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

for
ICF Energy Breakfast
National Press Club
Washington DC

by
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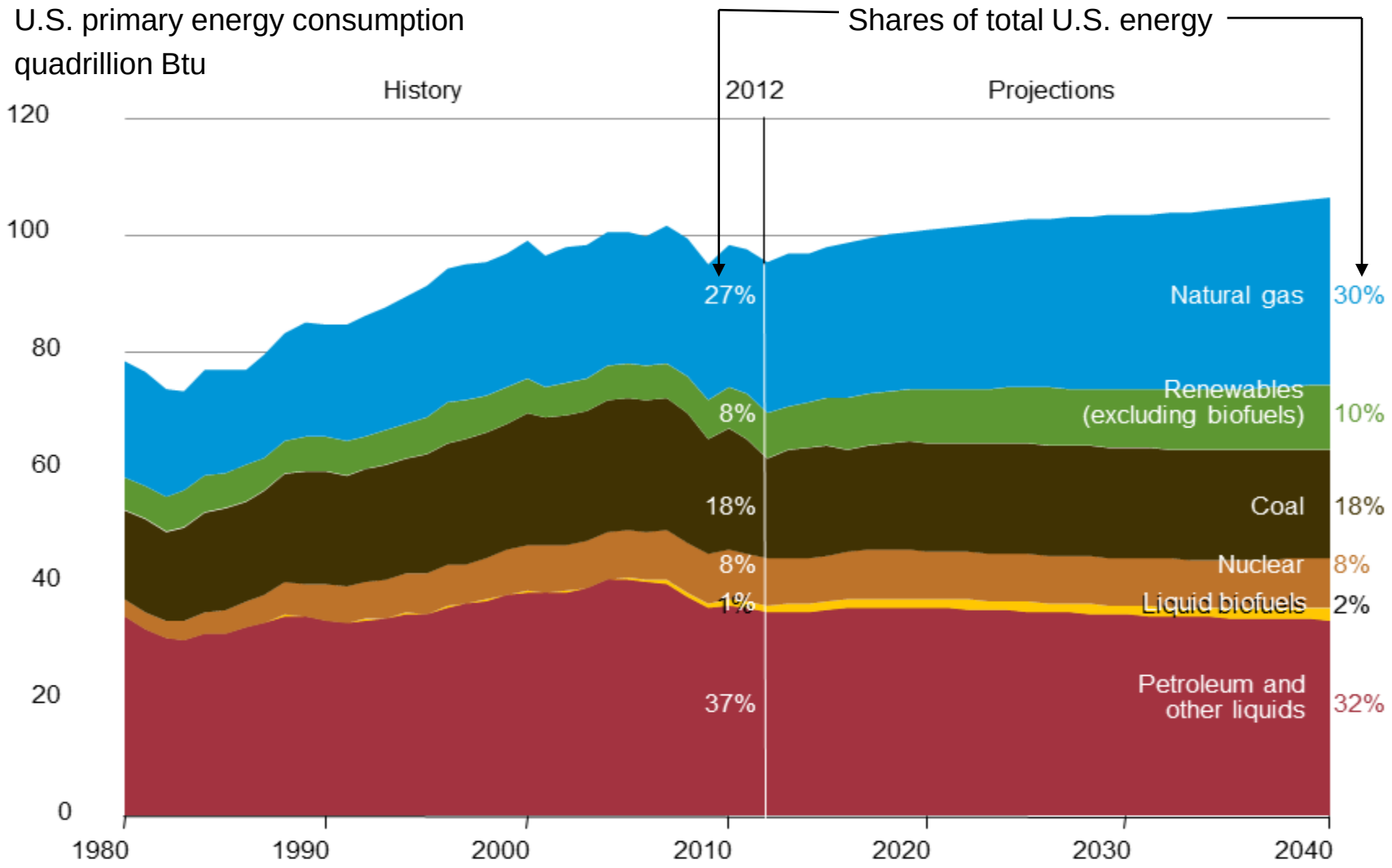
U.S. energy use grows slowly over the projection reflecting both economic recovery and energy efficiency improvement



Source: EIA, Annual Energy Outlook 2014 Reference case

Key results from the *2014 Annual Energy Outlook* Reference case (current laws and policies)

- Growing domestic production of natural gas and oil continues to reshape the U.S. energy economy, with crude oil approaching the 1970 all-time high of 9.6 million barrels per day
- Light-duty vehicle energy use declines sharply reflecting slowing growth in vehicle miles traveled and accelerated improvement in vehicle efficiency
- With continued growth in shale gas production, natural gas becomes the largest source of U.S. electric power generation, surpassing coal by 2035, and boosting production and natural gas consumption in manufacturing
- Strong growth in domestic natural gas production supports increased exports of both pipeline and liquefied natural gas
- With strong growth in domestic oil and gas production, U.S. dependence on imported fuels falls sharply
- Improved efficiency of energy use and a shift away from carbon-intensive fuels keep U.S. energy-related carbon dioxide emissions below their 2005 level through 2040

Why long-term projections ~~might~~/~~could~~/will be wrong

- Different relative fuel prices
- Faster / slower economic and energy demand growth
- Changing policies and regulations
- Changing consumer preferences
- Faster / slower technology progress
- Technology breakthroughs

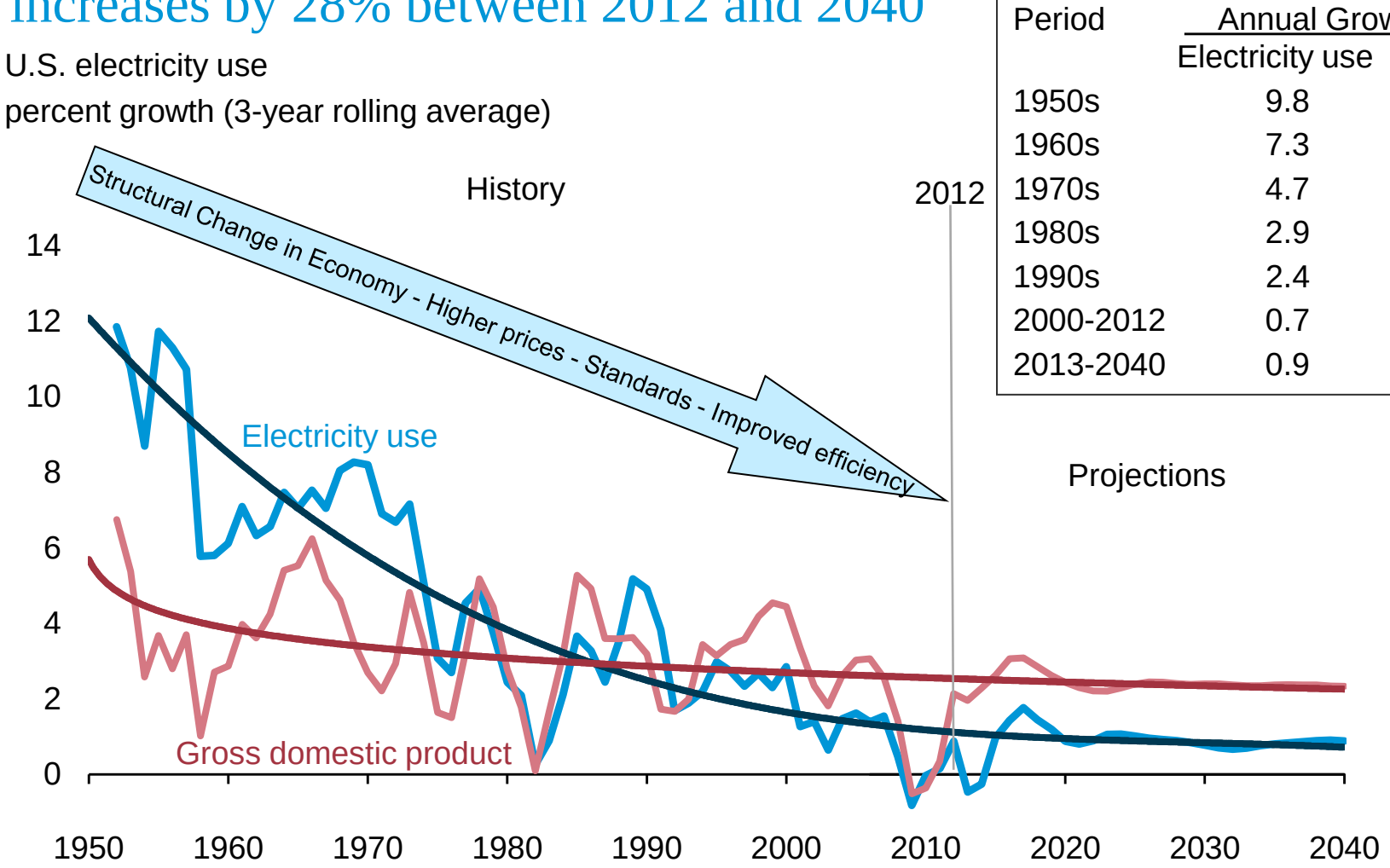
The electricity sector and greenhouse gas emissions

Takeaways – Greenhouse gases and electricity

- Coal is expected to lose generation share to natural gas and renewables, but the speed of adjustment depends on domestic natural gas prices, which reflect the resource base, extraction costs, and gas demand from all sectors and uses
- Slow projected growth in U.S. electricity demand makes it difficult for new generation sources to gain market share absent policy intervention; projected capacity additions are substantially reduced in an alternative scenario of near-zero sales growth through 2040
- The electricity sector is the main source of cost-effective reductions in U.S. energy-related carbon dioxide emissions
- New policies that target particular sources or uses of energy or energy-related emissions really matter for the future supply mix

Growth in electricity use slows, but electricity demand still increases by 28% between 2012 and 2040

Period	Annual Growth	
	Electricity use	GDP
1950s	9.8	4.1
1960s	7.3	4.4
1970s	4.7	3.2
1980s	2.9	3.0
1990s	2.4	3.2
2000-2012	0.7	1.8
2013-2040	0.9	2.4

