Views on the long-term outlook for energy: *AEO2013, IEO2011, and APERC*

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Overview

- Brief EIA overview
- Annual Energy Outlook projections (U.S.)
- Comparison with APEC projections
- International Energy Outlook projections
- Look ahead to IEO2013

EIA Analysis – what we project

- Annual Energy Outlook
  - United States long-term energy-economy energy supply and demand model out to 2040; Projections of production, imports, conversion, consumption, and prices of energy
- Short –Term Energy Outlook
- International Energy Outlook
  - 16 world regions
  - Projections by fuel and industrial sub-sector out to 2040
  - Baseline data from EIA & IEA
- *We also collect and publish U.S. energy data!*
  - Natural gas production & consumption
  - End-use sectoral consumption
  - Refinery & gas plant production

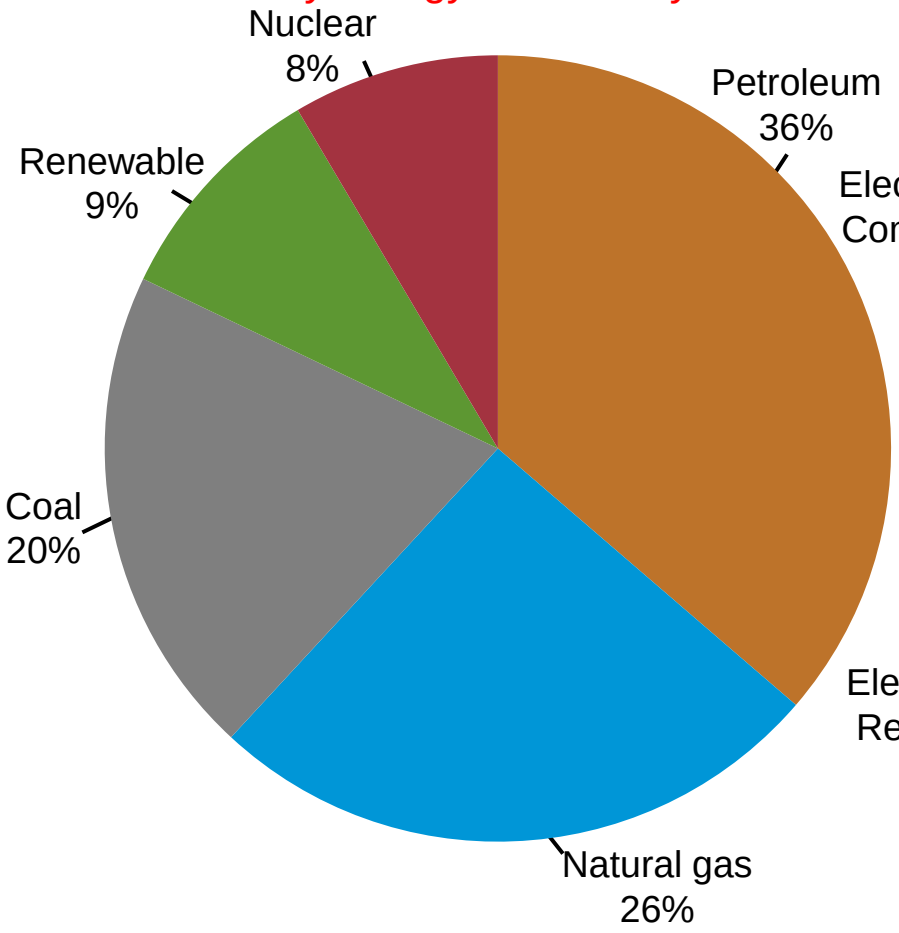
Key results from the *AEO2013* Reference case:

- Growth in energy production outstrips consumption growth
- Crude oil production, particularly from tight oil plays, rises sharply over the next decade
- Shale gas helps spur natural gas production which serves the industrial and power sectors and an expanding export market, including LNG
- Transportation: fuel economy standards, natural gas in heavy-duty vehicles
- U.S. energy-related carbon dioxide emissions remain more than 5 percent below their 2005 level through 2040, reflecting increased efficiency and the shift to a less carbon-intensive fuel mix

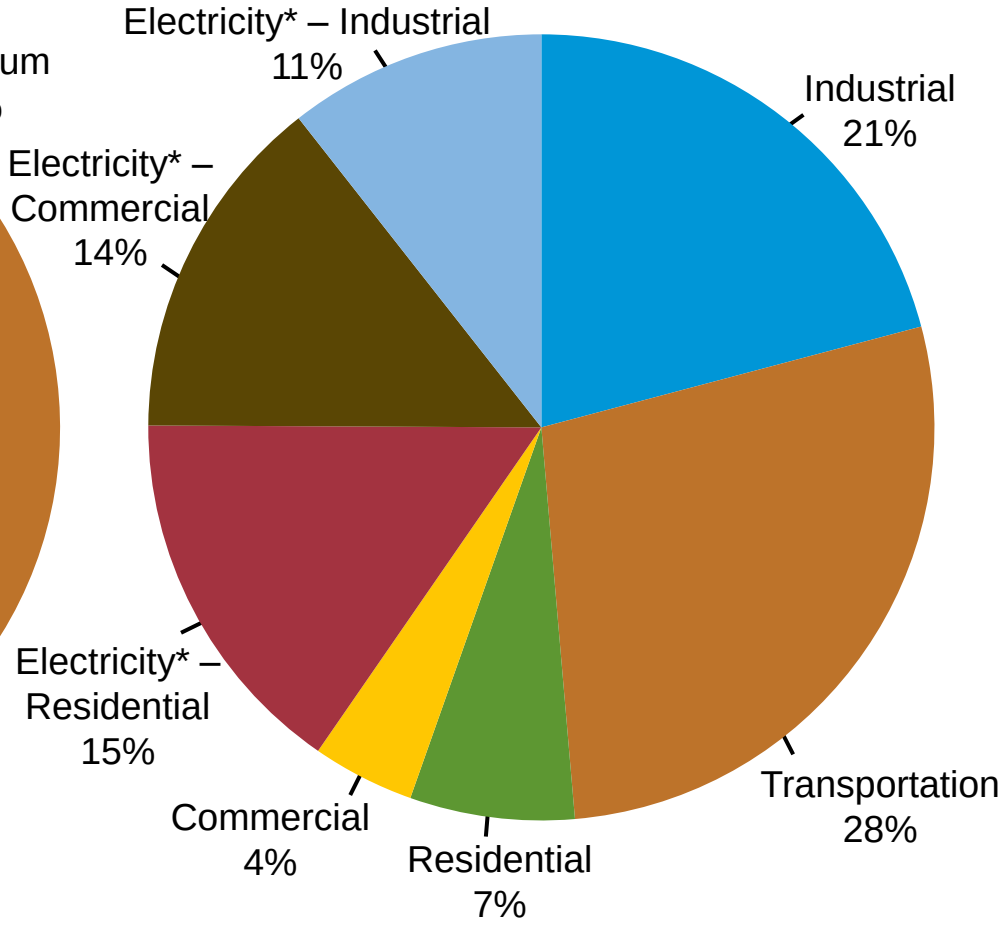
Current U.S. energy consumption is 82% fossil fuels; demand is broadly distributed among the major sectors

2011 total U.S. energy use = 97.3 quadrillion Btu

Primary energy demand by fuel



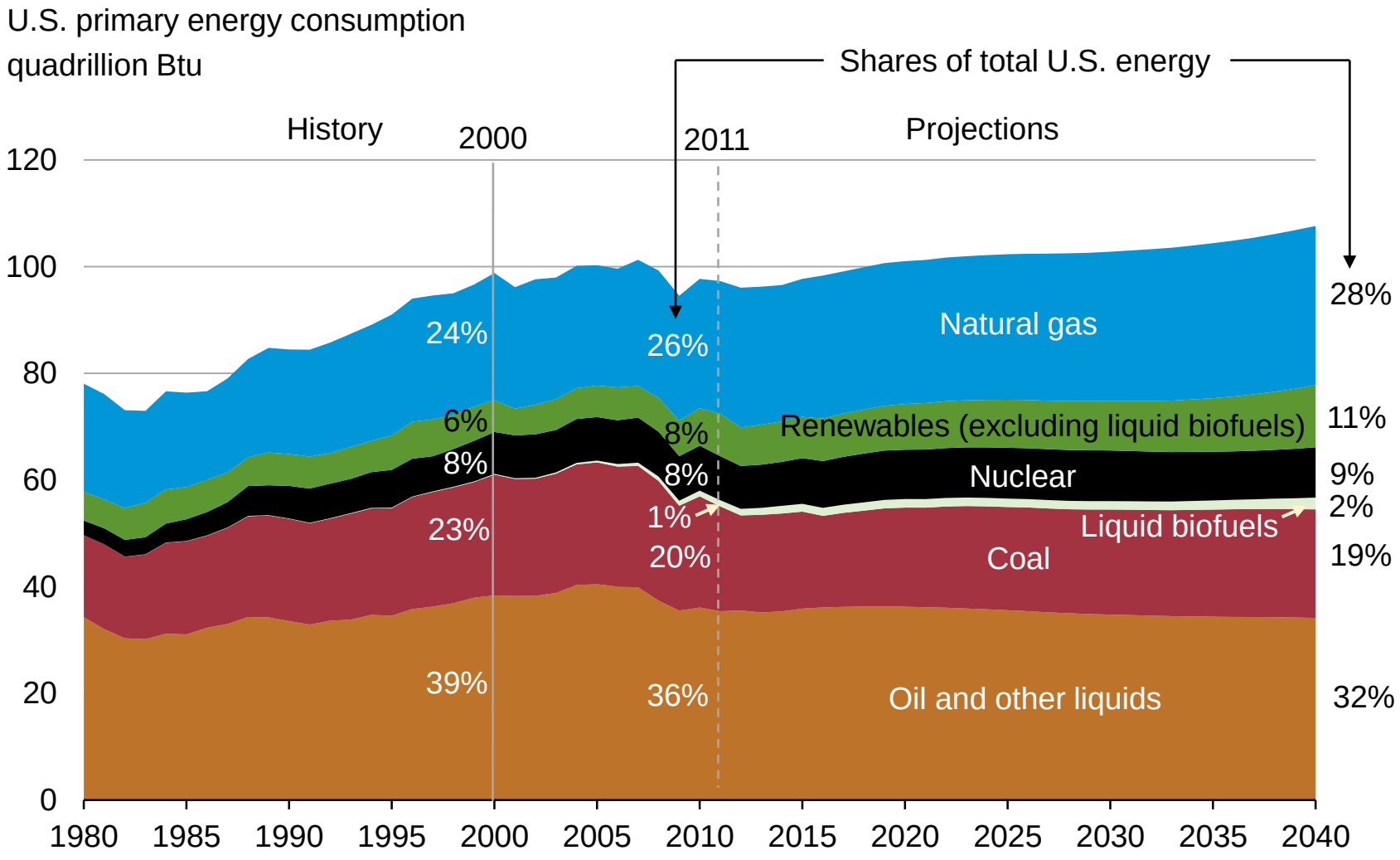
Primary energy demand by sector



Source: EIA, Annual Energy Review 2011

** End use electricity includes losses in generation*

U.S. energy use grows slowly over the projection reflecting improving energy efficiency and a slow and extended economic recovery

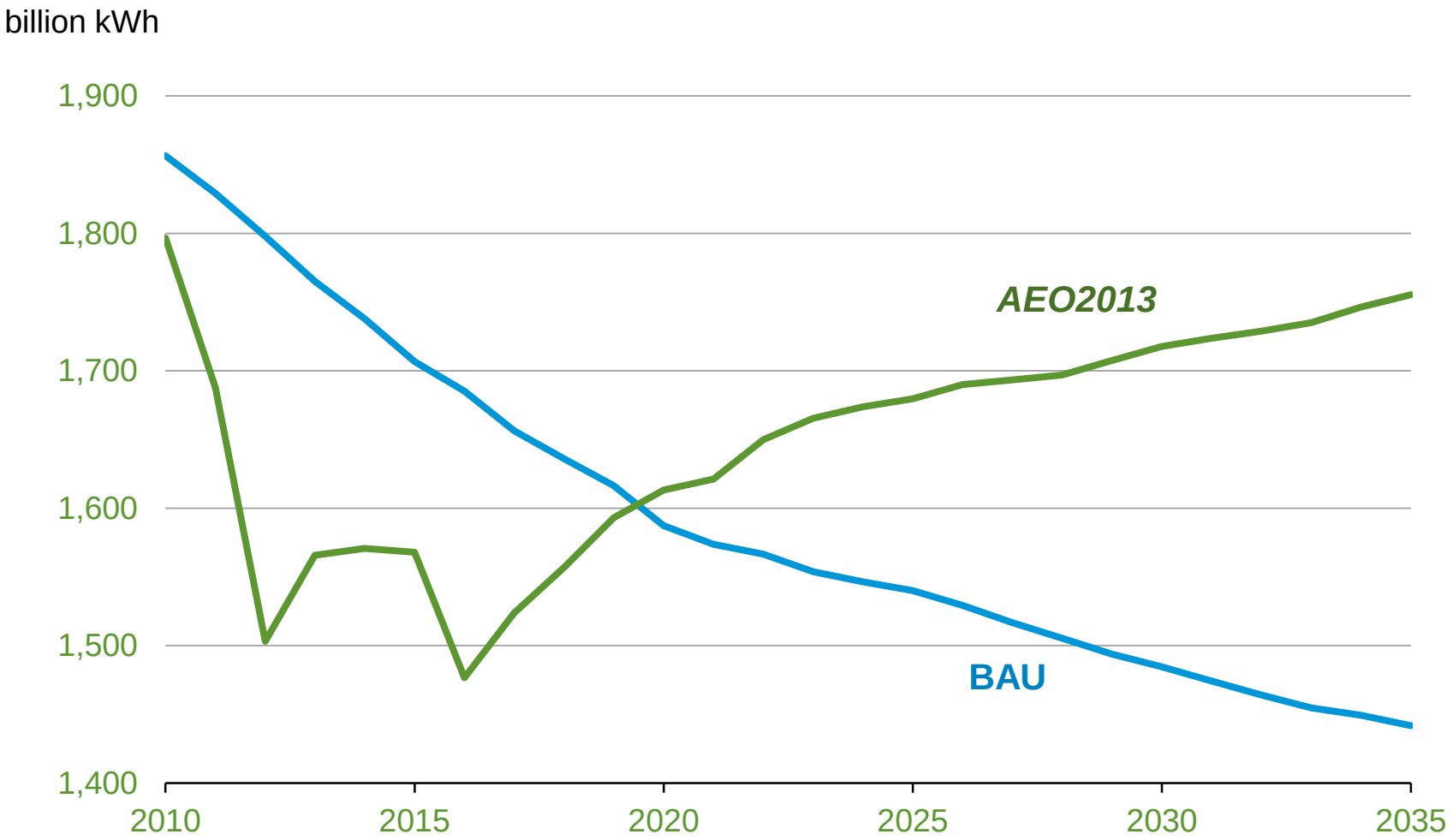


Source: EIA, Annual Energy Outlook 2013 Early Release

Comparisons between APERC BAU scenario and AEO2013

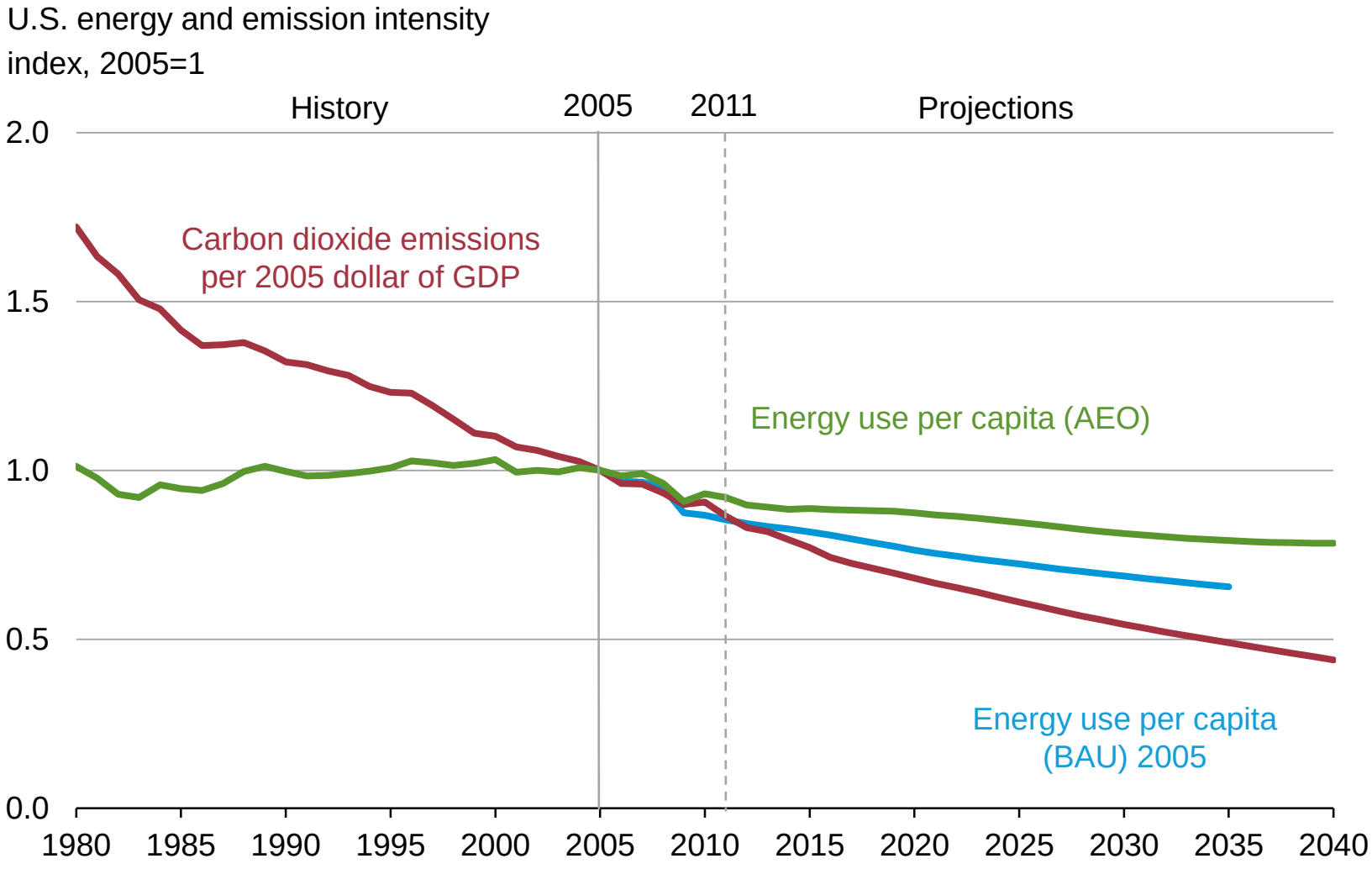
- Total U.S. delivered energy demand (industrial + transportation + commercial + residential) almost identical, as is GDP growth and natural gas net imports but…
- Primary natural gas demand & production grows more in BAU scenario from 2010 - 2035; “oil” production also more optimistic in BAU scenario
- Coal-fired generation in *AEO2013* is 3% *higher* in 2035 while in BAU it is 22% *lower* as compared to 2009
- Renewable power generation doubles (2010 – 2035) in BAU; increases by only 64% in *AEO2013;* difference = 150 TWh by 2035
- Greater fuel efficiency gains/different vehicle fleet composition in LDVs assumed in BAU
- Petroleum liquids projections in industry quite different, especially in the petrochemical sector; *AEO2013* shows increase due to growth in chemicals sector & concurrent LPG+naphtha demand; BAU shows decline (?)

