

Selected U.S. energy issues: a view from the Energy Information Administration



for

AAAS Fellows

Department of Energy

May 20, 2016

by

Howard Gruenspecht, Deputy Administrator

EIA mission: independent statistics and analysis

- EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment
- By law, data, analyses, and forecasts provided by EIA are independent of approval by any other officer or employee of the U.S. Government

The screenshot shows the EIA website interface. At the top, there is a navigation bar with the EIA logo, the text "Independent Statistics & Analysis U.S. Energy Information Administration", and links for "Sources & Uses", "Topics", and "Geography". A search bar is on the right. Below the navigation is a large banner image of solar panels and a power line tower. A dark overlay on the banner contains the text: "Annual Energy Outlook 2016 Early Release with summary of Reference case projections through 2040".

What's New

- AEO2016 Early Release: Summary of Two Cases | May 17
- 2012 CBECs consumption and expenditures, detailed tables, and public use microdata | May 17
- International Energy Outlook 2016 | May 11

Coming Up

- India Country Analysis Brief | Uranium Marketing Annual | Annual Energy Outlook | More >

Today in Energy *Posted May 18, 2016*

Future power sector carbon dioxide emissions depend on status of Clean Power Plan

Trends in carbon dioxide (CO₂) emissions from electricity generation through 2040 depend significantly on whether or not the Clean Power Plan (CPP) rule issued last August by the U.S. Environmental Protection Agency (EPA) is implemented. Analysis in EIA's *Annual Energy Outlook 2016* (AEO2016) examines what the CPP could mean for the fuels used to generate electricity, especially coal. [More](#).

U.S. energy-related carbon dioxide (CO₂) emissions (1990-2040)
million metric tons

Year	Historical (1990-2015)	No Clean Power Plan case	Reference case (includes Clean Power Plan)
1990	~1,500	~1,500	~1,500
2000	~2,500	~2,500	~2,500
2010	~4,500	~4,500	~4,500
2015	~5,500	~5,500	~5,500
2020	-	~6,000	~4,500
2025	-	~6,500	~3,500
2030	-	~7,000	~2,500
2035	-	~7,500	~1,500
2040	-	~8,000	~1,000

Source: EIA, *Annual Energy Outlook 2016*

Data Highlights

- WTI crude oil futures price**
5/17/2016: \$48.31/barrels
↑ \$3.55 from week earlier
↓ \$11.12 from year earlier
- Natural gas futures price**
5/17/2016: \$2.048/MMBtu
↑ \$0.110 from week earlier
↓ \$0.982 from year earlier
- Retail gasoline price**
5/16/2016: \$2.242/gal
↑ \$0.022 from week earlier
↑ \$0.502 from year earlier
- Crude oil inventories**
5/13/2016: 541.3 million barrels
↑ 1.3 million barrels from week earlier
↑ \$9.1 million barrels from year earlier
- Weekly coal production**
5/7/2016: 10.949 million tons
↓ 0.310 million tons from week earlier
↓ 5.104 million tons from year earlier

EIA's data collection system integrates all energy sectors

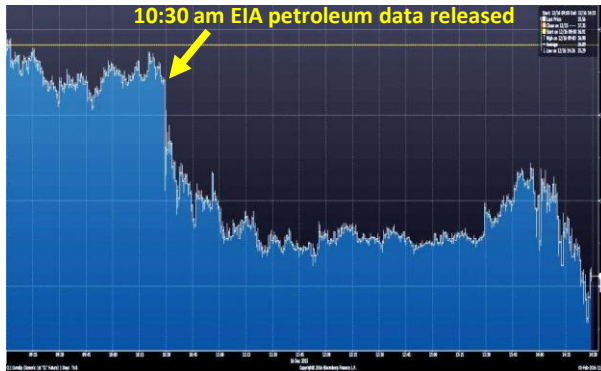


Complete list of EIA's active surveys and forms at www.eia.gov/survey/

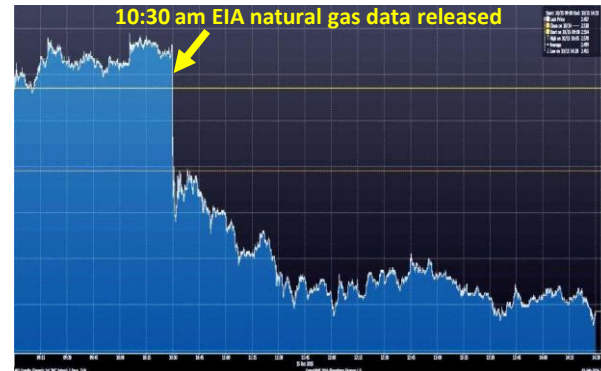
The release of EIA's oil and natural gas inventory data has an immediate impact on energy markets

Producers, consumers, utilities, regulators, investors, and analysts use a wealth of EIA energy statistics in their day-to-day activities in the global energy marketplace.

- The Weekly Natural Gas Storage Report (WNGSR) is designated as a Principal Economic Indicator.
- The Weekly Petroleum Status Report (WPSR) provides statistics on oil and petroleum product stocks, imports, and production.



Data Represent NYMEX Light, Sweet Crude Oil (WTI) Near-Month Futures Contract December 16, 2015
Source: Bloomberg Finance LP (February 1, 2016)

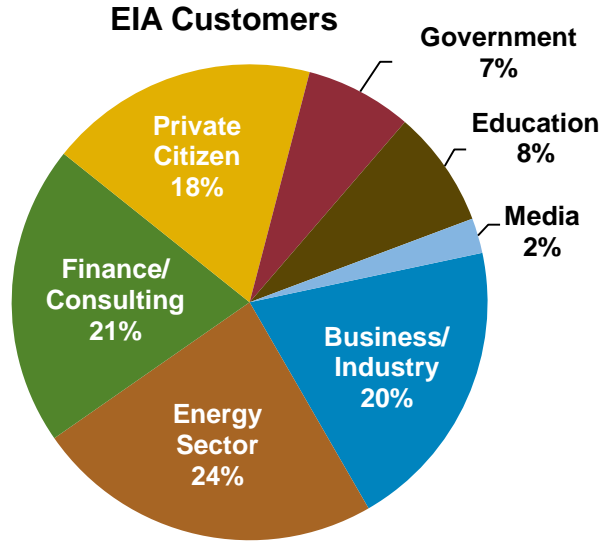


Data Represent NYMEX Henry Hub Natural Gas Near-Month Futures Contract October 15, 2015
Source: Bloomberg Finance LP (February 1, 2016)

Analyses, Projections, and Special Reports

- *Today in Energy* (daily), Natural Gas Weekly Update, This Week in Petroleum
 - Discussion of recent data and market conditions
- *Short-Term Energy Outlook* (monthly)
 - Forecasts U.S. supplies, demands, imports, stocks, and prices of energy with a horizon of 12 to 24 months
- *Annual Energy Outlook*
 - Presents 25- to 30-year projection and analysis of U.S. energy supply, demand, and prices
 - Basis for special analyses of policy proposals requested by the Administration and Congress; recent studies have examined the Clean Power Plan and relaxation of restrictions on crude oil exports
- *International Energy Outlook*
 - Assesses international crude, liquid fuel, and natural gas markets

EIA information is used by a range of stakeholders



Source: 2015 Customer Satisfaction

Customer-focused Performance Results

- **Quality:** 90% of customers are satisfied or very satisfied with the quality of EIA information
- **Timeliness:** 95% of selected EIA recurring products meet their release date target

Examples of Activities

Government

- Executive Agencies – WH, DOE, & EPA use EIA data to track energy markets and program performance and to analyze policy proposals
- Congress – policy development and agency funding
- State Governments – planning and program development

Energy Sector

- Consumers – monitor price forecasts
- Producers – track inventory statistics

Business/Industry

- Manufacturers – market research

Finance/Consulting

- Commodities Analysts – market response to supply data

Media/Education

- Journalists – cite energy statistics
- Teachers – use Energy Kids materials
- Researchers – energy forecasting and modeling

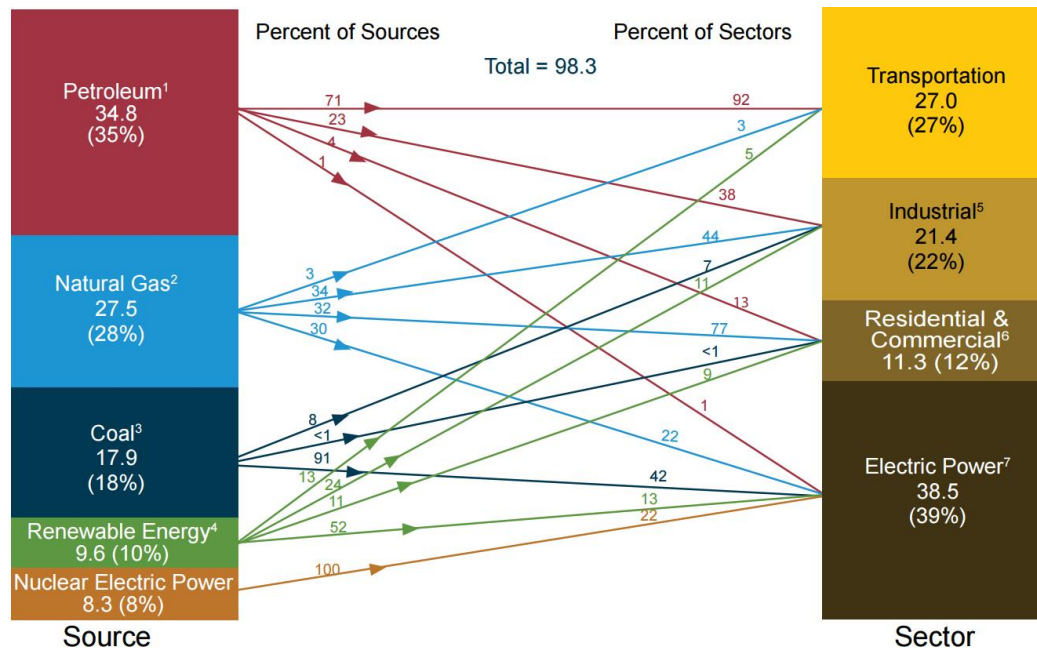
Private Citizens

- Public – research gasoline prices

U.S. Energy Overview

In the United States, oil is used mainly in transport where it dominates, while coal and nuclear use is concentrated in power generation. Natural gas and renewable energy use is more diversified

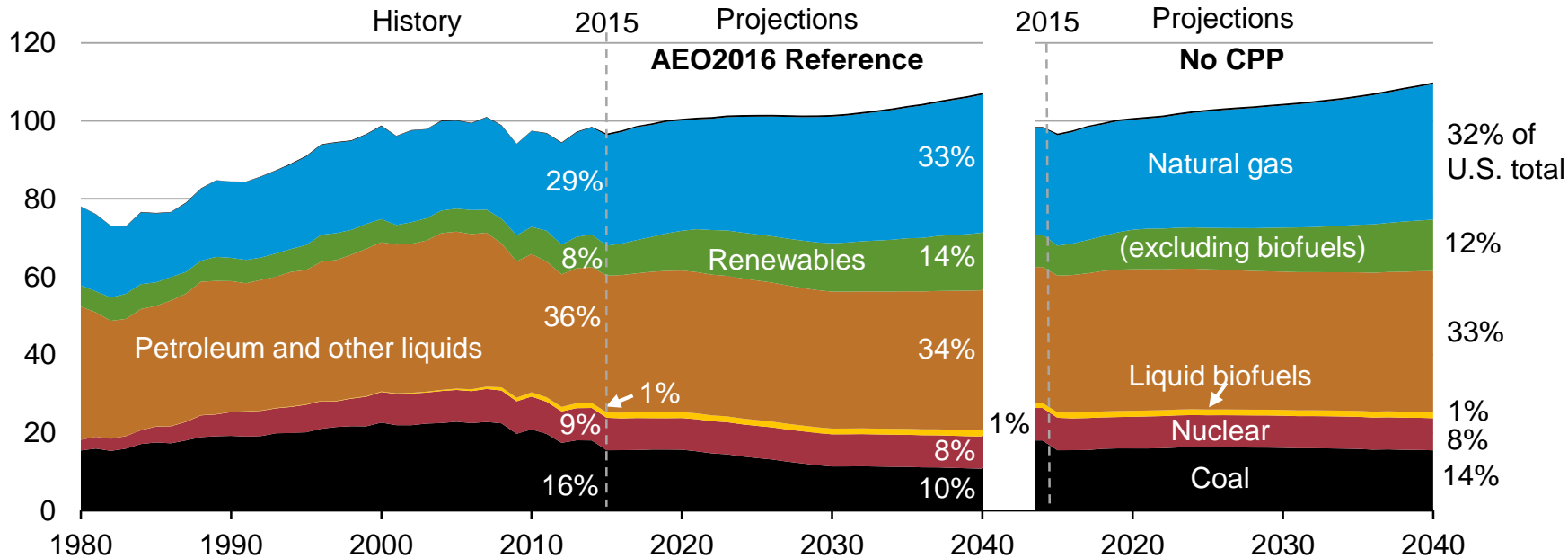
primary energy consumption by source and sector, 2014
quadrillion Btu



