

The Outlook for Natural Gas Production, Demand, and Trade: Short- and Long-term Perspectives



Industrial Energy Consumers of America

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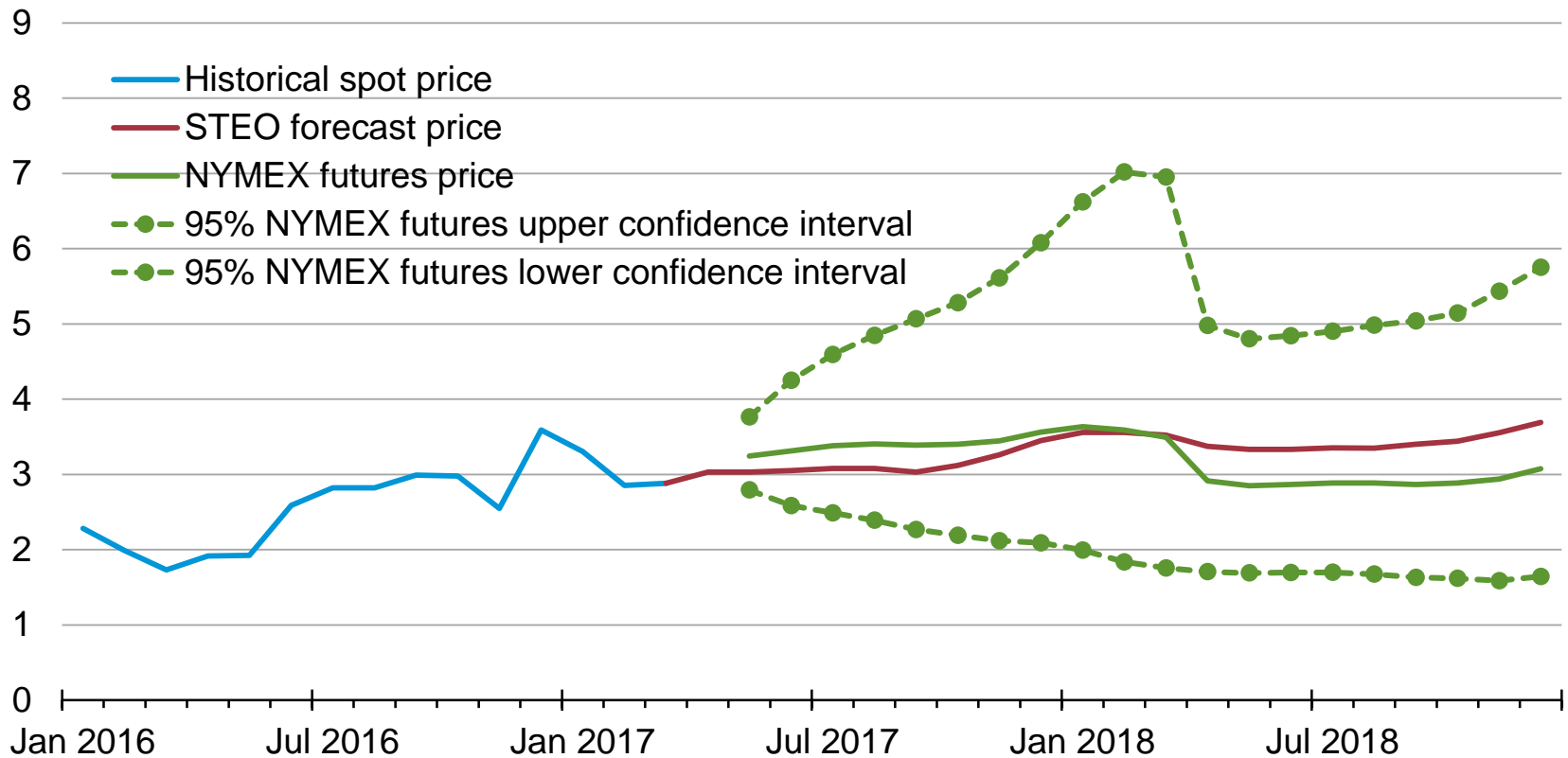
by

Howard Gruenspecht, Acting Administrator

Short-term view

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

Henry hub natural gas price
dollars per million BTU



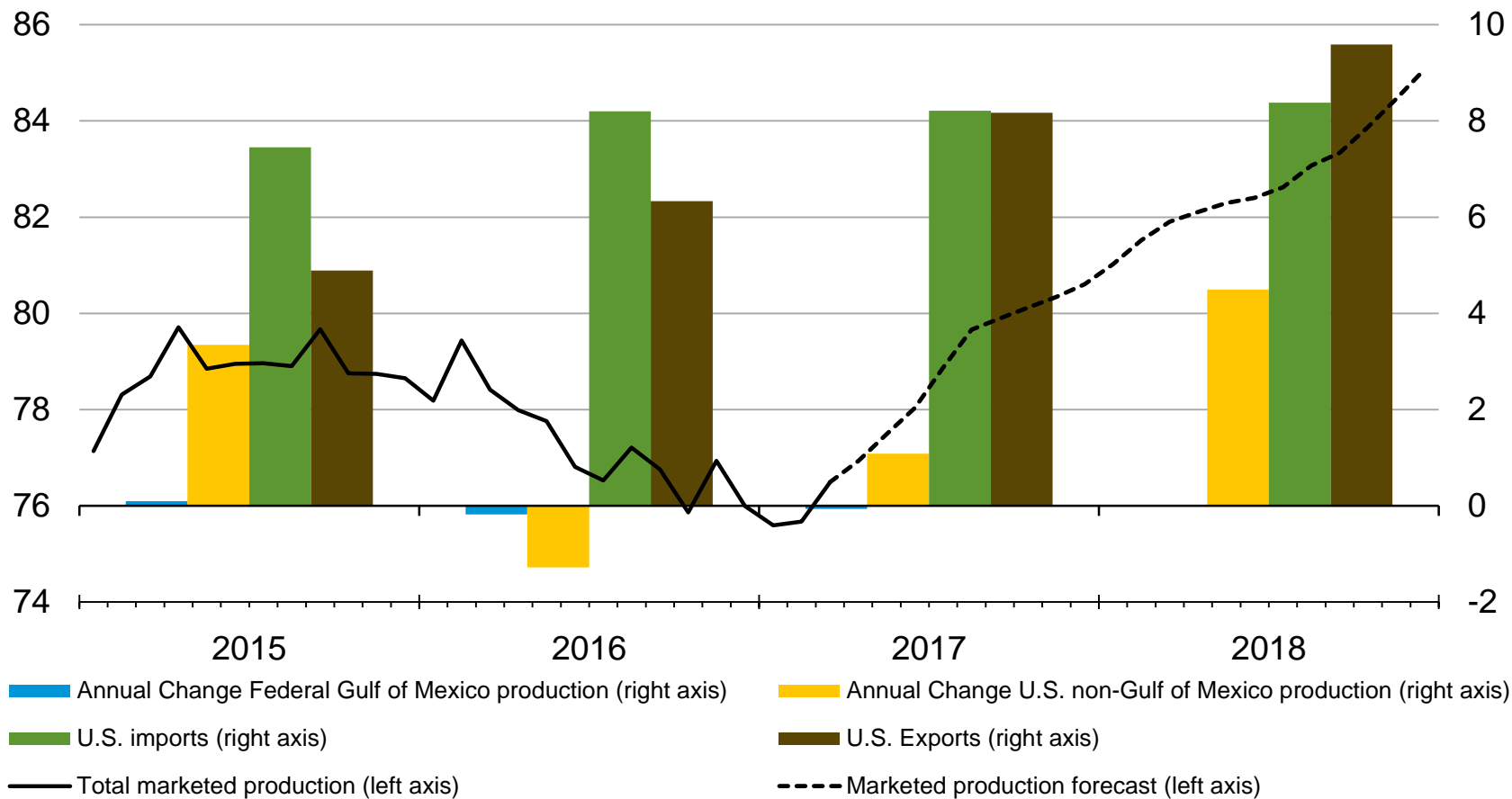
Note: Confidence interval derived from options market information for the 5 trading days ending Apr 6, 2017. Intervals not calculated for months with sparse trading in near-the-money options contracts.

Source: Short-Term Energy Outlook, April 2017

U.S. natural gas production expected grow in 2017 and 2018 with natural gas exports exceeding imports in 2018

U.S. natural gas production and trade
billion cubic feet per day (Bcf/d)

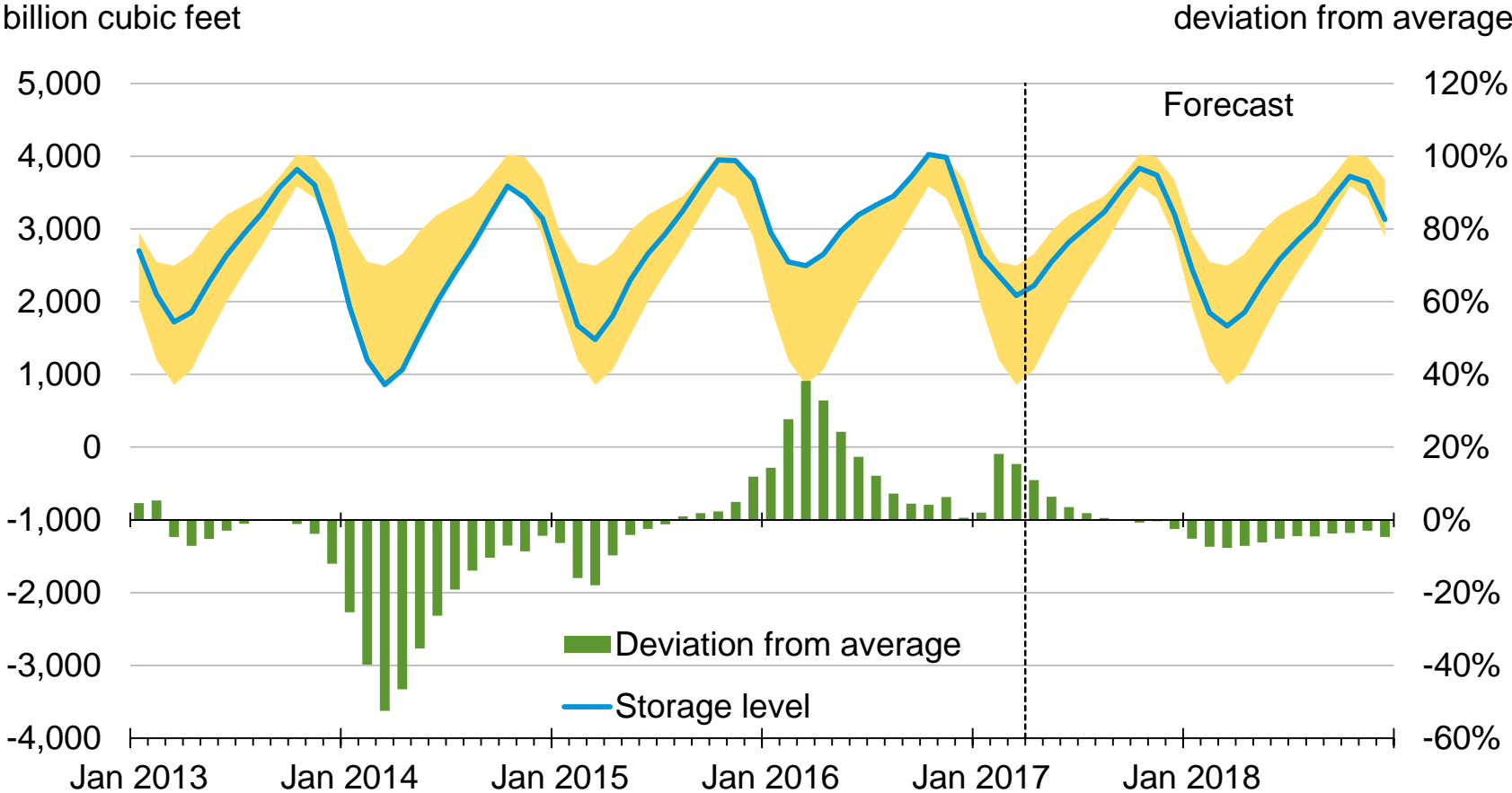
billion cubic feet per day (Bcf/d)



Source: Short-Term Energy Outlook, April 2017

Monthly U.S. working natural gas storage levels in 2018 are forecast to be slightly below the 2012-16 monthly average level

U.S. working natural gas in storage
billion cubic feet



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.

