# EIA's Global Energy Outlook

*For*

*The Institute of Energy Economics, Japan*

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*By*

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# International Energy Outlook: key findings in the 2016 Reference case

- World energy consumption increases from 549 quadrillion Btu in 2012 to 629 quadrillion Btu in 2020 and then to 815 quadrillion Btu in 2040, a 48% increase (1.4%/year). Non-OECD Asia (including China and India) account for more than half of the increase.

- The industrial sector continues to account for the largest share of delivered energy consumption; the world industrial sector still consumes over half of global delivered energy in 2040.

- Renewable energy is the world's fastest-growing energy source, increasing by 2.6%/year; nuclear energy grows by 2.3%/year, from 4% of the global total in 2012 to 6% in 2040.

- Fossil fuels continue to supply more than three-fourths of world energy use in 2040.

# International Energy Outlook: key findings in the 2016 Reference case (continued)

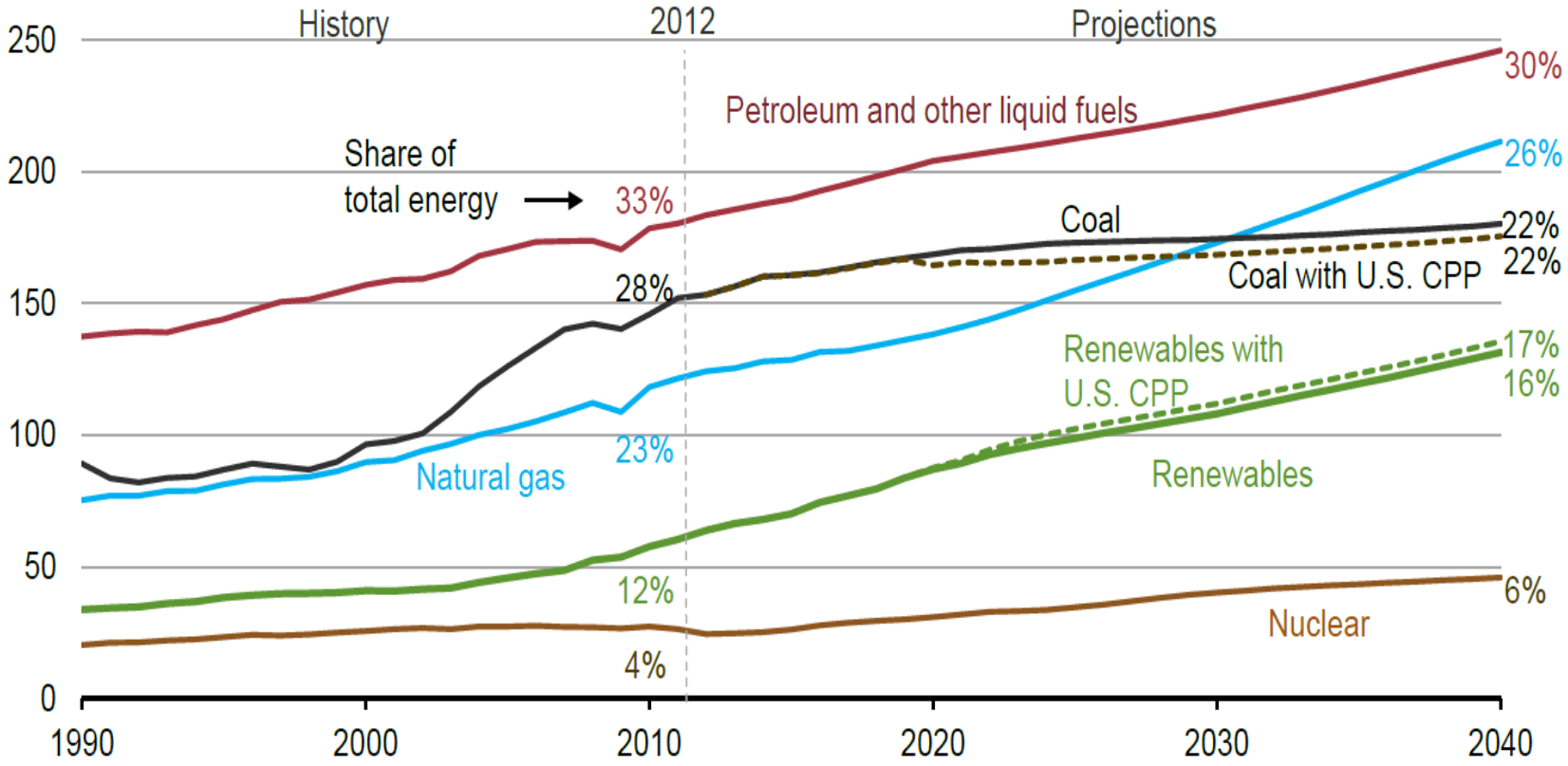
- Among the fossil fuels, natural gas grows the fastest. Coal use plateaus in the mid-term as China shifts from energy-intensive industries to services and worldwide policies to limit coal use intensify. By 2030, natural gas surpasses coal as the world's second largest energy source.

- In 2012, coal provided 40% of the world's total net electricity generation. By 2040, coal, natural gas, and renewable energy sources provide roughly equal shares (28-29%) of world generation.

- With current policies and regulations, worldwide energy-related carbon dioxide emissions rise from about 32 billion metric tons in 2012 to 36 billion metric tons in 2020 and then to 43 billion metric tons in 2040, a 34% increase.

# Global energy shares: Renewables grow fastest, coal use plateaus, natural gas surpasses coal by 2030, and oil maintains its leading share

