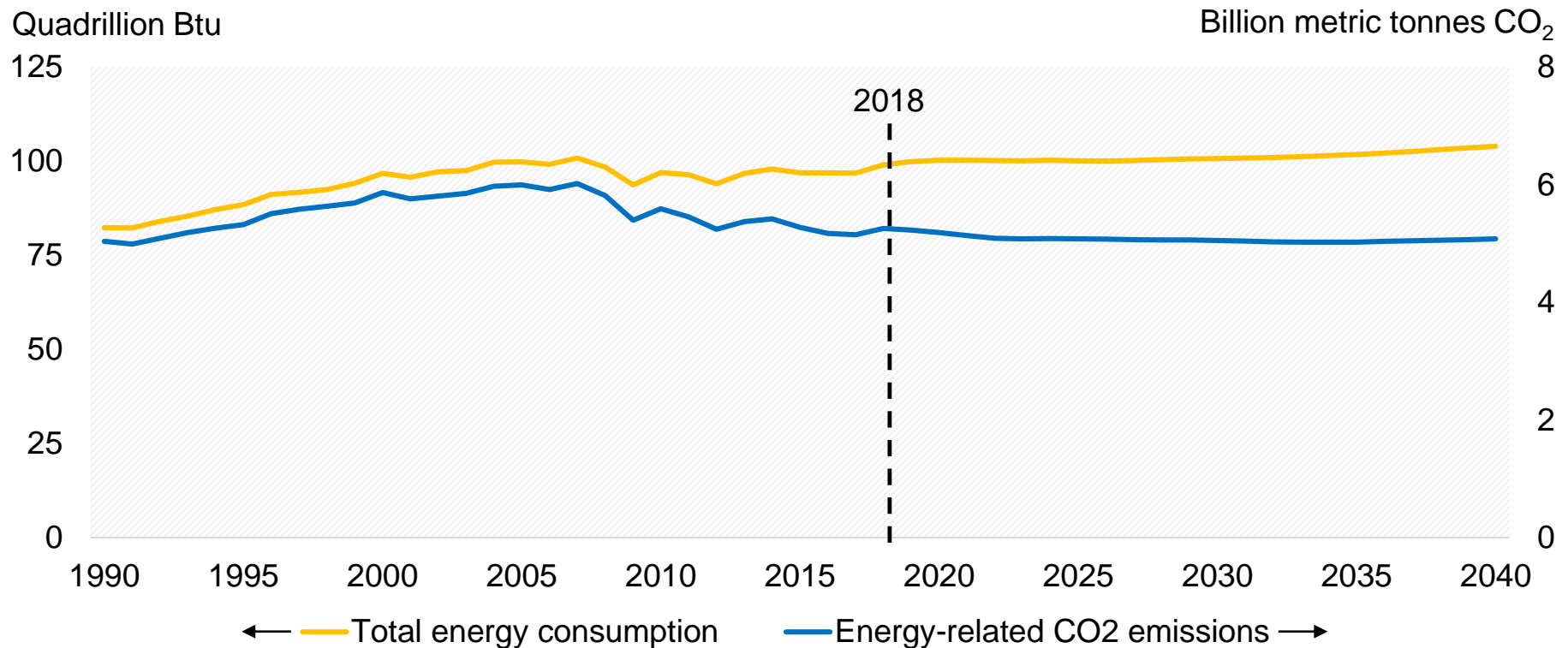
- U.S. energy consumption should continue to grow in total, with natural gas, wind and solar leading growth



source: U.S. EIA AEO (2018)

# Increased U.S. natural gas use and energy efficiencies have reduced CO<sub>2</sub> emissions as energy demand has grown

- Since 2005, total energy-related CO<sub>2</sub> emissions declined faster than total energy consumption, due largely to natural gas substitution for coal in power
- As energy consumption grows in the future, energy efficiency improvements and increased renewables and natural gas use should restrain CO<sub>2</sub> emissions



source: EIA AEO (2018)



# Global Oil Markets



# Oil prices relate to many uncertain factors

## CURRENT FACTORS

Supply / Demand →

Seasonality →

Inventories →

Capacity utilization →

Value after refining →

Current market level  
and recent direction →

## FUTURE EXPECTATIONS

← Geopolitics

← Demand growth

← Supply growth

← Capacity growth

← Logistics availability  
marine, pipelines

**MARKET PRICES**

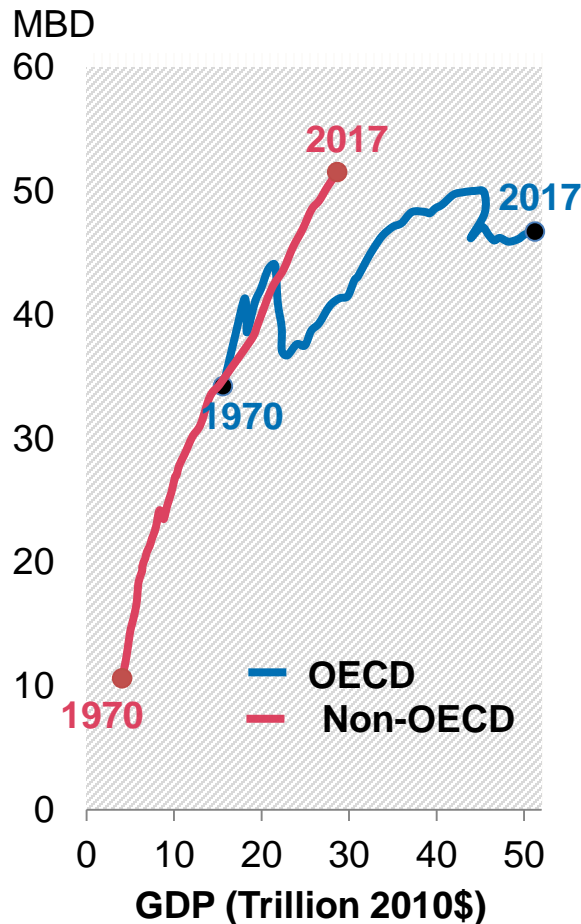
Willing Buyers  
& Willing Sellers

## FINANCIAL MARKETS

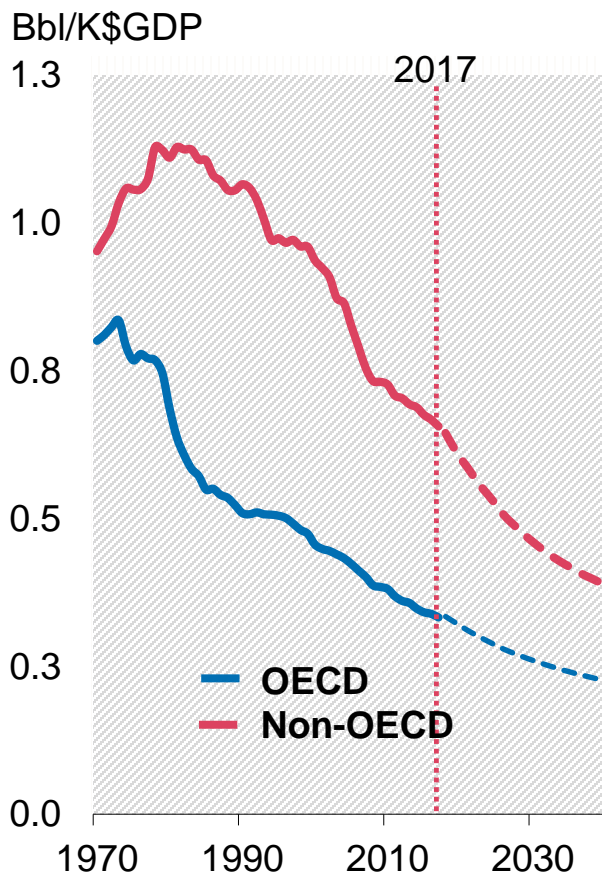
interest rates, foreign exchange rates, equity markets