Source: EIA Monthly Energy Review

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

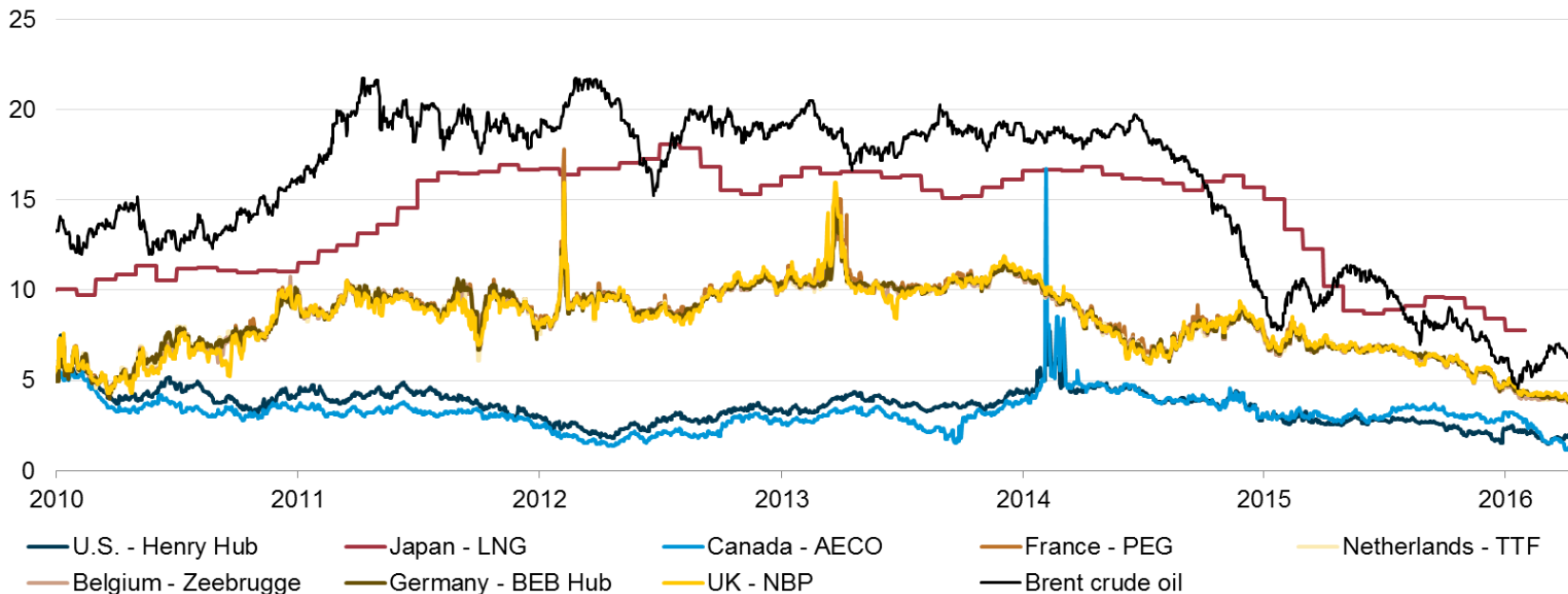


Source: EIA, Annual Energy Outlook 2016

North American natural gas prices are low compared to prices in the rest of the world, although spreads have narrowed recently

select global natural gas and crude oil prices with average monthly LNG prices in Japan

U.S. dollars per million British thermal unit

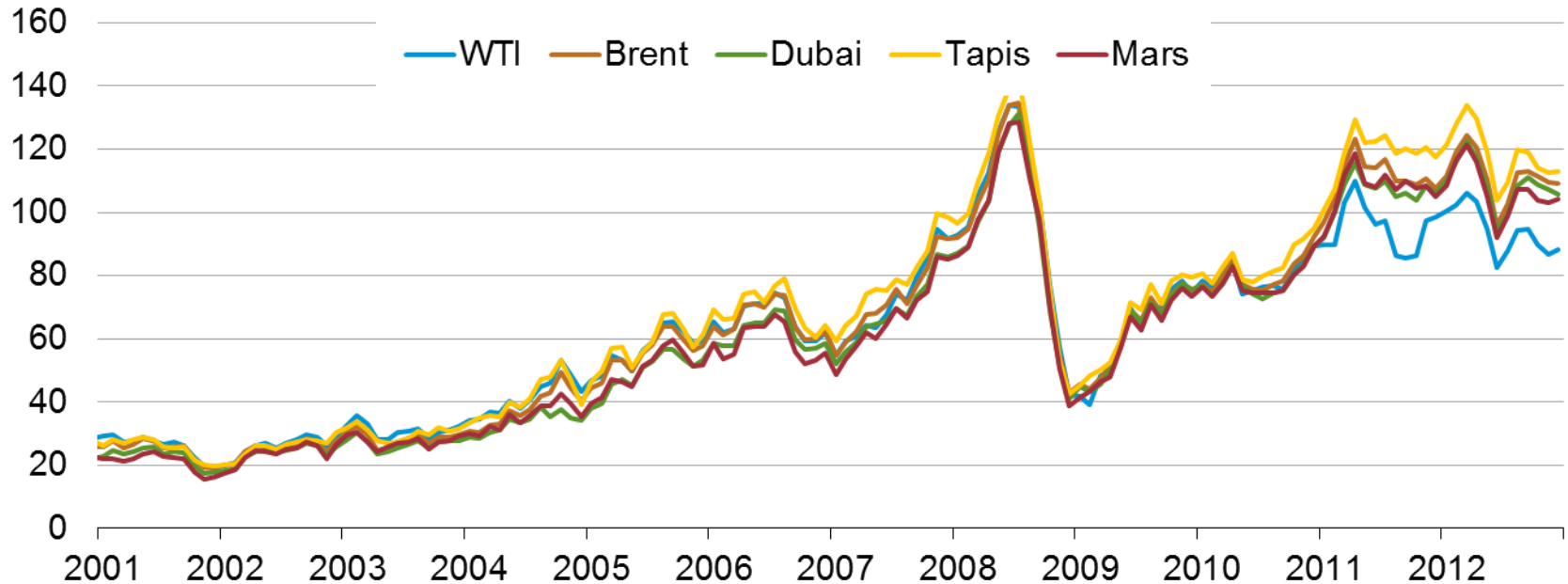


Source: EIA, Bloomberg L.P.

World oil prices move together due to arbitrage

Global crude oil prices

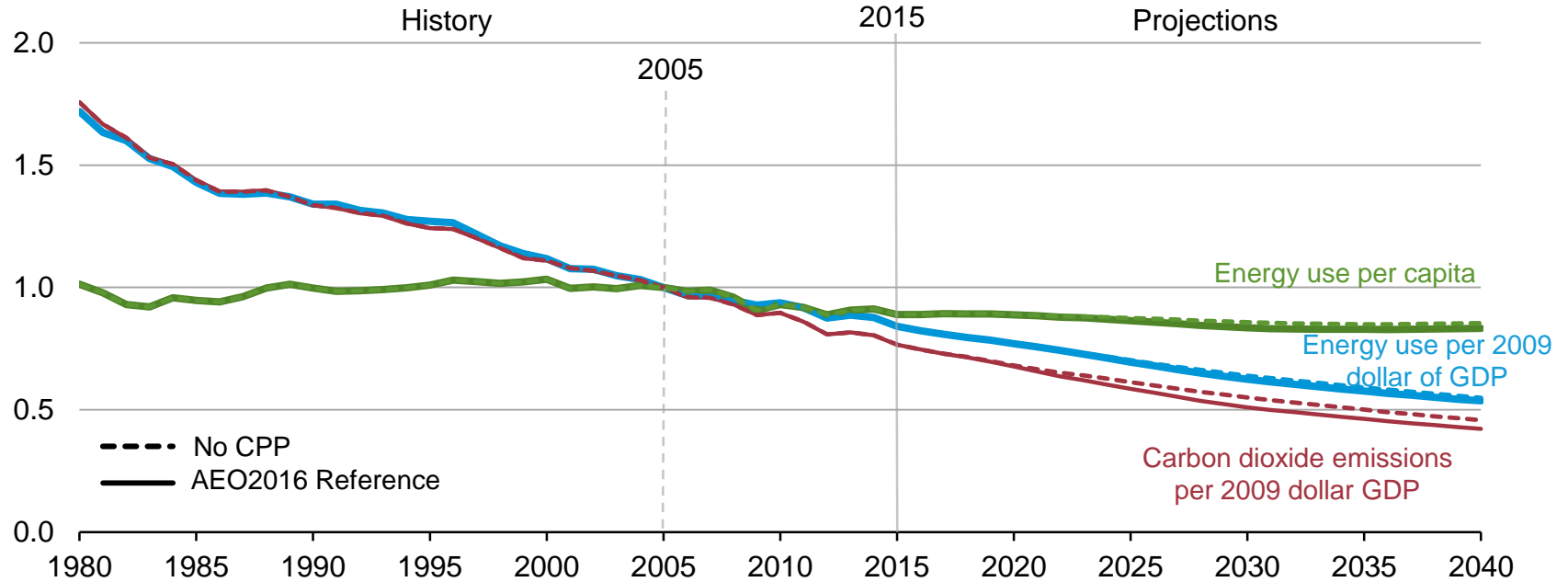
Nominal dollars per barrel, monthly average



Sources: Bloomberg, Thomson Reuters

CO2 emissions per dollar of gross domestic product (GDP) decline faster than energy use per dollar of GDP with a shift towards low- and no-carbon fuels

energy and emission intensity
index, 2005=1

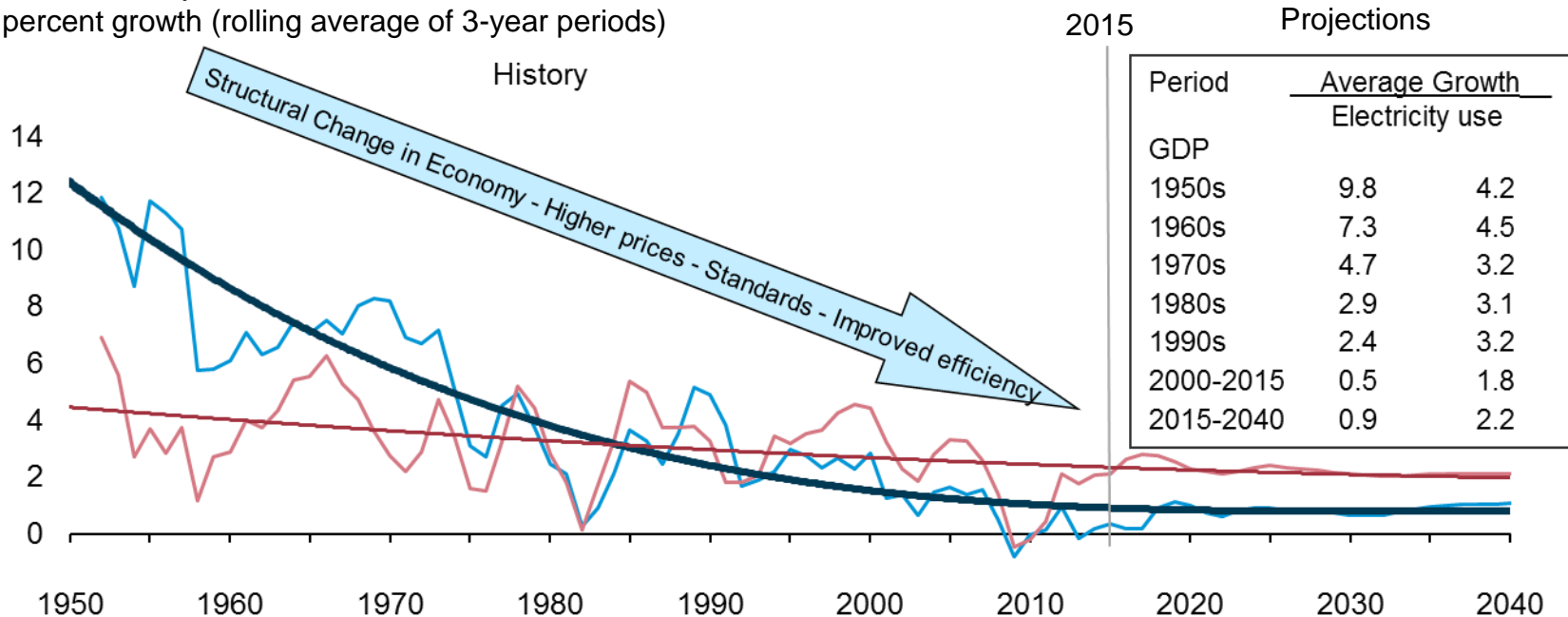


Source: EIA, Annual Energy Outlook 2016 Reference case

Electricity

Electricity use (including direct use) is expected to continue to grow, but the rate of growth slows over time as it has almost continuously over the past 60 years