Coal-fired power generation (BAU vs. AEO Ref. case)



Source: APERC BAU Scenario and Annual Energy Outlook 2013 Early Release

Energy and CO_2 per dollar of GDP continue to decline; per-capita energy use also declines

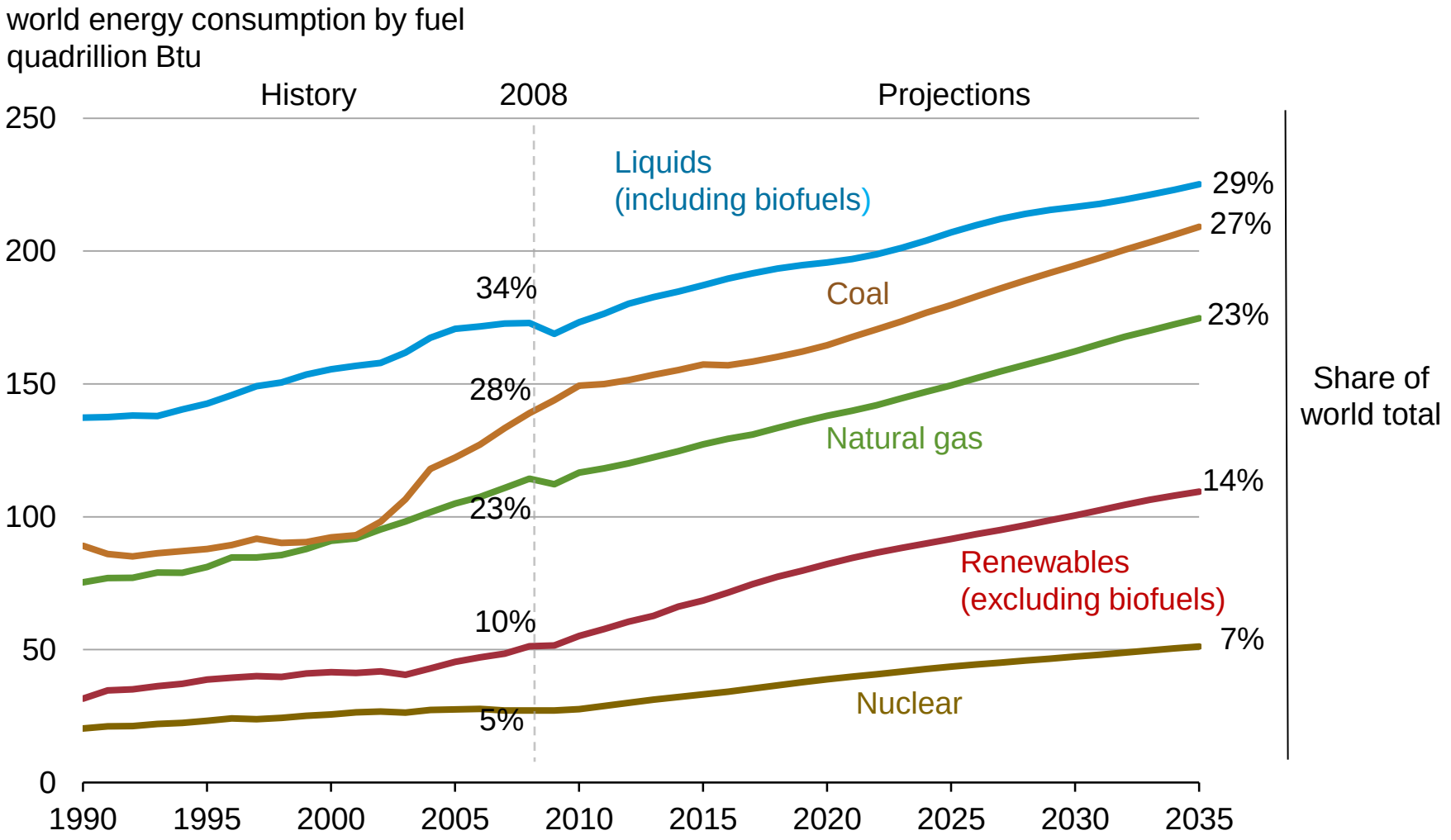


Source: EIA, Annual Energy Outlook 2013 Early Release

Key findings in the IEO2011 Reference case

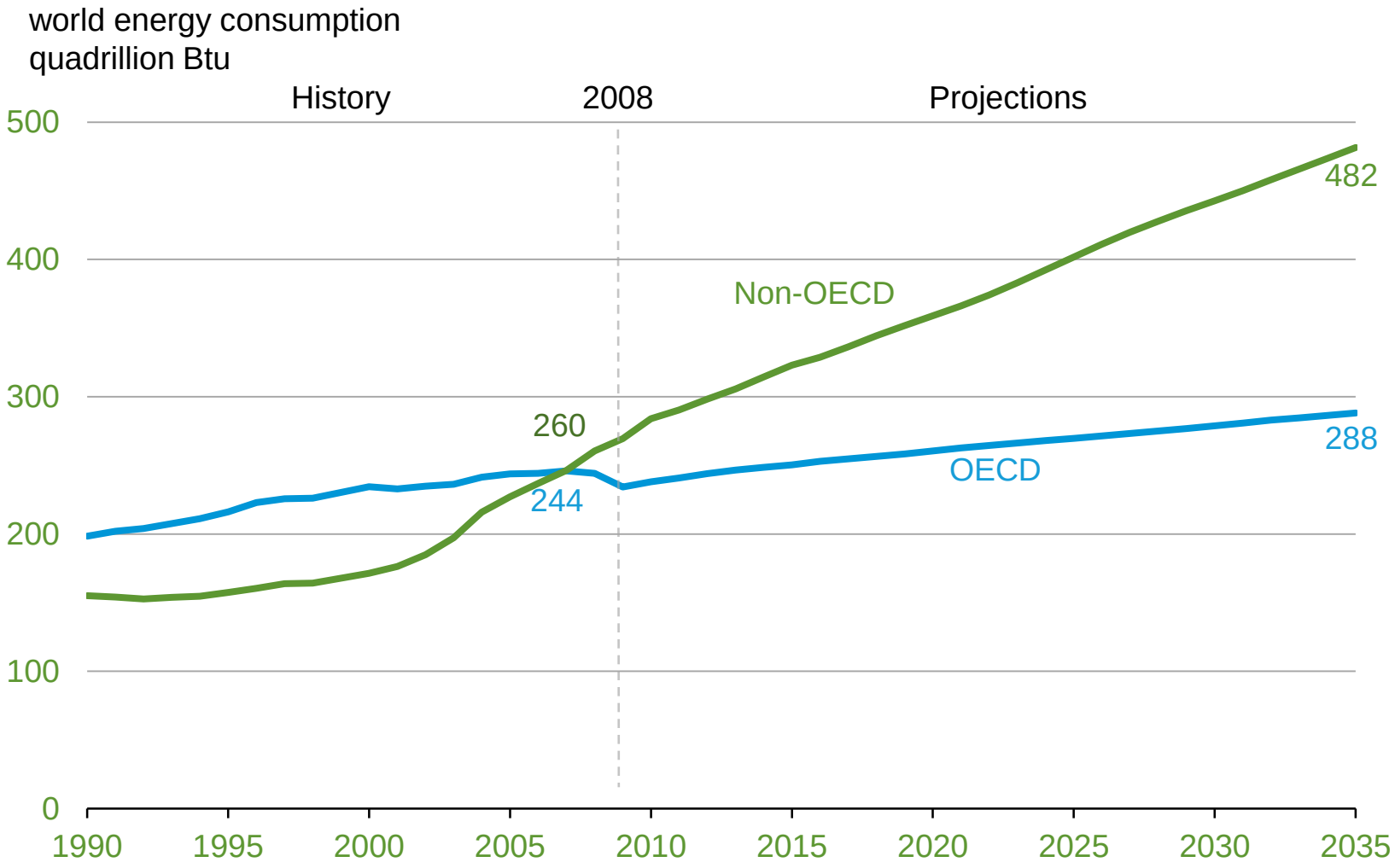
- World energy consumption increases by 53% between 2008 and 2035 with half of the increase attributed to China and India
- Renewables are the world's fastest-growing energy source at 2.8% per year; renewables' share of world energy is roughly 15% in 2035
- Liquid fuels remain the largest energy source worldwide through 2035 with declining shares; oil share of total energy declines to 28% in 2035
- Increasing supplies of unconventional natural gas support growth in projected worldwide gas use; projected 2035 natural gas use 8 percent higher than IEO2010
- Worldwide energy-related carbon dioxide emissions rise 43 percent between 2008 and 2035, reaching 43.2 billion metric tons in 2035

Renewables are the fastest growing source of energy consumption



Source: EIA, International Energy Outlook 2011

Non-OECD nations drive the increase in energy demand



Source: EIA, International Energy Outlook 2011

But world events have compounded the uncertainty associated with the outlook…

- The economic recovery from the 2008-2009 recession has been (and continues to be) uneven: U.S., Europe, and Japan vs. China and India
- Impacts of Fukushima Daiichi nuclear disaster on world sentiment for nuclear power
  - Demand sectors' electricity efficiency improvements
  - Alternative fuel choices for power generation (bunker fuel, natural gas)
- Chinese choices in new power plant capacity
- Shale natural gas potential
- Continuation of Middle Eastern petroleum subsidies

Considerations and model additions for IEO2013 and beyond

- Industrial Fuel Switching Algorithm (World Bank cross-price elasticities)
- Chinese petrochemical future feedstocks…naphtha → coal → LPG?
- Chinese coal-to-liquids (CTL) development
- Energy-intensive industry future efficiency improvements
- Integration of Chinese coal supply & demand (coal supply curve?)
- Water for energy & energy for water
- Explicit cogeneration implementation

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

Annual Energy Review | www.eia.gov/totalenergy/data/annual

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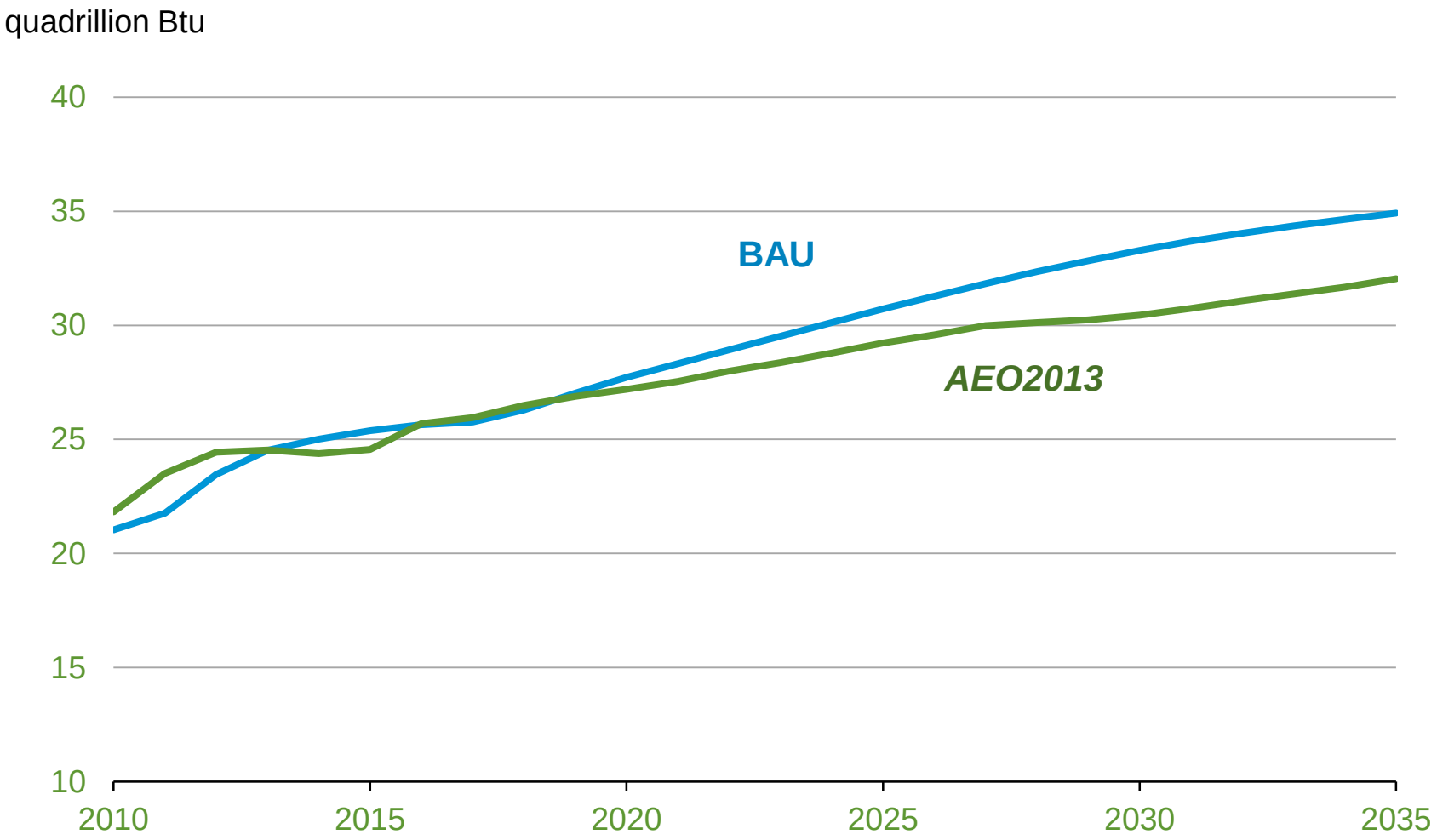
Backup slides

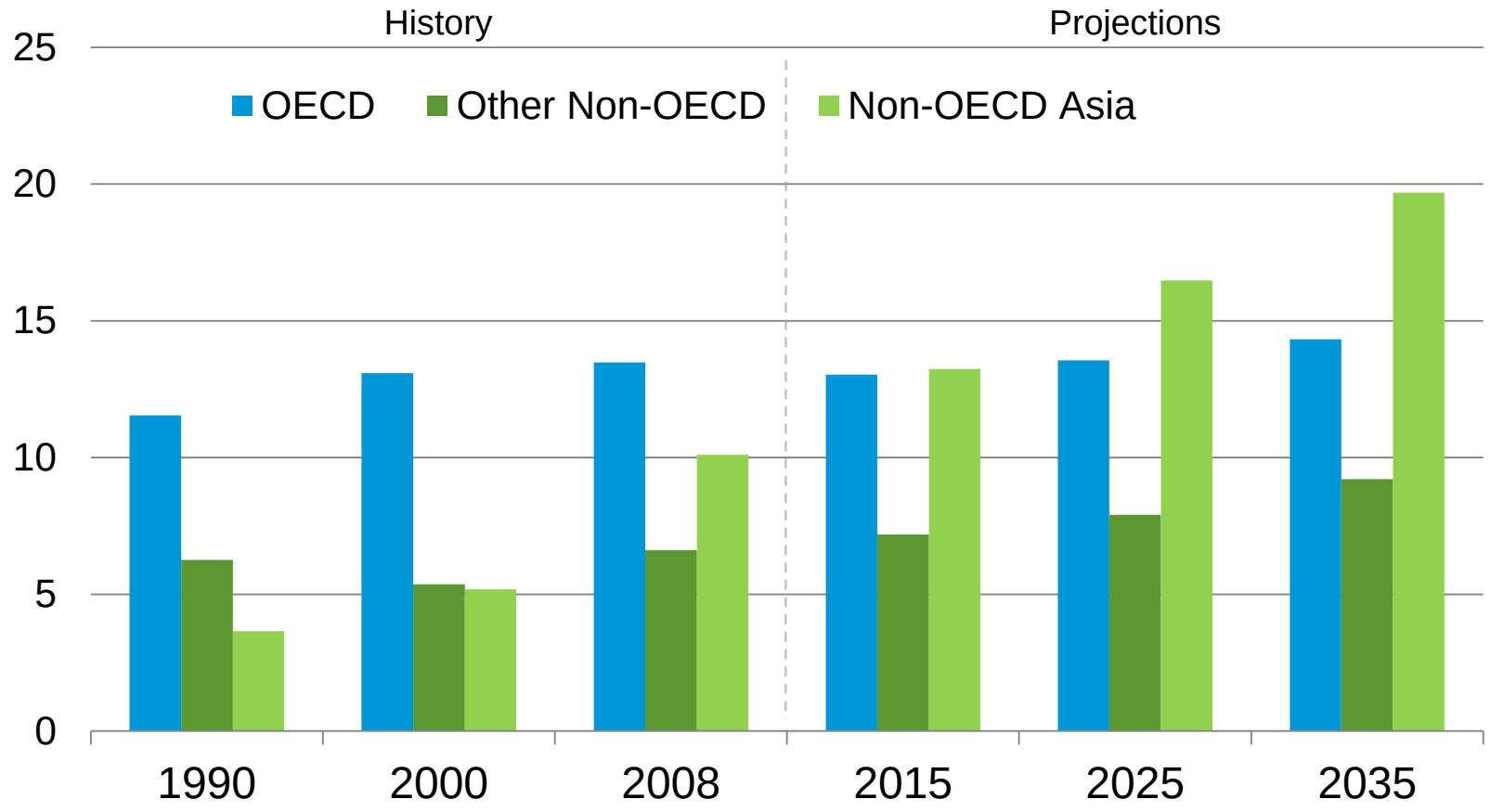
U.S. natural gas production (BAU vs. AEO Ref. case)



Source: APERC BAU Scenario and Annual Energy Outlook 2013 Early Release

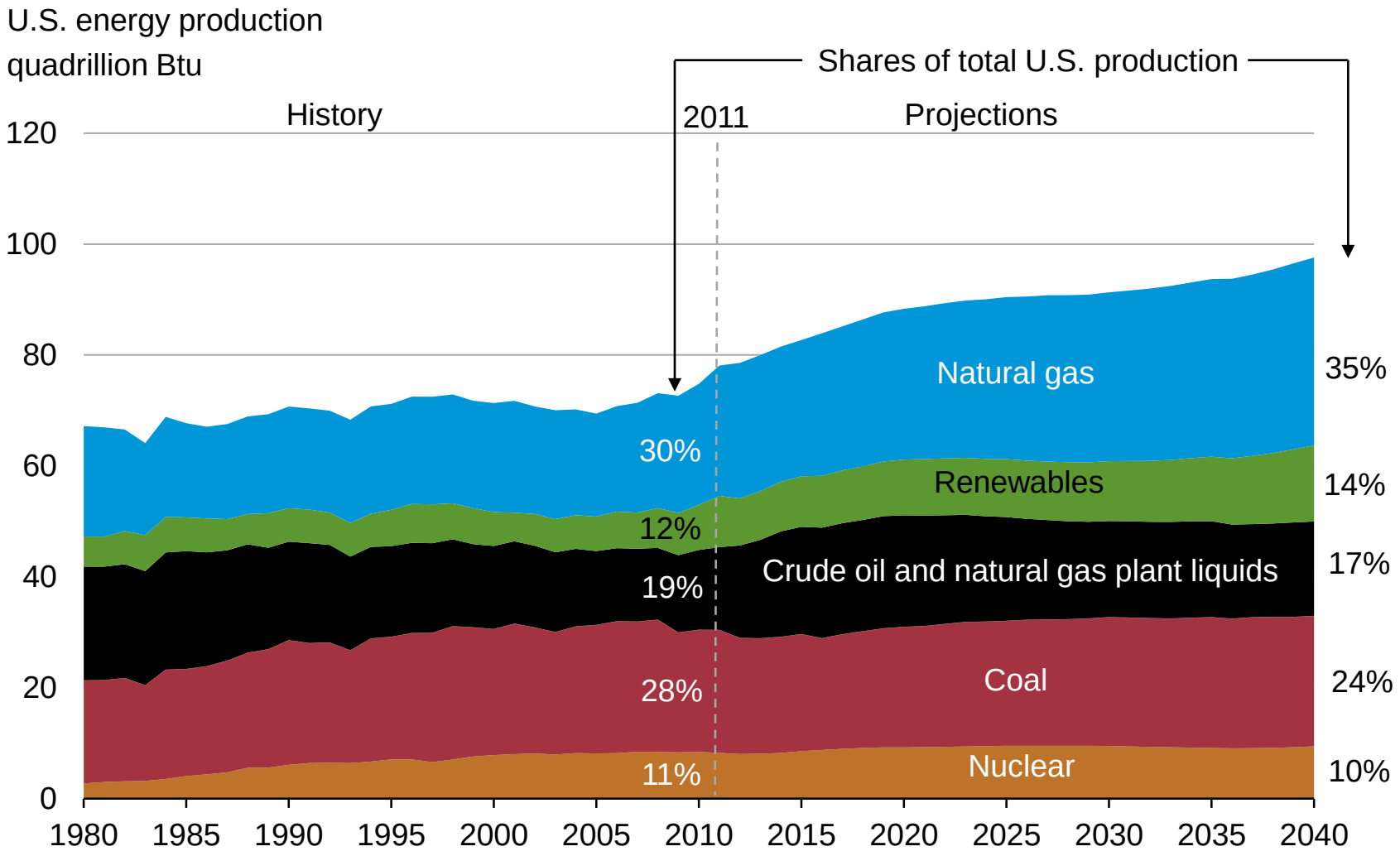
Non-OECD Asia accounts for almost 75% of the world increase in energy-related carbon dioxide emissions

world energy-related carbon dioxide emissions
billion metric tons



Source: EIA, International Energy Outlook 2011

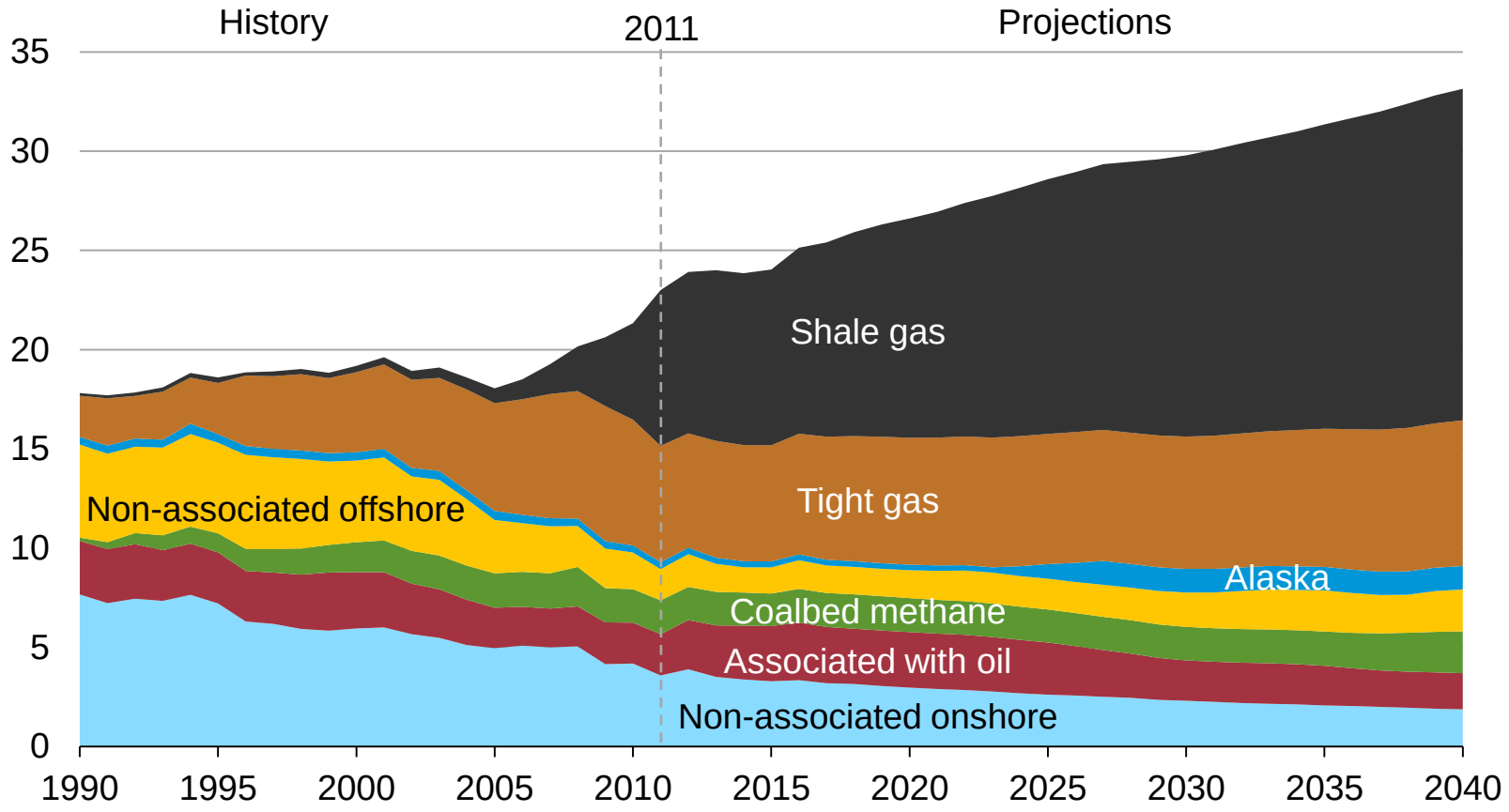
Domestic production grows rapidly over projection period, particularly natural gas and renewables, and liquids in the near term



