The Big Picture: An Overview of Energy Use and Supply

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by
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Major takeaways

Based on EIA's Reference case projections to 2040 *in the Annual Energy Outlook 2015 and International Energy Outlook 2013 that generally reflect current policies, including final regulations and the sunset of tax credits under current law:*

United States

- With reliance on fossil fuels, U.S. energy consumption grows modestly with reductions in energy intensity resulting from improved technologies and trends driven by existing laws and regulations – notably in transportation
- U.S. energy production grows substantially – led by increasing shale gas and tight oil production – that contributes to lower reliance on energy imports
- Renewables provide an increased share of electricity generation, reflecting rising long-term natural gas prices and the high capital costs of new coal and nuclear generation capacity
- Improved efficiency of energy consumption in end-use sectors and a shift away from more carbon-intensive fuels help to stabilize U.S. energy-related carbon dioxide (CO_2) emissions, which remain below the 2005 level through 2040

Major takeaways (continued)

World View

- World energy consumption increases well over 50 percent. Half of the increase is attributed to China and India
- Electric power generation nearly doubles
- Renewable energy and nuclear power are the world's fastest-growing energy sources; however, fossil fuels continue to supply almost 80 percent of world energy use through 2040
- Natural gas is the fastest growing fossil fuel in the outlook. Coal grows faster than liquid fuel consumption until after 2030, mostly due to increases in China's consumption of coal and tepid growth in liquids demand attributed to slow growth in the OECD and high sustained oil prices
- The industrial sector accounts for the largest share of delivered energy consumption, consuming over half of global delivered energy in 2040
- Worldwide energy-related CO_2 emissions increase around 15 percent by 2020 and 45 percent by 2040 from about 31 billion metric tons in 2010

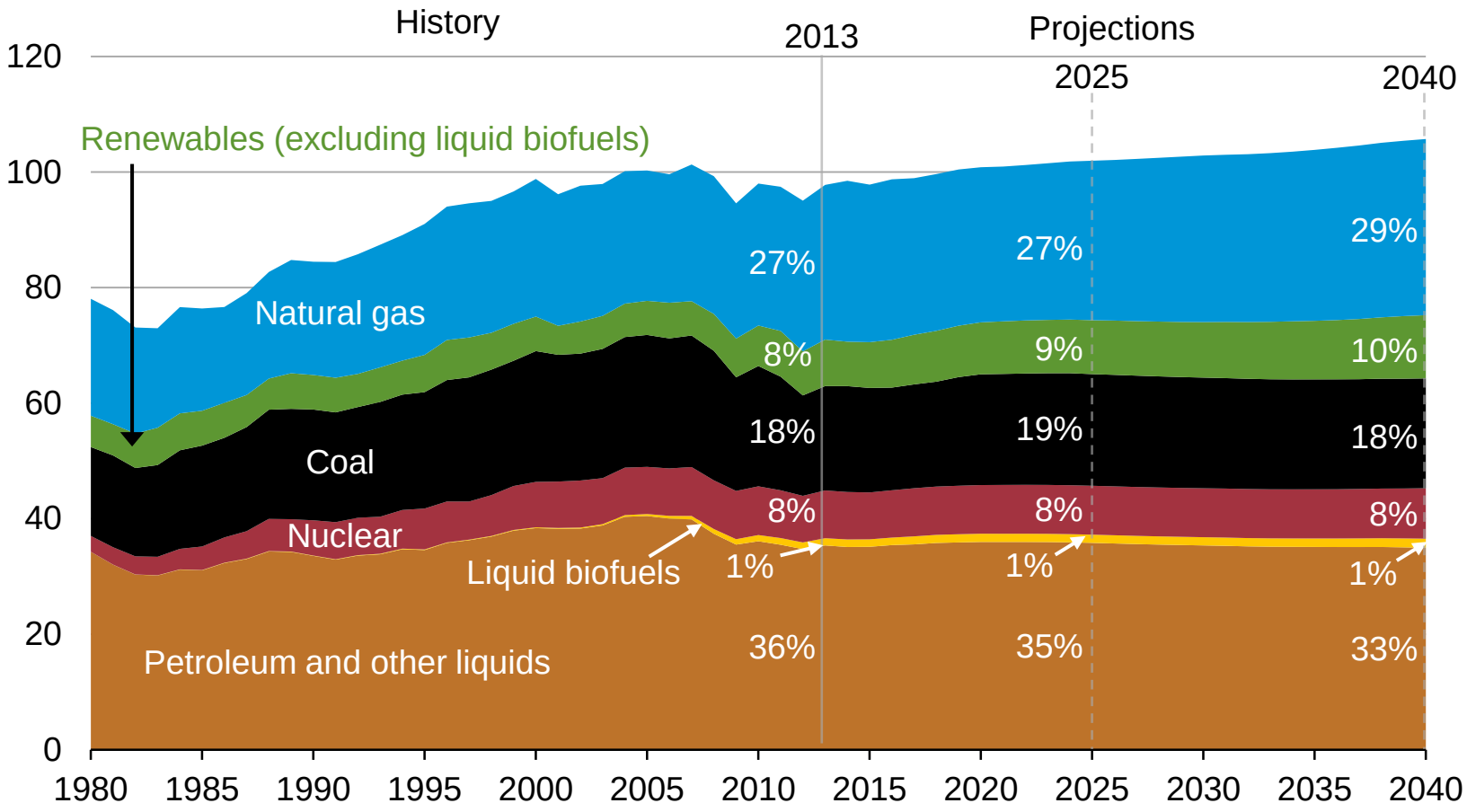
Comparative metrics for energy

- One Btu is approximately equal to the energy released in the burning of a wood match
- **A quadrillion Btu** is 10^15 Btu
- One quadrillion Btu is equal to 172 million barrels of crude oil
- One quadrillion Btu is equal to 500,000 100-ton railroad cars of coal
- A **trillion cubic feet (tcf)** of natural gas equals 1.03 quadrillion Btu
- A **trillion kilowatthours** of electricity equal 3.1 quadrillion Btu
- A **million barrels of oil per day over a year** is equal to 2.1 quadrillion Btu

United States

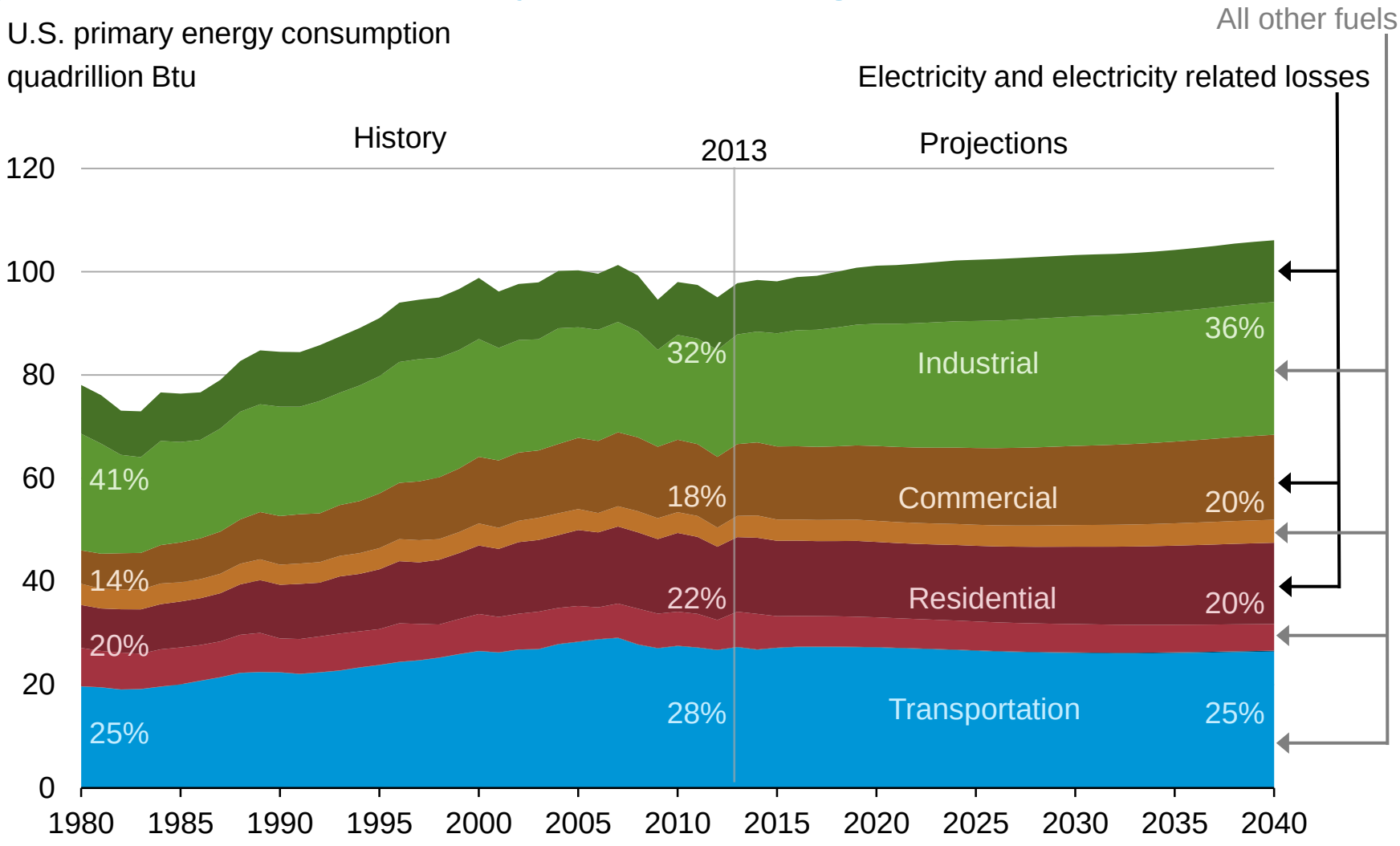
Reductions in energy intensity largely offset impact of GDP growth, leading to slow projected growth in energy use

U.S. primary energy consumption
quadrillion Btu



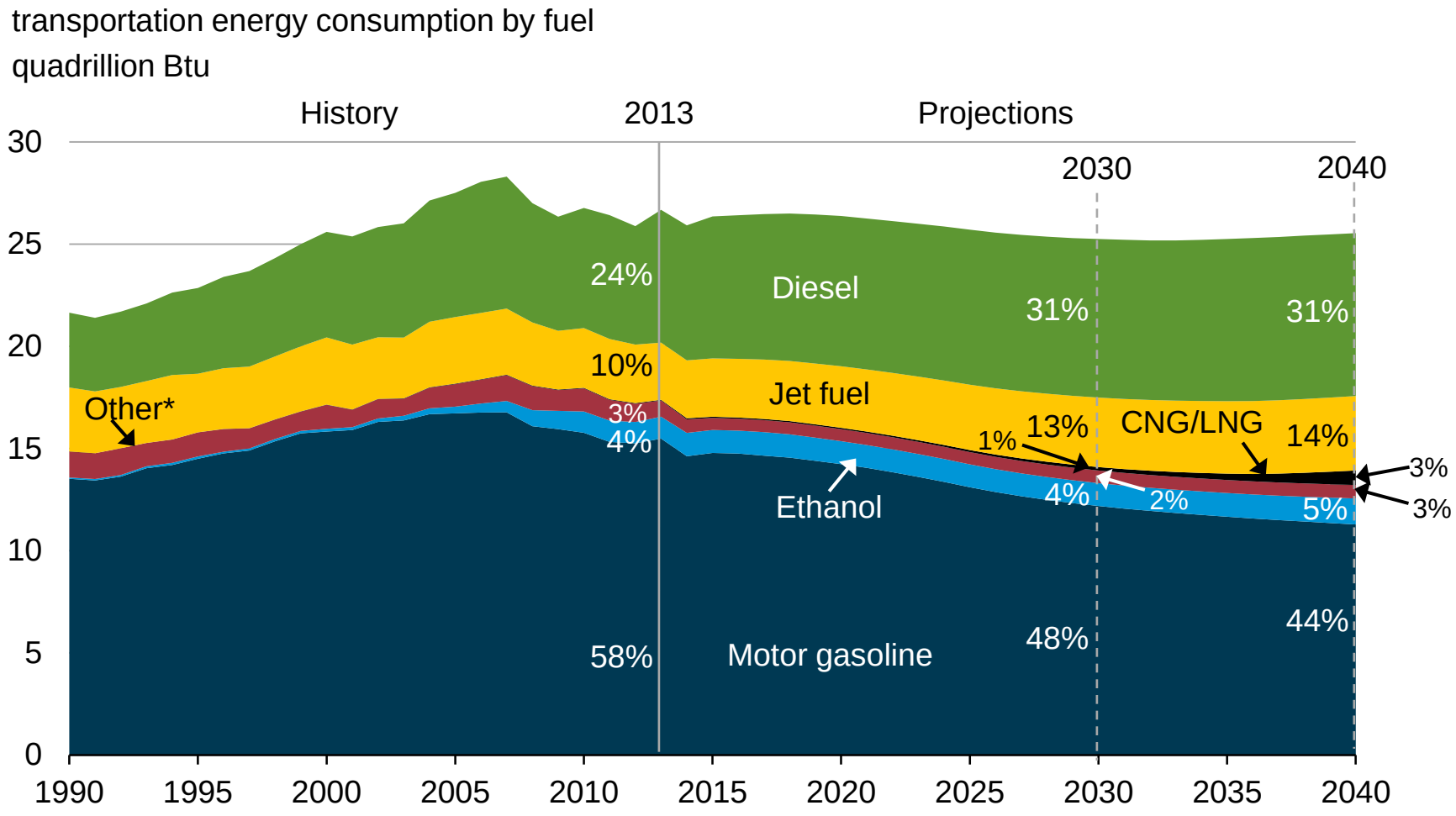
Source: EIA, Annual Energy Outlook 2015 Reference case

Most of U.S. energy use occurs in industry and transportation with major demands for electricity in the buildings and industrial sectors