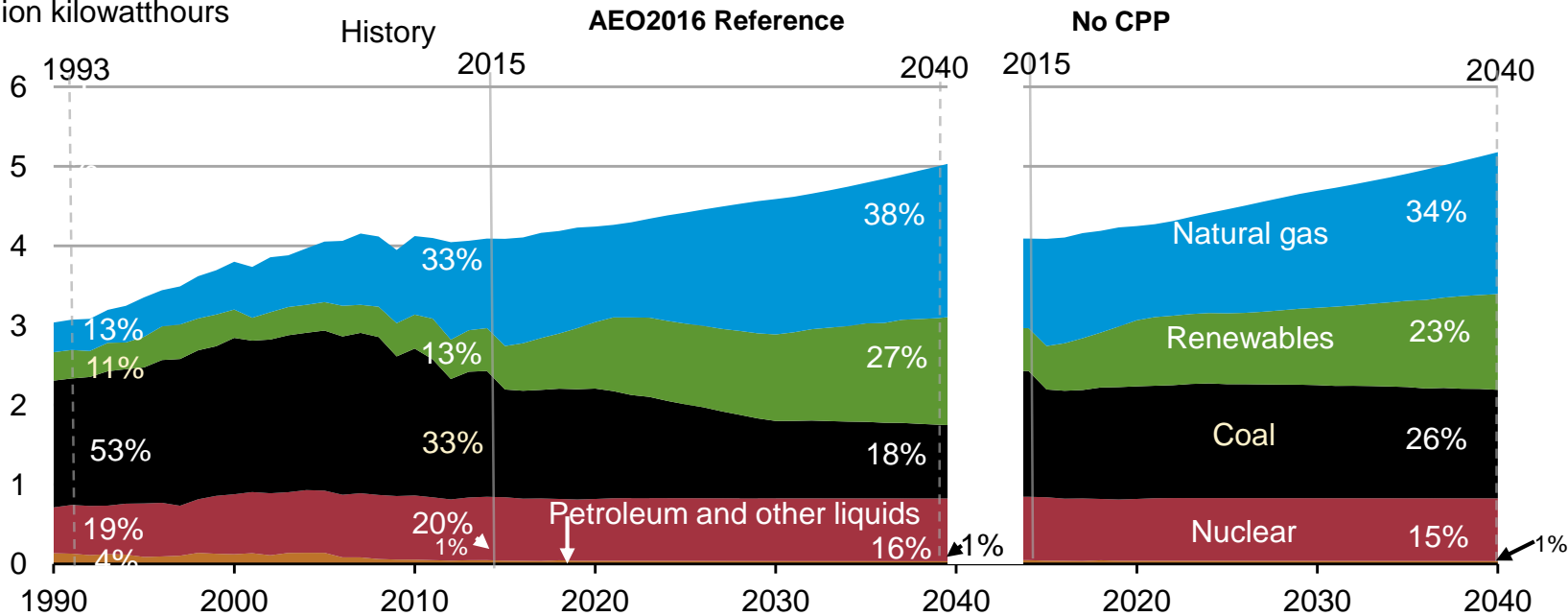
U.S. electricity use and GDP
percent growth (rolling average of 3-year periods)



Clean Power Plan accelerates shift to lower-carbon options for generation, led by growth in renewables and gas-fired generation; results are likely sensitive to CPP implementation approach

electricity net generation

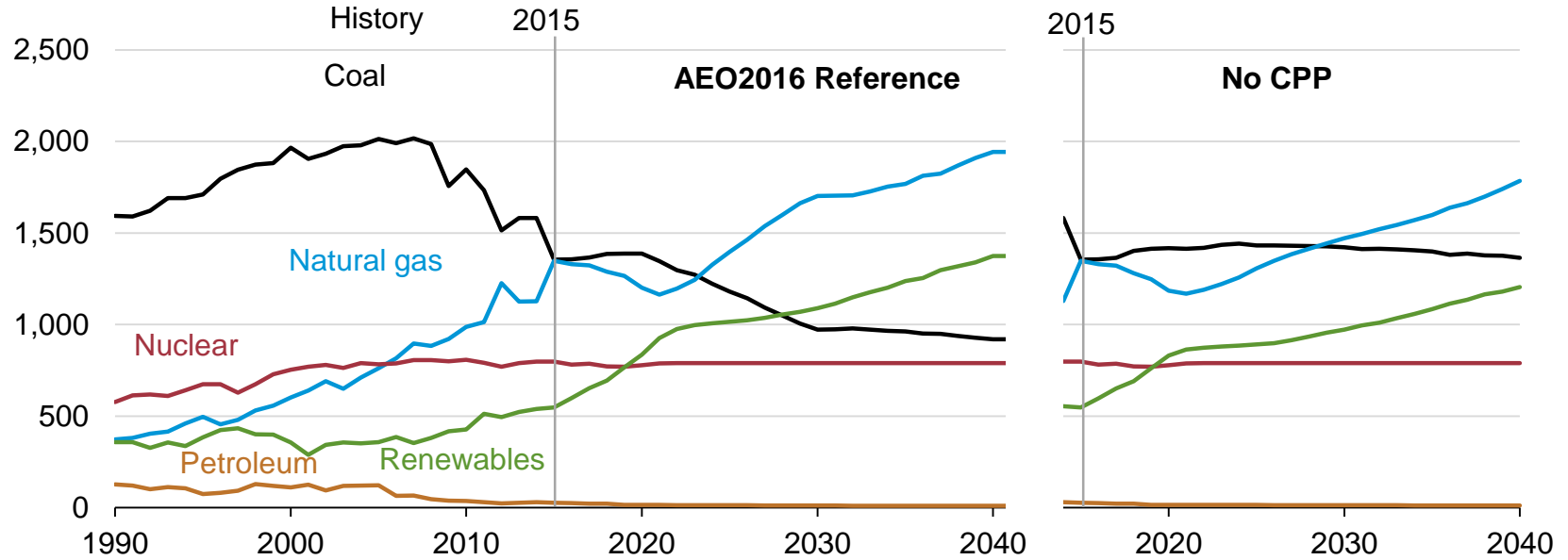
trillion kilowatthours



Source: EIA, Annual Energy Outlook 2016

Natural gas generation falls through 2021; both 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

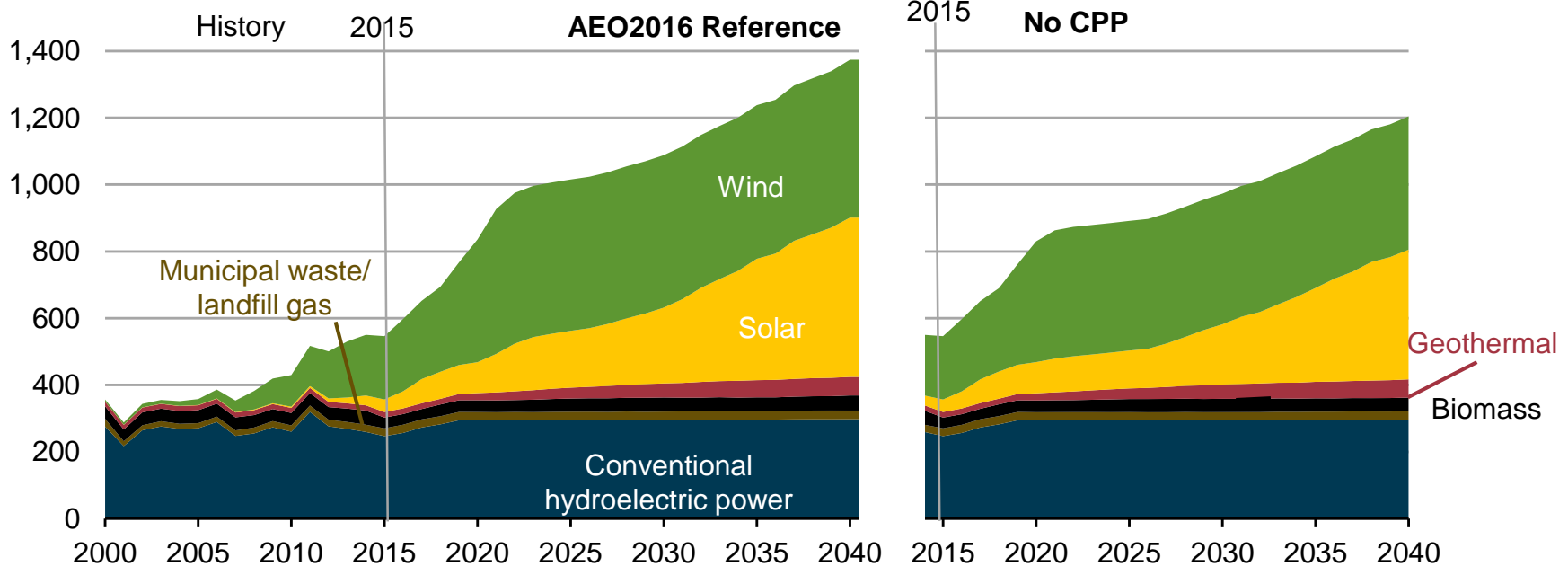


Source: EIA, Annual Energy Outlook 2016

Changing tax and cost assumptions contribute to stronger solar growth, with the Clean Power Plan providing a boost to renewables

renewable electricity generation by fuel type

billion kilowatthours

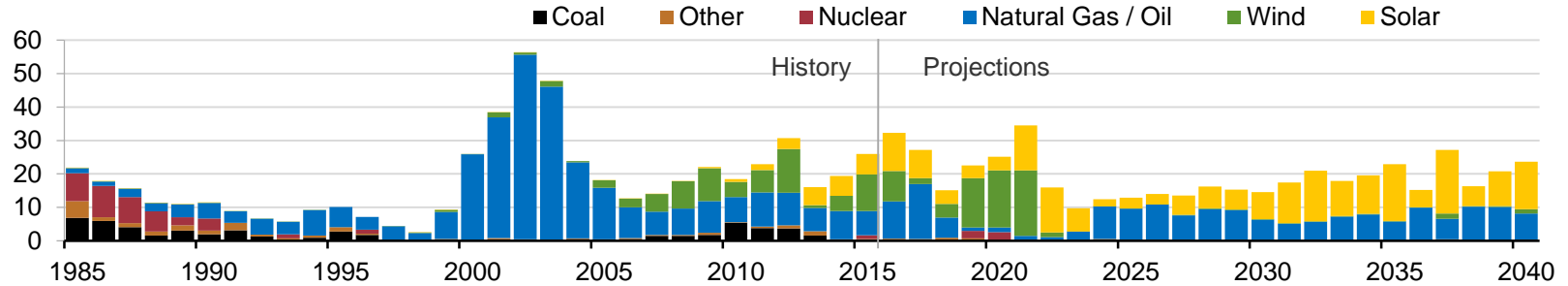


Source: EIA, Annual Energy Outlook 2016

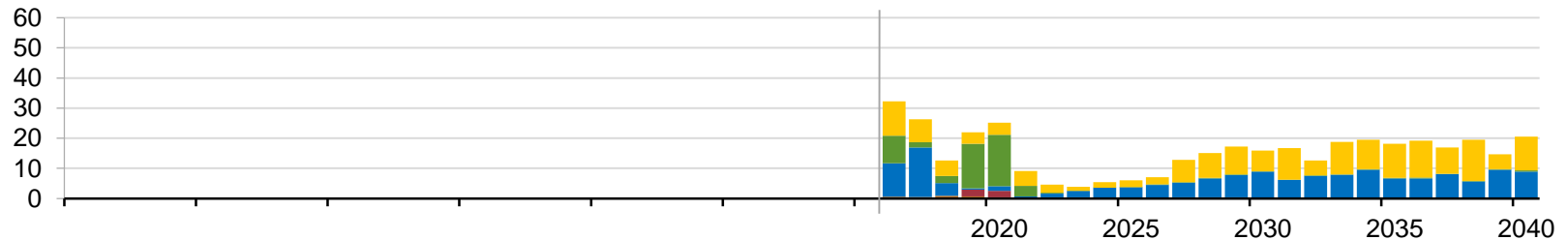
Lower costs and extension of renewable tax credits boost projected additions of wind and solar capacity prior to the 2022 effective date of the Clean Power Plan (CPP)