Source: EIA, Annual Energy Outlook 2013 Early Release

Shale gas production leads growth in production through 2040

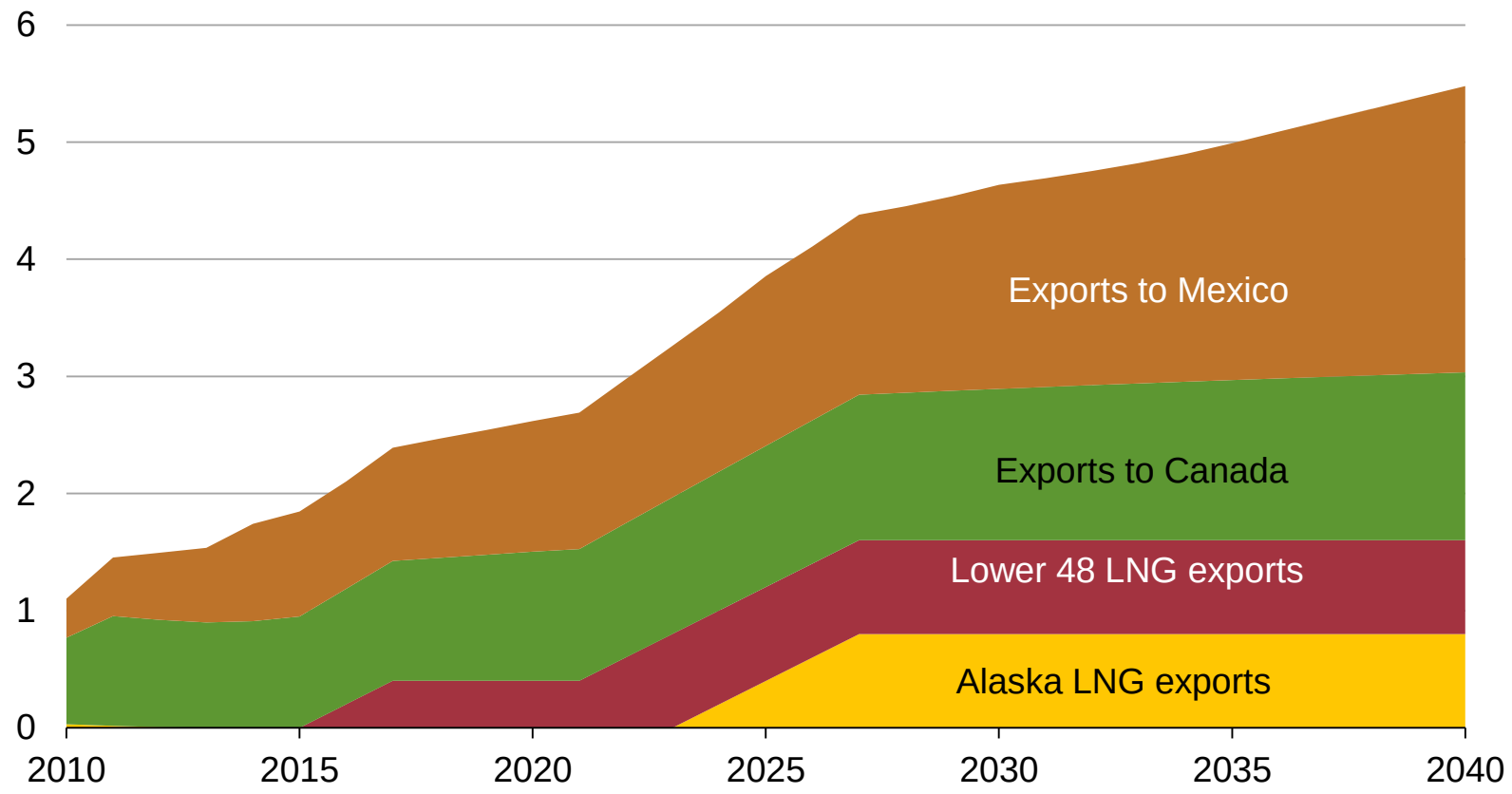
U.S. dry natural gas production
trillion cubic feet



Source: EIA, Annual Energy Outlook 2013 Early Release

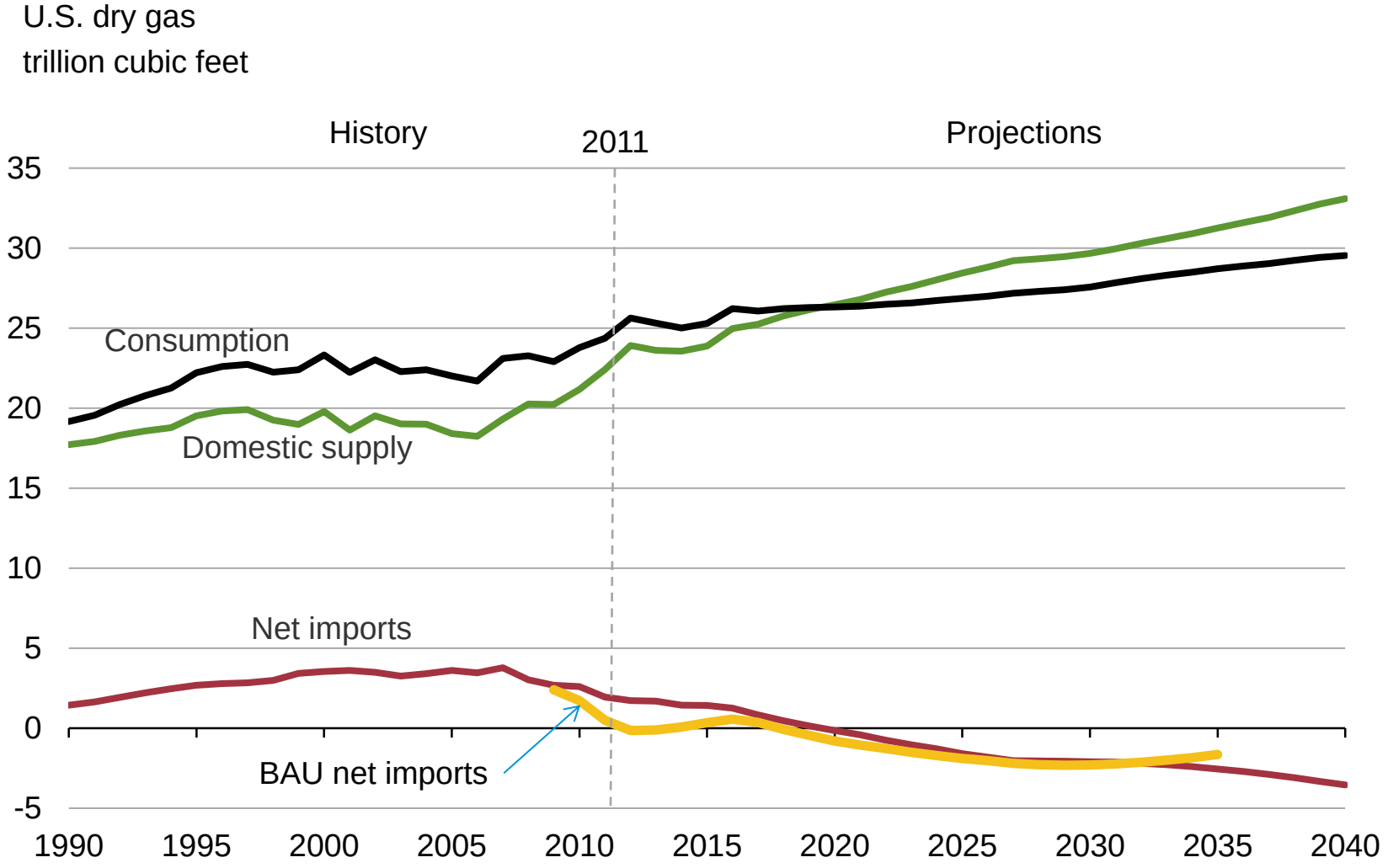
Total natural gas exports nearly quadruple by 2040 in the *AEO2013* Reference case

U.S. natural gas exports
trillion cubic feet



Source: EIA, Annual Energy Outlook 2013 Early Release

Domestic natural gas production grows faster than consumption and the U.S. becomes a net exporter of natural gas around 2020

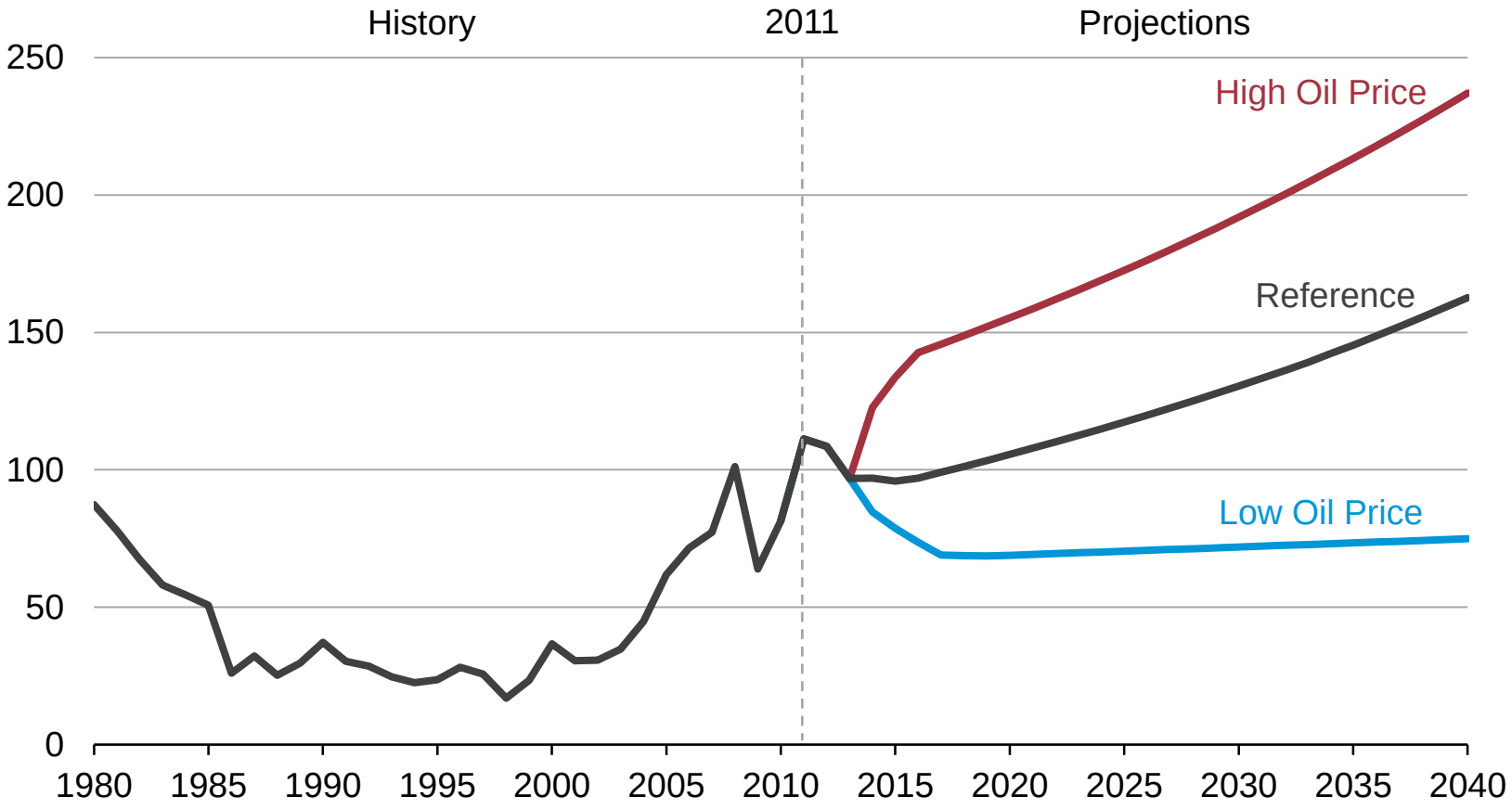


Source: EIA, Annual Energy Outlook 2013 Early Release

Reference case oil price initially drops and then rises steadily, but there is uncertainty about the future trajectory

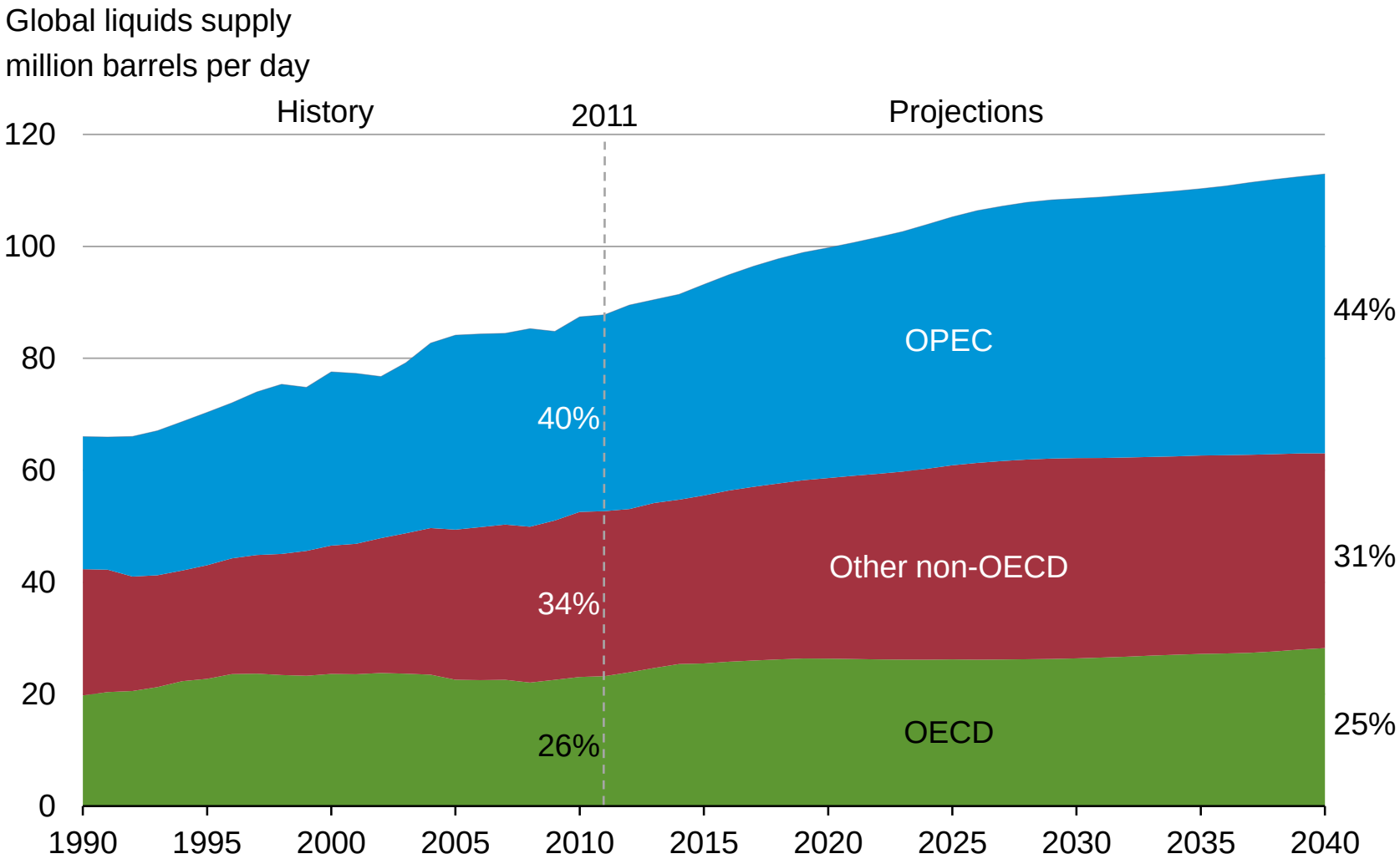
Annual average spot price of Brent crude oil

2011 dollars per barrel



Source: EIA, Annual Energy Outlook 2013 Early Release

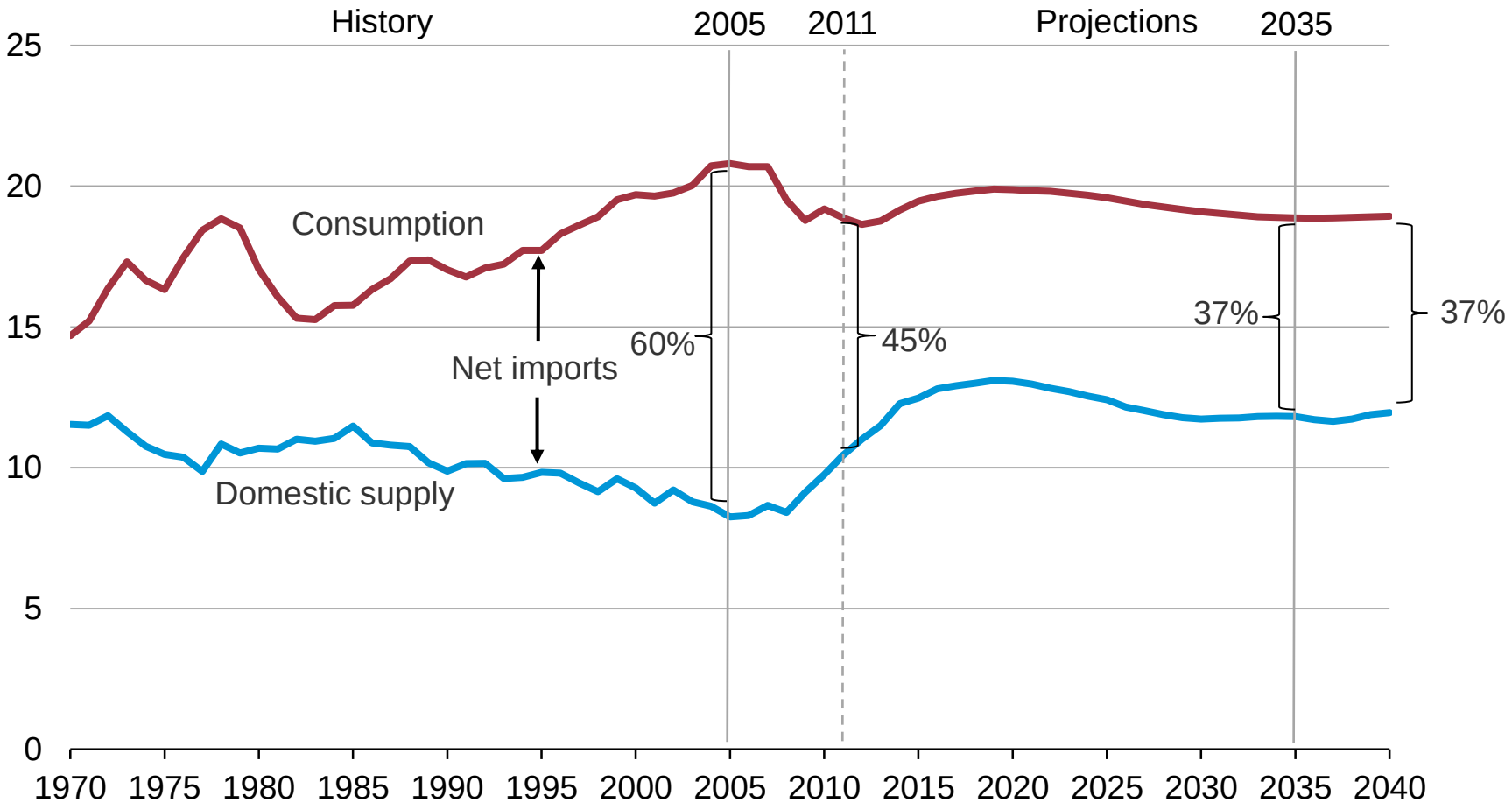
Global liquids supply increases 26 percent with regional market shares relatively stable