Long-term projections: overview

Key takeaways related to natural gas from AEO2017

- 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, 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
- 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

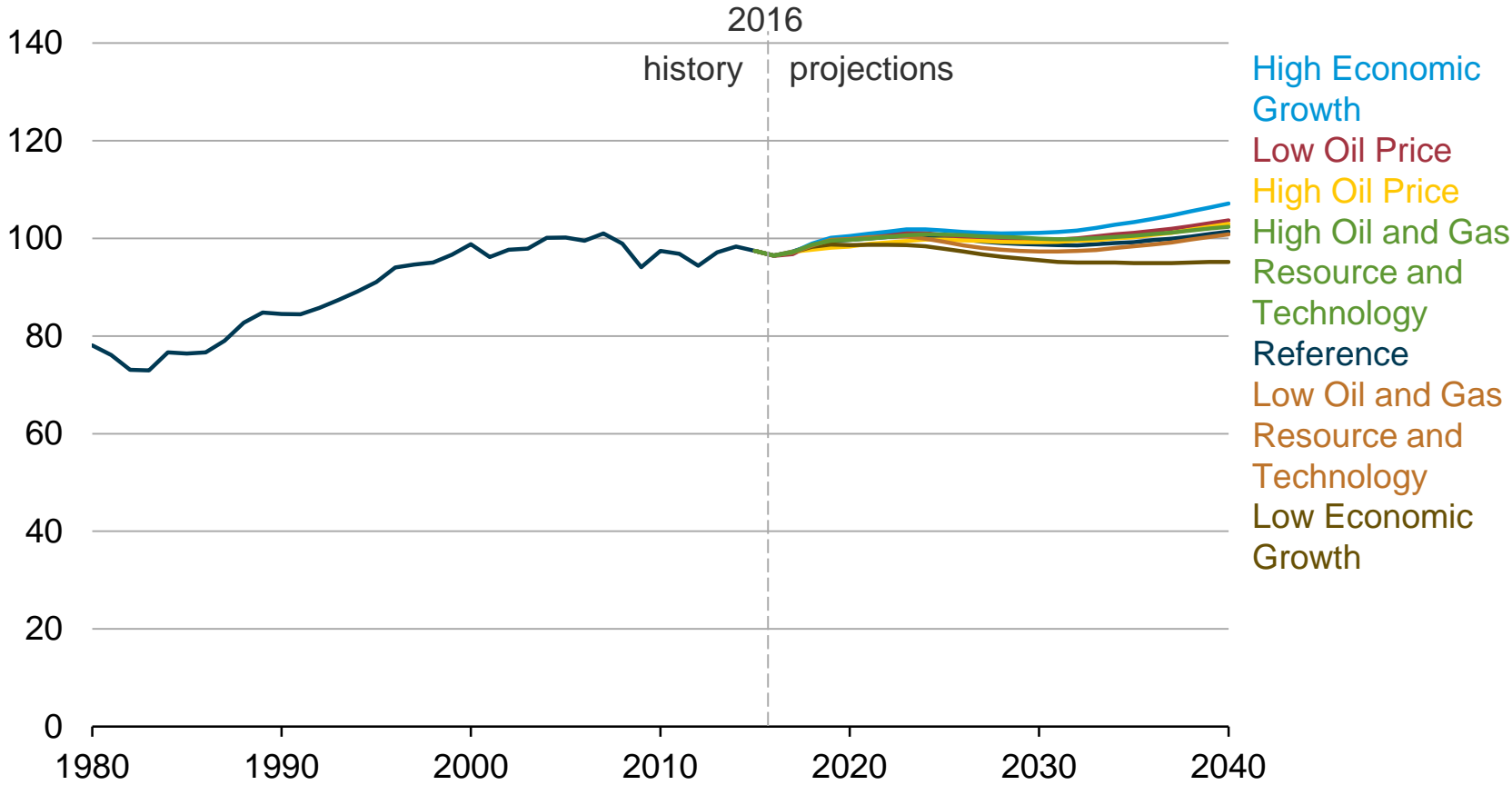
- Different relative fuel prices
- Faster / slower economic and energy demand growth
- Changing policies and regulations
- Changing consumer preferences
- Faster / slower technology progress
- Technology breakthroughs

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

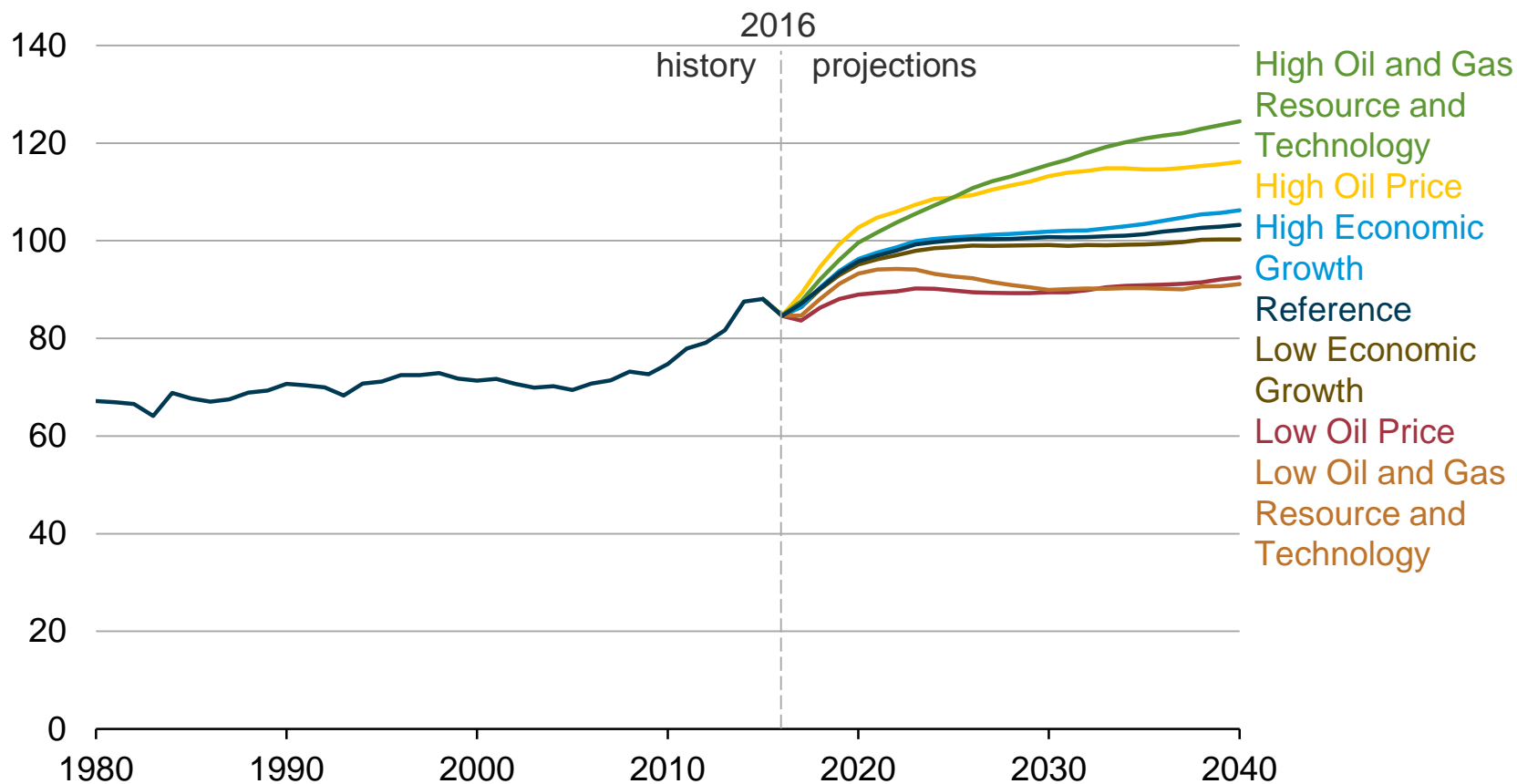
total energy consumption
quadrillion British thermal units