Source: EIA, Annual Energy Outlook 2015 Reference case

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



Source: EIA, Annual Energy Outlook 2015 Reference case

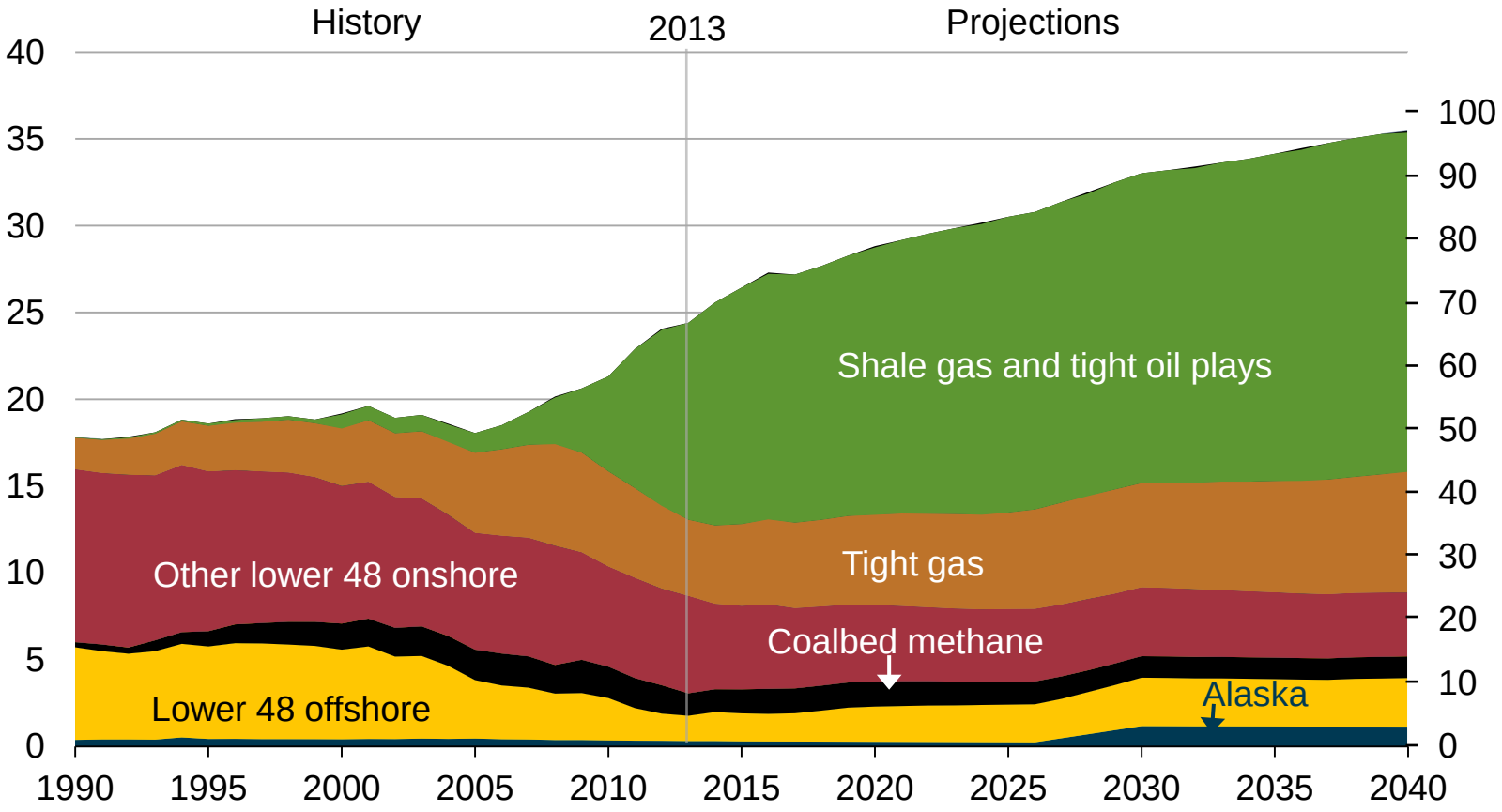
**Includes aviation gasoline, propane, residual fuel oil, lubricants, electricity, and liquid hydrogen*

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

U.S. dry natural gas production

trillion cubic feet

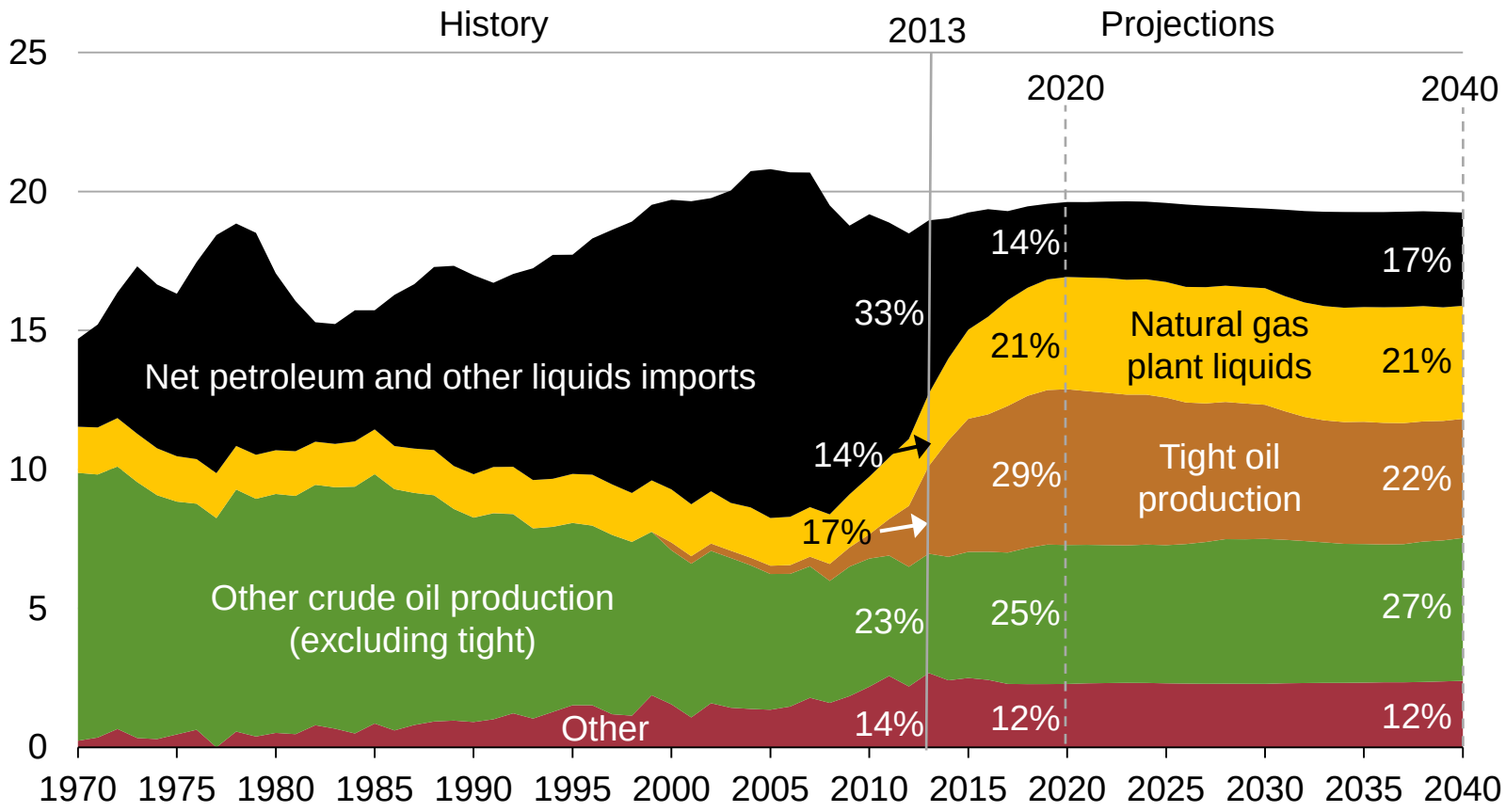
billion cubic feet per day



Source: EIA, Annual Energy Outlook 2015 Reference case

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

U.S. liquid fuels supply
million barrels per day



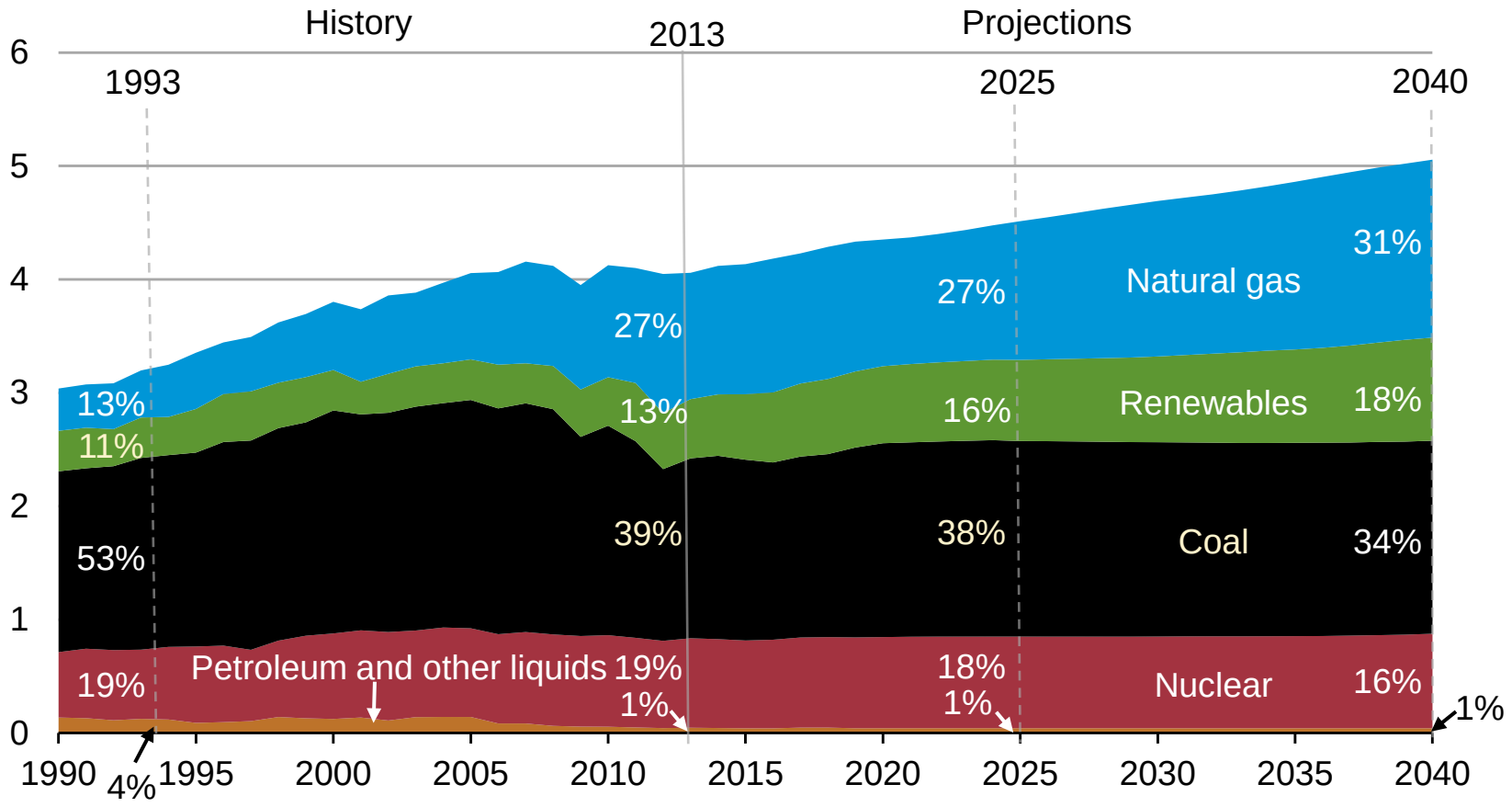
Note: "Other" includes refinery gain, biofuels production, all stock withdrawals, and other domestic sources of liquid fuels

Source: EIA, Annual Energy Outlook 2015 Reference case

Over time the electricity mix gradually shifts to lower-carbon options, led by growth in renewables and gas-fired generation