world energy consumption
quadrillion Btu

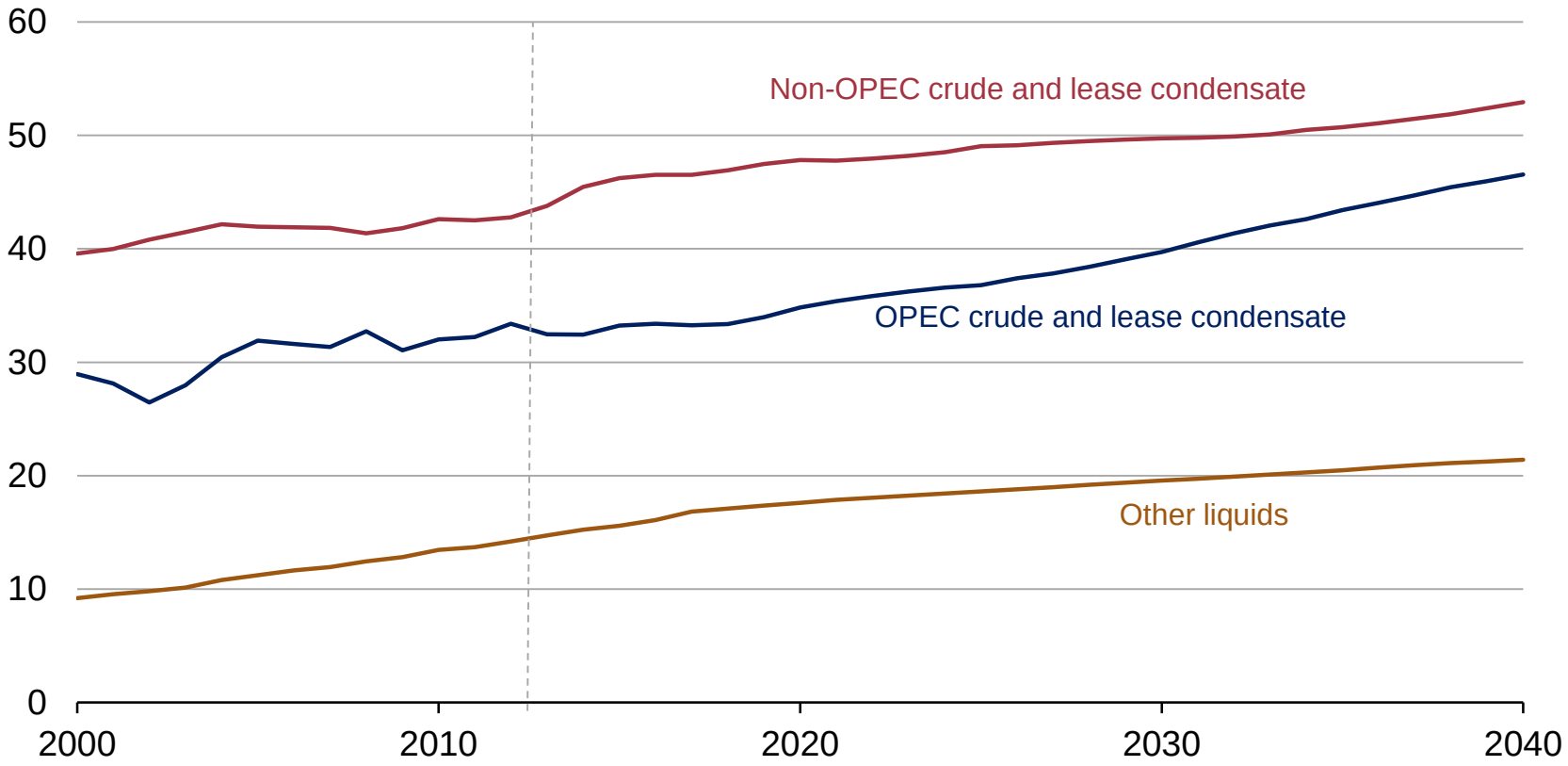



*Source: EIA, International Energy Outlook 2016 and EIA, Analysis of the Impacts of the Clean Power Plan (May 2015)*