annual capacity additions, gigawatts

AEO2016 Reference



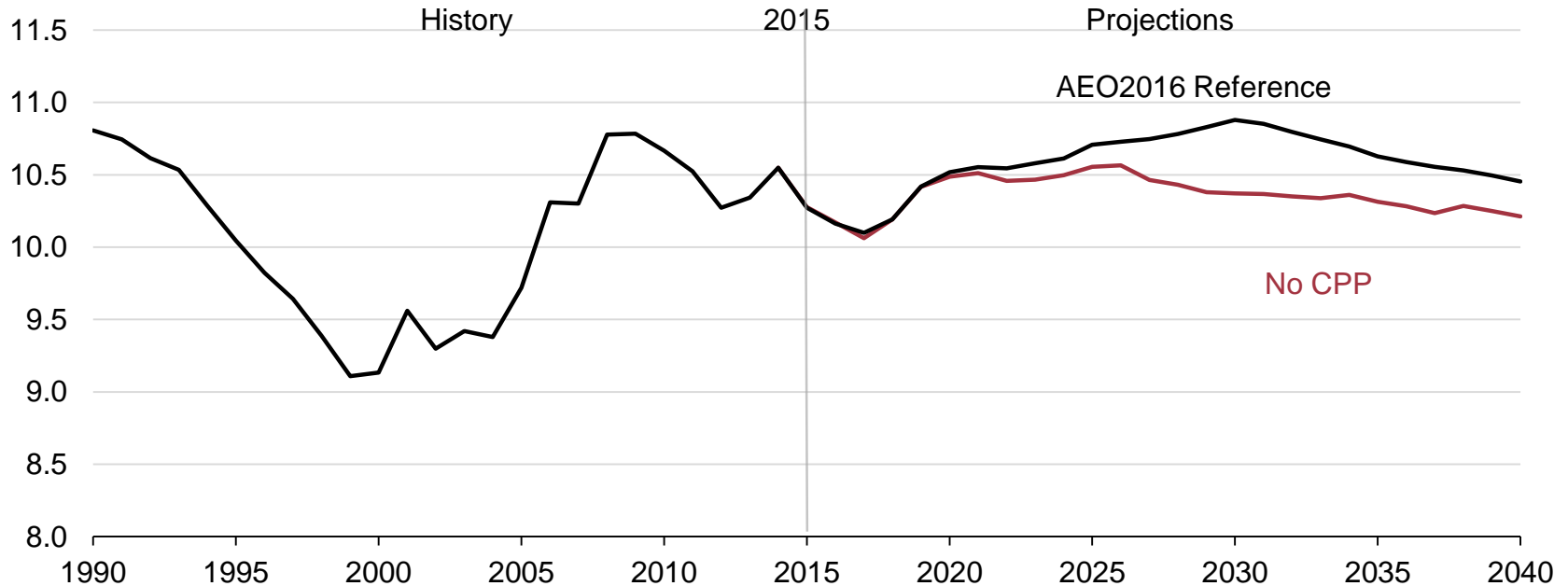
No CPP



Source: EIA, Annual Energy Outlook 2016

Reference case electricity prices average 3% above the No CPP case from 2025-30; this result may vary with different Clean Power Plan (CPP) implementation approaches

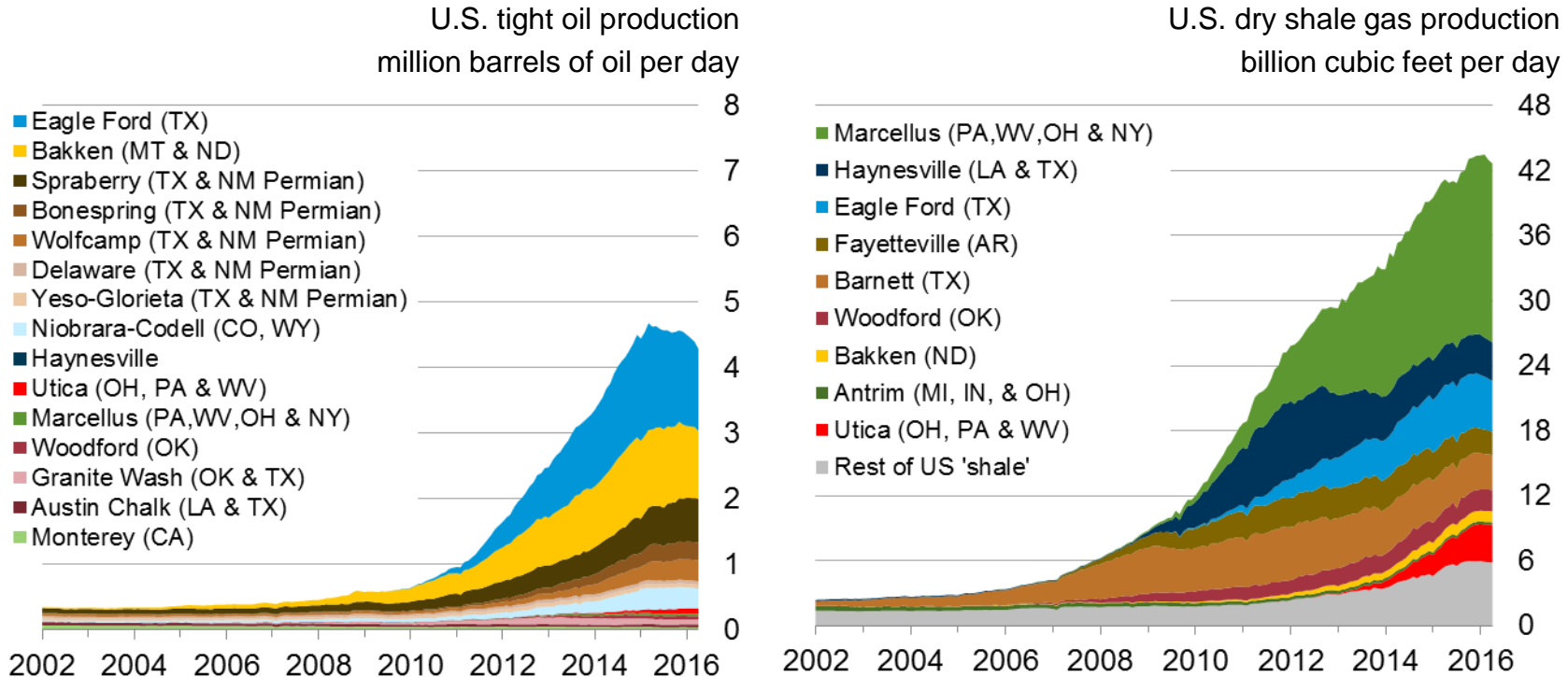
average electricity price
2015 cents per kilowatthour



Source: EIA, Annual Energy Outlook 2016

Petroleum and Natural Gas

The U.S. has experienced a rapid increase in natural gas and oil production from shale and other tight resources

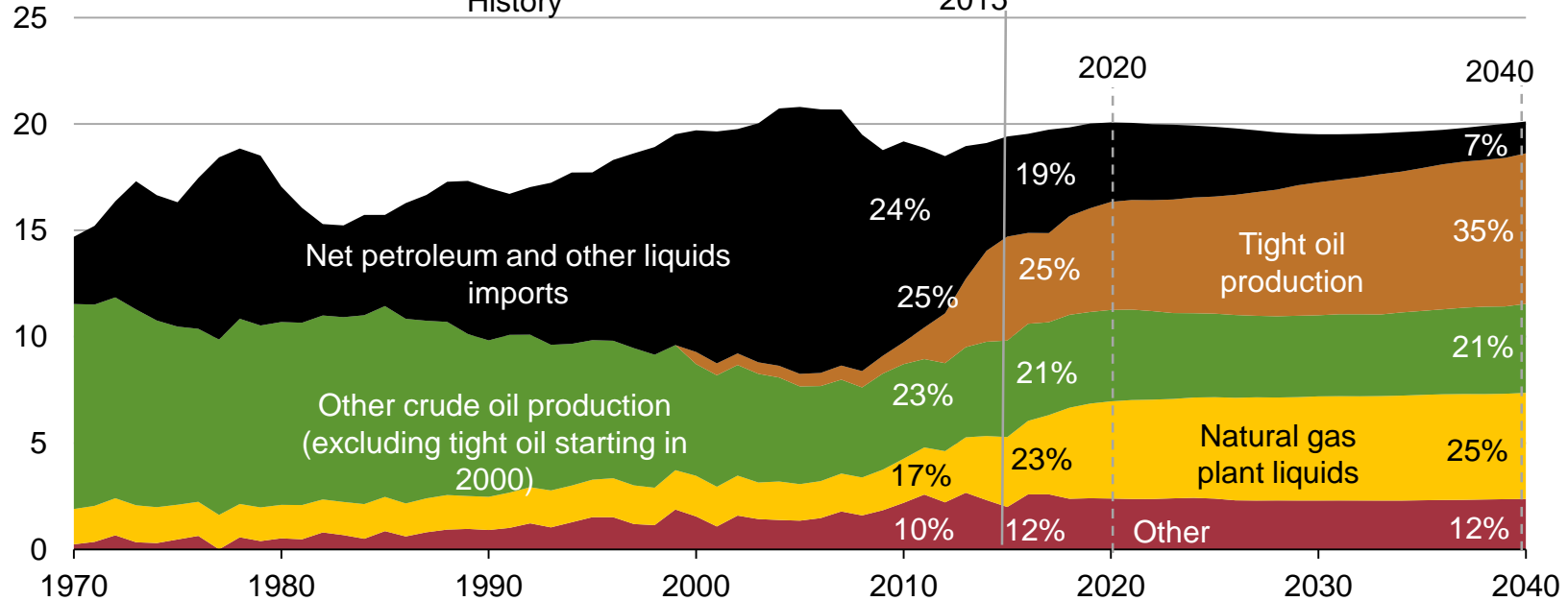


Sources: EIA derived from state administrative data collected by DrillingInfo Inc. Data are through April 2016 and represent EIA's official tight oil & shale gas estimates, but are not survey data. State abbreviations indicate primary state(s). Note: Scales are presented at approximate barrel of oil equivalent.

