The Outlook for Oil and Natural Gas Production in the United States: Short- and Long-term Perspectives

44th Annual International Energy Conference
The International Research Center for Energy and Economic Development
April 25, 2017 | Boulder, CO

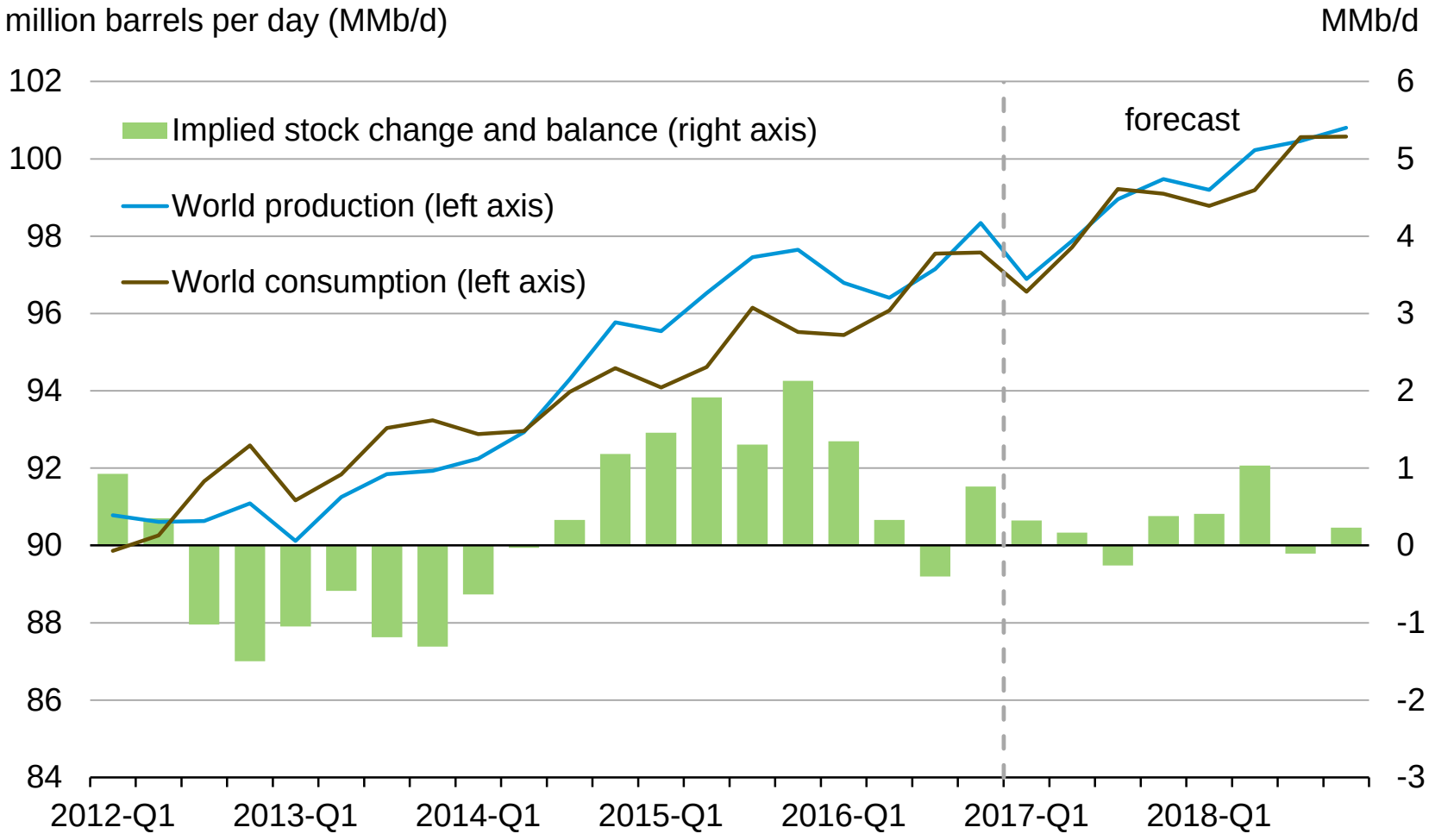
By
Howard Gruenspecht, Acting Administrator

Short-term view

Global crude oil balances are expected to tighten through 2018

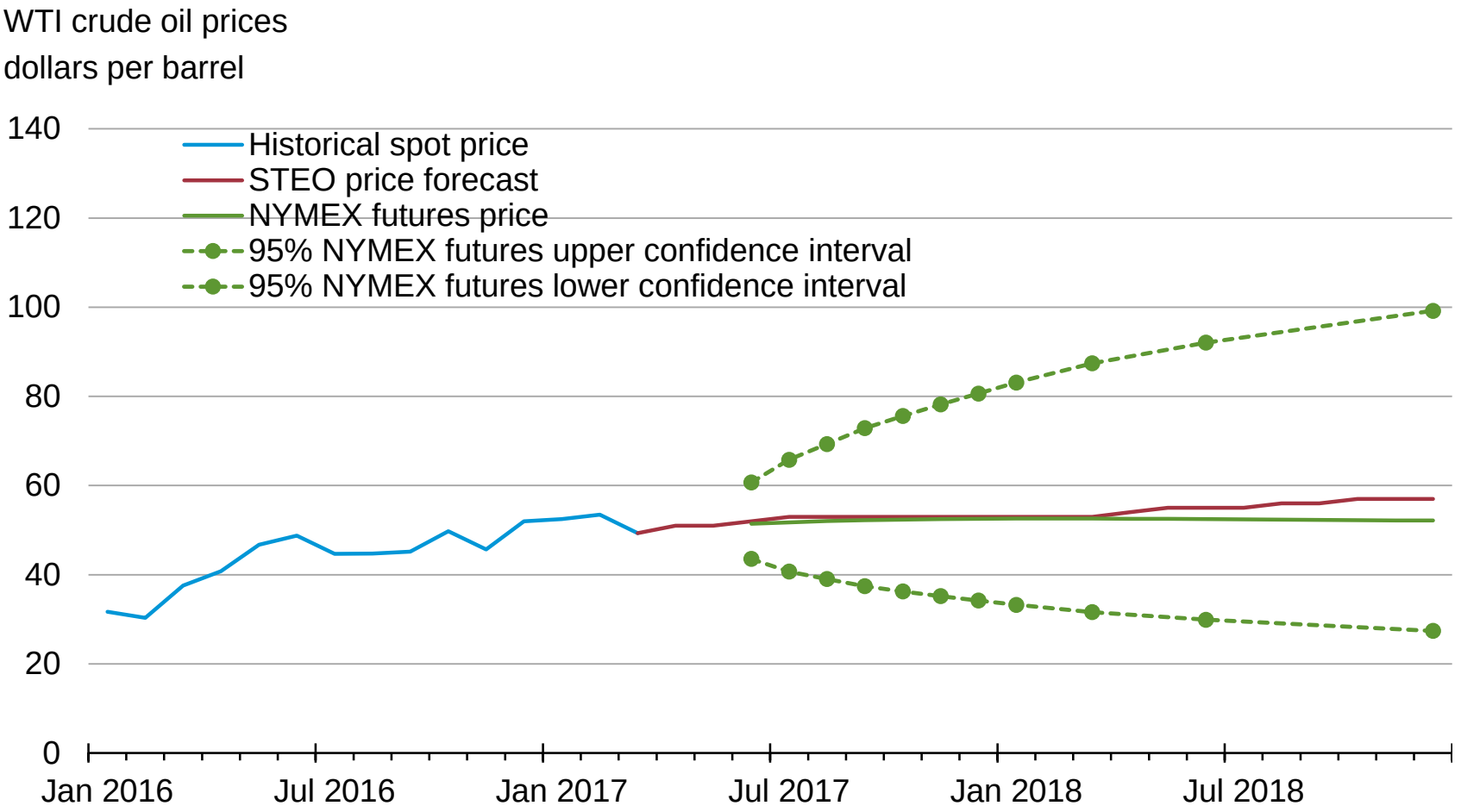
world liquid fuels production and consumption balance

million barrels per day (MMb/d)



Source: Short-Term Energy Outlook, April 2017

WTI is forecast to average $52/barrel in 2017 and $55/barrel in 2018; Brent averages $2/barrel above WTI in both years

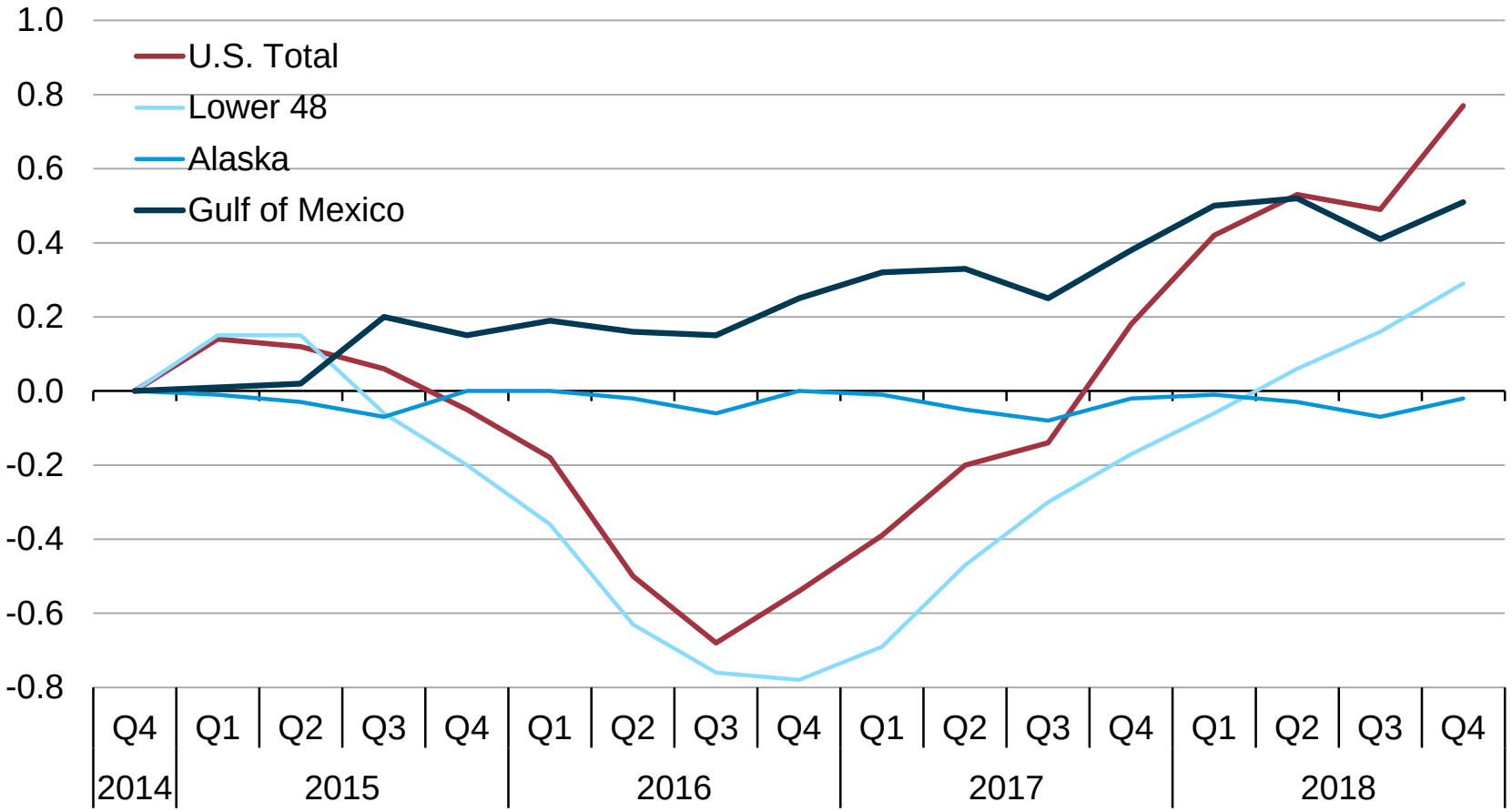


Note: Confidence interval derived from options market information for the 5 trading days ending Apr 6, 2017. Intervals not calculated for months with sparse trading in near-the-money options contracts.