# Liquid fuels supplies from both OPEC and non-OPEC producers increase through 2040

world production of petroleum and other liquid fuels

million barrels per day

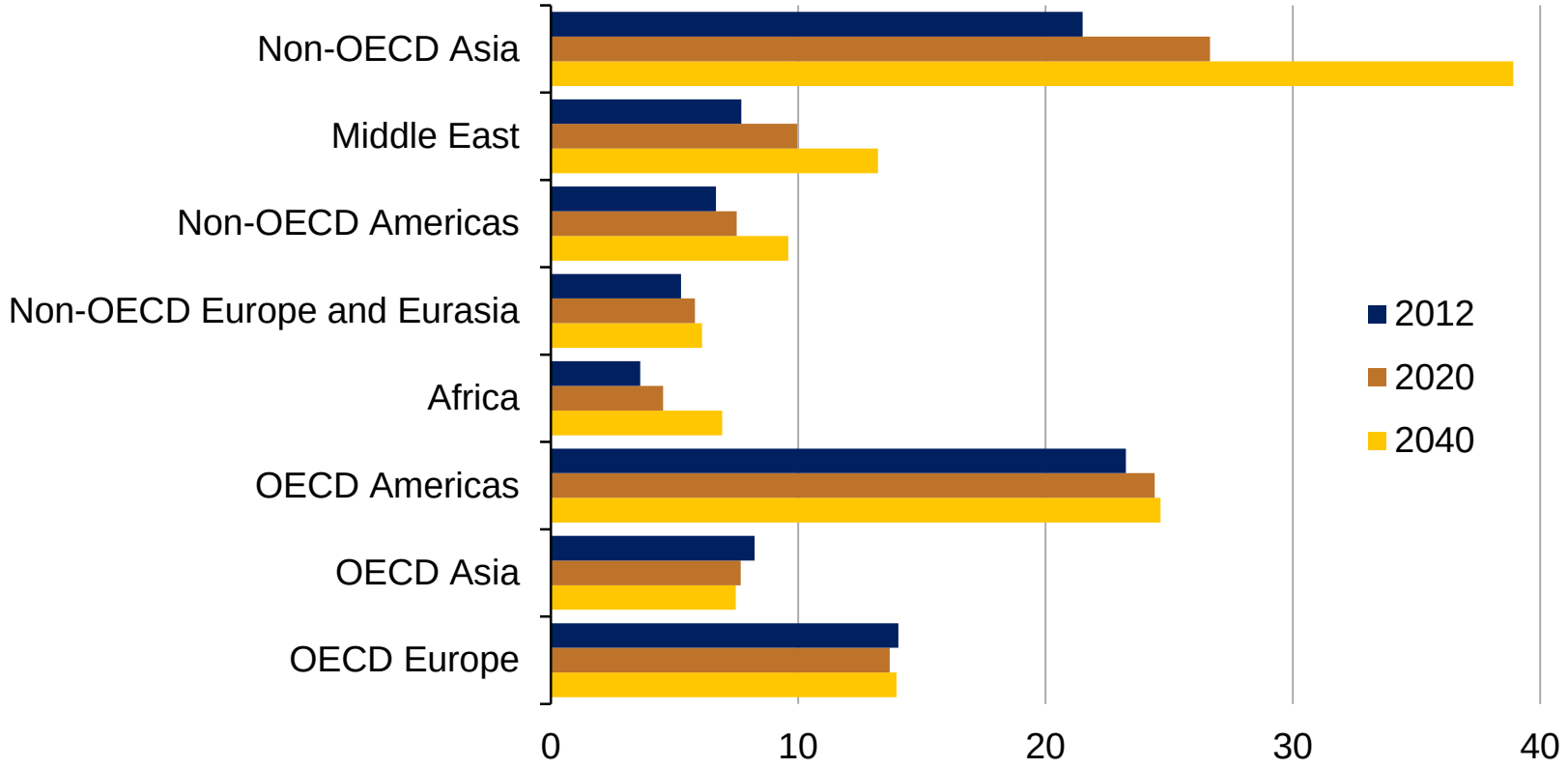



*Source: EIA, International Energy Outlook 2016*

# Most of the growth in world oil consumption occurs in the non-OECD regions — especially Asia

world petroleum and other liquid fuels consumption

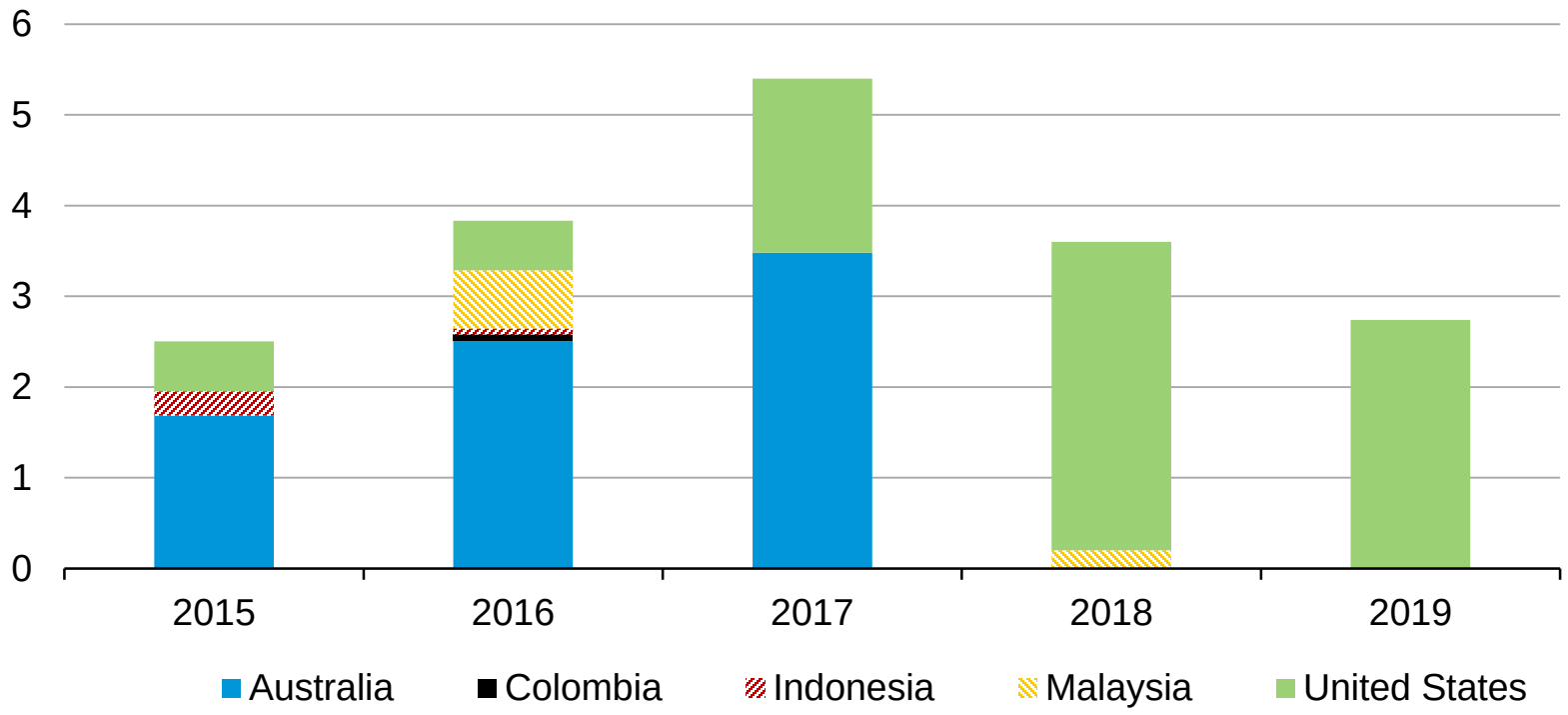
million barrels per day




*Source: EIA, International Energy Outlook 2016*

# Liquefaction capacity additions over the 2015-19 time period will increase global capacity by over 30%

LNG capacity additions
billion cubic feet per day

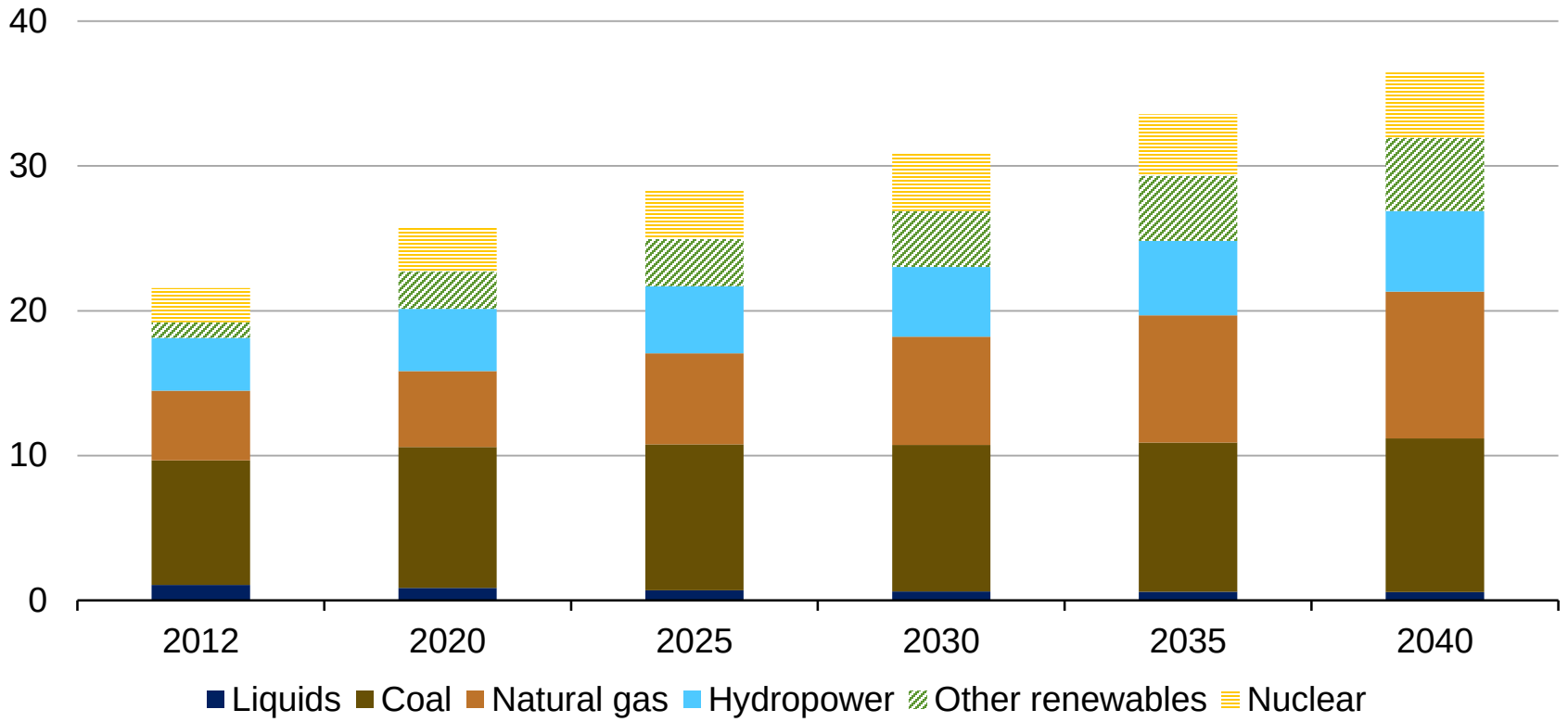



*Note: Capacity additions in 2015-19 include projects currently under construction, and represent nameplate capacity, not adjusted for ramp-up*
*Source: U.S. Energy Information Administration estimates based on trade press*