# As the global economy grows, EIA expects efficiency gains and oil demand to continue to grow

## Oil demand and GDP by region

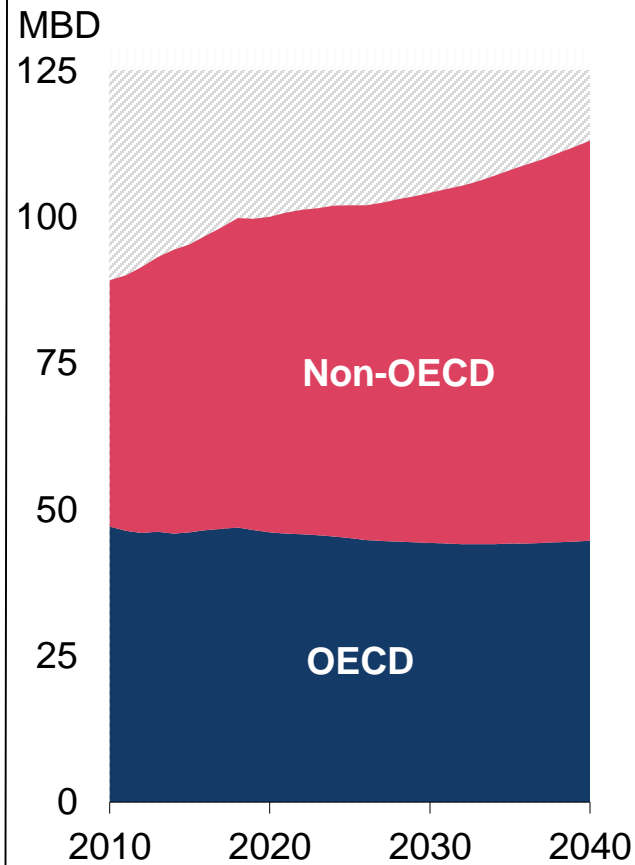


## Oil-to-global GDP ratio



source: EIA IEO (2017) – Reference case

## Oil demand projections





# Natural Gas



# Low U.S. natural gas prices motivate LNG production and exports

- U.S. natural gas prices have remained less than one-third of many international levels

## Global natural gas landed prices (\$/MMBtu) – July 2018

sources: U.S. [FERC](#) (Aug. 2018), METI



# With globalization, natural gas markets could more than double by 2040

## Global natural gas by source

BCFD

600 ■ Gas traded by pipeline  
■ Gas traded as LNG  
■ Domestic production

400

200

0

2016

2040

source: BP (2018)

BCFD

100

80

60

40

20

0

1990 2000 2010 2020 2030 2040

■ N. America  
■ Russia  
■ Middle East  
■ Africa  
■ Australia  
■ Others

## LNG exports

BCFD

100

80

60

40

20

0

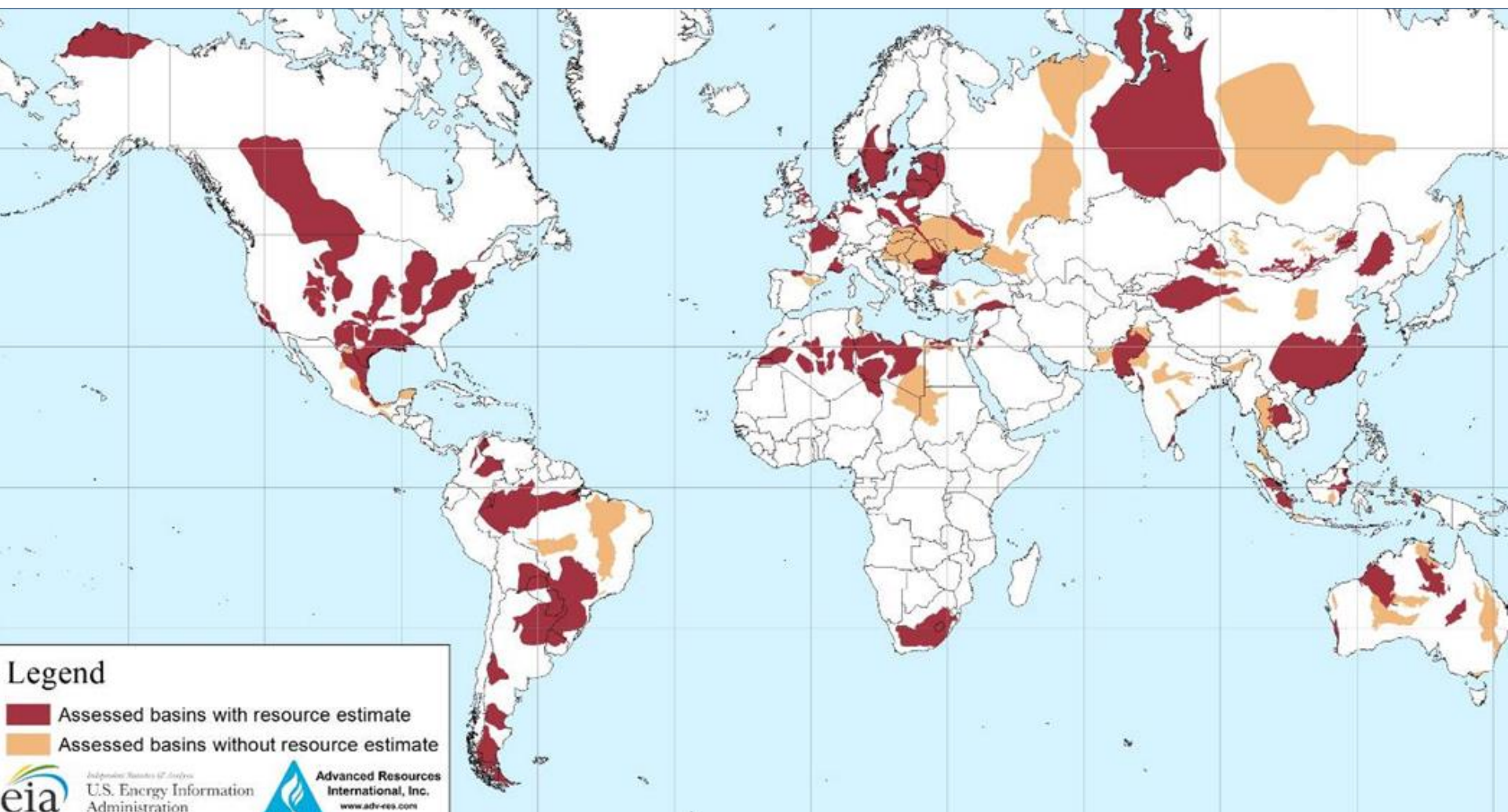
1990 2000 2010 2020 2030 2040

■ Others  
■ Europe  
■ OECD Asia  
■ India  
■ China  
■ Other Emerging Asia

## LNG imports

# Shale plays are widely dispersed globally...

- API standards could help to advance the globalization of tight oil and shale gas production