Source: Short-Term Energy Outlook, April 2017

Total U.S. crude oil production is forecast to return to its pre-price-decline level by late 2017

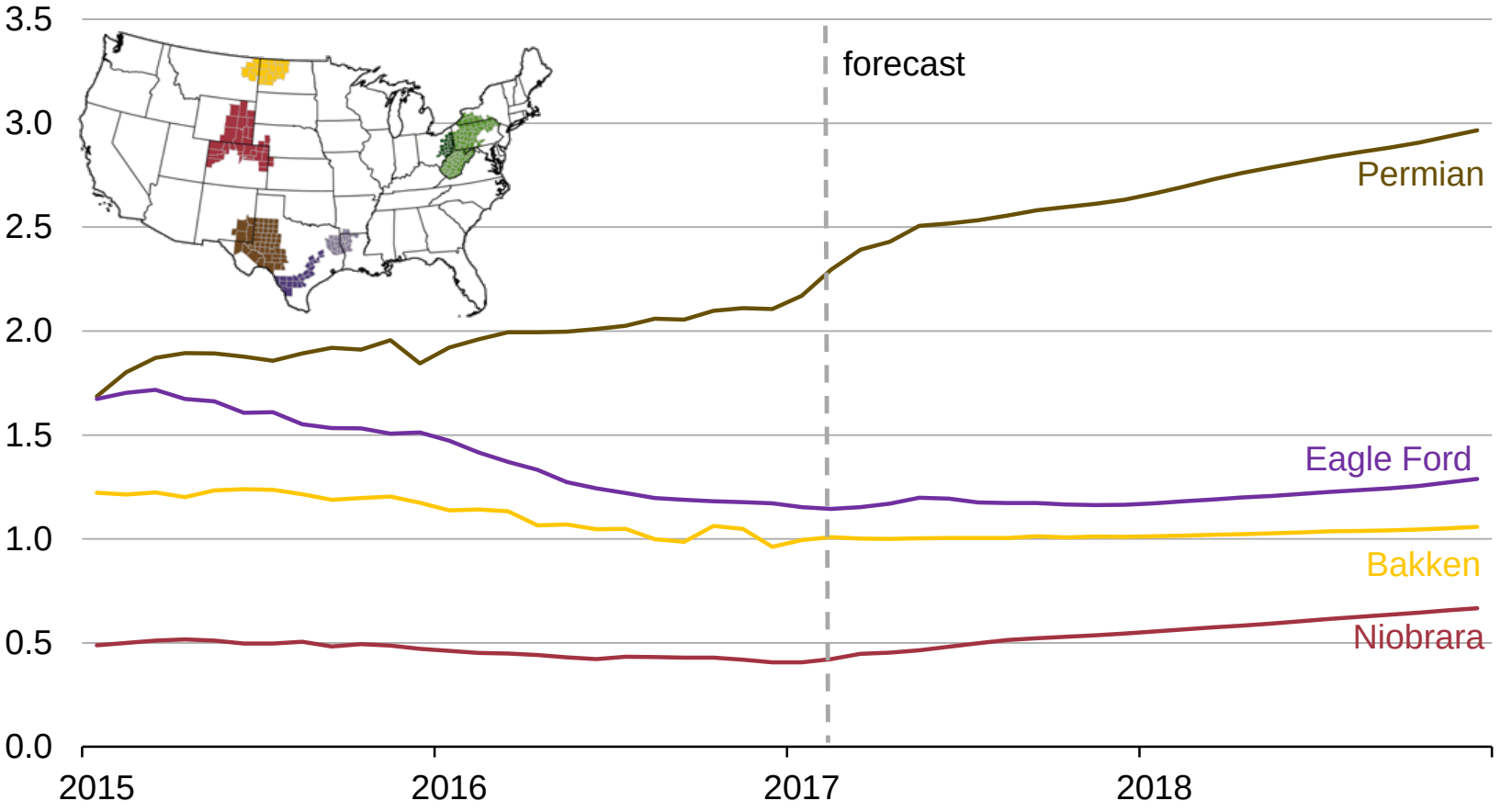
U.S. quarterly average crude oil production
million barrels per day (change from 4Q14)



Source: Short-Term Energy Outlook, April 2017

Crude oil production in the Permian is expected to lead the recovery in U.S. tight oil production

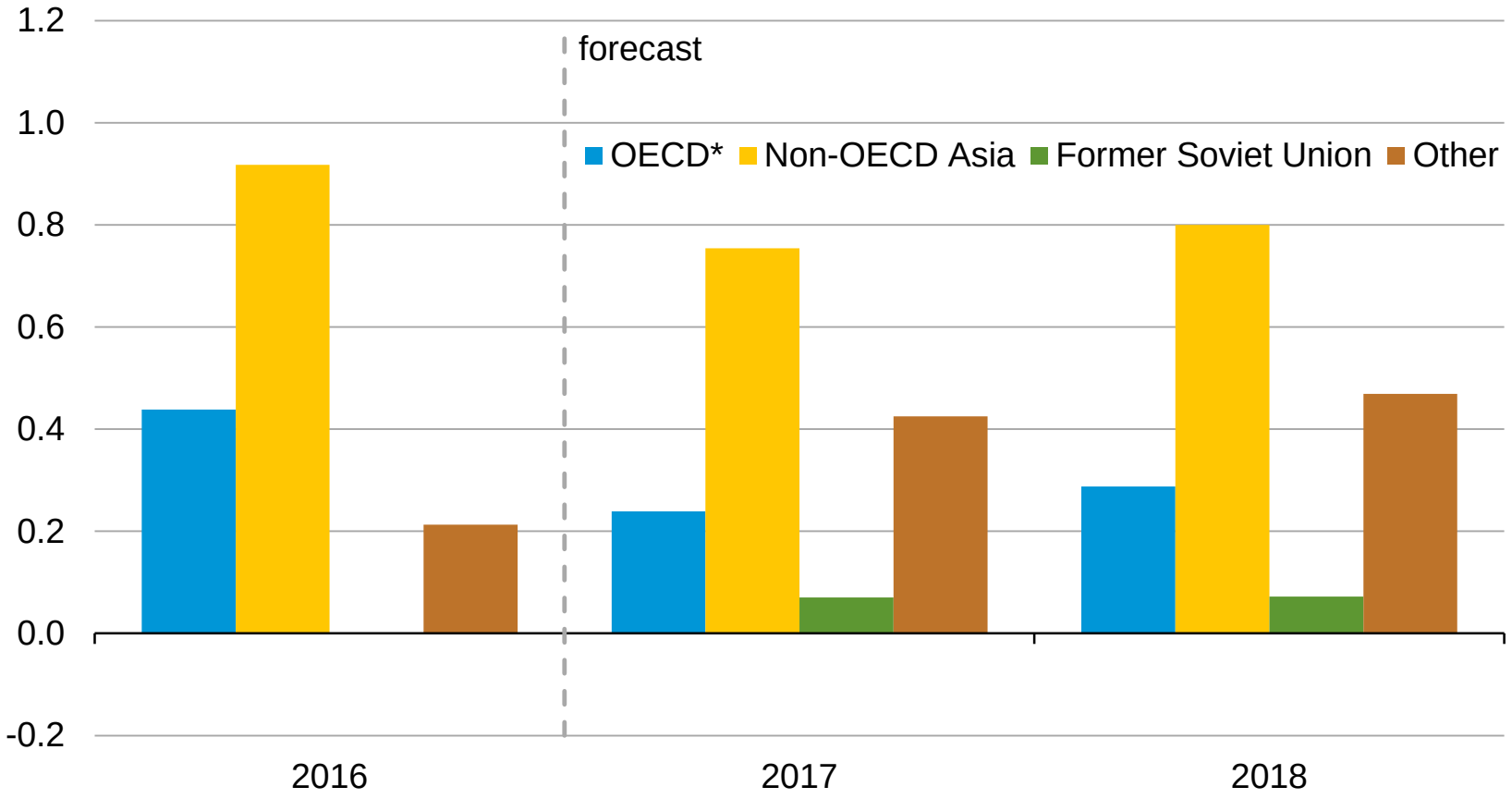
crude oil production in major tight oil regions
million barrels per day



Source: Short-Term Energy Outlook, April 2017

Non-OECD Asia is the main contributor to expected oil consumption growth in the next two years

global liquid fuels consumption growth
million barrels per day

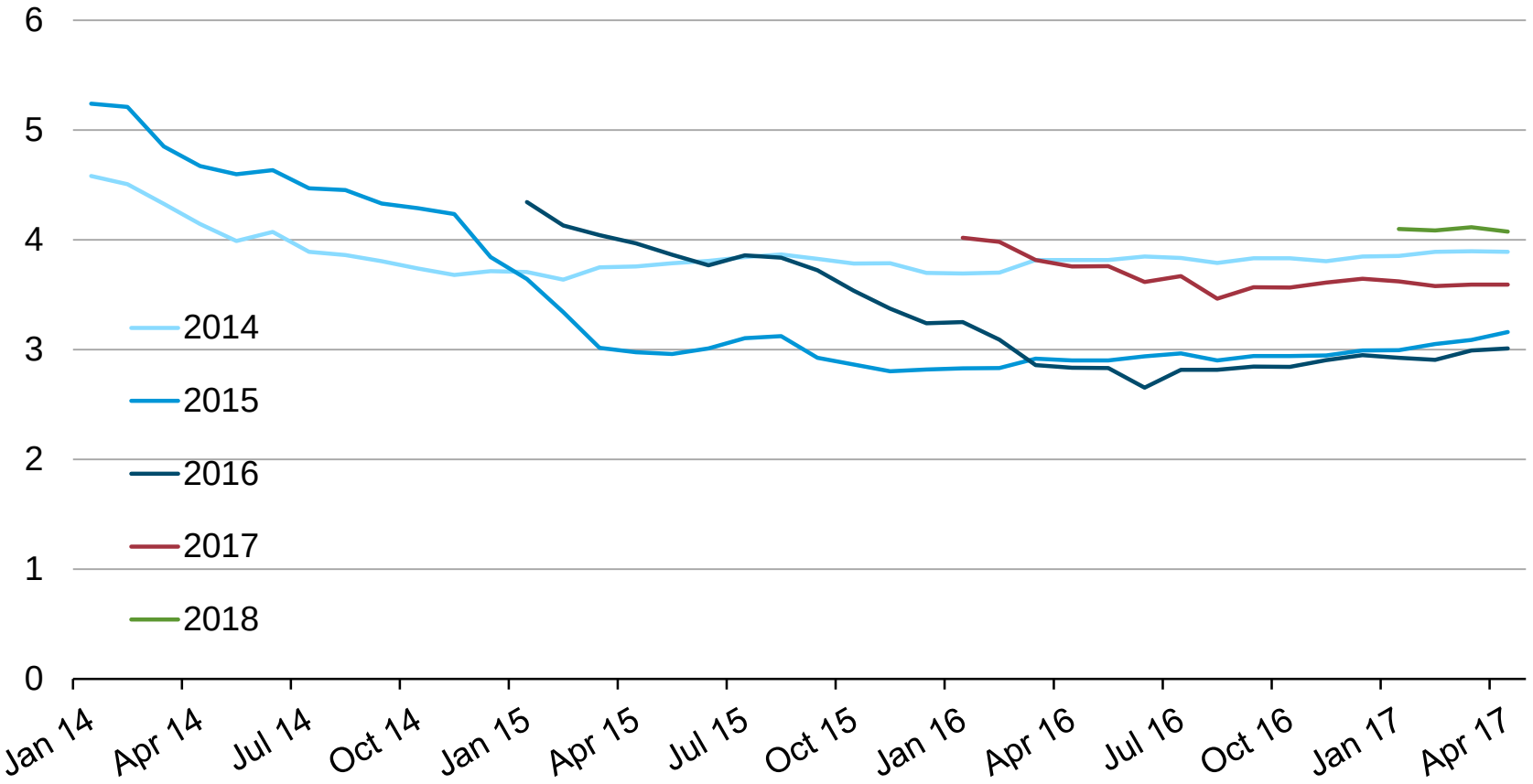


*Note: * Countries belonging to the Organization for Economic Cooperation and Development*

Source: Short-Term Energy Outlook, April 2017

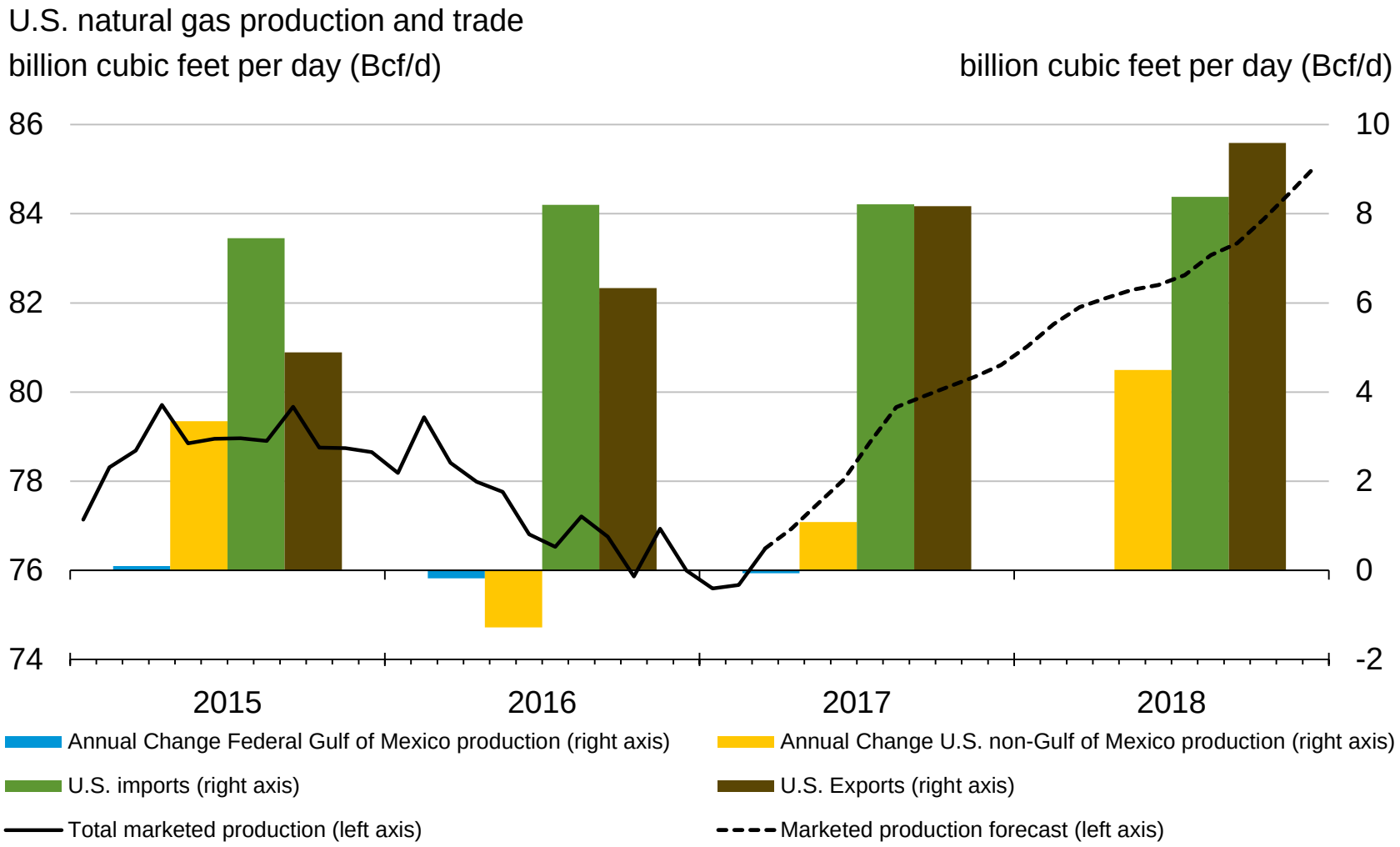
EIA's views of non-OECD GDP growth were frequently reduced during 2014 and 2015, but have been relatively stable over the past year

