

# Annual Energy Outlook 2018



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# AEO2018 Highlights

- U.S. net energy exports occur over the projection period to 2050 in most cases
  - U.S. becomes a net energy exporter by 2022 in Reference Case
  - Strong domestic production and relatively flat demand
- Increased energy efficiency offsets growth in energy demand
  - Energy consumption grows about 0.4%/year on average in the Reference case
  - Gross Domestic Product is expected to average 2.0% annual growth to 2050 in the Reference case
- U.S. liquids and natural gas production continues to grow through 2042 and 2050, respectively
  - Result of further tight and shale resources development, despite relatively low prices
- Most new electricity generation capacity will be natural gas/renewables after 2022 (Reference case)
  - Result of low natural gas prices, declining renewables technology costs and supportive policies

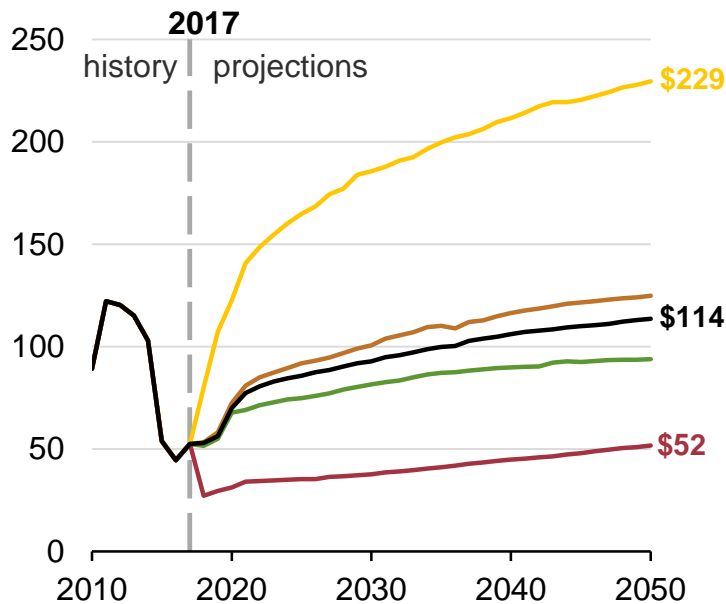
# AEO2018 cases examine a range of conditions through 2050

- **Reference case:**
  - Considers improvements in known technologies
  - Current views in economic and demographic trend
  - Current laws and regulations remain unchanged
- **High and Low Economic Growth cases:**
  - High case assumes compound annual growth rates for U.S. gross domestic product of 2.6%
  - Reference case 2.0%
  - Low case assumes 1.5%
- **High and Low Oil and Gas Resource and Technology cases:**
  - High case - more accessible resources and lower extraction technology costs than in the Reference case
  - Low case - fewer accessible resources and higher extraction technology costs than the Reference case
- **High and Low Oil Price cases:** Brent crude prices by 2050 in 2017 dollars
  - \$229 per barrel in the High Oil Price case
  - \$114/b in the Reference case
  - \$52/b in the Low Oil Price case

# Crude oil price projections are sensitive to global conditions, while U.S. natural gas prices depend more on domestic resources