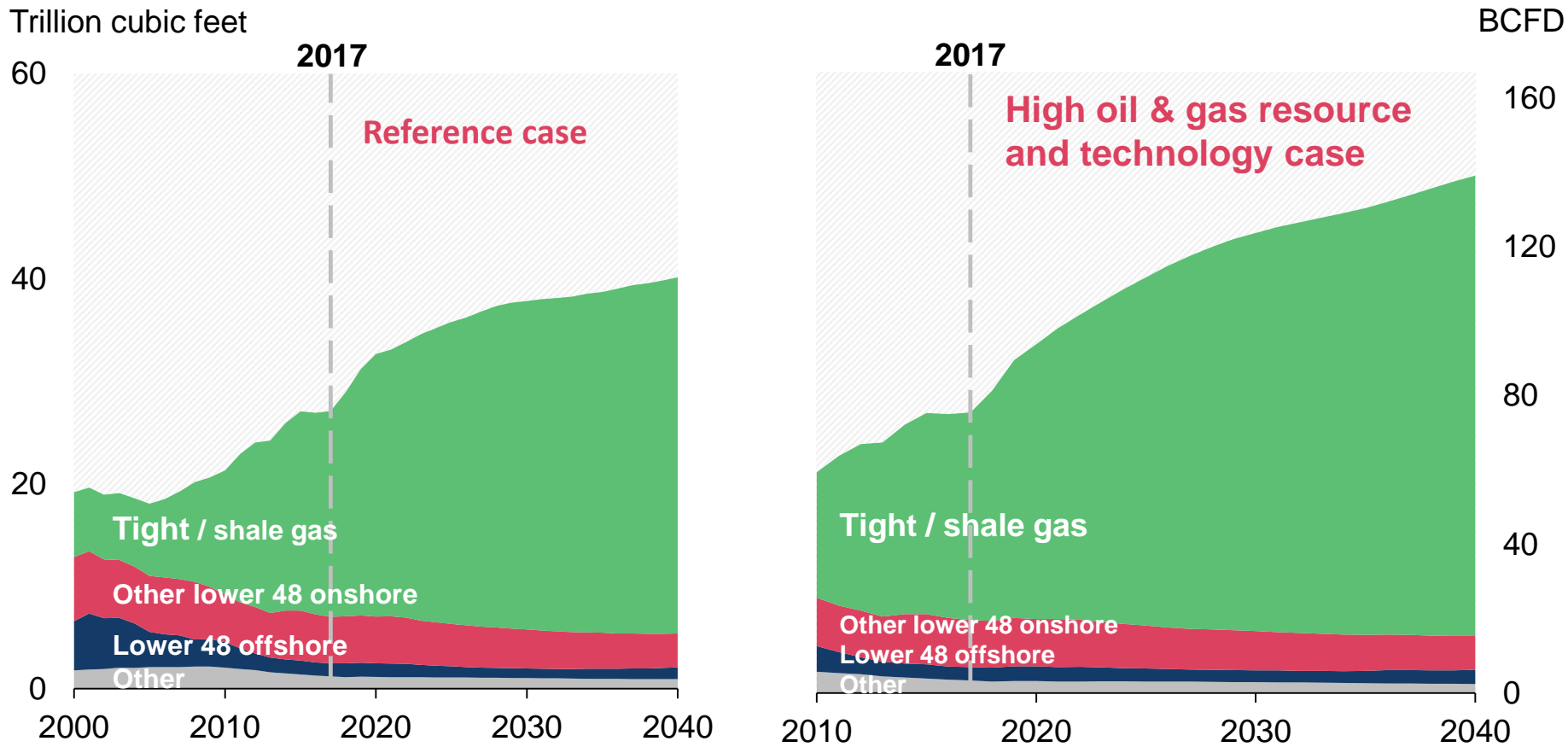
....and particularly across North America



# EIA projects that U.S. tight oil and shale gas production will remain dominant sources for decades to come

- Upgraded resource assessments have driven EIA's projections of tight oil and shale gas growth