electricity net generation

trillion kilowatthours

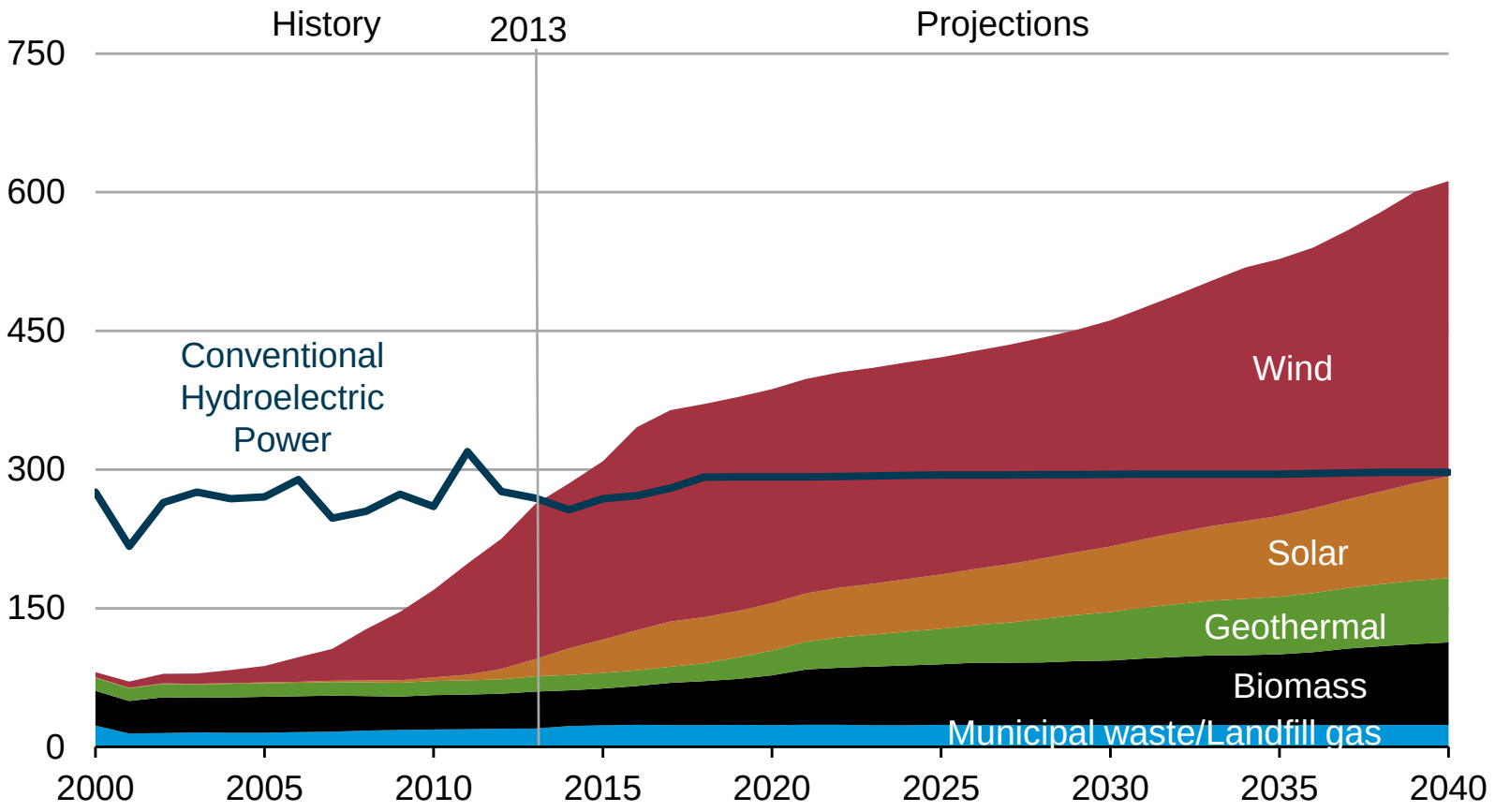


Source: EIA, Annual Energy Outlook 2015 Reference case

Non-hydro renewable generation grows to double hydropower generation by 2040

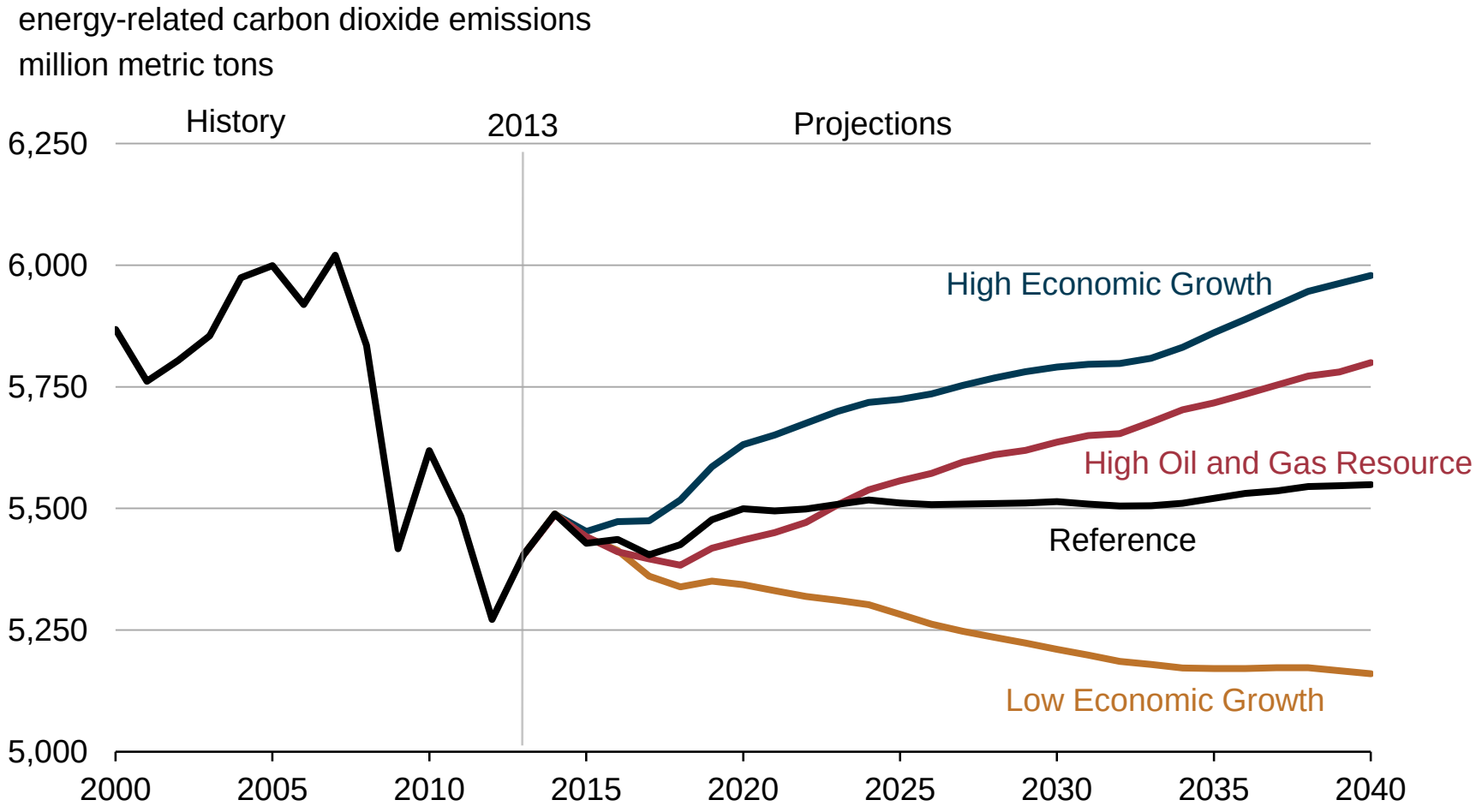
renewable electricity generation by fuel type

billion kilowatthours



Source: EIA, Annual Energy Outlook 2015 Reference case

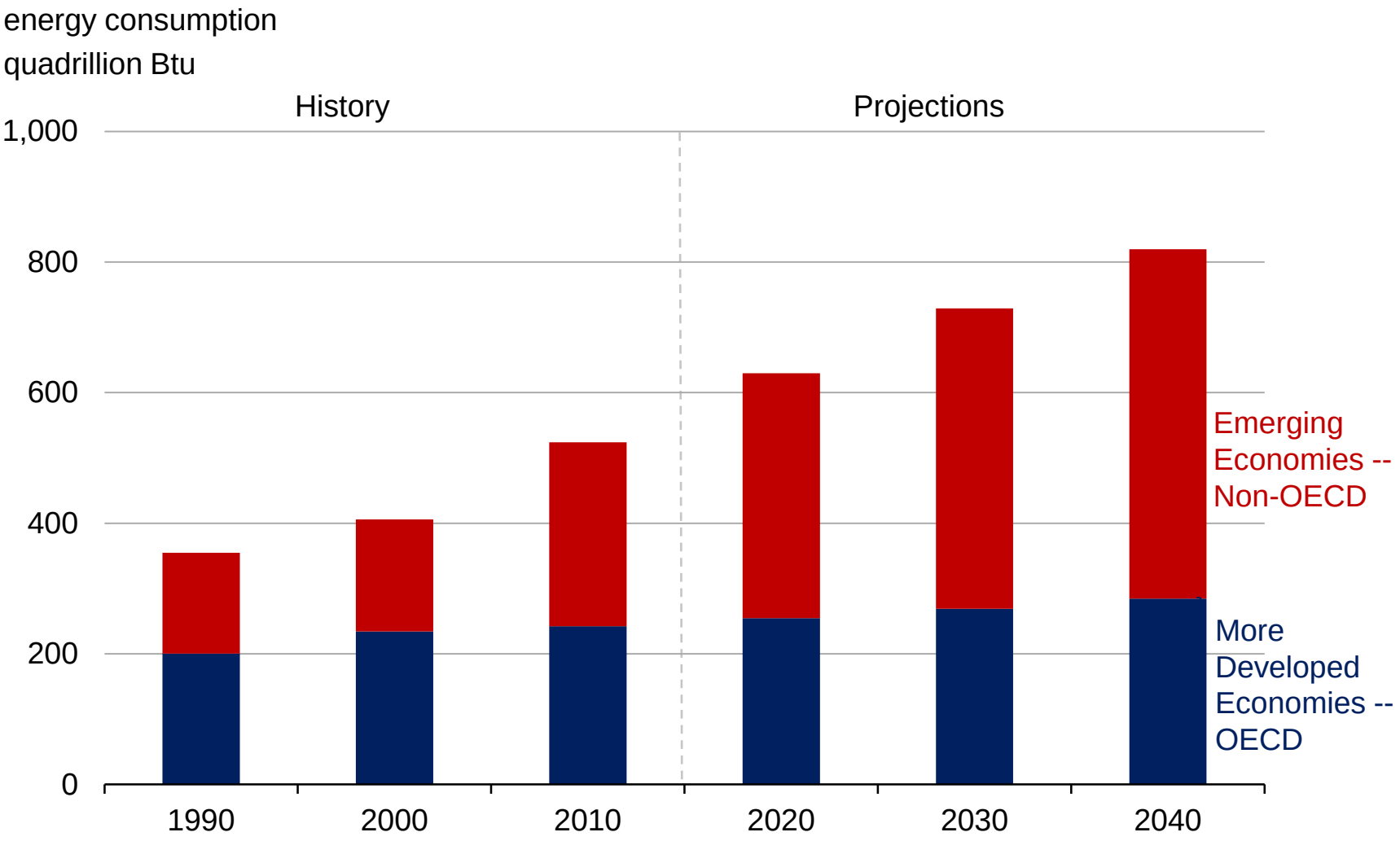
Energy-related CO_2 emissions are sensitive to the influence of future economic growth and energy price trends on energy consumption