non-OECD GDP growth by STEO forecast
percent change year-over-year



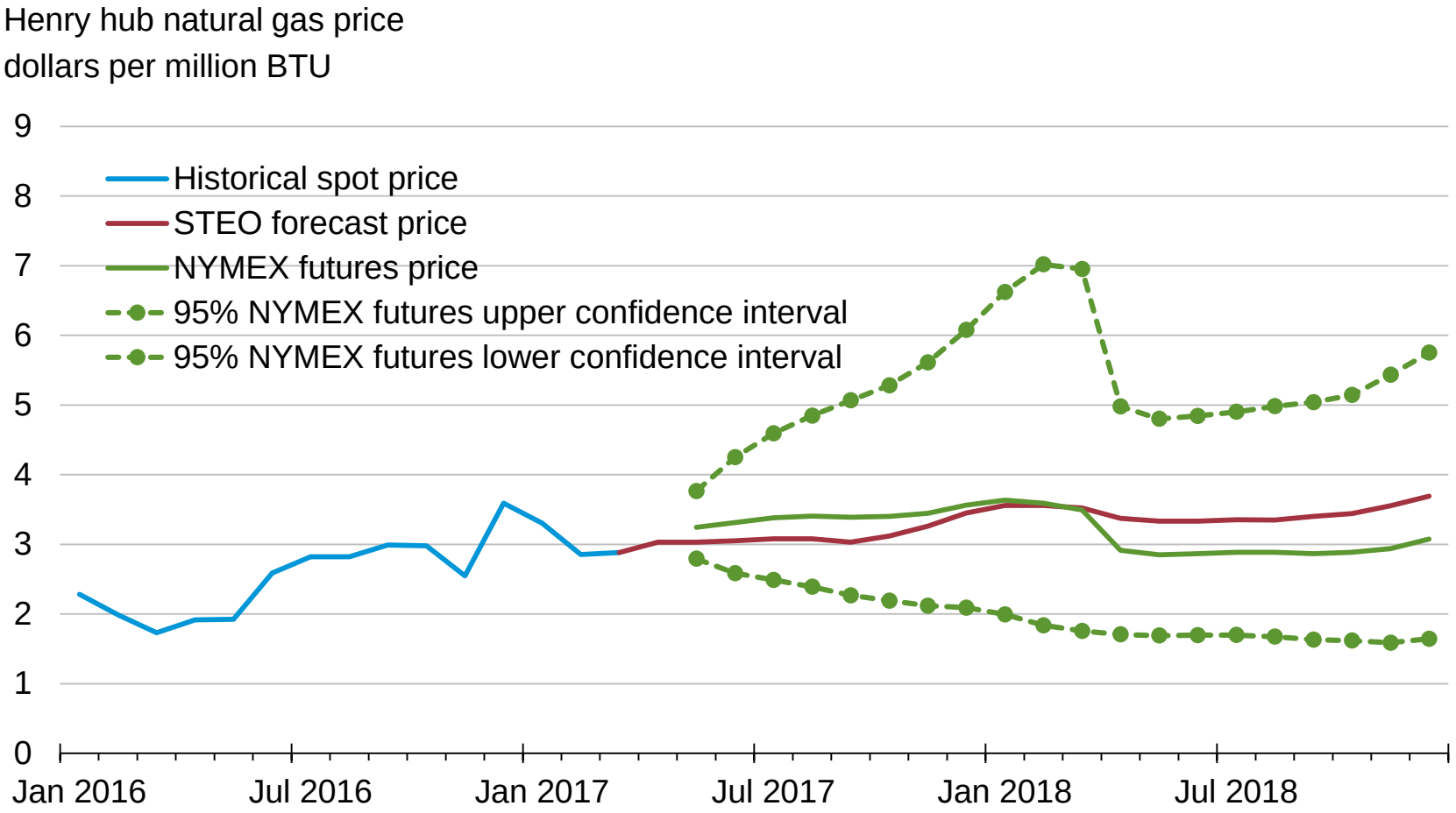
Source: Short-Term Energy Outlook, April 2017

U.S. natural gas exports are forecast to overtake imports in 2018



Source: Short-Term Energy Outlook, April 2017

Natural gas prices are forecast below $4 per million BTU through 2018, but weather and other factors contribute to wide uncertainty



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Source: Short-Term Energy Outlook, April 2017

Long-term U.S. projections

Key takeaways from AEO2017

- With strong domestic production and relatively flat demand, the United States becomes a net energy exporter over the projection period in most cases

- U.S. crude oil production rebounds from recent lows, driven by continued development of tight oil resources; with consumption flat to down compared to recent history, net crude oil and petroleum product imports as a percentage of U.S. product supplied decline across most cases

- Across most cases, natural gas production increases despite relatively low and stable prices, supporting higher levels of domestic consumption and natural gas exports

- With modest electricity demand growth, the primary driver for new electricity generation capacity in the Reference case is the retirement of fossil fuel units, largely spurred by the Clean Power Plan (CPP), the near-term availability of renewable tax credits, state-level policies to promote renewables, and nuclear retirements; even if the CPP is not implemented natural gas and renewables are the primary sources of new generation capacity; the future generation mix is sensitive to the price of natural gas and the growth in electricity demand

Key takeaways from AEO2017 (continued)

- Transportation energy consumption peaks in 2018 in the Reference case because rising fuel efficiency outweighs increases in total travel and freight movements throughout the projection period

- Despite growth in the number of households and the amount of commercial floorspace, improved equipment and efficiency standards contribute to residential and commercial energy consumption remaining relatively flat or declining slightly from 2016 to 2040 in the Reference case

- With economic growth and relatively low energy prices, industrial energy consumption increases during the projection period across all cases; energy intensity declines in the Reference case and most side cases as a result of technological improvements

Why long-term projections ~~might/could/~~will be wrong

- Different relative fuel prices
- Faster / slower economic and energy demand growth
- Changing policies and regulations
- Changing consumer preferences
- Faster / slower technology progress
- Technology breakthroughs

AEO2017 includes side cases with different assumptions of macroeconomic growth, world oil prices, technological progress, and energy policies

- Oil prices are primarily driven by global market balances that are mainly influenced by factors external to the NEMS model; in the Reference case, oil prices reach $109/b in 2016 dollars, compared to $43/b in the Low Oil Price case and $228/b in the High Oil Price case

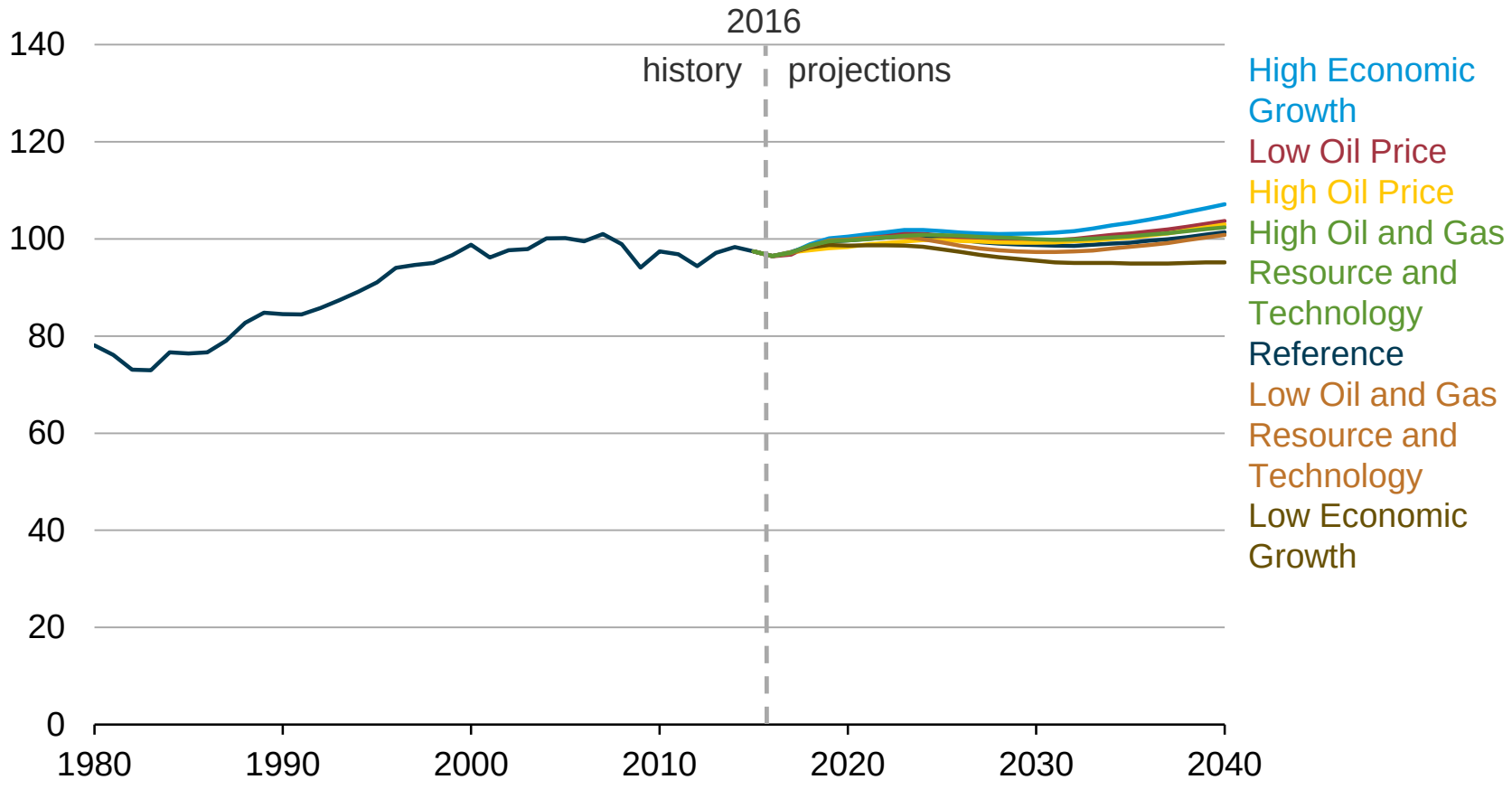
- In the High Oil and Gas Resource and Technology case, lower costs and higher resource availability than in the Reference case allow for higher production at lower prices; in the Low Oil and Gas Resource and Technology case, more pessimistic assumptions about resources and costs are applied

- The effects of economic assumptions on energy consumption are addressed in the High and Low Economic Growth cases, which assume compound annual growth rates for U.S. gross domestic product of 2.6% and 1.6%, respectively, from 2016–40, compared with 2.2% annual growth in the Reference case

- A case assuming that the Clean Power Plan (CPP) is not implemented can be compared to the Reference case to show how that policy could affect energy markets and emissions

Energy consumption varies modestly across the AEO cases, bounded by the High and Low Economic Growth cases

total energy consumption
quadrillion British thermal units

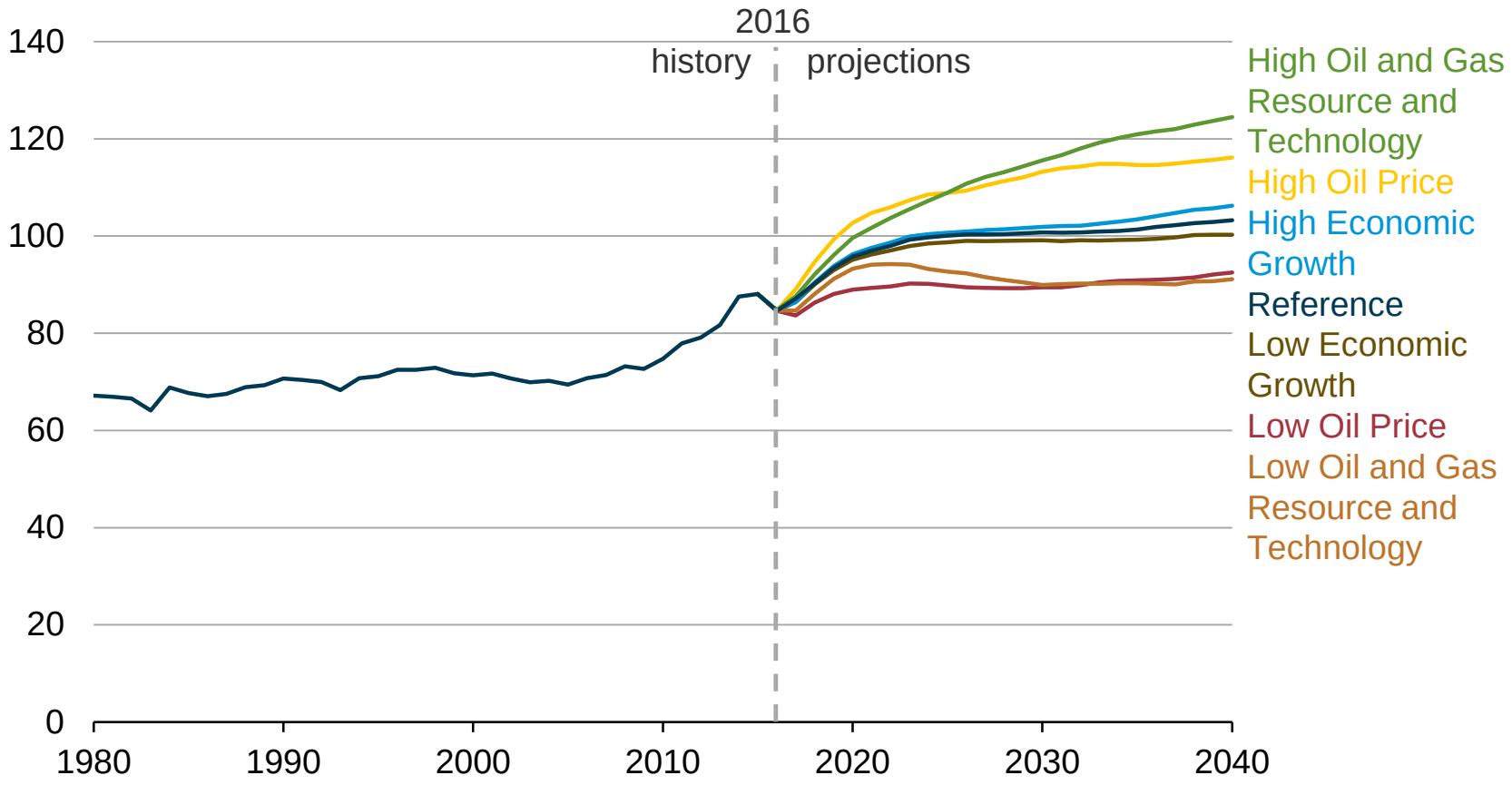


Source: EIA, Annual Energy Outlook 2017

Energy production varies more substantially across AEO cases, bounded by the Oil and Gas Resource and Technology cases