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

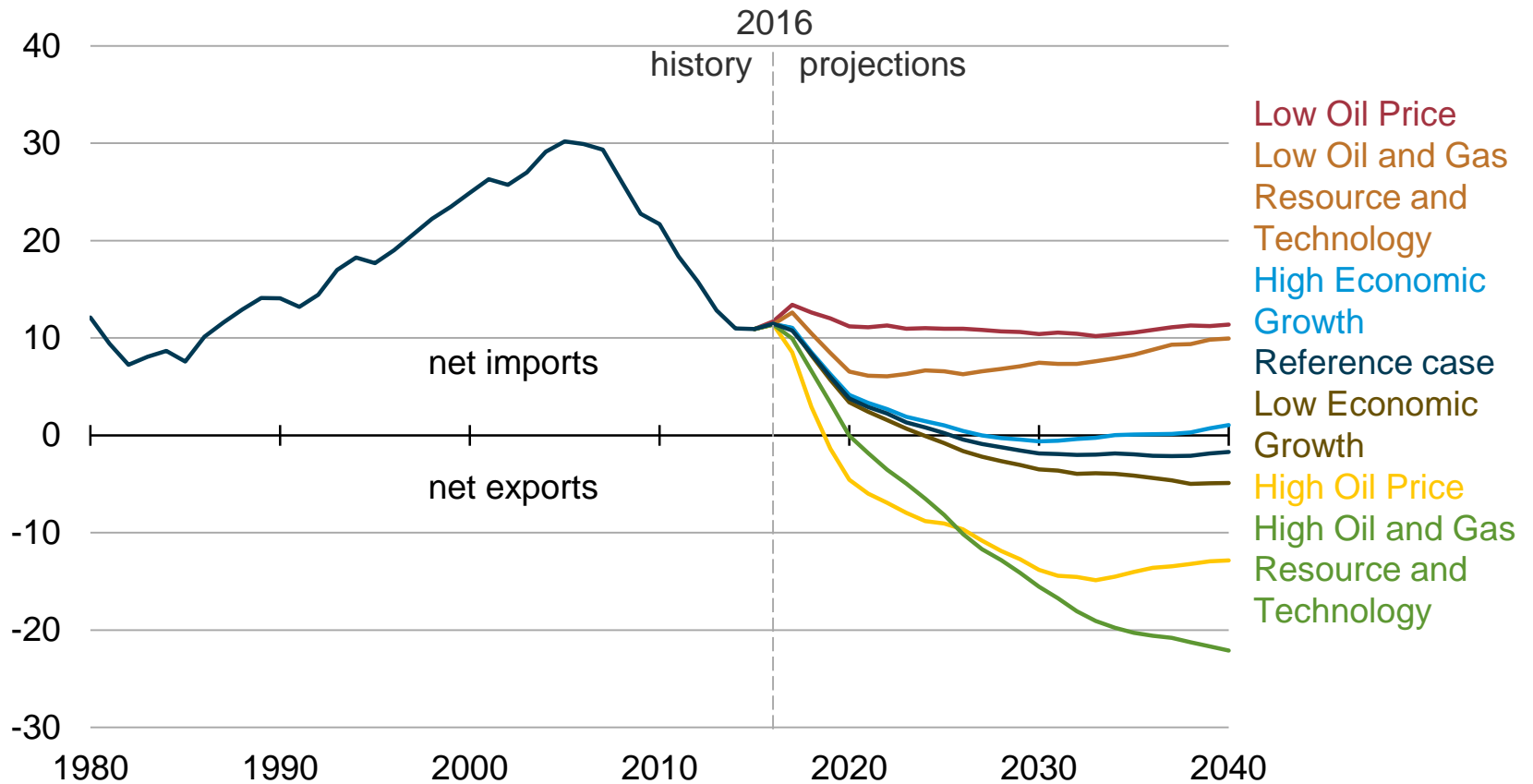


Source: EIA, Annual Energy Outlook 2017

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

net energy trade

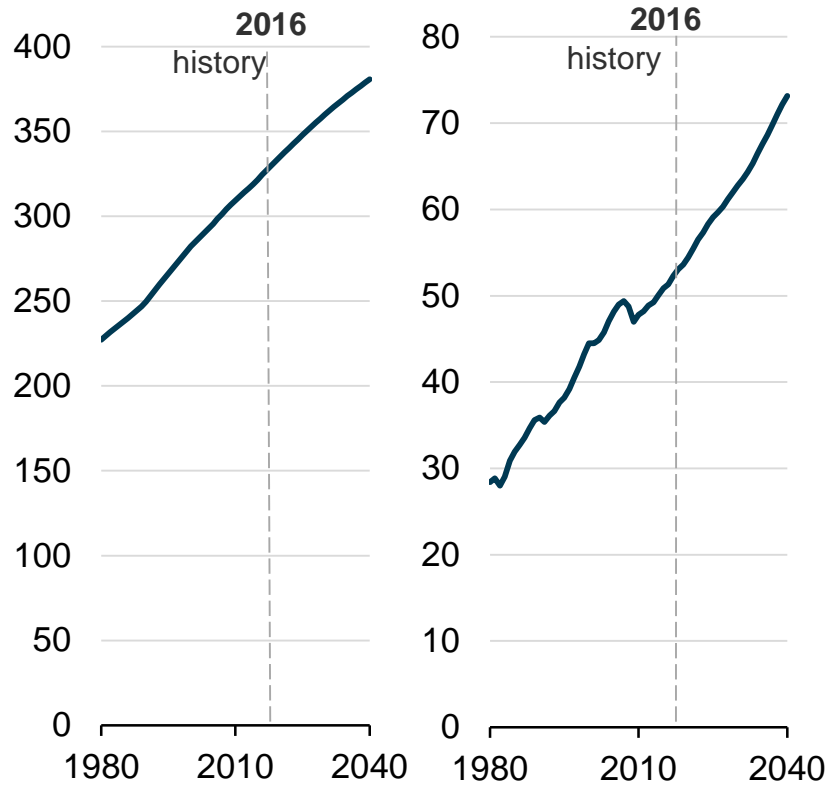
quadrillion British thermal units



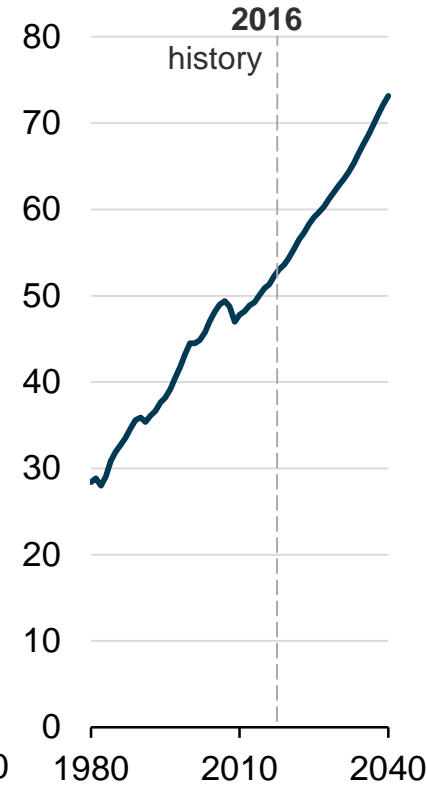
Source: EIA, Annual Energy Outlook 2017

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

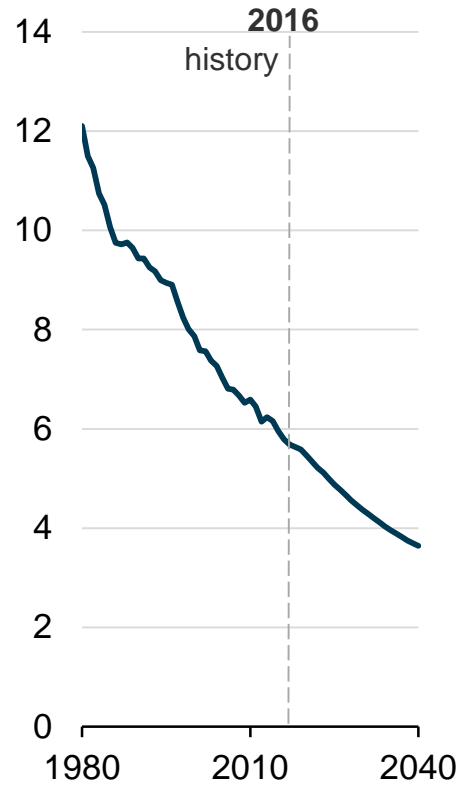
U.S. population
million people



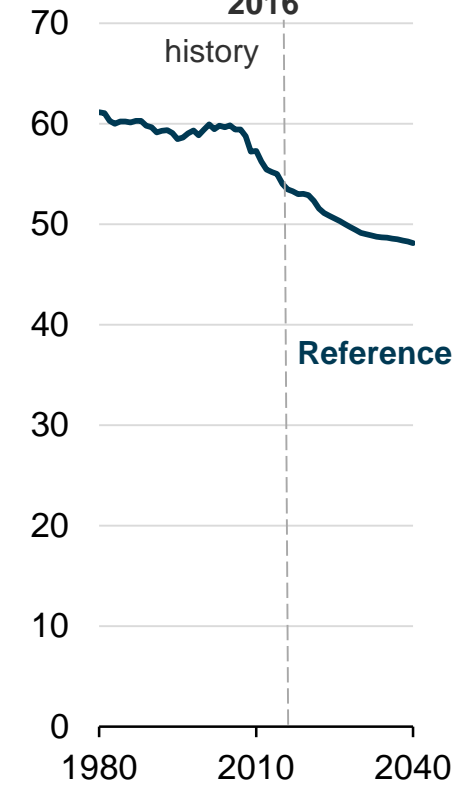
gross domestic product per capita
thousand dollars per person



energy intensity
thousand British thermal units per dollar



carbon intensity
metric tons CO2 per billion British thermal units

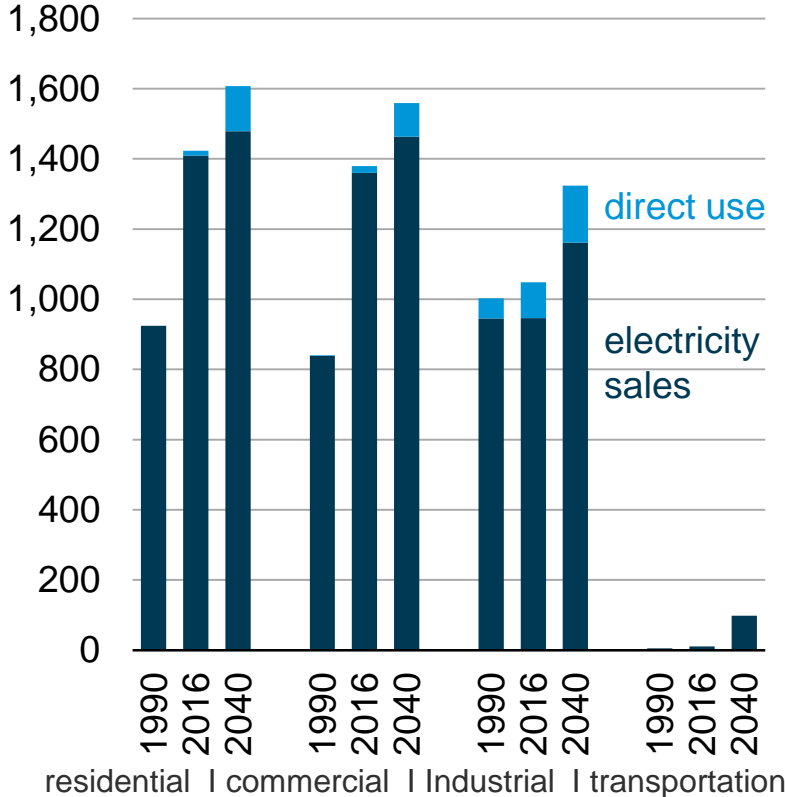


Source: EIA, Annual Energy Outlook 2017

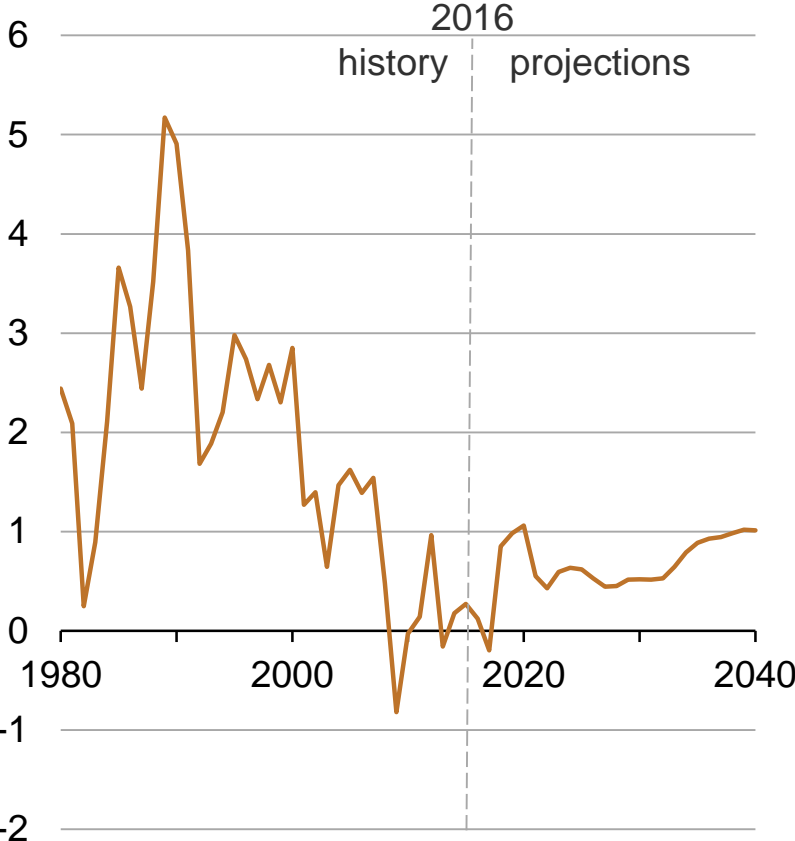
Electricity

Electricity use continues to increase, but the rate of growth remains lower than historic averages in the Reference case