Source: EIA, Annual Energy Outlook 2015

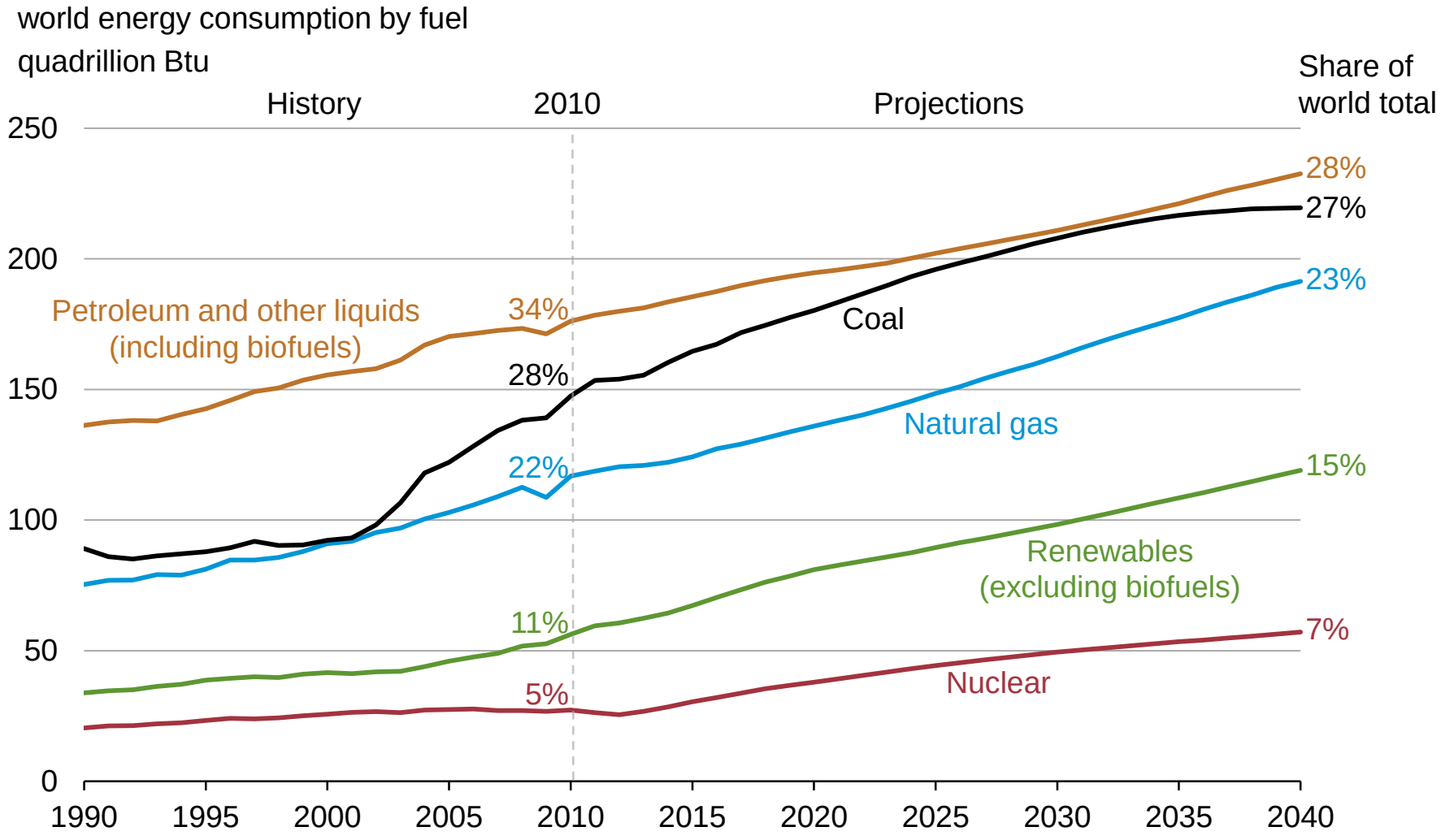
World View

World energy consumption increases by well over 50 percent



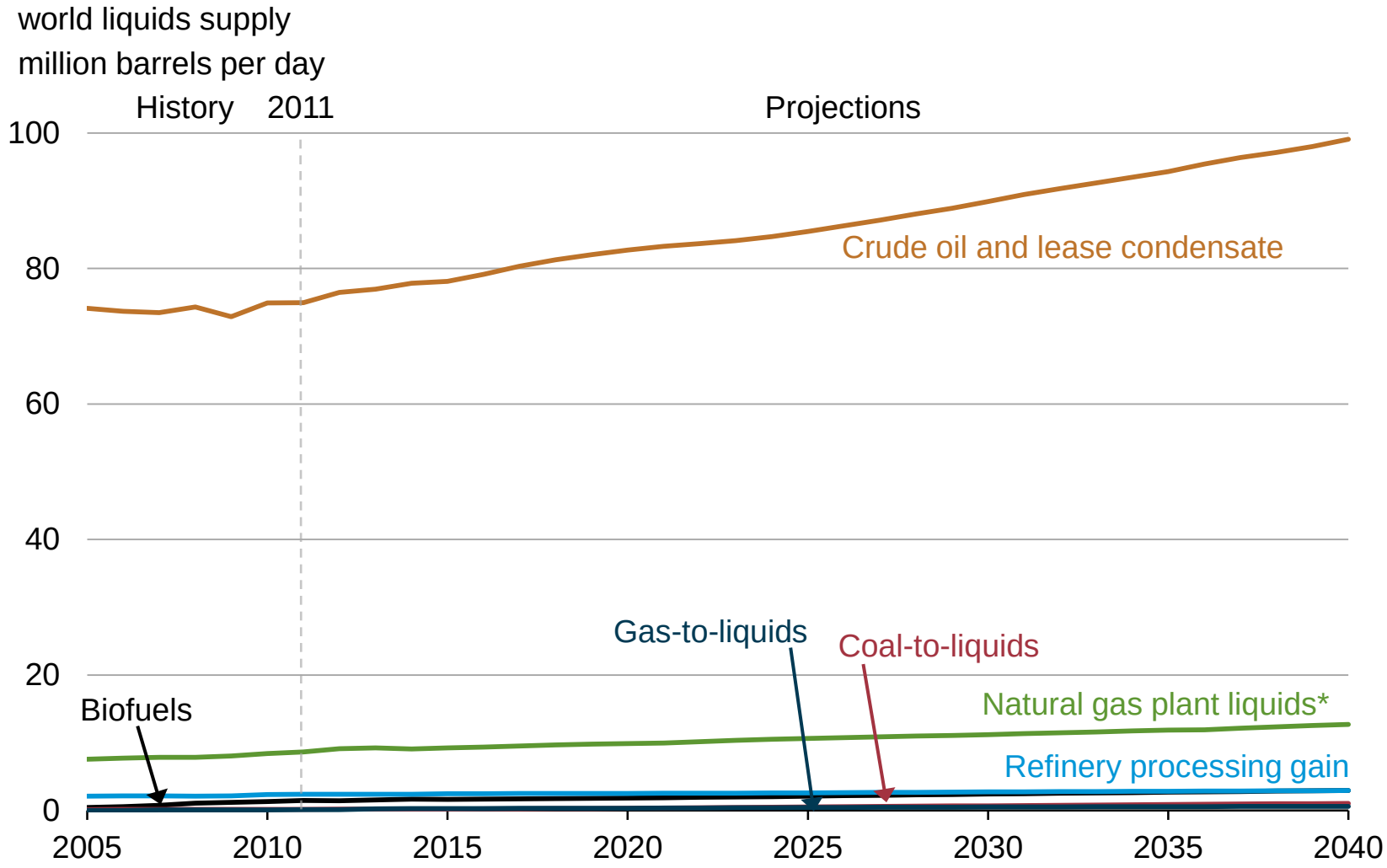
Source: EIA, International Energy Outlook 2013

Renewable energy and nuclear power are the fastest growing source of energy consumption



Source: EIA, International Energy Outlook 2013

World petroleum and other liquid fuels are primarily from crude oil and lease condensate with notable amount of natural gas plant liquids



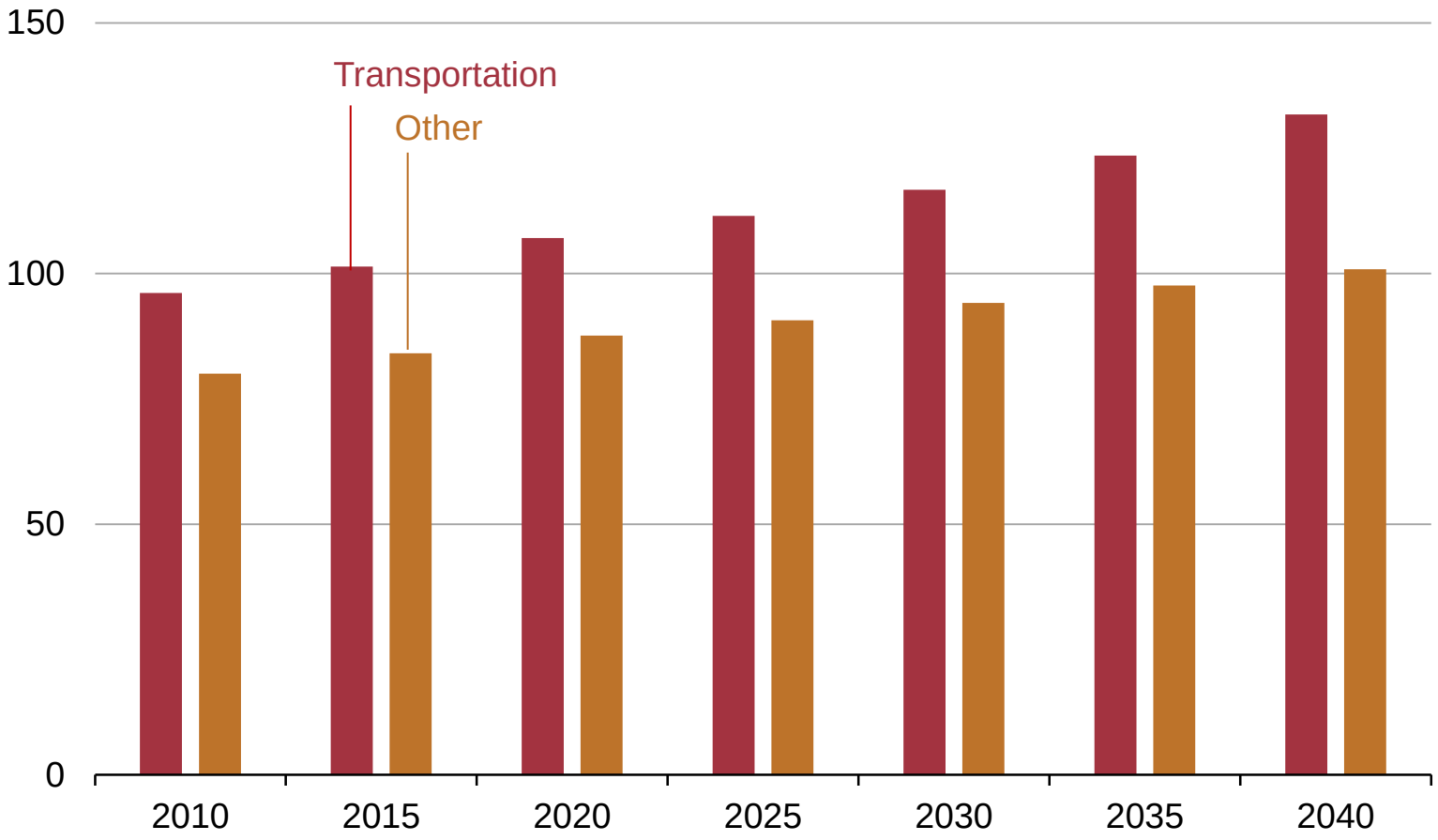
Source: EIA, International Energy Outlook 2014

***Ethane, liquefied petroleum gases (propane, normal butane, and isobutane), and natural gasoline separated from natural gas at natural gas processing, fractionating, and cycling plants.**

Transportation uses most of the world's petroleum and other liquid fuels

petroleum and other liquids consumption

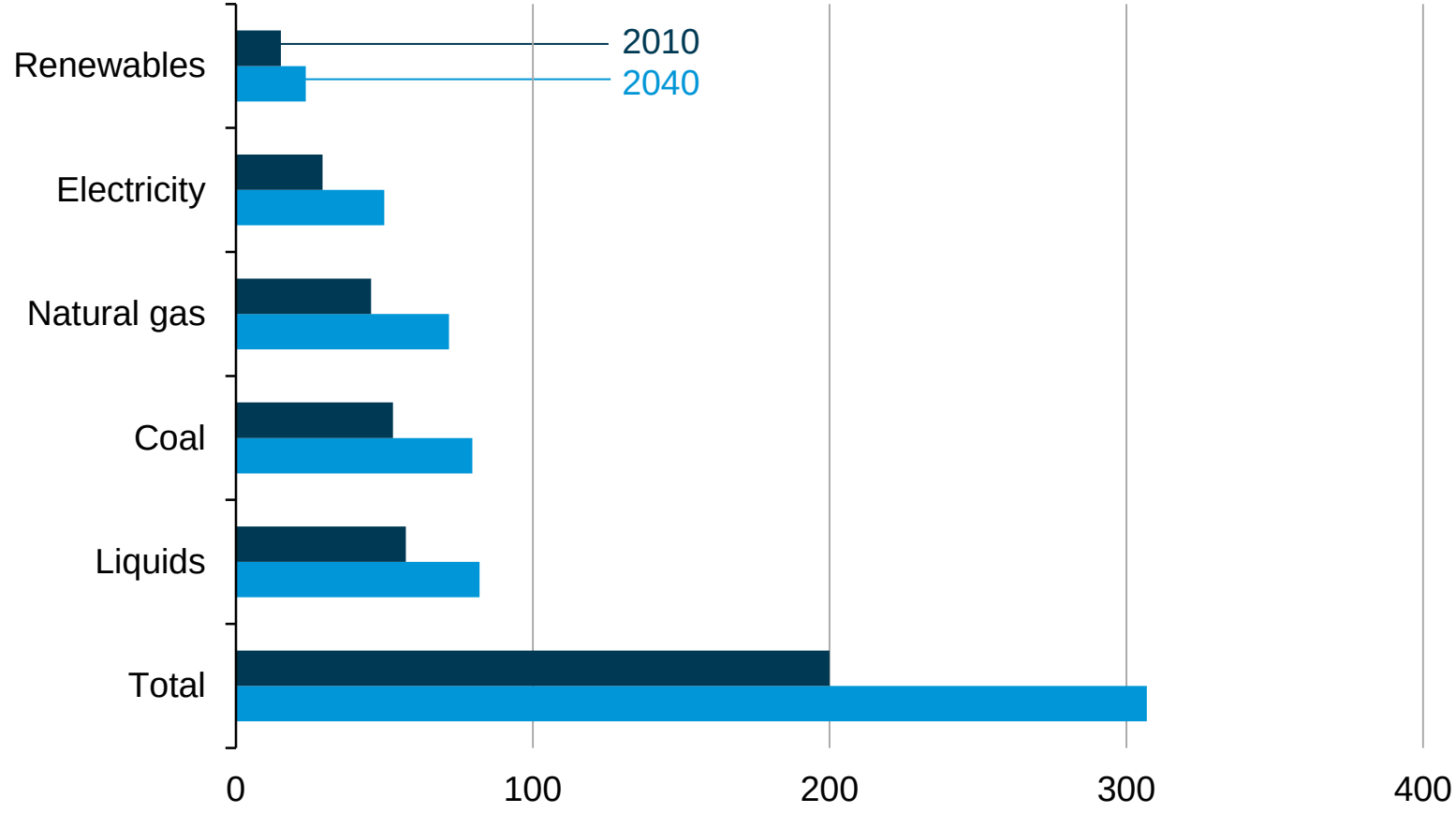
quadrillion Btu



Source: EIA, International Energy Outlook 2013

The industrial sector uses most of the world's delivered energy from a variety of energy sources

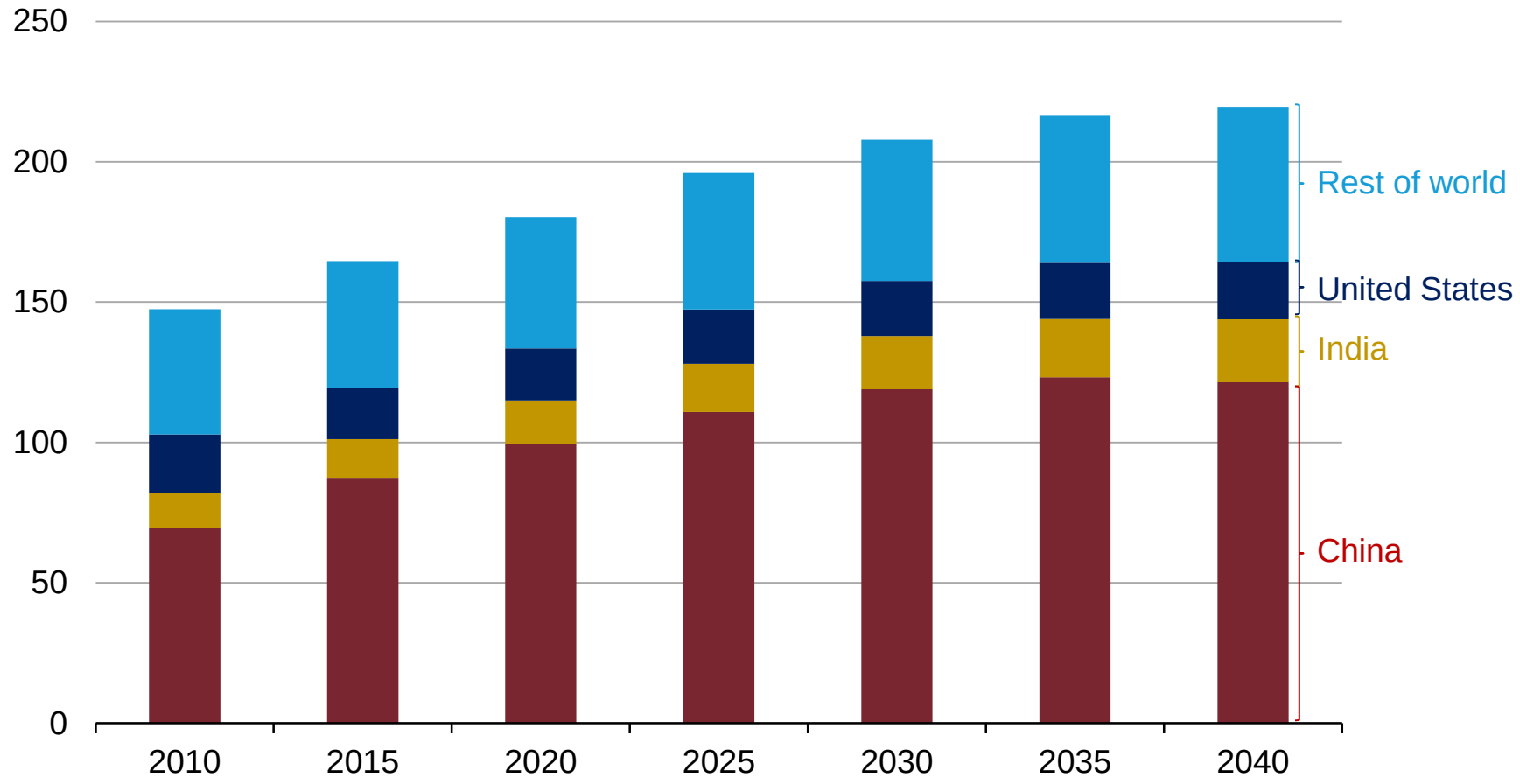
industrial sector delivered energy consumption
quadrillion Btu