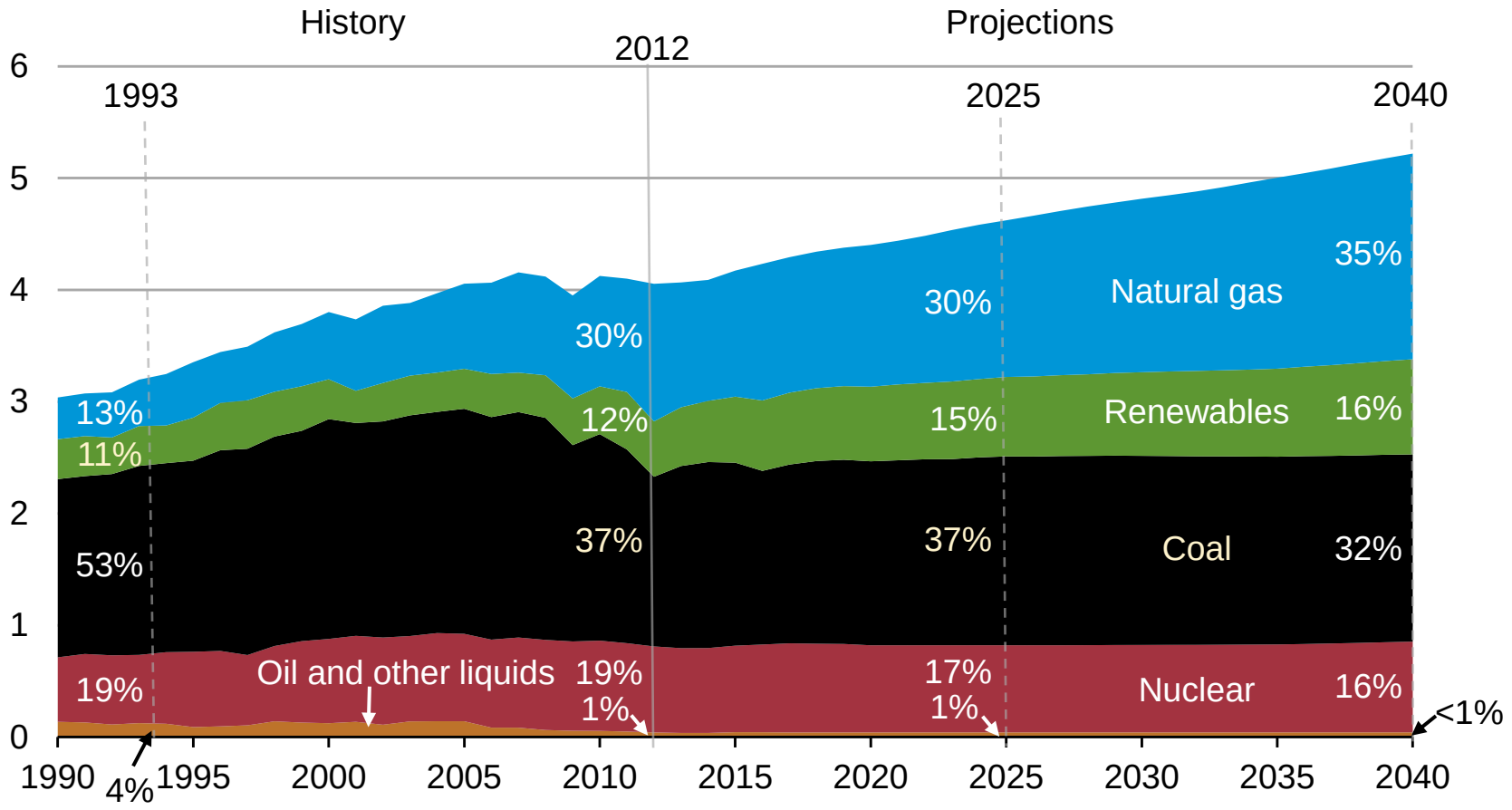


Source: EIA, Annual Energy Outlook 2014 Reference case

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

electricity net generation

trillion kilowatthours per year

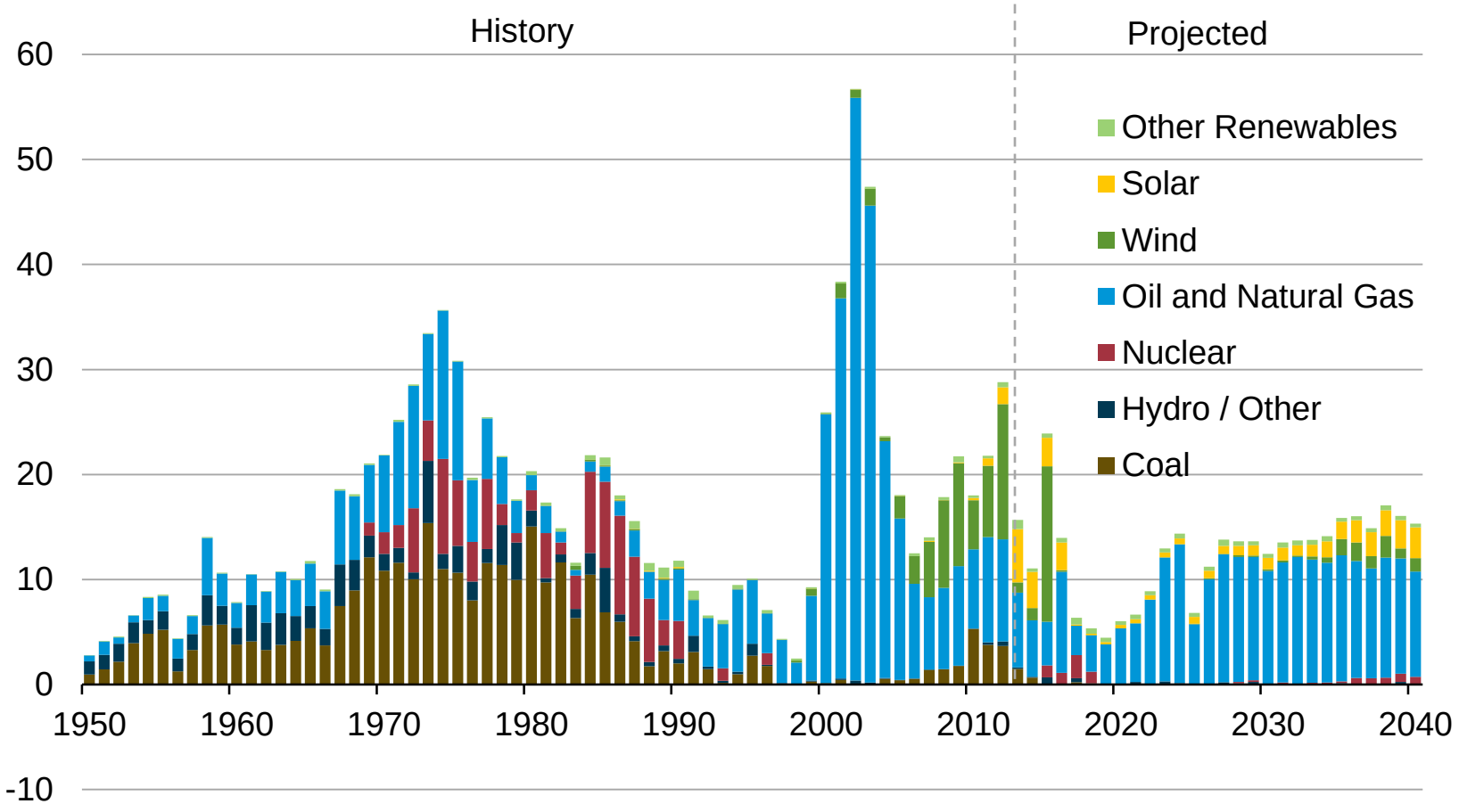


Source: EIA, Annual Energy Outlook 2014 Reference case

Gas-fueled units account for most projected capacity additions in the *AEO2014* Reference case

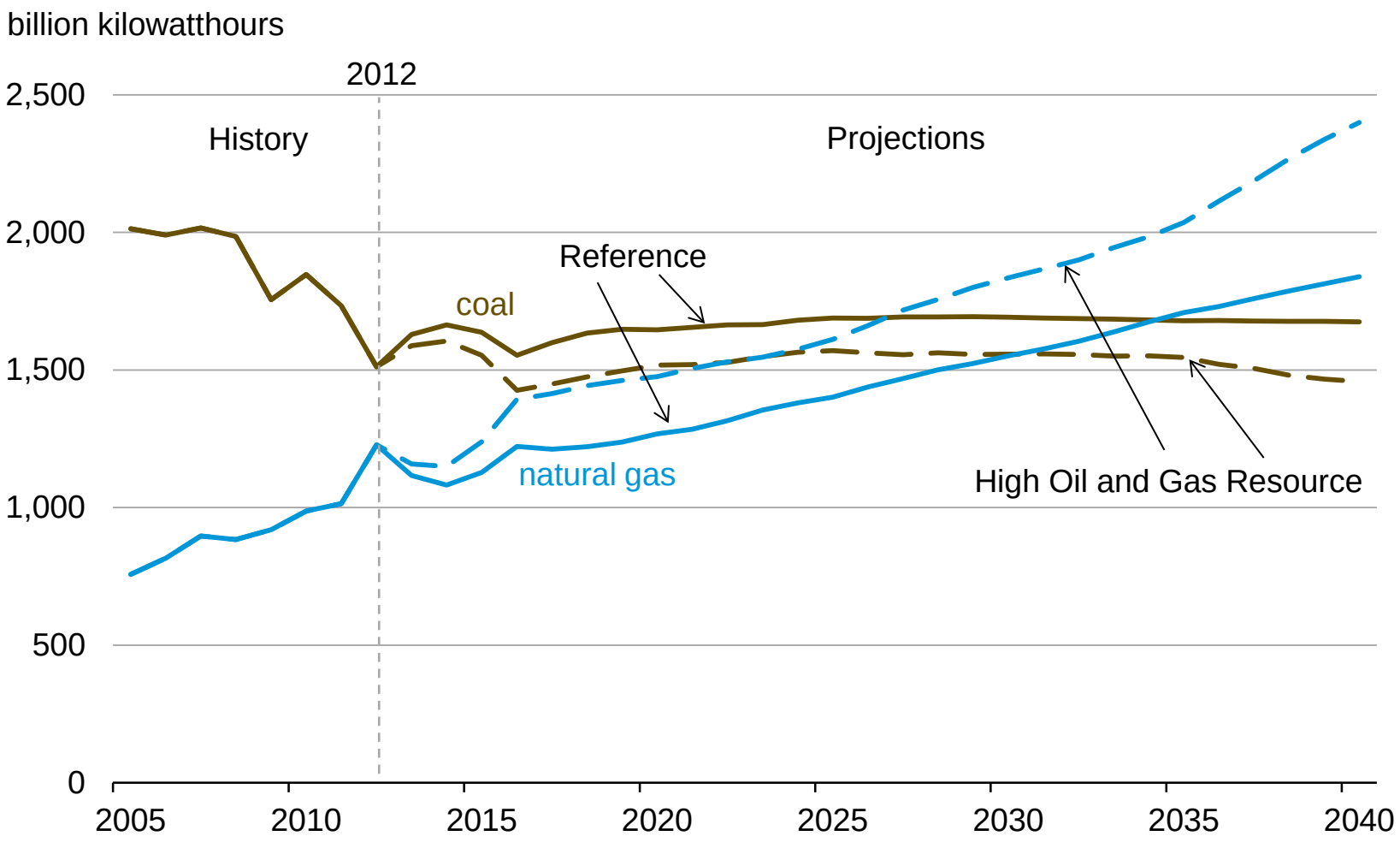
U.S. electricity generation capacity additions

gigawatts



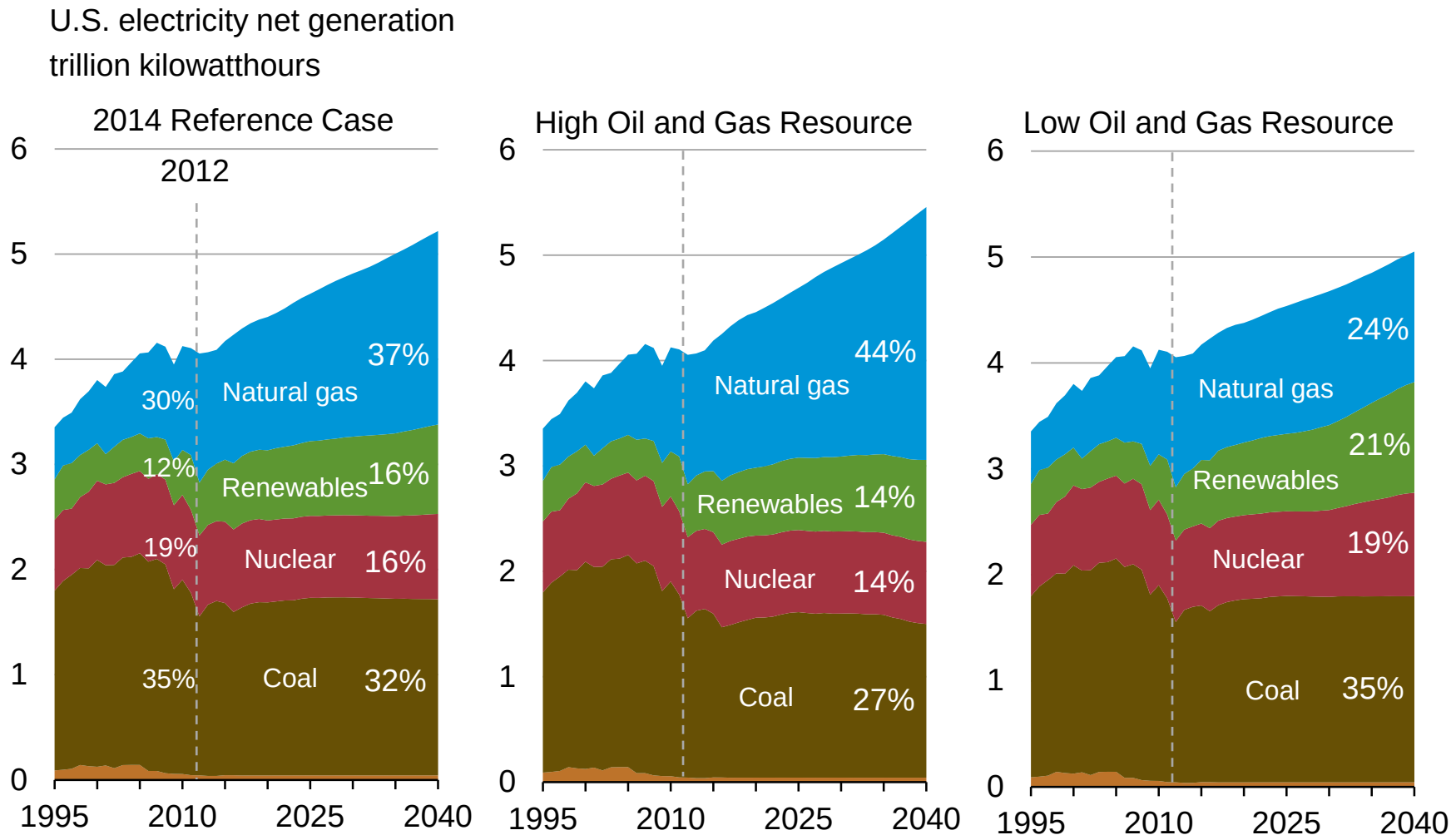
Source: Form EIA-860 & EIA Annual Energy Outlook 2014

Natural gas surpasses coal as the largest generation source; this happens more quickly under high oil and gas resource assumptions



Source: Annual Energy Outlook 2014 Reference case and High Oil and Gas Resource case

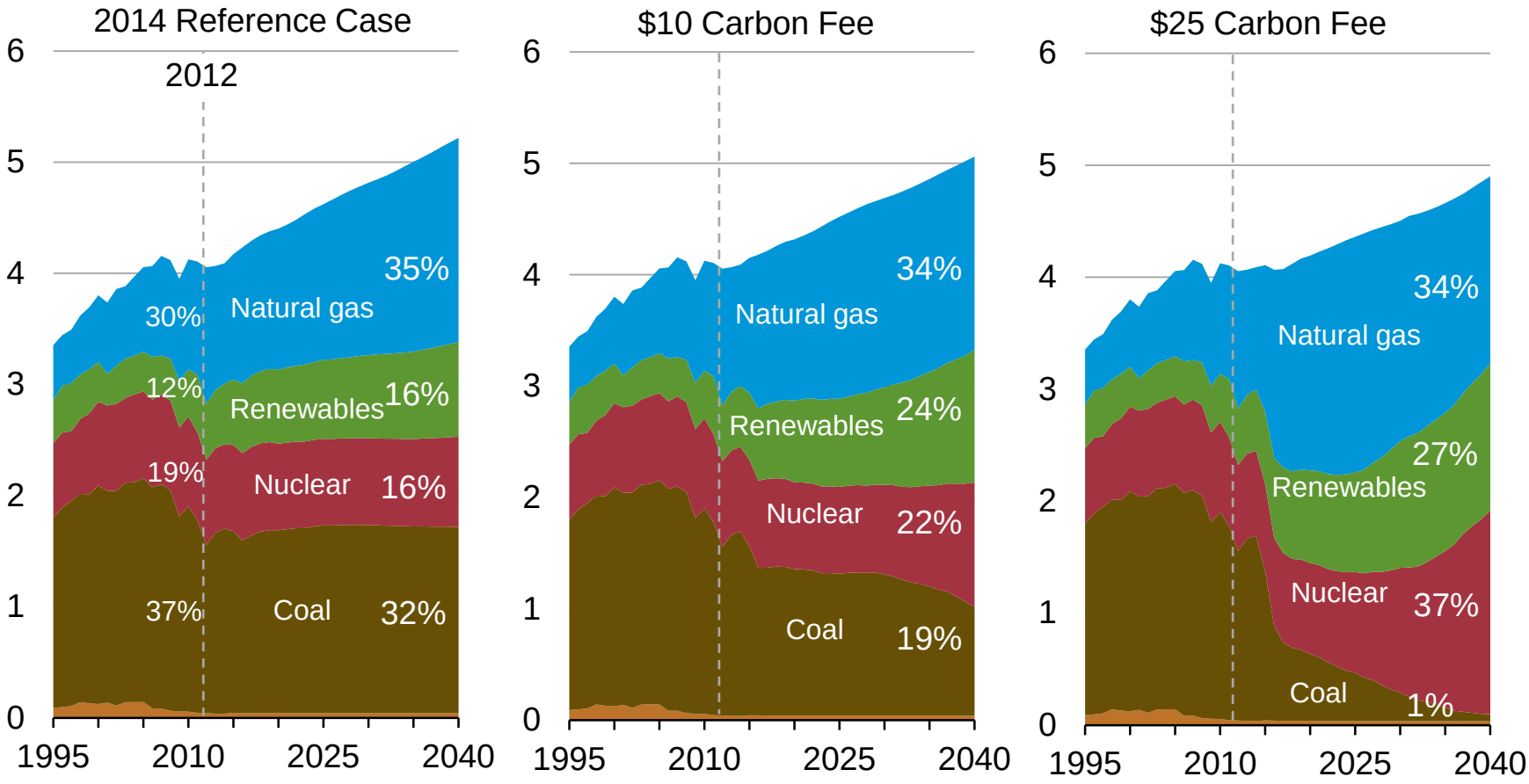
Coal generation is reduced in a high gas availability case, but it does not gain much in a low gas availability case



Source: EIA, Annual Energy Outlook 2014 Reference case, High Oil and Gas Resource case, and Low Oil and Gas Resource case

An implicit or explicit carbon value growing at a 5% real rate has a major impact on the projected generation mix in *AEO2014*