electricity use by sector
billion kilowatthours



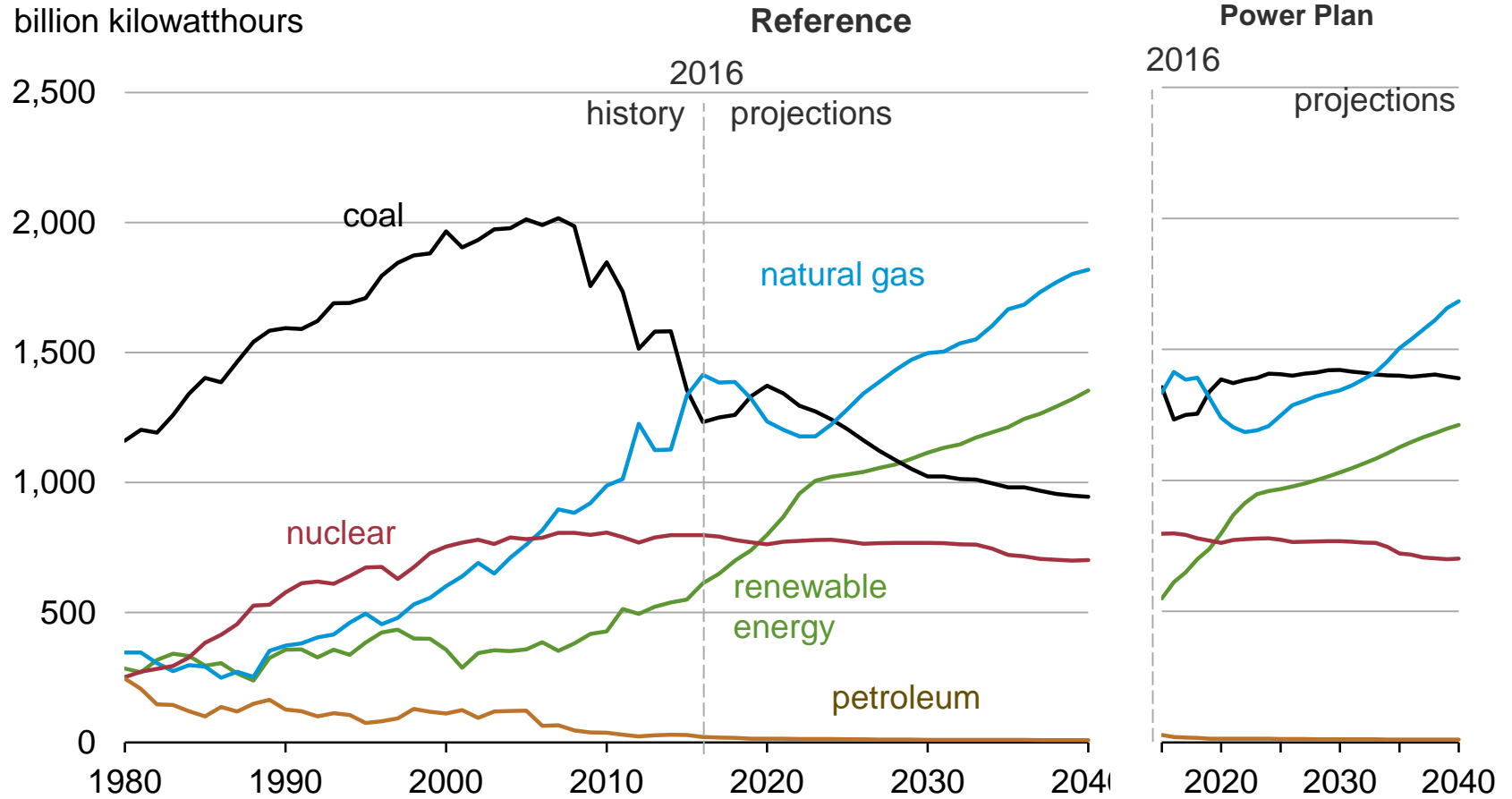
electricity use growth rate
percent growth (three-year rolling average)



Source: EIA, Annual Energy Outlook 2017

Fuel prices and current laws and regulations drive growing shares of renewables and natural gas in the electricity generation mix as coal's share declines over time in the Reference case

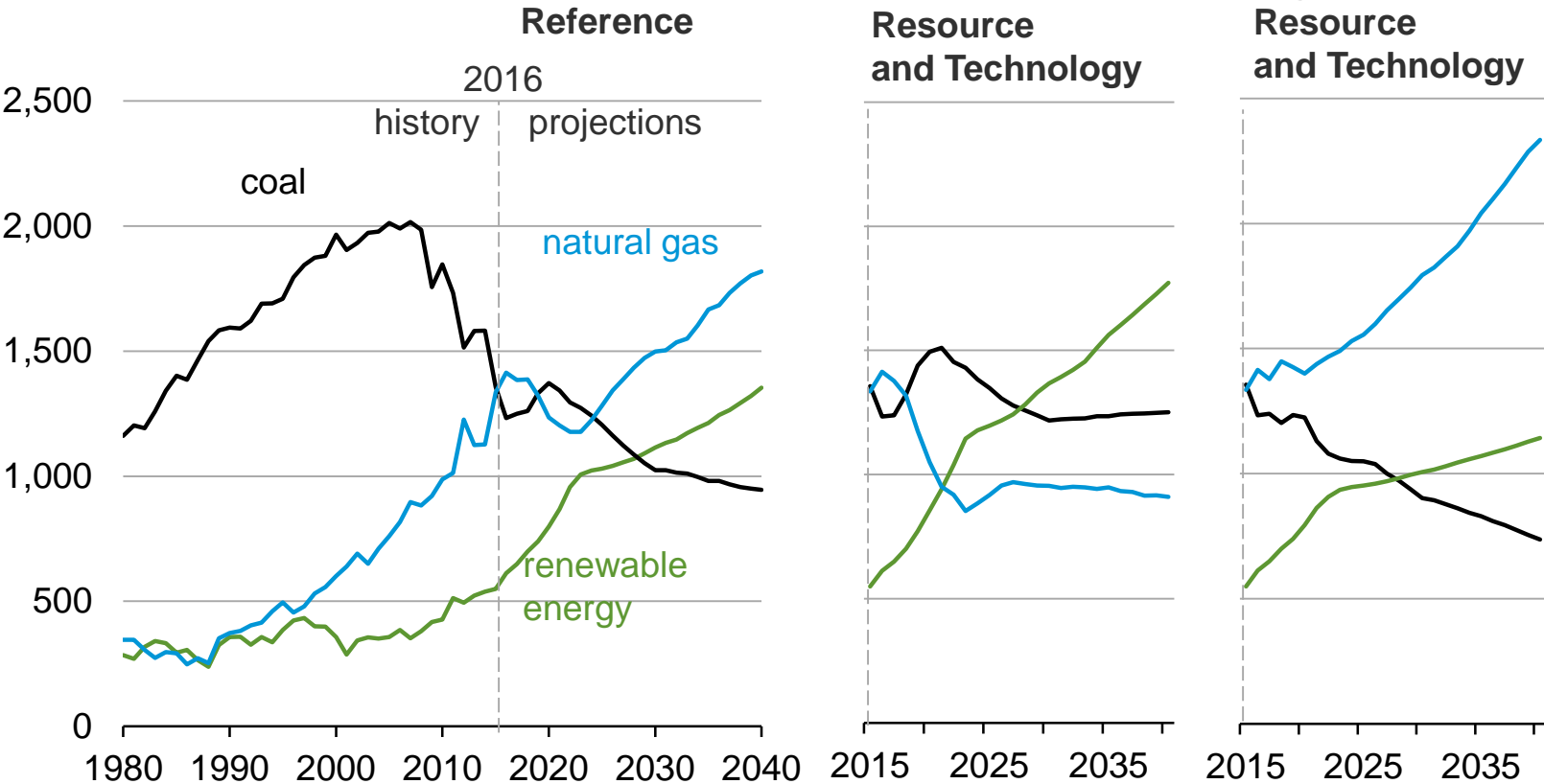
U.S. net electricity generation from select fuels
billion kilowatthours



Source: EIA, Annual Energy Outlook 2017

Natural gas resource availability affects prices and plays a critical role in determining the mix of coal, natural gas, and renewable generation