Source: EIA, International Energy Outlook 2013

Three countries account for the bulk of world coal consumption that continues to grow

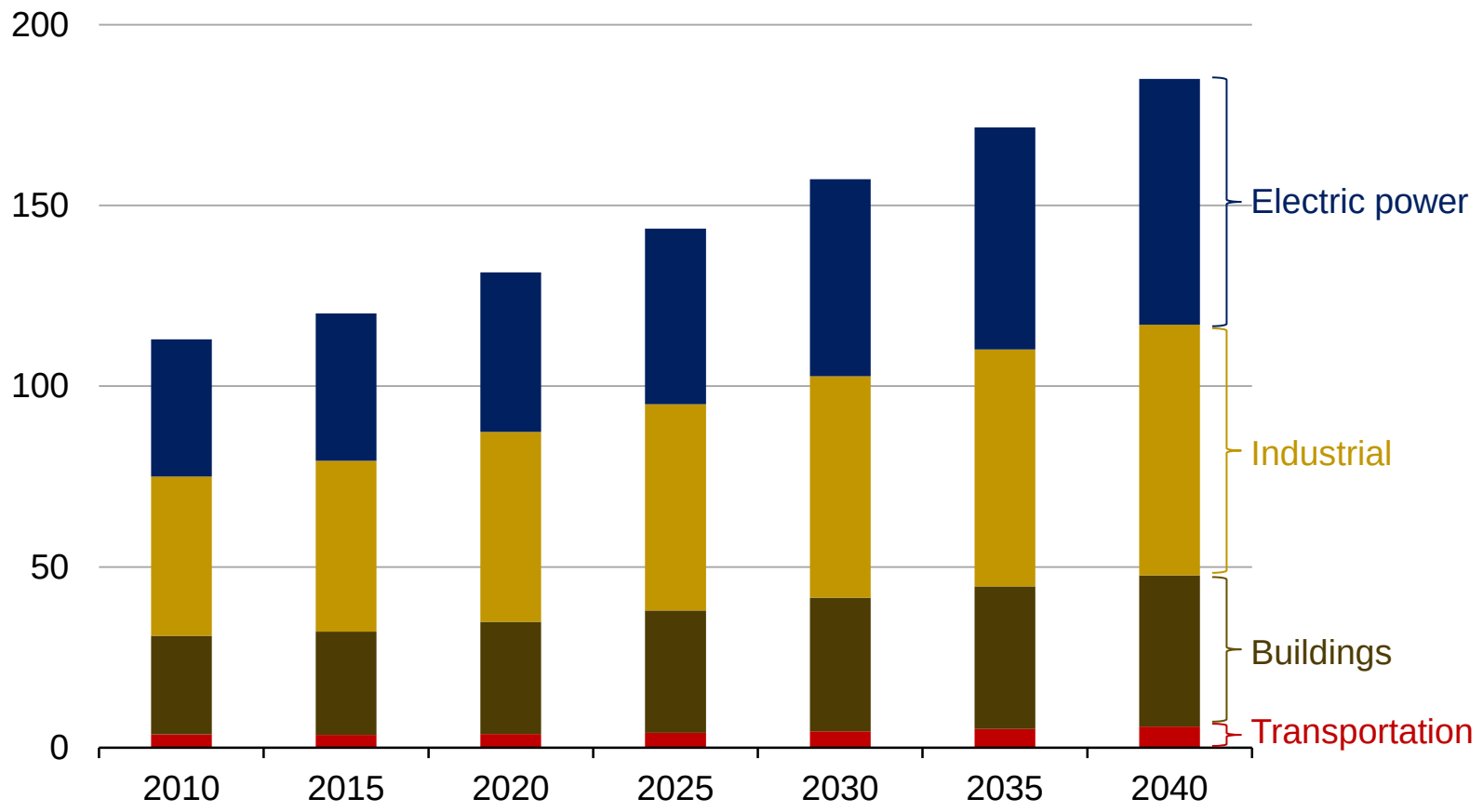
coal consumption
quadrillion Btu



Source: EIA, International Energy Outlook 2013

Natural gas grows largely to serve growing electric and industrial demands

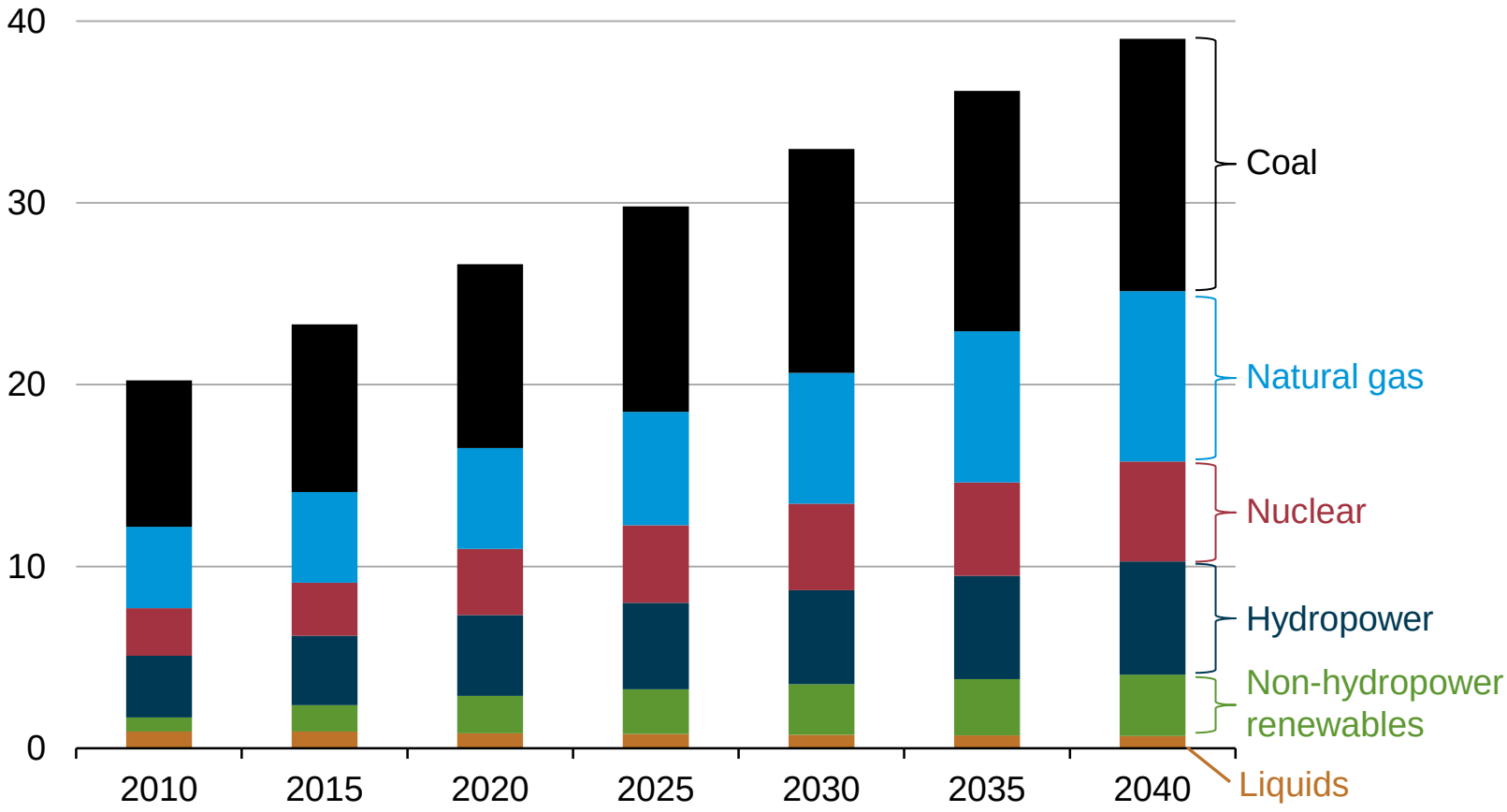
natural gas consumption
trillion cubic feet



Source: EIA, International Energy Outlook 2013

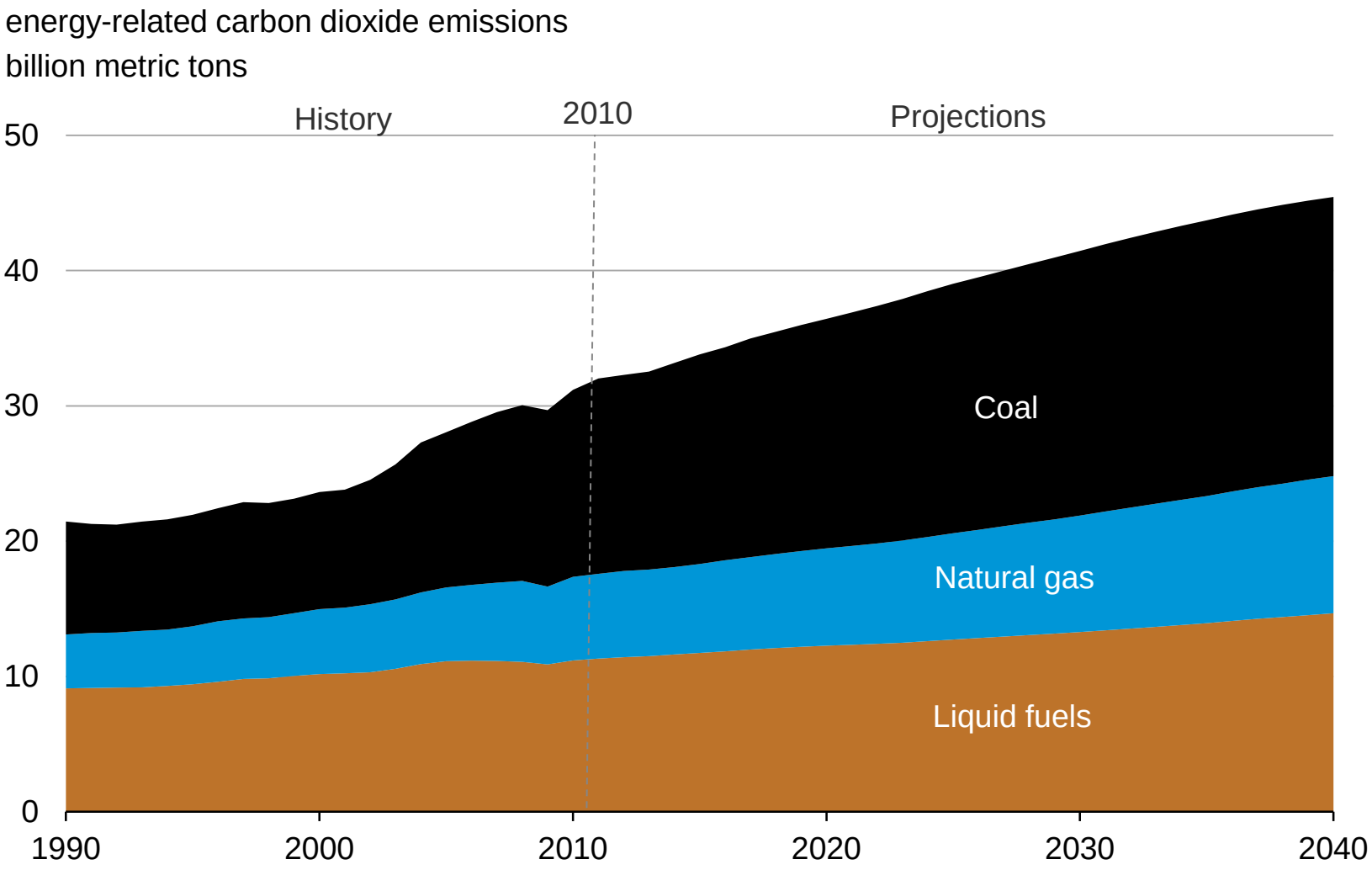
World electricity generation nearly doubles

net electricity generation
trillion kilowatthours



Source: EIA, International Energy Outlook 2013

World energy-related CO_2 emissions increase around 45 percent

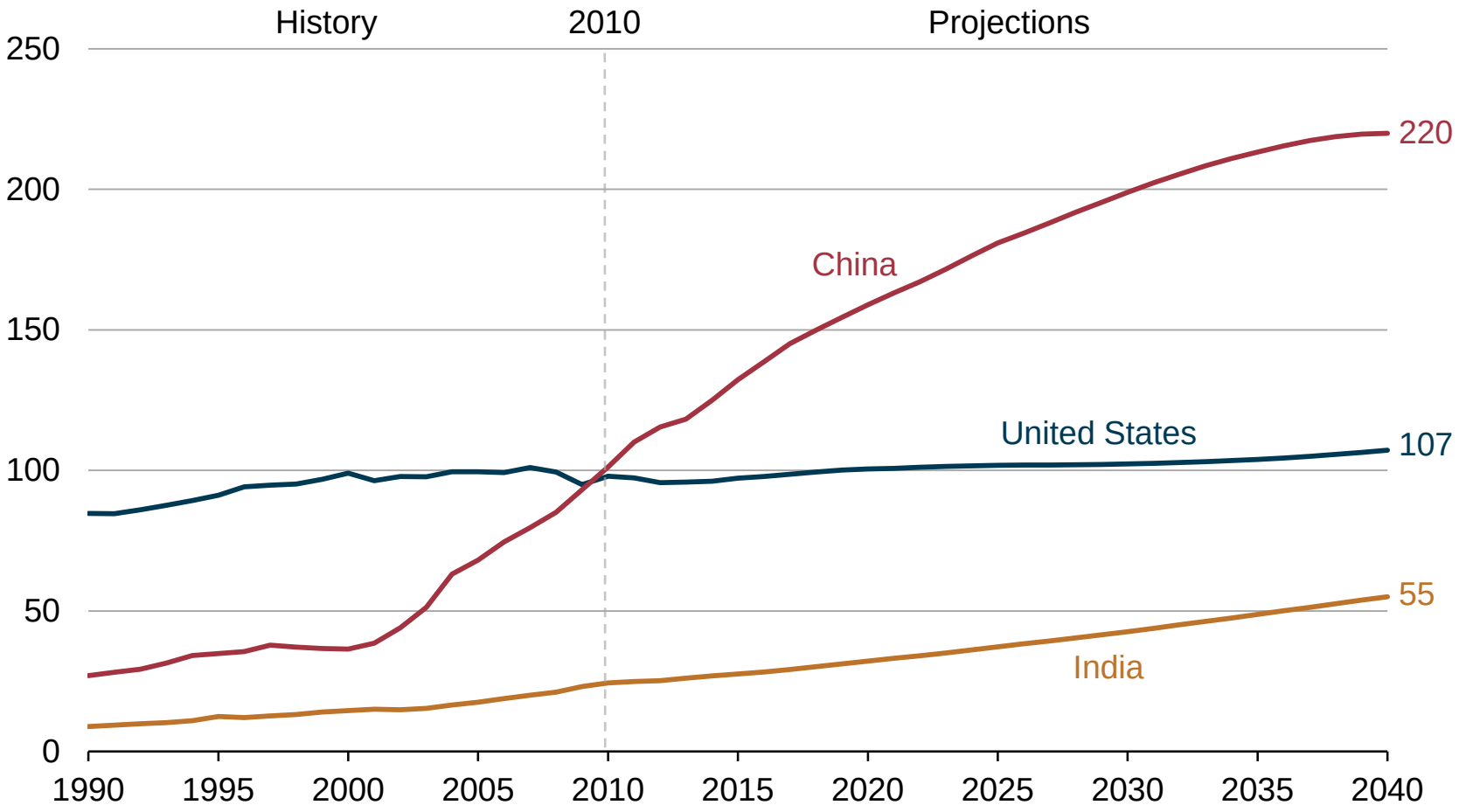


Source: EIA, International Energy Outlook 2013

China and India

By 2040, China's energy use will be double the U.S. level; India's a little more than half despite its faster GDP growth