Source: EIA, Annual Energy Outlook 2013 Early Release

U.S. dependence on imported liquids declines

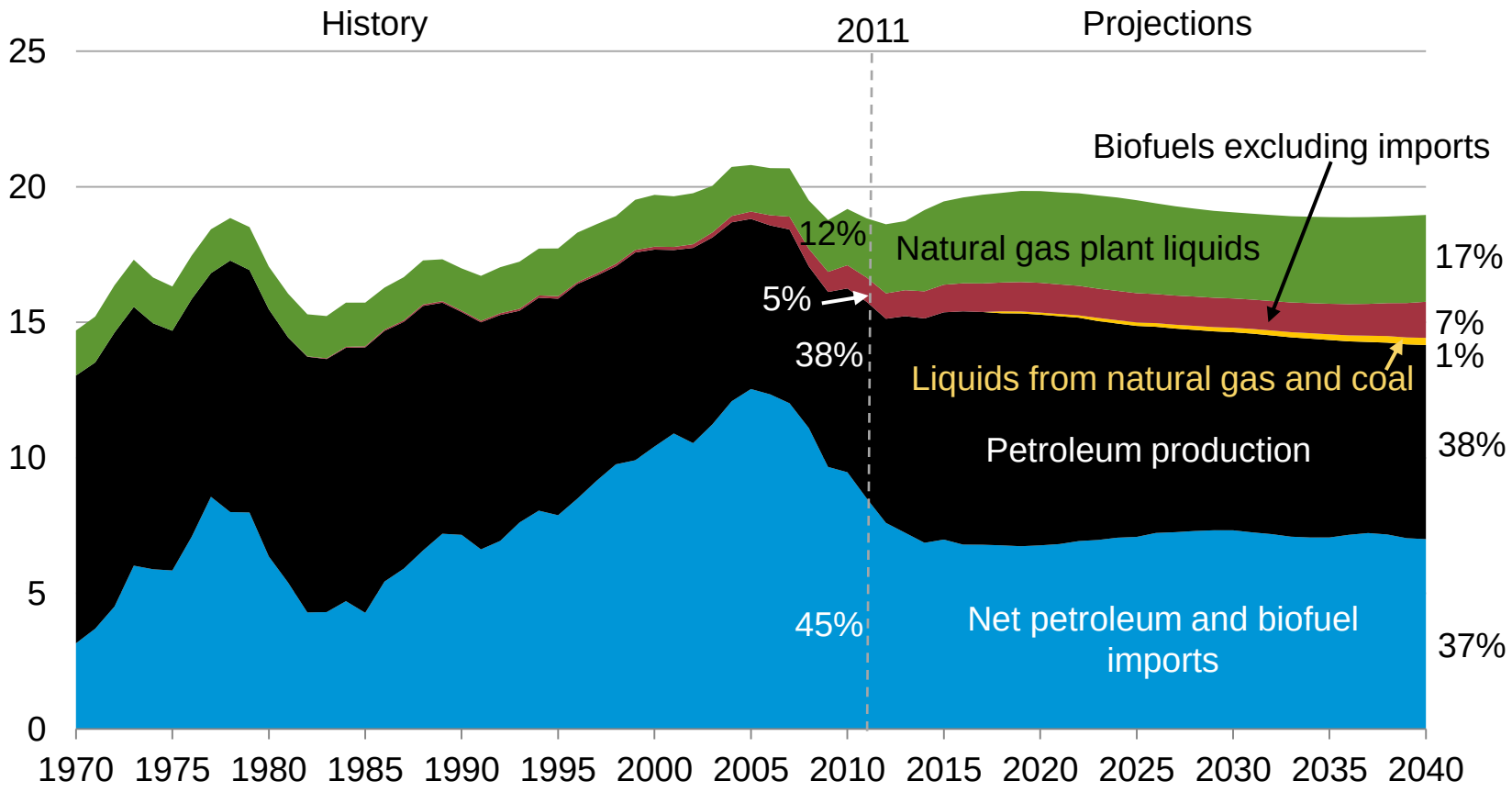
U.S. liquid fuel supply
million barrels per day



Source: EIA, Annual Energy Outlook 2013 Early Release

U.S. import share of liquid fuels declines due to increased production of tight oil and gas liquids, and greater fuel efficiency

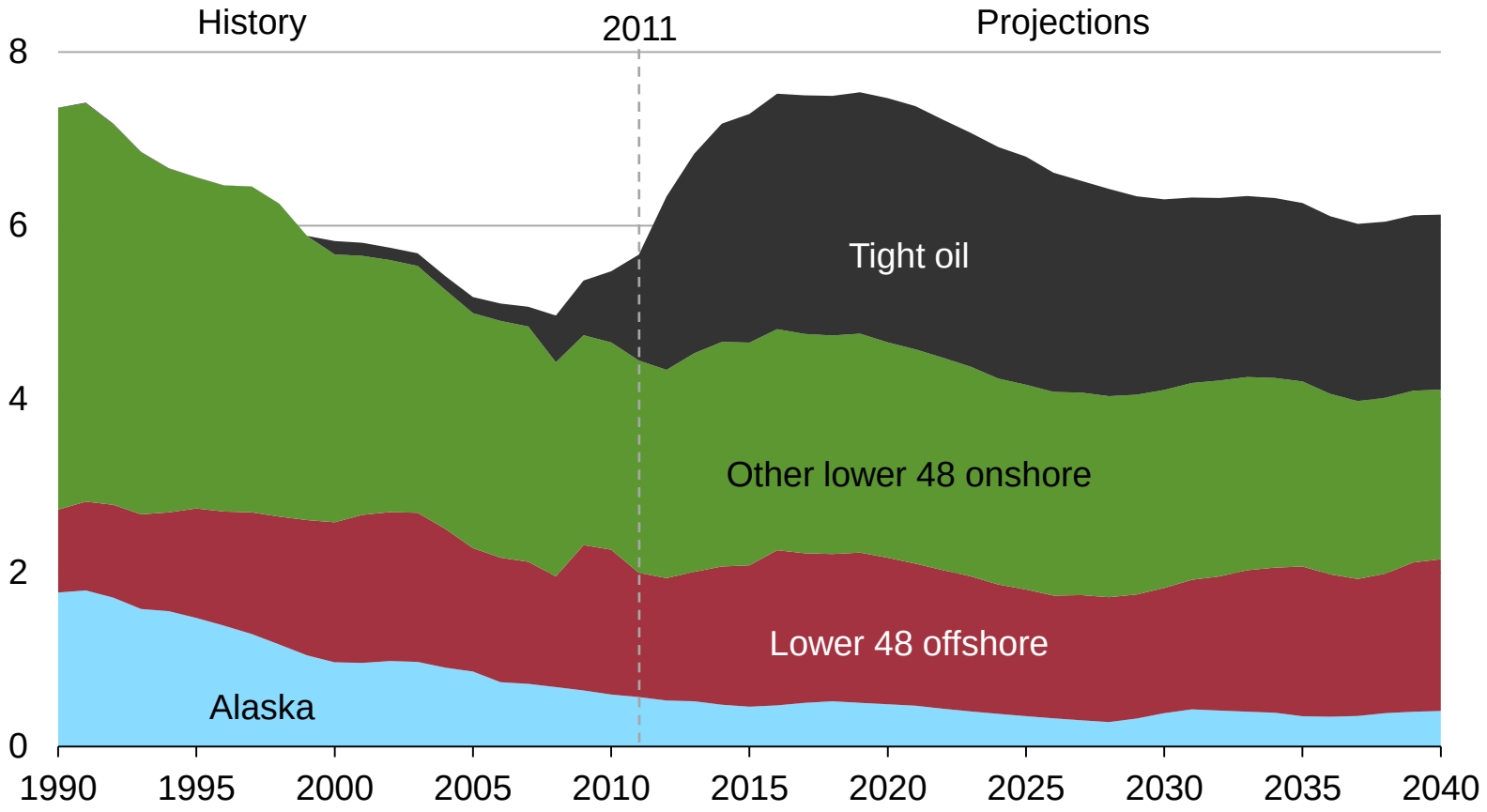
U.S. liquid fuels supply
million barrels per day



Source: EIA, Annual Energy Outlook 2013 Early Release

U.S. tight oil production leads a growth in domestic production of 2.6 million barrels per day between 2008 and 2019

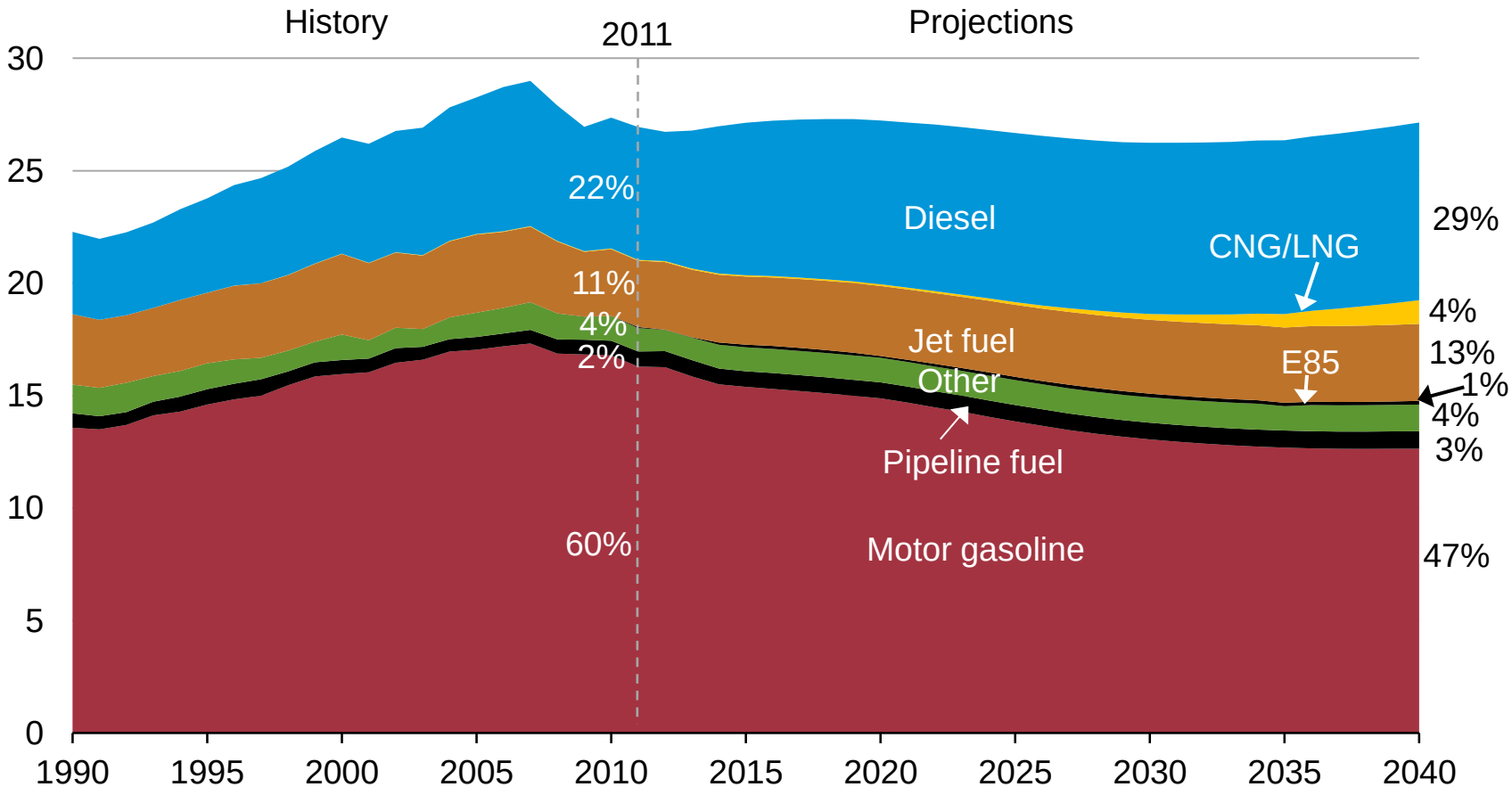
U.S. crude oil production
million barrels per day



Source: EIA, Annual Energy Outlook 2013 Early Release

Transportation sector motor gasoline demand declines

Transportation energy consumption by fuel
quadrillion Btu

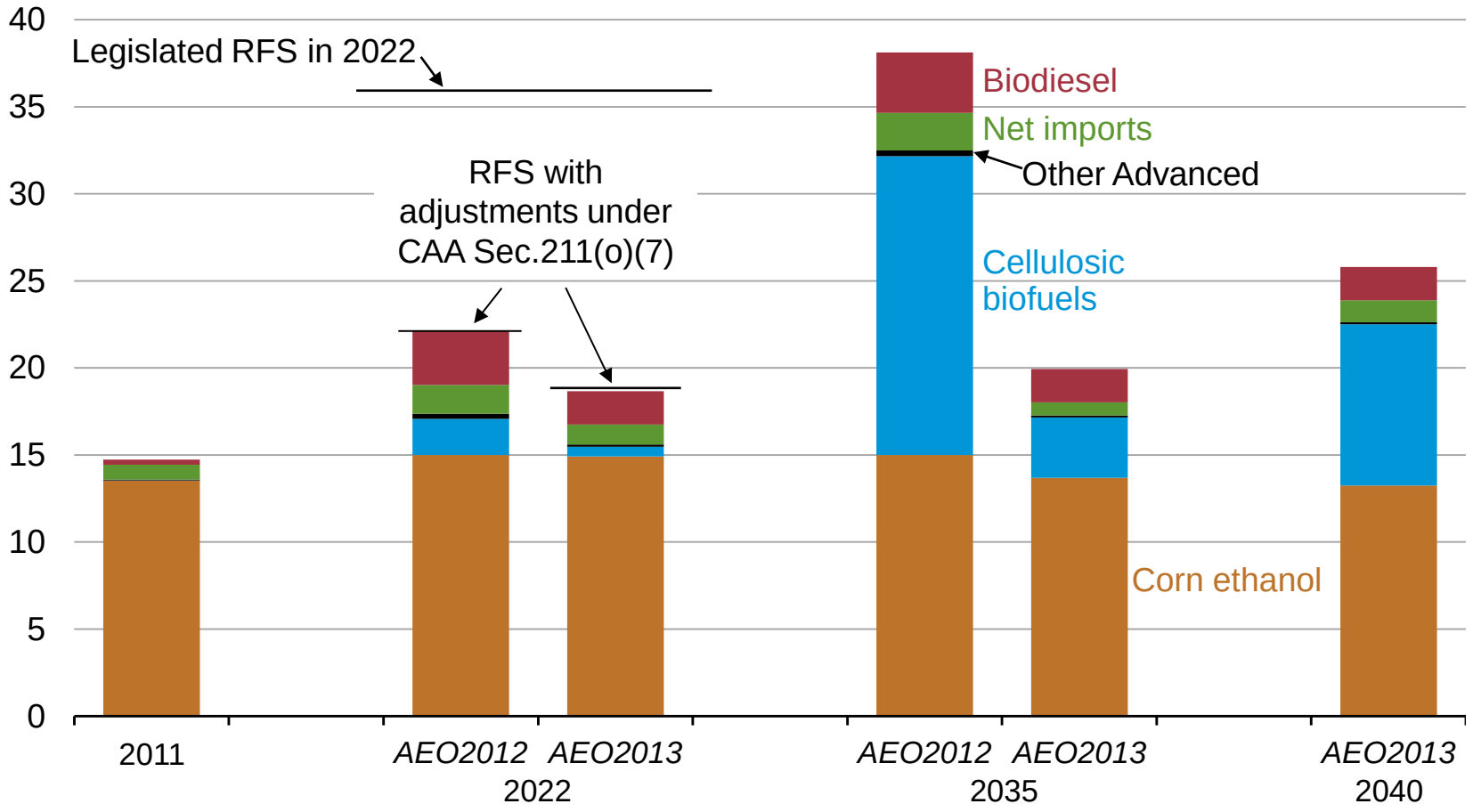


Source: EIA, Annual Energy Outlook 2013 Early Release

Biofuels grow at a slower rate due to lower crude oil prices and slower growth in E85 sales

Renewable fuel standard credits

billions ethanol-equivalent gallons

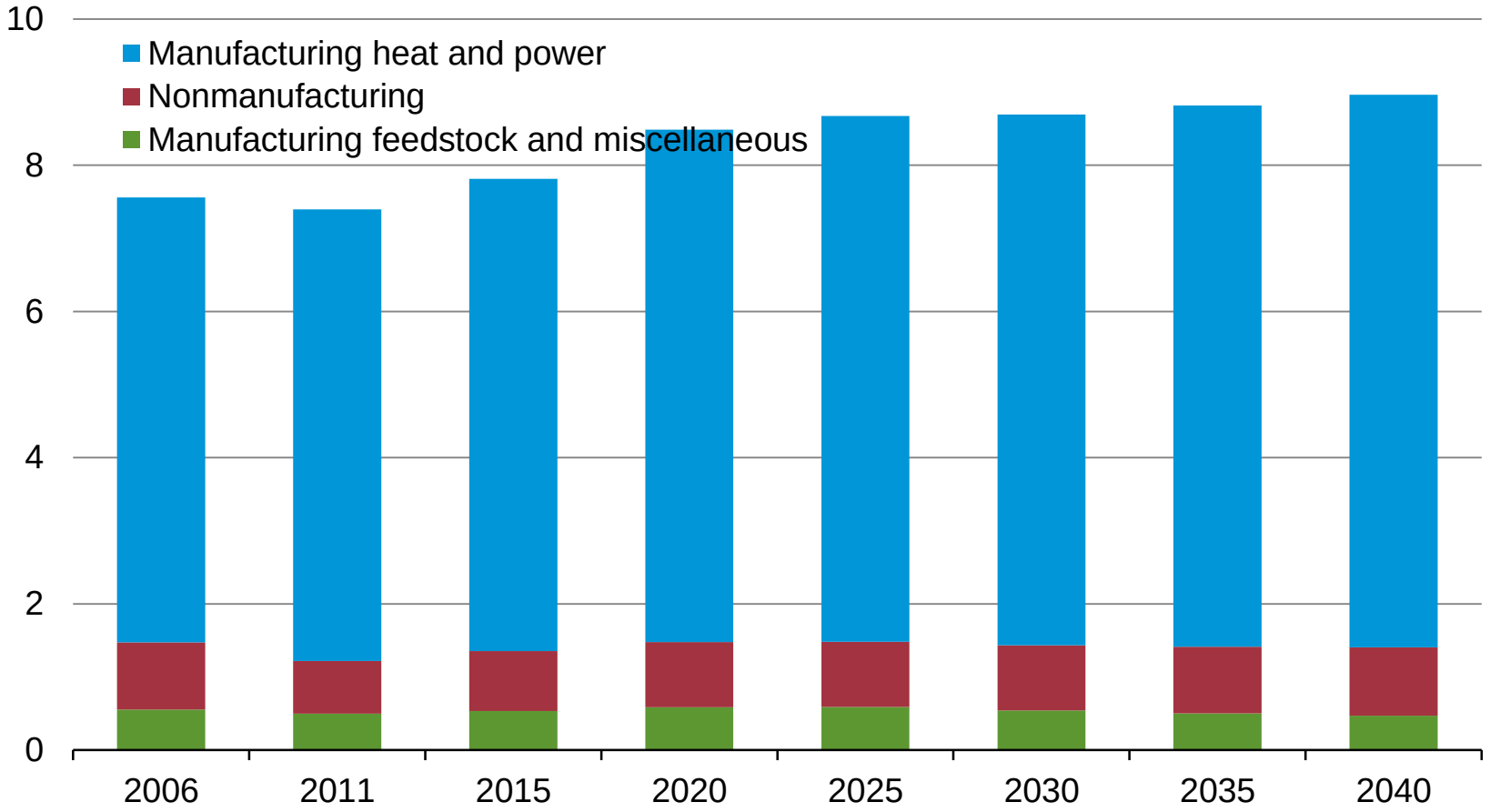


Sources: EIA, Annual Energy Outlook 2013 Early Release and EIA, Annual Energy Outlook 2012