## U.S. natural gas production by type and sensitivity case

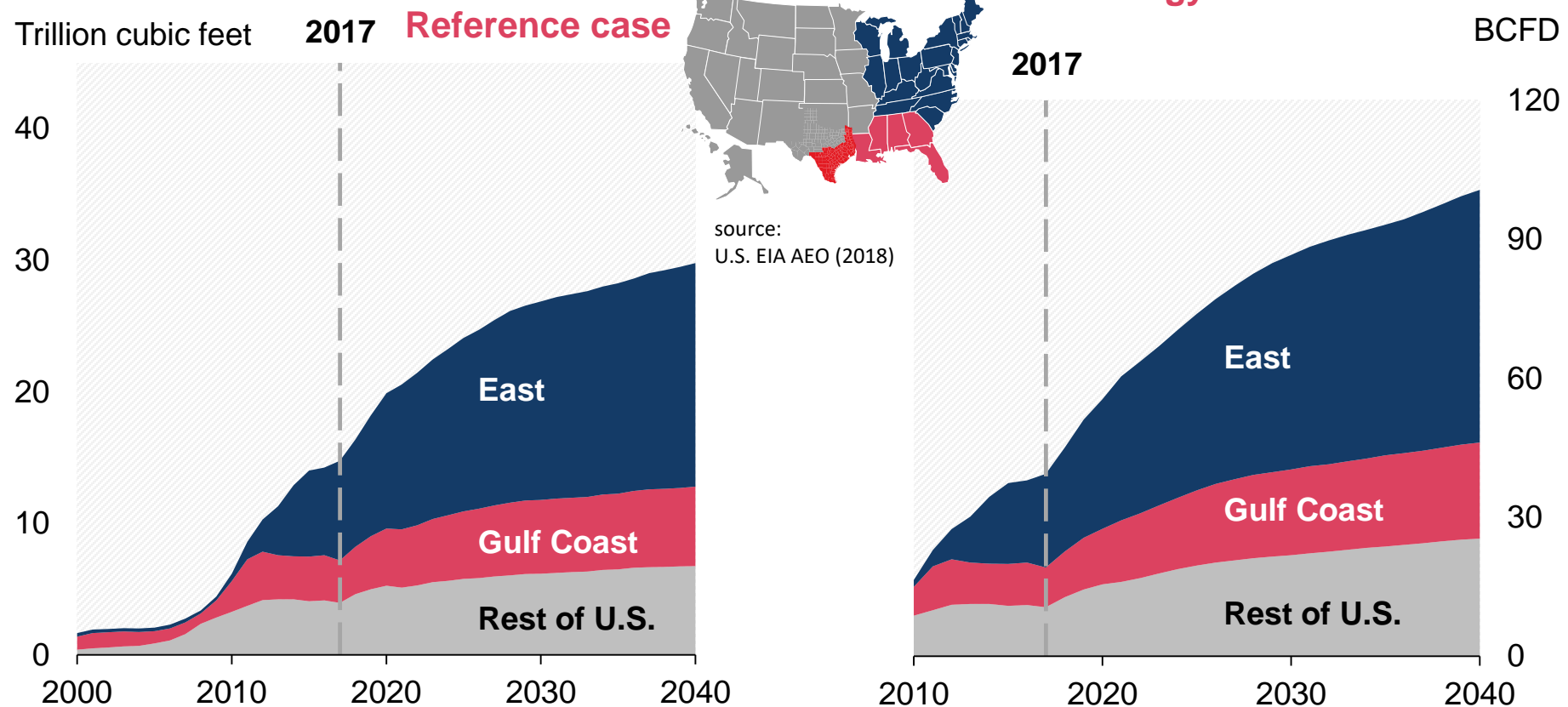


source: U.S. EIA AEO (2018)

# EIA expects the East to dominate U.S. natural gas production

- Continued development of the Marcellus and Utica plays in the East is the main driver of growth in total U.S. shale gas production across most cases

## Shale gas production by region



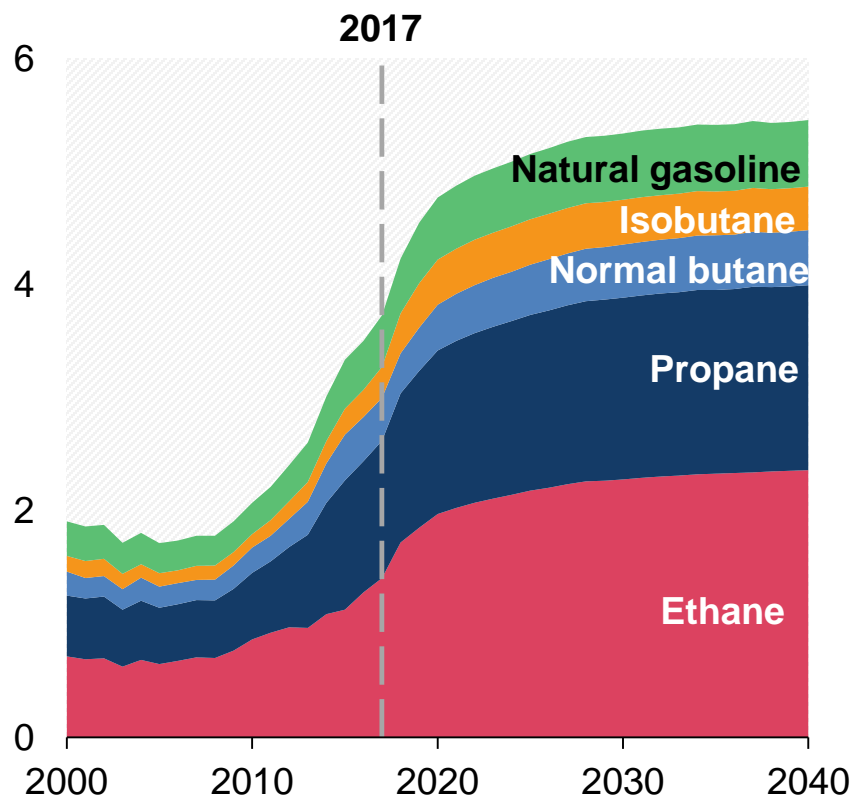


# Liquids-rich gas production in the East and Southwest fuels growth and petrochemical industry potential

- EIA projects that U.S. ethane production should be sustained above 2 million barrels per day

## U.S. natural gas liquids (NGL) production by fuel

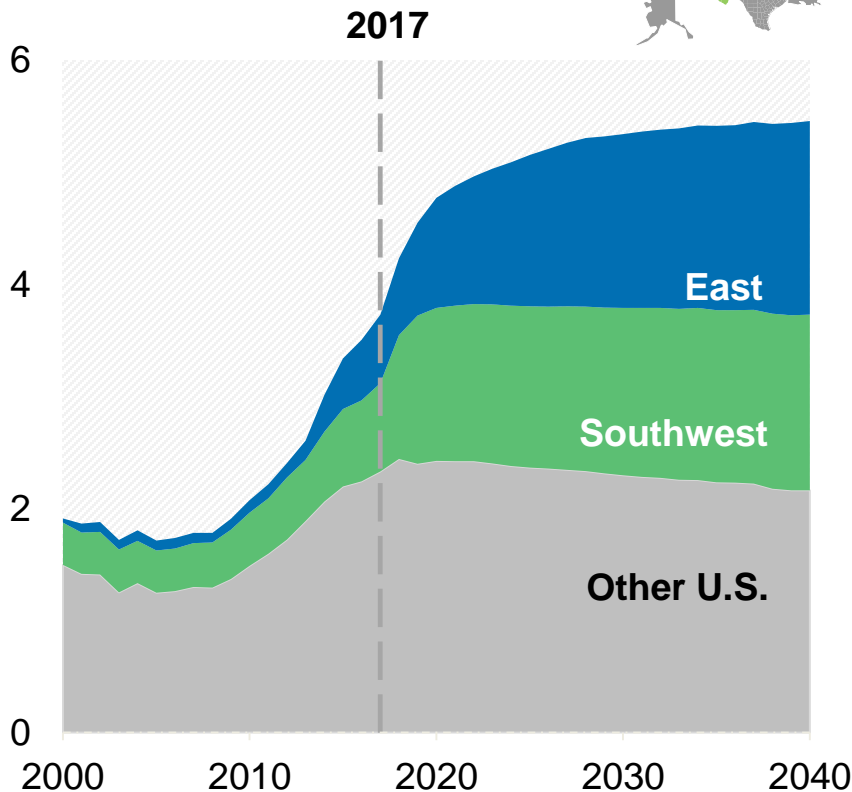
MBD



source: U.S. EIA AEO (2018)