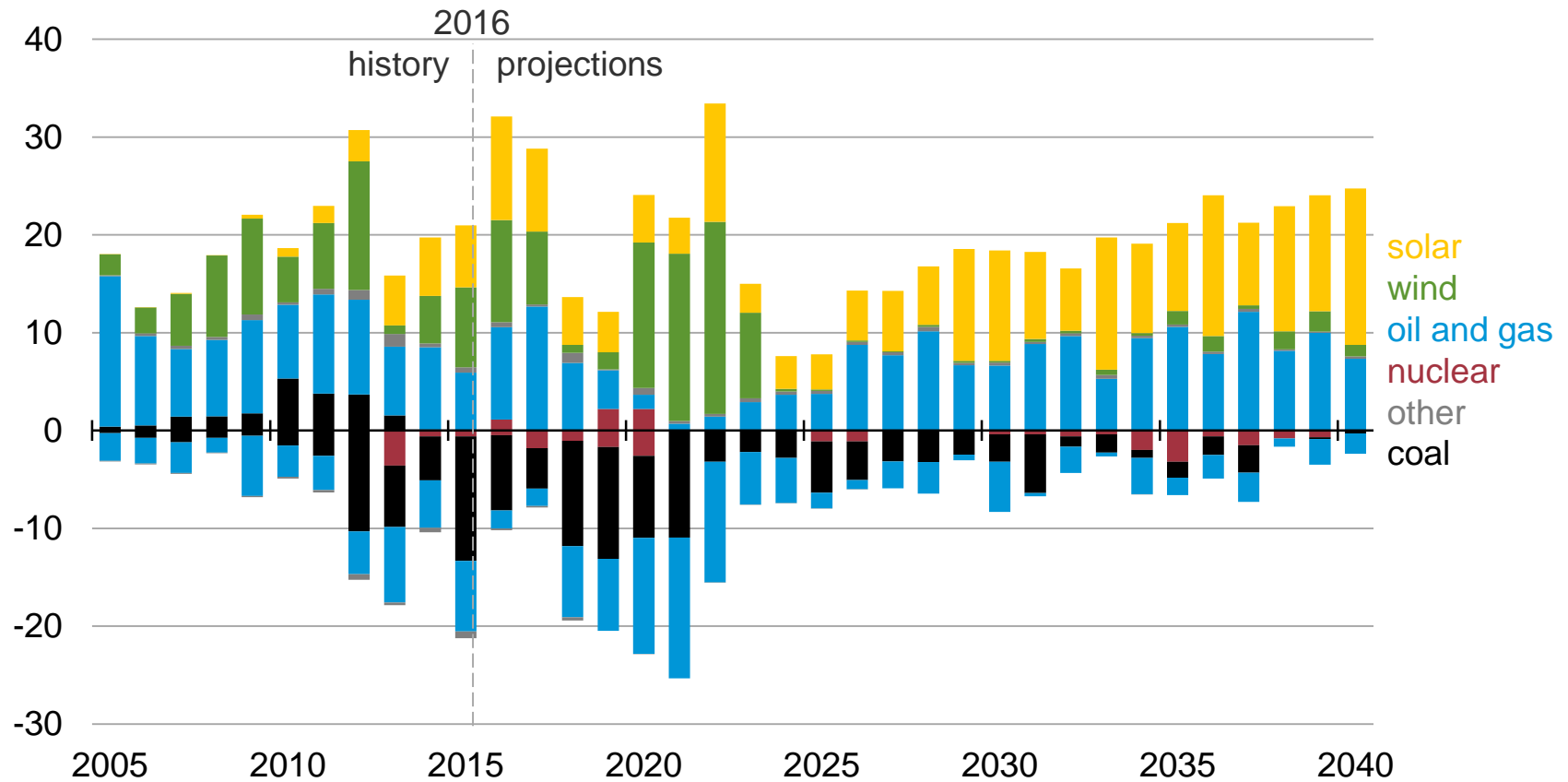
U.S. net electricity generation from select fuels
billion kilowatthours



Source: EIA, Annual Energy Outlook 2017

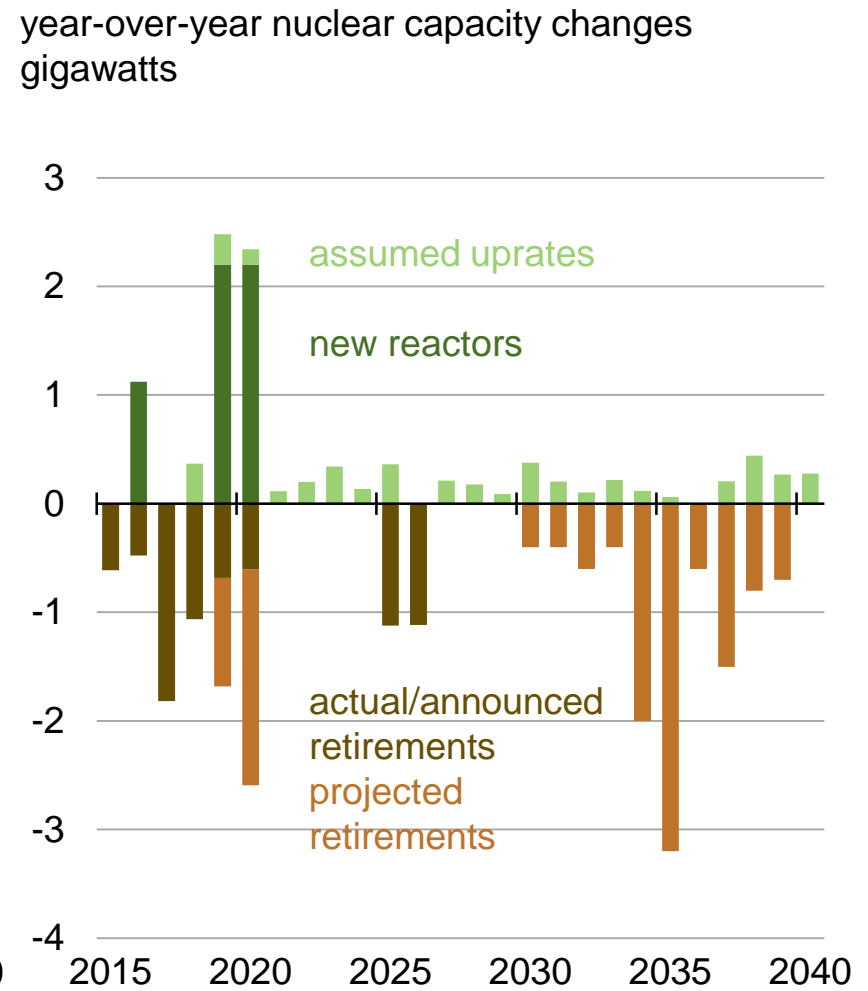
Lower capital costs and the availability of tax credits boost near-term wind additions and sustain solar additions; whereas coal-fired unit retirements in the Reference case are driven by low natural gas prices and the Clean Power Plan

annual electricity generating capacity additions (+) and retirements (-) (Reference case)
gigawatts



Source: EIA, Annual Energy Outlook 2017

The assumption that 25% of nuclear plants that reach age 60 are retired leads to net nuclear capacity decreases in AEO2017



Source: EIA, Annual Energy Outlook 2017

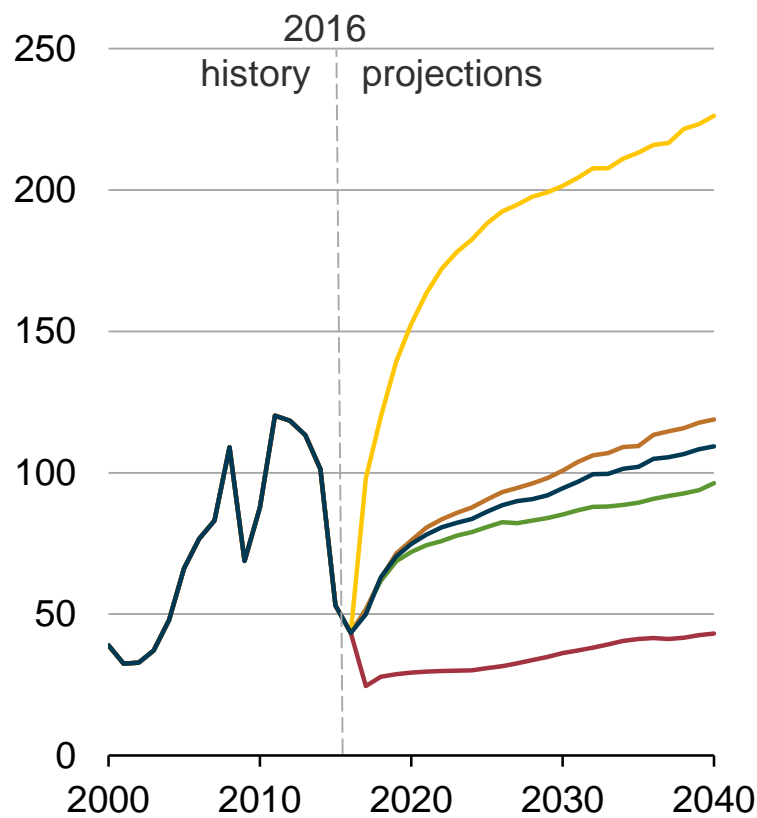
Food for thought – electricity

- Possible effect of “deep decarbonization” strategies for buildings and transportation in increasing electricity use
- Actual retirement pattern of existing nuclear capacity
- “Going big” (larger, more interconnected grids to smooth effects of intermittent renewables) vs. “going small” (microgrids, on-site storage)
 - To what extent is experience with cellular communications technology an appropriate indicator for developments surrounding distributed renewable power?
- Relative roles of storage and load that is more responsive to variable generation in accommodating more non-dispatchible generation on the grid