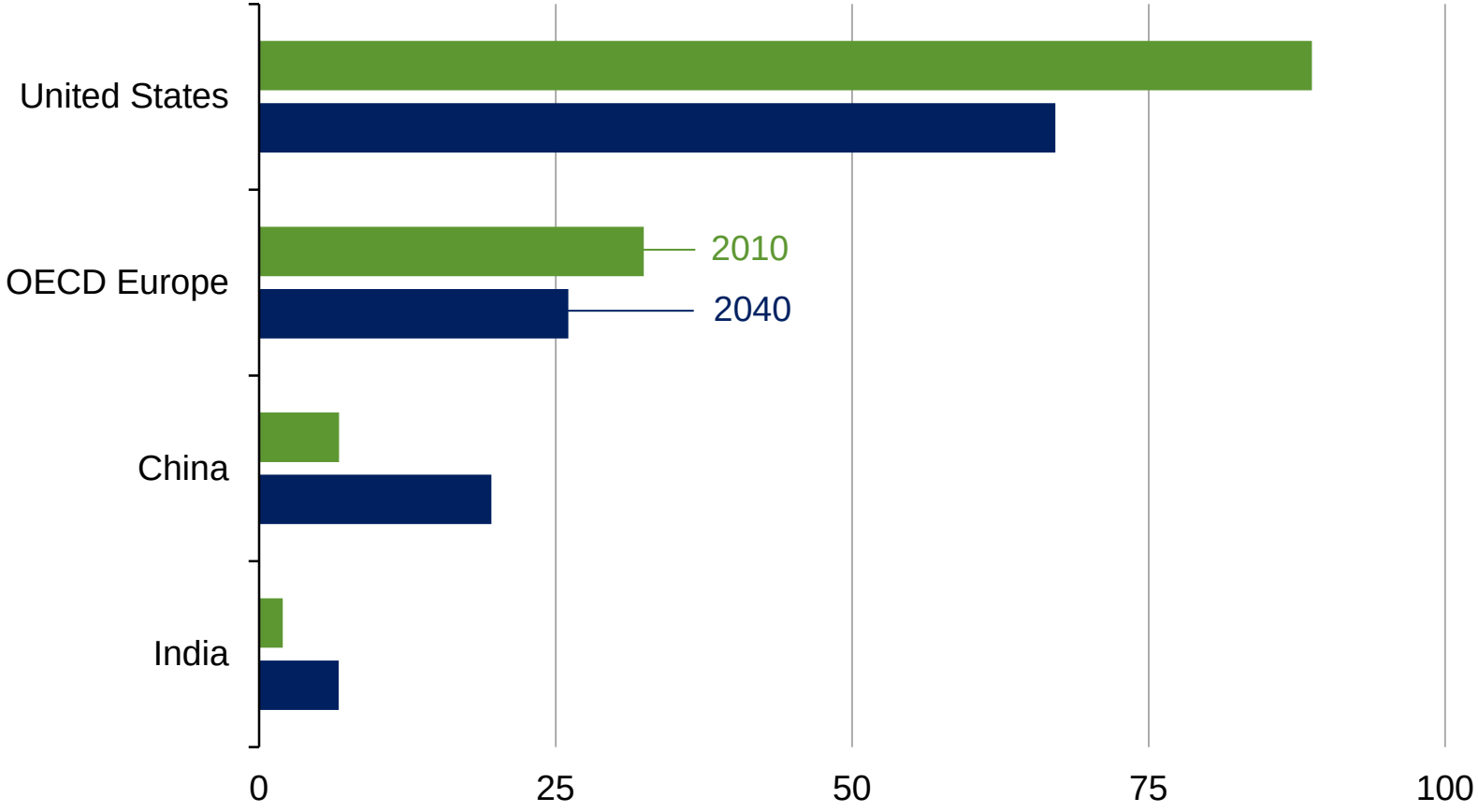
energy consumption by selected country
quadrillion Btu



Source: EIA, International Energy Outlook 2013

Transportation energy use per person projected to remain much less in China and India relative to United States and Europe

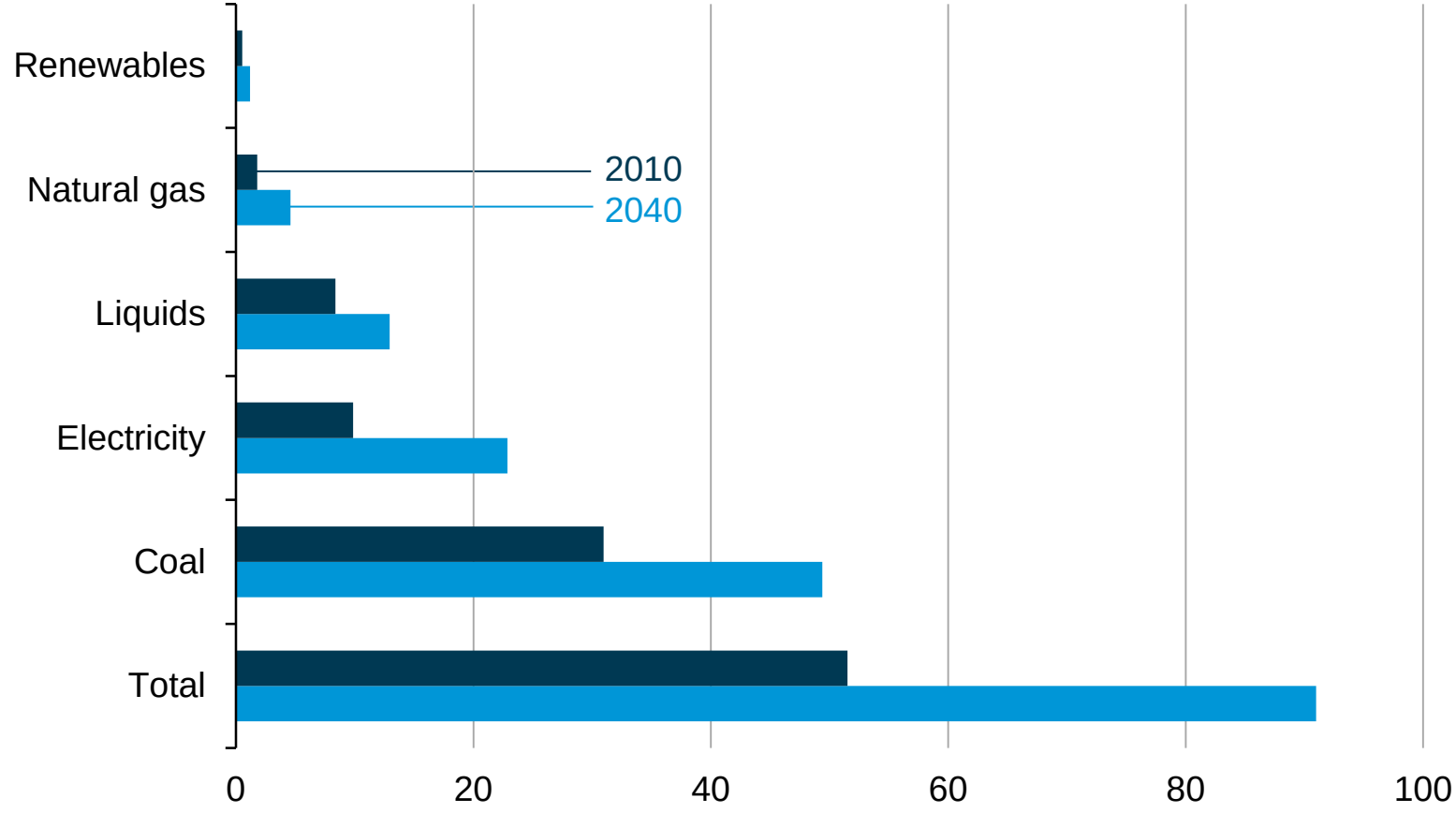
transportation primary energy consumption
million Btu per person



Source: EIA, International Energy Outlook 2013

China's industrial sector delivered energy consumption is driven by coal and electricity use

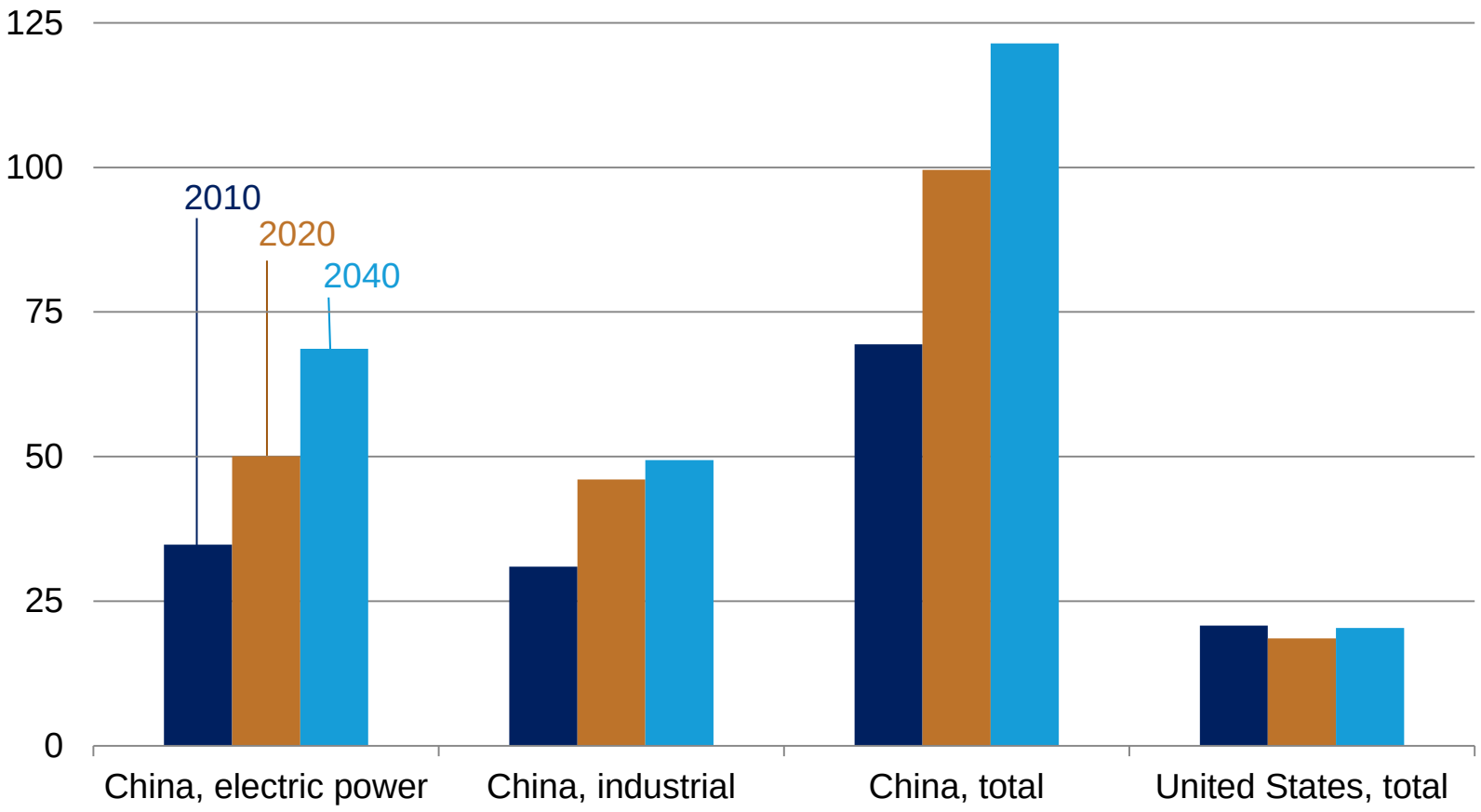
industrial delivered energy consumption
quadrillion Btu



Source: EIA, International Energy Outlook 2013

China's coal consumption mainly serves both the electric power and industrial sectors

coal consumption
quadrillion Btu



Source: EIA, International Energy Outlook 2013

There are many issues that increase uncertainty…

- Slower economic growth in China and other key economies (Brazil, Russia, among others)
- Unforeseen technological changes
- U.S. tight oil production in low world oil price environment
- Continued unrest in the Middle East and North Africa, and the potential for unrest elsewhere
- Mexican energy reform
- Sanctions and Russia
- OPEC production profile decisions
- Timing and extent of Iran's return to oil export market in light of negotiations
- Climate and other policies

Major takeaways

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For more information

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

Annual Energy Outlook | www.eia.gov/forecasts/aeo

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

International Energy Outlook | www.eia.gov/forecasts/ieo

Today In Energy | www.eia.gov/todayinenergy

Monthly Energy Review | www.eia.gov/totalenergy/data/monthly

State Energy Portal | www.eia.gov/state

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

Main sources

- United States: EIA's *Annual Energy Outlook 2015*
- World and other countries: EIA's *International Energy Outlook 2013 and International Energy Outlook 2014* (focusing on petroleum and other liquids)