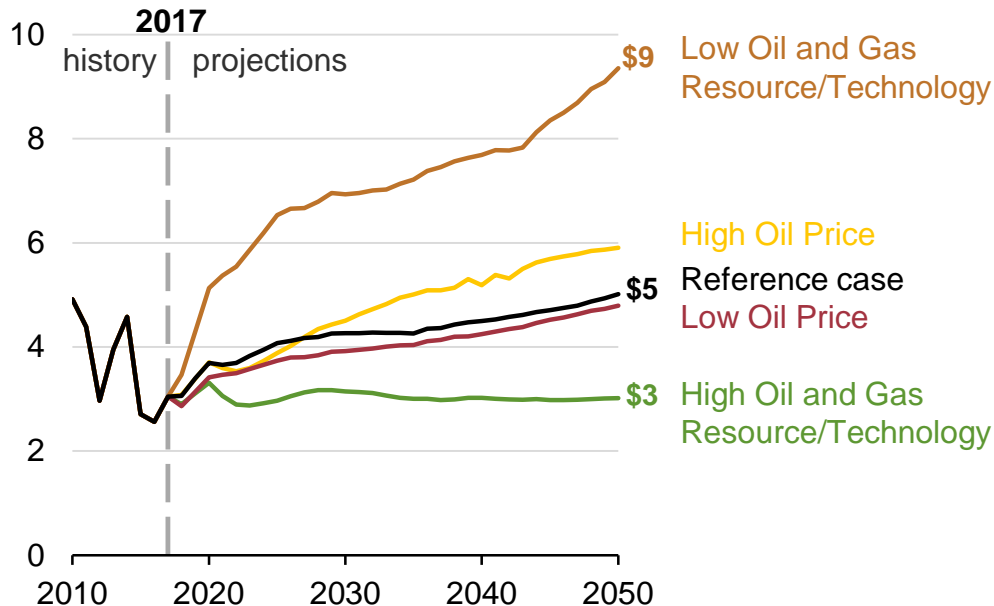
## North Sea Brent oil price

2017 dollars per barrel



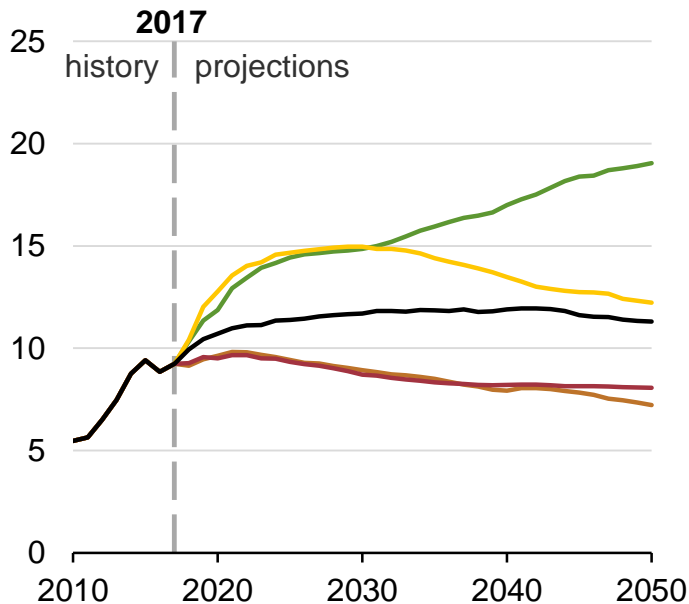
## Henry Hub natural gas price

2017 dollars per million Btu

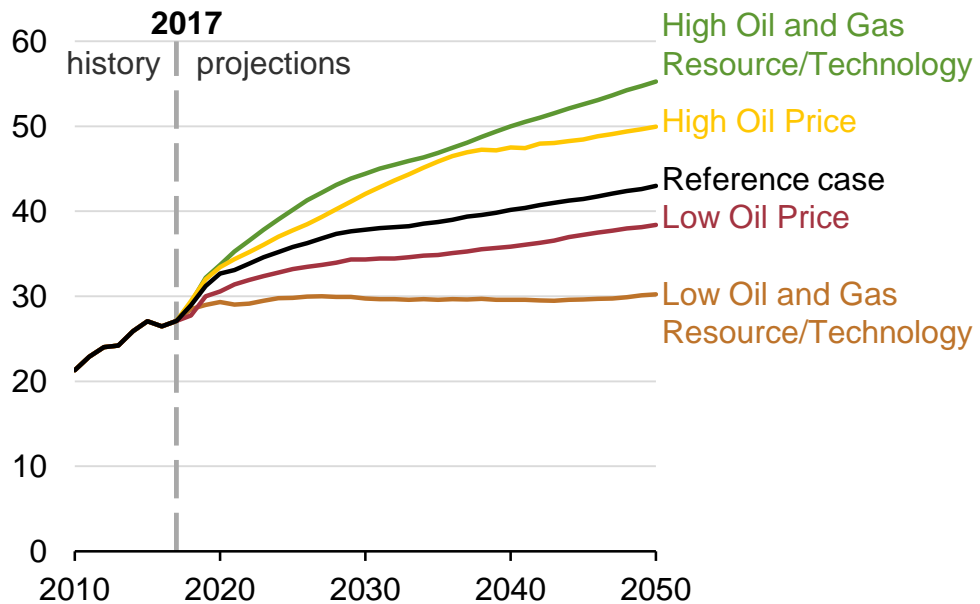


# U.S. crude oil and natural gas production are more sensitive to resource availability and technological improvements

**Crude oil production**  
million barrels per day

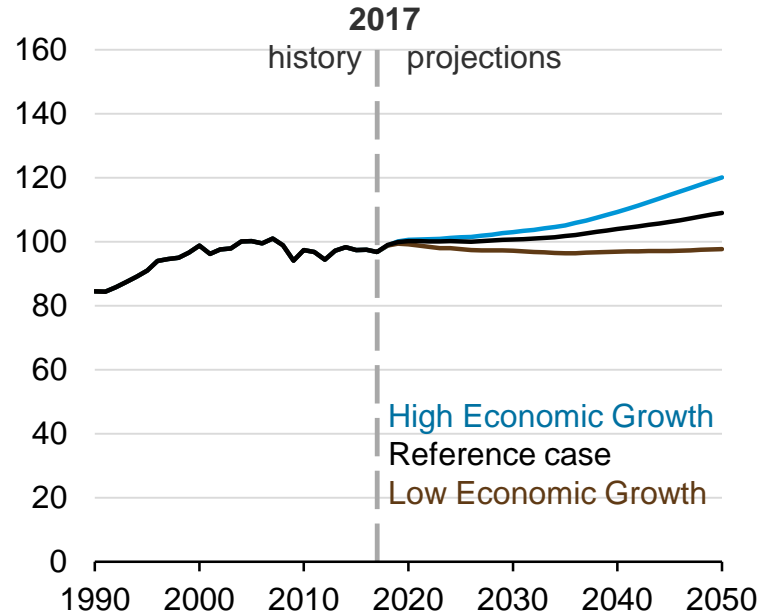


**Dry natural gas production**  
trillion cubic feet

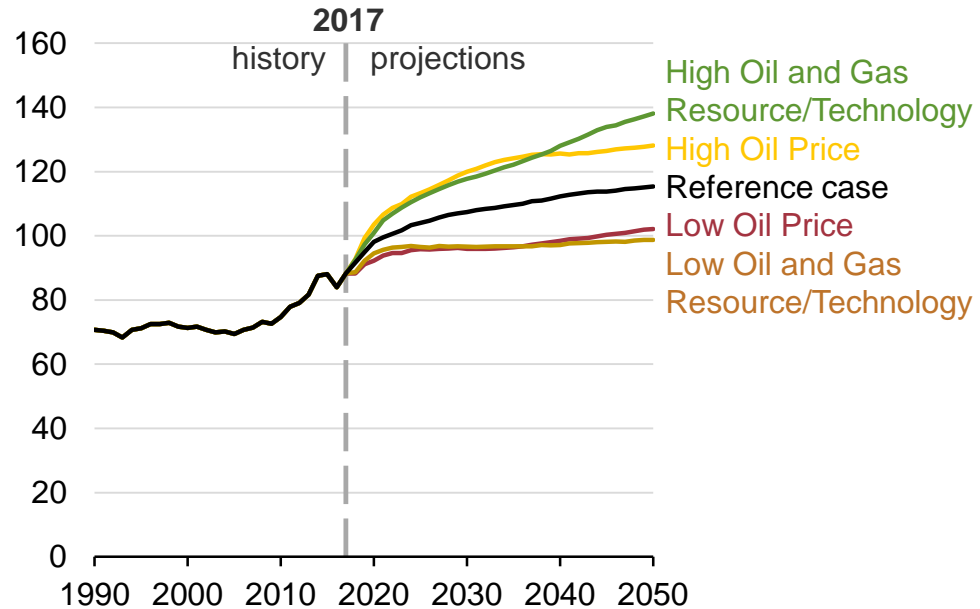


# Growth in U.S. energy production surpasses domestic consumption in most cases

**Total U.S. energy consumption**  
quadrillion British thermal units



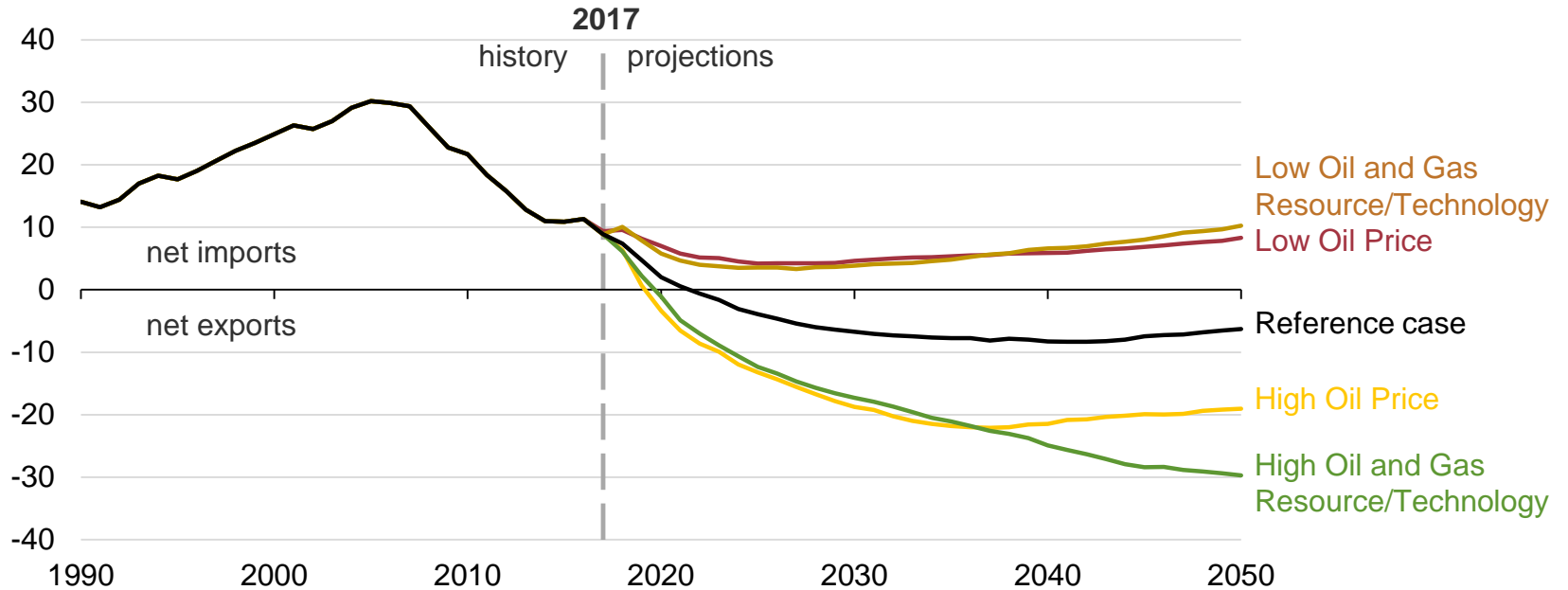
**Total U.S. energy production**  
quadrillion British thermal units