# Renewables, natural gas, and coal all contribute roughly the same amount of global net electricity generation in 2040

world net electricity generation by source

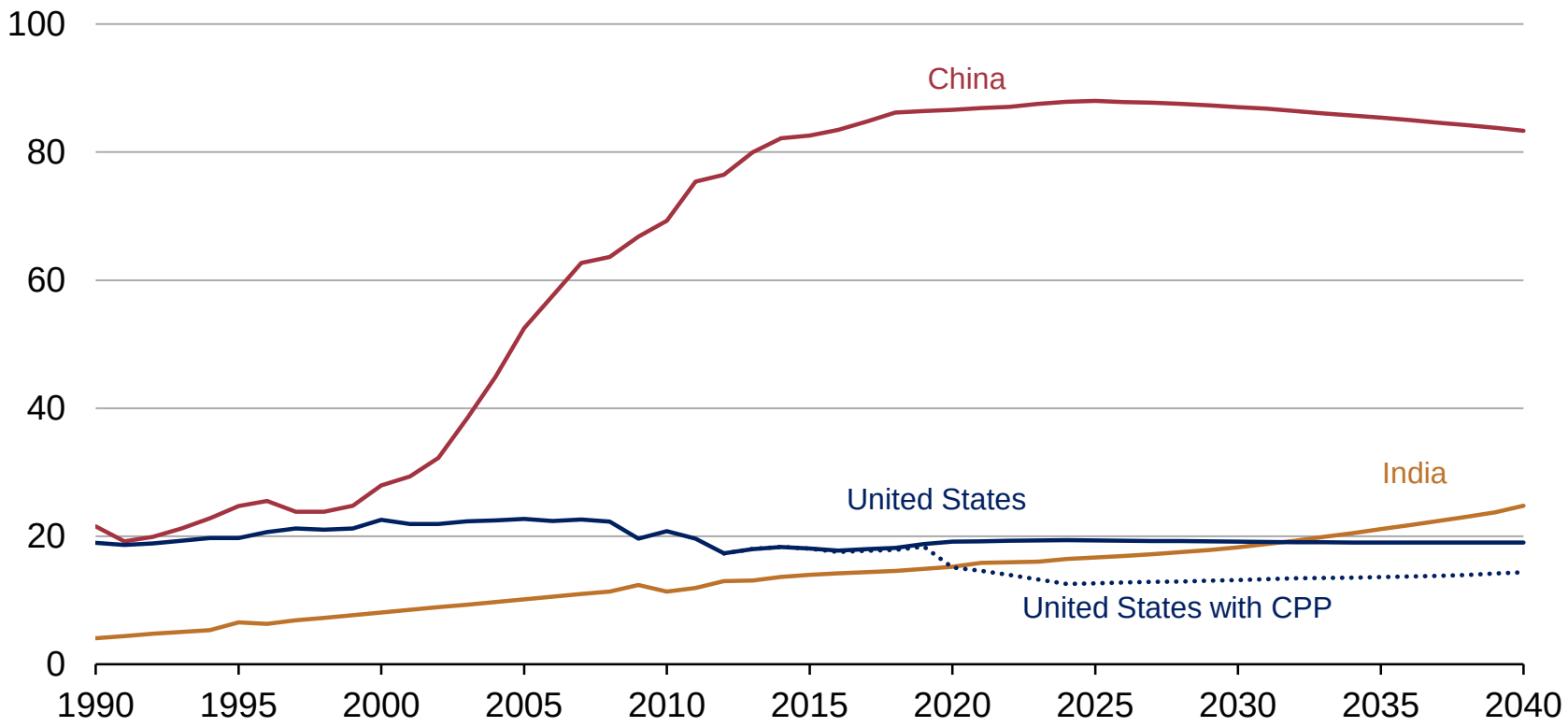
trillion kilowatthours




*Source: EIA, International Energy Outlook 2016*

# Of the world's three largest coal consumers, only India is projected to continue to increase throughout the projection

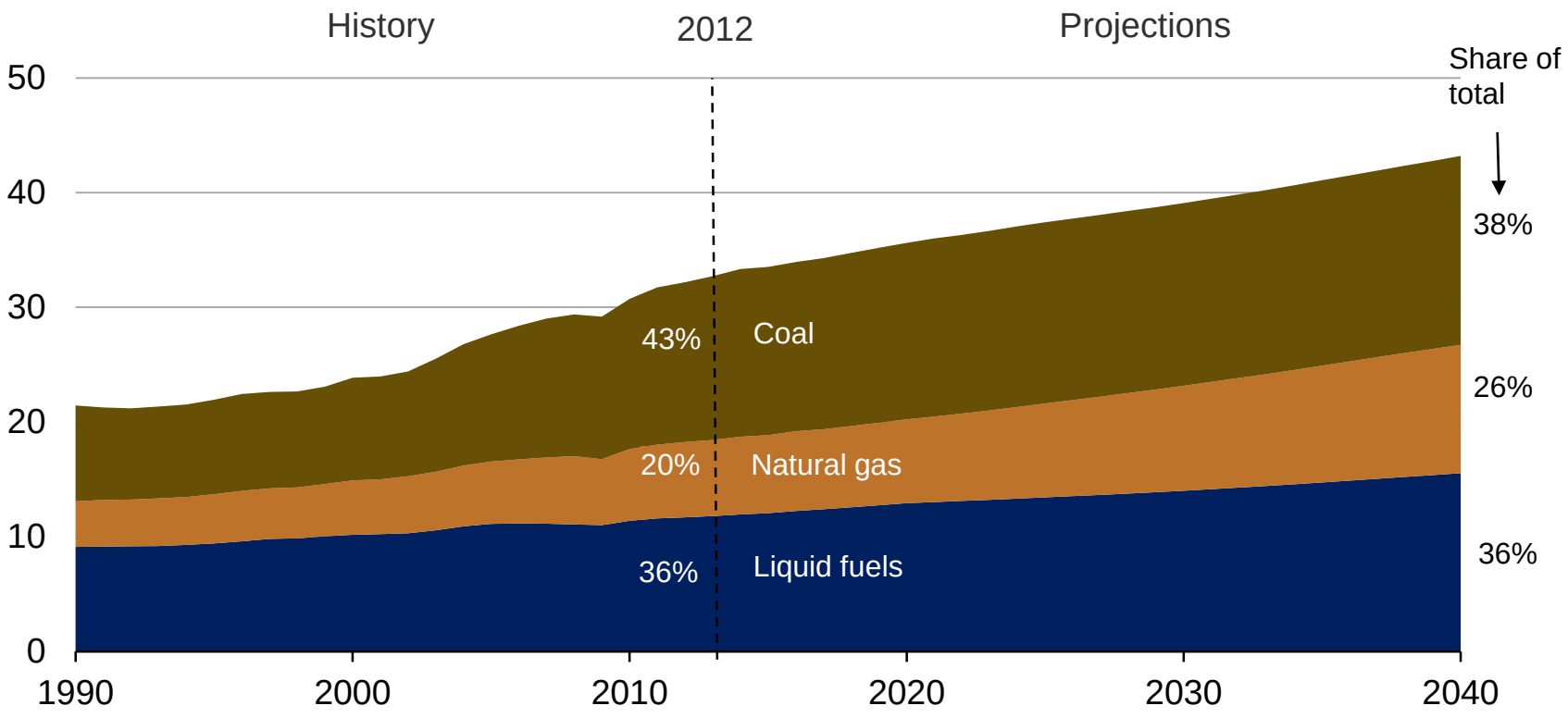
coal consumption in the US, China, and India
quadrillion Btu




*Source: EIA, International Energy Outlook 2016 and EIA, Analysis of the Impacts of the Clean Power Plan (May 2015)*

# Coal remains the world's largest source of energy-related CO2 emissions, but by 2040 its share declines to 38%

world energy-related carbon dioxide emissions
billion metric tons




*Source: EIA, International Energy Outlook 2016*

# U.S. Energy Outlook: key takeaways from AEO2016

- Energy use per dollar of Gross Domestic Product declines through 2040 allowing for economic growth without upward pressure on energy consumption and related emissions.
- Electricity demand growth slows while non-power sector generation increases, dampening the need for central power station generation.
- Market forces drive up oil prices throughout the projection and U.S. production increases in response.
- Natural gas production increases despite relatively low and stable natural gas prices.
- Technological improvements are key drivers of U.S. oil and gas production.