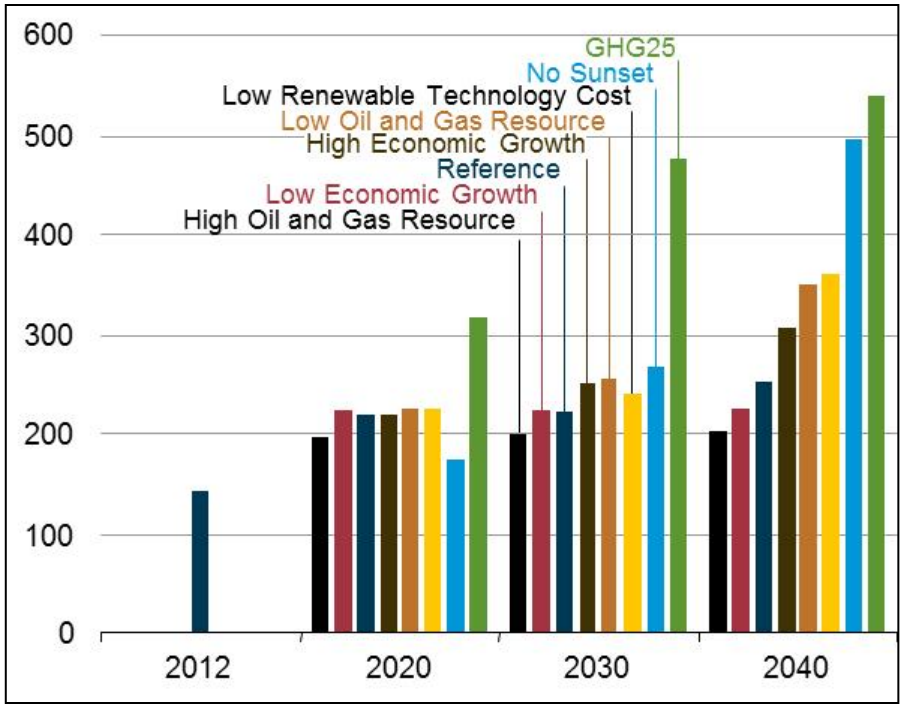
U.S. electricity net generation
trillion kilowatthours



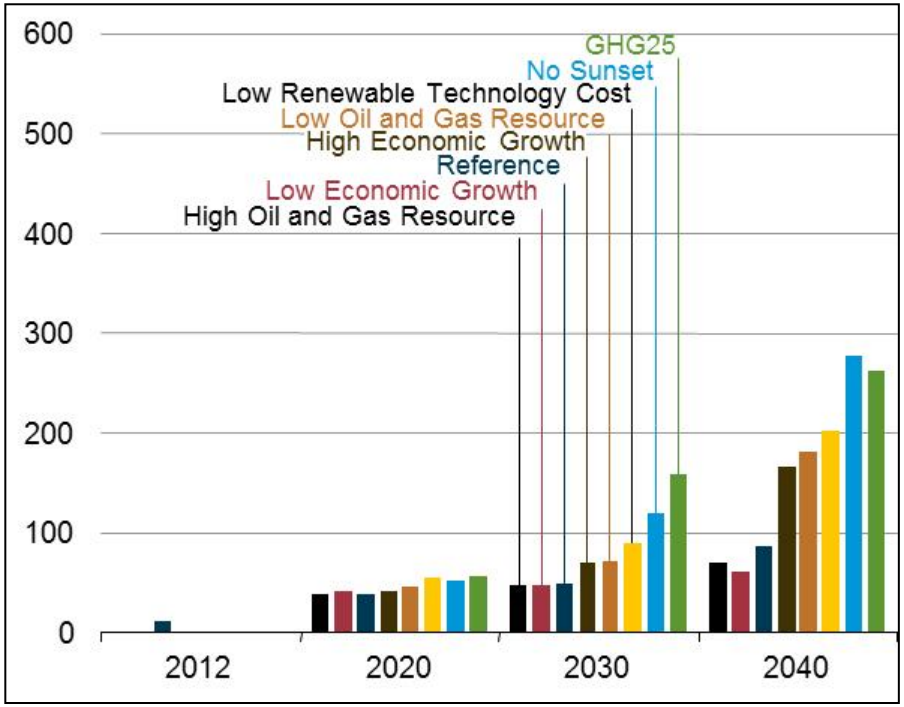
Source: EIA, Annual Energy Outlook 2014

Both future policies and future natural gas market and economic conditions have a major impact on projected wind and solar generation

Wind generation in 8 cases 2020, 2030 & 2040
billion kilowatthours per year

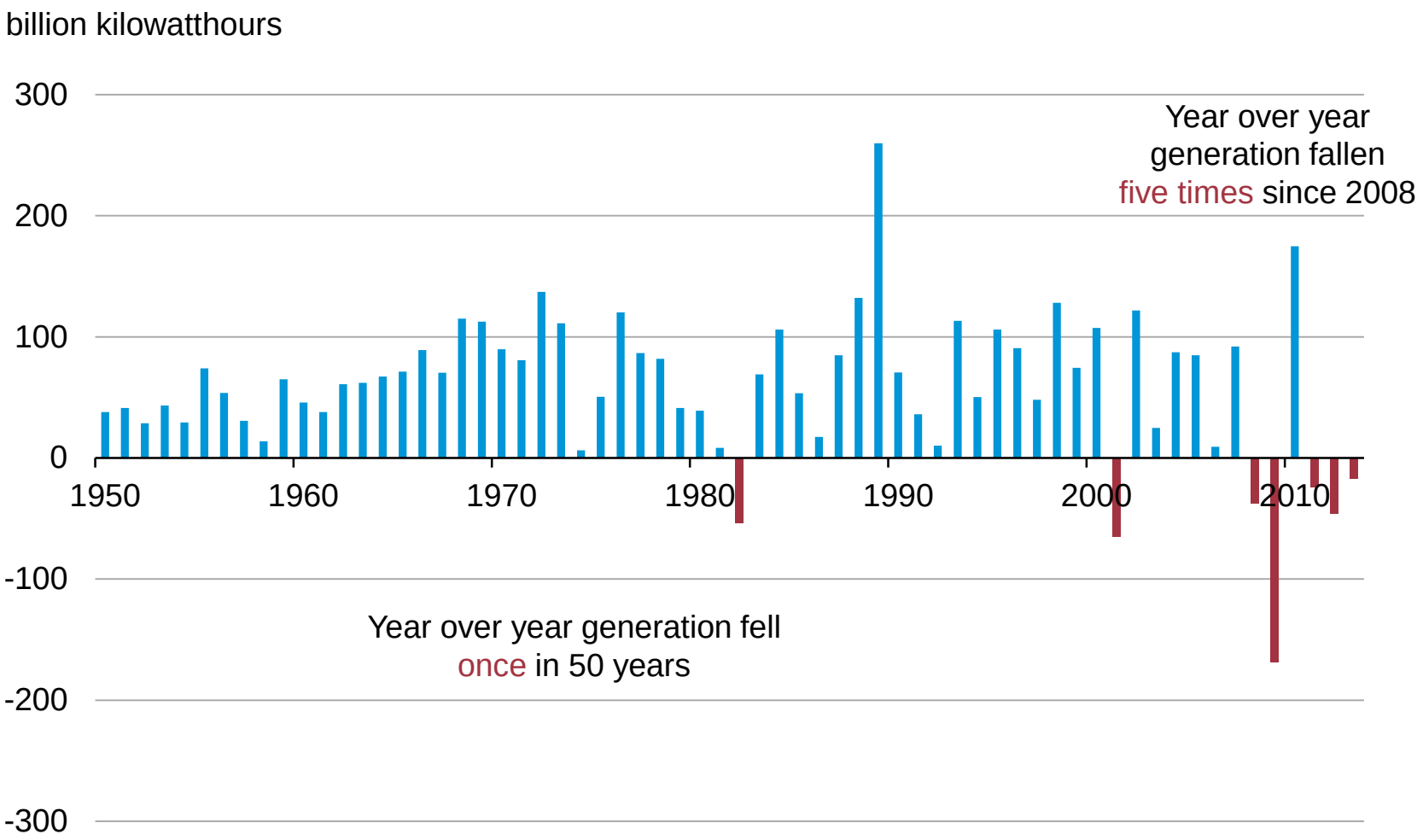


Solar generation in 8 cases, 2020, 2030, 2040
billion kilowatthours per year



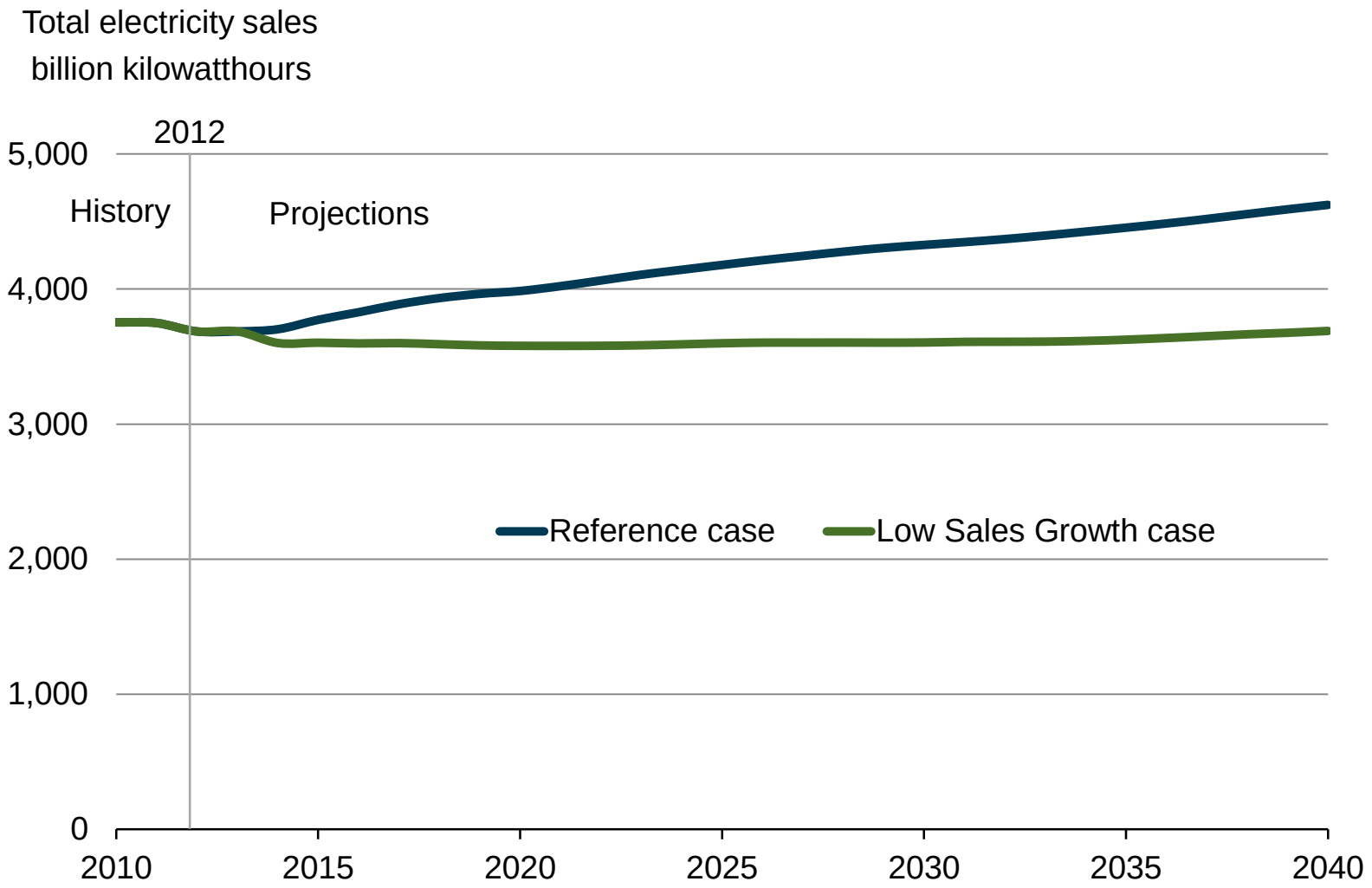
Source: EIA Annual Energy Outlook 2014

Electricity sales have decreased in 5 of the last 6 years; prior to 2008, sales declined only twice in 58 years



Source: Energy Information Administration, Form EIA-923 and predecessor forms.

EIA considered a low electricity sales growth case in AEO2014

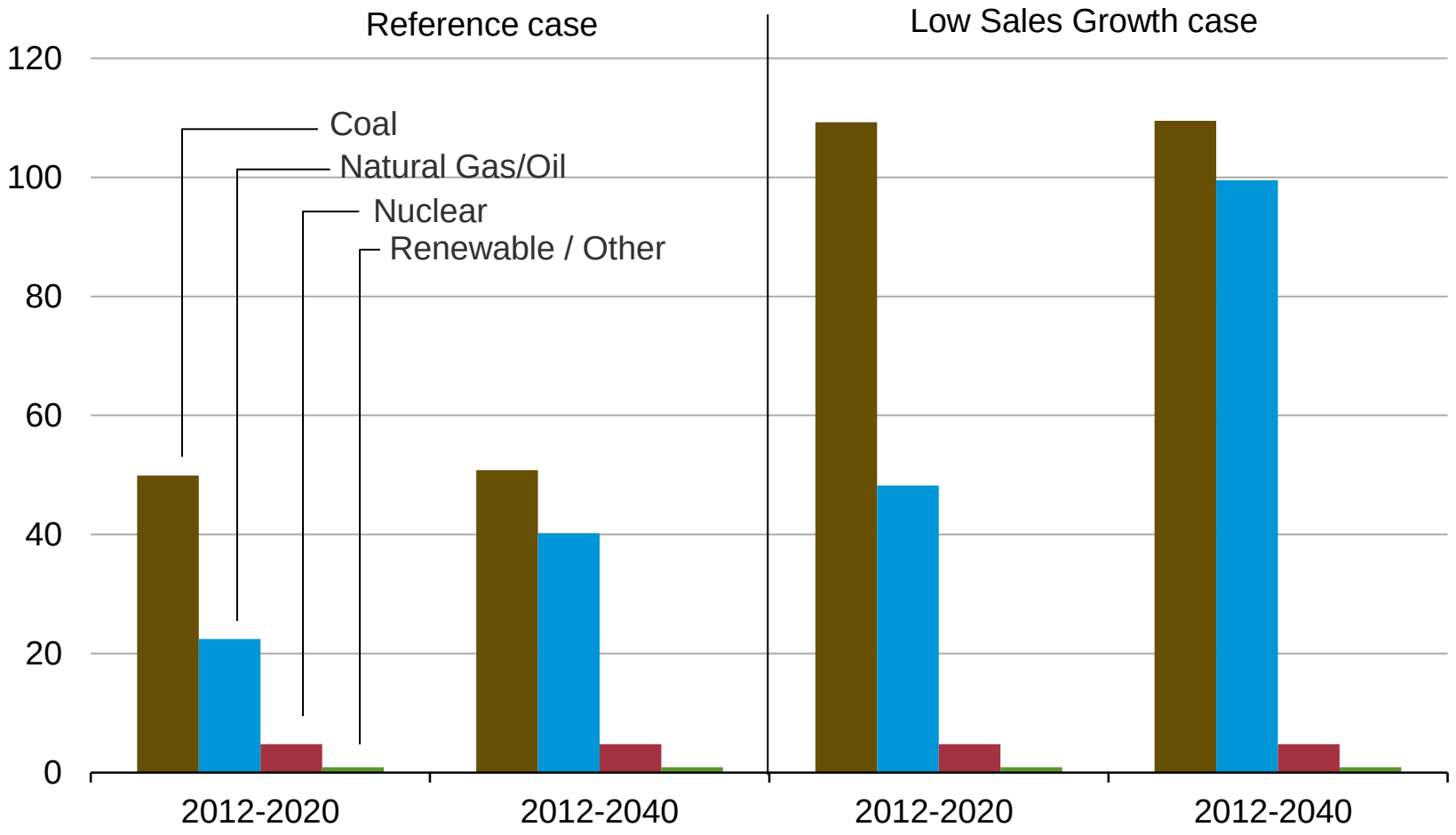


Source: EIA, Annual Energy Outlook 2014

More fossil capacity is retired in the Low Sales Growth case

U.S. electric power sector capacity retirements

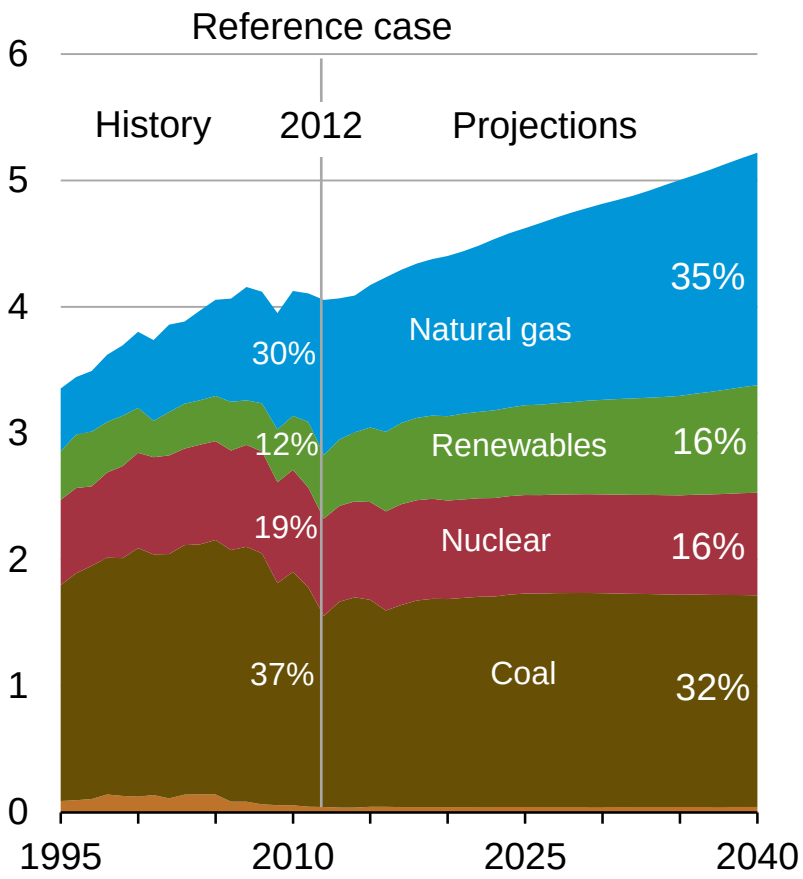
gigawatts (cumulative)