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



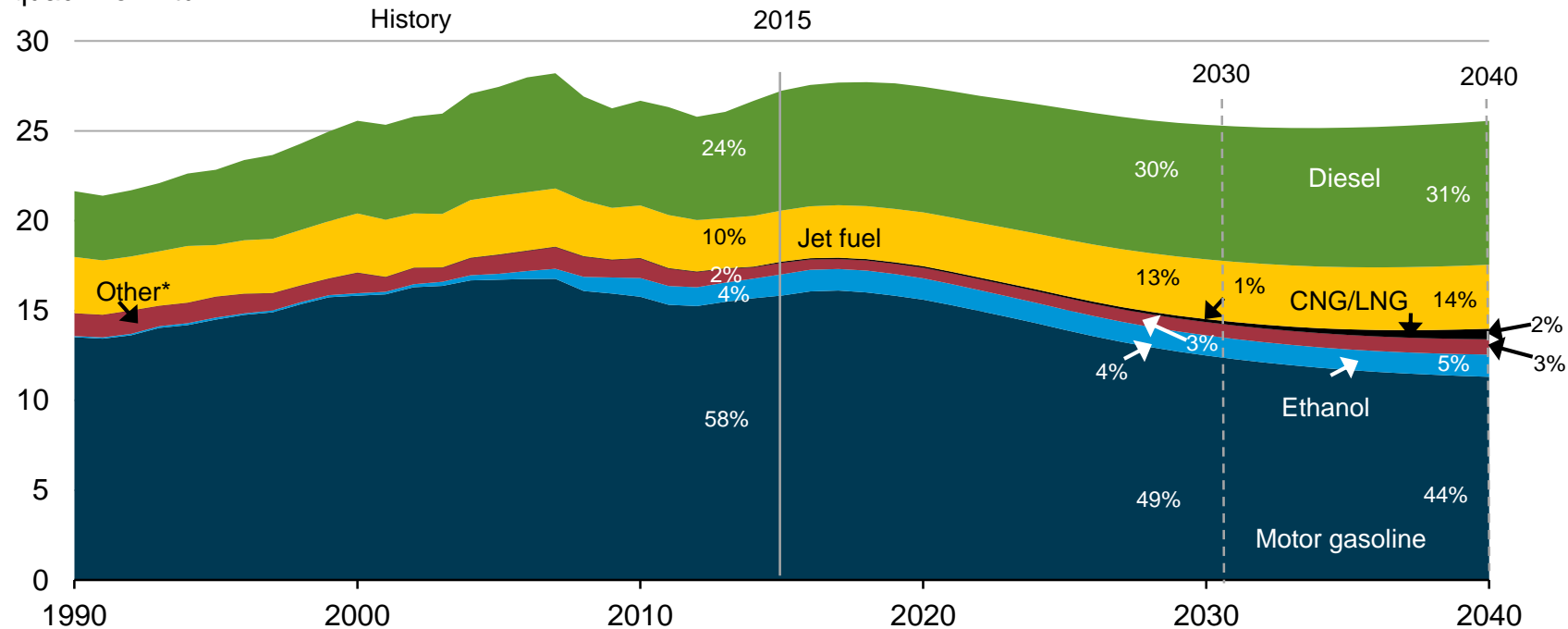
Note: "Other" includes refinery gain, biofuels production, all stock withdrawals, and other domestic sources of liquid fuels

Source: EIA, Annual Energy Outlook 2016

In the transportation sector, motor gasoline use declines; diesel fuel, jet fuel, and natural gas use all grow

transportation energy consumption by fuel

quadrillion Btu



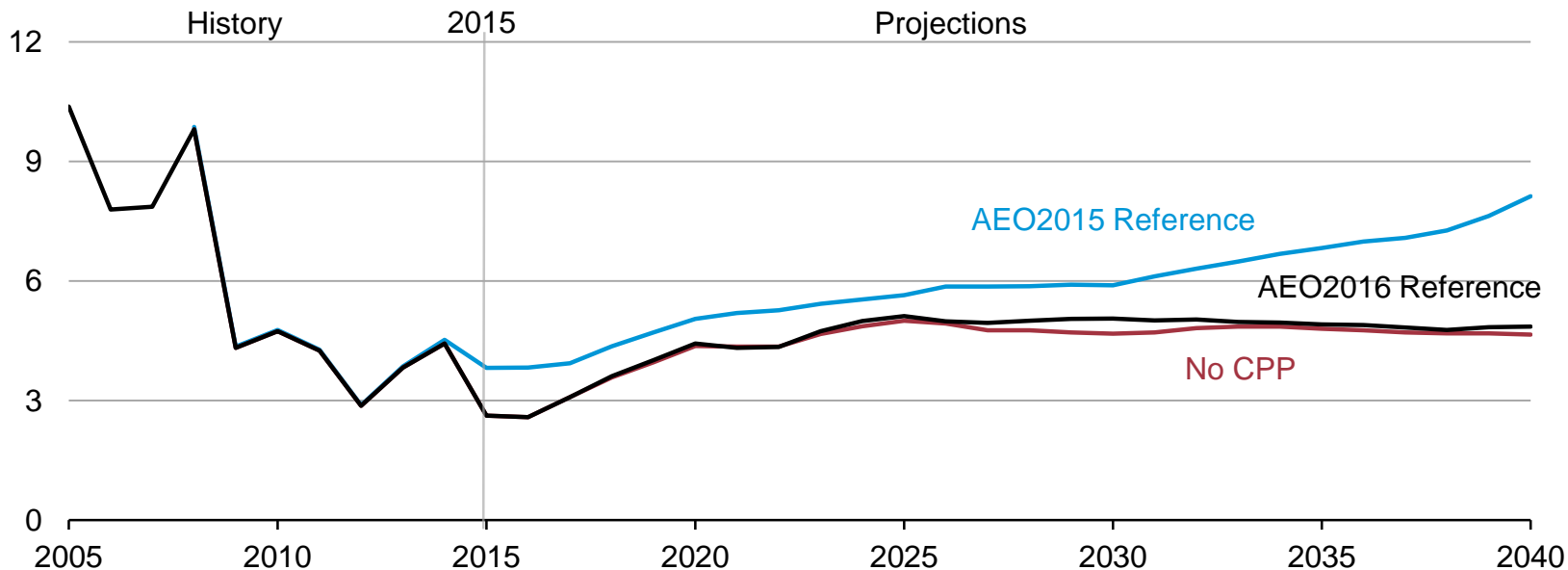
Source: EIA, Annual Energy Outlook 2016

*Includes aviation gasoline, propane, residual fuel oil, lubricants, electricity, and liquid hydrogen

Natural gas prices are projected to remain below \$5 per million British thermal units through most of the projection period with or without the Clean Power Plan

average Henry Hub spot prices for natural gas

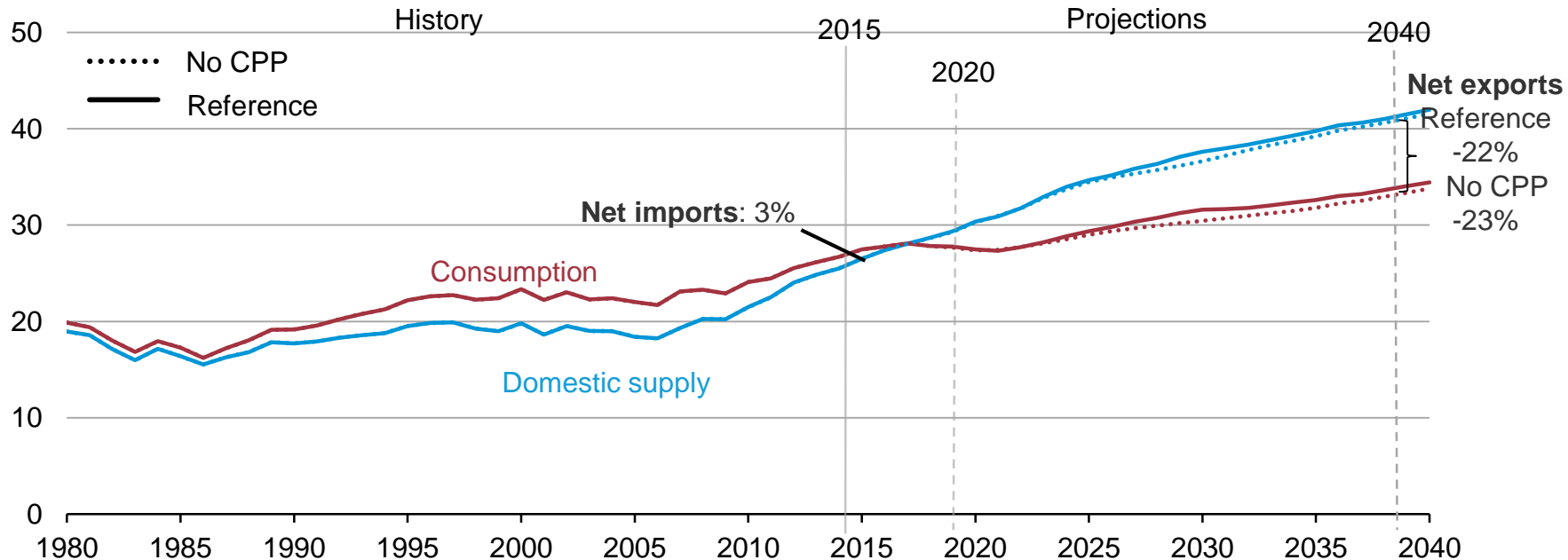
2015 dollars per million Btu



Source: EIA, Annual Energy Outlook 2016

U.S. natural gas production exceeds consumption, making the United States a net exporter of natural gas in the very near future