total energy production

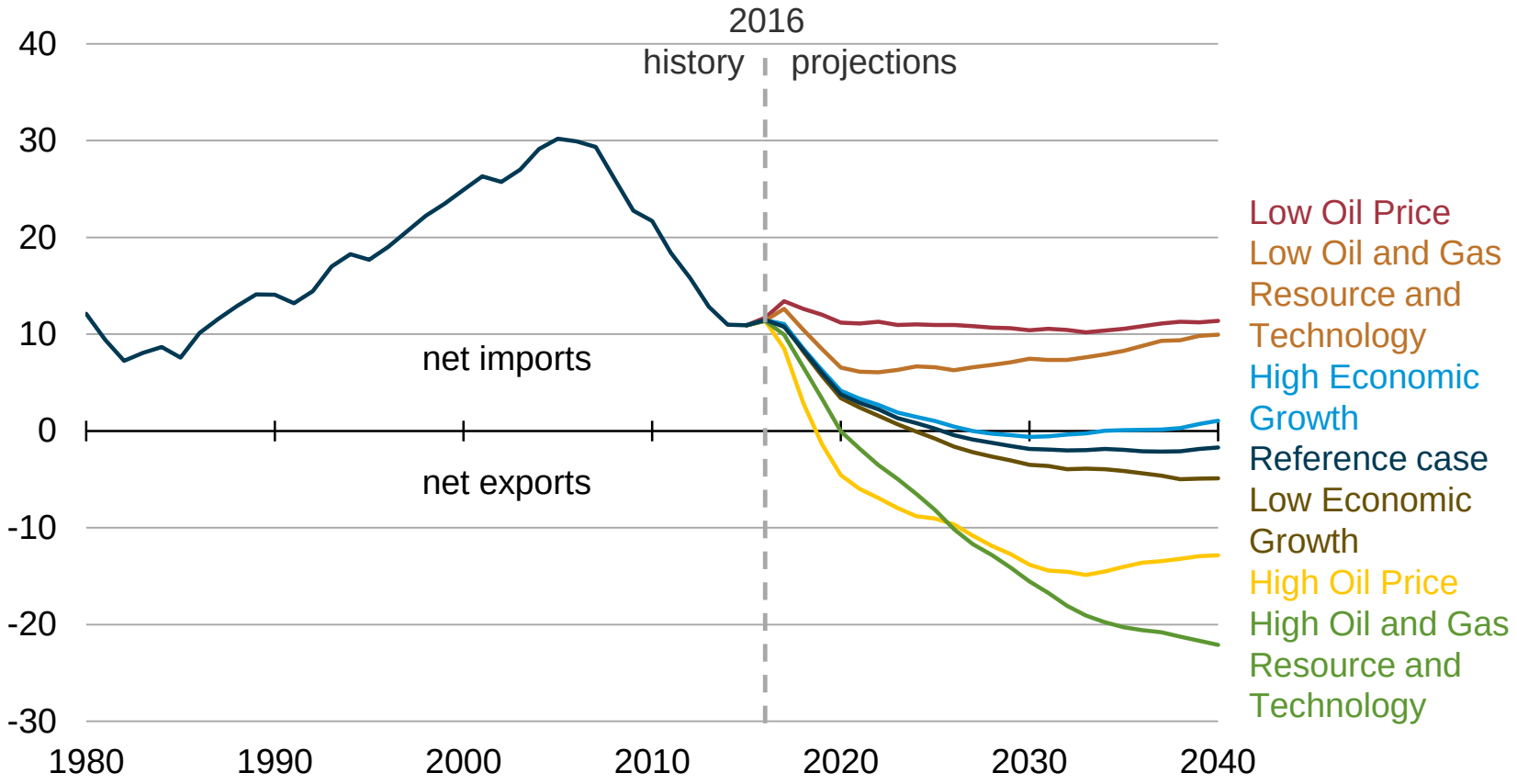
quadrillion British thermal units



Source: EIA, Annual Energy Outlook 2017

The United States becomes a net energy exporter in most cases as petroleum liquid imports fall and natural gas exports rise

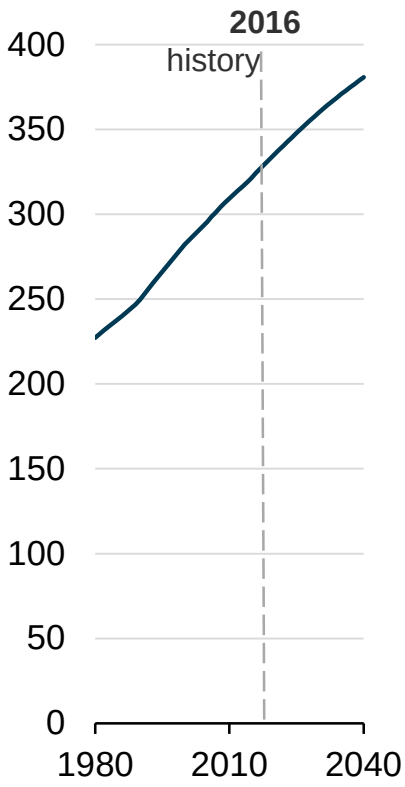
net energy trade
quadrillion British thermal units



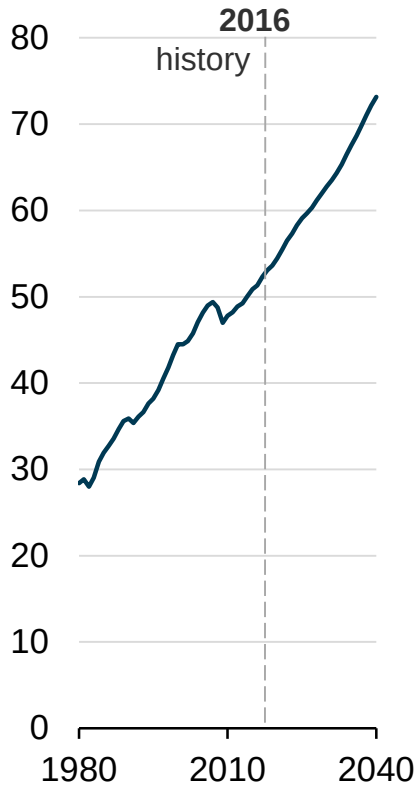
Source: EIA, Annual Energy Outlook 2017

Although population and economic output per capita are assumed to continue rising, energy intensity and carbon intensity are projected to continue falling in the Reference case

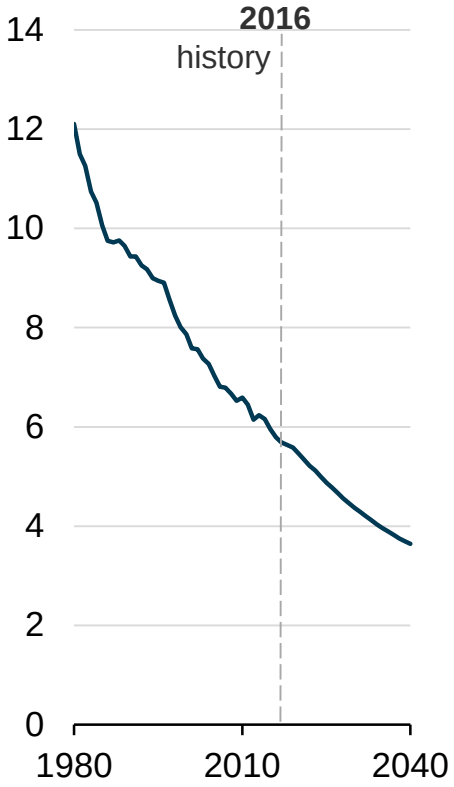
U.S. population
million people



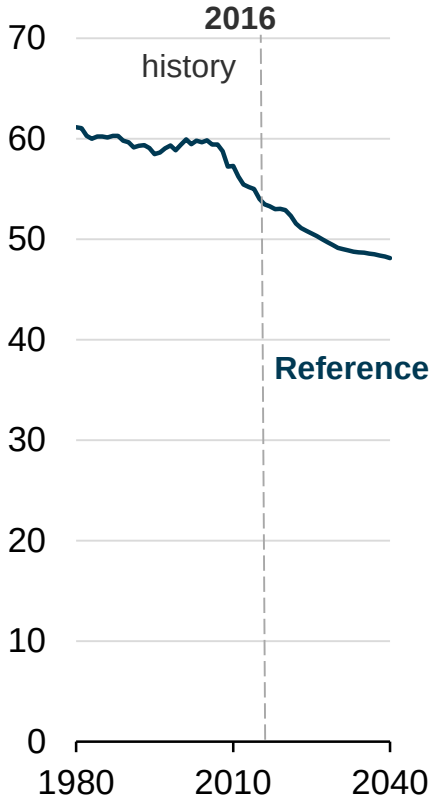
gross domestic product per capita
thousand dollars per person



energy intensity
thousand British thermal units per dollar



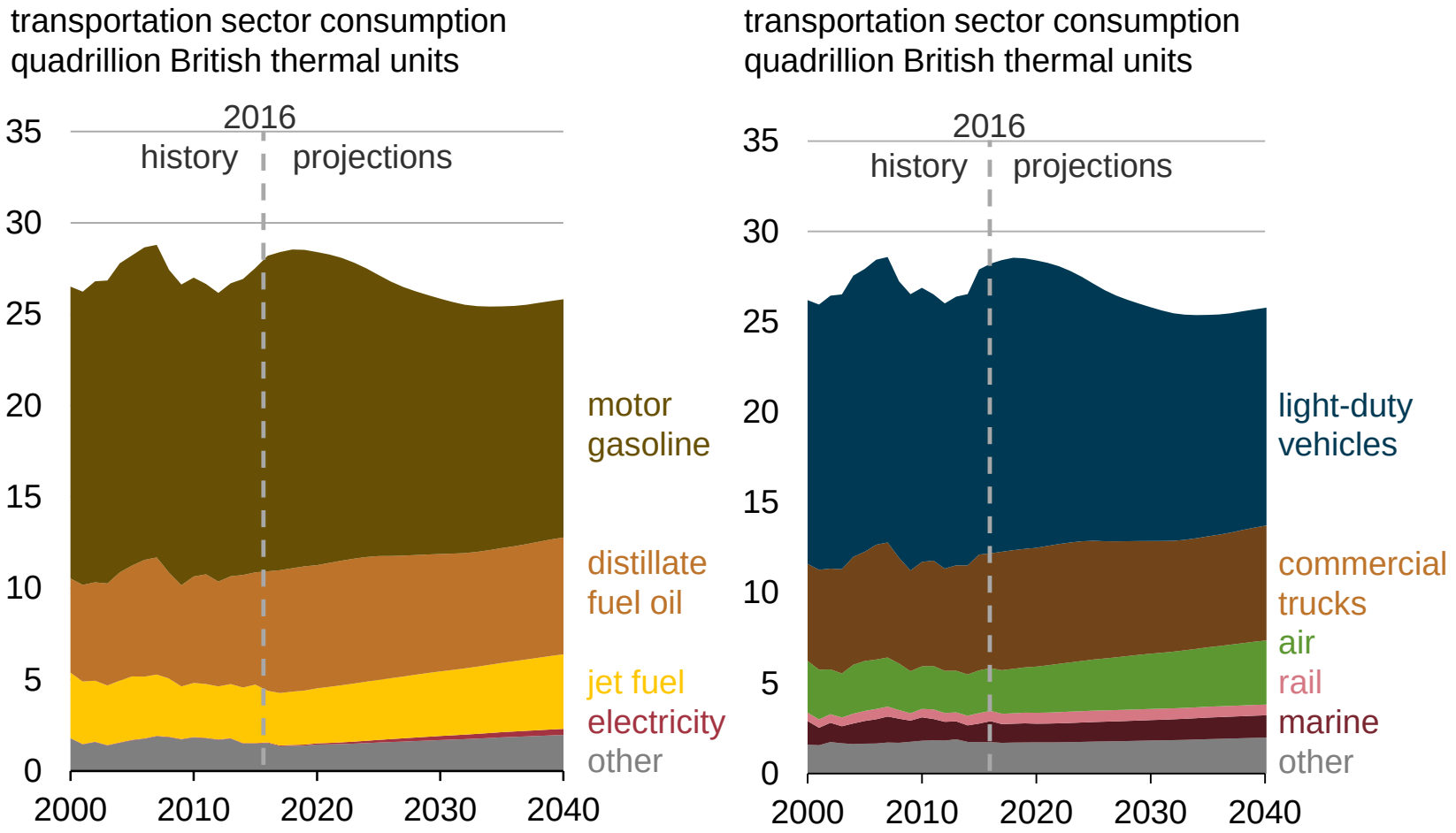
carbon intensity
metric tons CO2 per billion British thermal units