# U.S. Energy Outlook: key takeaways from AEO2016 (continued)

- Net exports of liquefied natural gas range between 3.5 Tcfand 10.6 Tcfin 2040 depending on relative prices in foreign markets
- EPA's proposed medium and heavy-duty vehicle Phase 2 standards would increase fuel economy, resulting in 18% lower diesel consumption in 2040 compared with the Reference case
- EPA's Clean Power Plan (CPP) requires states to reduce carbon dioxide emissions from existing fossil generators:
  - Details of the CPP implementation strategies selected by the states affect the overall generation mix, as well as consumer prices
  - CPP effects on coal production vary across regions

# U.S. Energy Outlook: key takeaways from AEO2016 (continued)

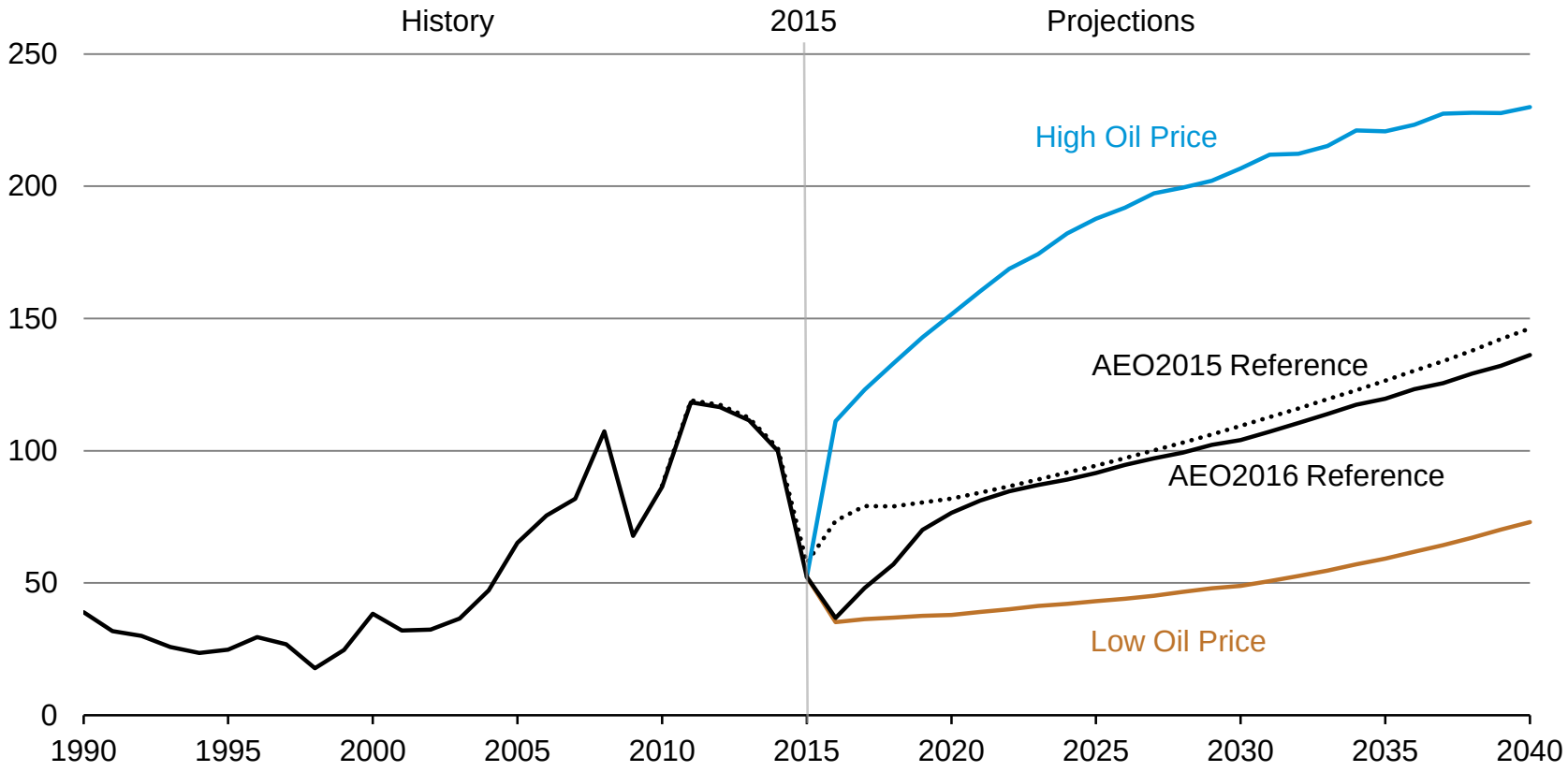
  - CPP, along with renewable tax credit extension and lower natural gas prices, contributes to a shift in the generation mix, with increases in generation from natural gas and renewables and reduced coal generation
  - Even if the CPP is not implemented, key factors combine to support a transition from coal to natural gas as the predominant fuel for electric generation

- Extending or expanding existing laws and regulations, including efficiency policies for appliances and vehicles, the CPP, and EPA's proposed Phase 2 standards for medium- and heavy-duty trucks results lower energy consumption and CO2 emissions than projected in the Reference case