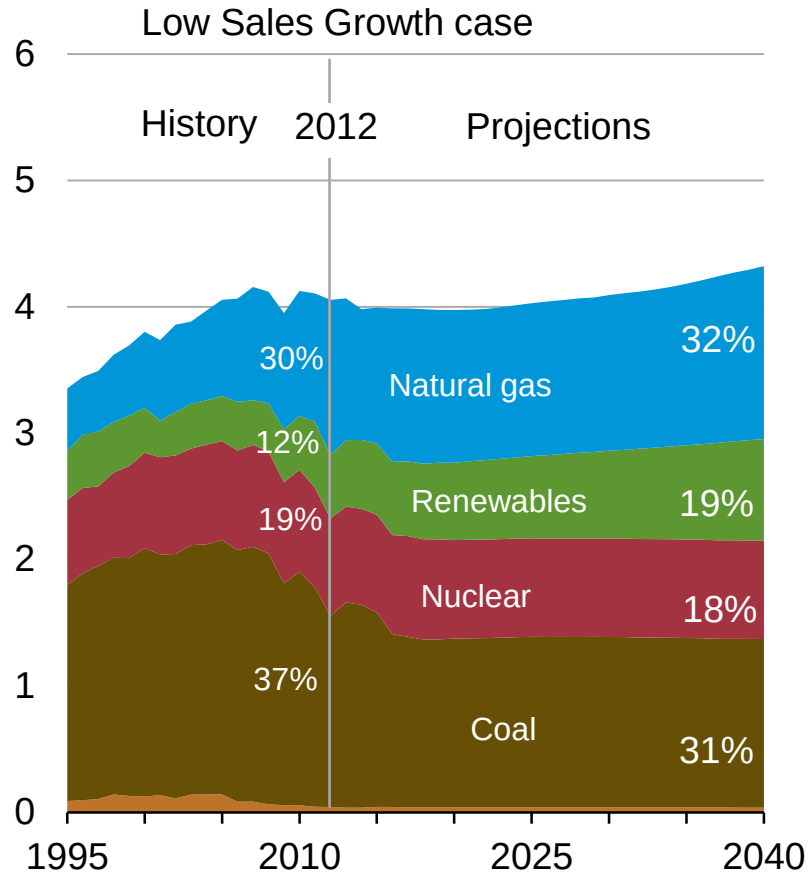


Source: EIA, Annual Energy Outlook 2014

Generation fueled by natural gas grows much more slowly in the Low Sales Growth case

U.S. electricity net generation
trillion kilowatthours





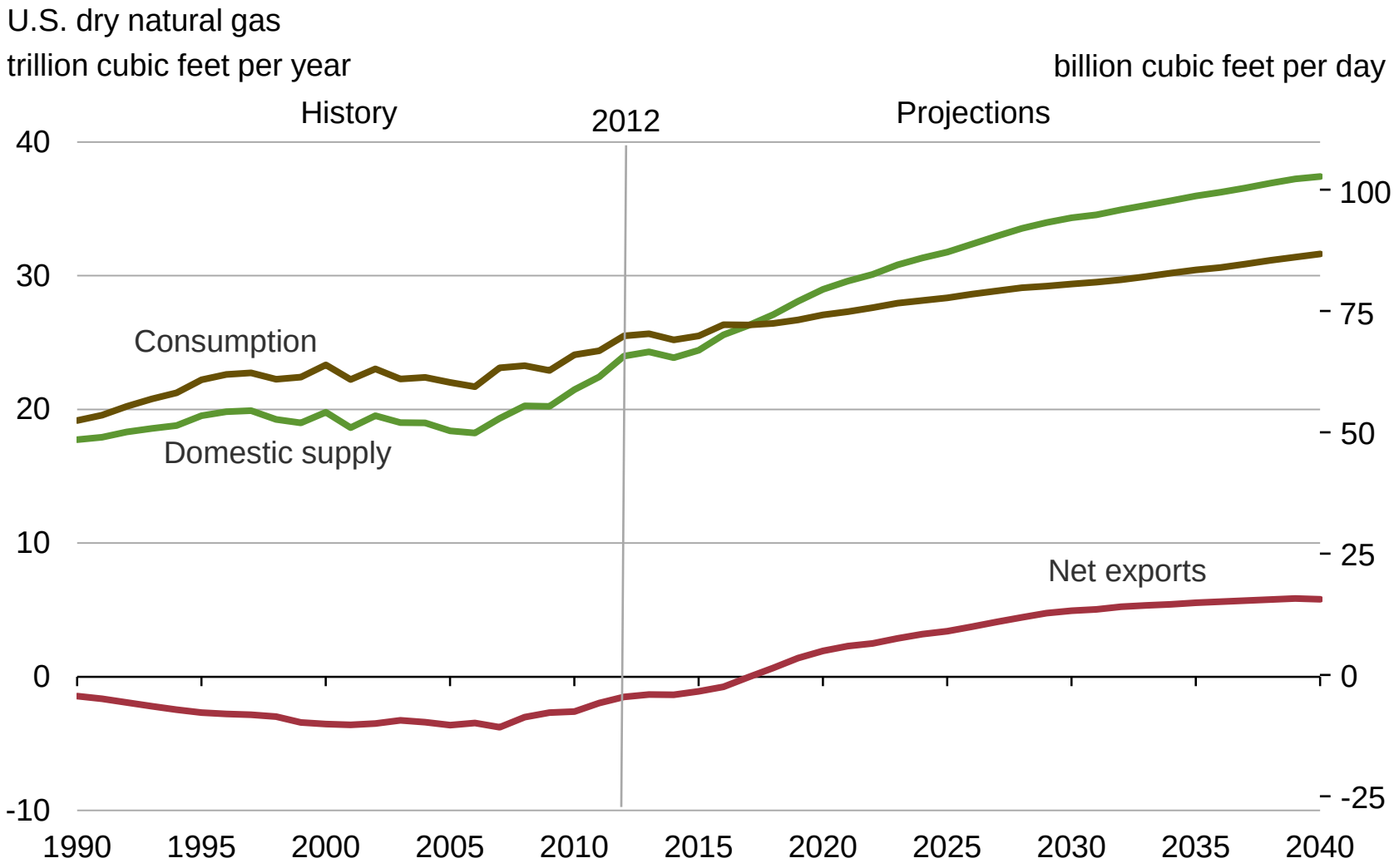
Source: EIA, Annual Energy Outlook 2014

Natural gas

Takeaways – Natural gas

- North American natural gas production is more likely to be limited by demand than supply
- U.S. natural gas demand growth is likely to be concentrated in electricity and industrial uses; natural gas exports and use in the transportation sector, where little natural gas is used today, are also likely to grow
- Potential challenges to natural gas demand growth include
  - Slow growth in U.S. electricity demand
  - Competition from offshore "stranded" gas for global LNG exports and siting of gas-intensive industries
  - Extent and nature of global price convergence in natural gas markets
- Future policies that target particular sources or uses of energy or energy-related emissions can really matter for future natural gas demand

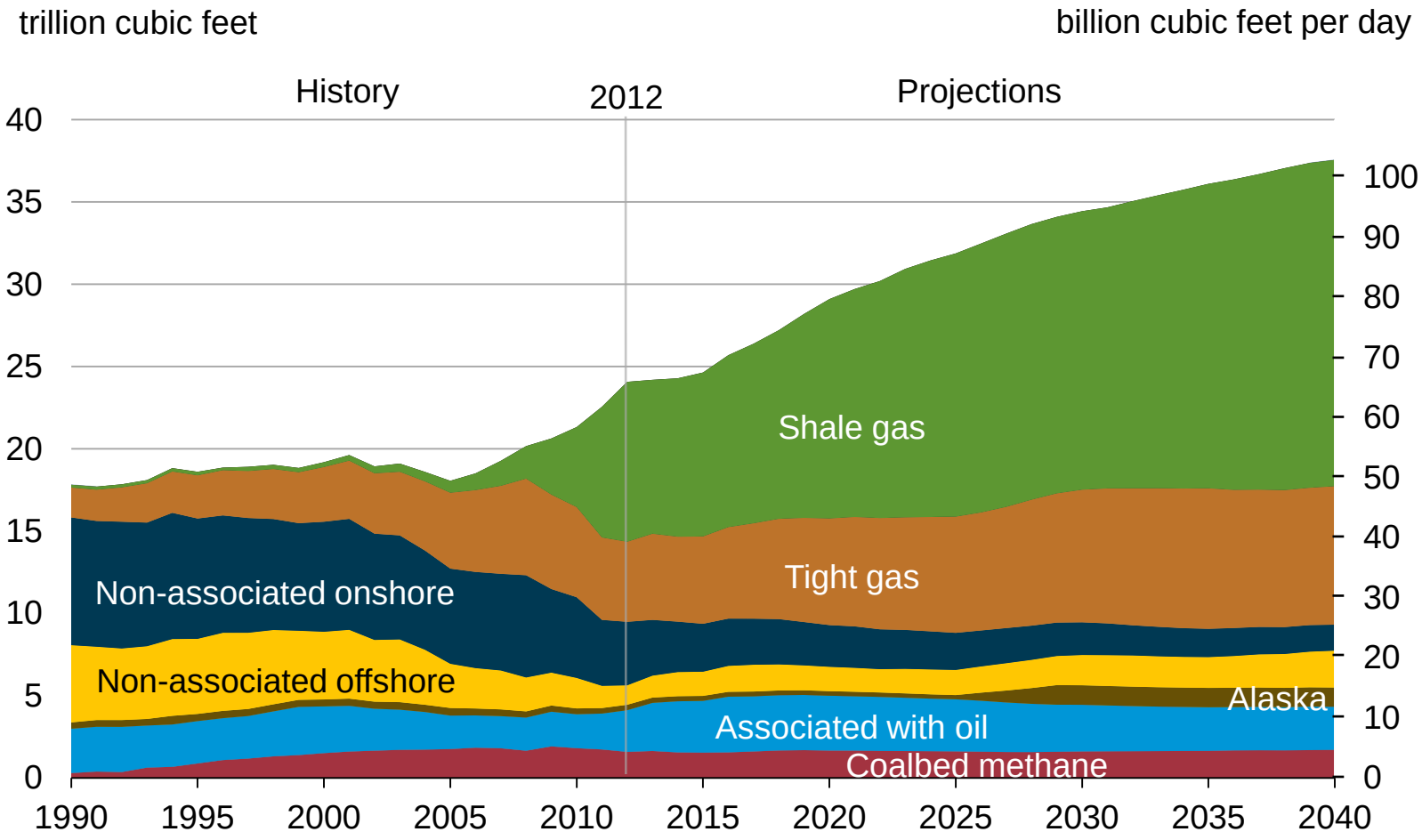
U.S. becomes a net exporter of natural gas in the near future



Source: EIA, Annual Energy Outlook 2014 Reference case

U.S. shale gas leads growth in total gas production through 2040, when production exceeds 100 billion cubic feet per day

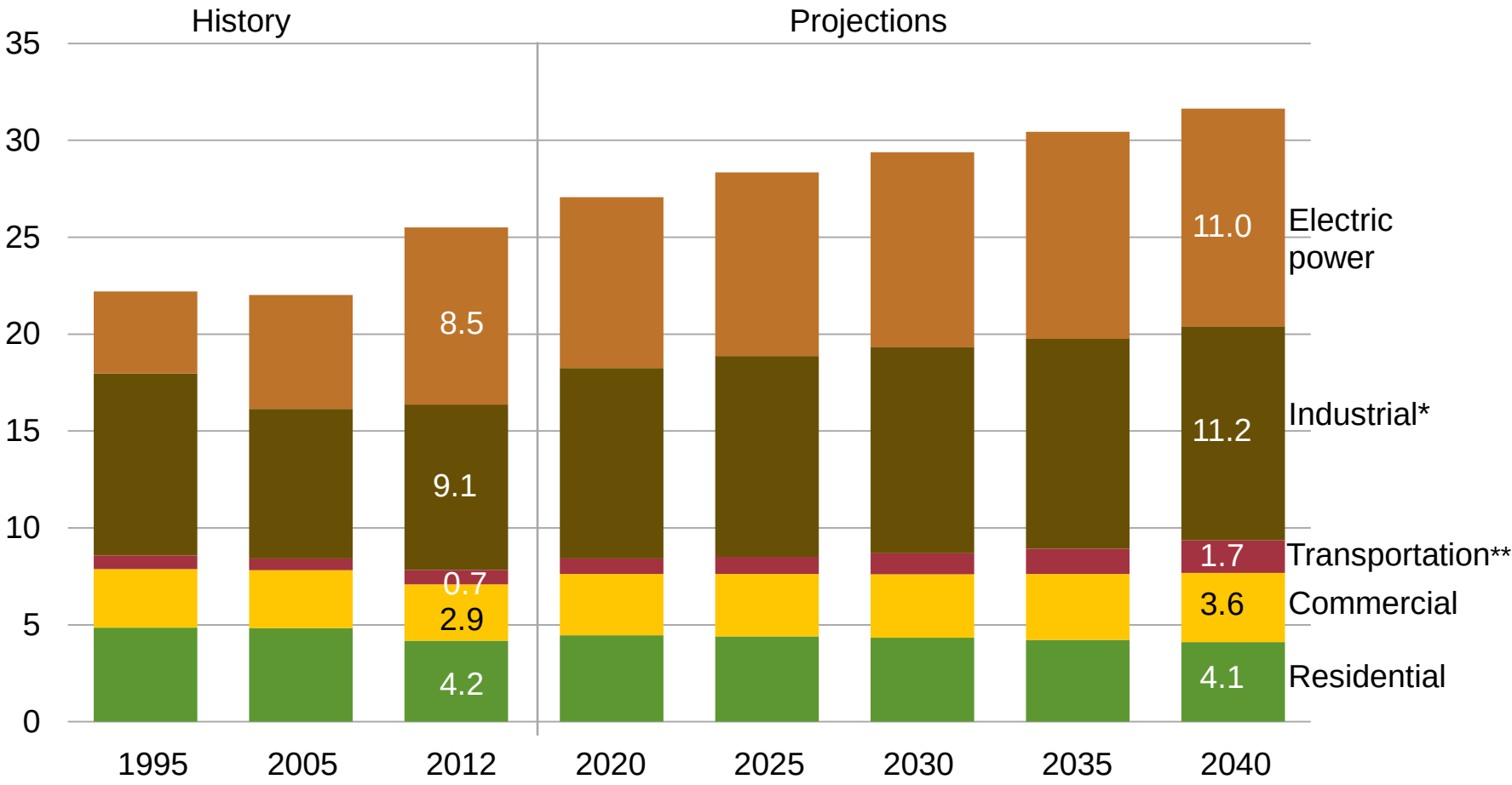
U.S. dry natural gas production



Source: EIA, Annual Energy Outlook 2014 Reference case

U.S. natural gas consumption growth is driven by electric power, industrial, and transportation use