Source: EIA, Annual Energy Outlook 2017

Transportation

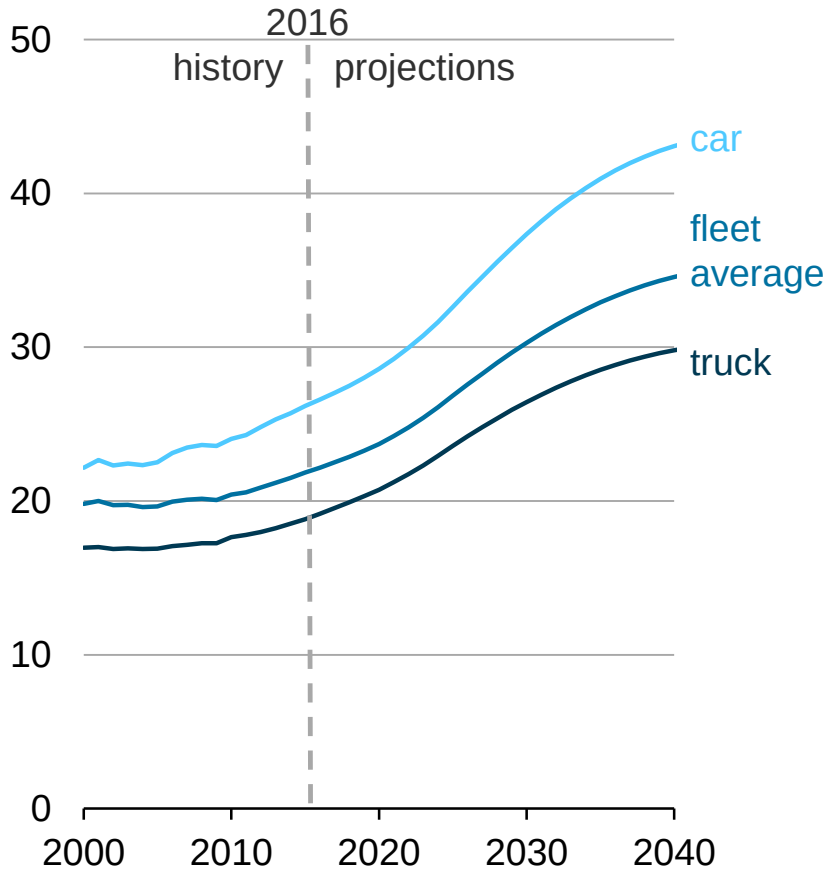
Transportation energy use declines between 2018 and 2034 in the Reference case, driven by improvements in fuel economy



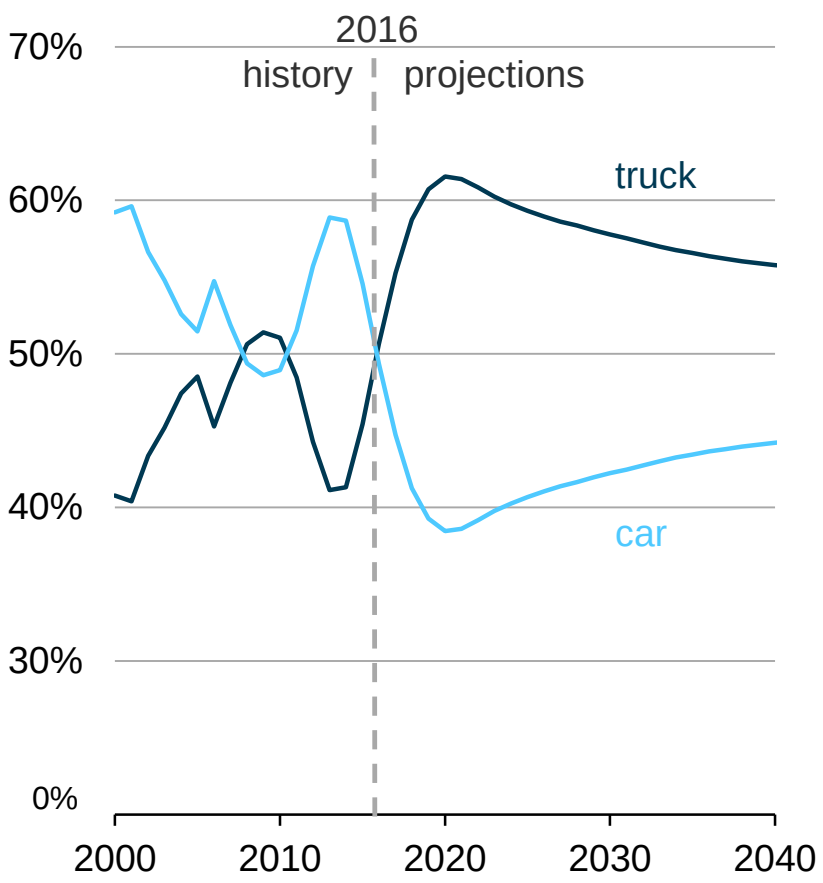
Source: EIA, Annual Energy Outlook 2017

Average light-duty fuel economy improves in the Reference case, even as the share of light-duty trucks increases

light-duty stock fleet fuel economy
miles per gallon

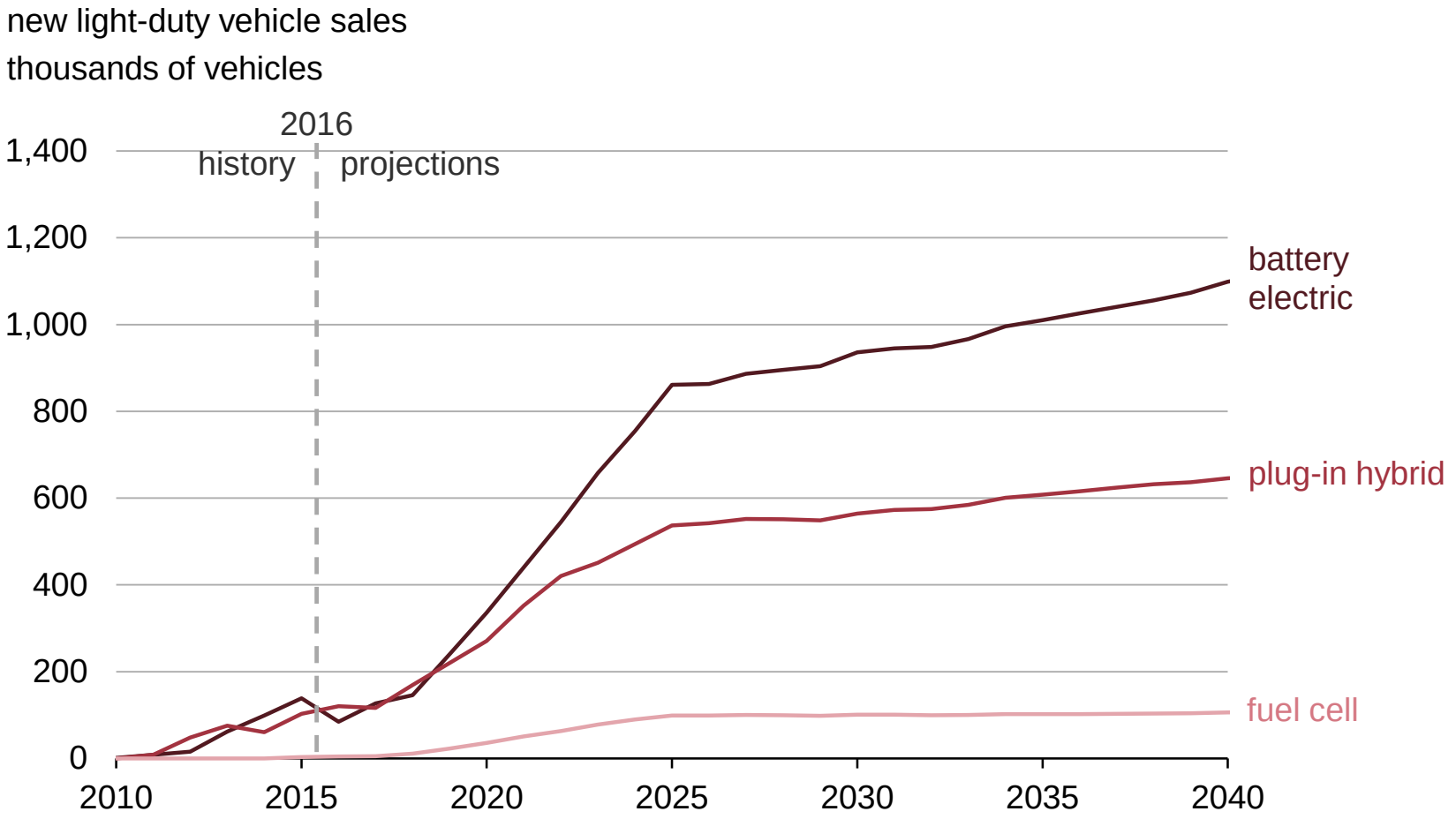


light-duty vehicle sales shares
percent



Source: EIA, Annual Energy Outlook 2017

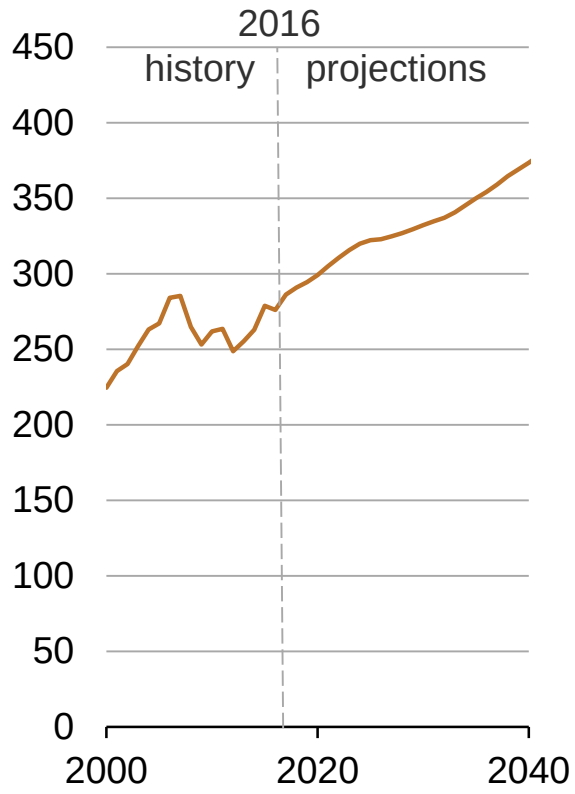
Sales of battery electric, plug-in electric hybrid, and fuel cell vehicles increase in the Reference case because of lower projected battery costs and existing state policies



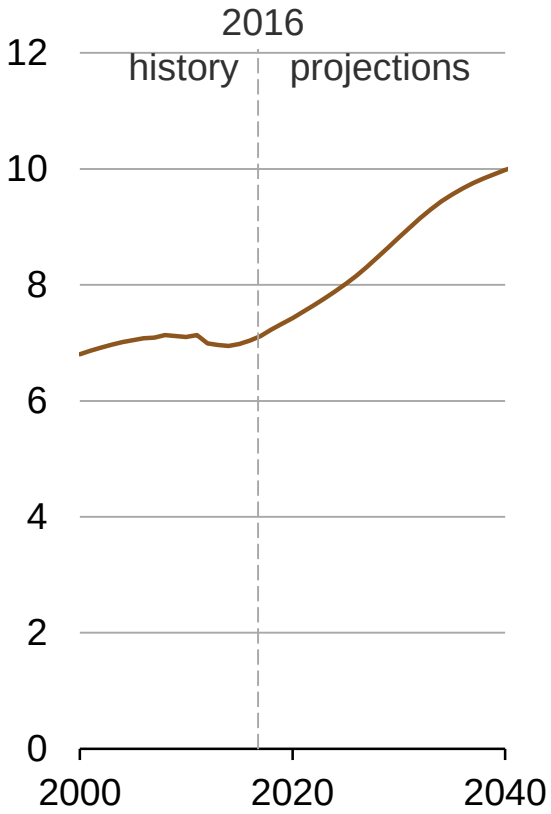
Source: EIA, Annual Energy Outlook 2017

With the second phase of fuel efficiency regulations, medium- and heavy-duty vehicle energy consumption declines over 2027-33 despite continued growth in miles traveled

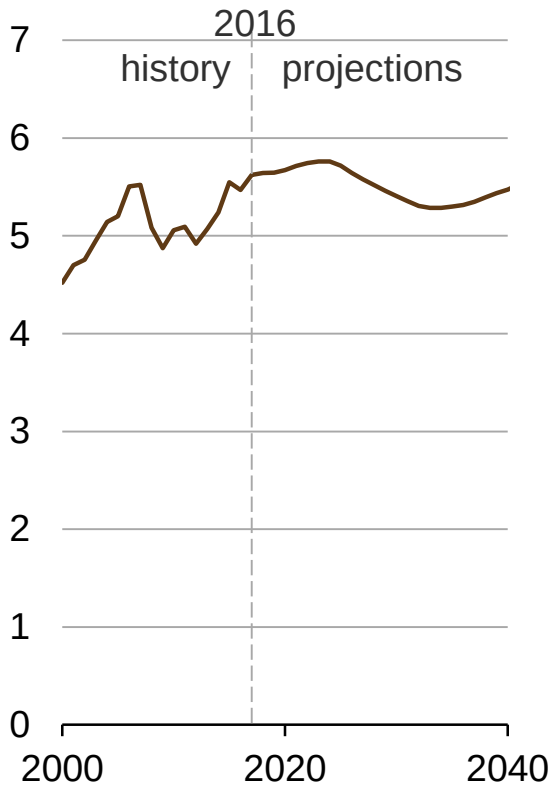
travel indicator
billion vehicle-miles traveled



stock fuel economy
miles per gallon



energy consumption
quadrillion British thermal units

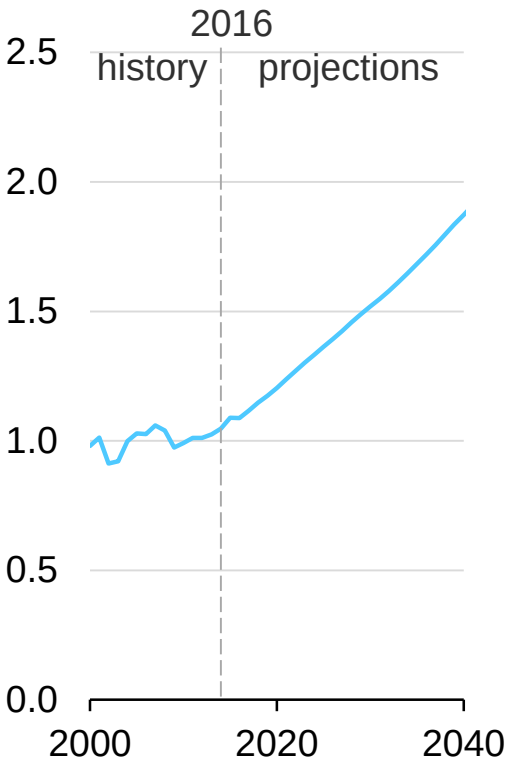


Source: EIA, Annual Energy Outlook 2017

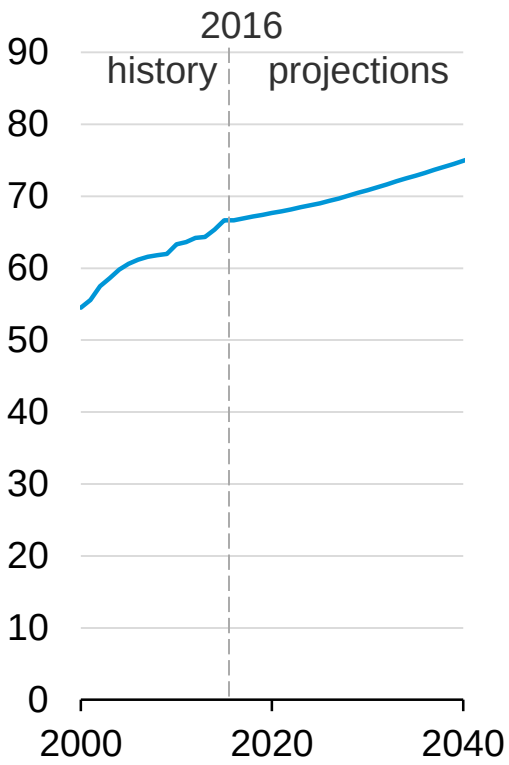
Even with improving commercial aircraft efficiency, jet fuel use rises in the Reference case with increased travel