# The United States becomes a net energy exporter in most cases

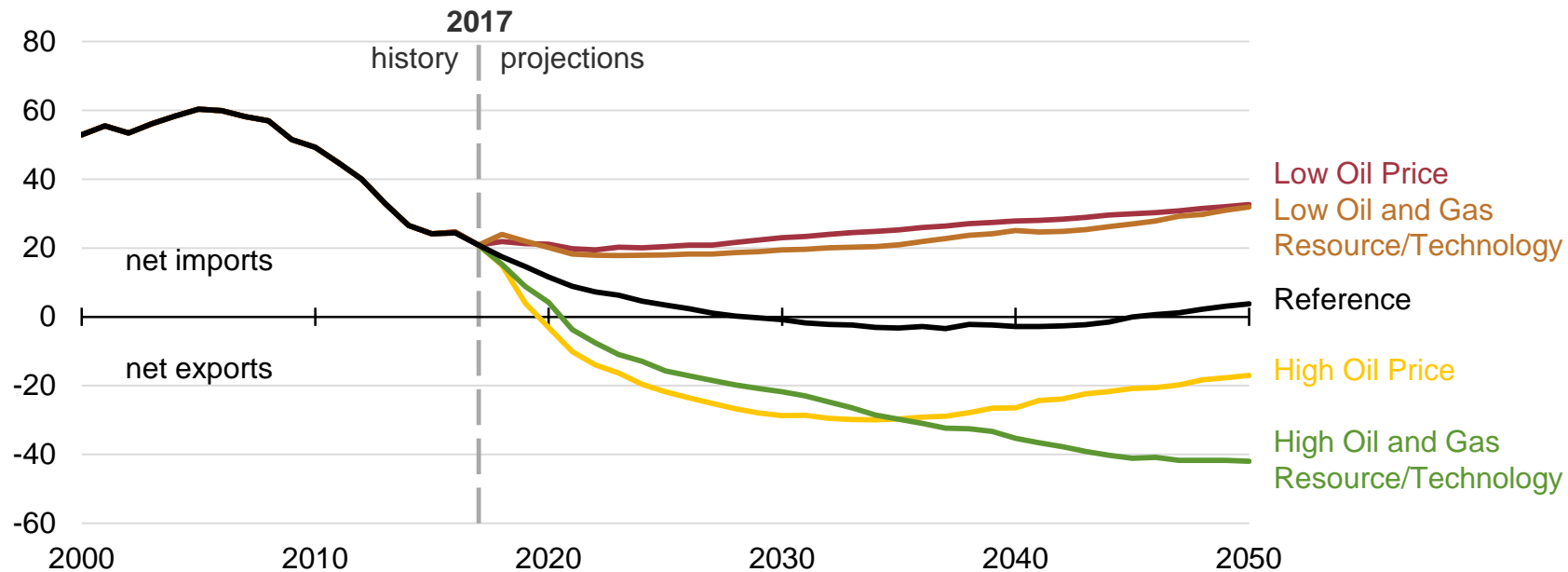
## Net energy trade

quadrillion British thermal units



# The United States becomes a net petroleum exporter in most cases

**Petroleum net imports as a percentage of product supplied**  
percent

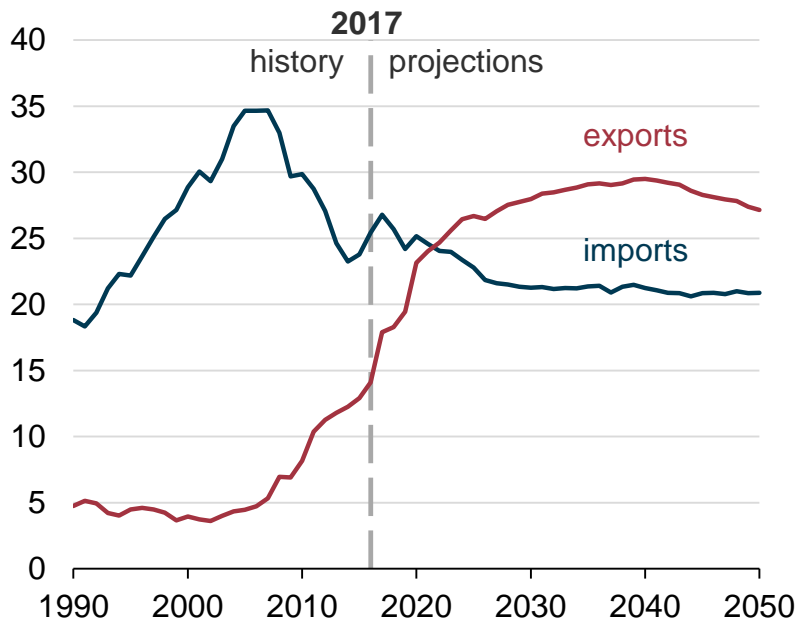




# The United States becomes a net energy exporter in the Reference case largely because of growing exports

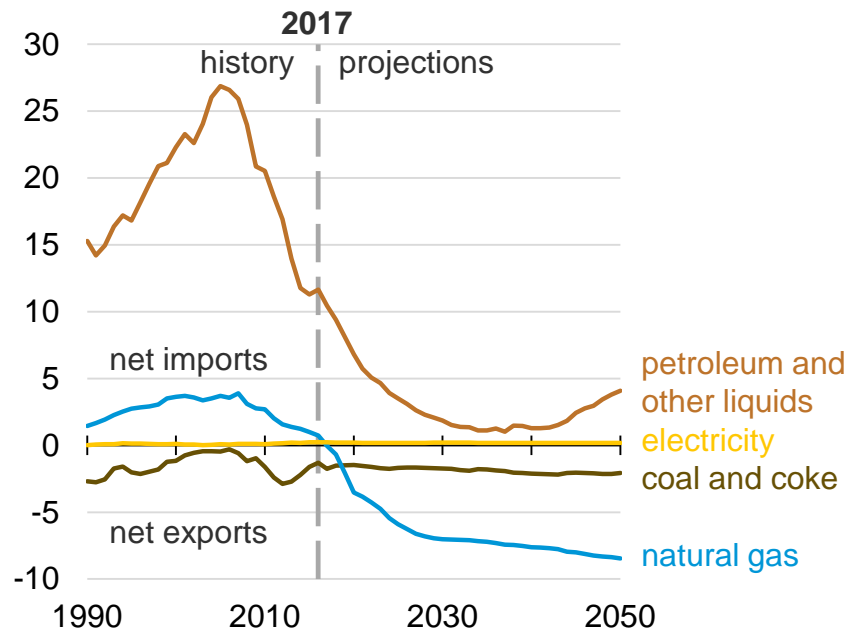
## U.S. energy trade (Reference case)

quadrillion British thermal units



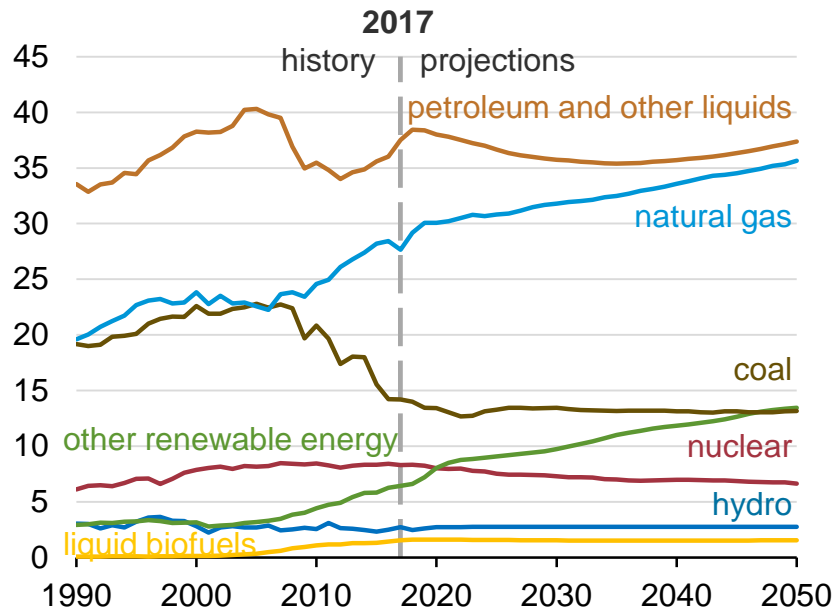
## Net U.S. energy trade (Reference case)