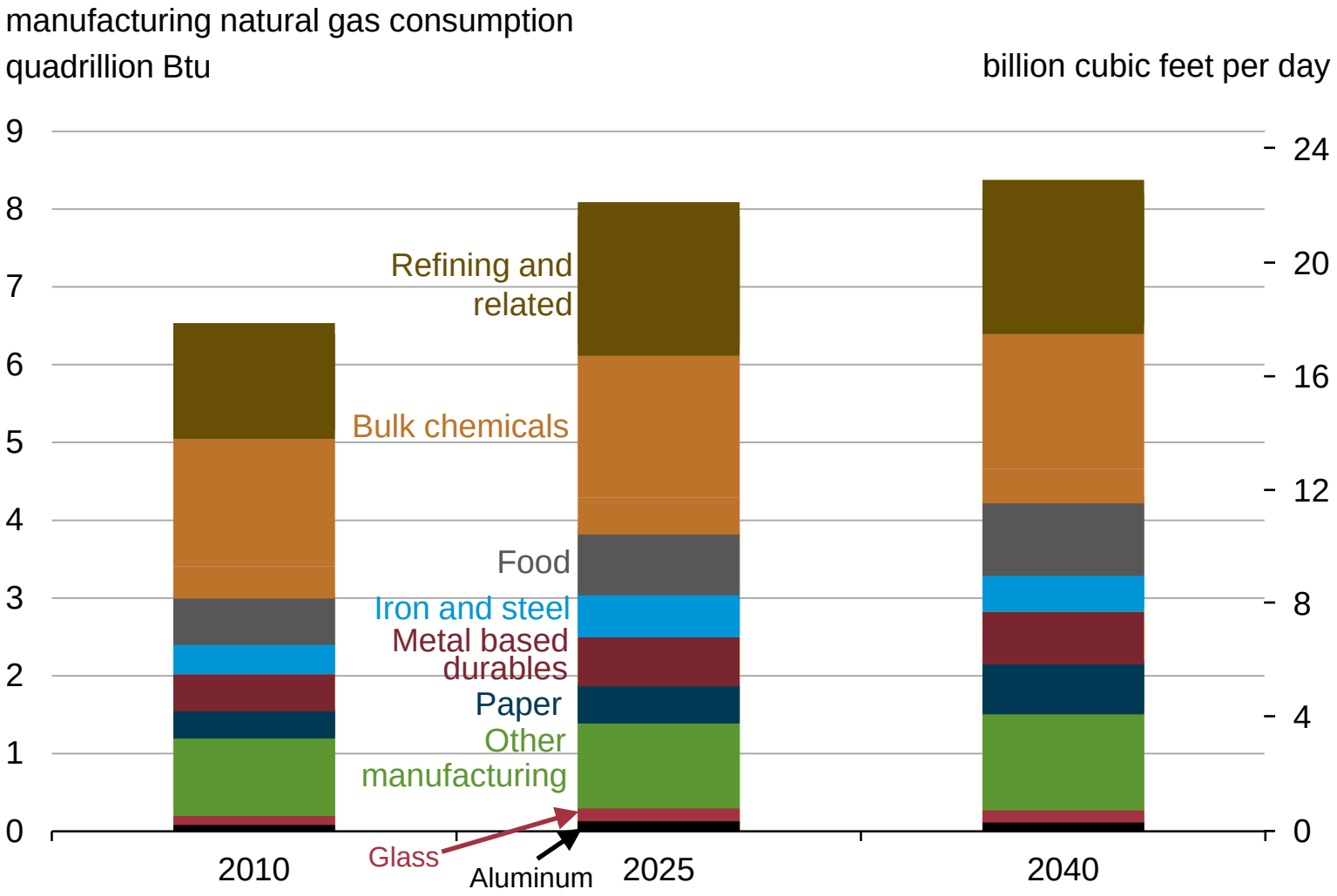
U.S. dry natural gas consumption
trillion cubic feet



Source: EIA, Annual Energy Outlook 2014 Reference case

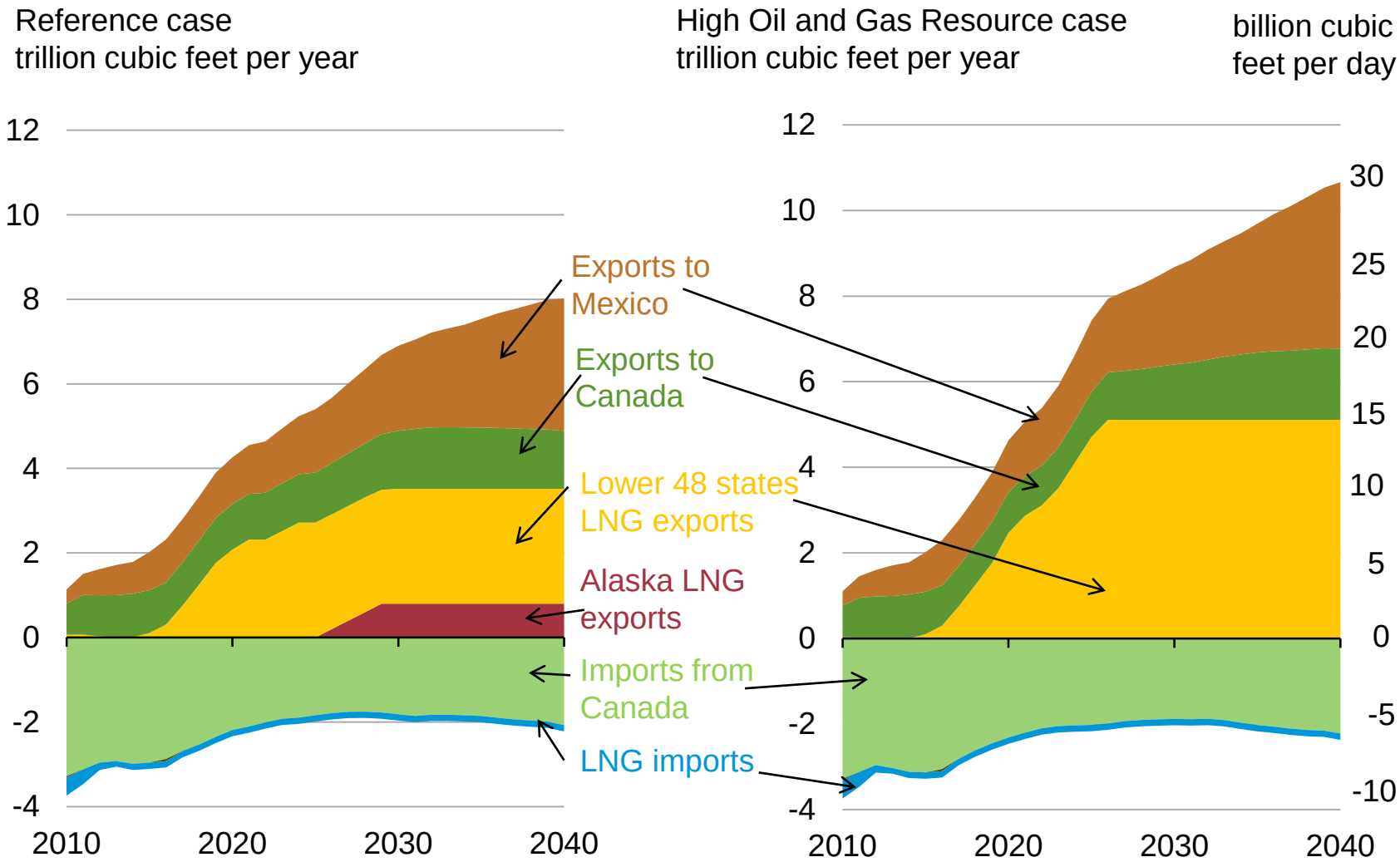
**Includes combined heat-and-power and lease and plant fuel*
***Includes pipeline fuel*

U.S. manufacturing output and natural gas use grows with low natural gas prices, particularly in the near term



Source: EIA, Annual Energy Outlook 2014 Reference case

Projected U.S. natural gas trade depends on assumptions regarding resources and future technology advances

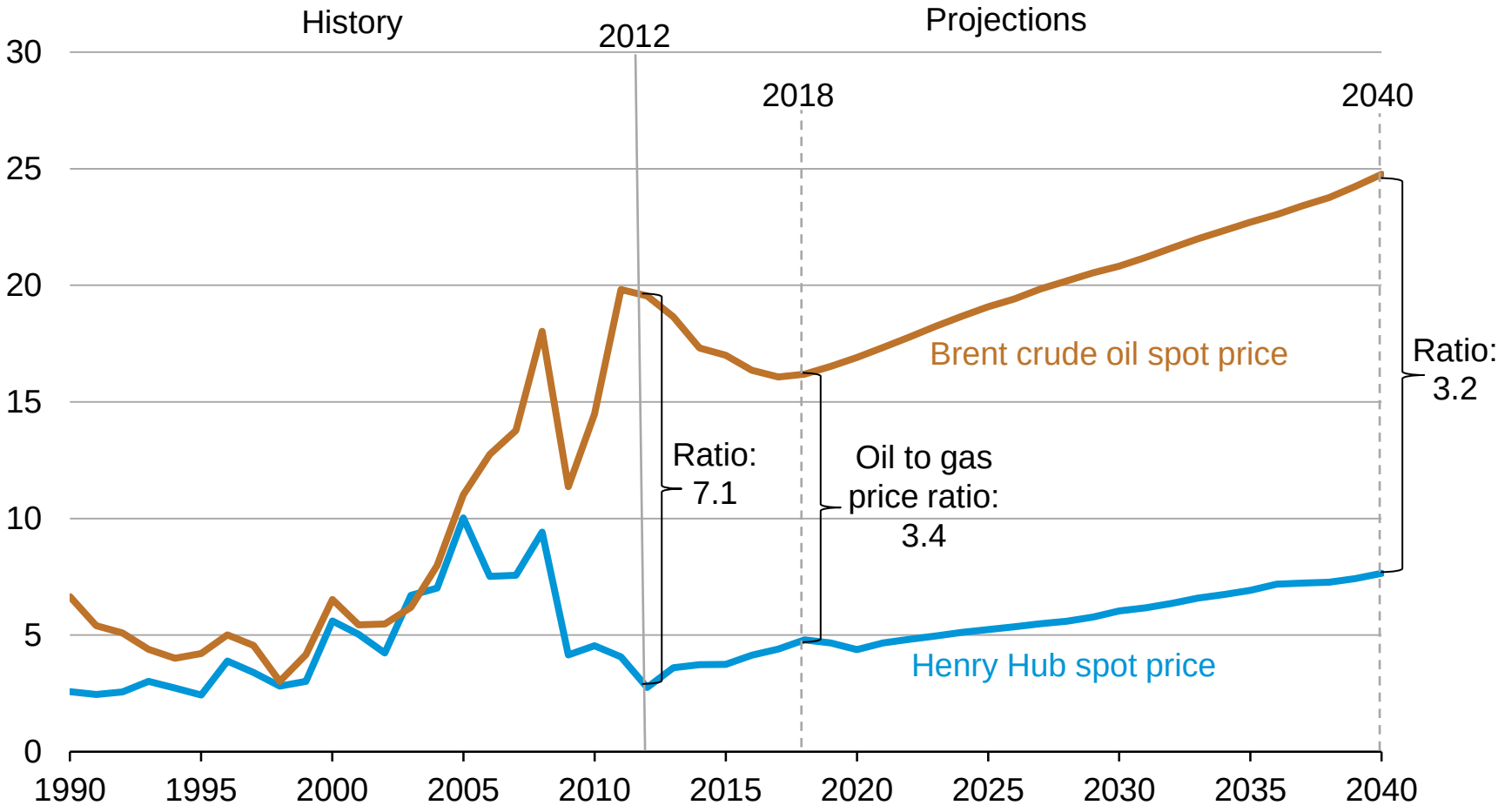


Source: EIA, Annual Energy Outlook 2014 Reference case and High Oil and Gas Resource case