Industrial natural gas usage grows, especially before 2025

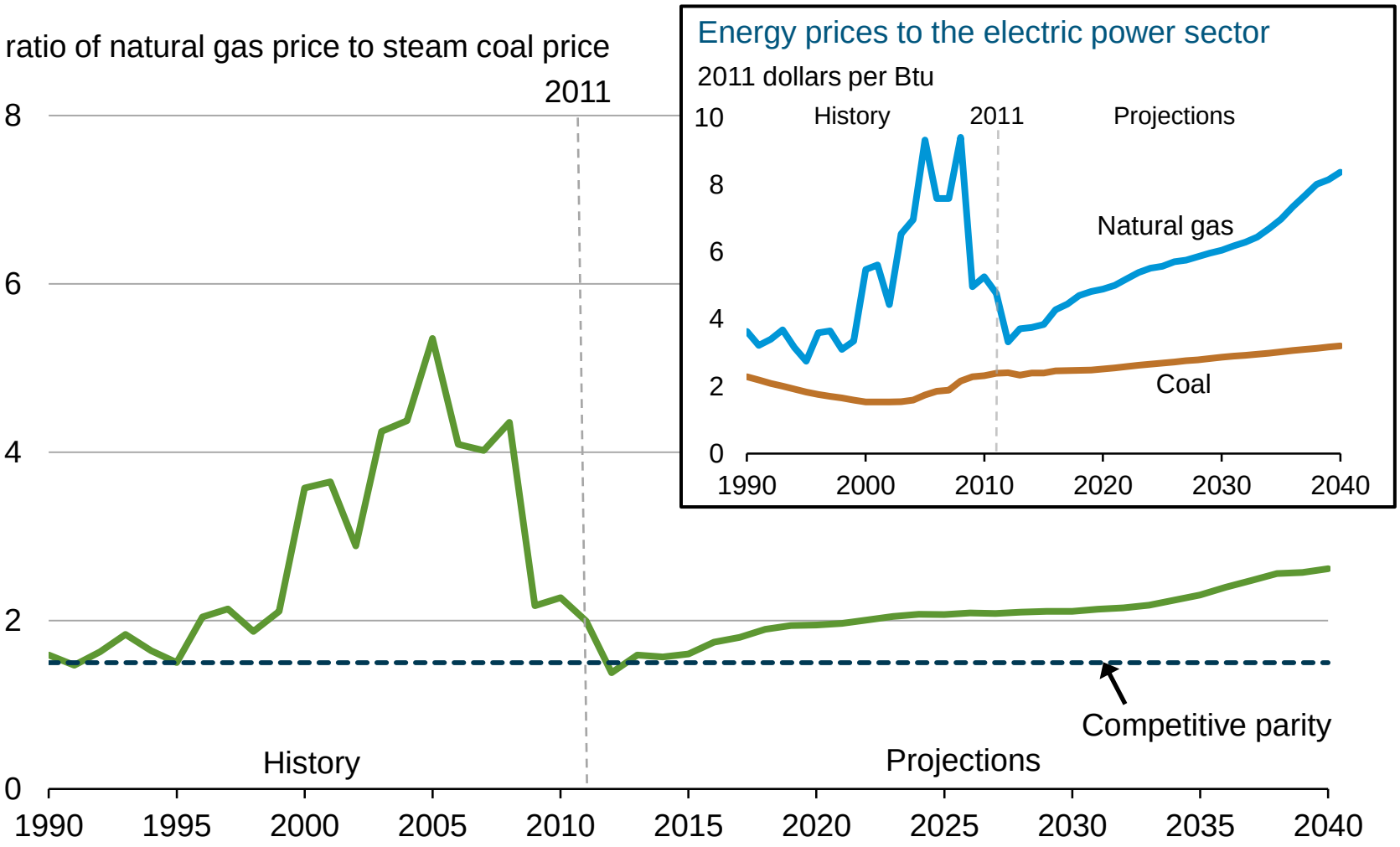
Industrial natural gas consumption

quadrillion Btu



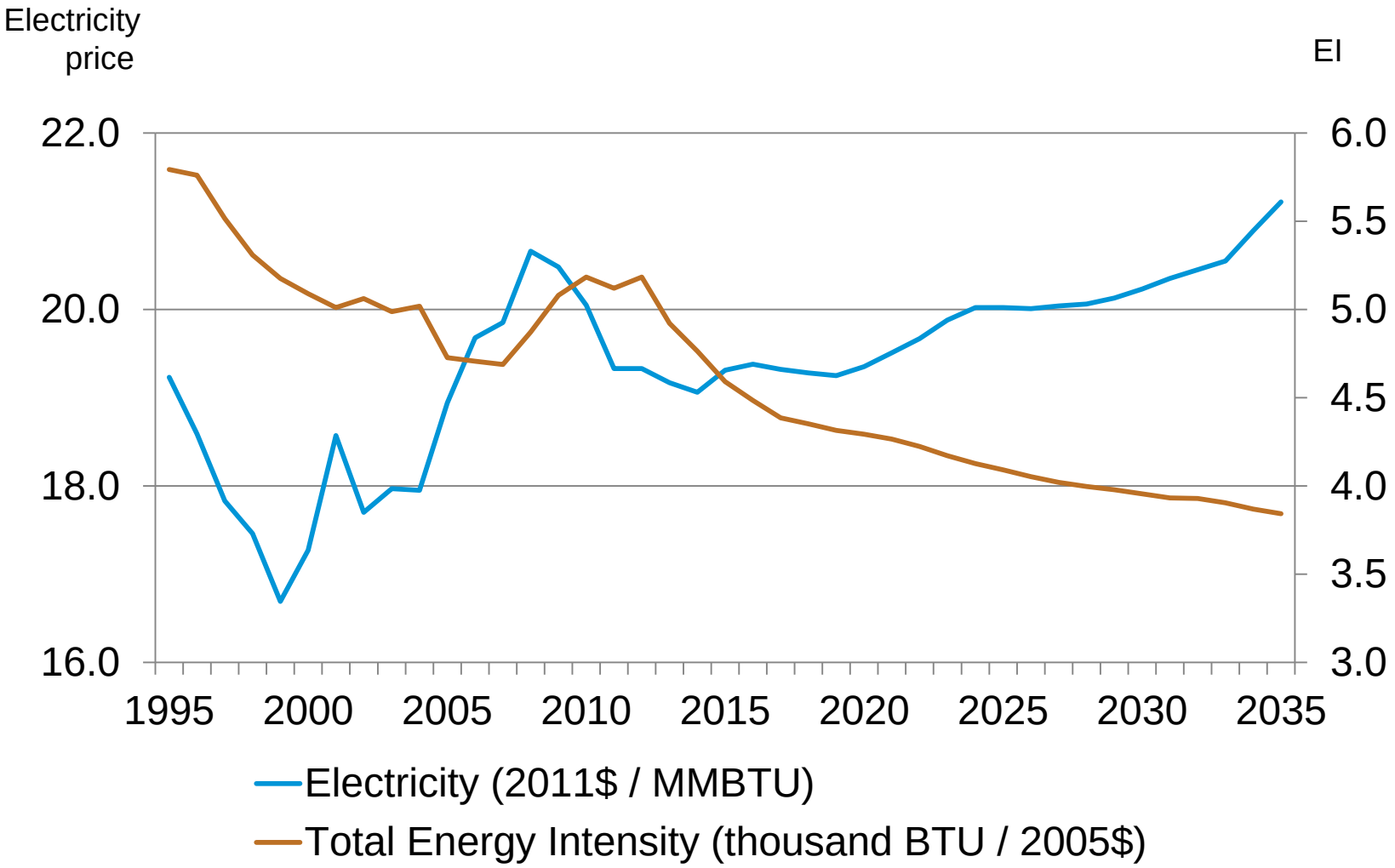
Source: EIA, Annual Energy Outlook 2013 Early Release

Coal regains some competitive advantage relative to natural gas over time on a national average basis