quadrillion British thermal units

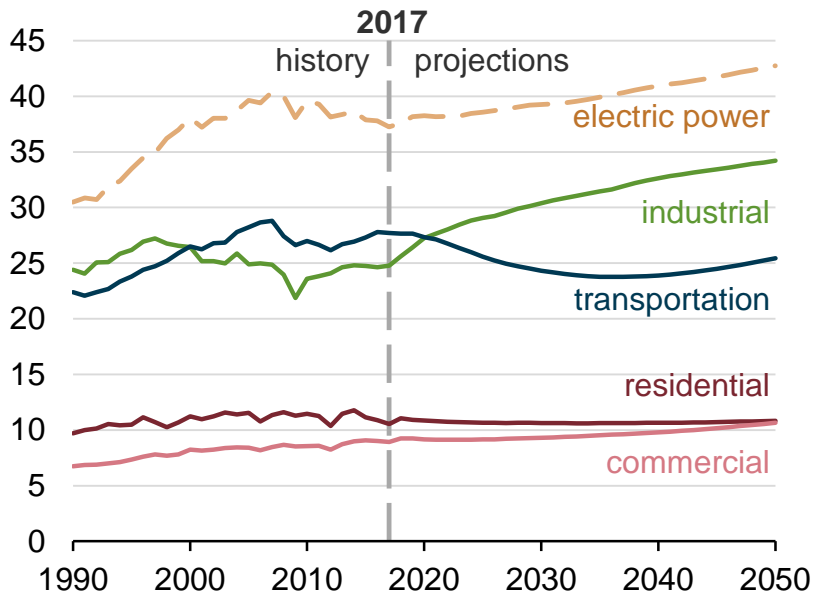


# The fuel sector mix of energy consumption changes over the projected period in the Reference case

**Energy Consumption by source (Reference case)**  
quadrillion British thermal units

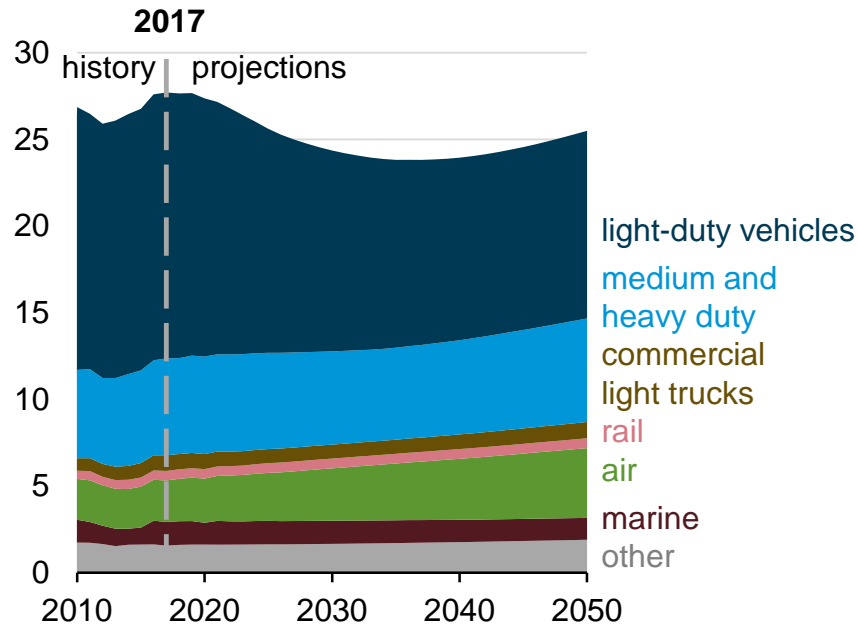


**Consumption by sector (Reference case)**  
quadrillion British thermal units

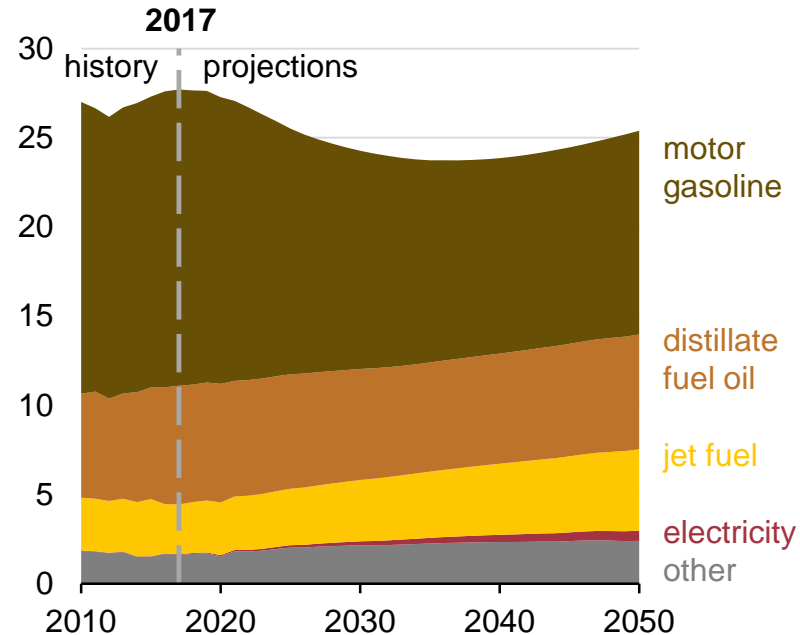


# Transportation demonstrates the impact of energy efficiency on consumption

**Energy consumption by travel mode – Reference case**  
quadrillion British thermal units



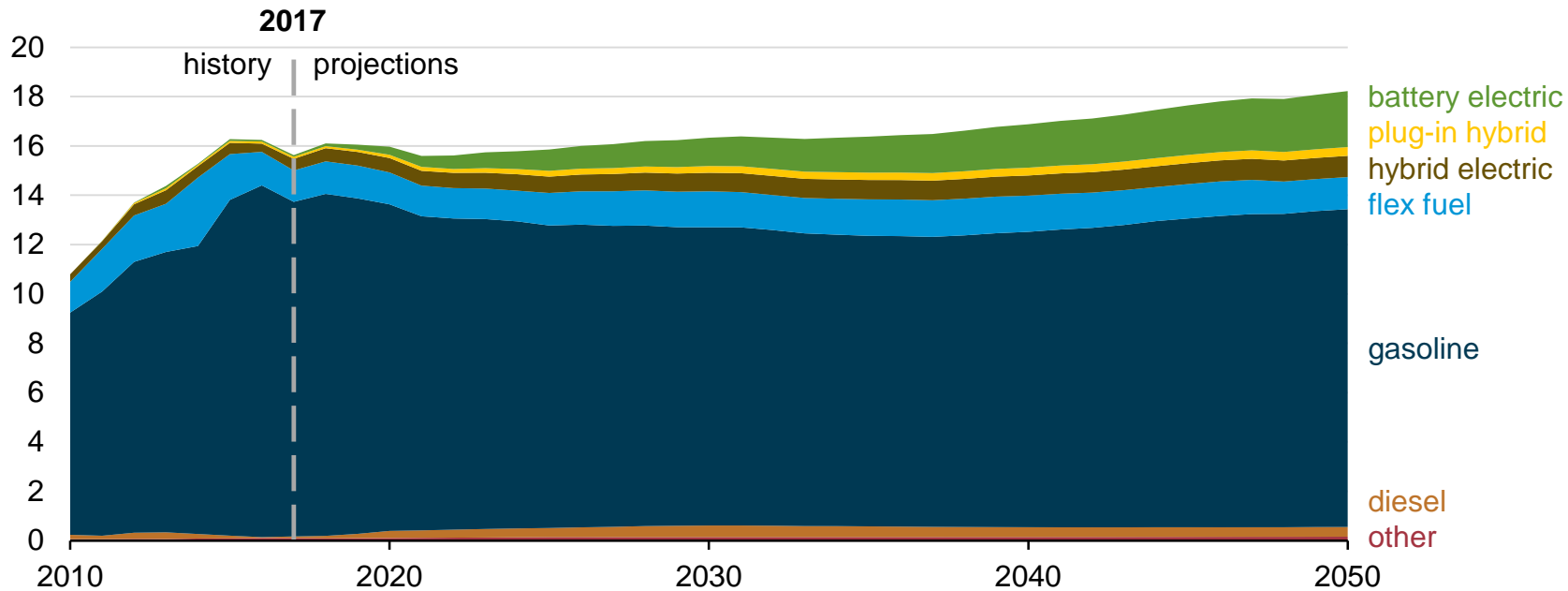
**Transportation sector energy consumption by fuel type**  
quadrillion British thermal units



# Light-duty vehicle fuel economy improves with increasing sales of more fuel-efficient cars, while electrified powertrains gain market share in the Reference case

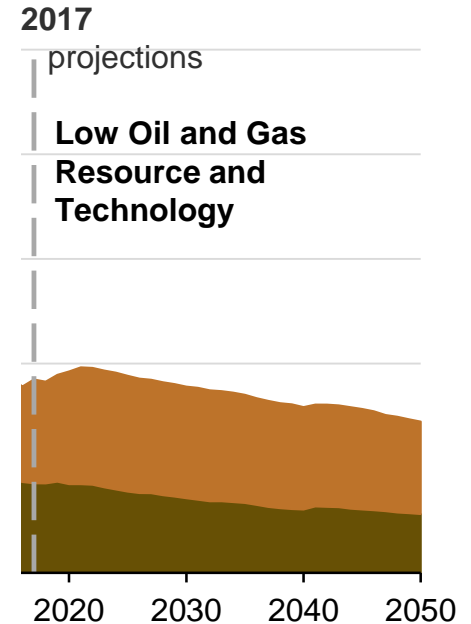
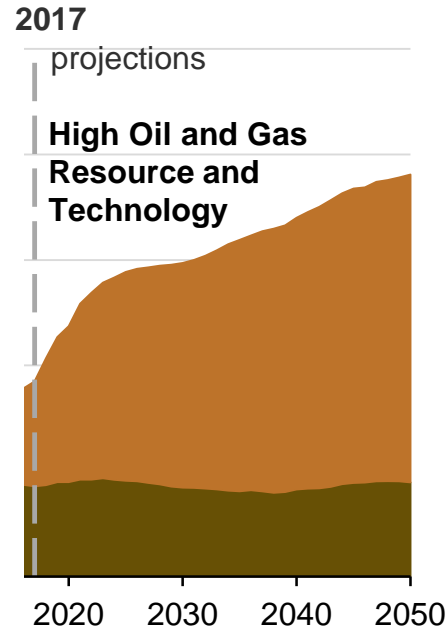
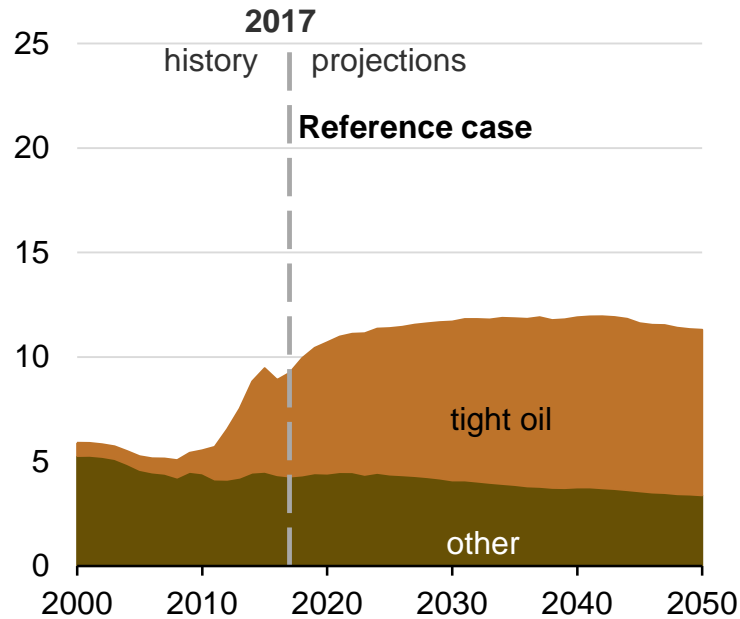
## Light-duty vehicle sales by fuel type

sales (millions)