U.S. natural gas prices are expected to remain well below crude oil prices

energy spot prices

2012 dollars per million Btu



Source: EIA, Annual Energy Outlook 2014 Reference case

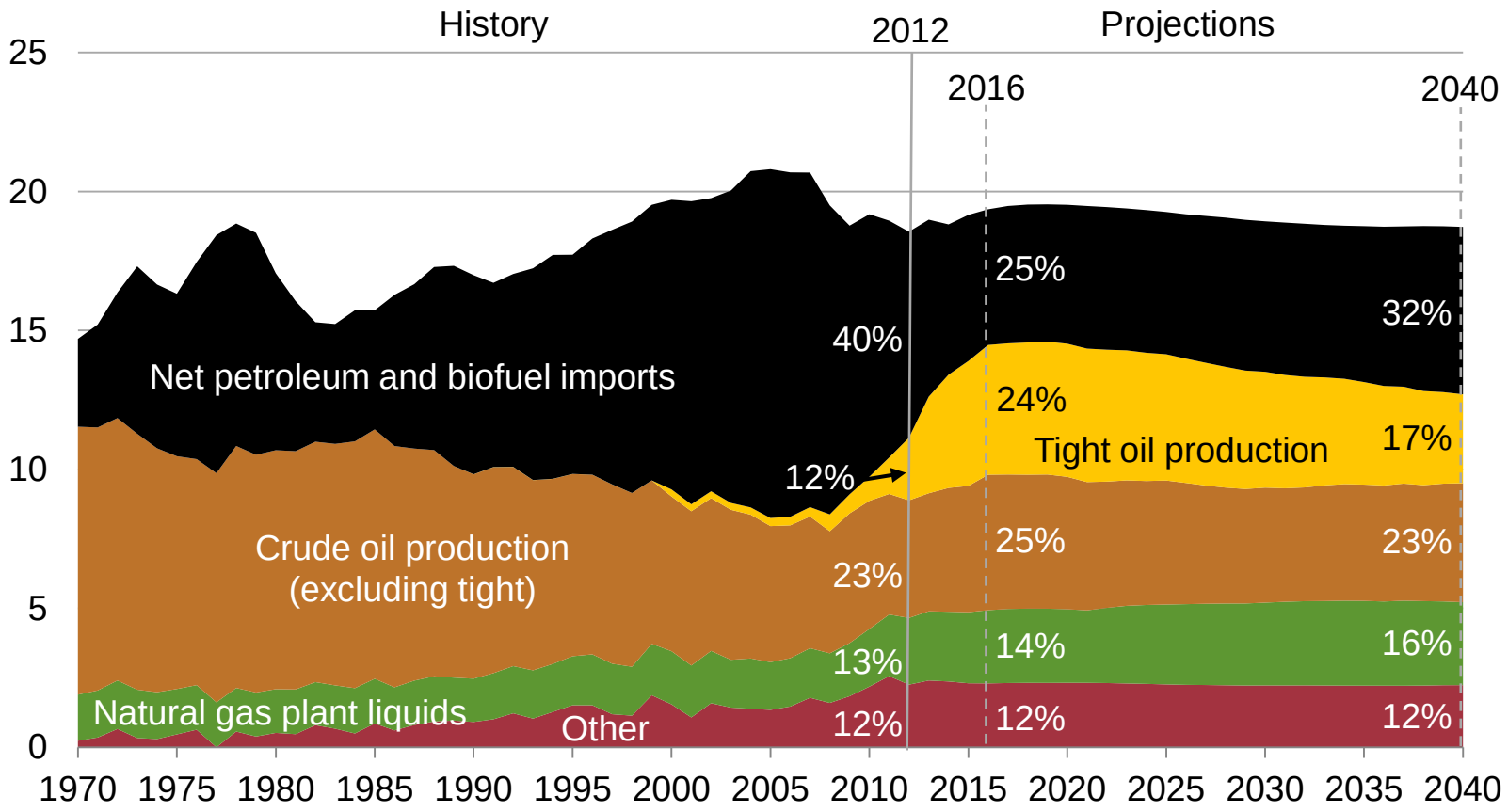
Oil

Takeaways - Oil

- Tight oil clearly matters for measures of U.S. oil import dependence, but its significance to global markets is not yet clear
- The Middle East remains the cockpit of “easy oil” and will remain central to the global oil market
- Historical analogues for the evolution of the call on OPEC (COO) provides some insight into alternative paths for the evolution of global oil markets
  - Between now and 2025, the change in the COO seems likely to fall between the 1973-85 and 2000-12 outcomes

Increased production of tight oil and greater fuel efficiency drive decline in petroleum and other liquids imports

U.S. liquid fuels supply
million barrels per day



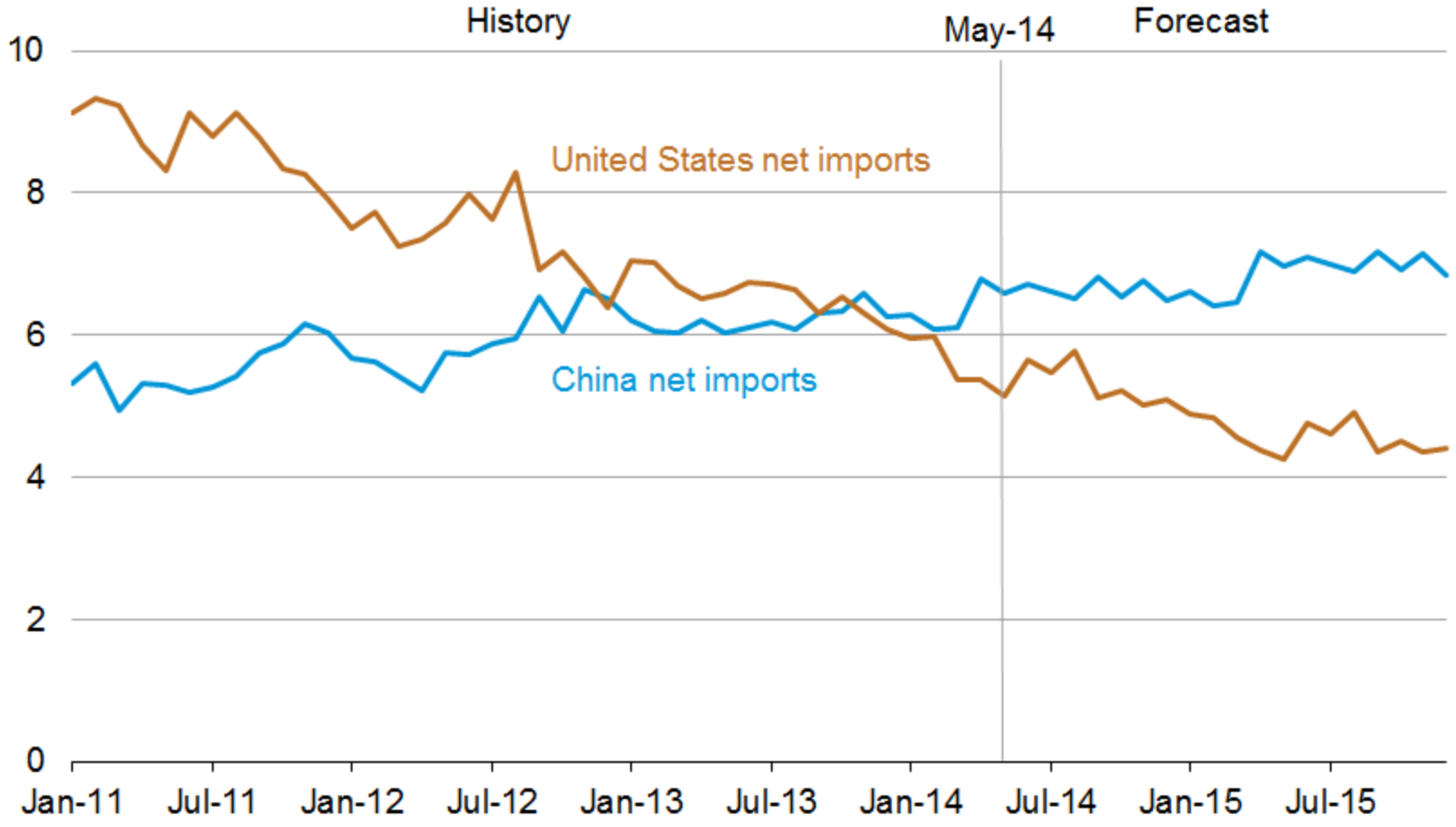
Note: "Other" includes refinery gain, biofuels production, all stock withdrawals, and other domestic sources of liquid fuels

Source: EIA, Annual Energy Outlook 2014 Reference case

Growing U.S. oil production and rising demand in China have together made China the world's largest net oil importer

net imports for China and the United States

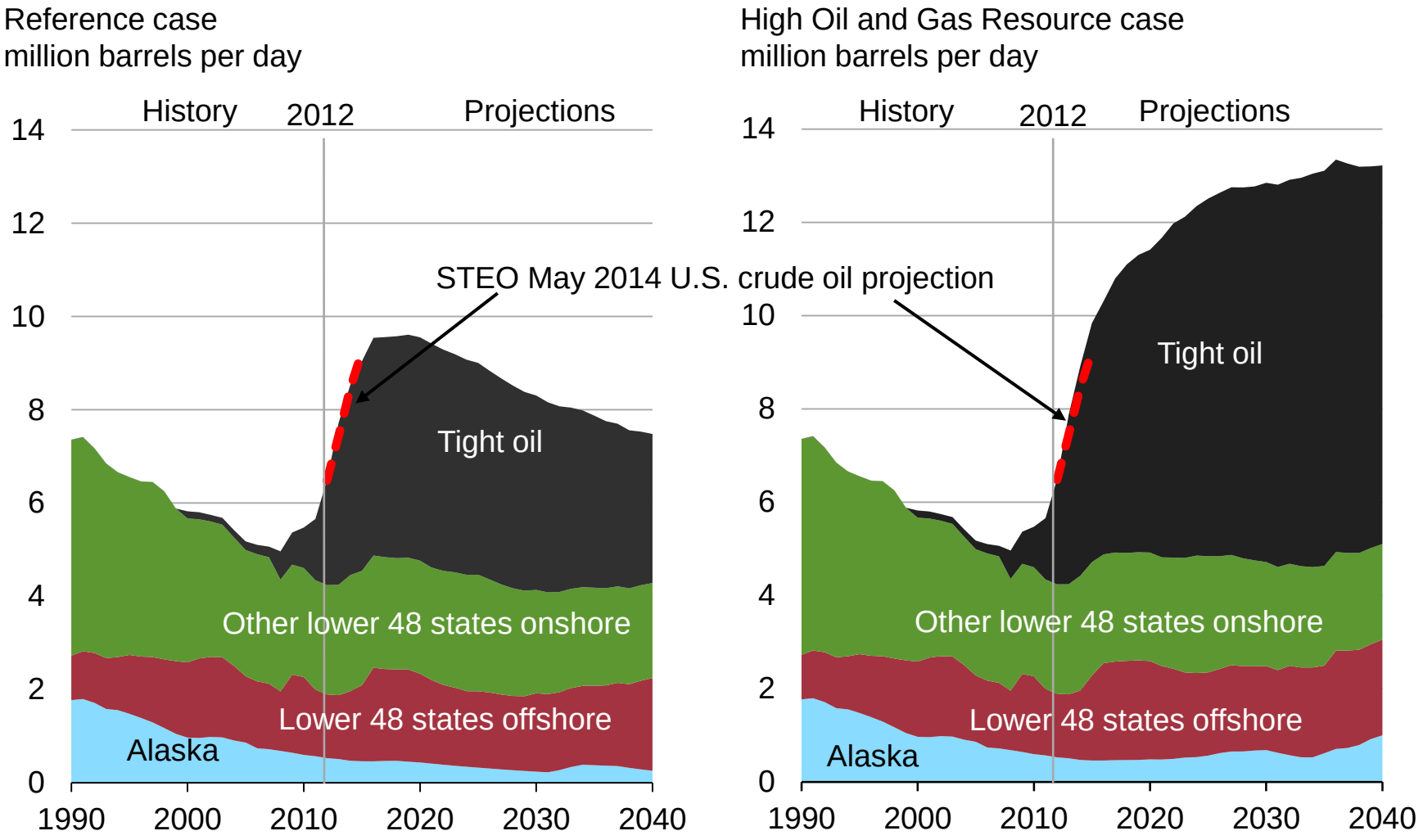
million barrels per day



Note: Net oil imports are defined as total liquid fuels consumption less domestic production

Source: EIA, Short-Term Energy Outlook, May 2014

Differences in resource and technology assumptions between the Reference and High Resource cases have major implications for projected production

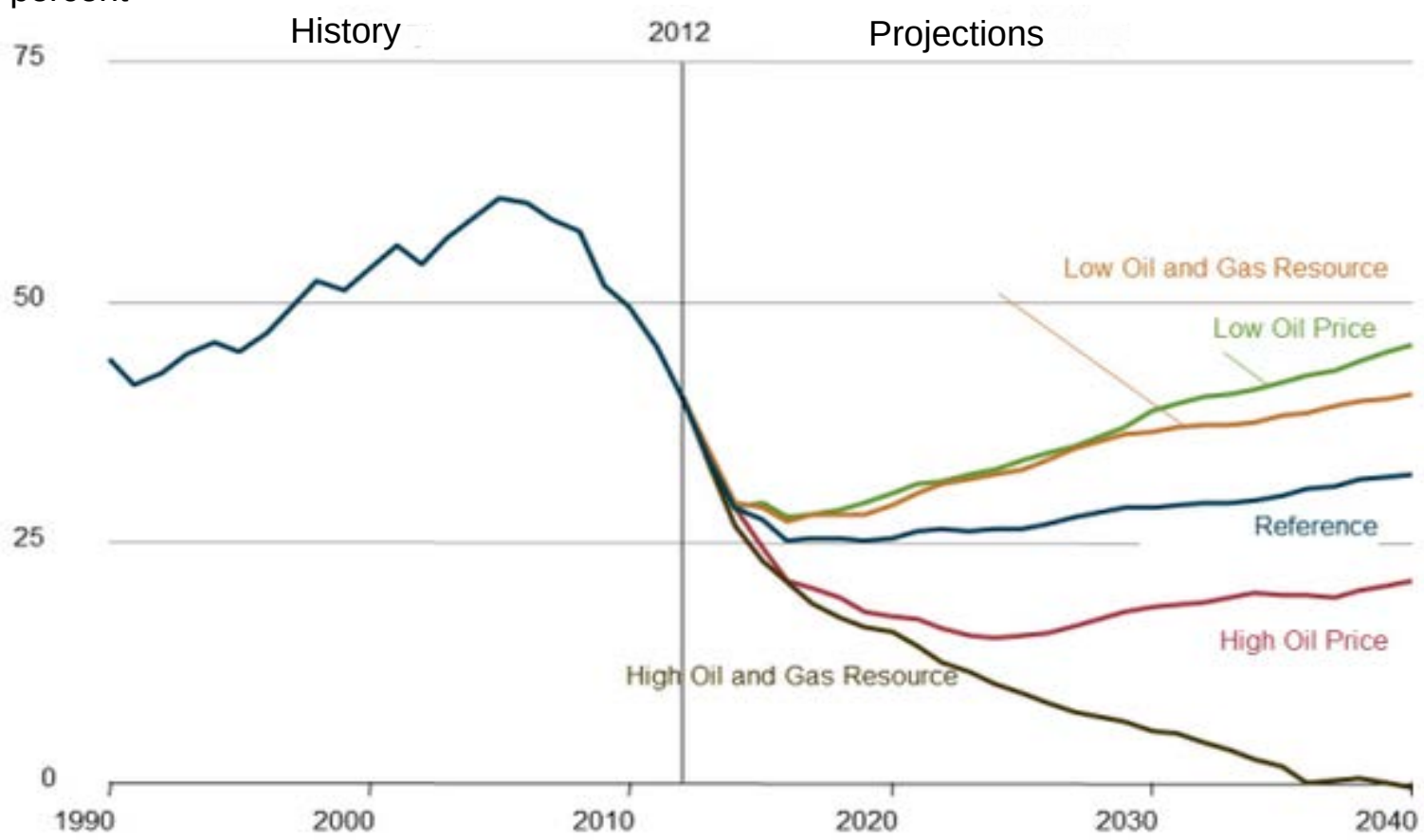


Source: EIA, Annual Energy Outlook 2014 Reference case and High Oil and Gas Resource case; Short Term Energy Outlook, May 2014

U.S. reliance on net imports of petroleum and other liquids is virtually eliminated by 2035 in High Oil and Gas Resource case