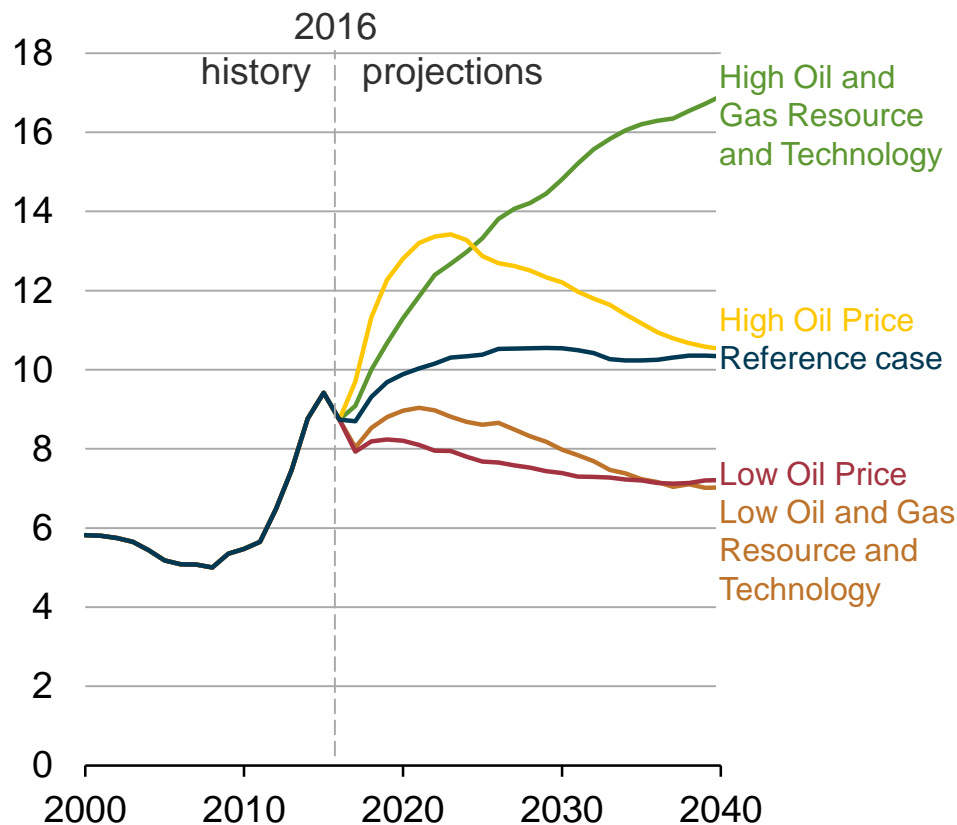
Hydrocarbon production and trade

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



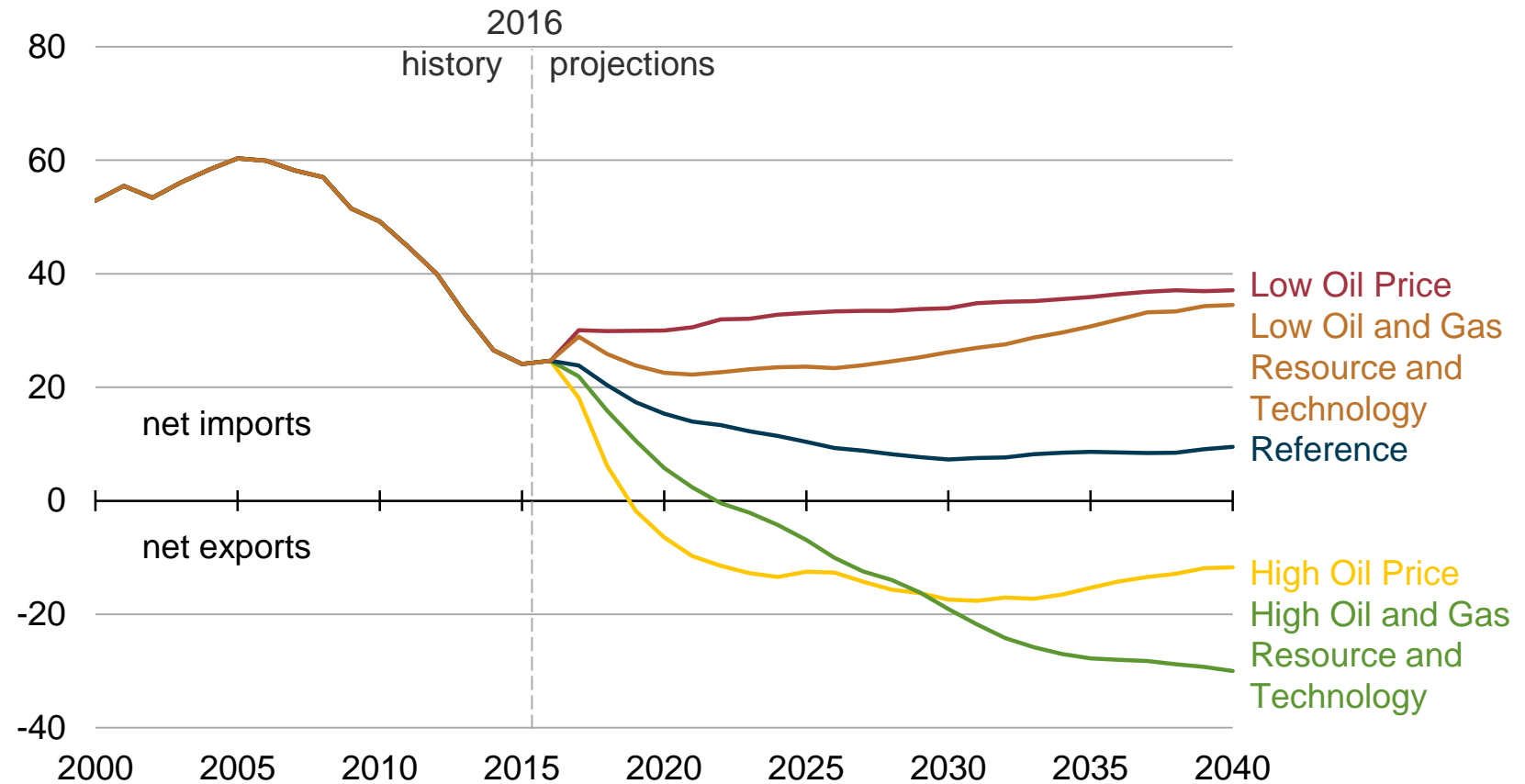
crude oil production
million barrels per day



Source: EIA, Annual Energy Outlook 2017

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

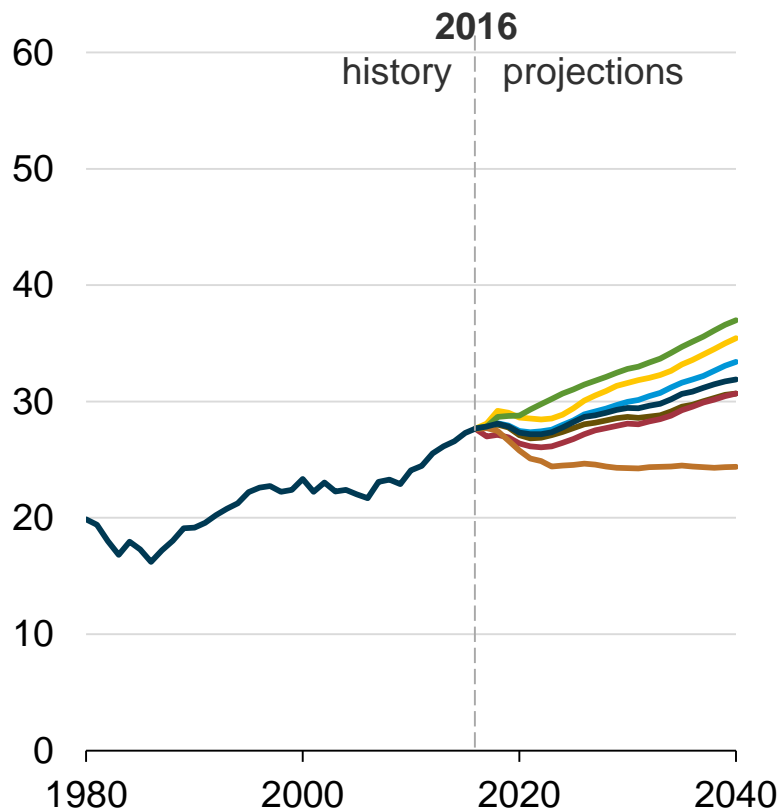
petroleum net imports as a percentage of products supplied
percent



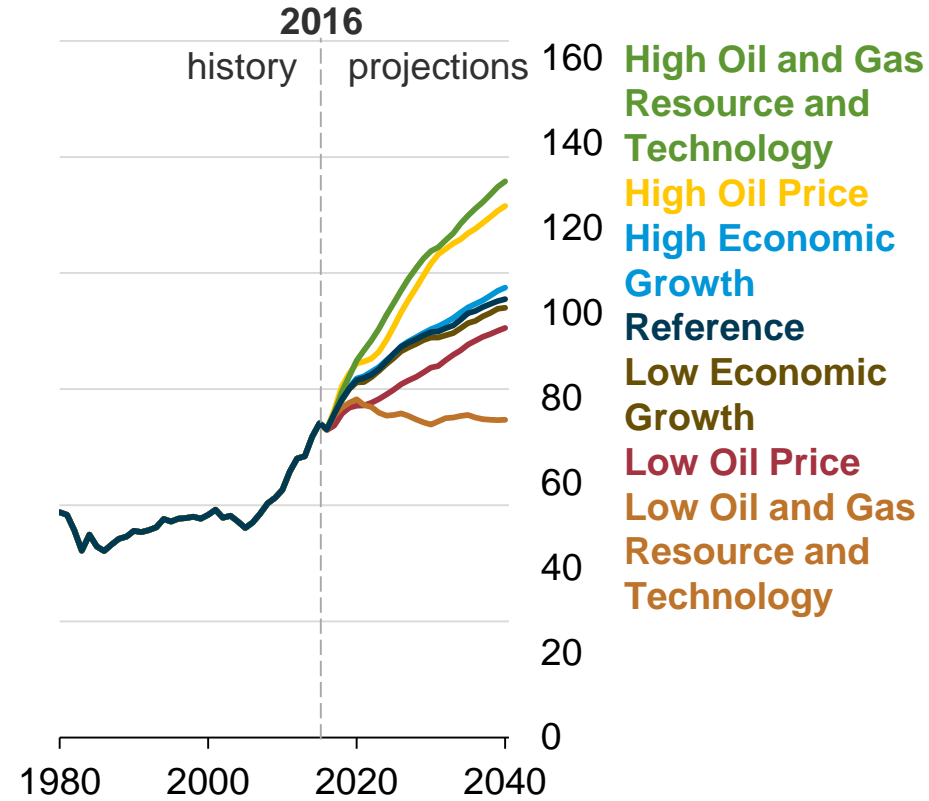
Source: EIA, Annual Energy Outlook 2017

Both use and production of natural gas increase across most AEO cases; the range across cases is wider for production than for use

Natural gas consumption
trillion cubic feet

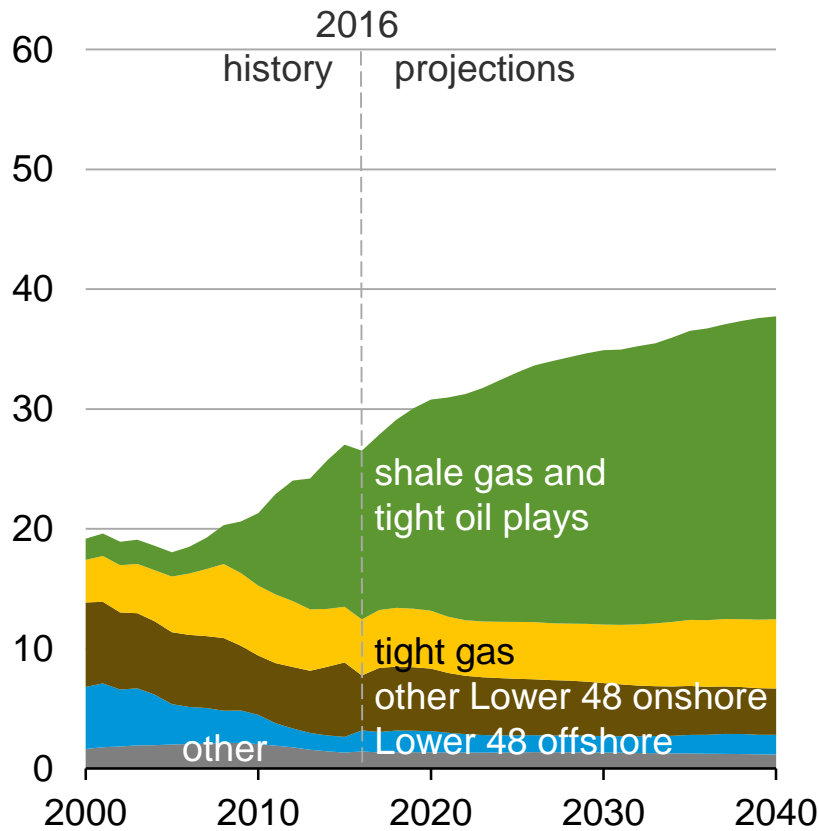


Natural gas production
billion cubic feet per day

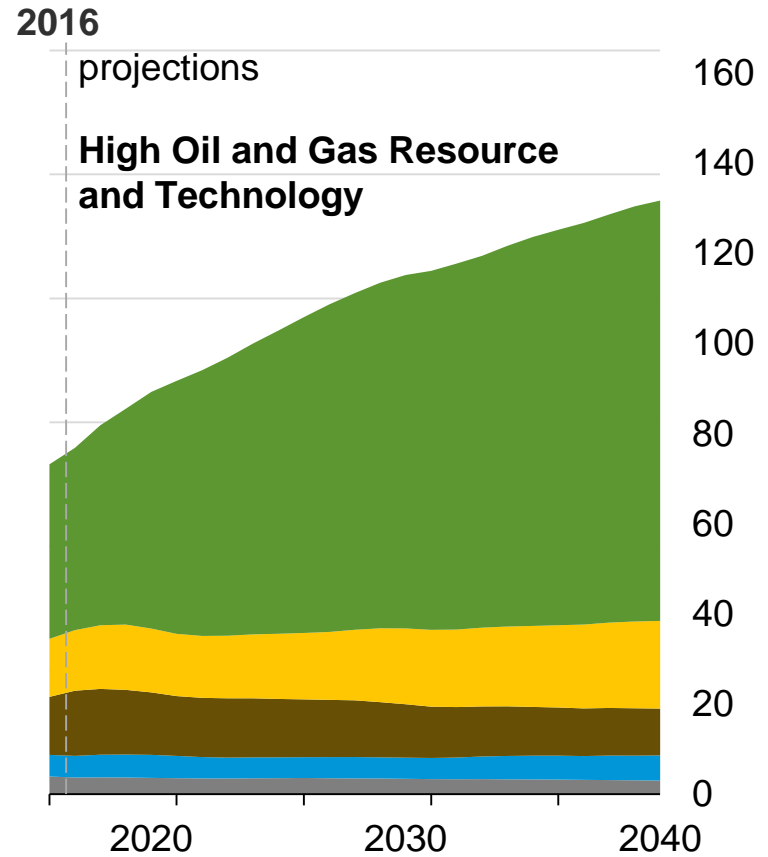


U.S. dry natural gas production is the result of continued development of shale gas and tight oil plays