## U.S. natural gas plant liquids production by region

MBD



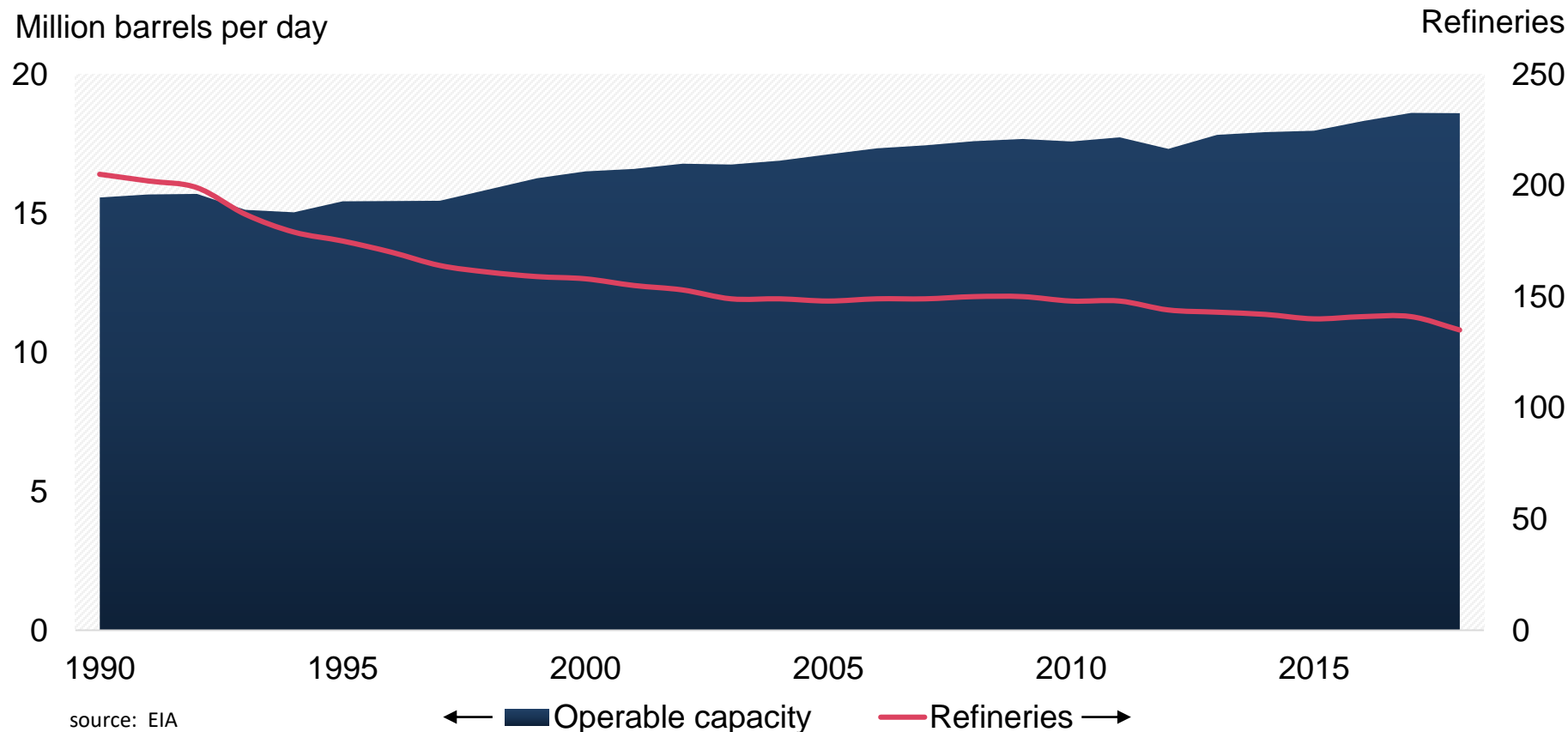
A nighttime photograph of an industrial facility, likely a refinery or petrochemical plant, situated along a body of water. A large bridge with a complex steel truss structure spans the water in the foreground. The industrial complex in the background is brightly lit with numerous lights, and its reflection is visible on the water's surface. The sky is dark blue, and a distant city skyline is visible on the horizon. A horizontal bar with segments of red, green, orange, and blue is positioned above the title.

# Leveraging the U.S. Energy Renaissance

# Refining capacity has expanded at existing facilities

- Although the number of refineries dropped over time — currently at 135 — refining capacity has continued to expand through industry investment

## U.S. refineries and their capacity

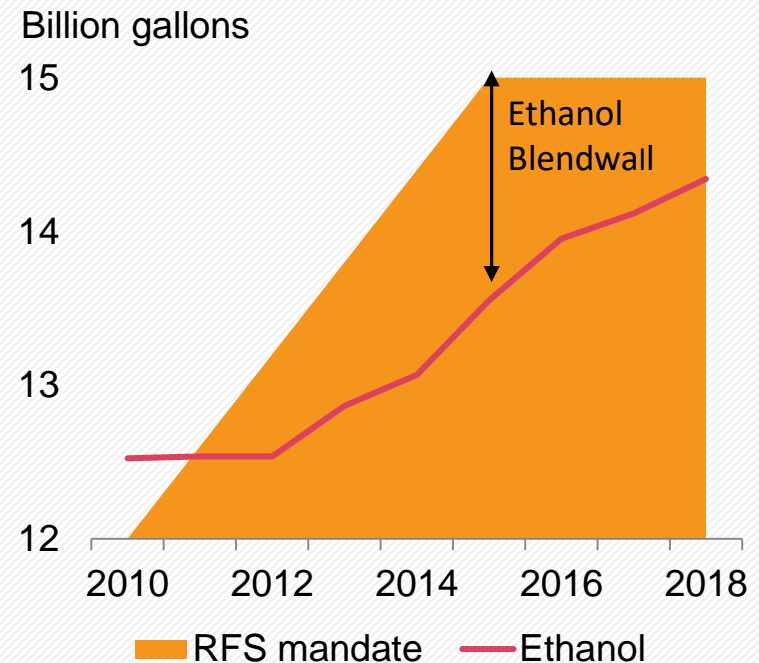
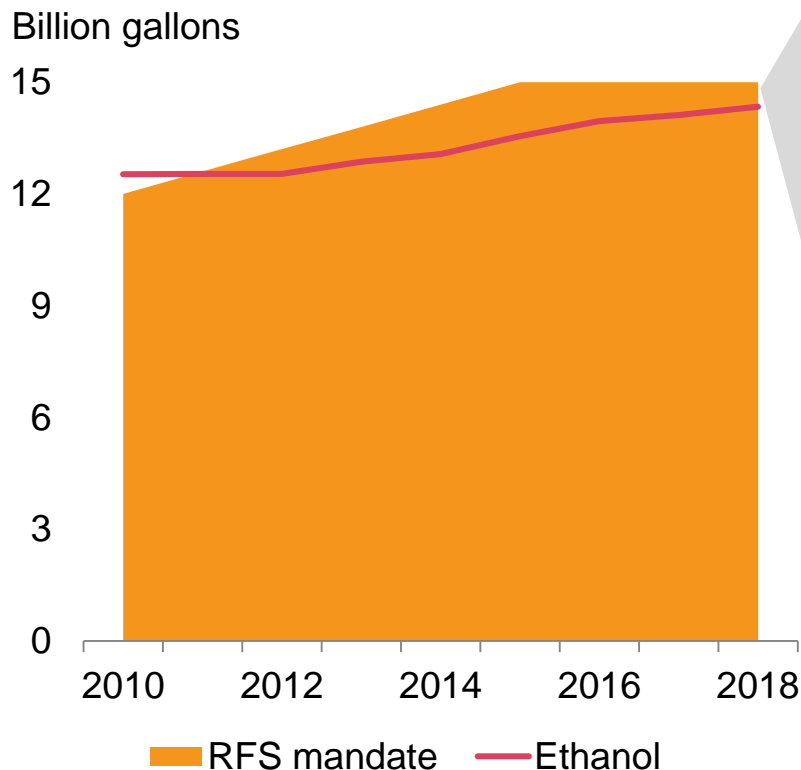