air transportation metrics

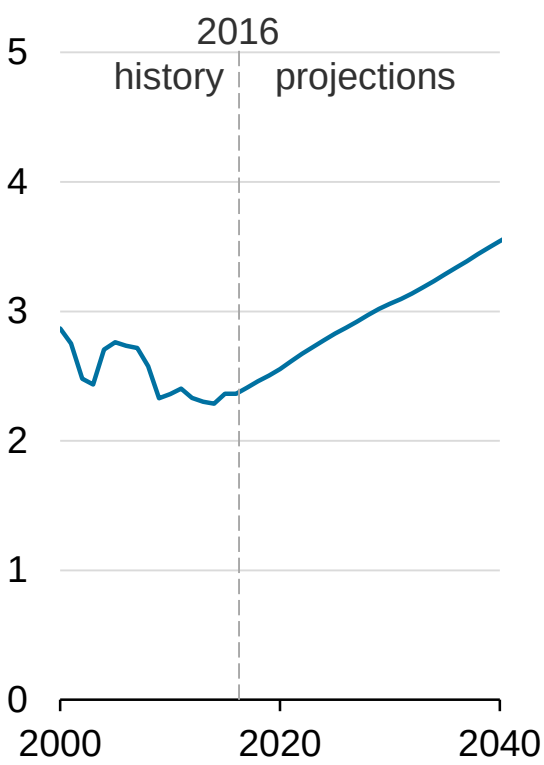
travel indicator
trillion seat-miles available



stock fuel economy
seat-miles per gallon



jet fuel consumption
quadrillion British thermal units



Source: EIA, Annual Energy Outlook 2017

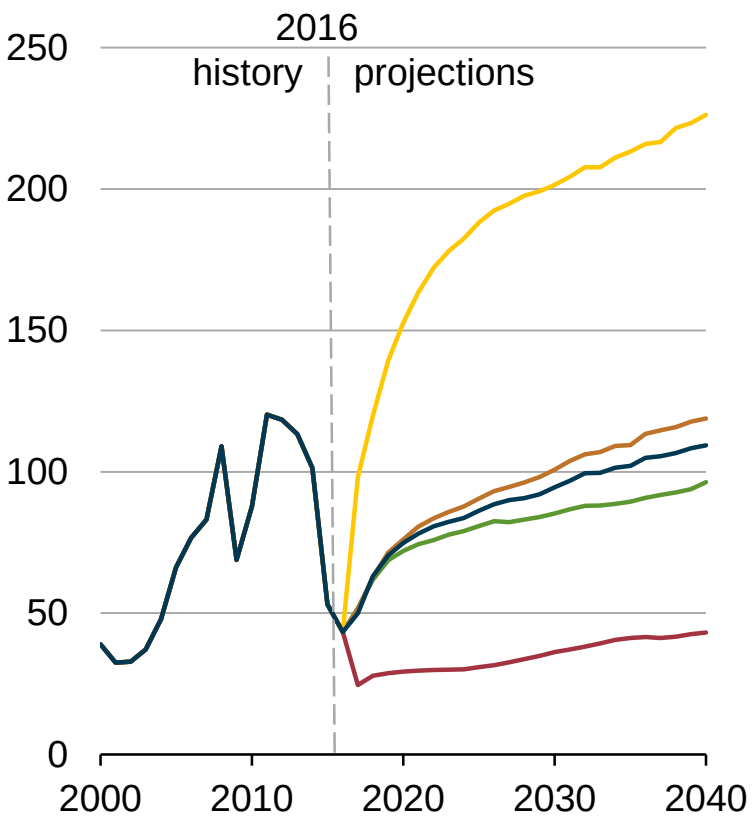
Food for thought – transportation

- Ride sharing
- Autonomous vehicle technology in both passenger and freight applications
- Actual uptake of vehicles fueled by electricity and/or hydrogen
- Teleworking and telepresence
- Possible pursuit of deep decarbonization
- Future vehicle efficiency and taxation policies

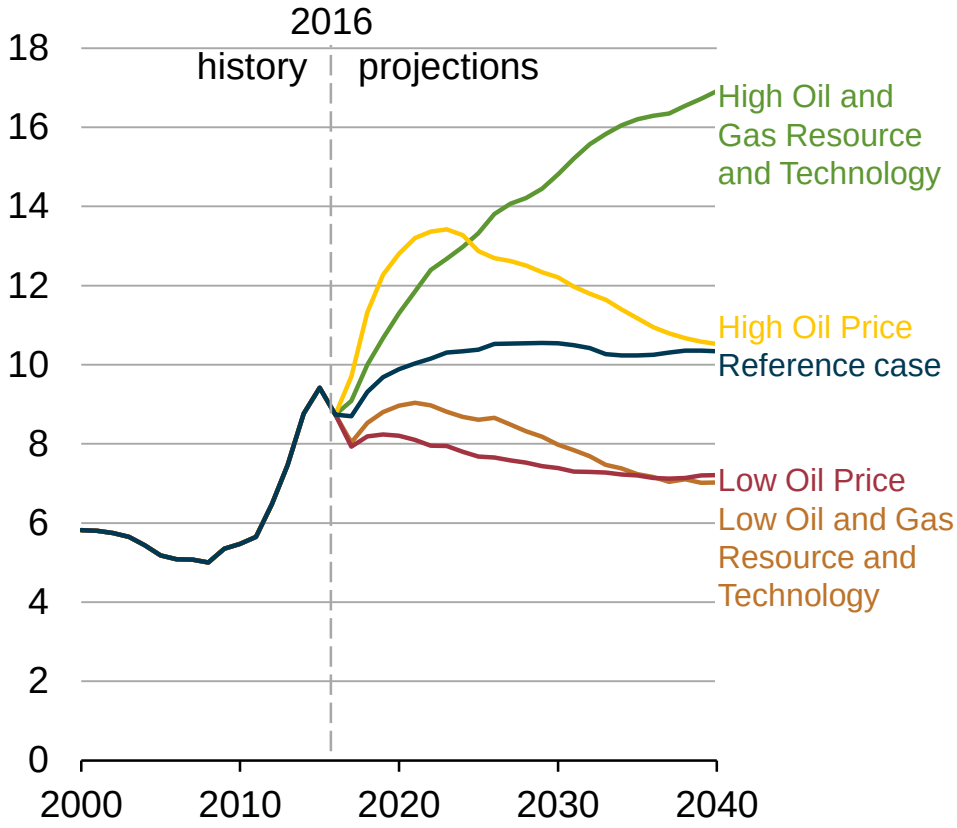
Hydrocarbon production and trade

Reference case oil prices and production rise from current levels, price paths and production levels in the side cases are very different from those in the Reference case

North Sea Brent oil price
2016 dollars per barrel

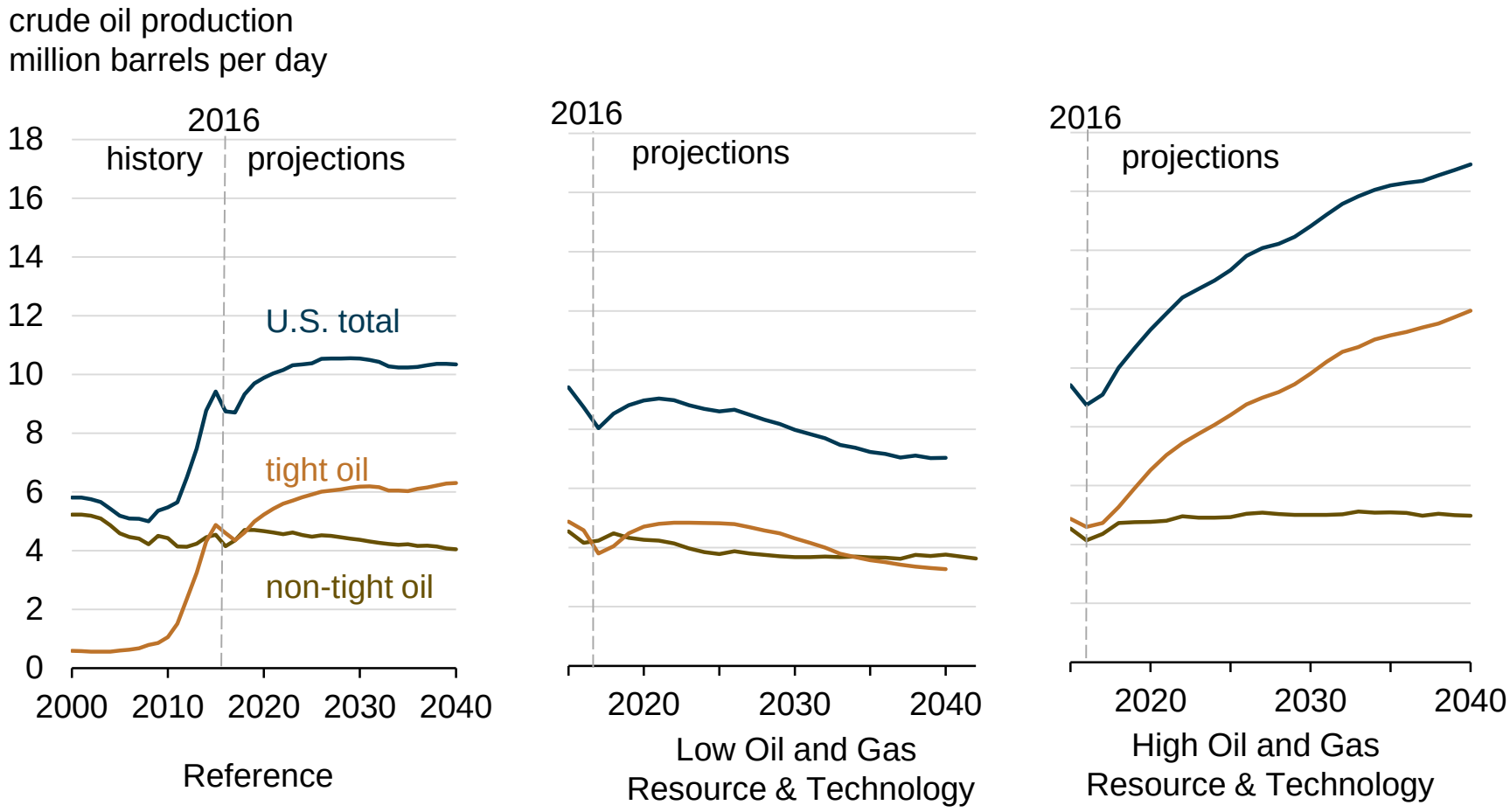


crude oil production
million barrels per day



Source: EIA, Annual Energy Outlook 2017

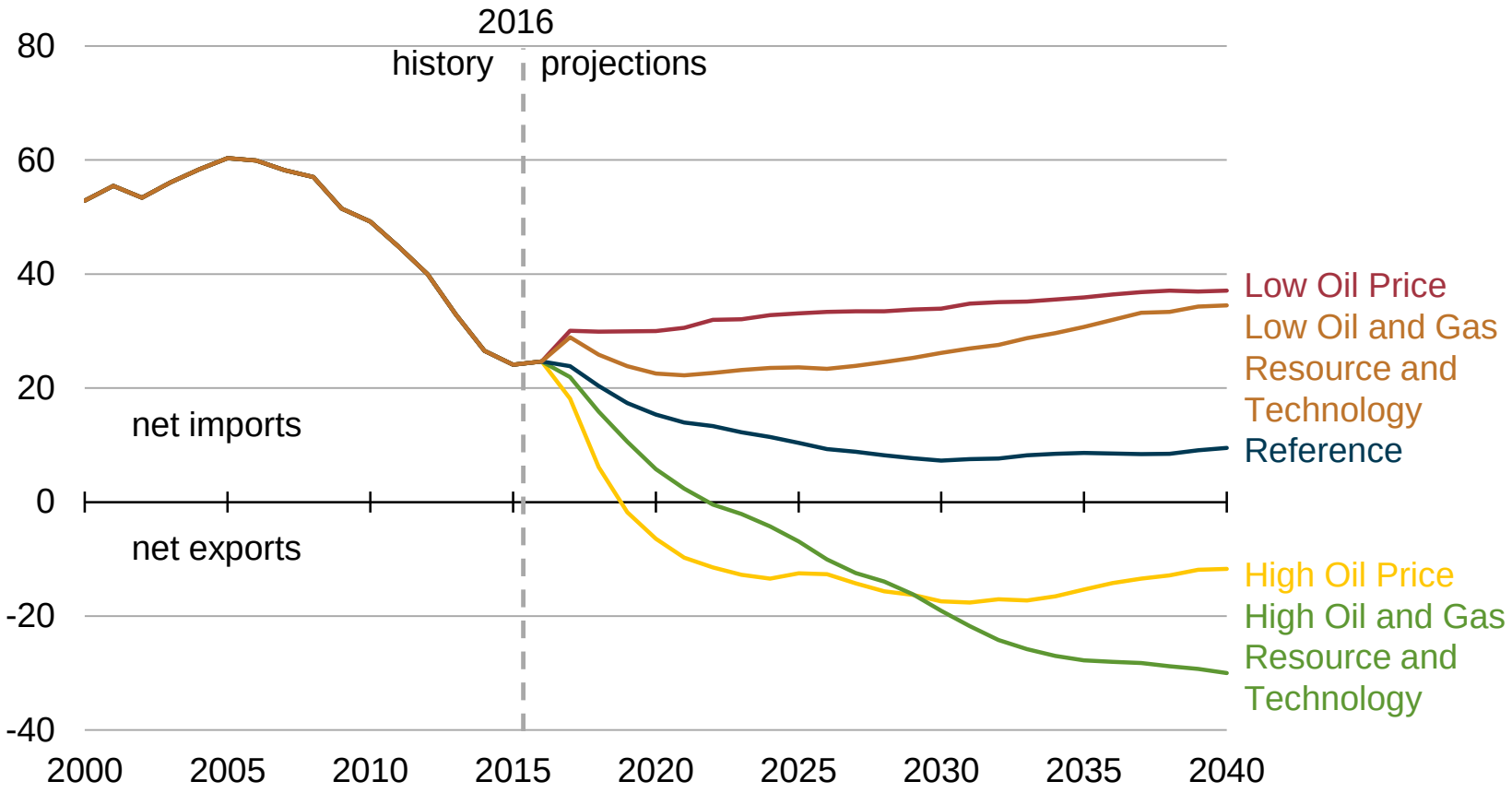
Tight oil dominates U.S. production in the Reference case, but other types of oil production continue to yield significant volumes