U.S. natural gas production by type
trillion cubic feet



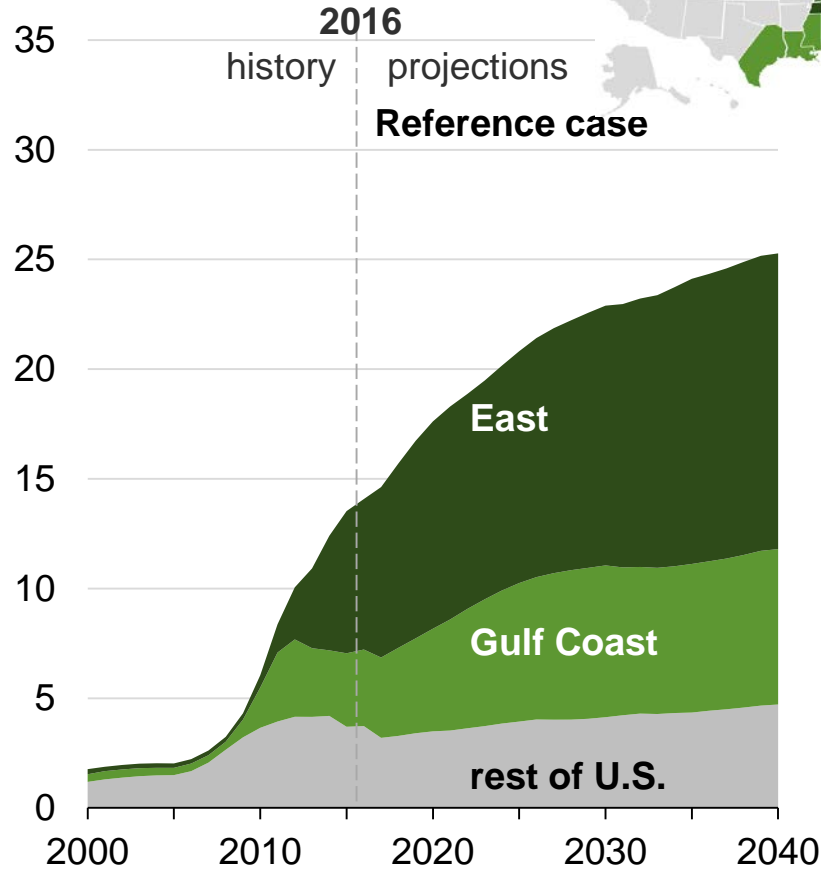
billion cubic feet per day



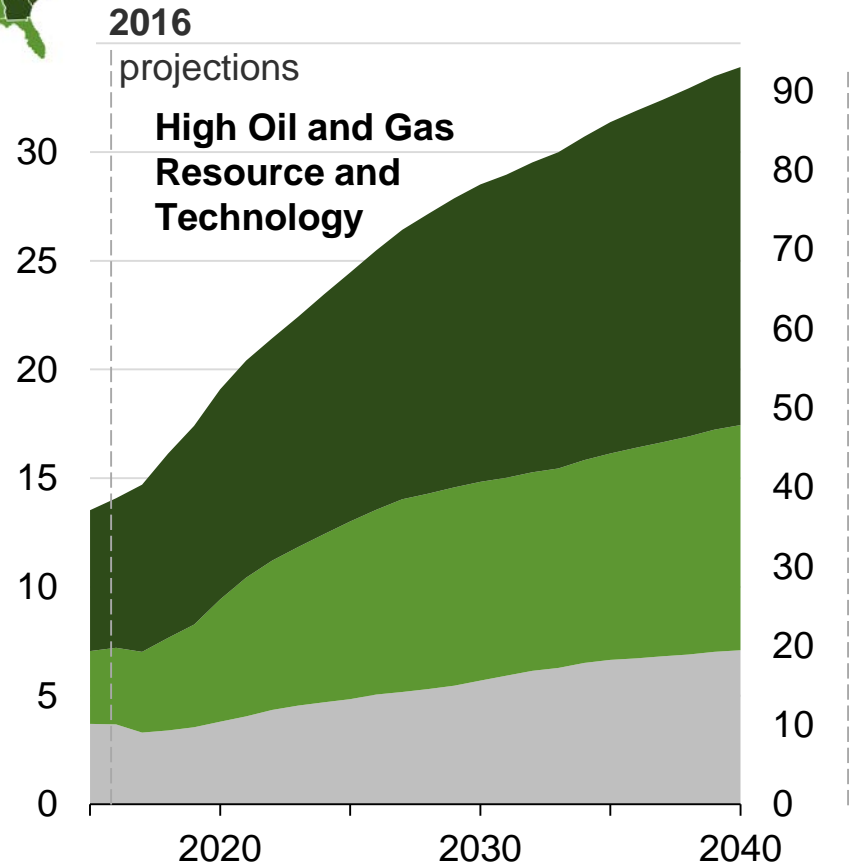
Source: EIA, Annual Energy Outlook 2017

Plays in the East lead production of U.S. natural gas from shale resources in the AEO Reference case

Shale gas production by region
trillion cubic feet



billion cubic feet per day

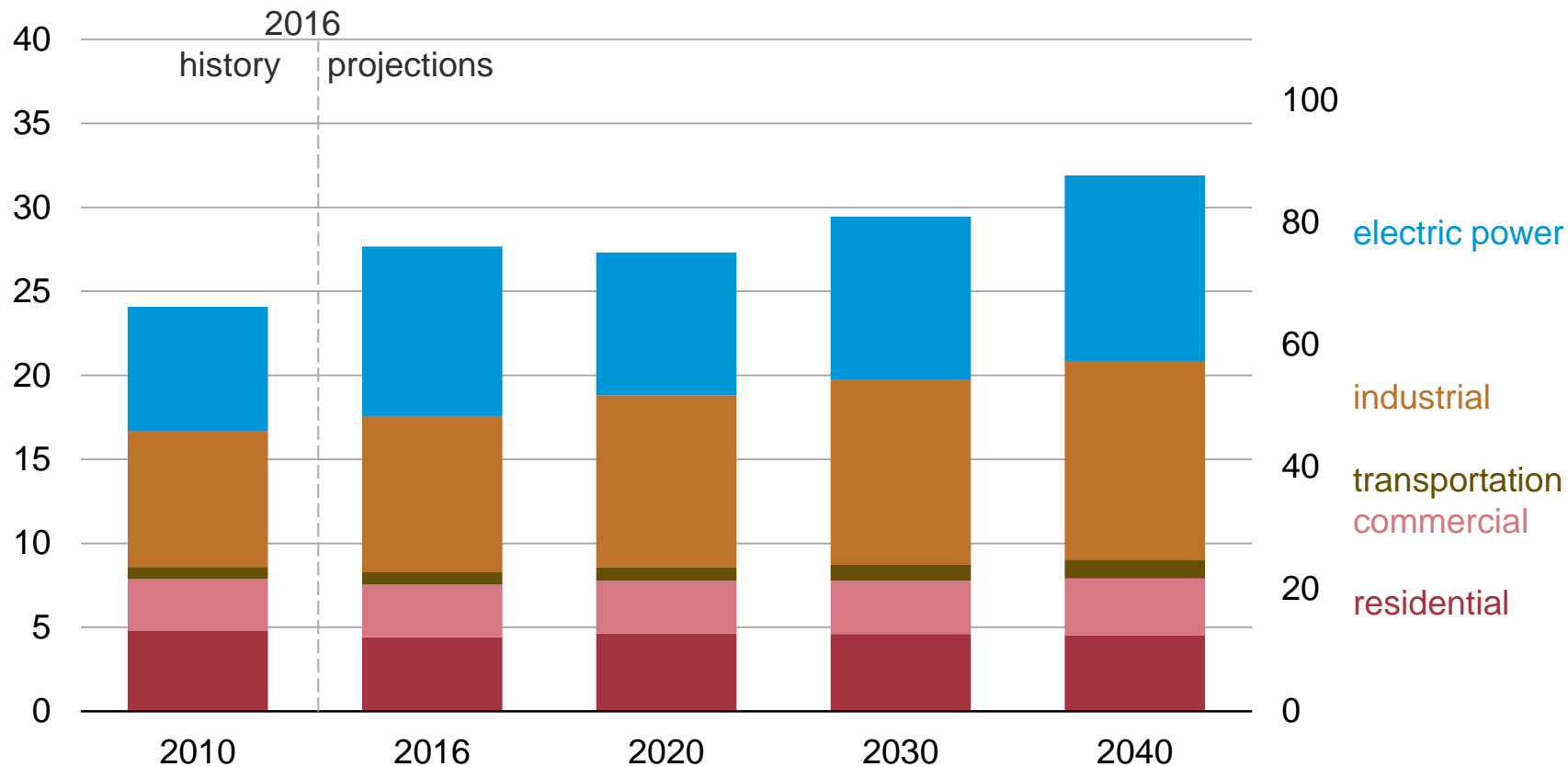


Increasing demand from industrial and electric power markets drive rising domestic consumption of natural gas in the Reference case