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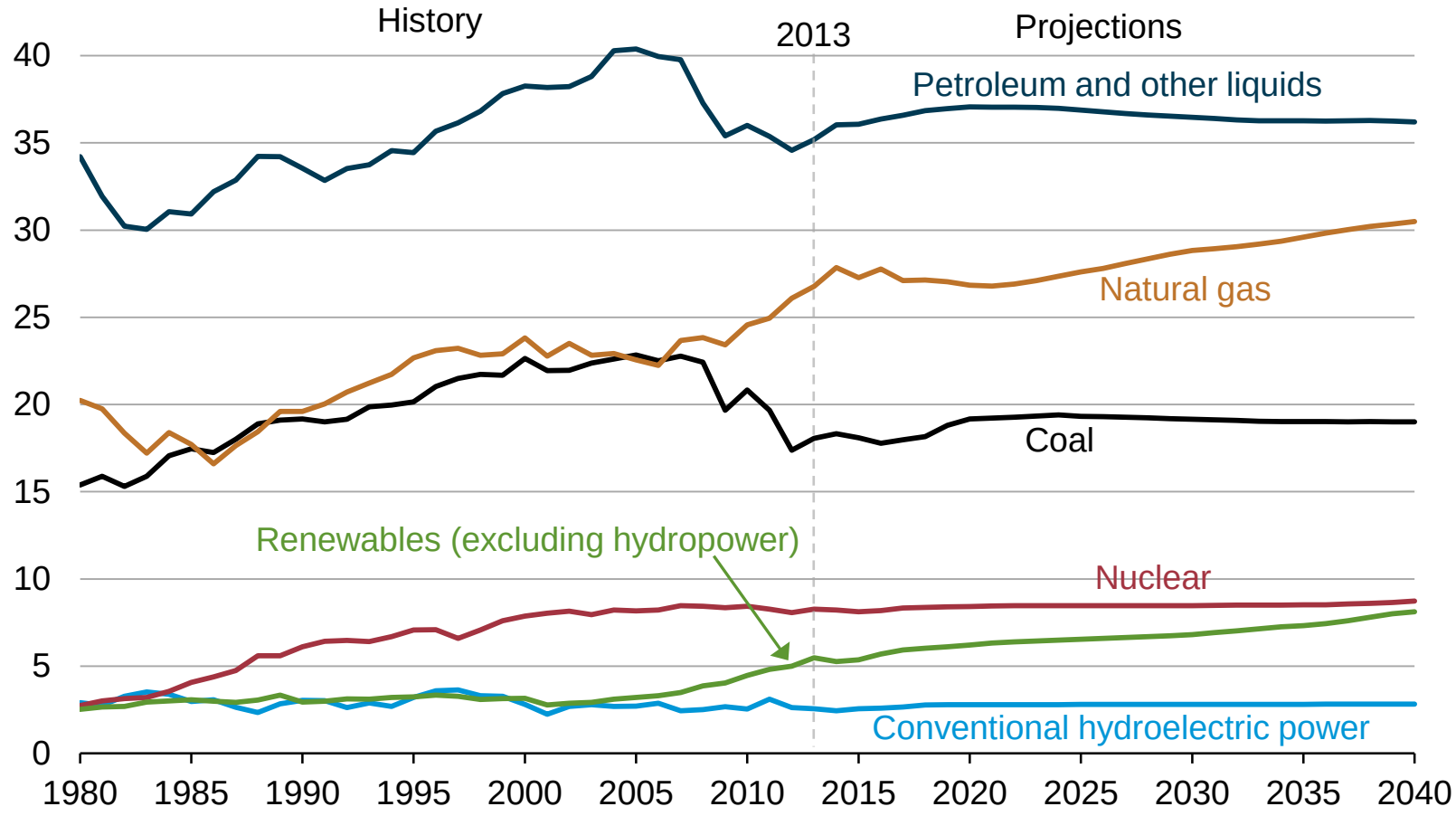
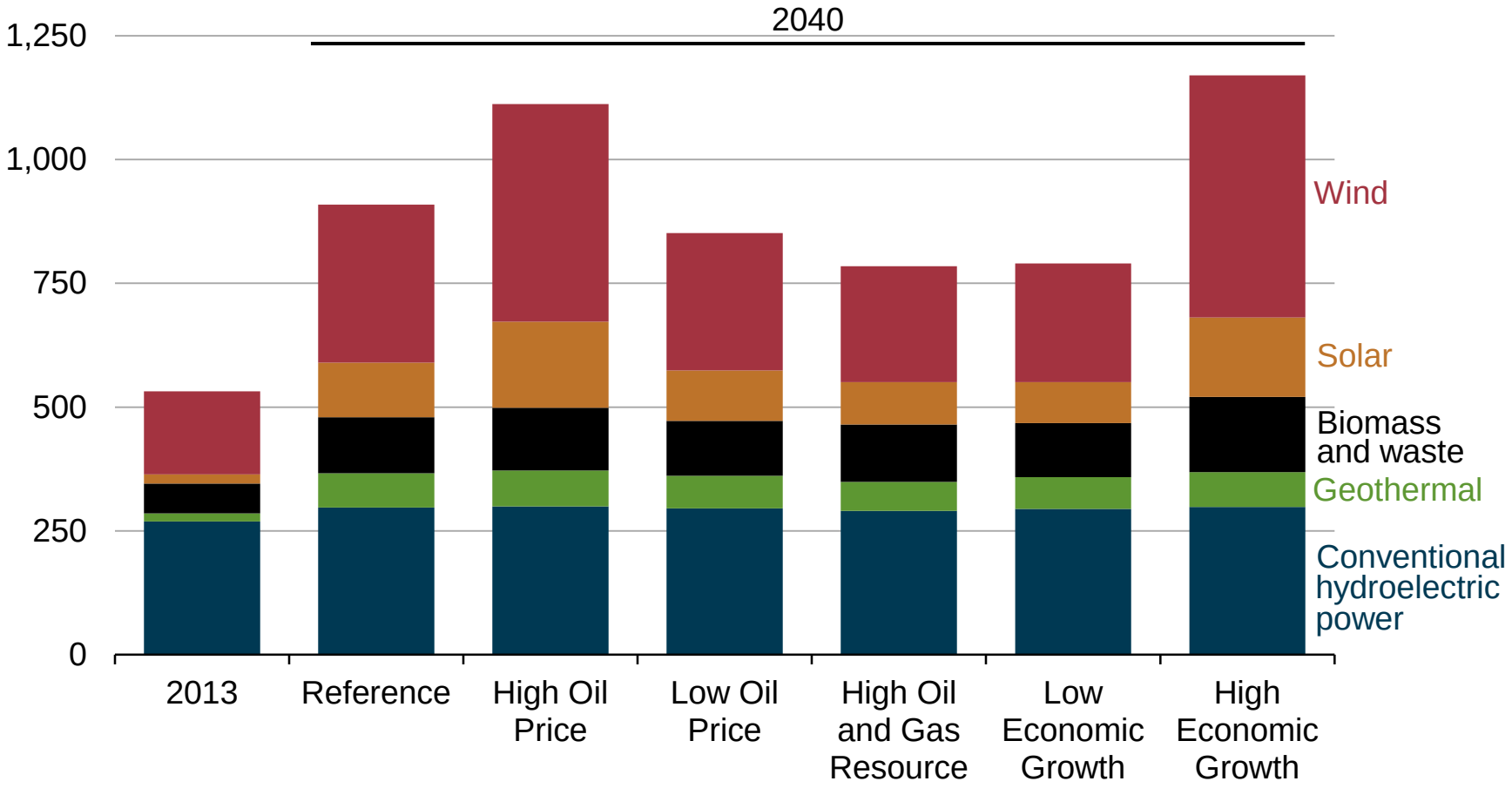
U.S. primary energy consumption
quadrillion Btu



Source: EIA, Annual Energy Outlook 2015 Reference case

Growth in wind and solar generation meets a significant portion of projected total electric load growth in all AEO2015 cases

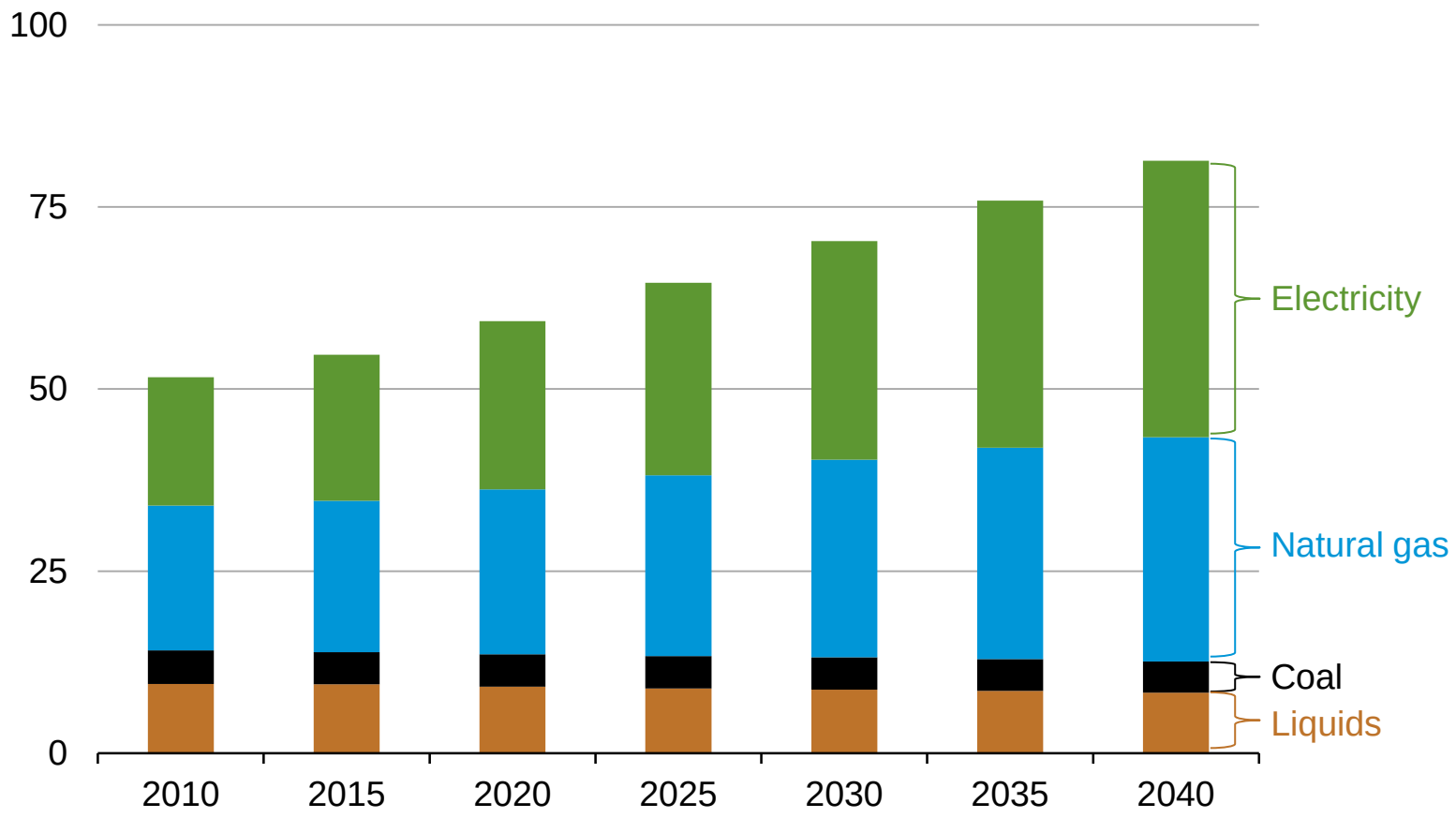
U.S. renewable generation in all sectors by fuel
billion kilowatthours



Source: EIA, Annual Energy Outlook 2015

World residential sector delivered energy consumption by energy source, 2010-2040

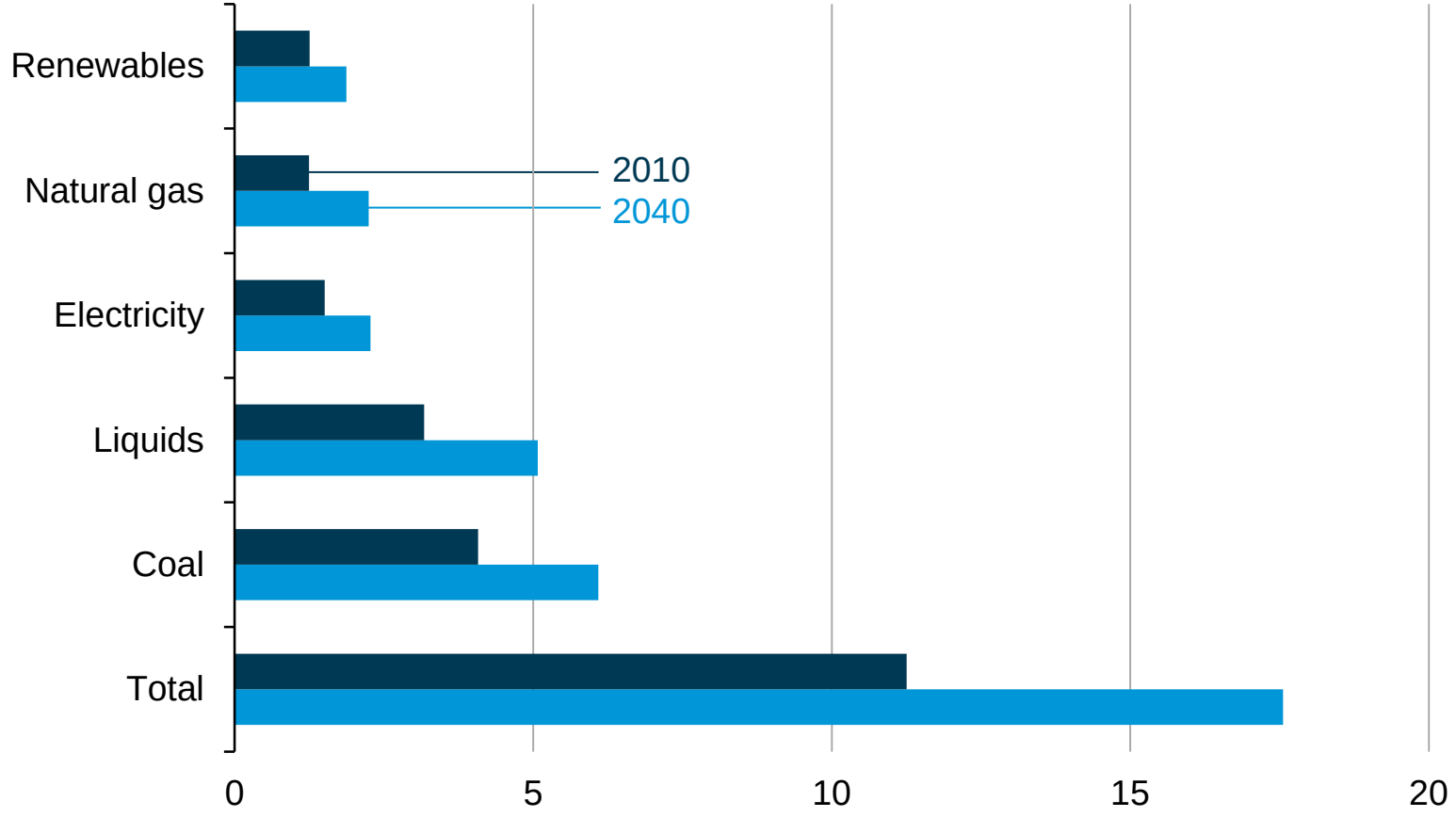
residential sector delivered energy consumption
quadrillion Btu