Source: EIA, Annual Energy Outlook 2017

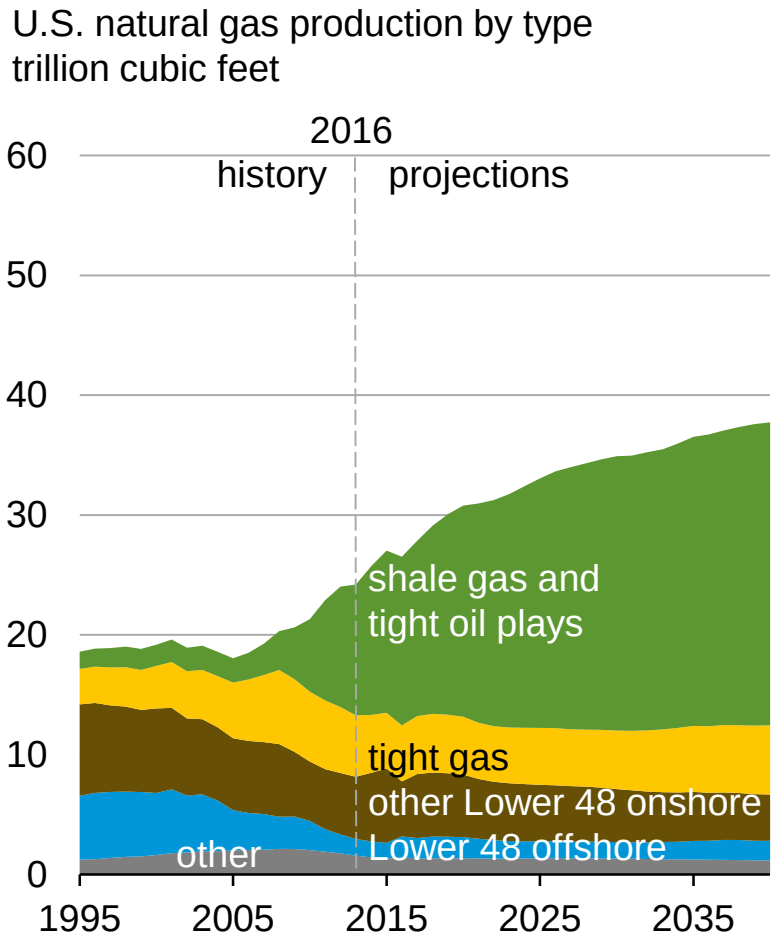
In the High Oil Price and the High Oil and Gas Resource and Technology cases, the United States becomes a net petroleum exporter

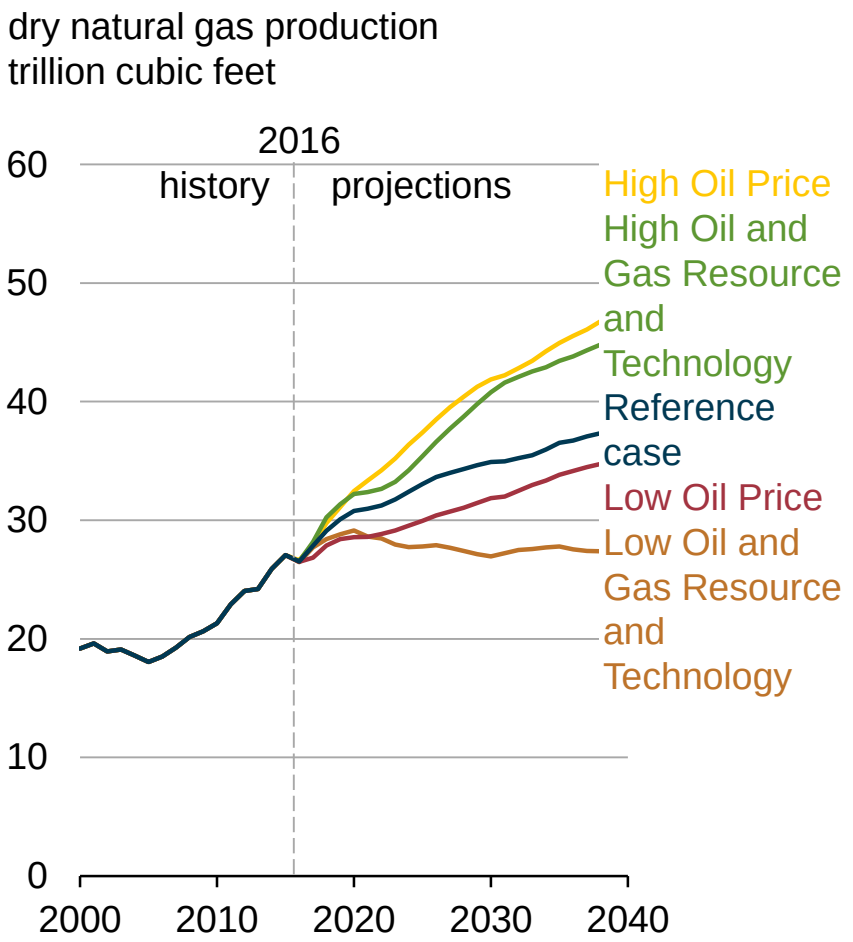
petroleum net imports as a percentage of products supplied
percent



Source: EIA, Annual Energy Outlook 2017

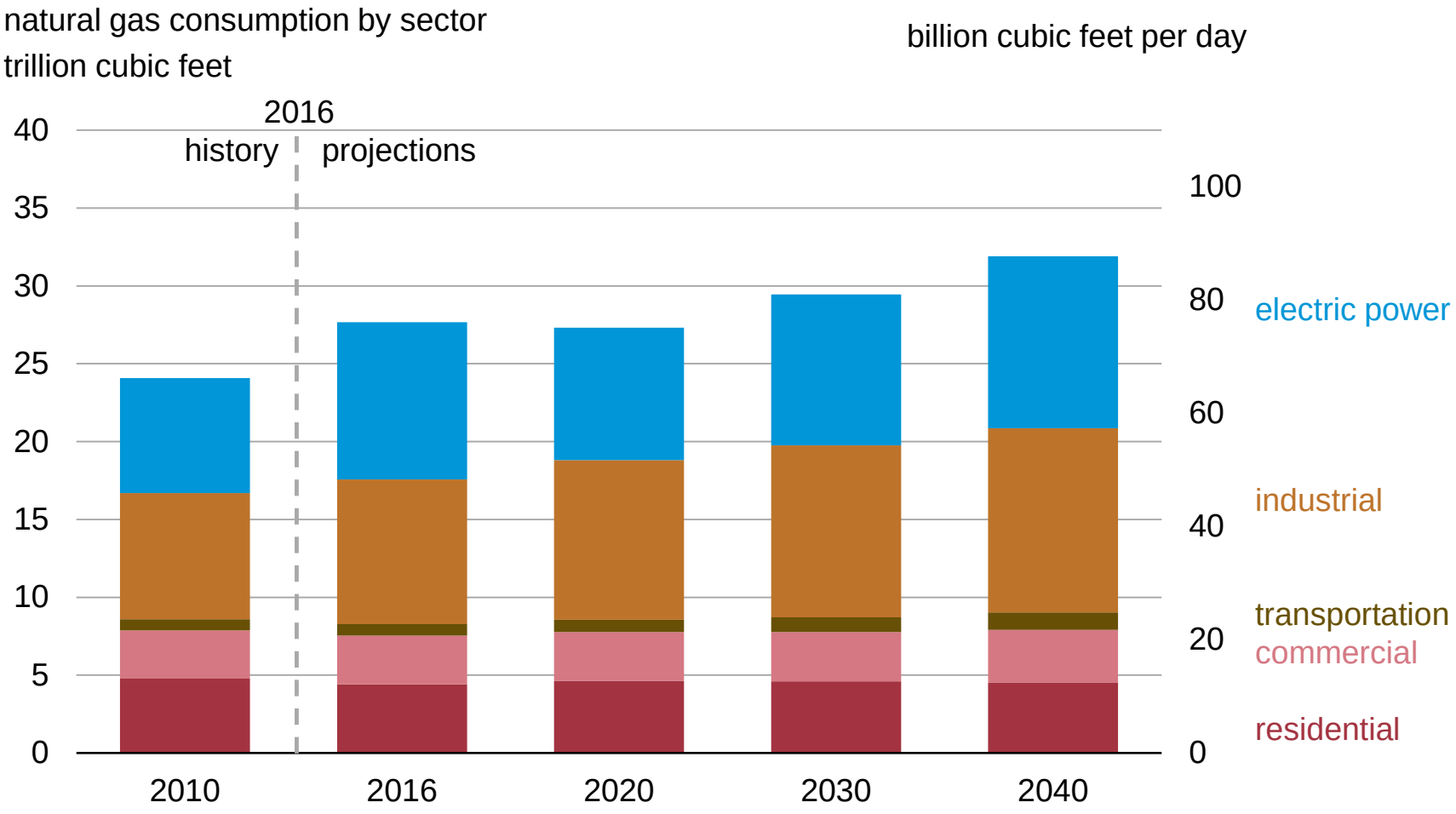
U.S. dry natural gas production is the result of continued development of shale gas and tight oil plays, alternative assumptions cause significant differences





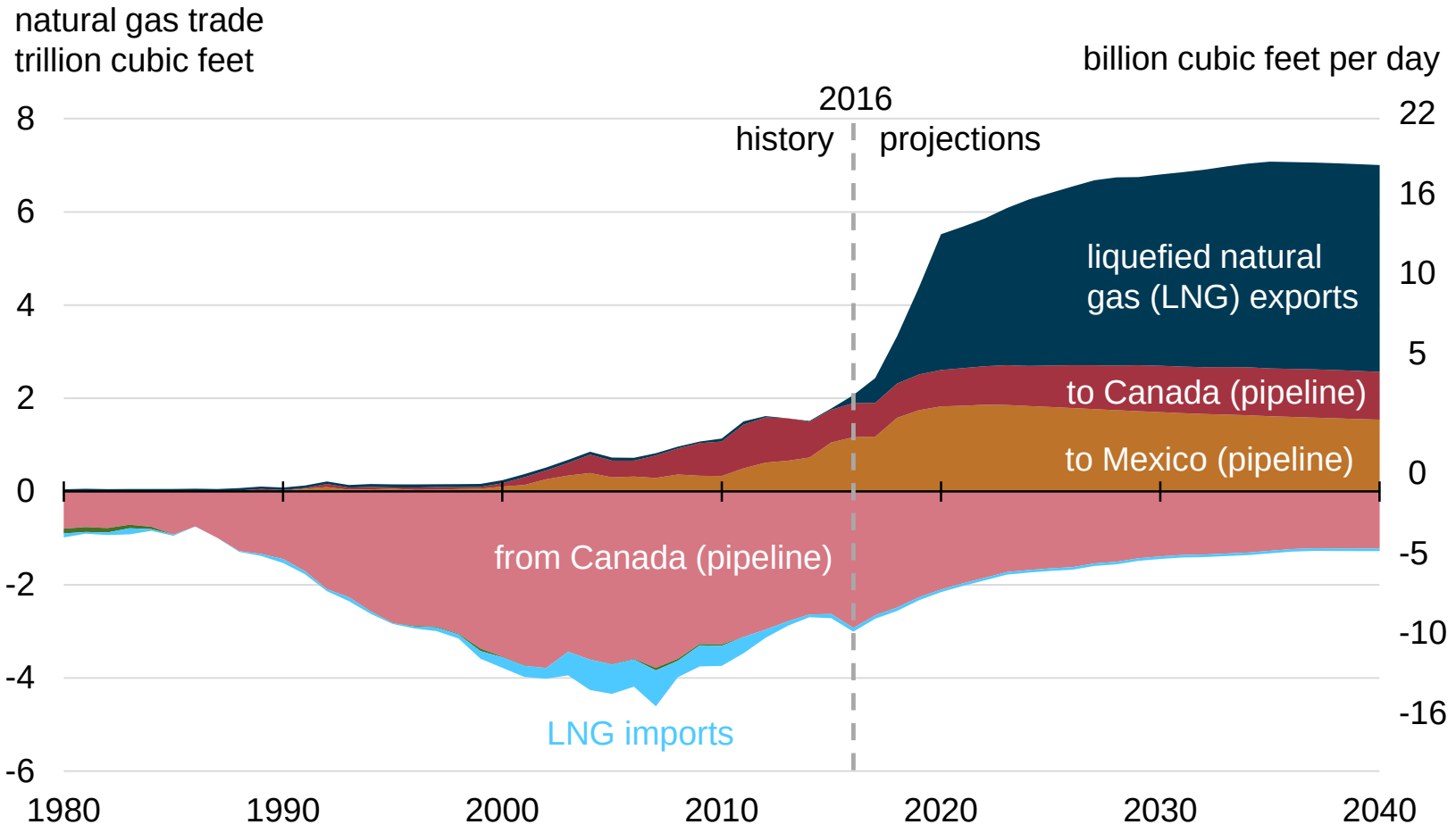
Source: EIA, Annual Energy Outlook 2017

Increasing demand from industrial and electric power markets drive rising domestic consumption of natural gas in the Reference case