# The Renewable Fuel Standard (RFS) mandate exceeds demand for ethanol that can be blended in E10 gasoline

- RFS mandate for renewable fuel has consistently exceeded the amount of ethanol that has been blended with gasoline
- RFS compliance has been achieved by RIN banking and blending more biodiesel into diesel fuel, above minimum requirements

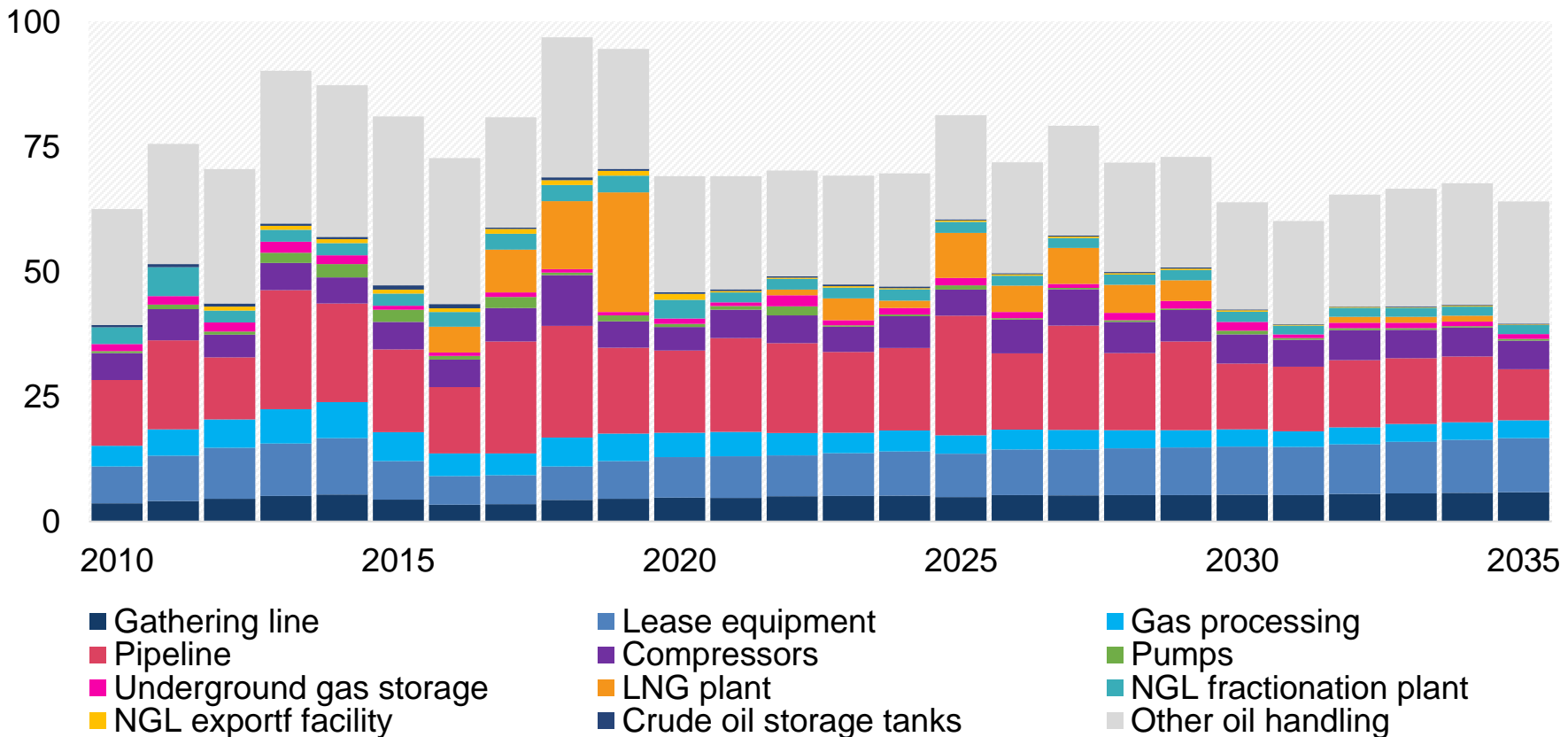
## Ethanol blending in gasoline sources: EPA, EIA



# Shale-driven energy production is reshaping the U.S. natural gas and oil infrastructure landscape

## U.S. total capital expenditures

Billion 2017\$

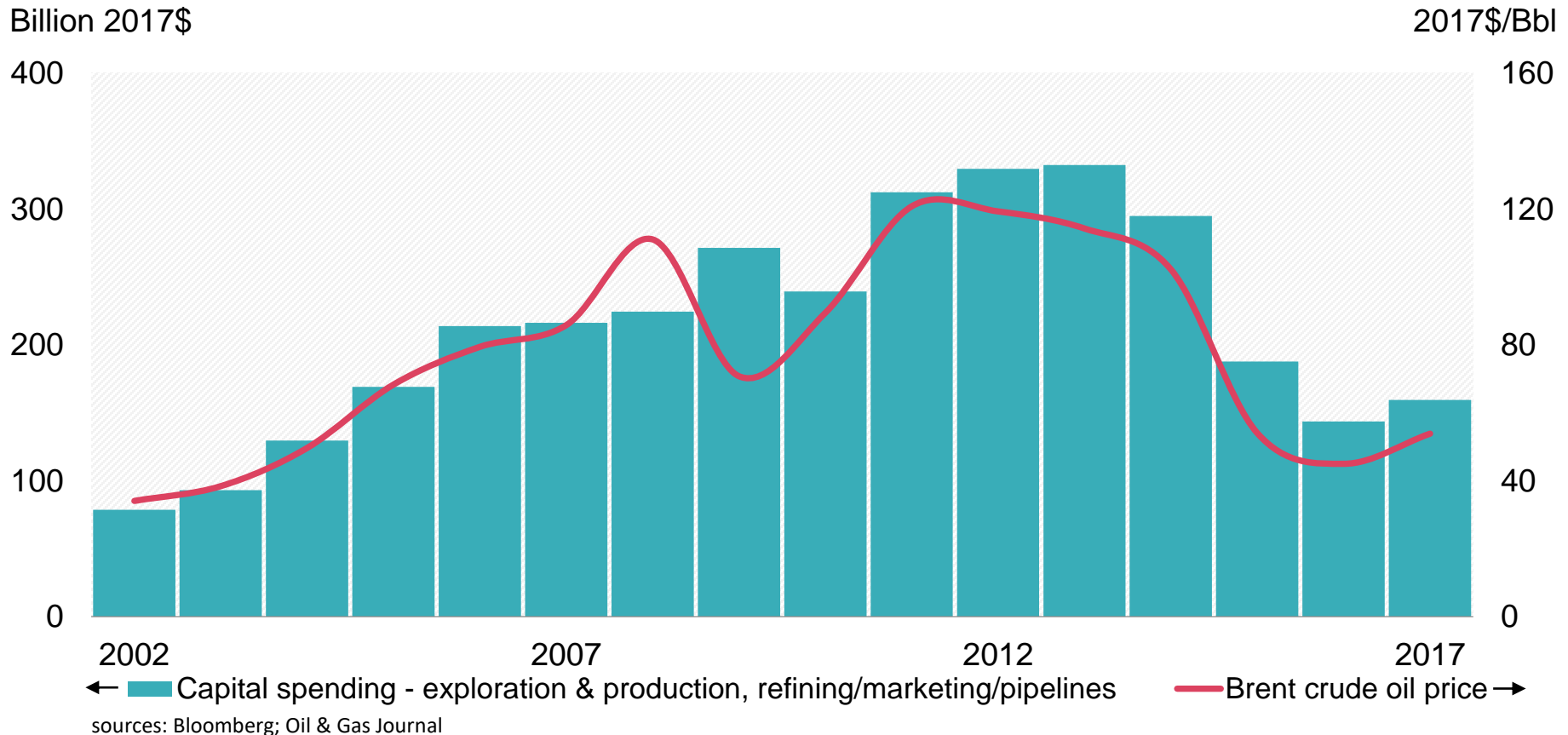


source: ICF, "U.S. Oil and Gas Infrastructure Investment through 2035," April 2017