# U.S. crude oil production growth led by tight oil

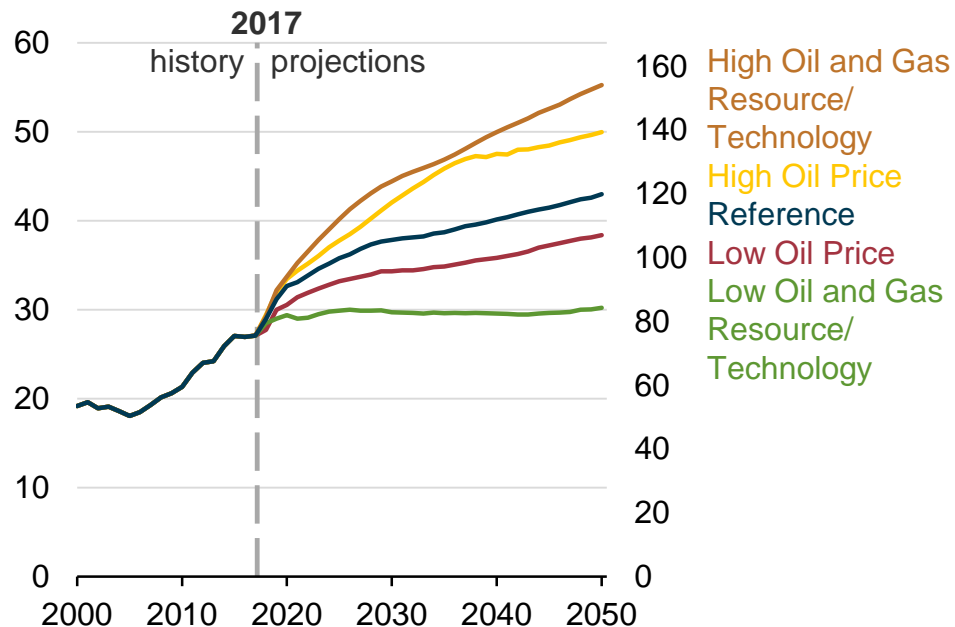
**Crude oil production**  
million barrels per day



# U.S. natural gas production and consumption continue to increase in most cases

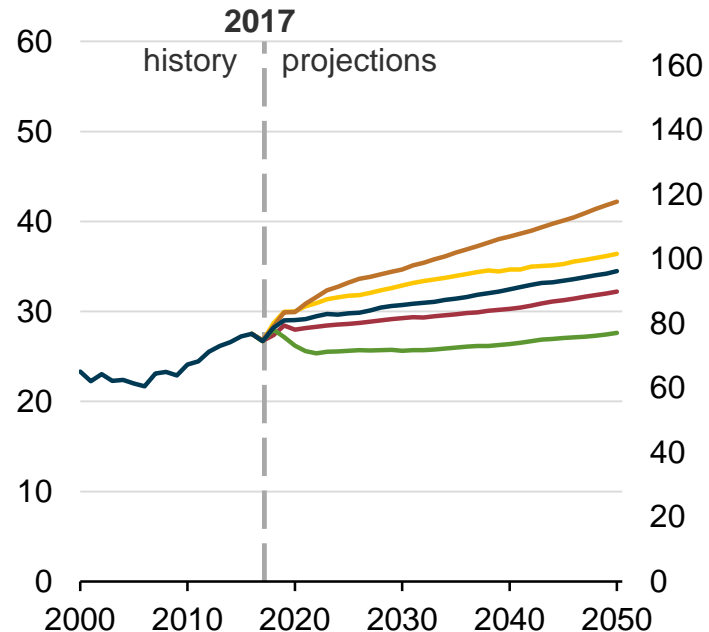
## U.S. natural gas production

trillion cubic feet per year    billion cubic feet per day



## U.S. natural gas consumption

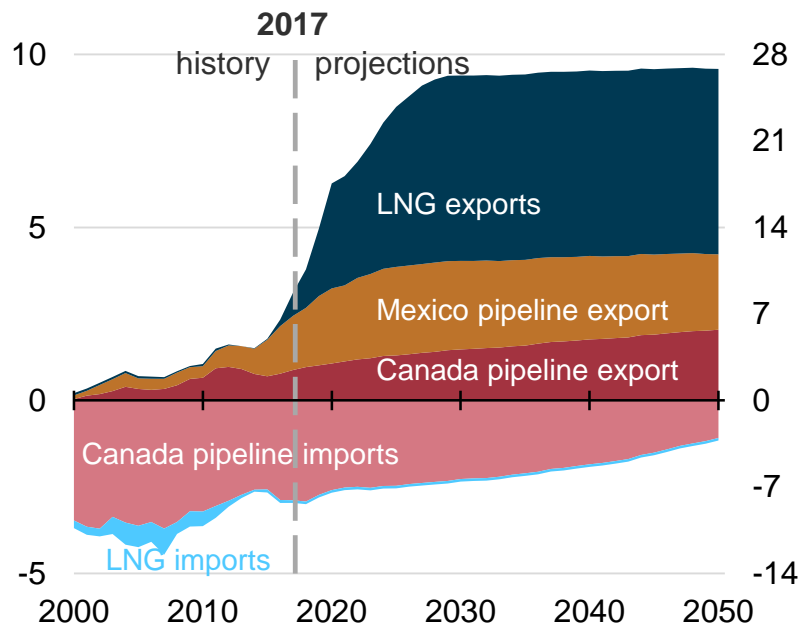
trillion cubic feet per year    billion cubic feet per day



# The United States becomes a net exporter of natural gas before 2020, although the level of LNG exports is uncertain

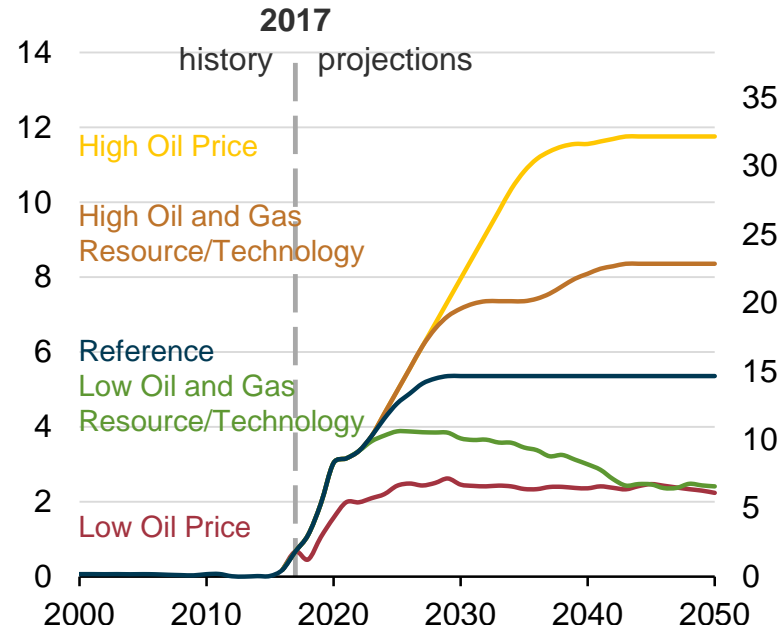
## Natural gas trade

trillion cubic feet per year      billion cubic feet per day



## Liquefied natural gas exports

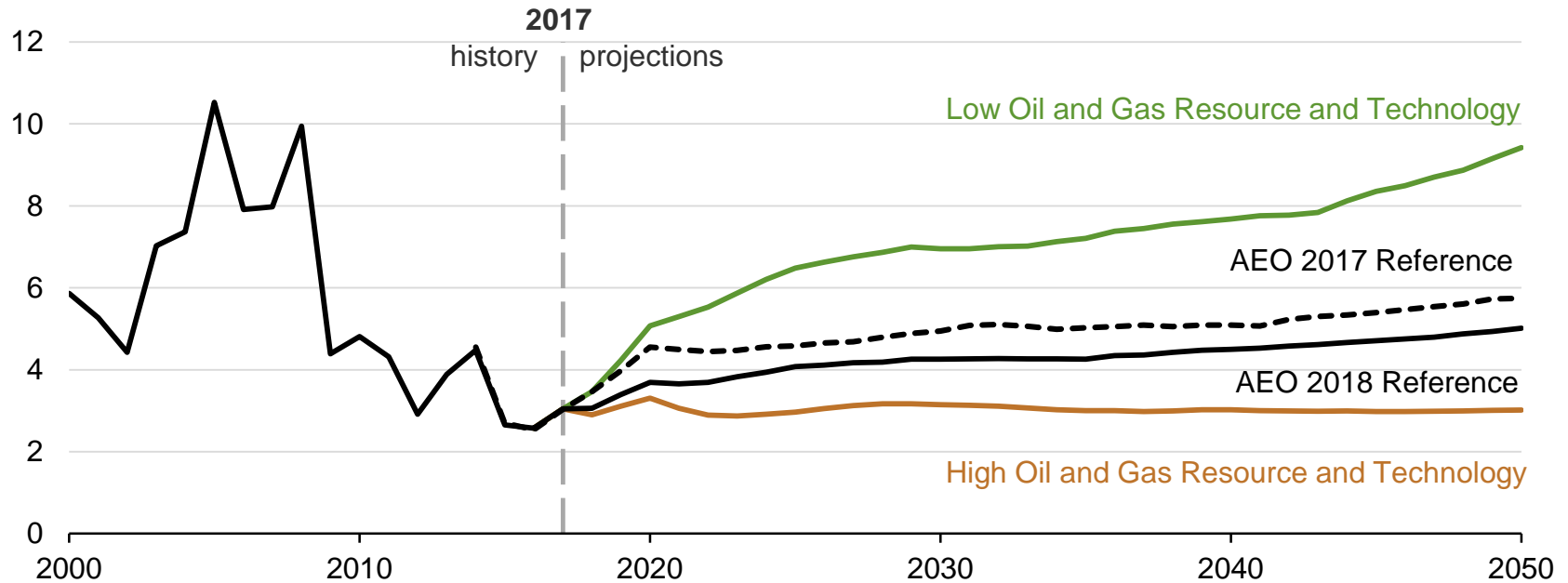
trillion cubic feet per year      billion cubic feet per day