# Near-term crude oil price scenario is lower in AEO2016

Brent crude oil spot price

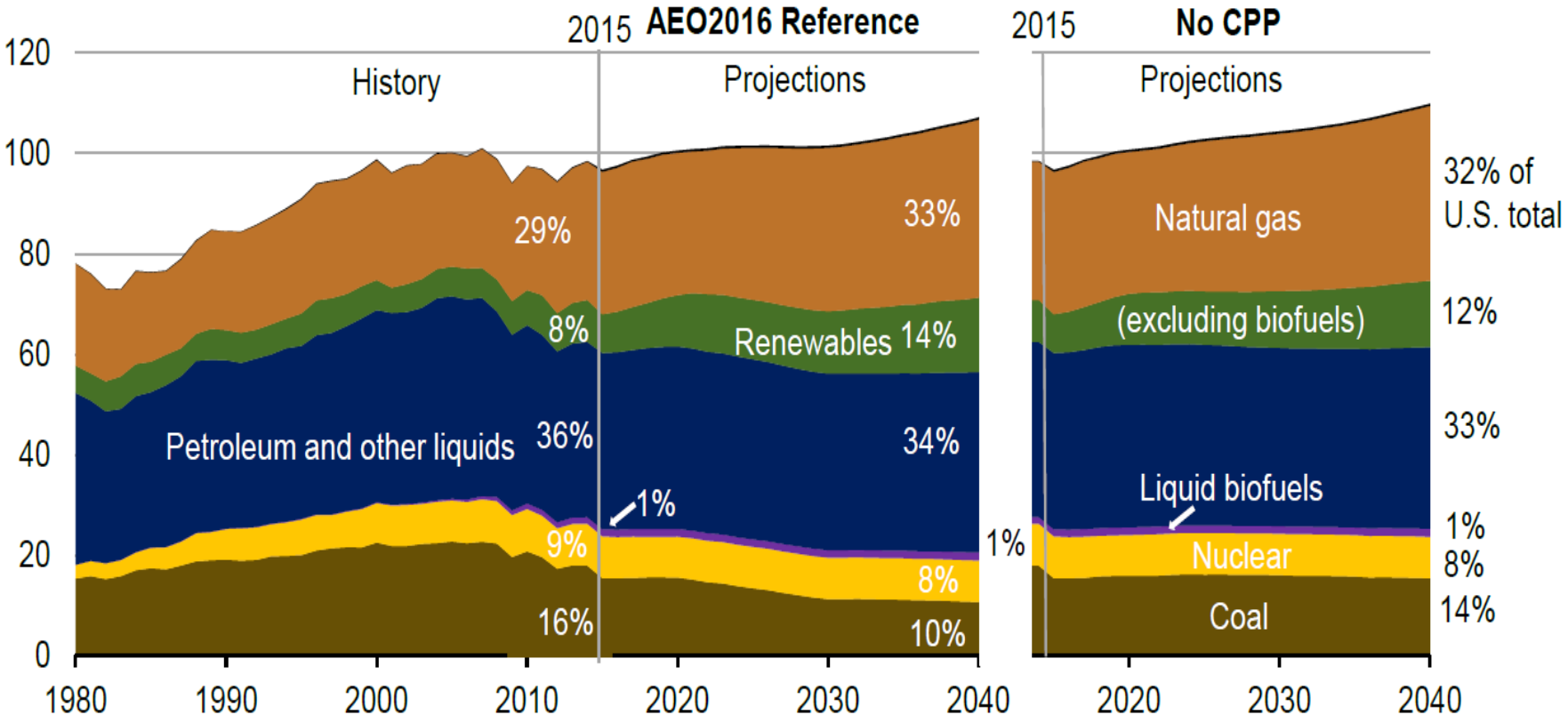
2015 dollars per barrel




*Source: EIA, Annual Energy Outlook 2016 Reference case and Annual Energy Outlook 2015 Reference case*

# Reductions in energy intensity largely offset impact of gross domestic product (GDP) growth, leading to slow projected growth in energy use

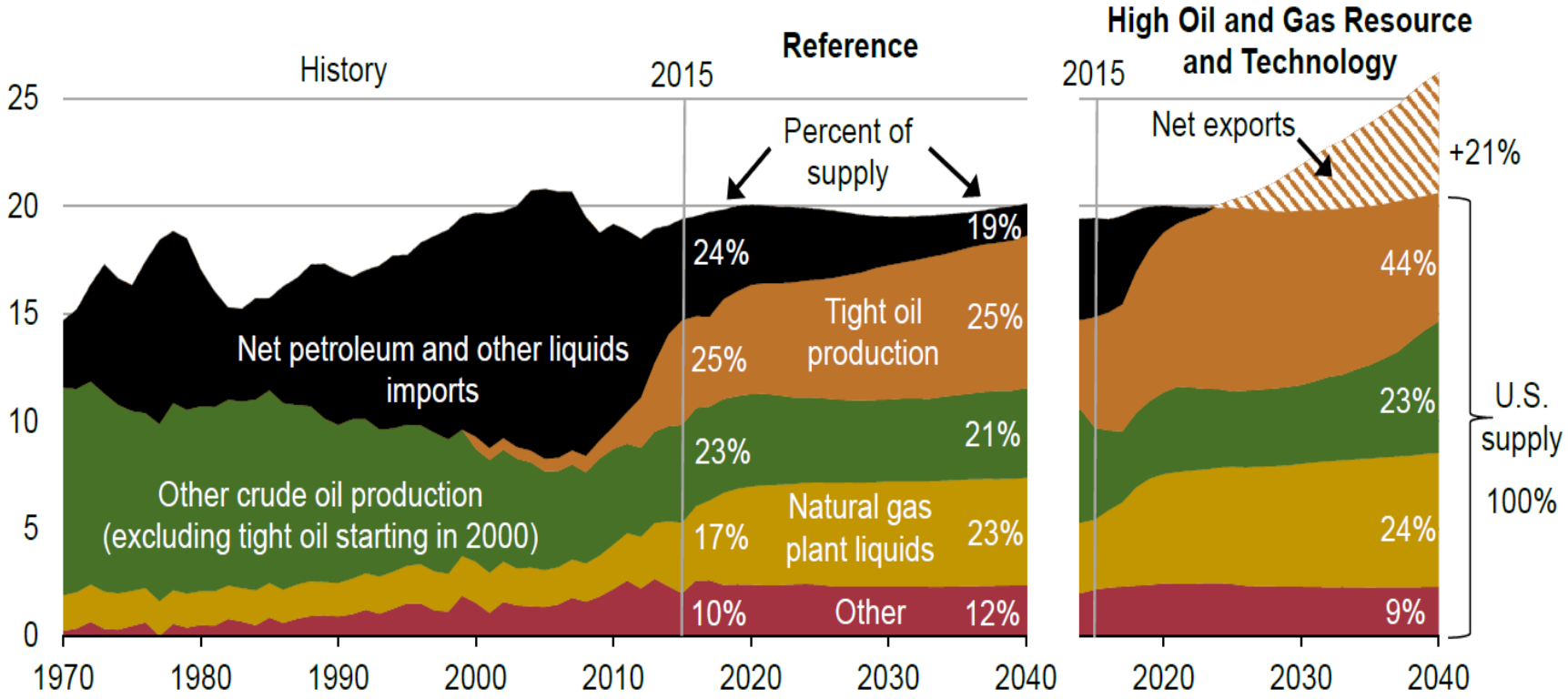
U.S. primary energy consumption
quadrillion Btu




*Source: EIA, Annual Energy Outlook 2016*

# Combination of increased tight oil production and higher fuel efficiency drives projected decline in oil imports

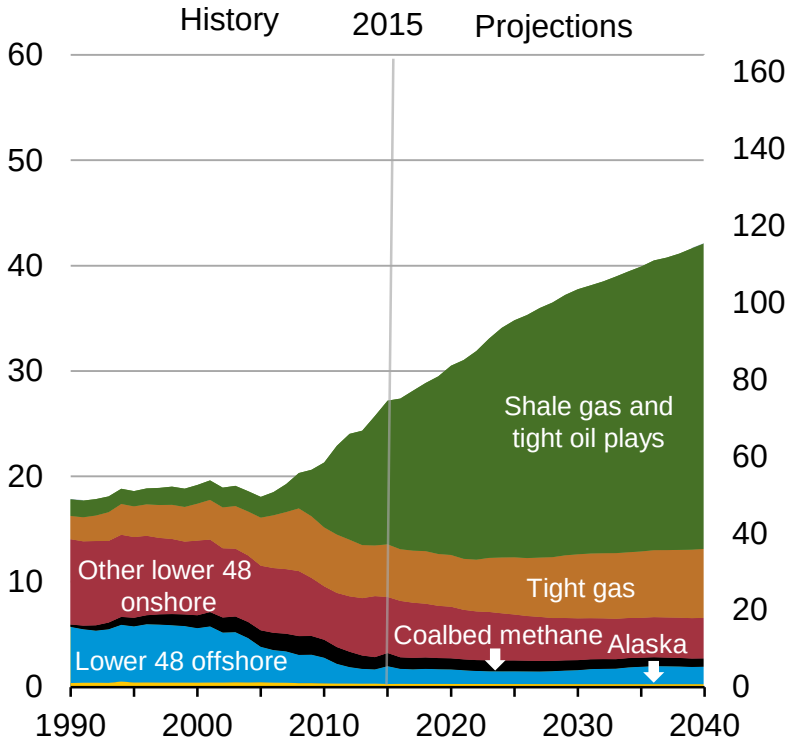
U.S. liquid fuels supply
million barrels per day