# Capital spending on U.S. projects requires a long lead time, but has necessarily responded to current prices

- Large capital projects take years to plan and build, but the industry's investments tend to follow the price cycle – it is hard to be countercyclical

## Capital spending for U.S. projects

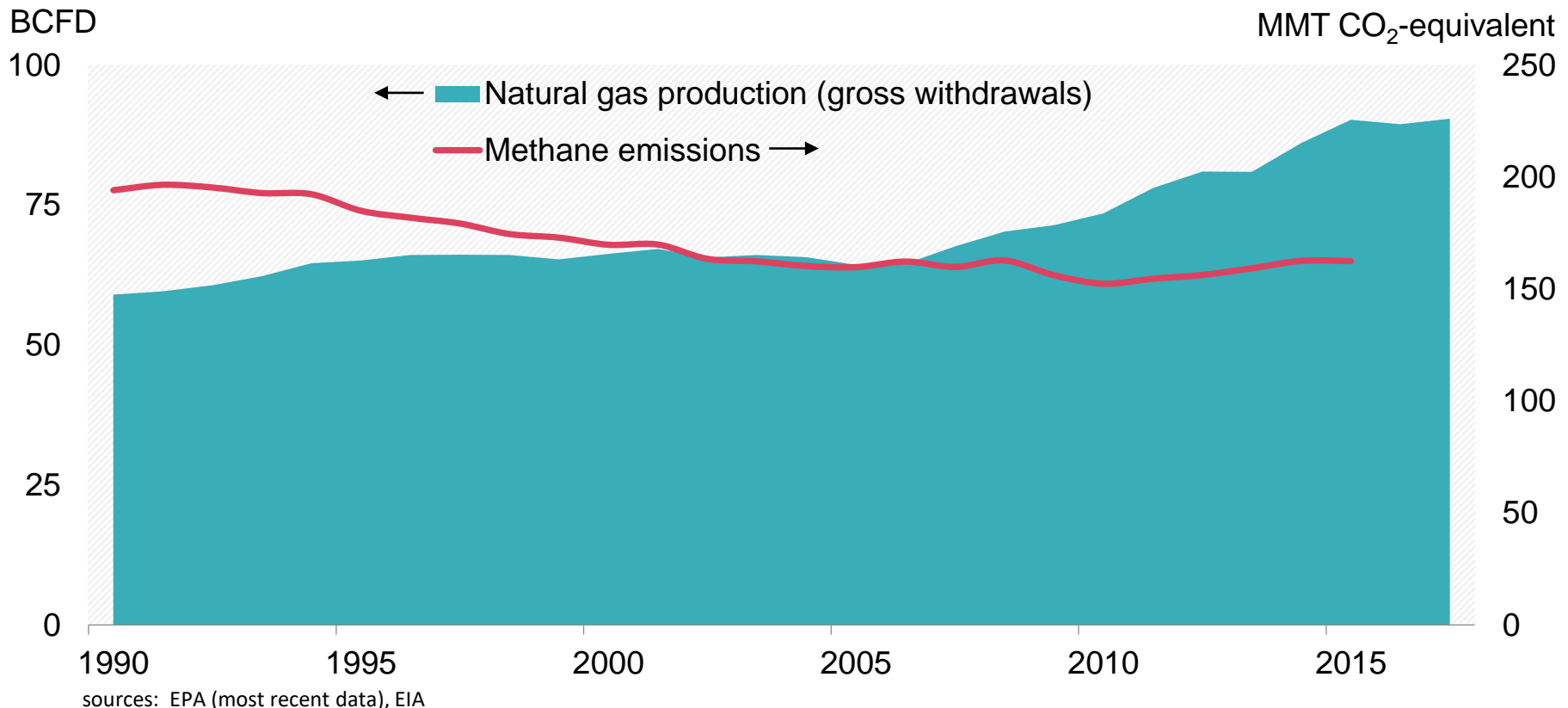




# Investments in new technologies reduced natural gas industry methane emissions despite production growth

- Between 1990 and 2015, natural gas systems' methane emissions fell by 16.3% even though natural gas production rose by more than 50%