# Natural gas prices remain relatively low compared to historic values

## Natural gas spot price at Henry Hub

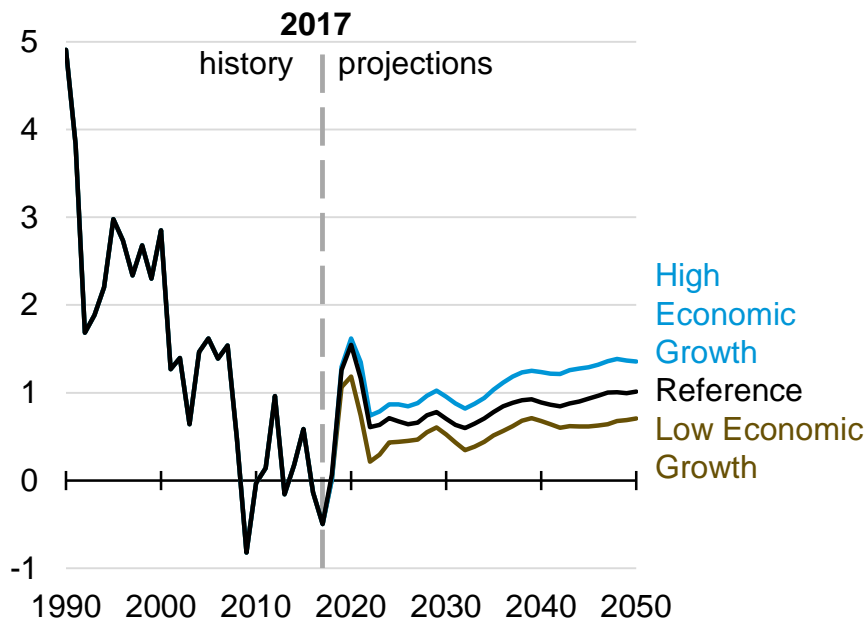
2017 dollars per million British thermal units



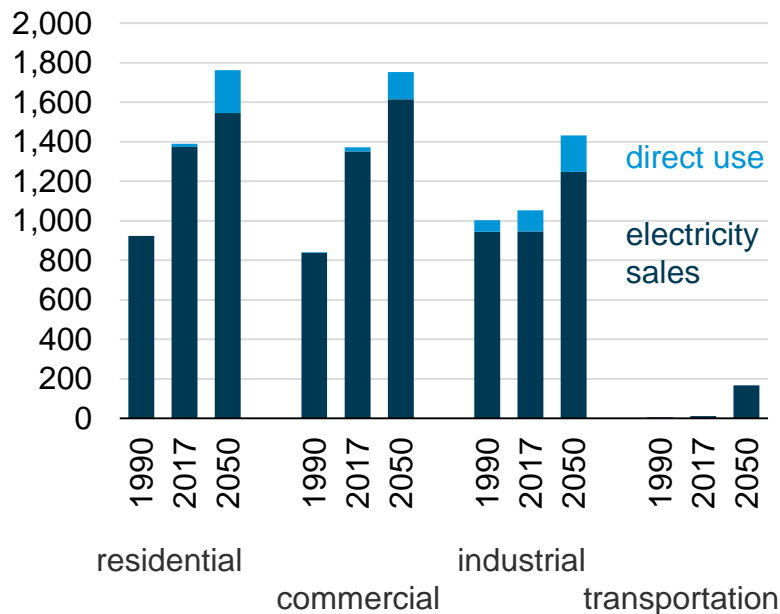


# Electricity consumption is expected to grow steadily through 2050

**Electricity use growth rate**  
percent growth (three-year rolling average)

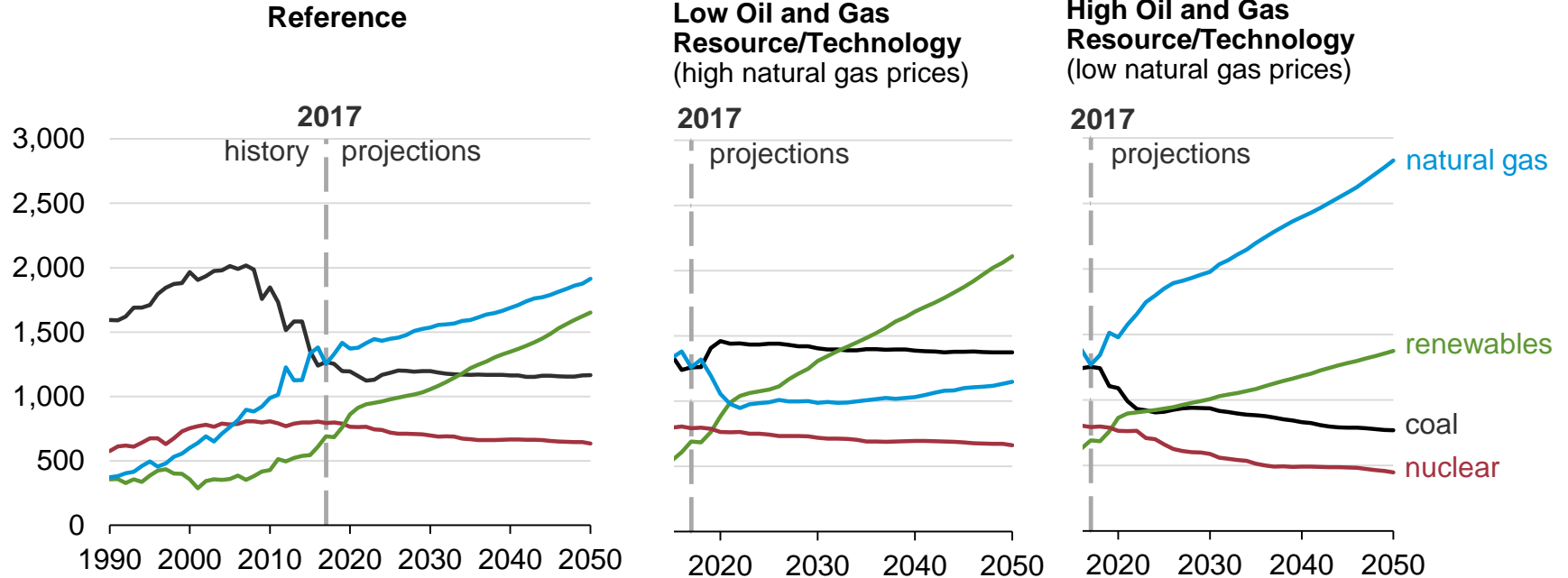


**Electricity use by end-use demand sector**  
billion kilowatthours



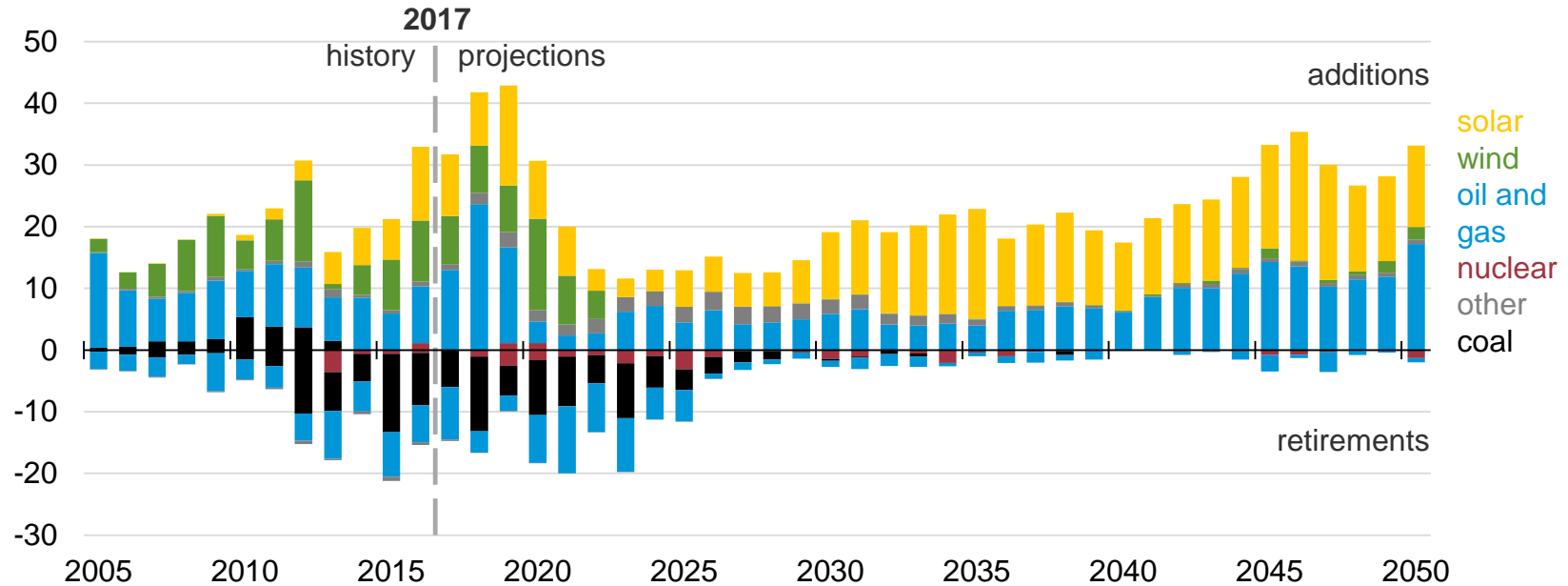
# The projected mix of electricity generation varies widely across cases as differences in fuel prices result in significant substitution