natural gas consumption by sector

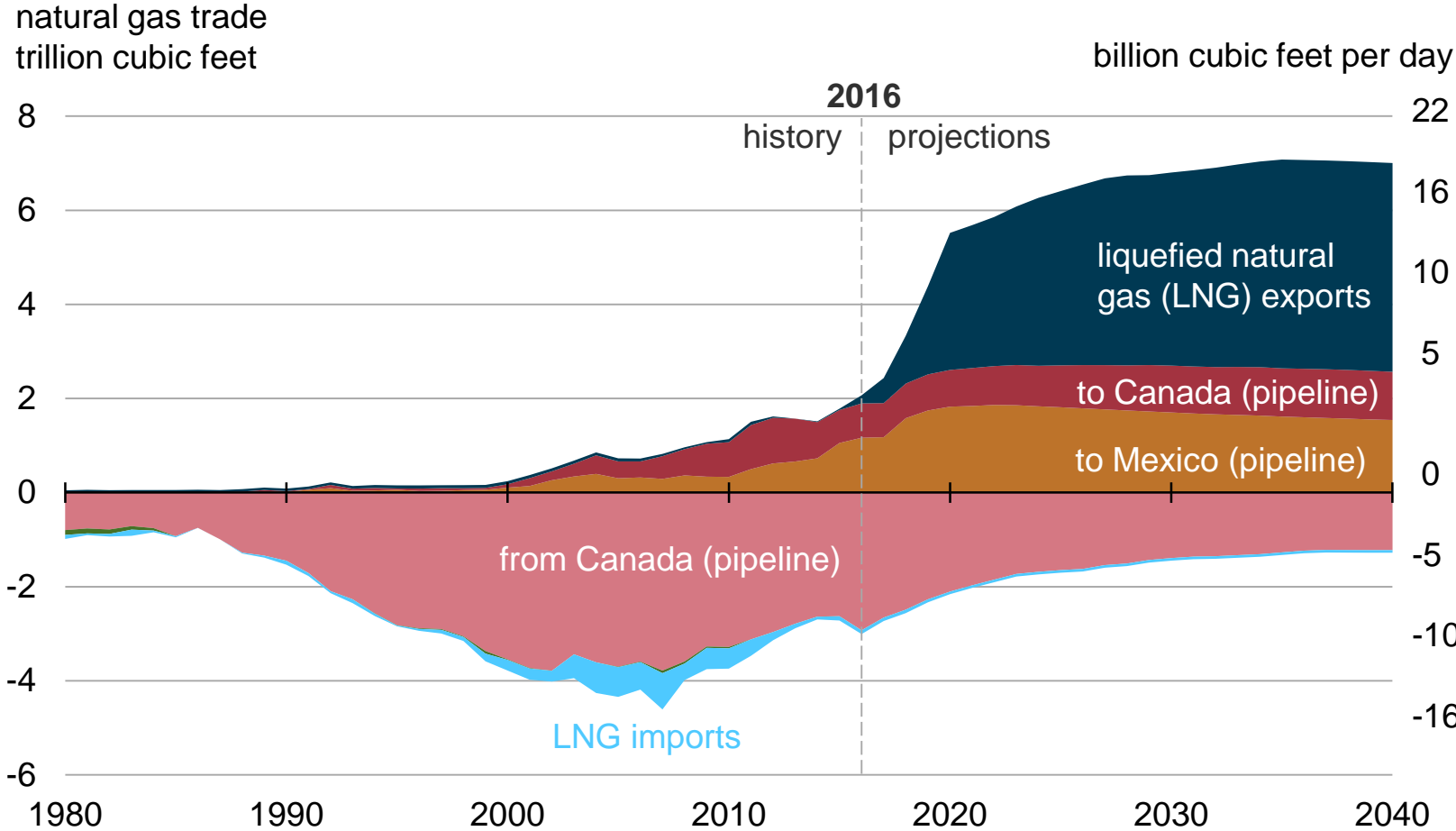
trillion cubic feet

billion cubic feet per day



Source: EIA, Annual Energy Outlook 2017

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

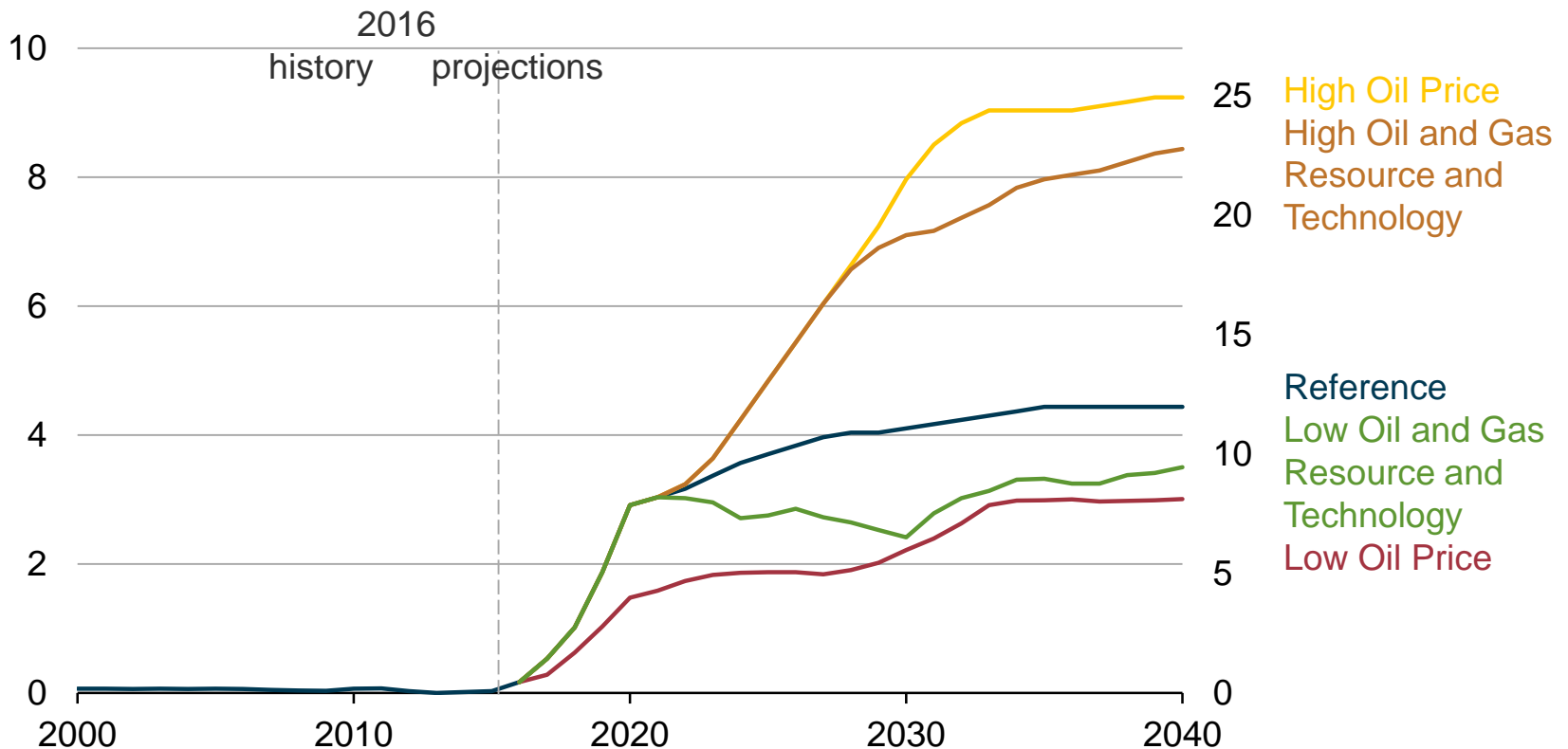


Source: EIA, Annual Energy Outlook 2017

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

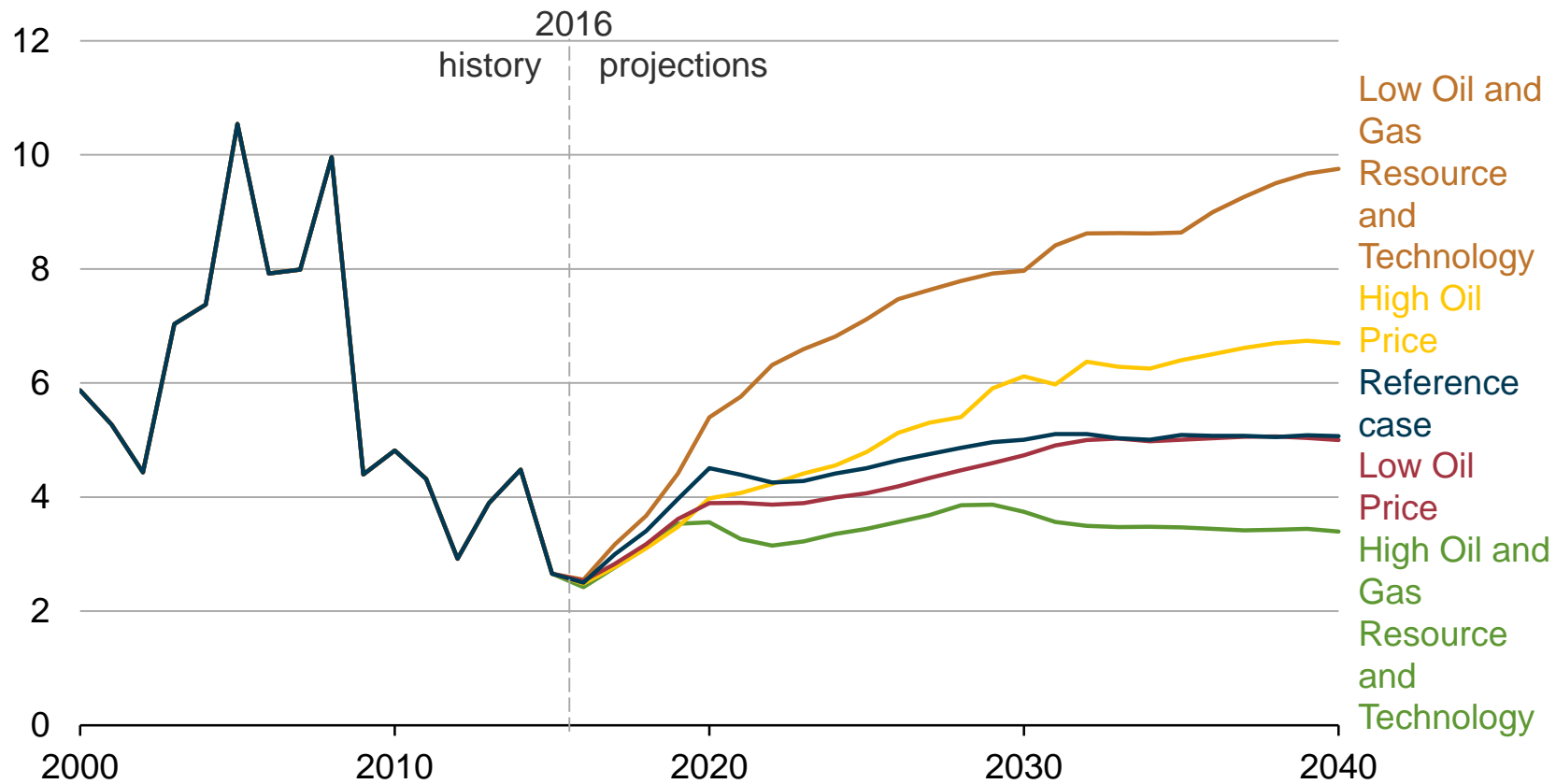
billion cubic feet per day



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 – natural gas production and trade

- Technology developments – to what extent will they continue to offset depletion of hydrocarbon resources
- Possible pursuit of deep decarbonization, particularly in the electricity generation and buildings sectors
- Geopolitics in key oil and natural gas producing regions – both internationally and within the United States
- Competitiveness of gas-fired generation with other technologies in developing countries where projected electricity demand growth is concentrated
- Technologies and policies affecting vehicle choice, which given dominant role of transportation sector in oil demand can significantly affect markets for oil and natural gas

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/

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