U.S. energy production and consumption
quadrillion Btu

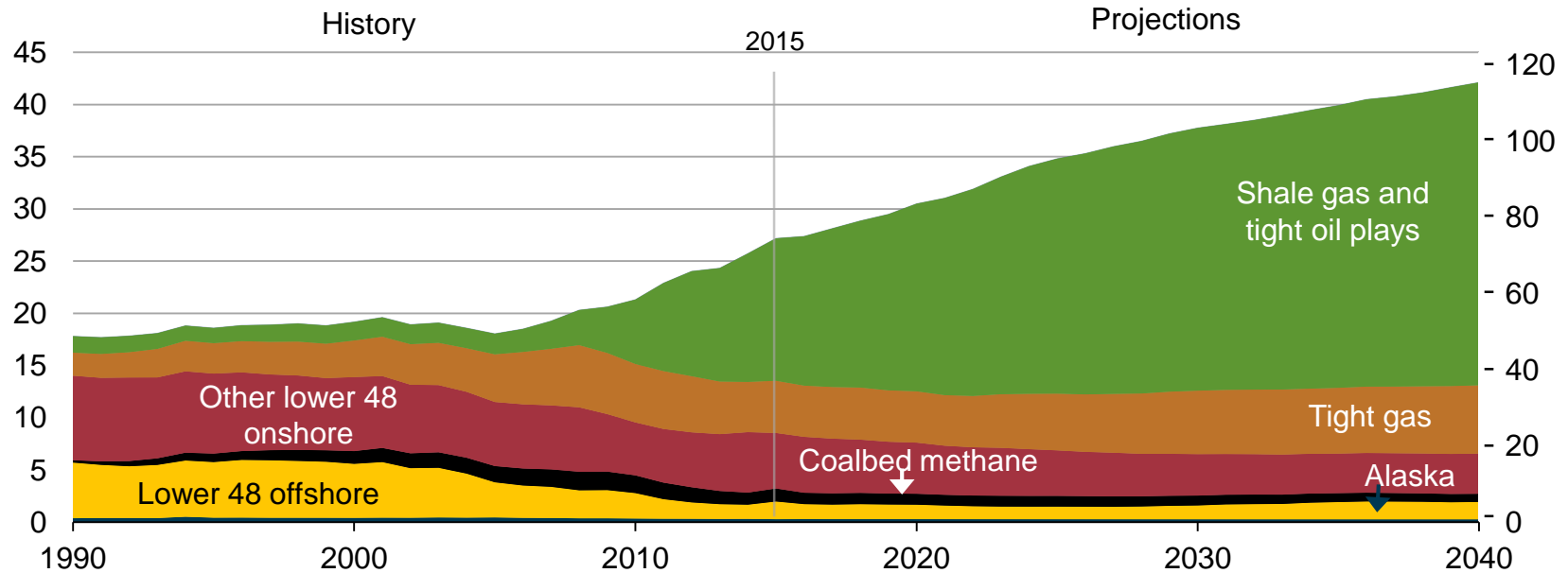


Source: EIA, Annual Energy Outlook 2016

Shale resources remain the dominant source of U.S. natural gas production growth

U.S. dry natural gas production
trillion cubic feet

AEO2016 Reference

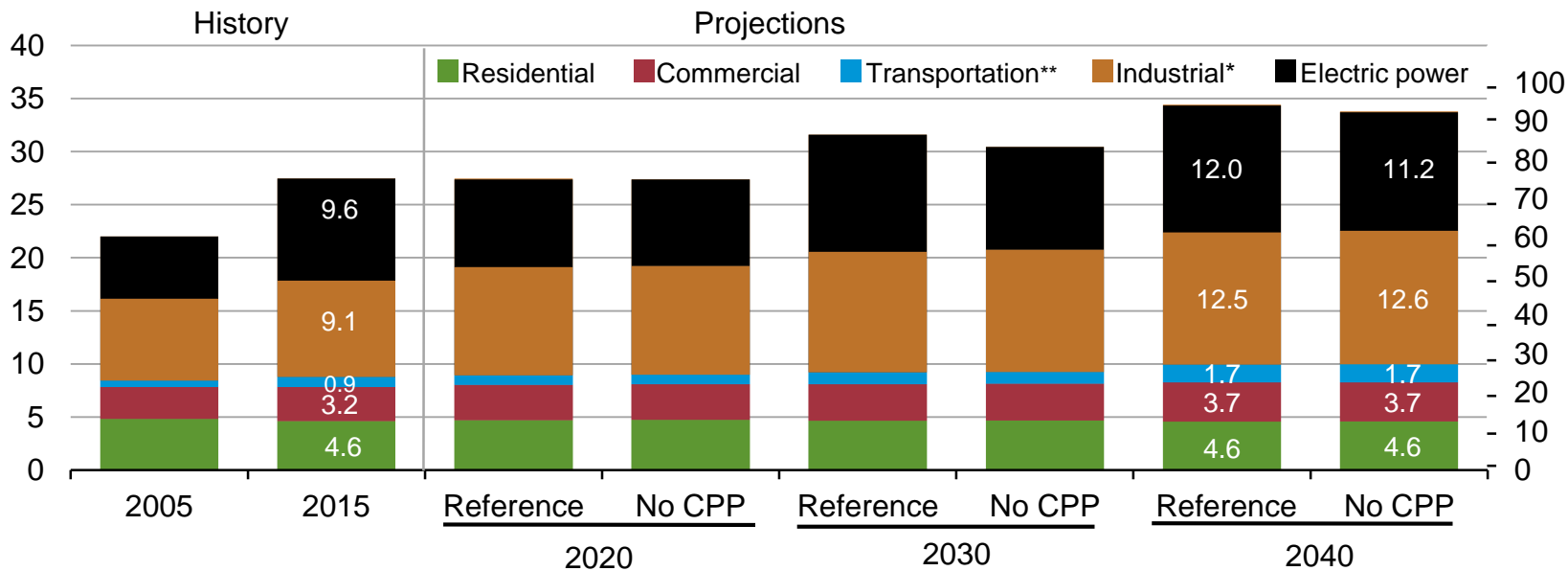


Source: EIA, Annual Energy Outlook 2016

Natural gas consumption growth is led by electricity generation and industrial uses; natural gas use rises in all sectors except residential

U.S. dry gas consumption
trillion cubic feet

billion cubic feet per day



Source: EIA, Annual Energy Outlook 2016

*Includes combined heat-and-power and lease, plant, and export liquefaction fuel
**Includes pipeline fuel

International Energy Outlook

Key findings in the IEO2016 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.

Key findings in the IEO2016 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.

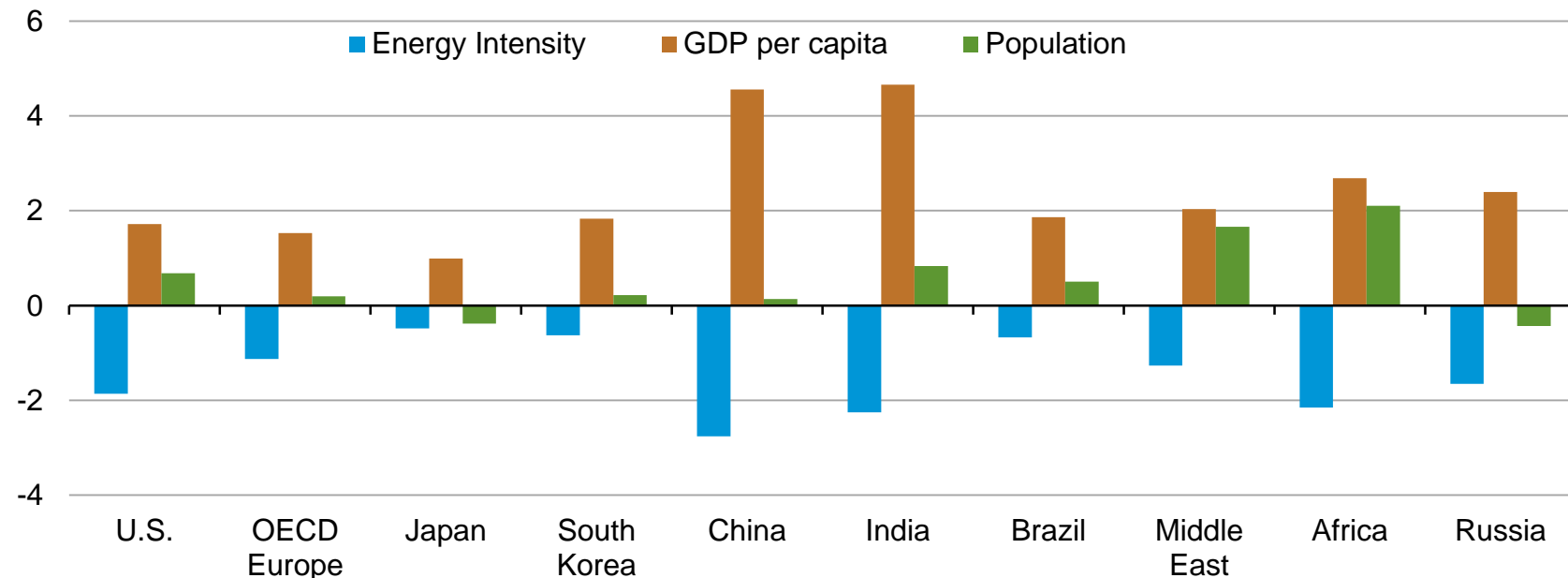
Many global issues increase uncertainty...

- Economic growth in key economies (China, Brazil, Russia, among others)
- Implementation and strength of climate policies
- Technology improvement rates (both supply and demand)
- Unrest in oil producing countries
- OPEC production
- Future of nuclear generating capacity

Economic activity and population drive increases in energy use; energy intensity (E/GDP) improvements moderate this trend

average annual percent change (2012–40)

percent per year

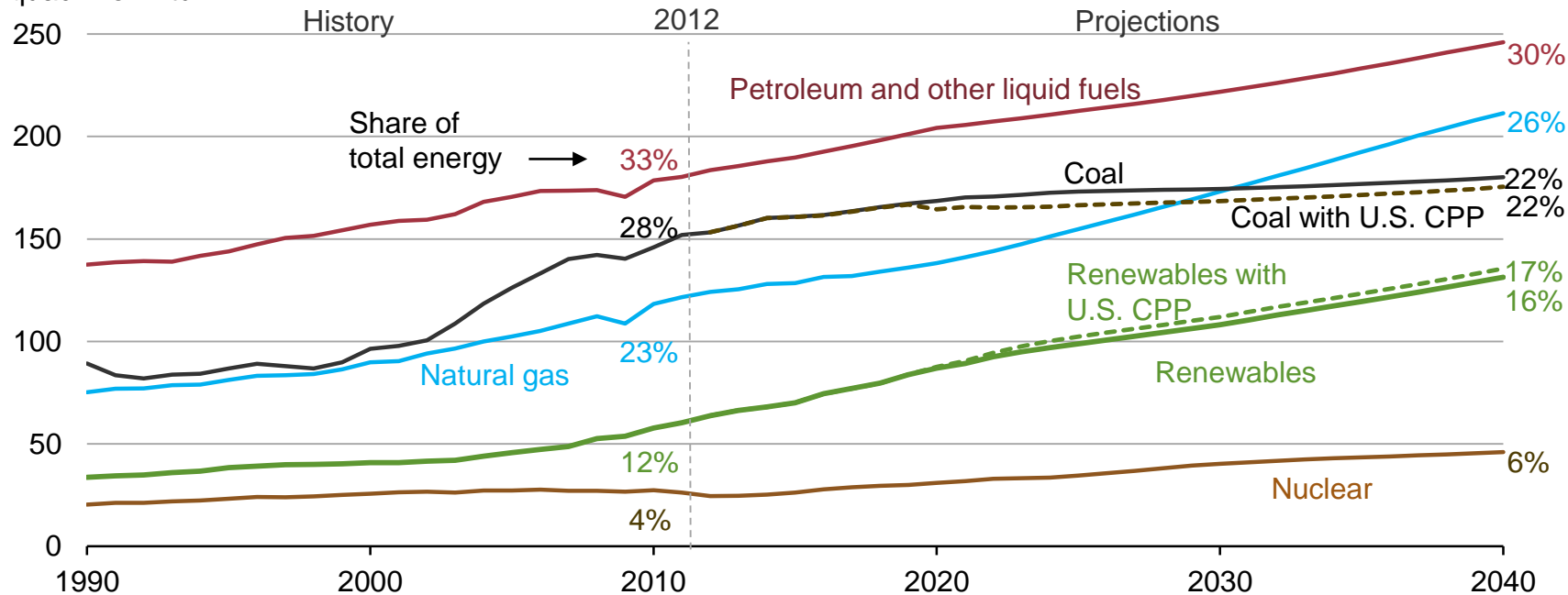


Source: EIA, International Energy Outlook 2016

Renewables grow fastest, coal use plateaus, natural gas surpasses coal by 2030, and oil maintains its leading share

world energy consumption

quadrillion Btu

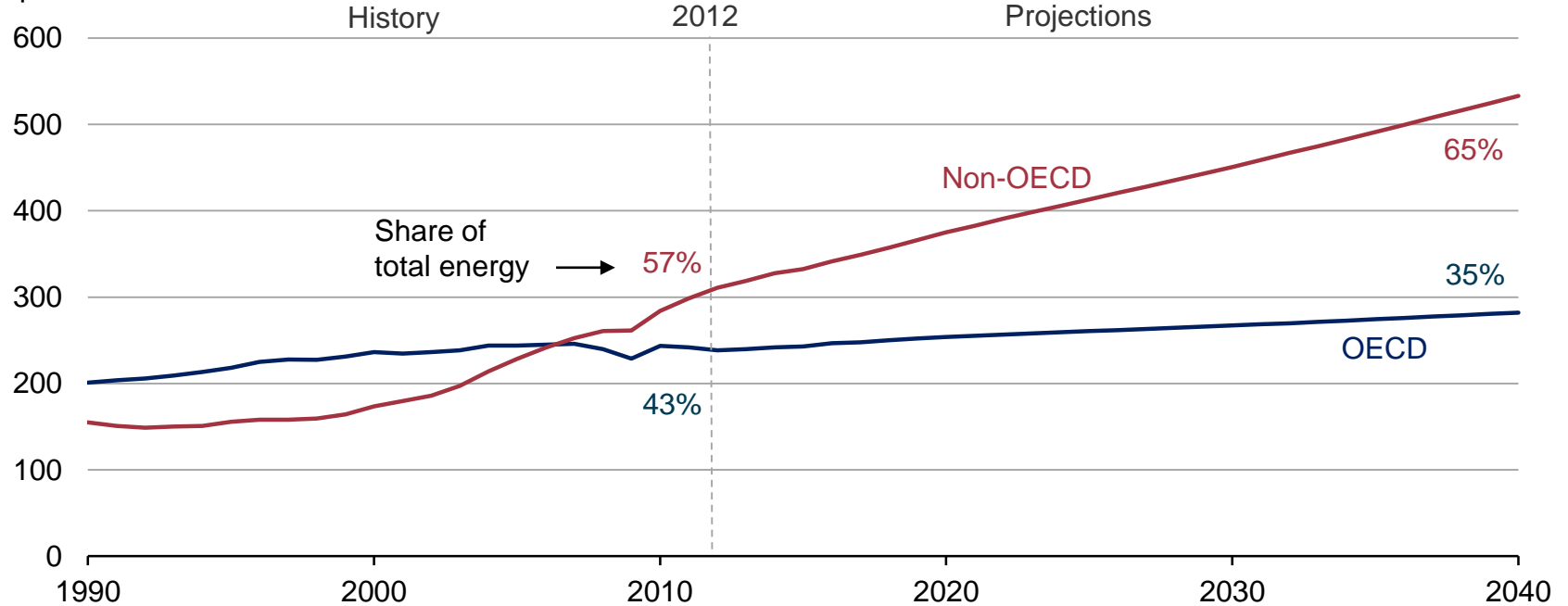


Source: EIA, International Energy Outlook 2016 and EIA, Analysis of the Impacts of the Clean Power Plan (May 2015)