**Electricity generation from selected fuels**  
billion kilowatthours



# Change in electricity generation fuel mix is reflected in shifting capacity additions and retirements

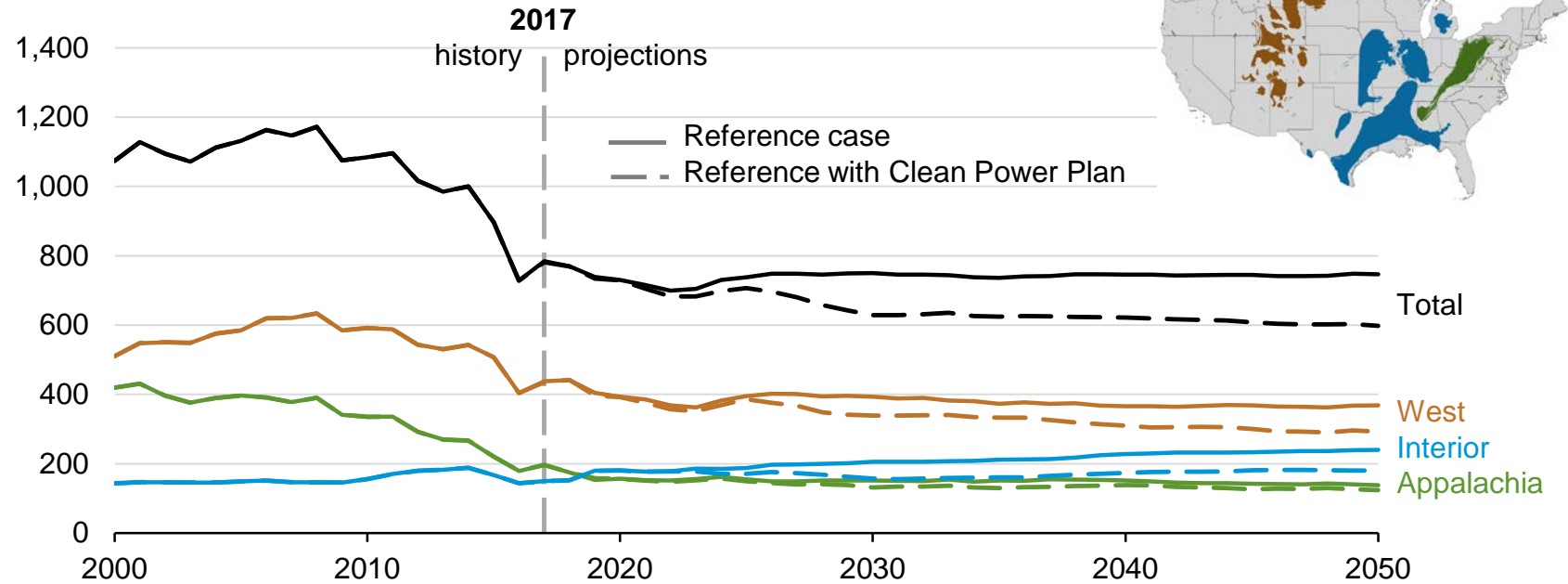
Annual electricity generating capacity additions and retirements (Reference case)  
gigawatts



# The electric power sector demand for coal remains flat through 2050

## U.S. Coal production by region – Reference Case with and without Clean Power Plan

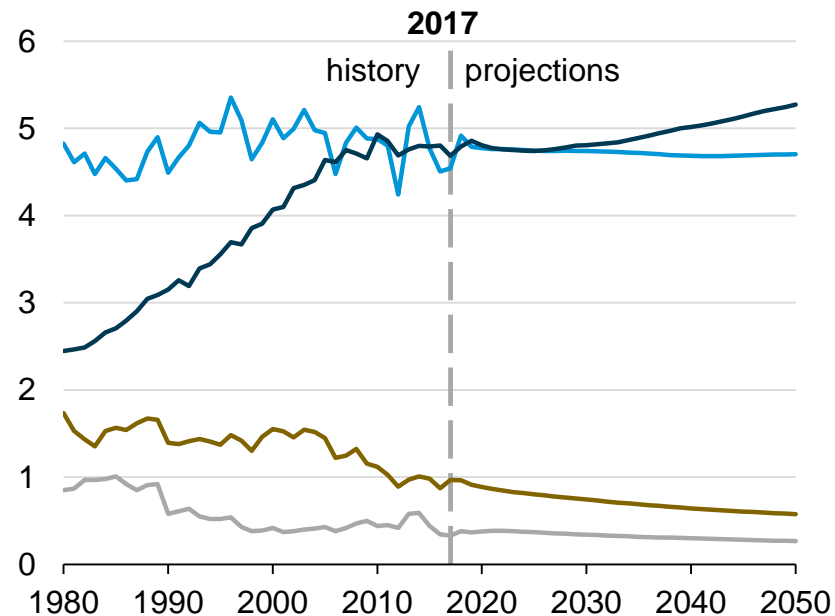
million short tons



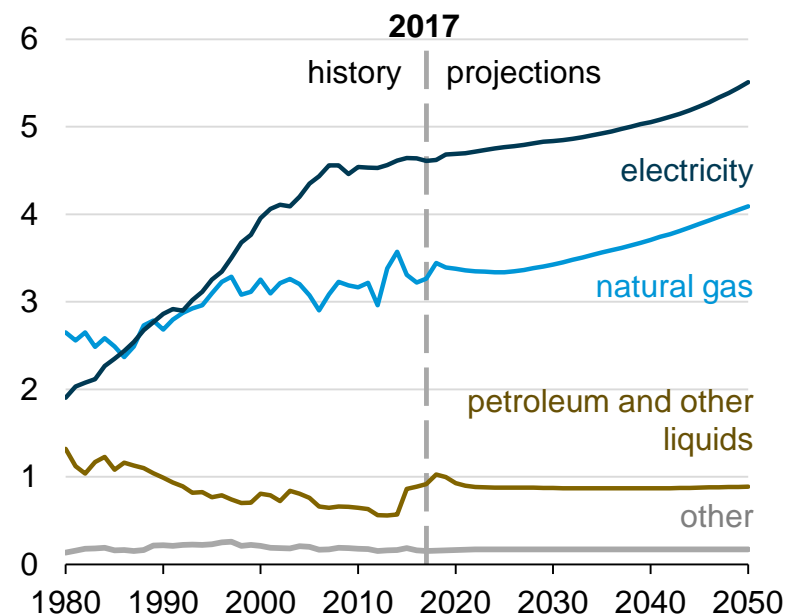
Coal production decreases through 2022 because of retirements of coal-fired electric generating capacity.