Source: EIA, Annual Energy Outlook 2017

Increased natural gas trade is dominated by liquefied natural gas exports in the Reference case

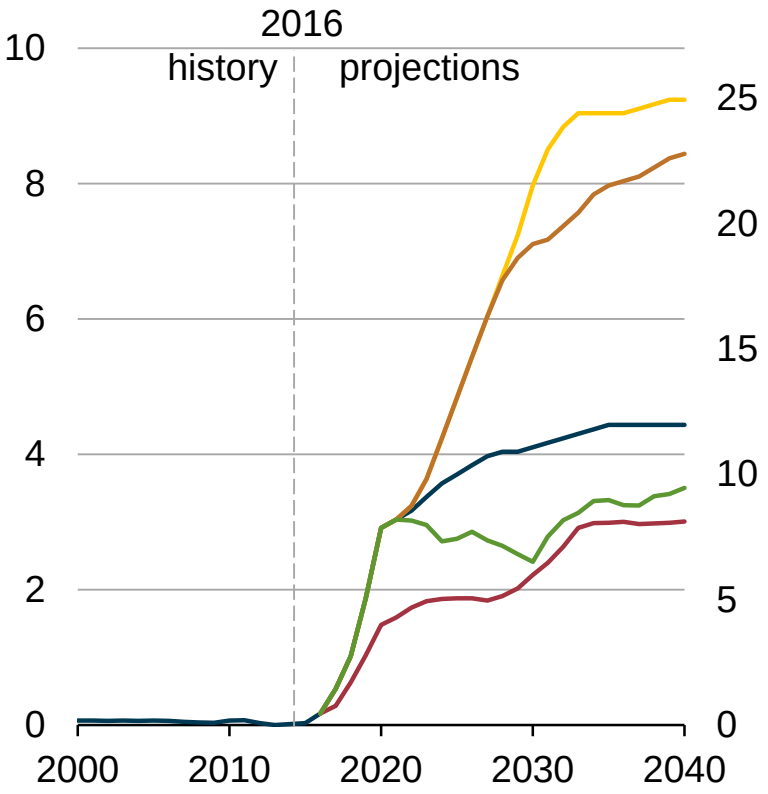


Source: EIA, Annual Energy Outlook 2017

U.S. LNG export levels vary across cases and reflect both the level of global demand, as well as by the difference between domestic and global natural gas prices

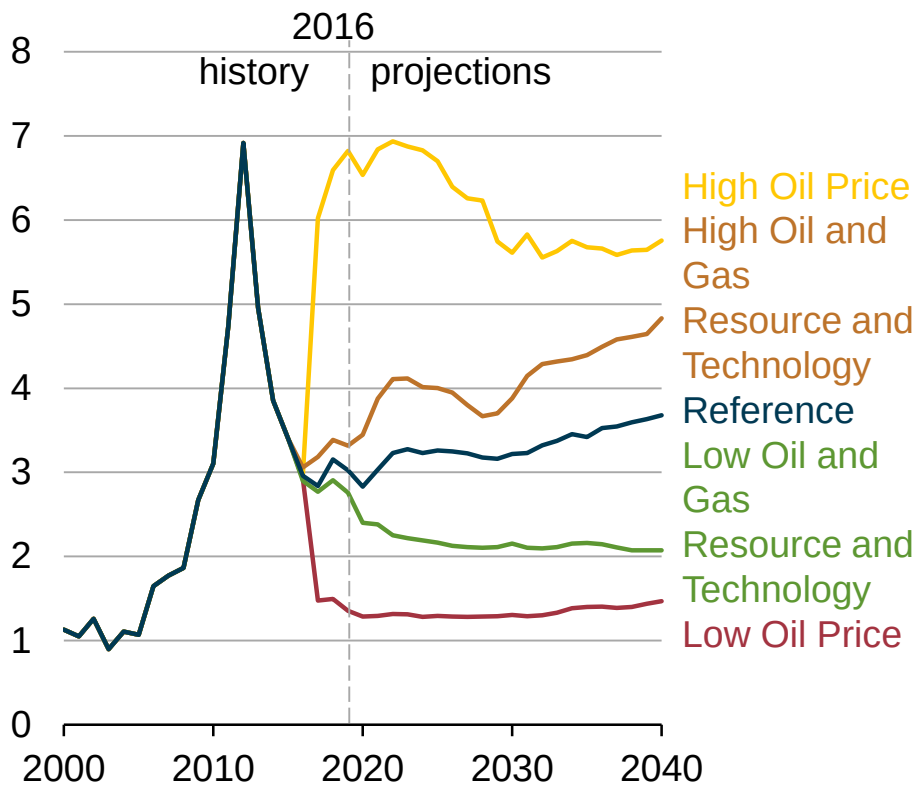
liquefied natural gas exports

trillion cubic feet billion cubic feet per day



oil-to-natural gas price ratio

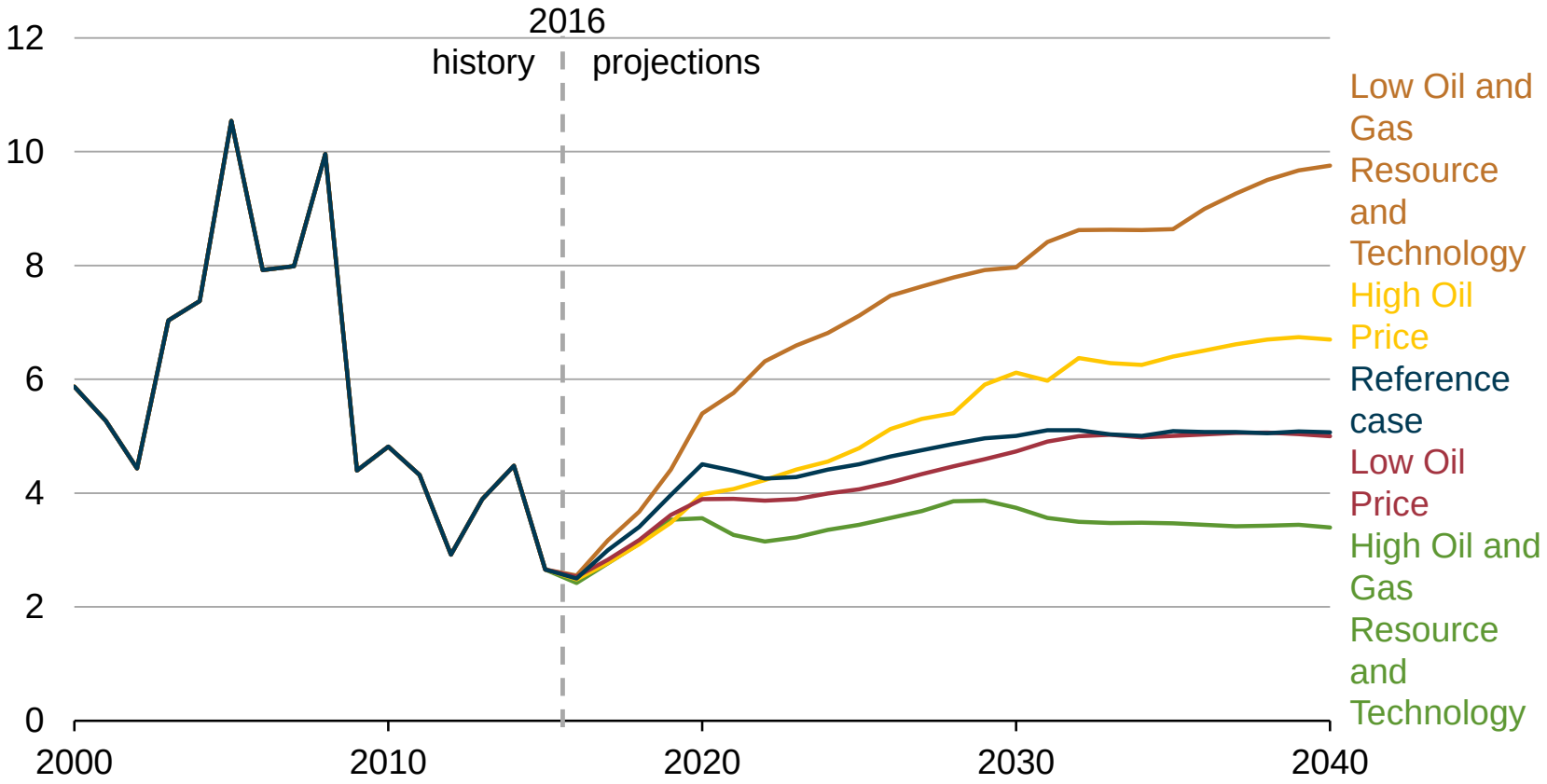
energy-equivalent terms



Source: EIA, Annual Energy Outlook 2017

Future domestic natural gas prices depend on both domestic resource availability and world energy prices

Henry Hub natural gas price
2016 dollars per million Btu



Source: EIA, Annual Energy Outlook 2017

Food for thought – hydrocarbon production and trade

- Technology developments – to what extent will they continue to offset depletion of hydrocarbon resources
- Geopolitics in key producing regions – both internationally and within the United States
- Possible pursuit of deep decarbonization, particularly in transportation applications
- Technologies and policies affecting vehicle choice, given dominant role of transportation sector in oil demand

For more information

U.S. Energy Information Administration home page | www.eia.gov

Annual Energy Outlook | www.eia.gov/aeo

International Energy Outlook | www.eia.gov/ieo

Short-Term Energy Outlook | www.eia.gov/steo

Monthly Energy Review | www.eia.gov/mer

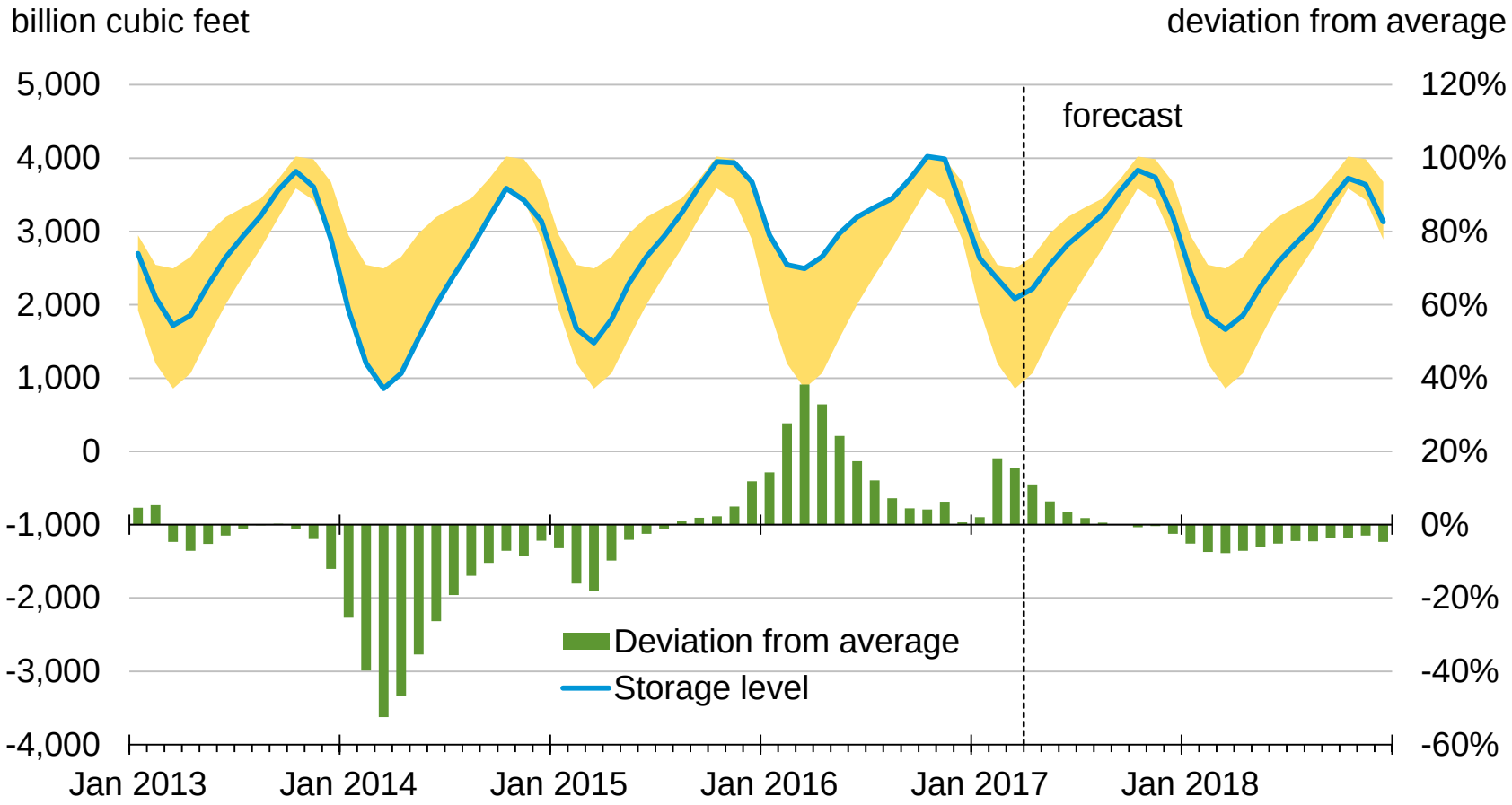
Today in Energy | www.eia.gov/todayinenergy

Drilling Productivity Report | www.eia.gov/petroleum/drilling/

State Energy Portal | www.eia.gov/state/

North American Collaboration on Energy Information | www.nacei.org/

U.S. working natural gas in storage



Note: Colored band around storage levels represents the range between the minimum and maximum from Jan. 2012 - Dec. 2016.

Source: Short-Term Energy Outlook, April 2017