Non-OECD nations drive the increase in total energy use

world energy consumption

quadrillion Btu

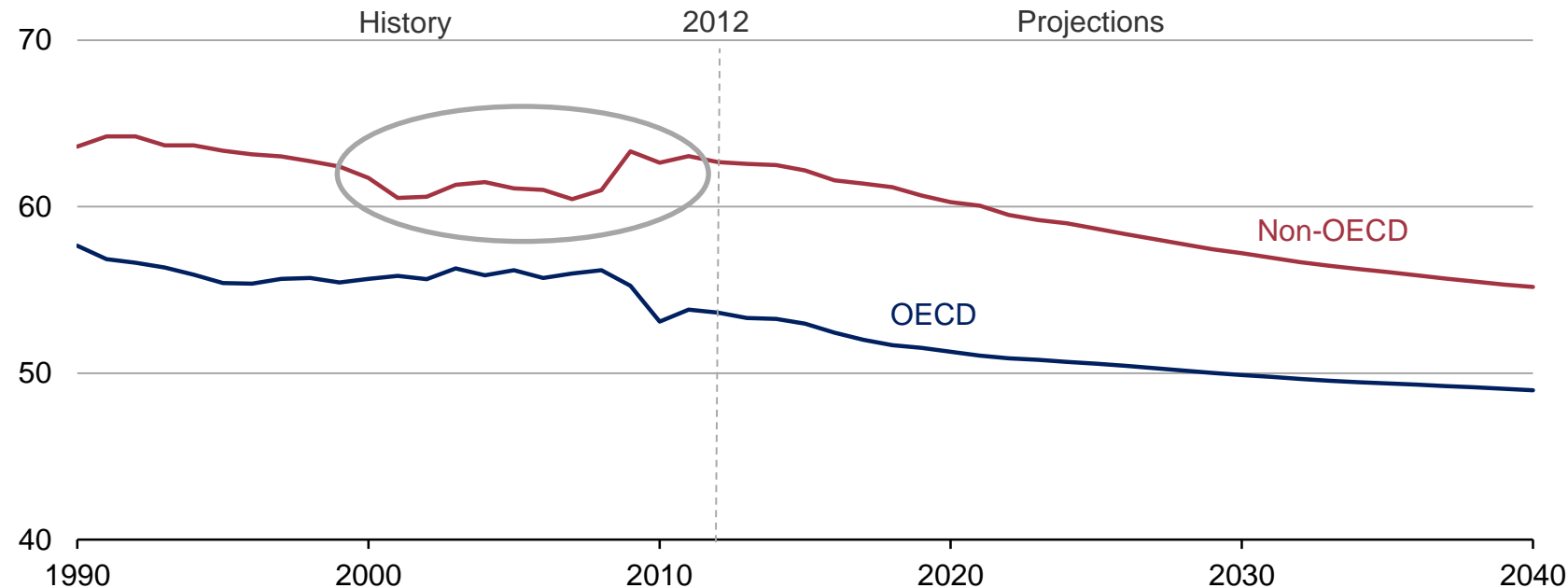


Source: EIA, International Energy Outlook 2016

Projected carbon intensity of energy use (CO₂/E) declines through 2040 in both OECD and non-OECD; non-OECD CO₂/E rose over 2000–12

carbon intensity of energy consumption, 1990-2040

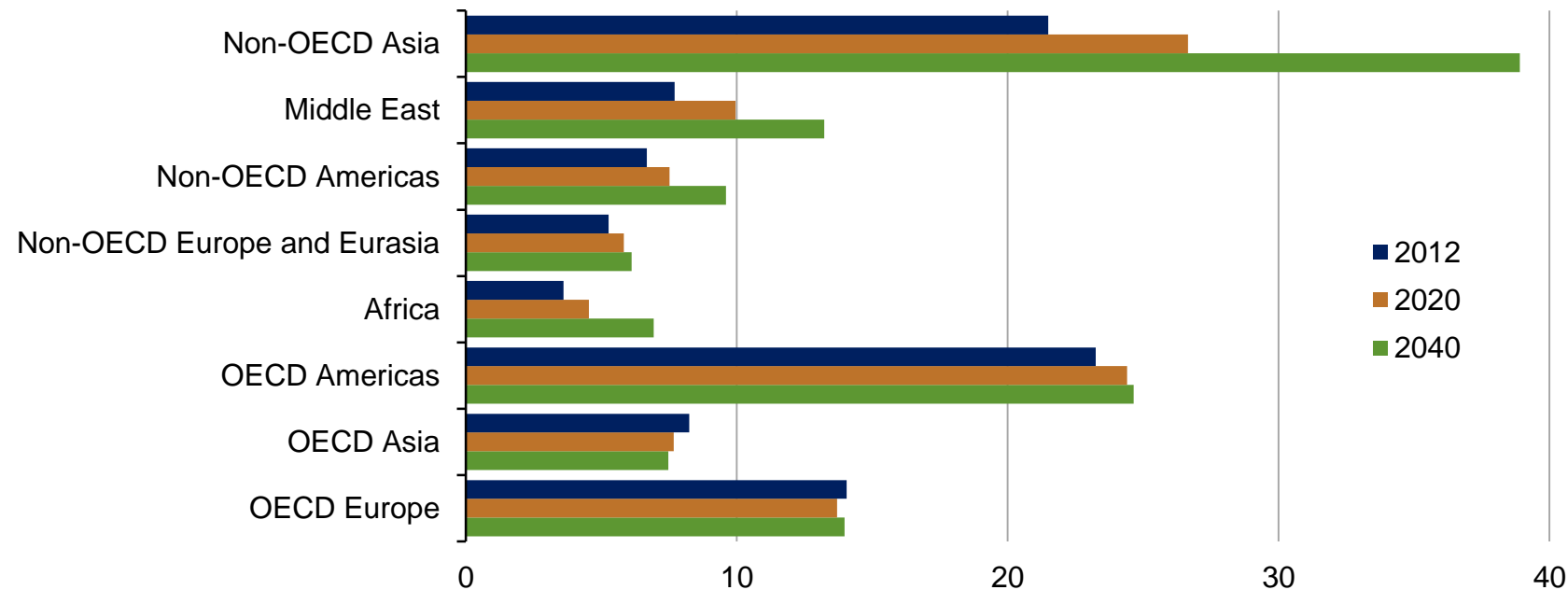
kilograms CO₂ per million Btu



Source: EIA, *International Energy Outlook 2016*

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

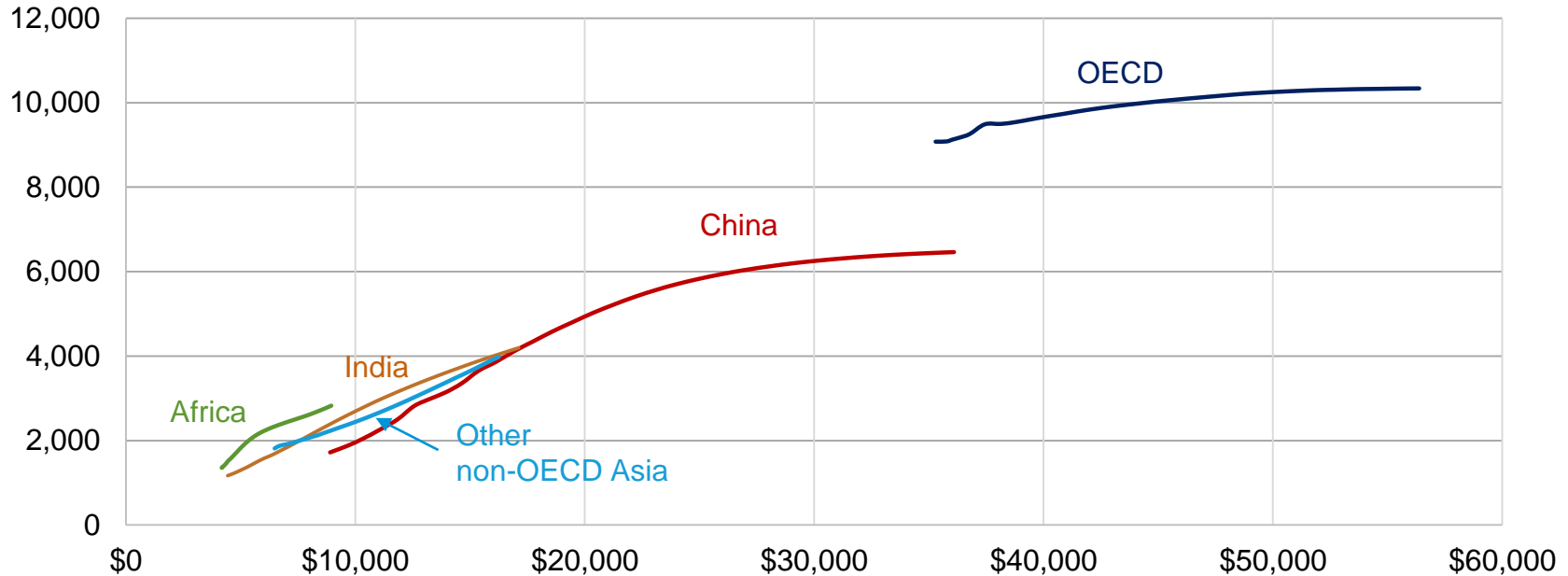
world petroleum and other liquid fuels consumption
million barrels per day



Source: EIA, *International Energy Outlook 2016*

Passenger-miles per person will rise as GDP per capita grows; travel growth is largely outside the OECD

passenger-miles per capita (left-axis) and GDP per capita (horizontal-axis) for selected country groupings 2010–40

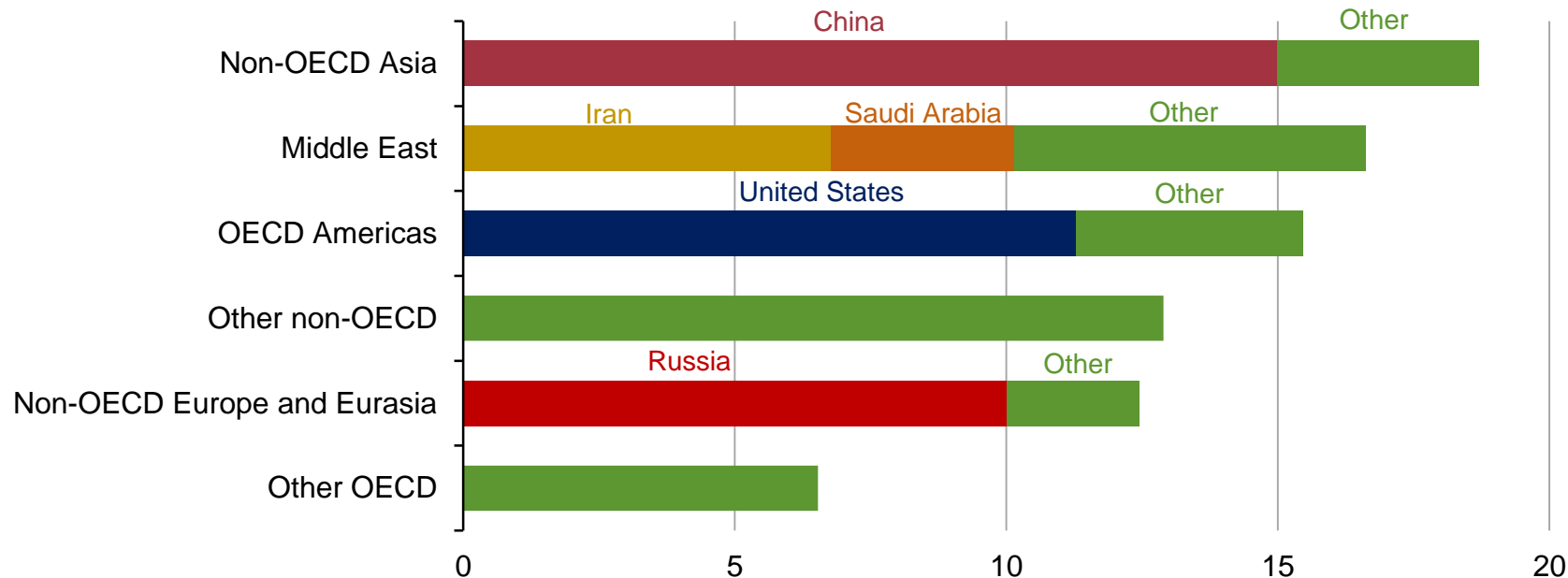


Source: EIA, *International Energy Outlook 2016*

Non-OECD Asia, Middle East, and OECD Americas account for the largest increases in natural gas production