# Residential and commercial energy consumption grows slowly through 2050

**Residential sector delivered energy consumption**  
quadrillion British thermal units

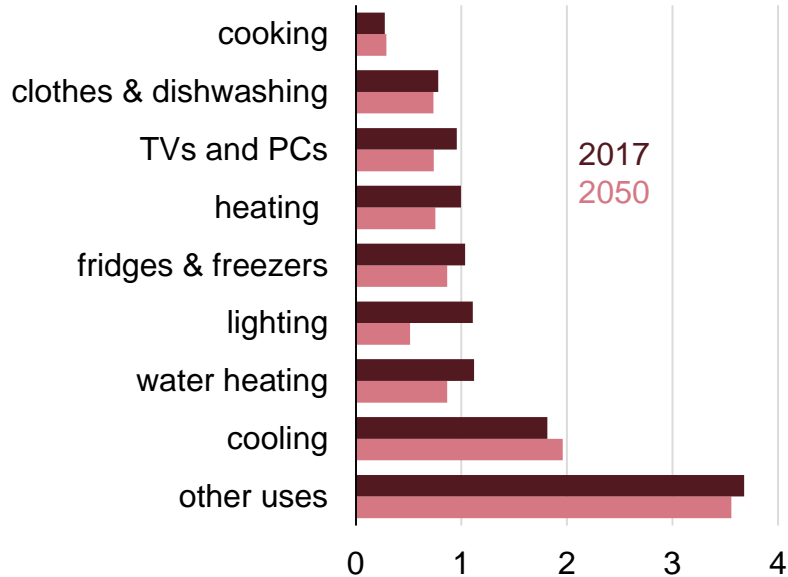


**Commercial sector delivered energy consumption**  
quadrillion British thermal units

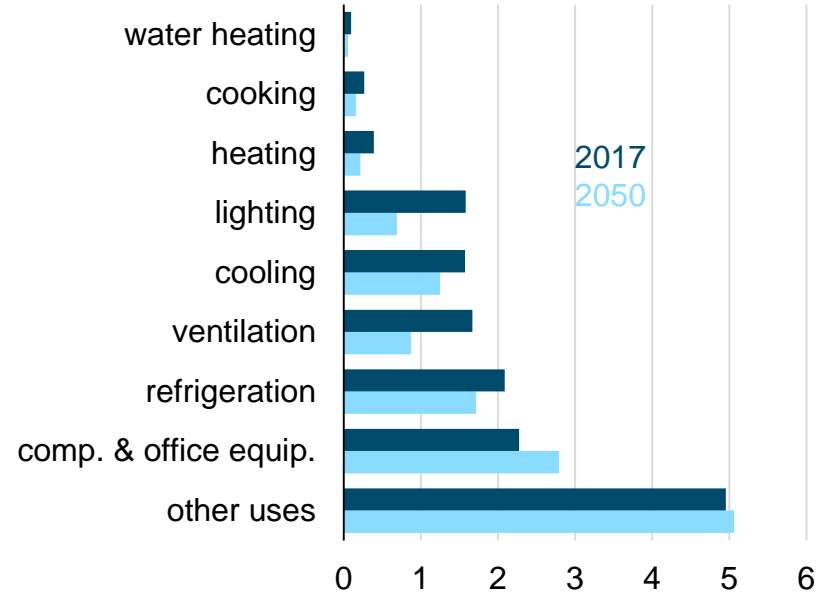


# Increased efficiency contributes to slowing the growth of electricity use in buildings sector

**Use of purchased electricity per household**  
thousand kilowatthours per household

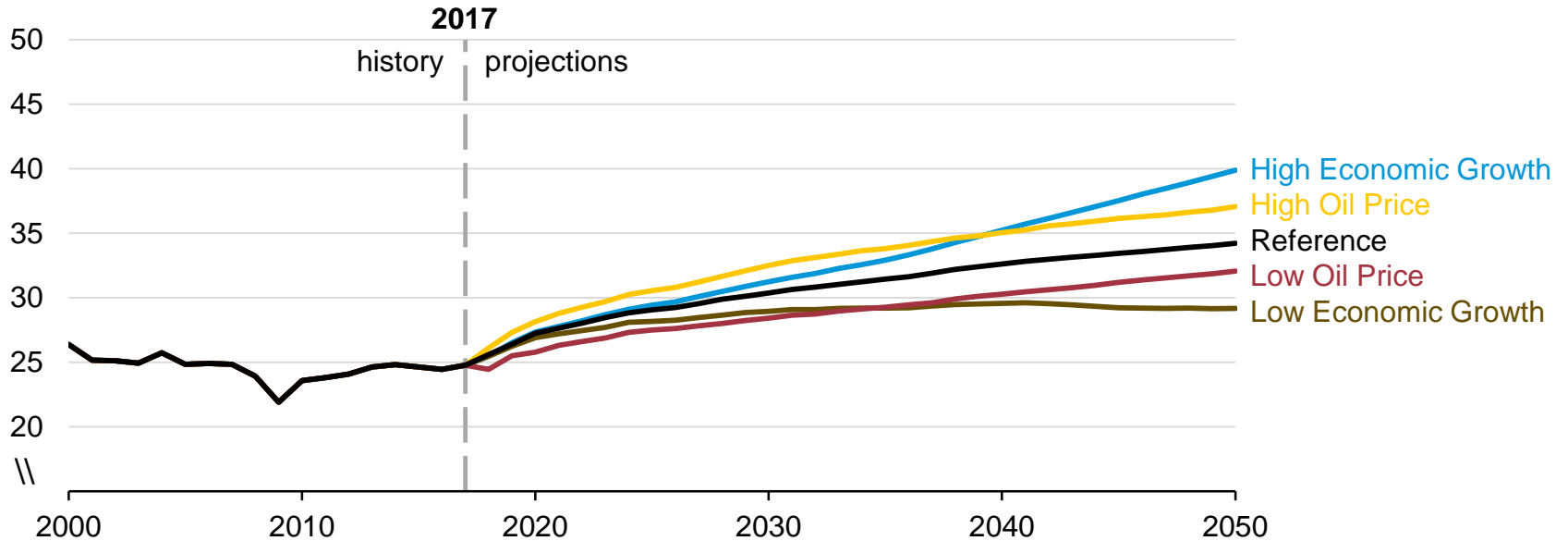


**Use of purchased electricity per square foot of commercial floorspace**  
thousand kilowatthours per thousand square feet



# Industrial energy consumption grows in all cases, driven by economic growth and relatively low energy prices

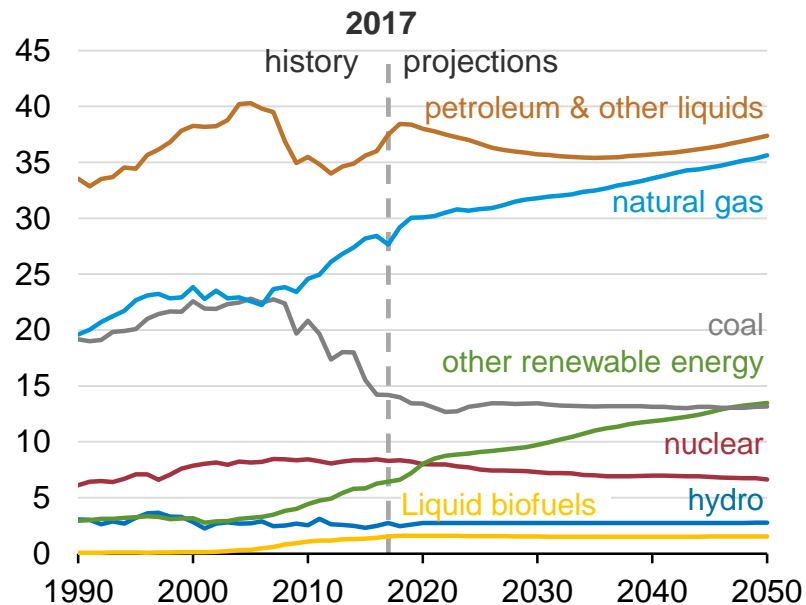
## U.S. industrial delivered energy consumption quadrillion British thermal units



# U.S. energy consumption and production sees significant changes through 2050 under current laws and policies

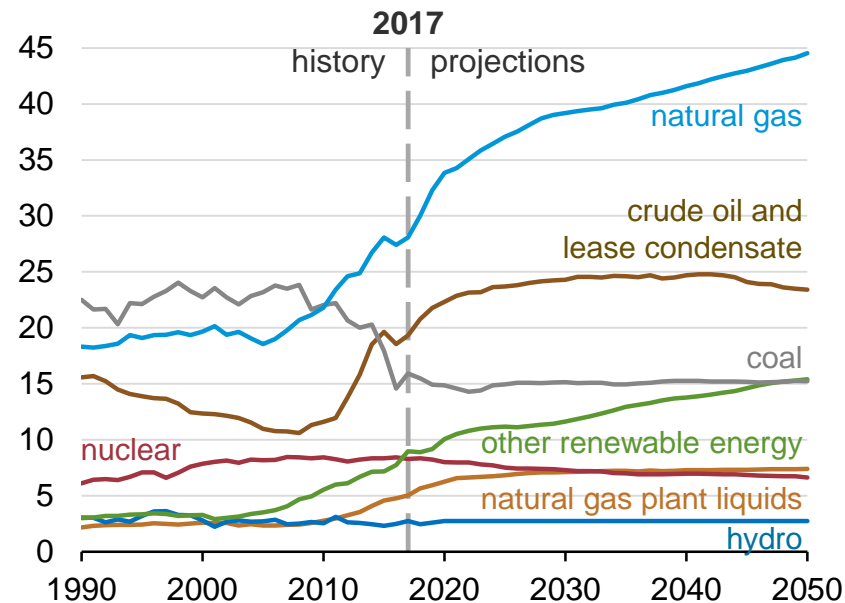
## Energy Consumption (Reference case)

quadrillion British thermal units



## Energy Production (Reference case)

quadrillion British thermal units





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