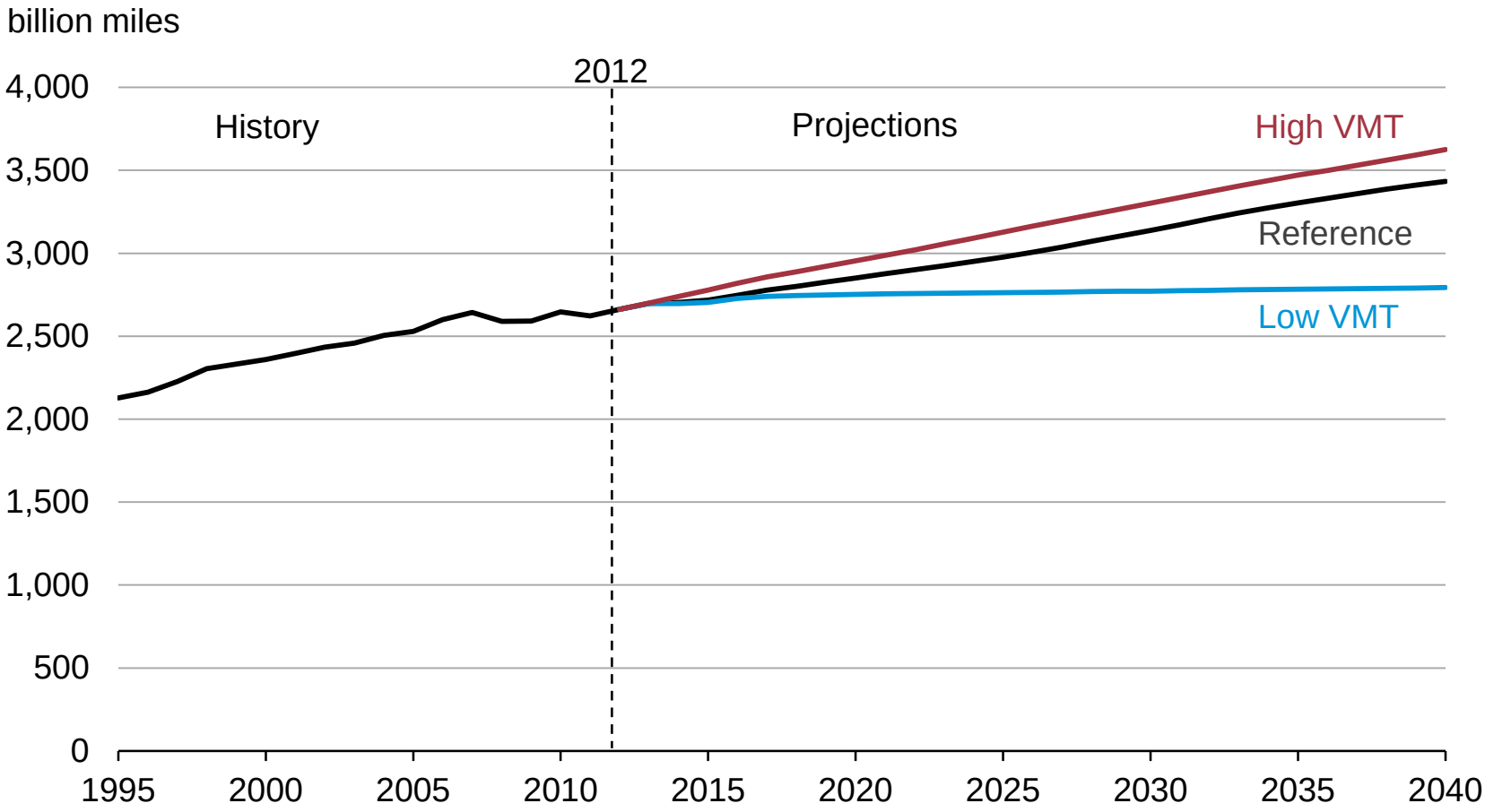
net import share of U.S. petroleum and other liquids consumption

percent



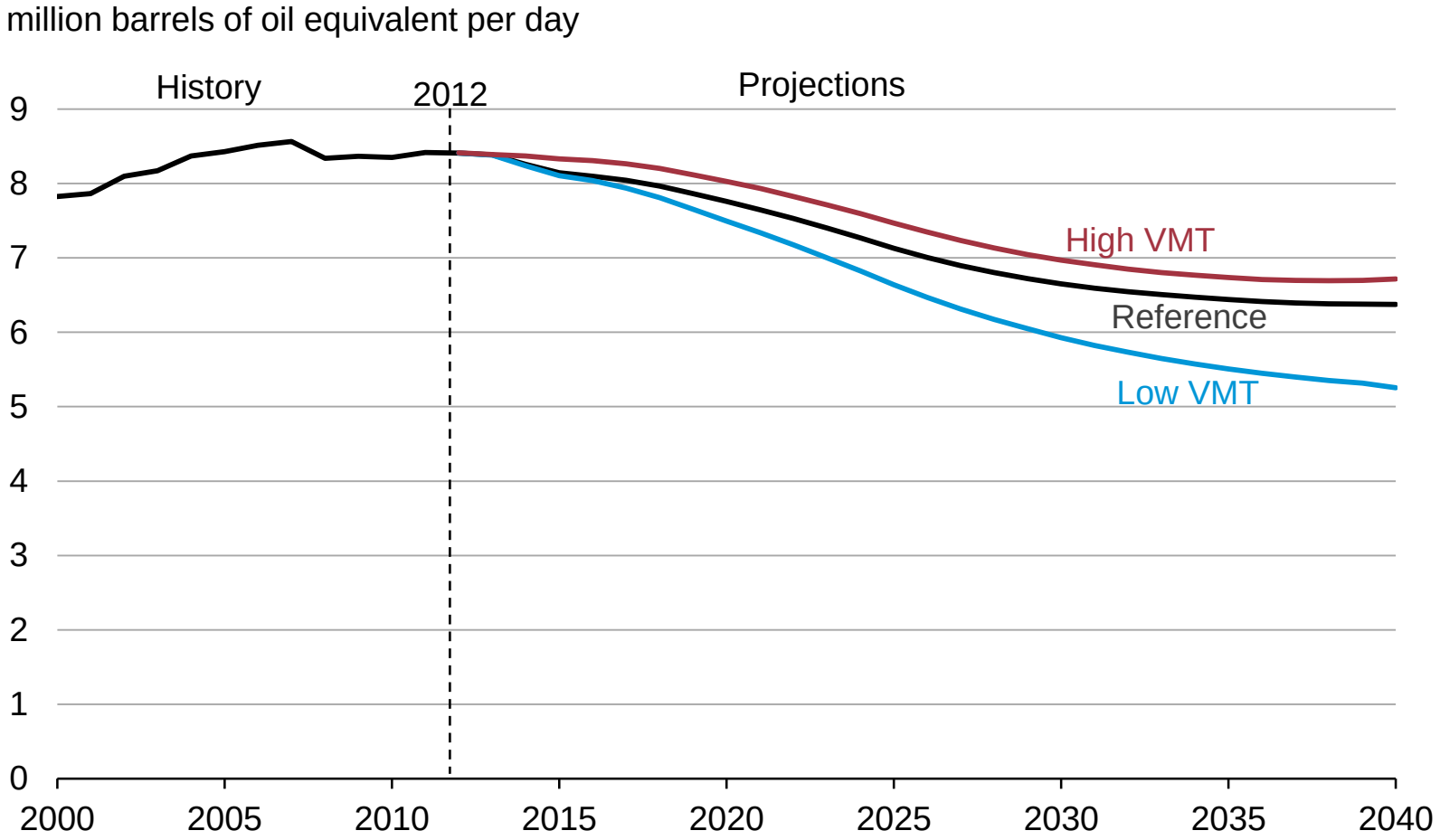
Source: EIA, Annual Energy Outlook 2014 Reference case, High Oil and Gas Resource case, Low Oil and Gas Resource case, High Oil Price case, and Low Oil Price case

Total light-duty vehicle miles traveled ranges from 3.6 trillion miles in the High VMT case to 2.8 trillion miles in the Low VMT case



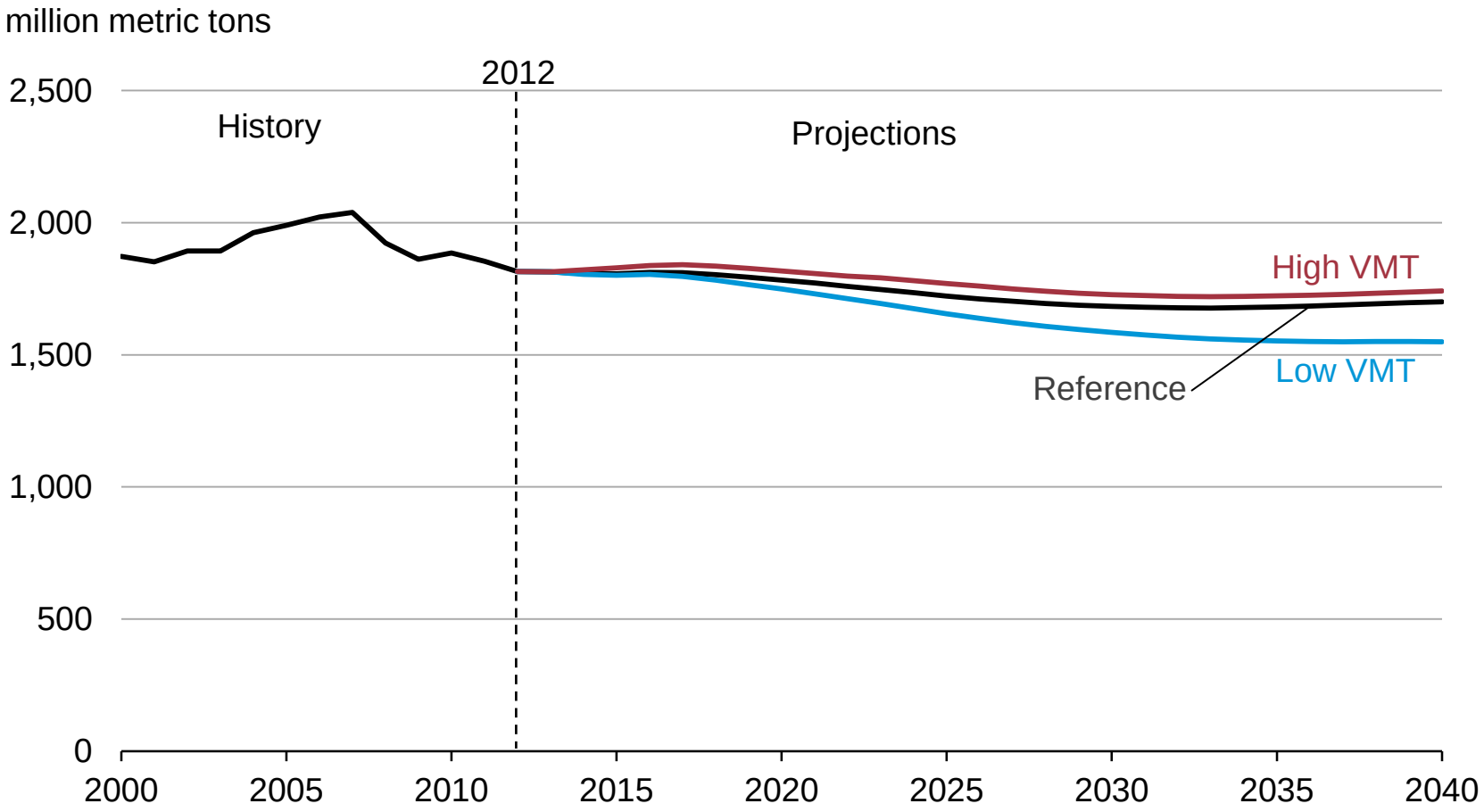
Source: U.S. Energy Information Administration AEO2014

Total light-duty vehicle transportation energy demand decreases by an average annual rate of 0.8% in the High VMT case, and 1.7% in the Low VMT case



Source: U.S. Energy Information Administration AEO2014

Total U.S. transportation carbon dioxide emissions increase by 3% in the High VMT case, decrease by 9% in the Low VMT case when compared to the Reference case



Source: U.S. Energy Information Administration AEO2014

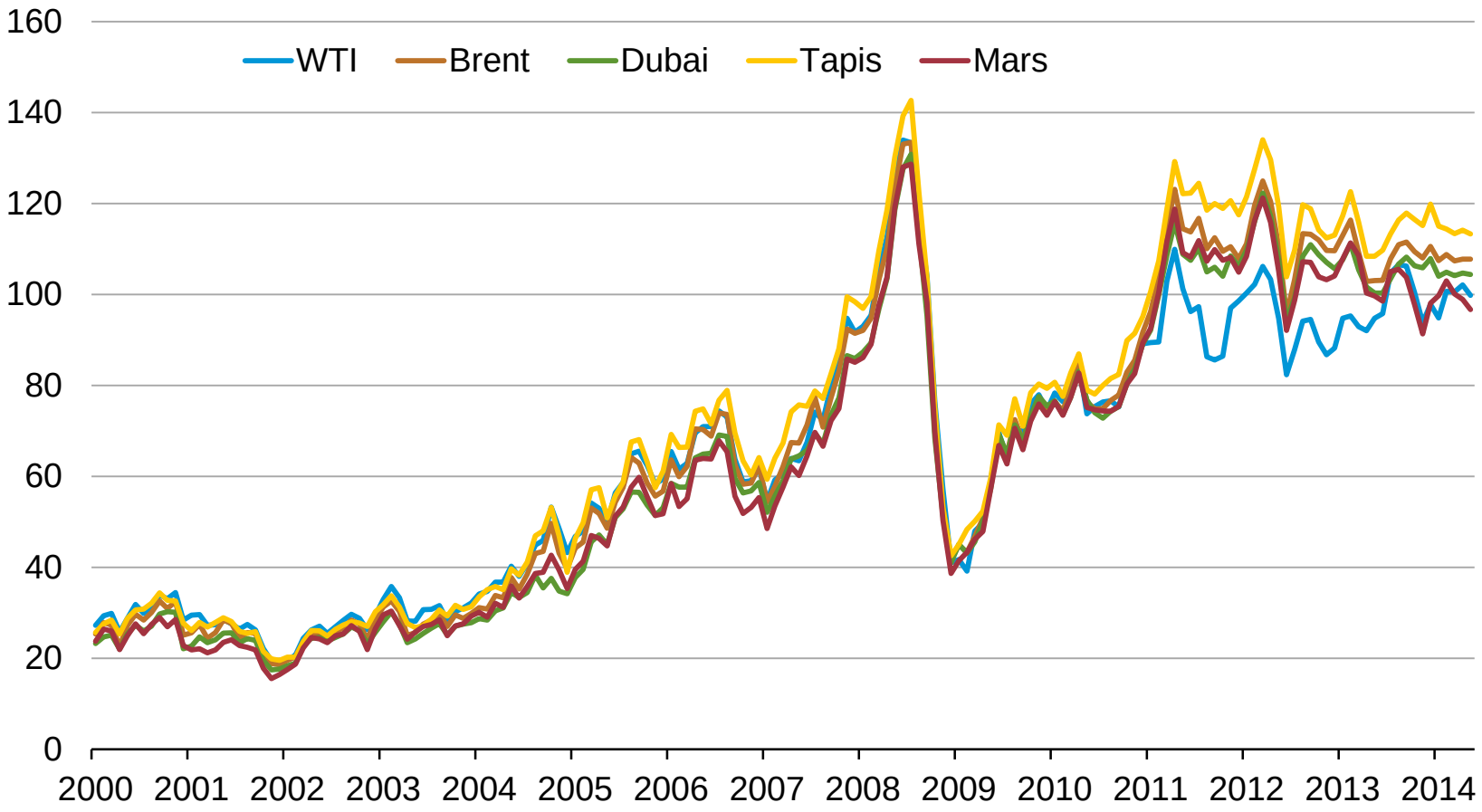
Change in world liquid fuel balances: comparison of two 12-year historical periods and the *AEO2014* Reference case over 2013-25 (million barrels per day)

	Actual		Projected AEO 2014 Reference Case
	1973–85	2000–12	2013–25
World Liquids Demand	+ 3	+12	+11 ?
OECD	-4	-2	0 ?
Non-OECD	+7	+15	+11 ?
World Liquids Supply	-1	+12	+11?
Non-OPEC Supply	+13	+ 6	+ 6 ?
OPEC Production	-14	+ 6	+ 5 ?