Source: EIA, Annual Energy Outlook 2013 Early Release

Comparison of Electricity Prices and Industrial EI

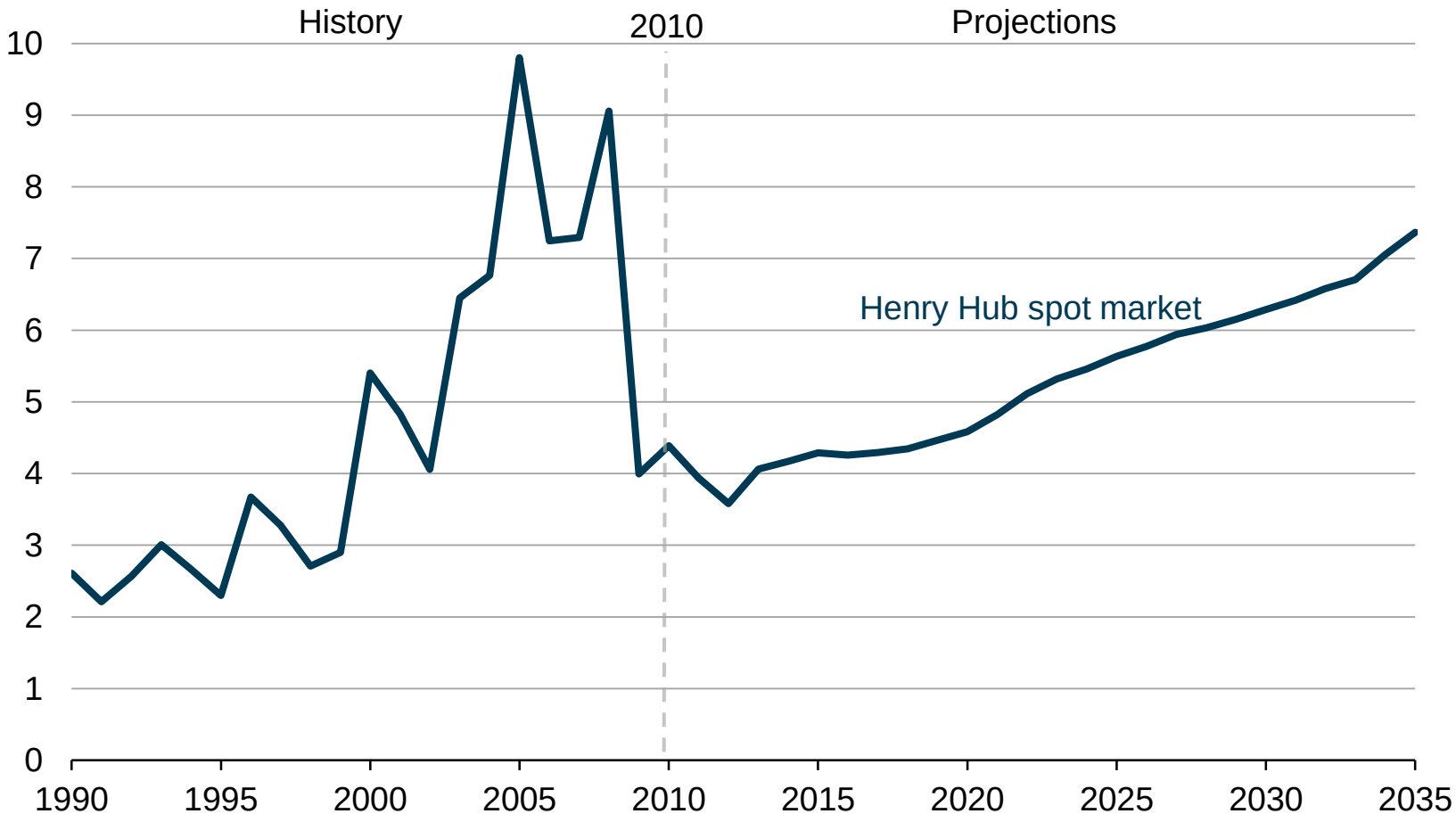


Source: AEO2012 run ref2012.d020112c

Annual average Henry Hub spot natural gas prices, 1990-2035

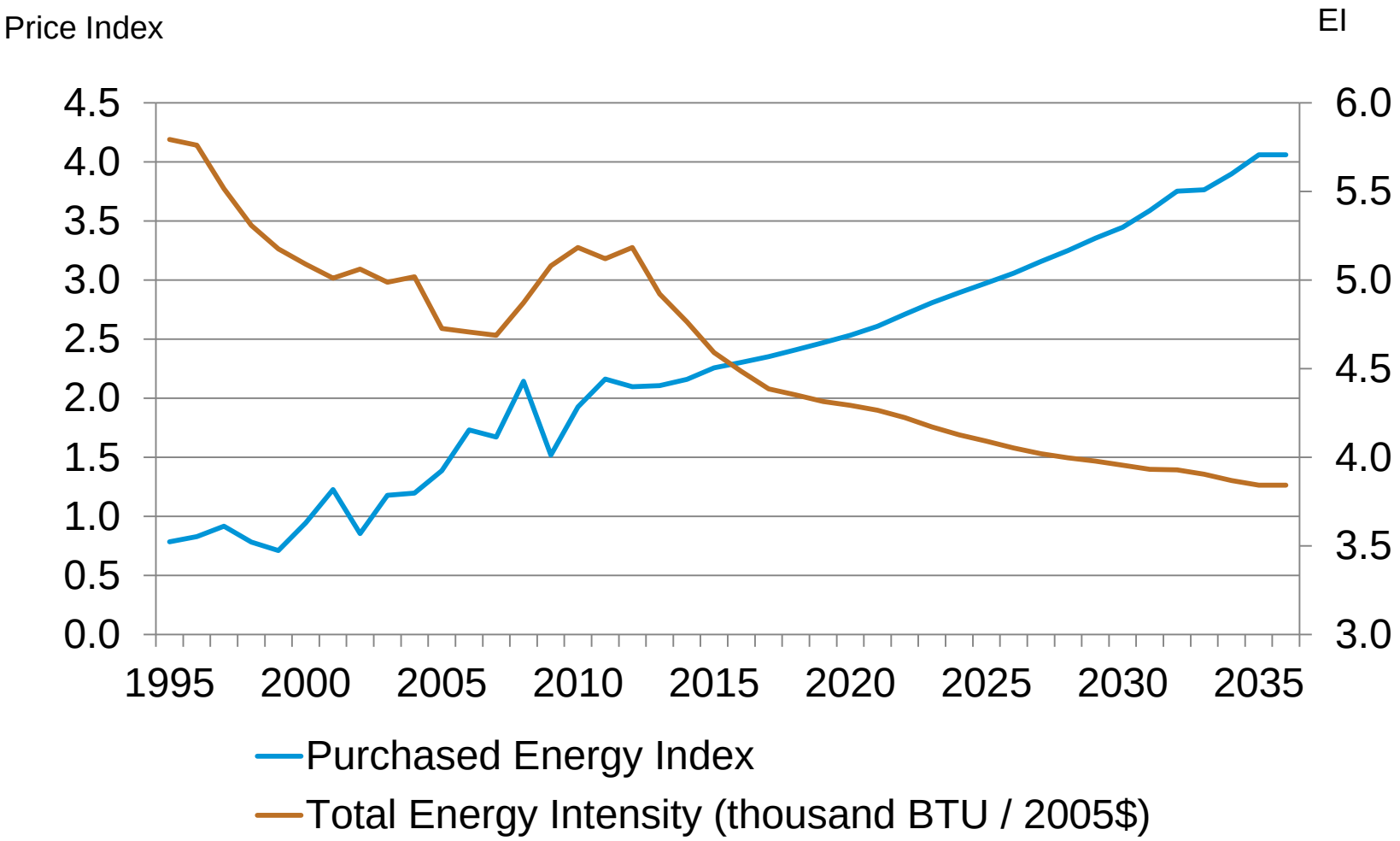
U.S. dry natural gas prices

2010 dollars per million Btu



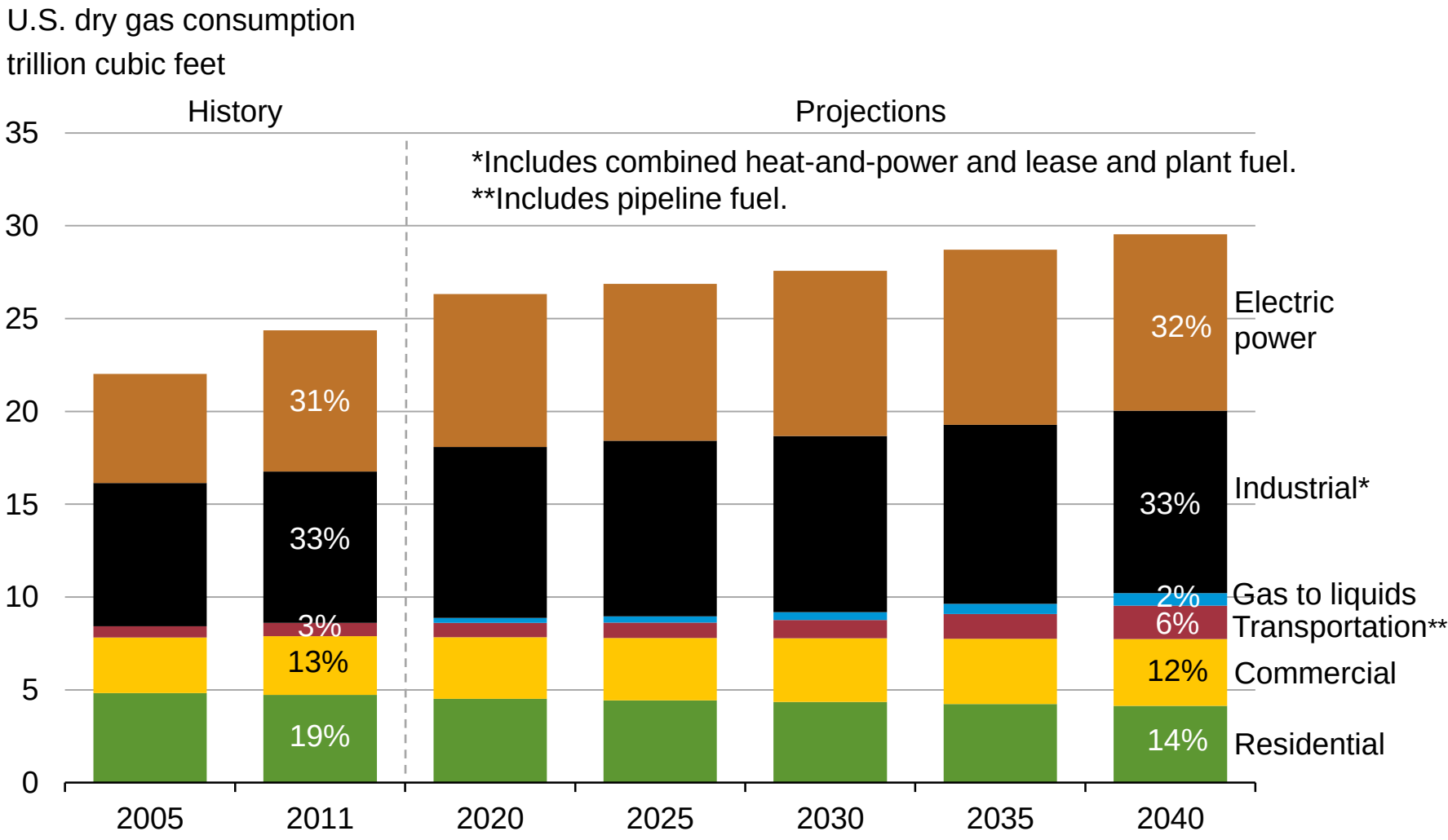
Source: EIA, Annual Energy Outlook 2012

Comparison of Fuel Price Index and Industrial Energy Intensity



Source: AEO2012 run ref2012.d020112c

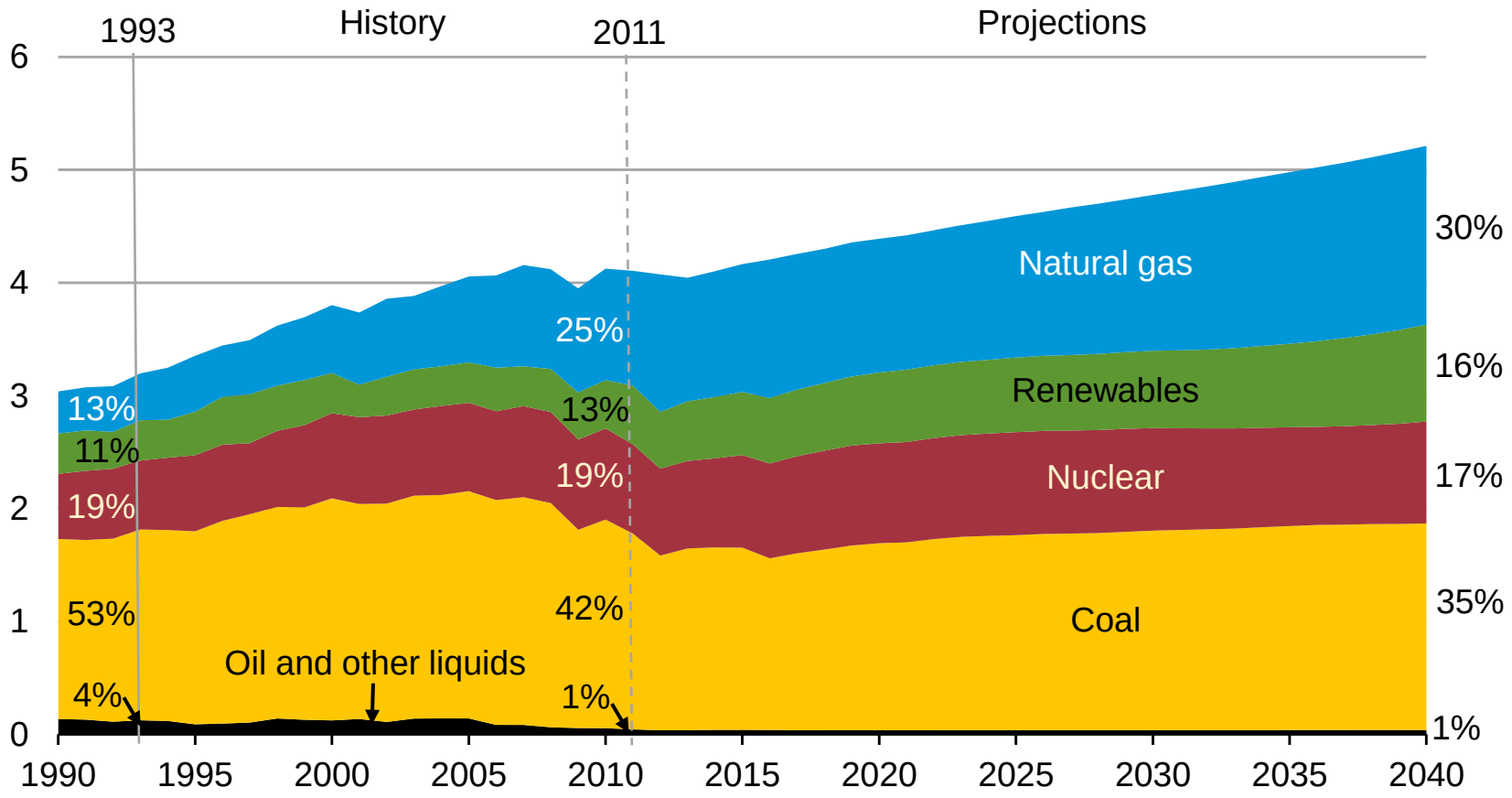
Natural gas consumption is quite dispersed with electric power, industrial, and transportation use driving future demand growth



Source: EIA, Annual Energy Outlook 2013 Early Release

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

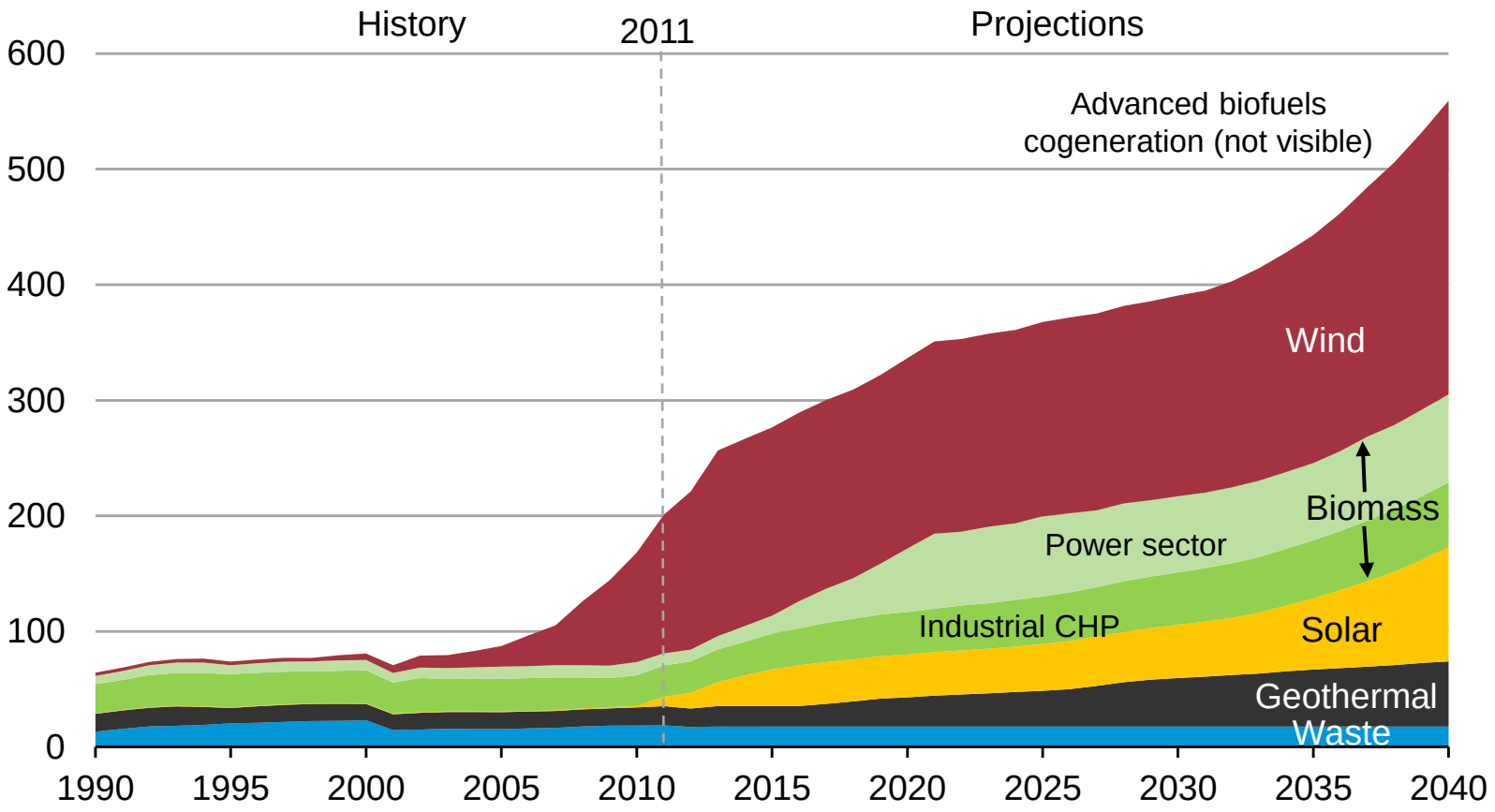
U.S. electricity net generation
trillion kilowatthours



Source: EIA, Annual Energy Outlook 2013 Early Release

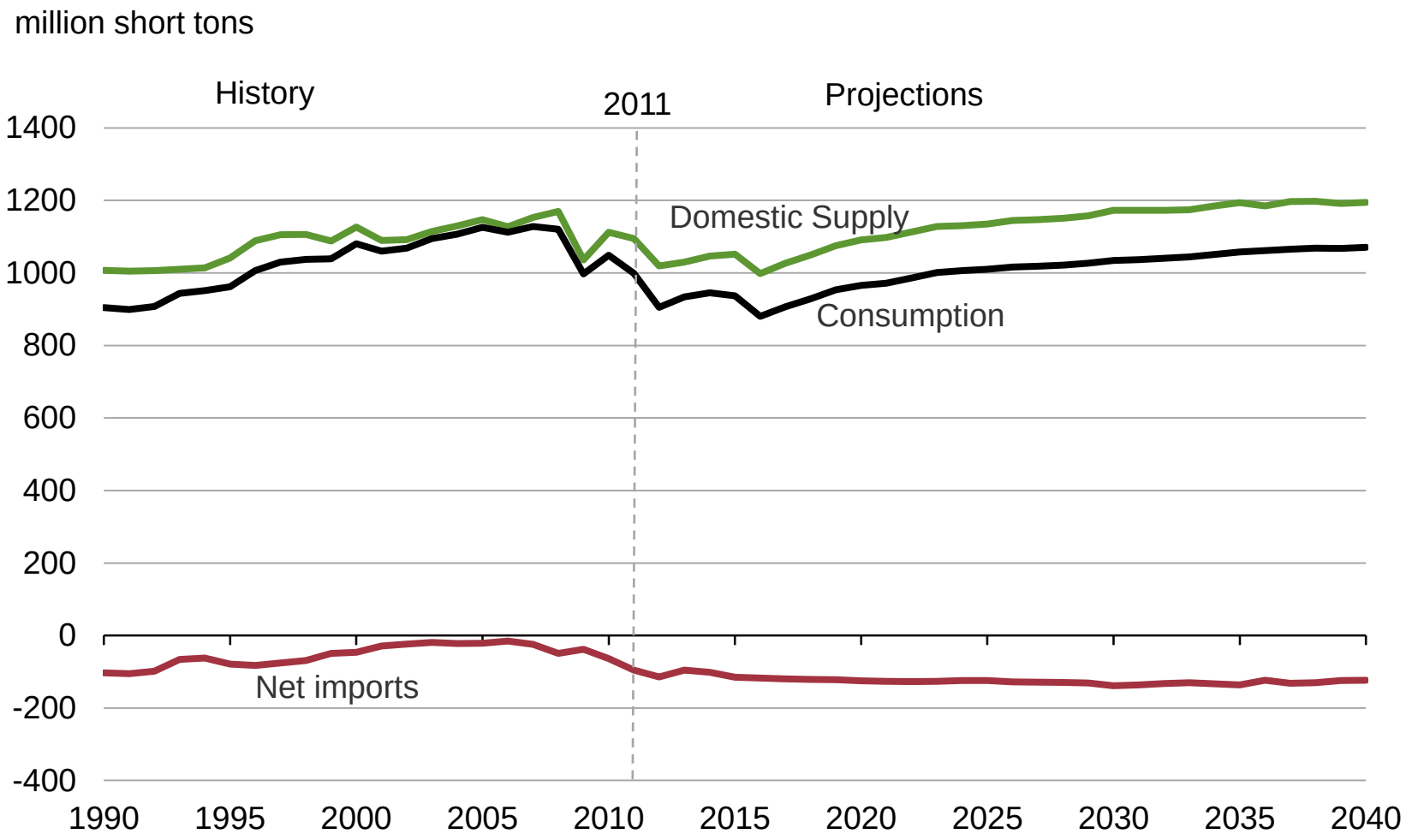
Non-hydro renewable generation more than doubles between 2011 and 2040

Non-hydropower renewable generation
billion kilowatthours per year



Source: EIA, Annual Energy Outlook 2013 Early Release

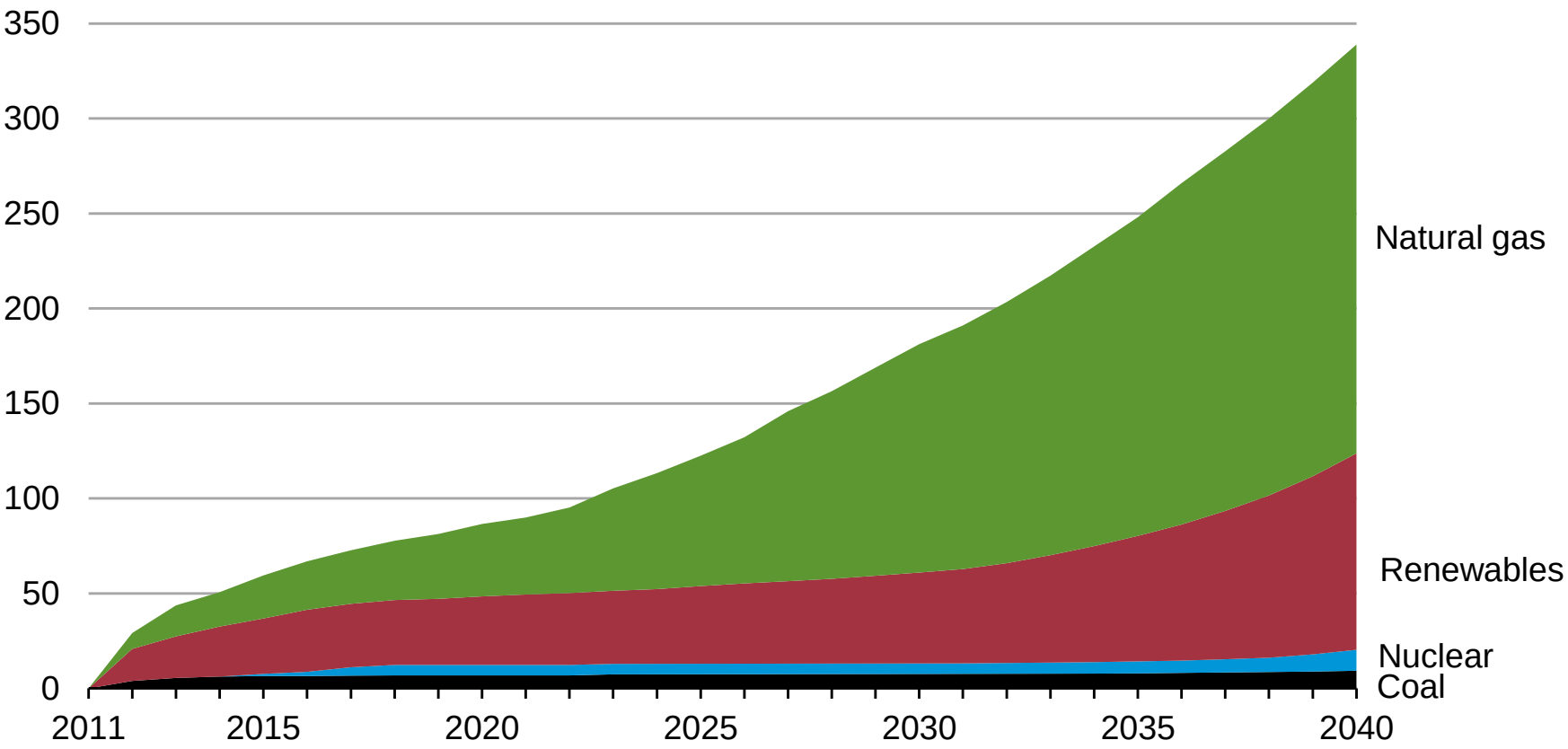
U.S. continues to be a net exporter of coal



Source: EIA, Annual Energy Outlook 2013 Early Release

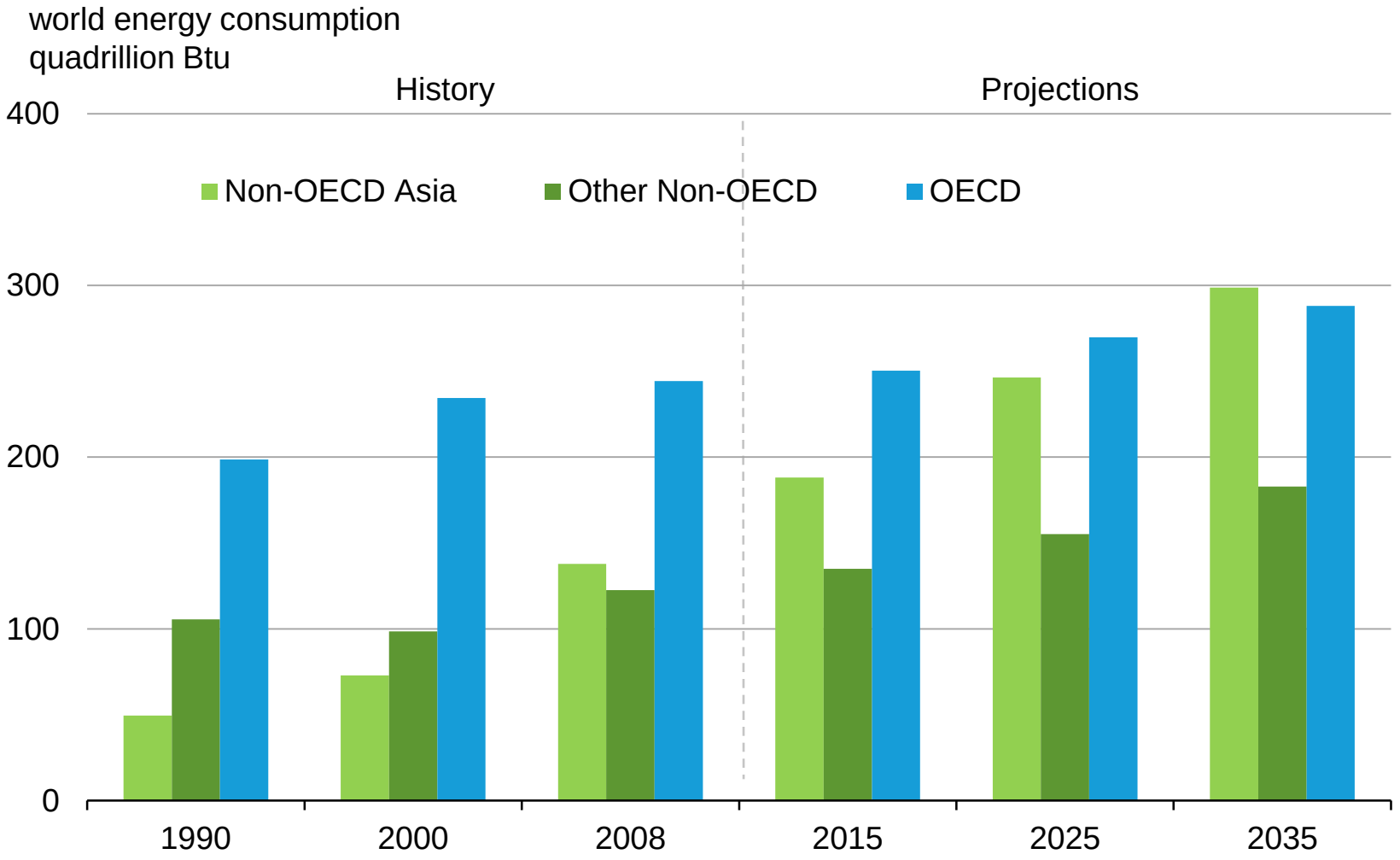
Natural gas and renewables account for the vast majority of capacity additions from 2012 to 2040

U.S. cumulative capacity additions
gigawatts



Source: EIA, Annual Energy Outlook 2013 Early Release

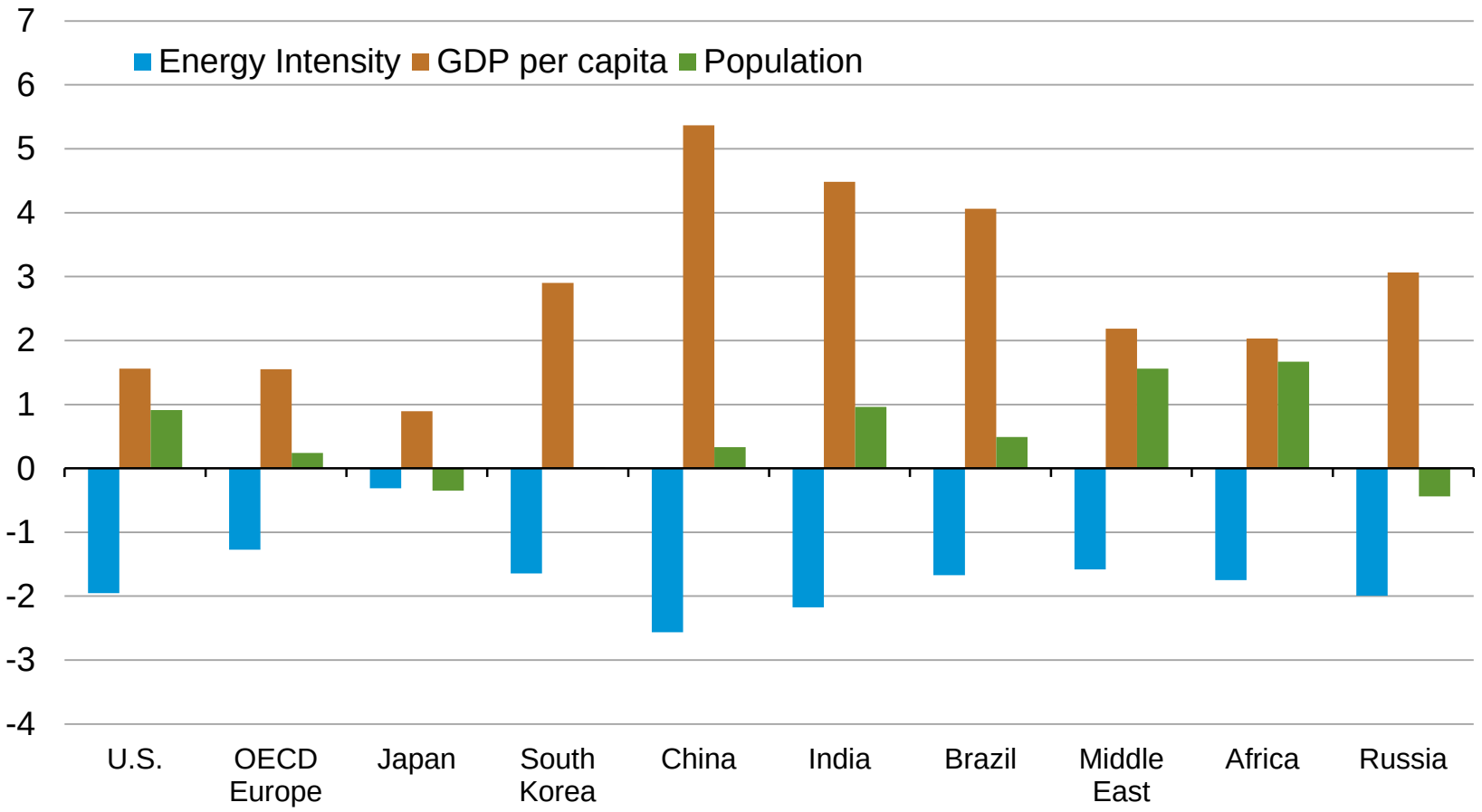
China and India account for about half of the world increase in energy use