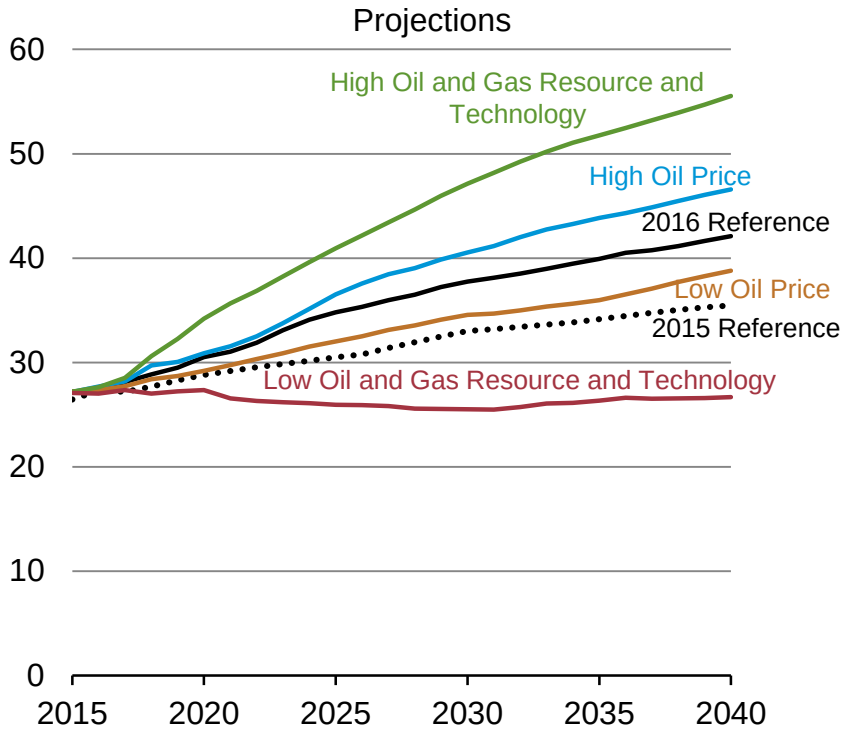

*Note: "Other" includes refinery gain, biofuels production, all stock withdrawals, and other domestic sources of liquid fuels*
*Source: EIA, Annual Energy Outlook 2016*

# U.S. natural gas production dominated by shale resources; alternative price and resource /technology assumptions could be quite different