world change in natural gas production, 2012–40

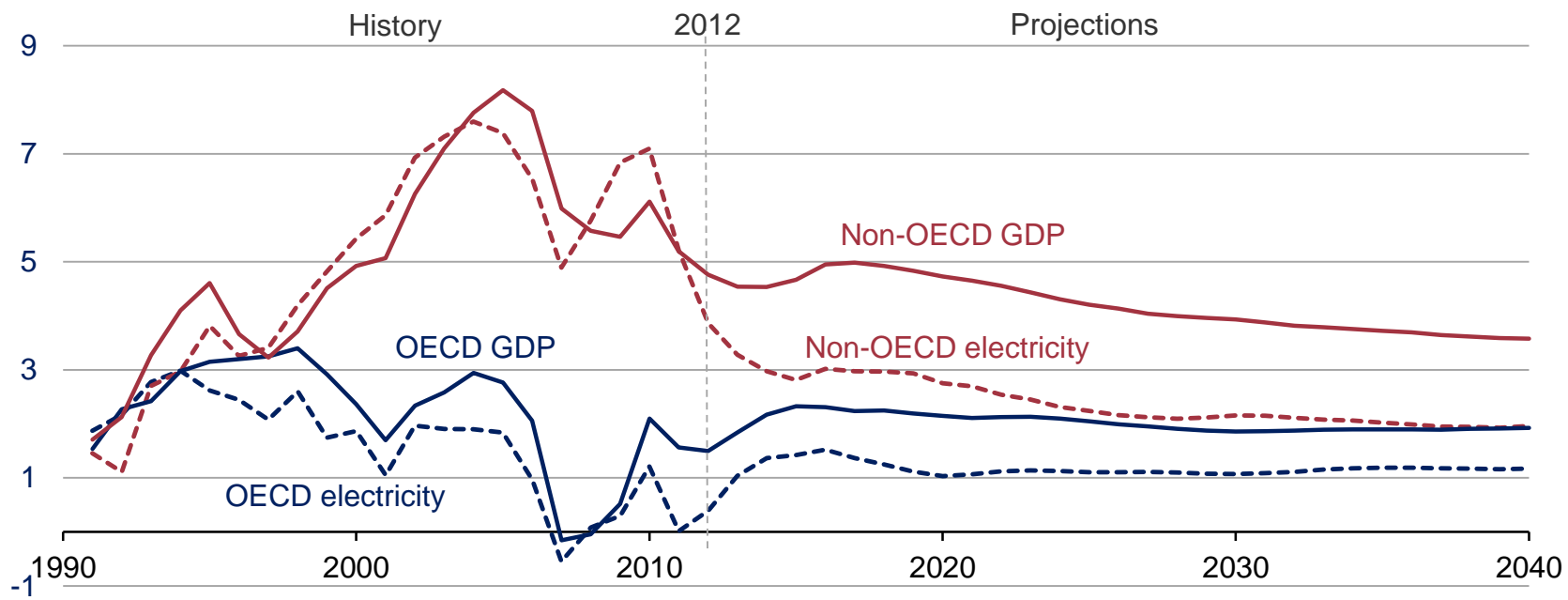
trillion cubic feet



Source: EIA, *International Energy Outlook 2016*

GDP drives electricity demand growth, but the electricity growth rate compared to the GDP growth rate becomes smaller over time

world GDP and net electricity generation
percent growth (rolling average of 3-year periods)

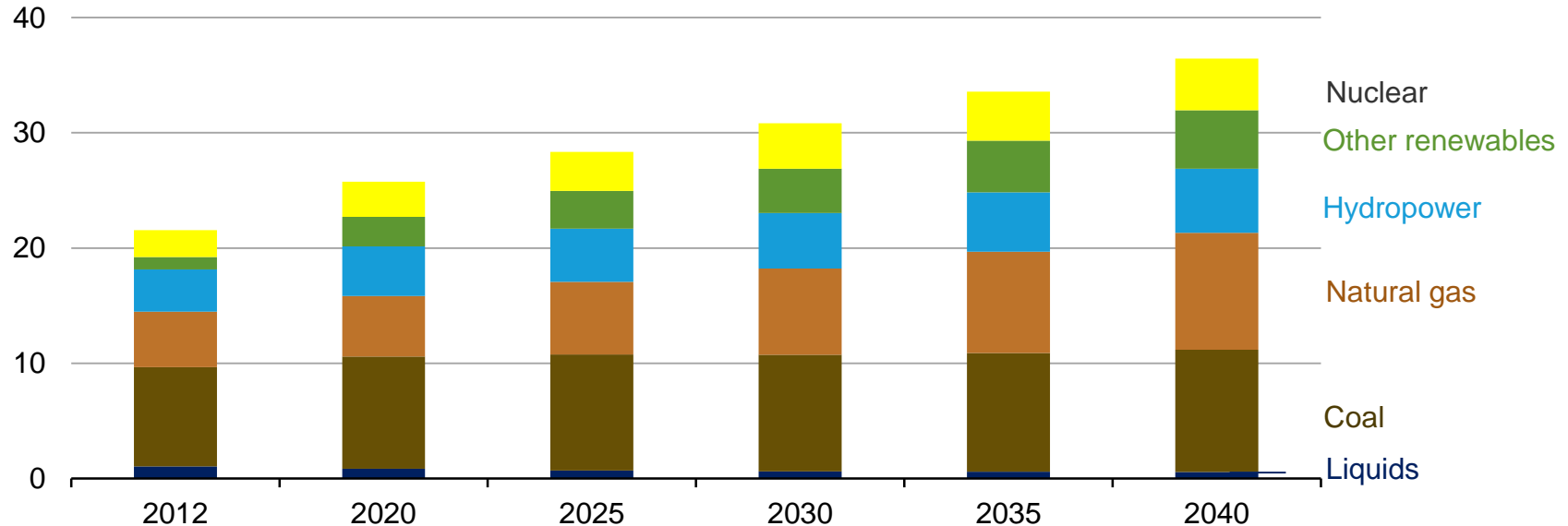


Source: EIA, International Energy Outlook 2016

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

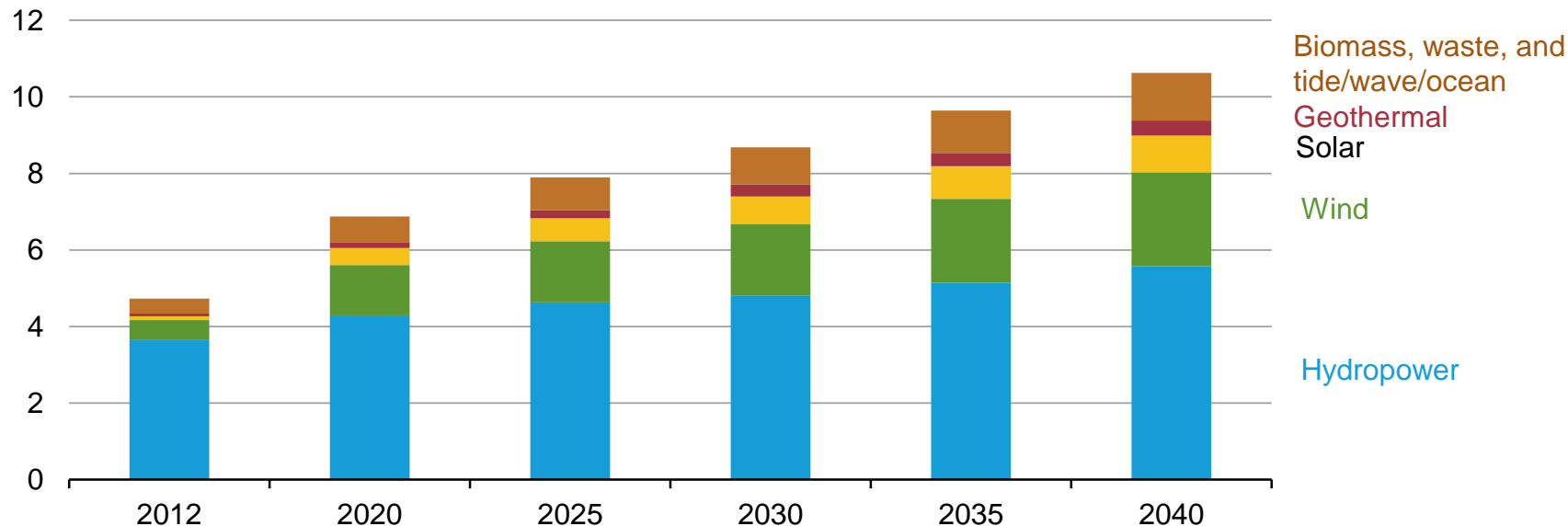


Source: EIA, International Energy Outlook 2016

Wind and hydropower each account for one third of the increase in renewable generation; solar is fastest-growing (8.3%/year)

world net electricity generation from renewable energy by source

trillion kilowatthours

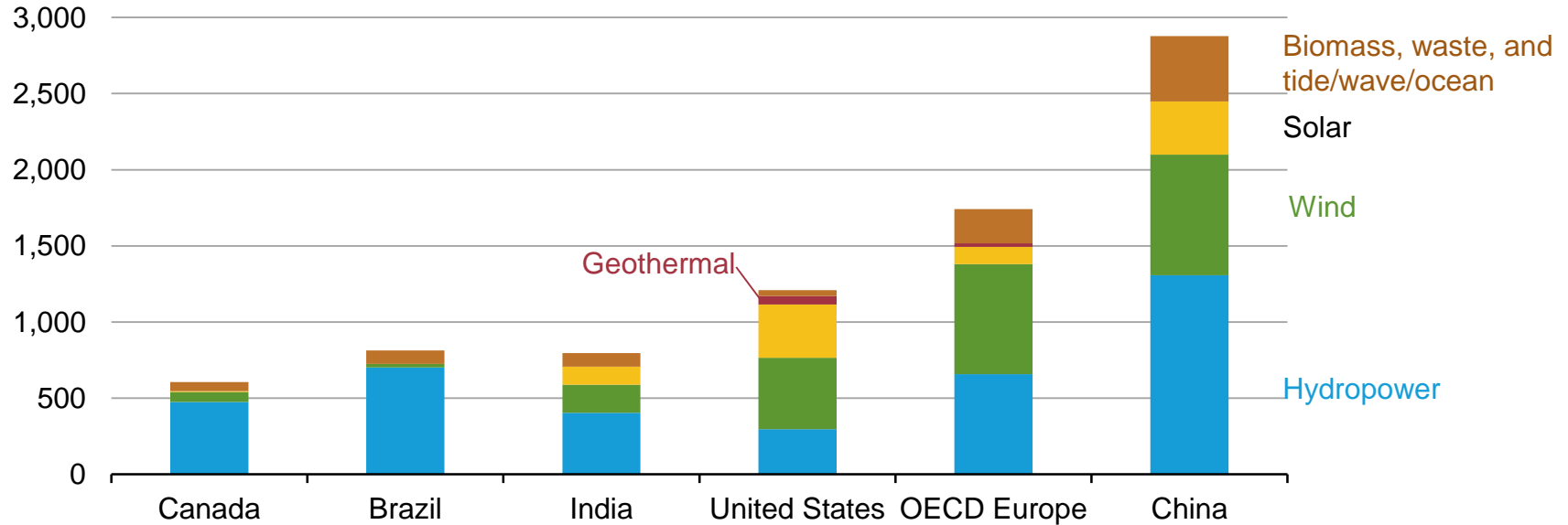


Source: EIA, International Energy Outlook 2016

Geographically, the scale and fuel mix of renewable generation in 2040 varies widely

renewable net electricity generation by selected country and country grouping, 2040

billion kilowatthours



Source: EIA, International Energy Outlook 2016 except United States, which is from the Annual Energy Outlook 2016 Reference case

For more information

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

Annual Energy Outlook | www.eia.gov/aeo

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

International Energy Outlook | www.eia.gov/ieo

Monthly Energy Review | www.eia.gov/mer

Today in Energy | www.eia.gov/todayinenergy

State Energy Profiles | www.eia.gov/state

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

International Energy Portal | www.eia.gov/beta/international/?src=home-b1