World oil prices move together due to arbitrage

global crude oil prices

nominal dollars per barrel, monthly average



Source: U.S. Energy Information Administration, based on Bloomberg

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

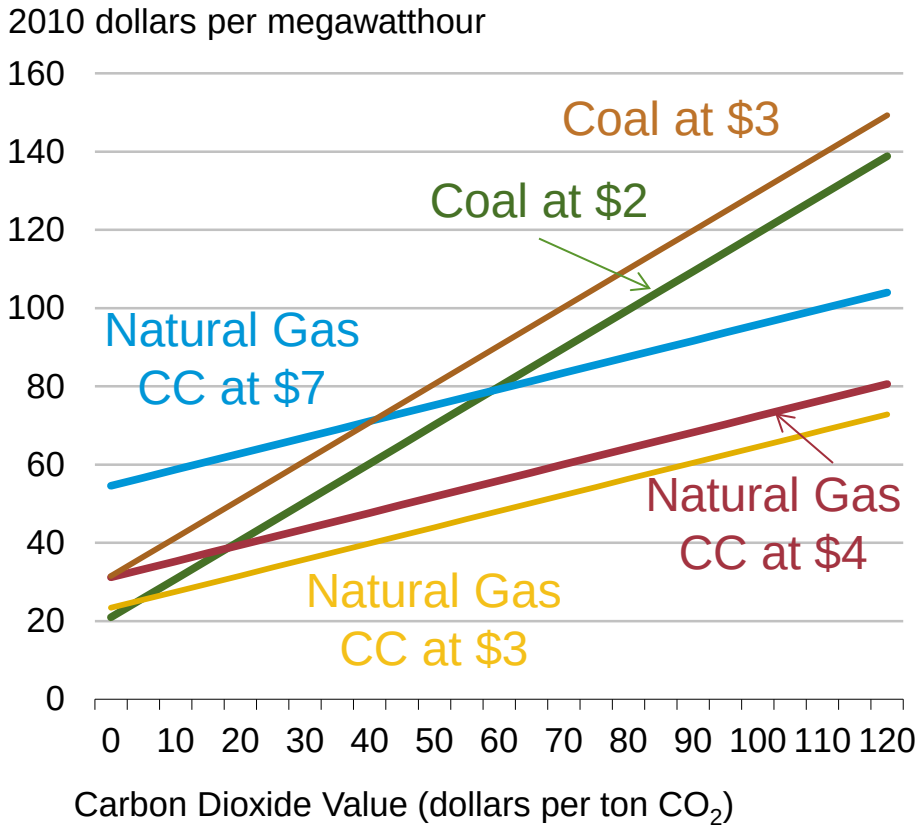
State Energy Portal | www.eia.gov/state

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

Supplementary slides

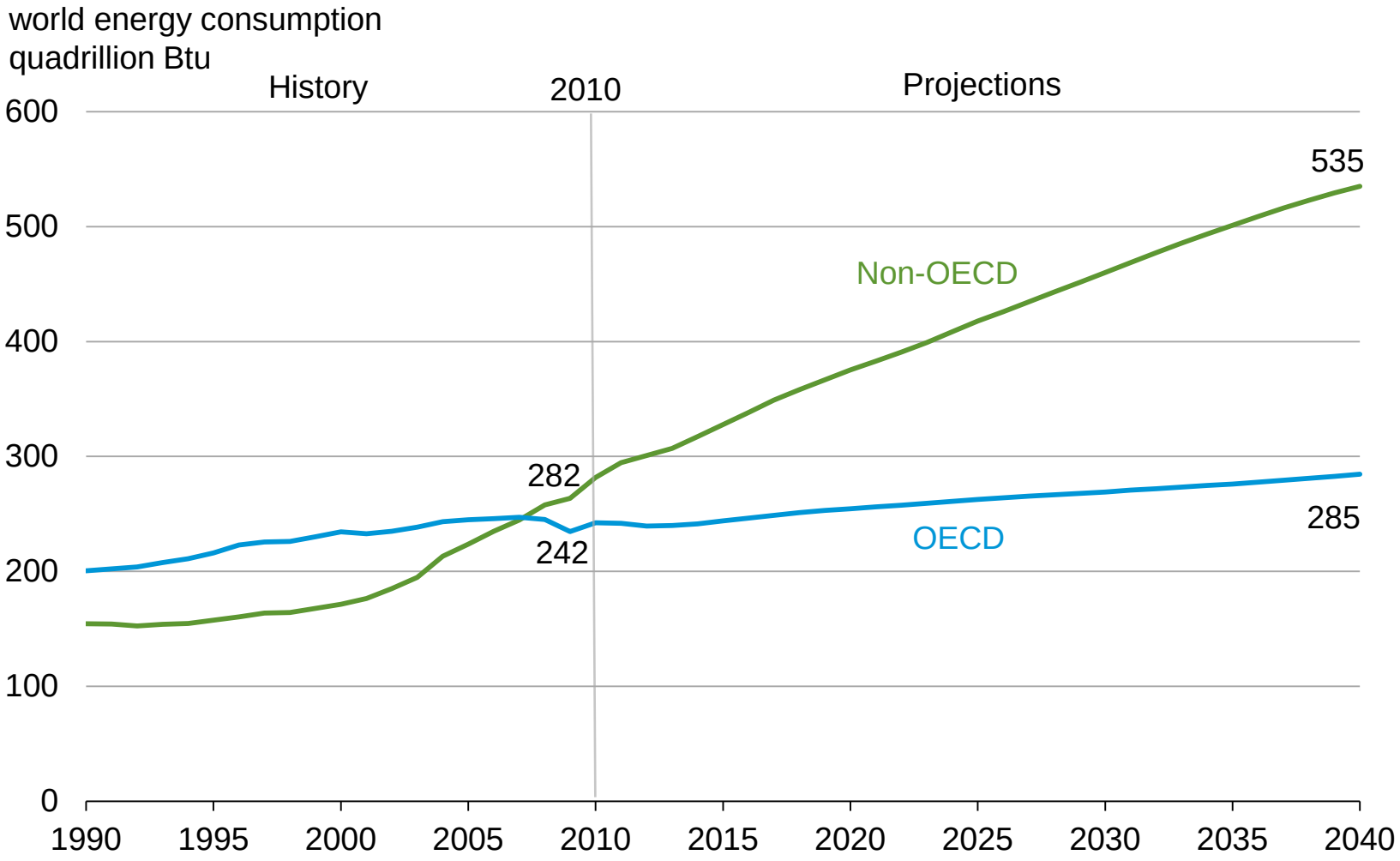
Operating costs: existing plants with and without a value on carbon

Fuel cost for existing coal and combined cycle natural gas units with a value placed on carbon dioxide emissions



- The “crossover point” for least-cost dispatch of coal and natural gas capacity depends on both fuel prices and the carbon value; at lower natural gas prices, the “crossover” occurs at a lower carbon value
- Environmental operating costs and retrofit costs for pollution controls at existing coal-fired plants can “raise the bar” for their continued operation.
  - For retrofit decisions, the unit’s perceived “useful life,” which plays a critical role, can be affected by views regarding future climate policies

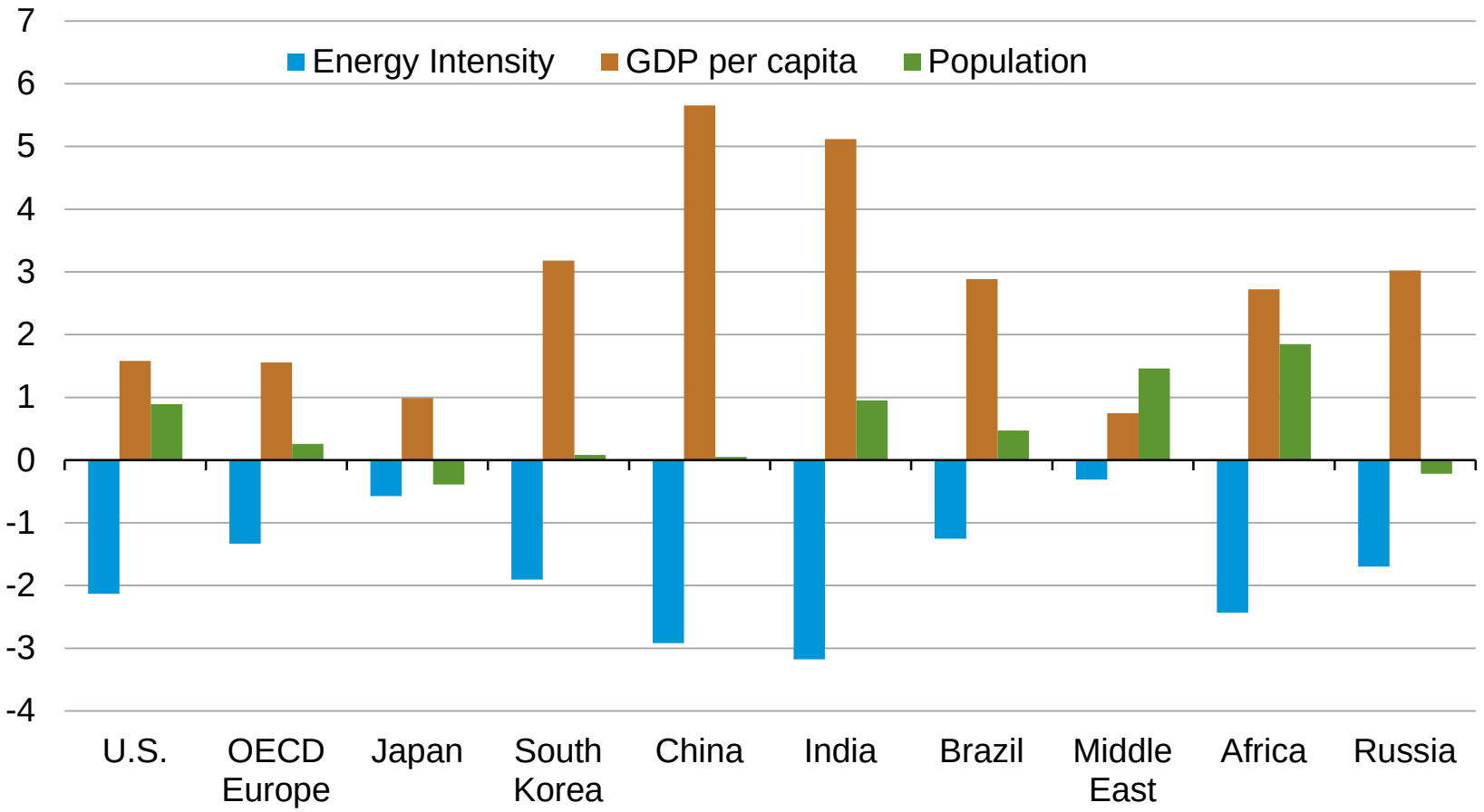
Non-OECD nations drive the increase in energy demand



Source: EIA, International Energy Outlook 2013

Economic activity and population drive increases in energy use; energy intensity improvements moderate this trend

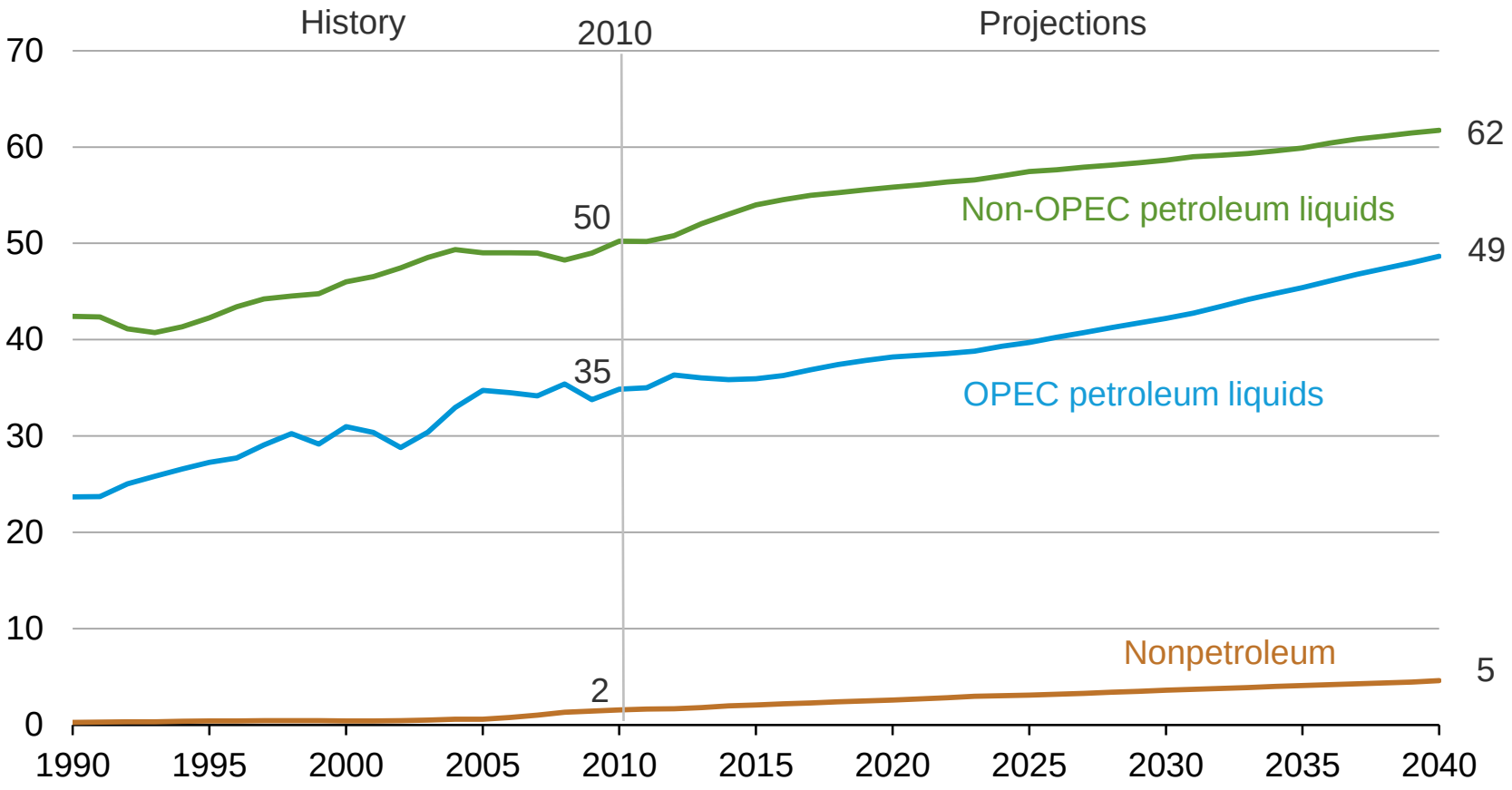
average annual change (2010-2040)
percent per year



Source: EIA, International Energy Outlook 2013

OPEC member countries contribute almost half of the total increase in world liquid supplies

world liquids production
million barrels per day



Source: EIA, International Energy Outlook 2013