Source: EIA, International Energy Outlook 2011

Growth in income and population drive rising energy use; energy intensity improvements moderate increases in energy demand

average annual change (2008-2035)
percent per year

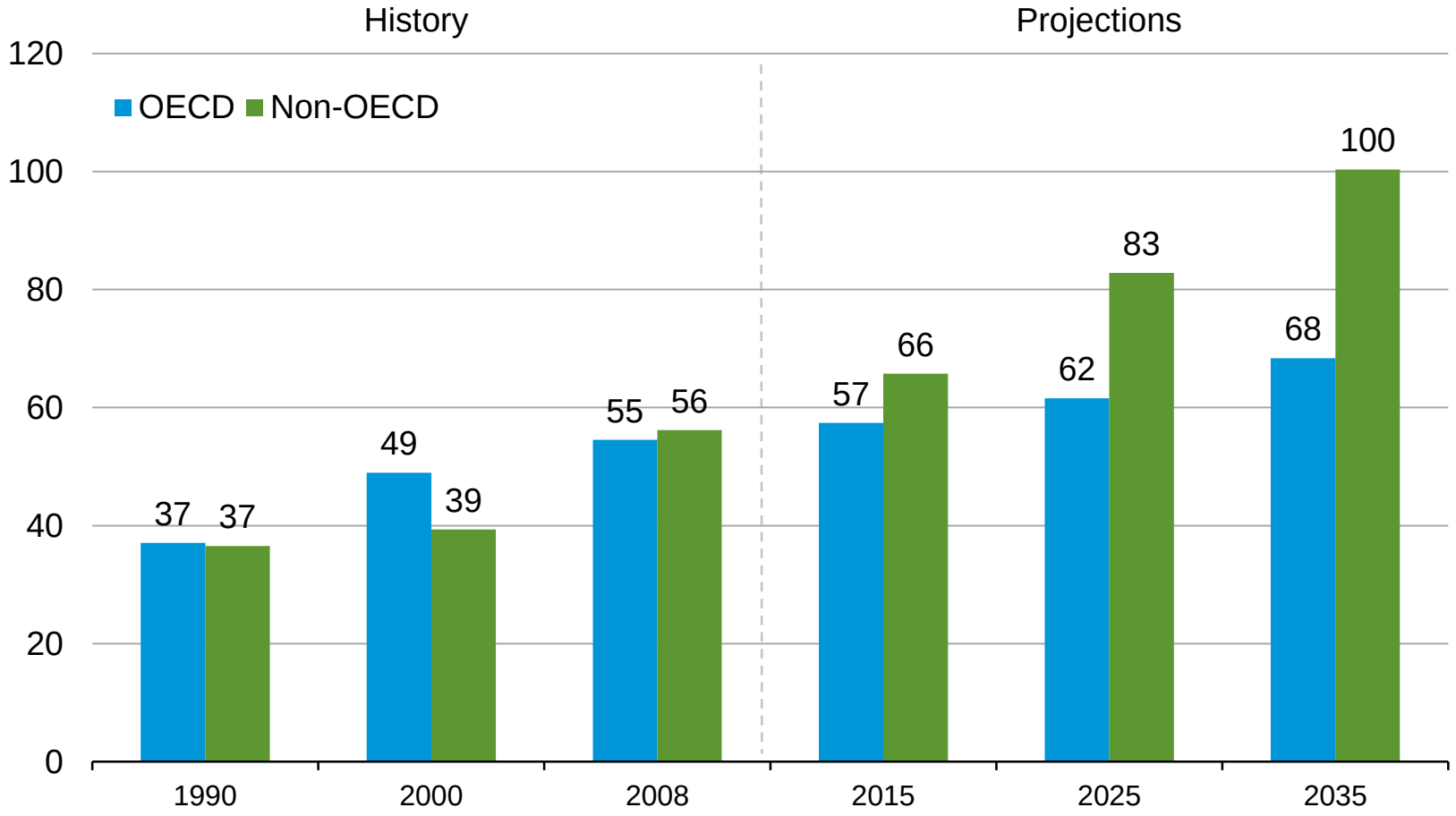


Source: EIA, International Energy Outlook 2011

Non-OECD nations account for 76% of the growth in natural gas consumption in the IEO2011 Reference case

world natural gas consumption

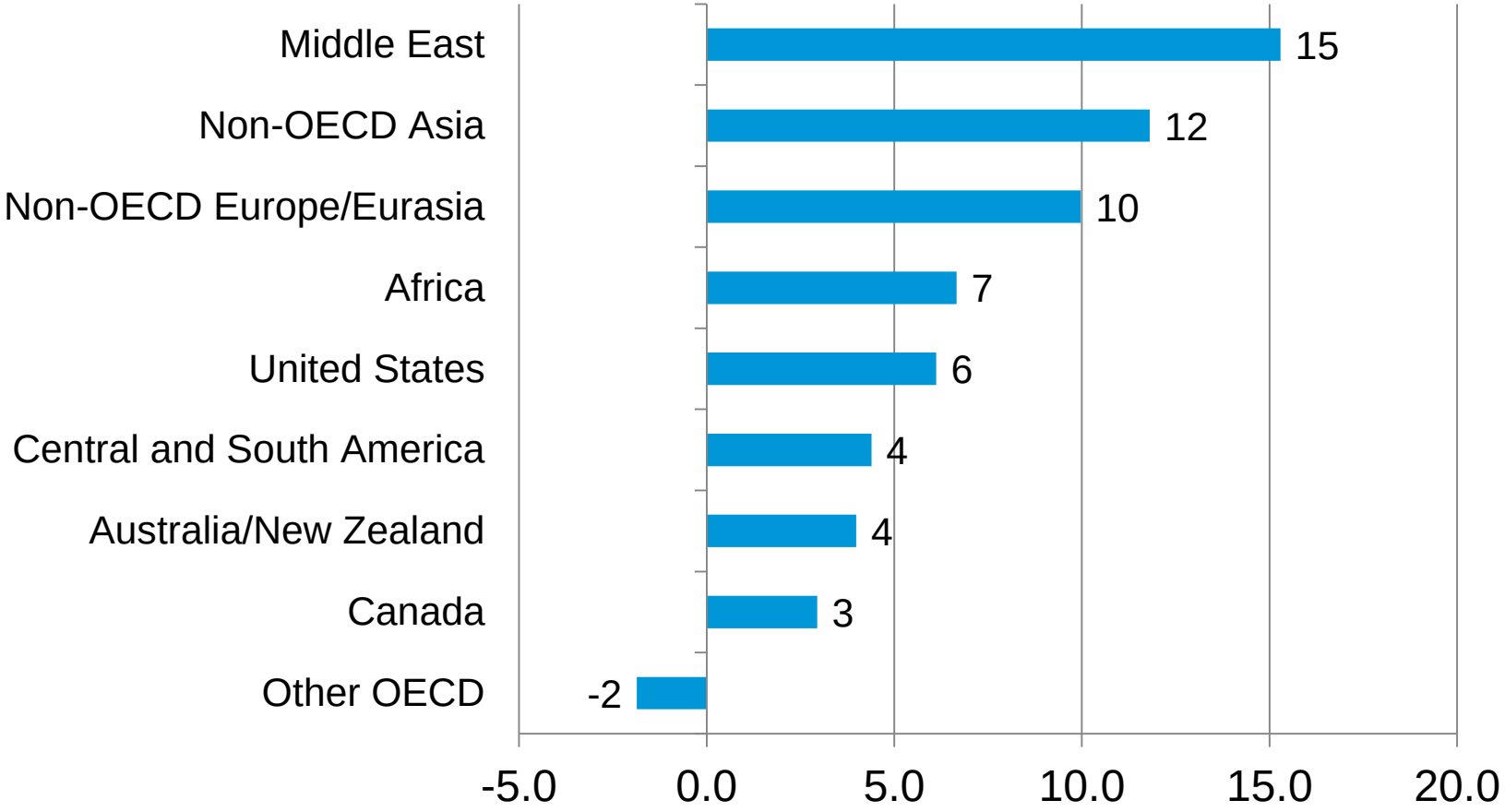
trillion cubic feet



Source: EIA, International Energy Outlook 2011

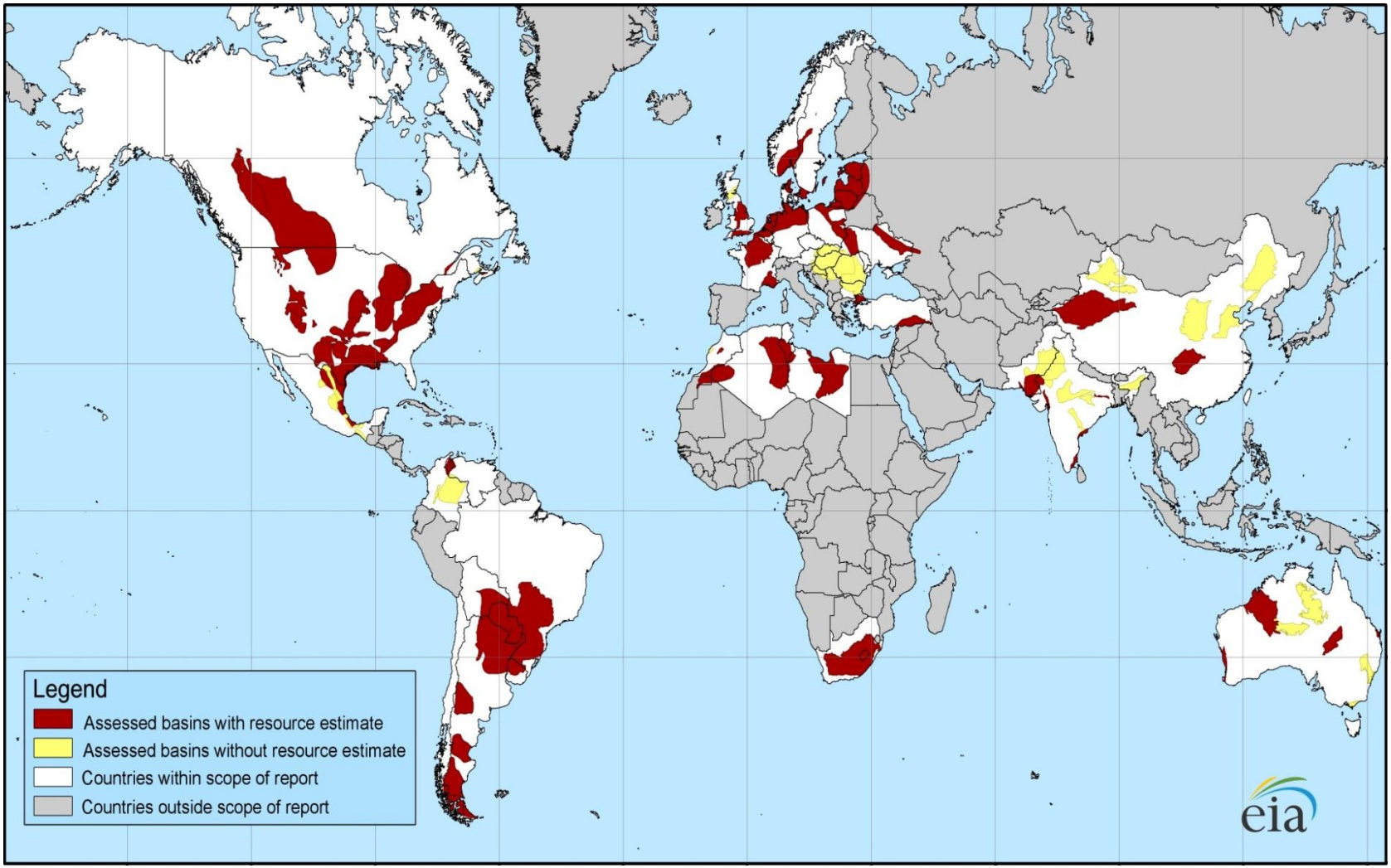
The Middle East and non-OECD Asia account for the largest increases in natural gas production

world natural gas production increment, 2008-2035
trillion cubic feet



Source: EIA, International Energy Outlook 2011

Initial assessment of shale gas resources in 48 major shale basins in 32 countries indicates a large potential



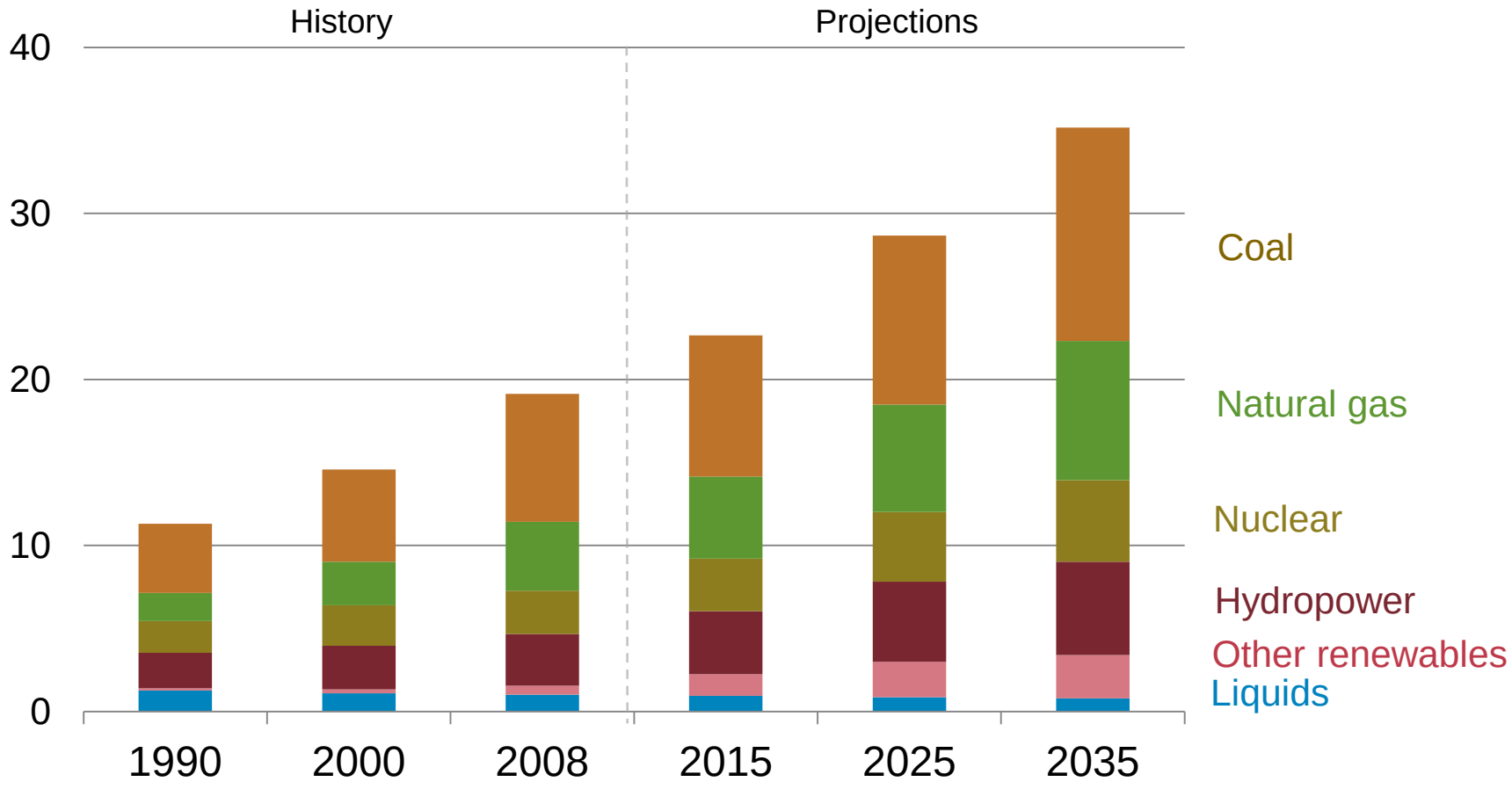
Source: U.S. Energy Information Administration

Estimates of technically recoverable shale gas resources in the 48 shale gas basins that were recently assessed

Continent		Technically Recoverable (trillion cubic feet)
North America	Canada, Mexico	1,069
Africa	Morocco, Algeria, Tunisia, Libya, Mauritania, Western Sahara, South Africa	1,042
Asia	China, India, Pakistan	1,404
Australia		396
Europe	France, Germany, Netherlands, Sweden, Norway, Denmark, U.K., Poland, Lithuania, Kaliningrad, Ukraine, Turkey	624
South America	Colombia, Venezuela, Argentina, Bolivia, Brazil, Chile, Uruguay, Paraguay	1,225

Renewables and natural gas are fastest growing, but coal still fuels the largest share of the world's electricity in 2035

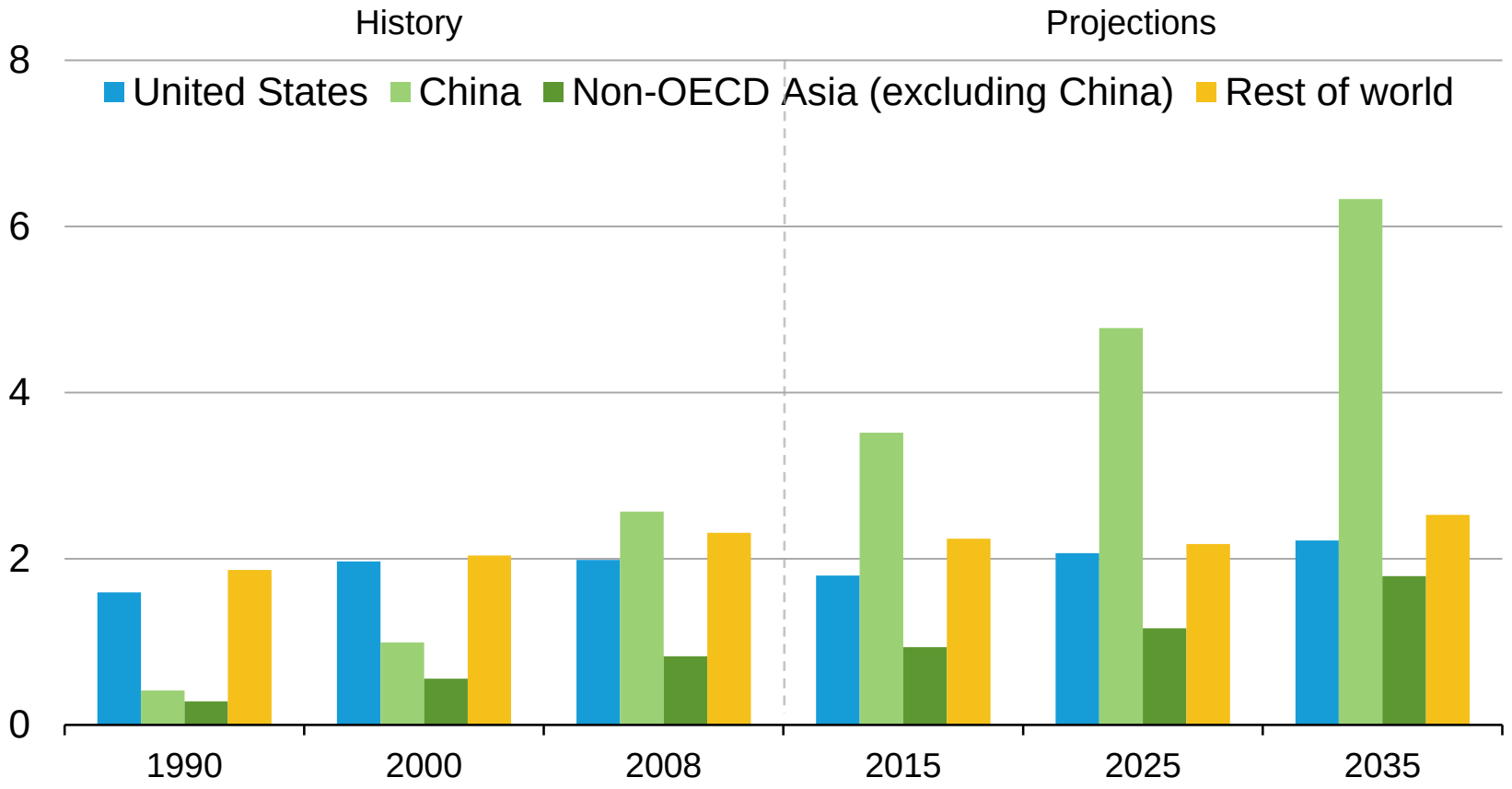
world electricity generation by fuel
trillion kilowatthours