## Natural gas production and methane emissions from natural gas systems

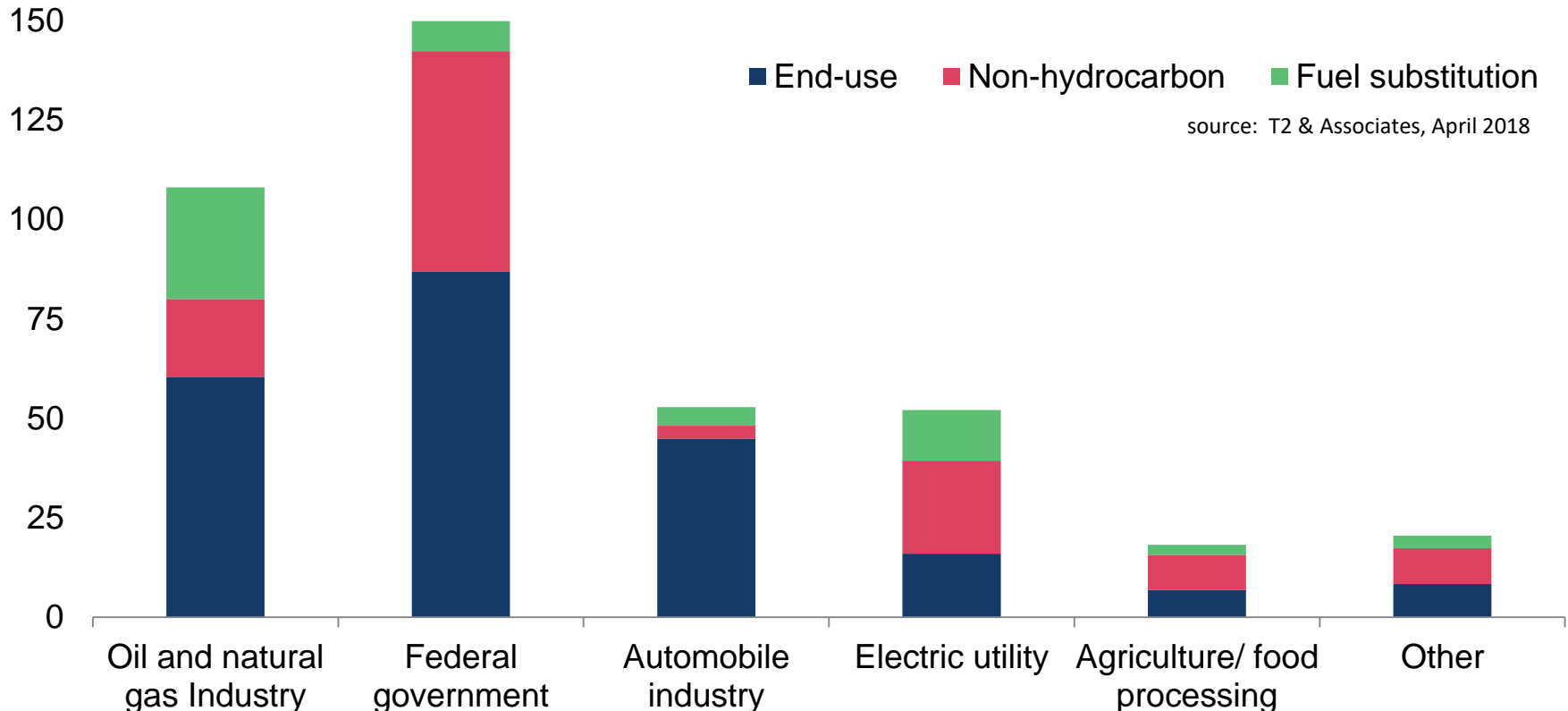


# The U.S. oil & natural gas industry spends billions on greenhouse gas-reducing technologies

- Between 2000 and 2016, oil & gas industry spending on carbon mitigating technologies was double that of every other individual industry

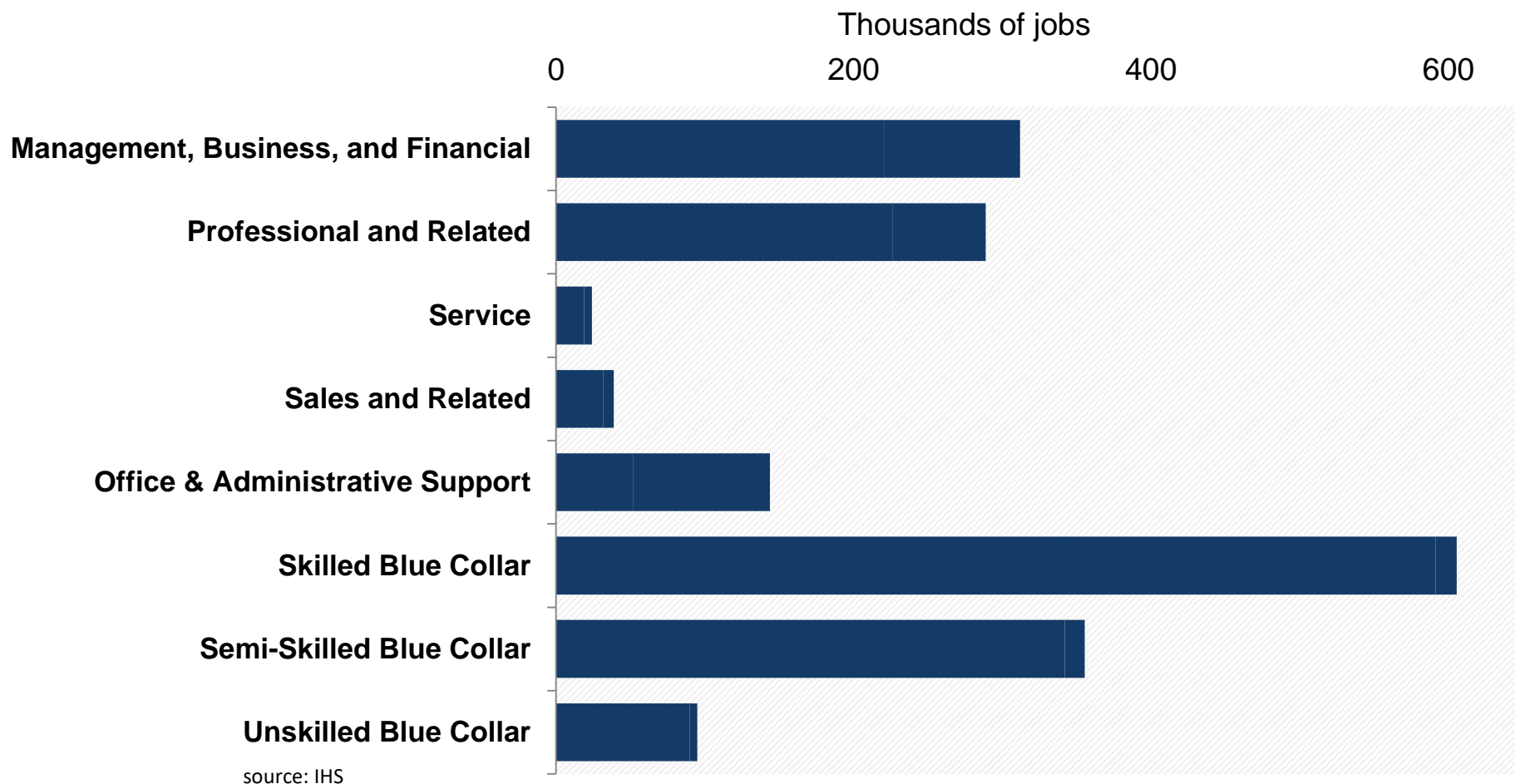
## Carbon mitigating technology investment by investor group (2000-2016)

Billion 2016\$



# Natural gas, oil, and petrochemical industry direct job opportunities by occupation (2015 to 2035)

- Total job opportunities are split roughly 60/40 between blue collar and white collar occupations





# Projected natural gas, oil, and petrochemical industry direct job opportunities through 2025 and 2035 (thousands)\*

| Job growth, 2015 to 2025        | African American | Hispanic     | Minority     | Total industry |
|---------------------------------|------------------|--------------|--------------|----------------|
| Baseline growth                 | 30.5             | 102.0        | 132.5        | 379.1          |
| Capital investments             | 14.7             | 77.9         | 92.6         | 142.3          |
| Replacement demand              | 18.2             | 39.9         | 58.1         | 282.0          |
| Pro-development policies        | 23.5             | 137.6        | 161.1        | 478.8          |
| <b>Total potential jobs</b>     | <b>86.9</b>      | <b>357.4</b> | <b>444.3</b> | <b>1,282.2</b> |
| <b>Job growth, 2015 to 2035</b> |                  |              |              |                |
| Baseline growth                 | 37.8             | 152.1        | 189.9        | 384.0          |
| Capital investment              | 14.6             | 99.9         | 114.4        | 105.0          |
| Replacement demand              | 39.0             | 9933         | 138.3        | 585.1          |
| Pro-development policies        | 39.1             | 225.2        | 264.3        | 789.8          |
| <b>Total potential jobs</b>     | <b>130.5</b>     | <b>576.5</b> | <b>706.9</b> | <b>1,863.9</b> |

source: IHS

\*"Minority" refers to the sum of African American and Hispanic workers