Source: EIA, International Energy Outlook 2013

India industrial sector delivered energy consumption by energy source, 2010 and 2040

industrial sector delivered energy consumption
quadrillion Btu



Source: EIA, International Energy Outlook 2013

Top ten countries with technically recoverable shale resources

Shale oil

Rank	Country	Billion barrels
1	Russia	75
2	United States	58
3	China	32
4	Argentina	27
5	Libya	26
6	Venezuela	13
7	Mexico	13
8	Pakistan	9
9	Canada	9
10	Indonesia	8
	World total	**345**

Shale gas

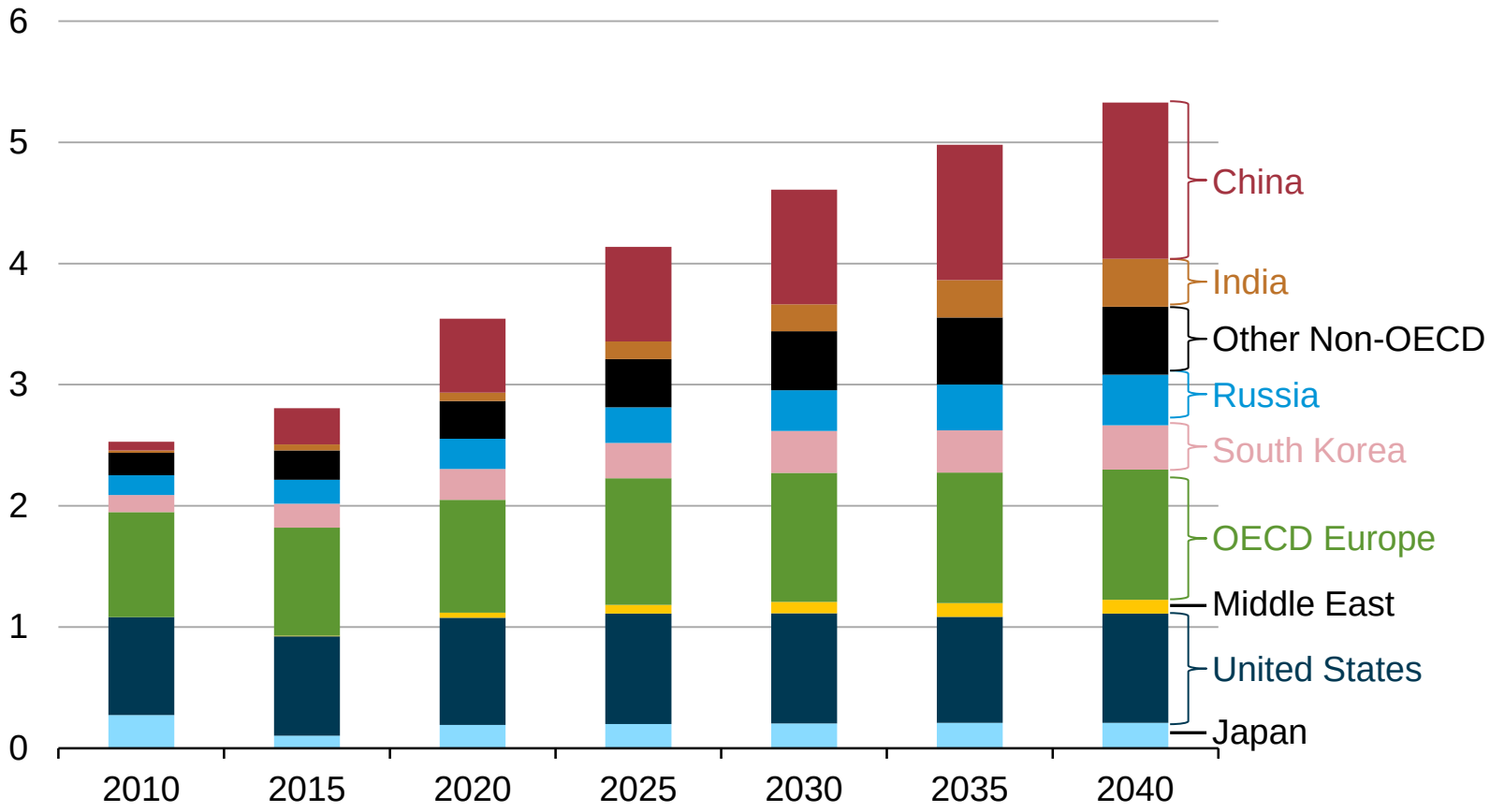
Rank	Country	Trillion cubic feet
1	China	1,115
2	Argentina	802
3	Algeria	707
4	United States	665
5	Canada	573
6	Mexico	545
7	Australia	437
8	South Africa	390
9	Russia	285
10	Brazil	245
	World total	**7,299**

Source: United States: EIA and USGS; Other basins: ARI.

Note: ARI estimates U.S. shale oil resources at 48 billion barrels and U.S. shale gas resources at 1,161 trillion cubic feet.

World net electricity generation from nuclear power by region, 2010-2040

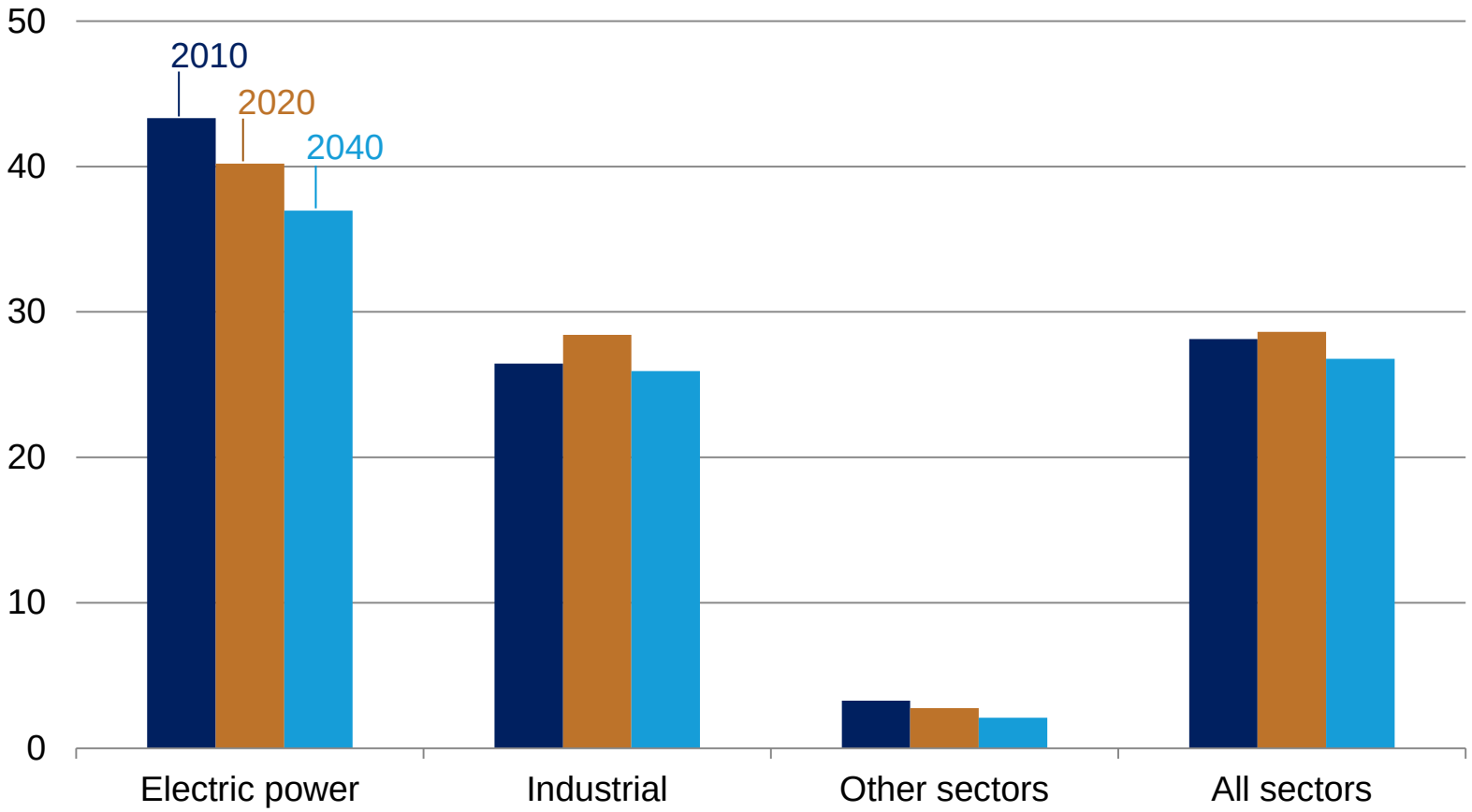
net electricity generation
trillion kilowatthours



Source: EIA, International Energy Outlook 2013

Coal share of world energy consumption by sector, 2010, 2020, and 2040

share of world energy consumption
percent

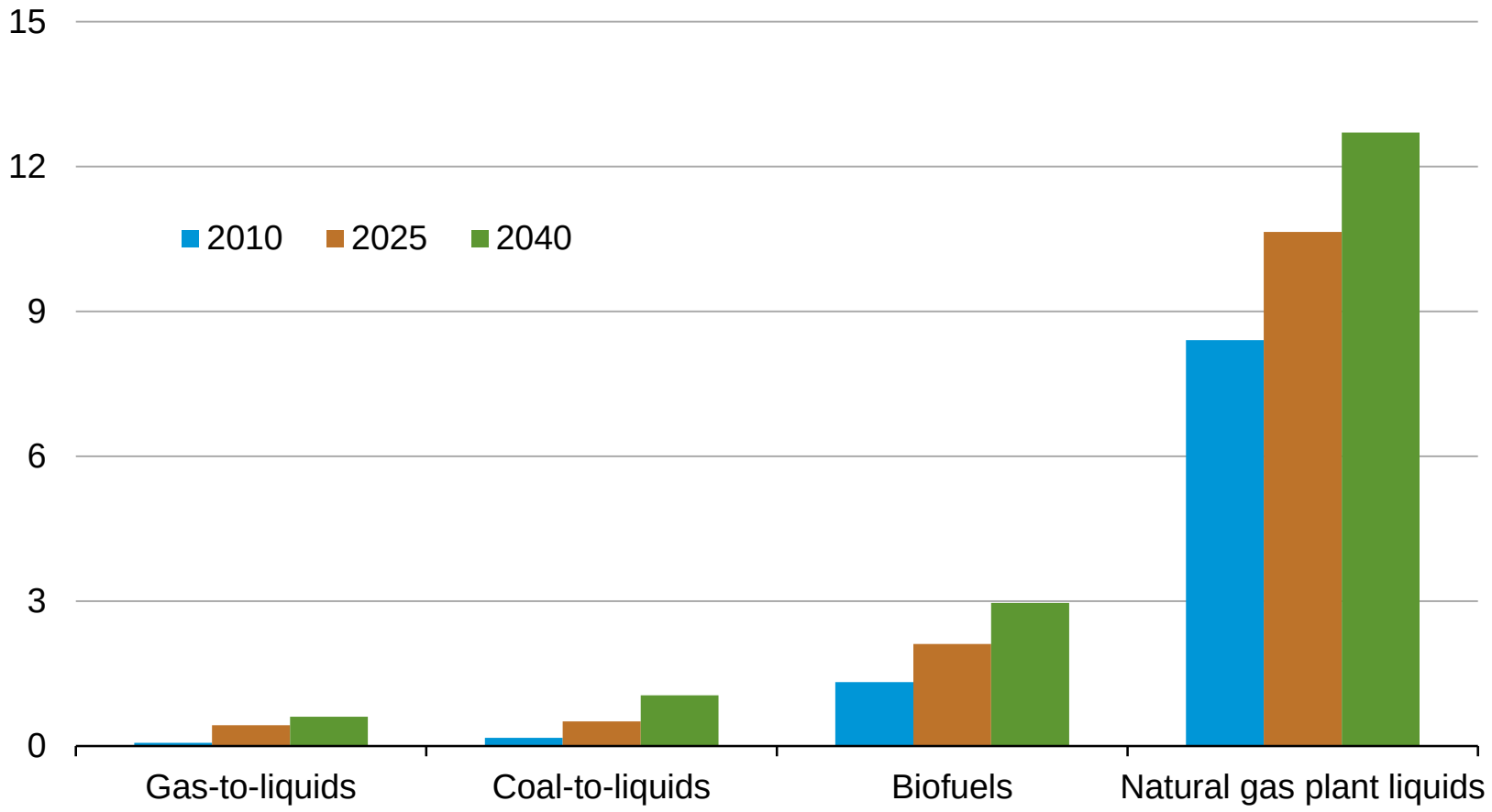


Source: EIA, International Energy Outlook 2013

Natural gas plant liquids and biofuels account for most of the other liquid fuels

world production of selected other liquid fuels, Reference case

million barrels per day



Source: EIA, International Energy Outlook 2014