U.S. dry natural gas production
trillion cubic feet billion cubic feet per day



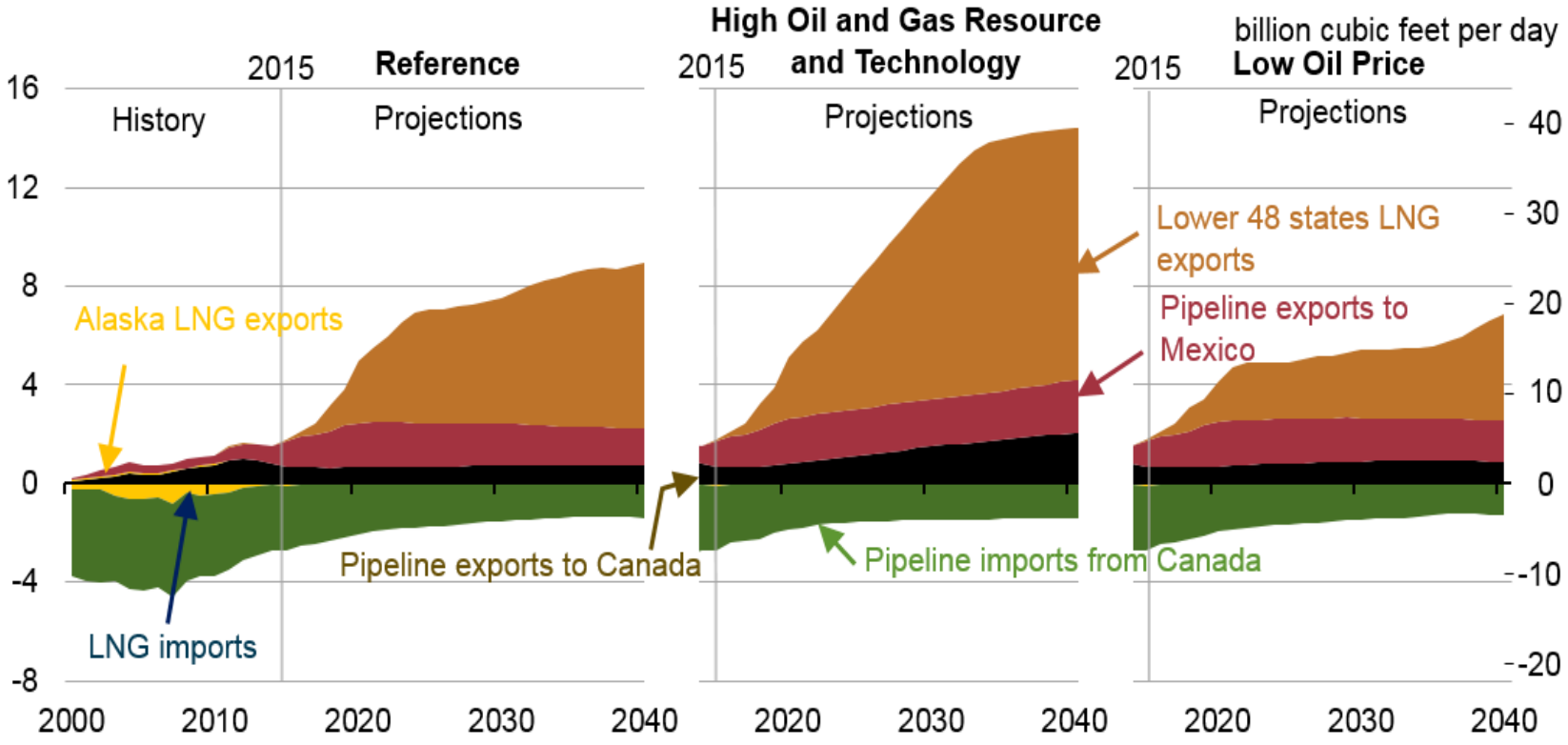

U.S. dry natural gas production
trillion cubic feet




*Source: EIA, Annual Energy Outlook 2016*

# Projected U.S. natural gas exports reflect the spread between domestic natural gas prices and world energy prices

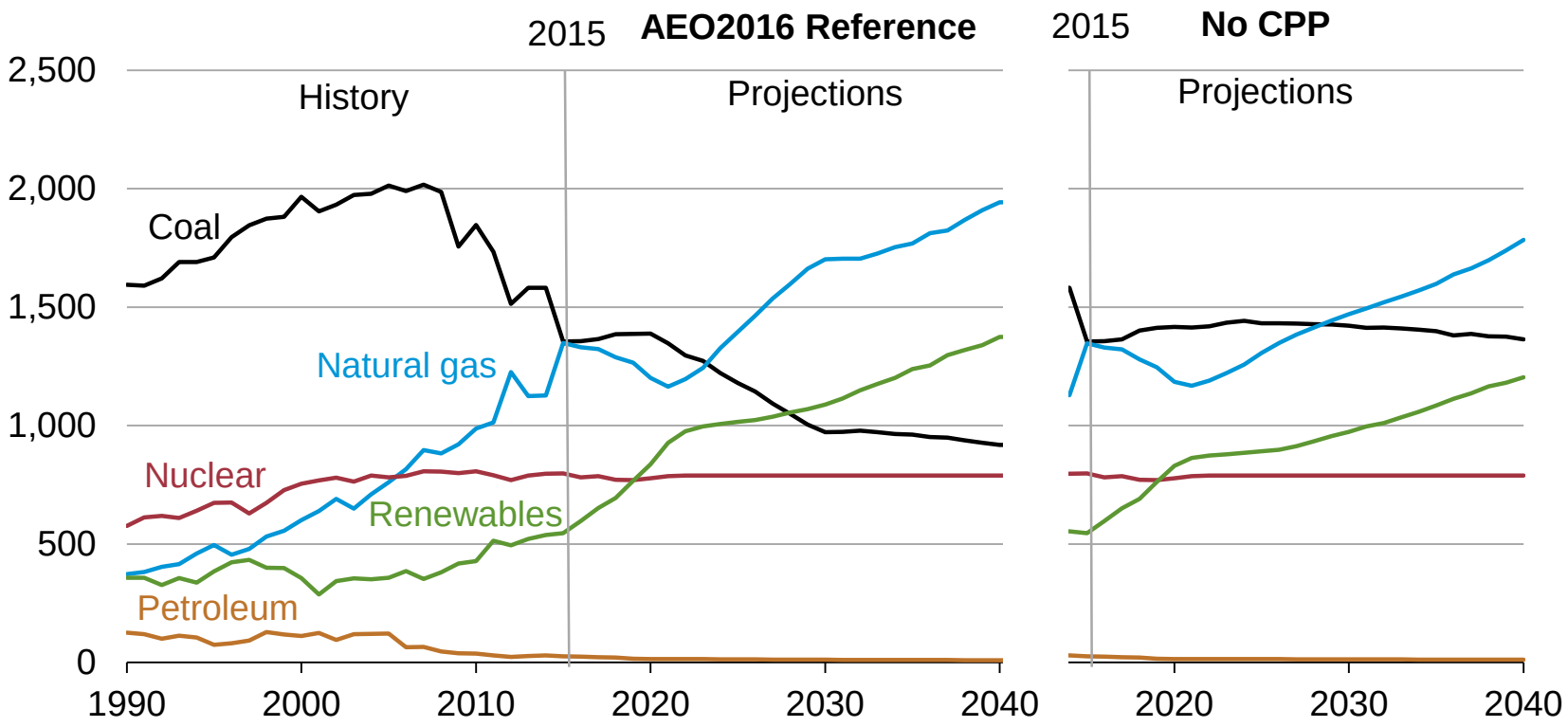
U.S. natural gas imports and exports
trillion cubic feet




*Source: EIA, Annual Energy Outlook 2016*

# Both natural gas and renewable generation surpass coal by 2030 in the Reference case, but only natural gas does so in the No CPP case

net electricity generation
billion kilowatthours

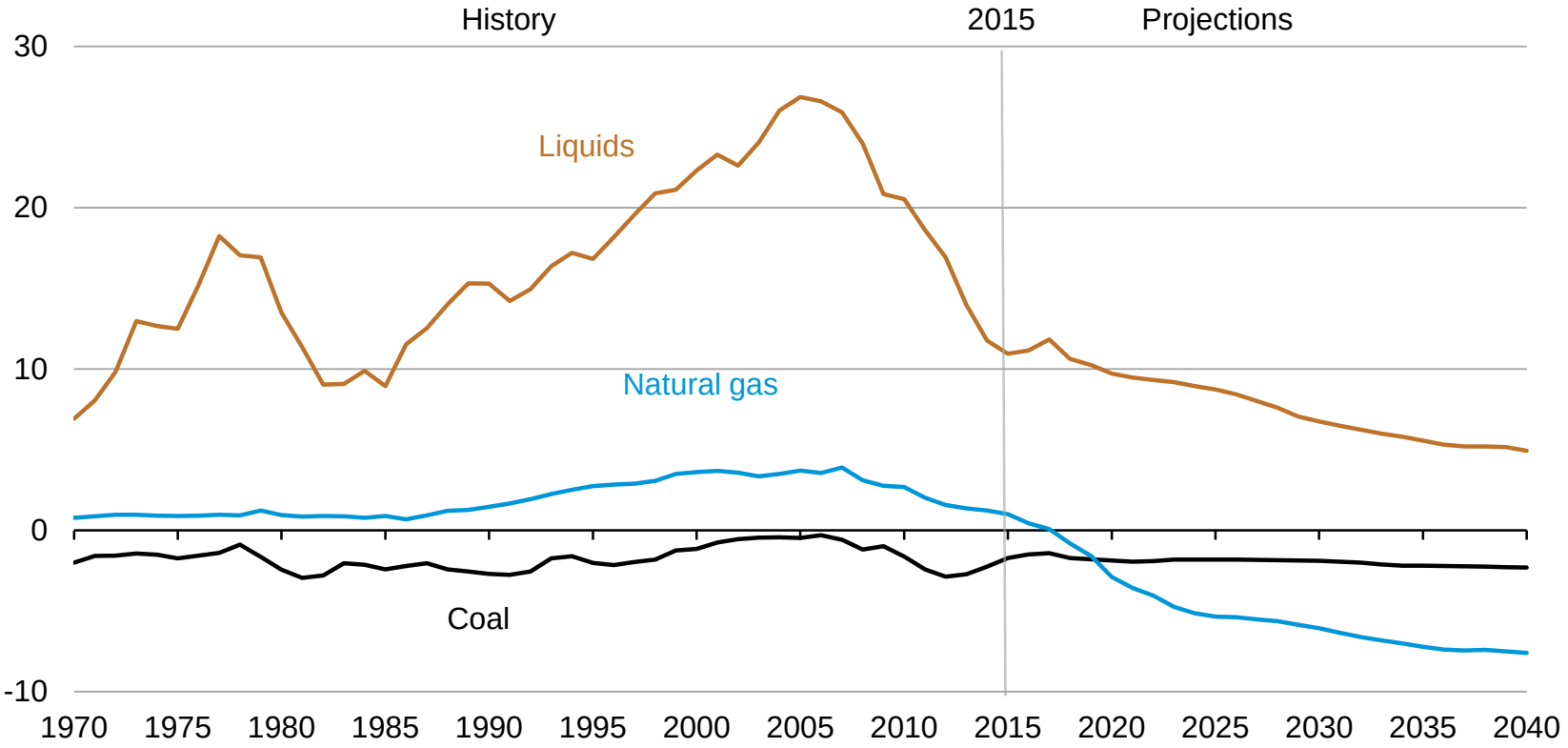



*Source: EIA, Annual Energy Outlook 2016*

# U.S. net energy imports trend downward, reflecting increased oil and natural gas production coupled with slowly growing or falling demand

U.S. net imports

quadrillion Btu




*Source: EIA, Annual Energy Outlook 2016*

# For more information

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

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

Annual Energy Outlook | www.eia.gov/aeo

International Energy Outlook | www.eia.gov/ieo

Monthly Energy Review | www.eia.gov/mer

Today in Energy | www.eia.gov/todayinenergy