Source: EIA, International Energy Outlook 2011

China accounts for nearly three-quarters of the world increase in coal-fired generation

coal-fired generation
trillion kilowatthours



Source: EIA, International Energy Outlook 2011

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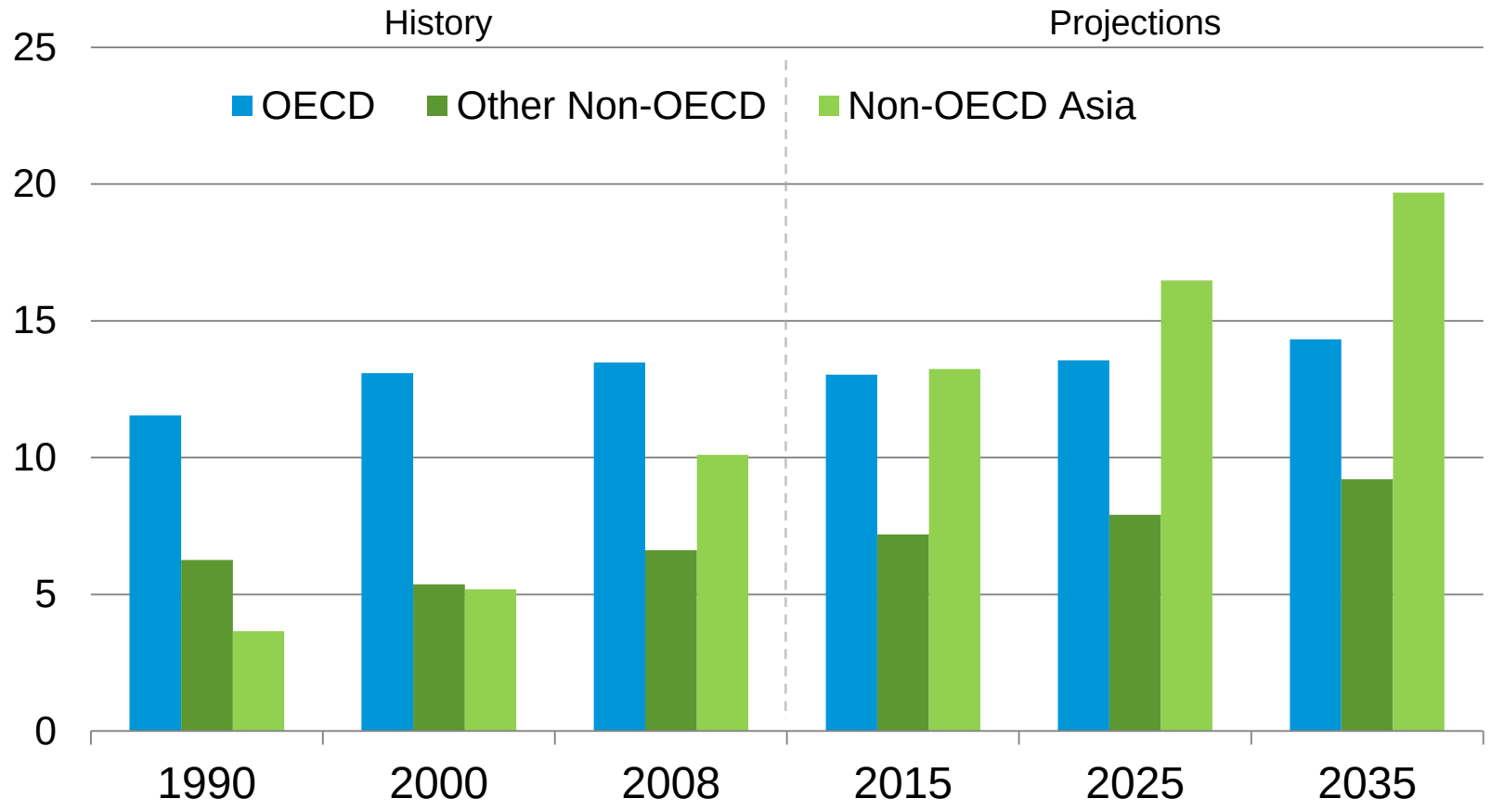
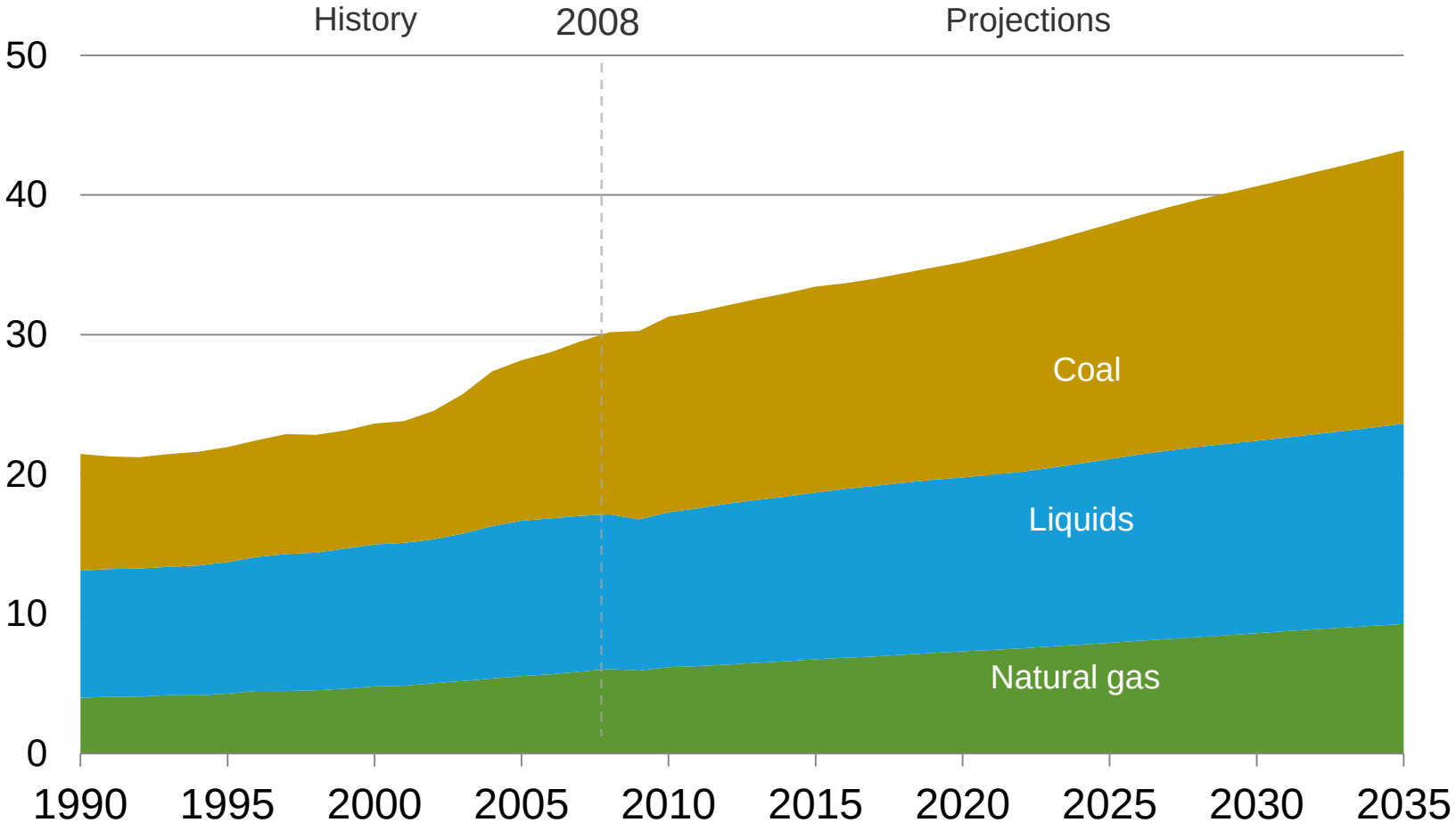
world energy-related carbon dioxide emissions
billion metric tons



Source: EIA, International Energy Outlook 2011

Coal continues to account for the largest share of carbon dioxide emissions throughout the projection

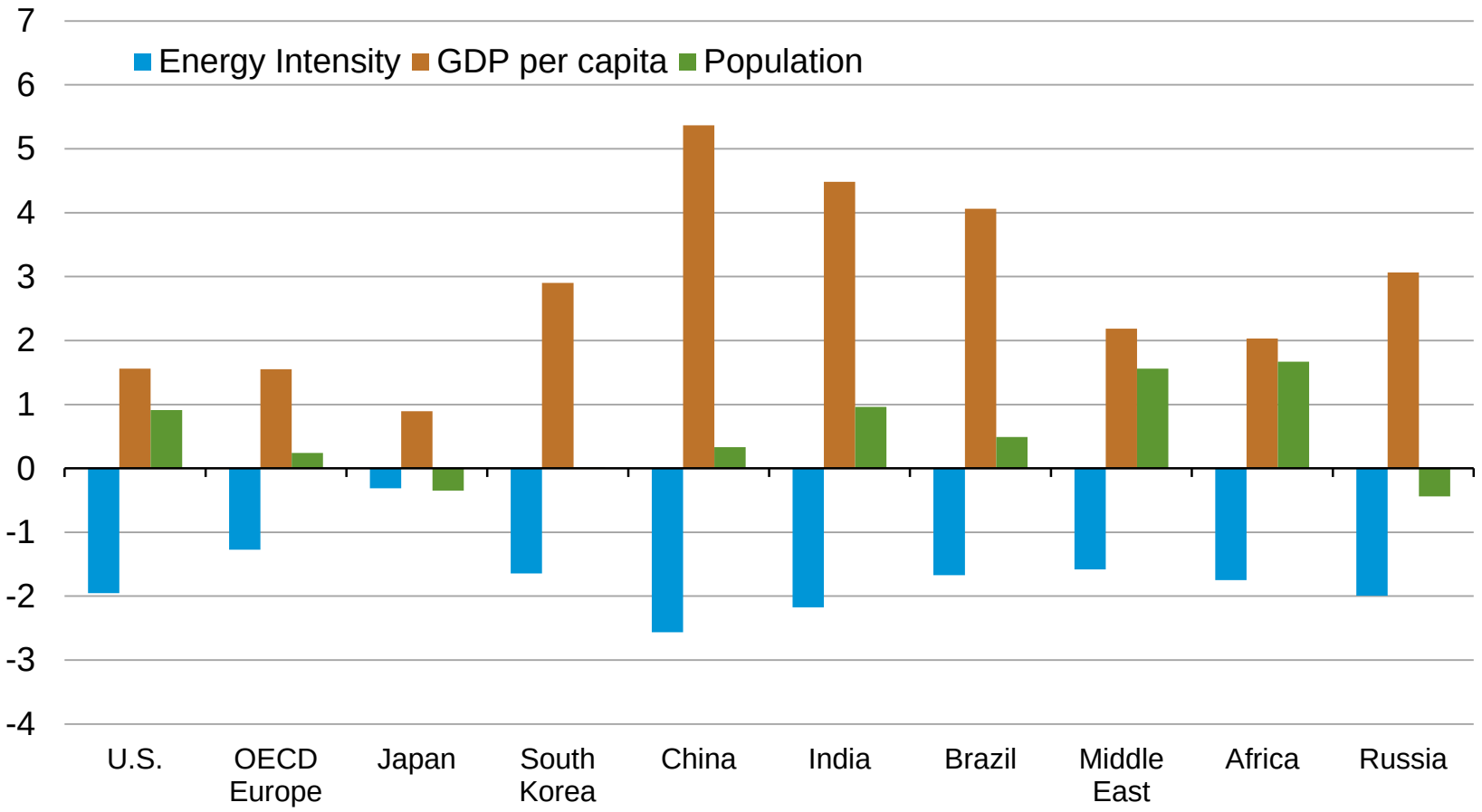
world energy-related carbon dioxide emissions by fuel
billion metric tons



Source: EIA, International Energy Outlook 2011

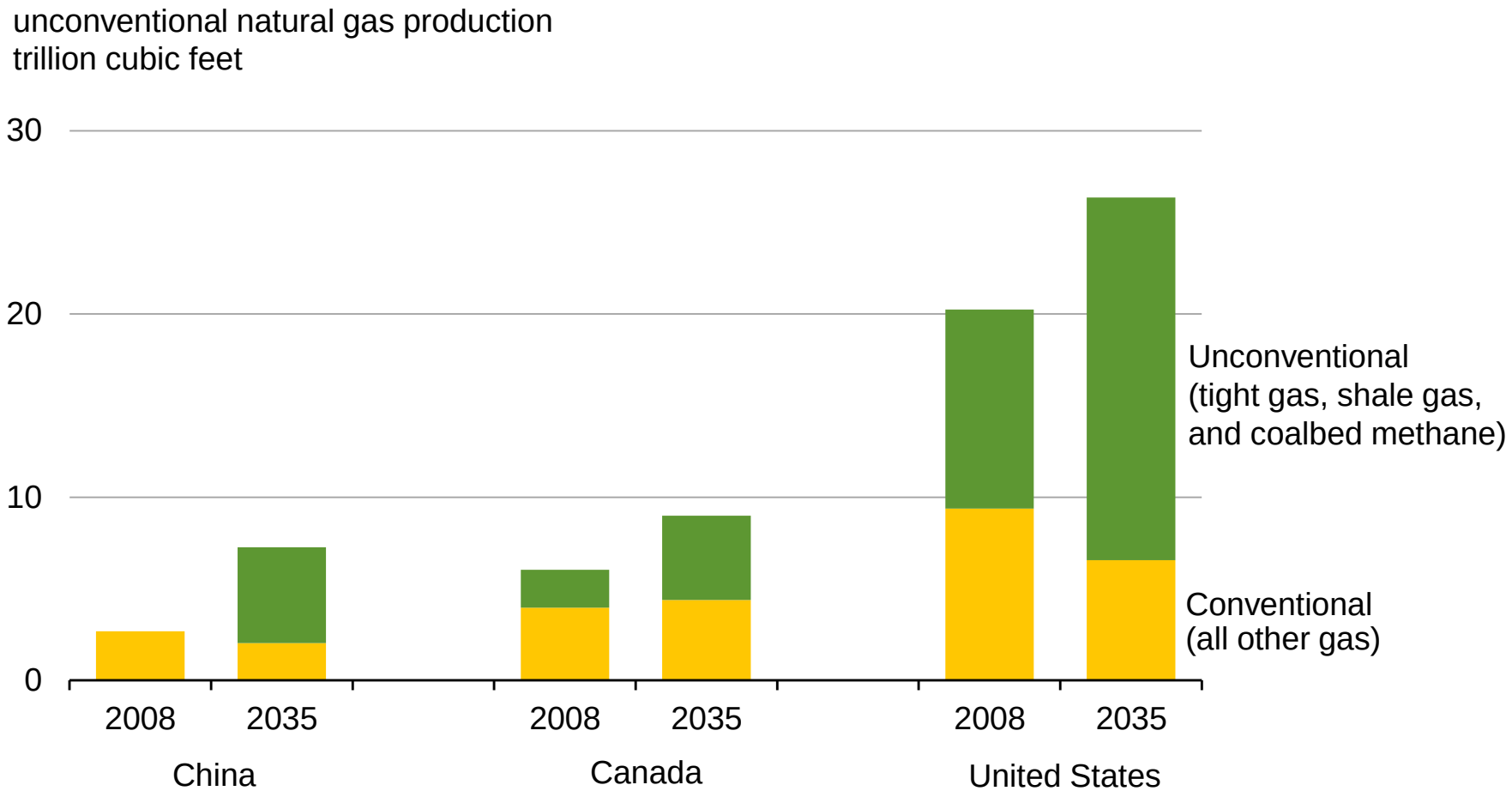
Growth in income and population drive rising energy use; energy intensity improvements moderate increases in energy demand

average annual change (2008-2035)
percent per year



Source: EIA, International Energy Outlook 2011

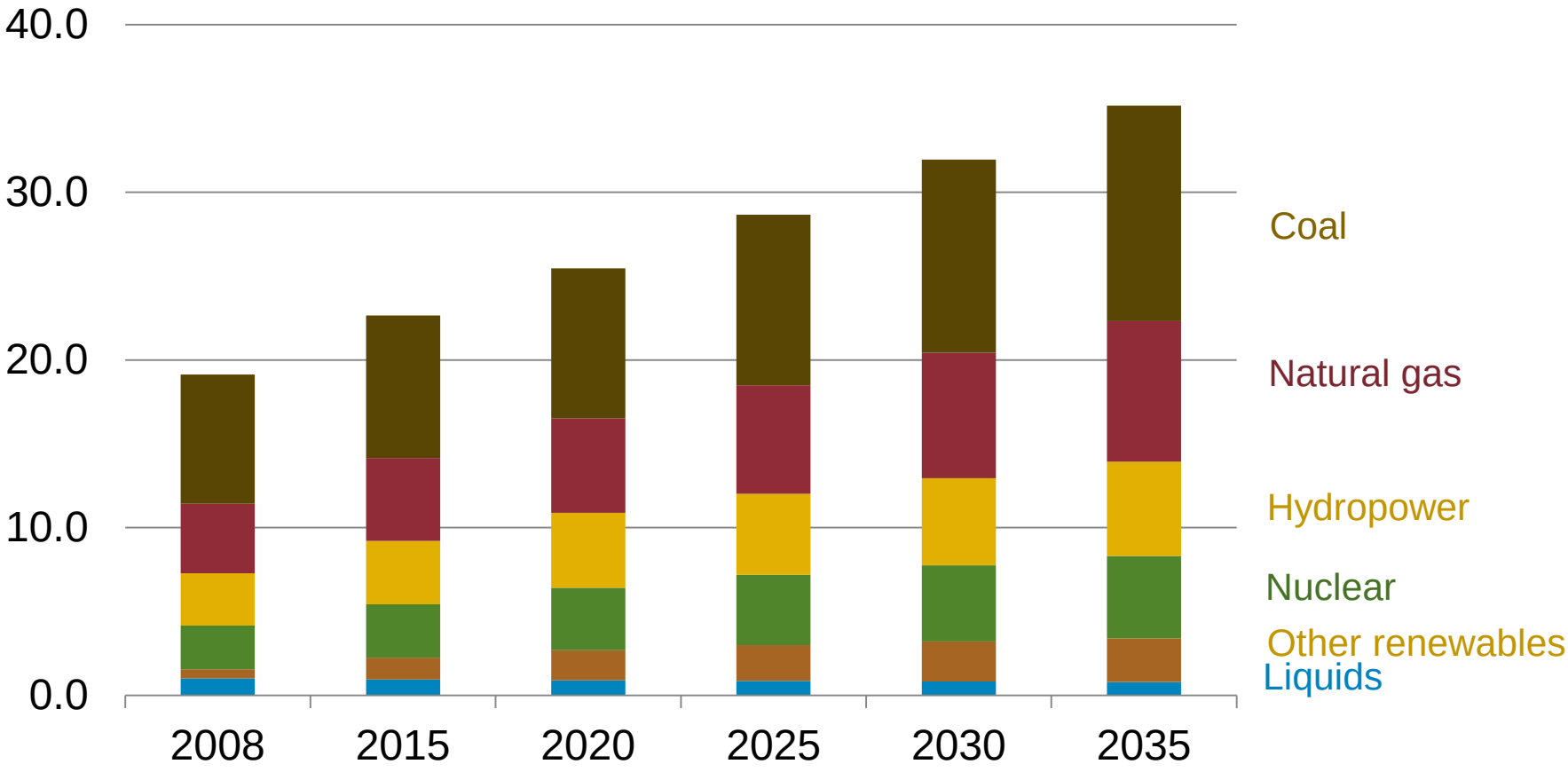
Unconventional gas is an increasingly important component of supply, not only for the U.S., but also China and Canada



Source: EIA, International Energy Outlook 2011

Renewables and natural gas are fastest growing, but coal still fuels the largest share of the world's electricity in 2035

world electricity generation by fuel
billion kilowatthours



Source: EIA, International Energy Outlook 2011