
Annual Energy Outlook 2011

Reference Case

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December 16, 2010
Washington, DC

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U.S. Energy Information Administration
Independent Statistics and Analysis

Key results from the *AEO2011* Reference case, which assumes current laws remain unchanged

- Increased estimates for U.S. shale gas resources drive increased U.S. production, lower prices, and lower imports of natural gas
- Industrial natural gas demand recovers, reversing recent trend
- Non-hydro renewables and natural gas are the fastest growing electricity generation sources, but coal remains the dominant fuel because of the large amount of existing capacity
- Oil imports fall due to increased domestic production—including biofuels—and greater fuel efficiency
- U.S. carbon dioxide emissions rise slowly, but do not pass 2005 levels again until 2027

What is included (and excluded) in developing EIA's "Reference case" projections?

- Generally assumes current laws and regulations
 - excludes potential future laws and regulations (e.g., proposed greenhouse gas legislation and proposed fuel economy standards are not included)
 - provisions generally sunset as specified in law (e.g., renewable tax credits expire)
- Some grey areas
 - adds a premium to the capital cost of CO₂-intensive technologies to reflect market behavior regarding possible CO₂ regulation
 - assumes implementation of existing regulations that enable the building of new energy infrastructure and resource extraction
- Includes technologies that are commercial or reasonably expected to become commercial over next decade or so
 - includes projected technology cost and efficiency improvements, as well as cost reductions linked to cumulative deployment levels
 - does not assume revolutionary or breakthrough technologies

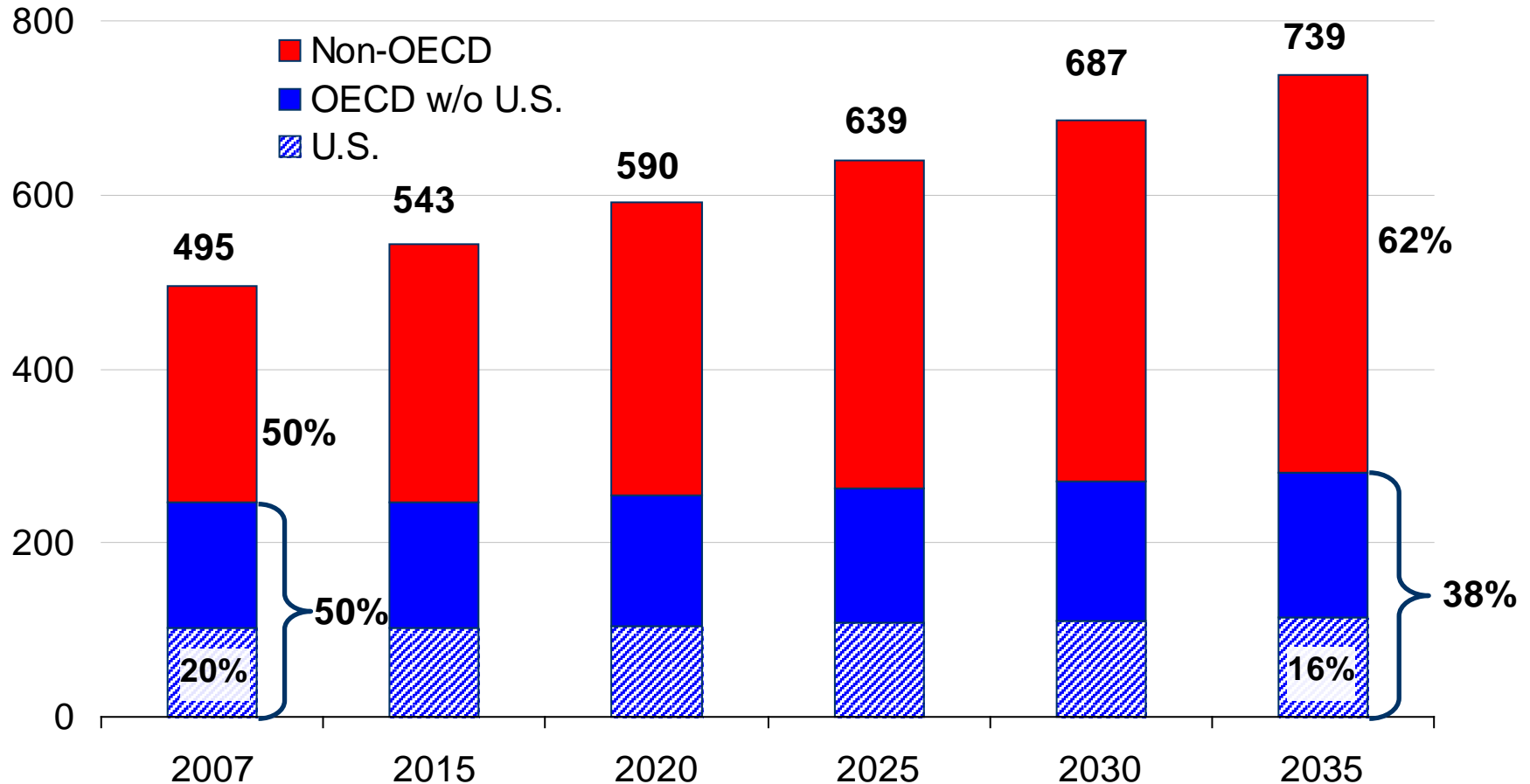
Key updates included in the *AEO2011* Reference case

- Natural gas and oil supply
 - More than doubled the technically recoverable U.S. shale gas resources assumed in *AEO2010* and added new shale oil resources
 - Updated offshore data and assumptions, pushing out start dates for several projects as a result of the drilling moratoria and delaying Atlantic and Pacific offshore leasing beyond 2017
- Electricity
 - Updated costs for new power plants
 - Expanded number of electricity regions to 22 from 13, allowing better regional representation of market structure and power flow
- Transport
 - Increased limit for ethanol blending into gasoline from E10 to E15 for approved vehicles, as a result of the EPA waiver granted in October 2010
 - Includes California's Low Carbon Fuel Standard, which reduces the carbon intensity of gasoline and diesel fuels in that state by 10% from 2012 through 2020
 - Revised light duty vehicle miles travelled downward
 - Updated electric and plug-in hybrid electric battery cost and size

Global energy consumption

Non-OECD countries account for vast majority of the nearly 50% projected increase in global energy use by 2035

energy consumption
quadrillion Btu

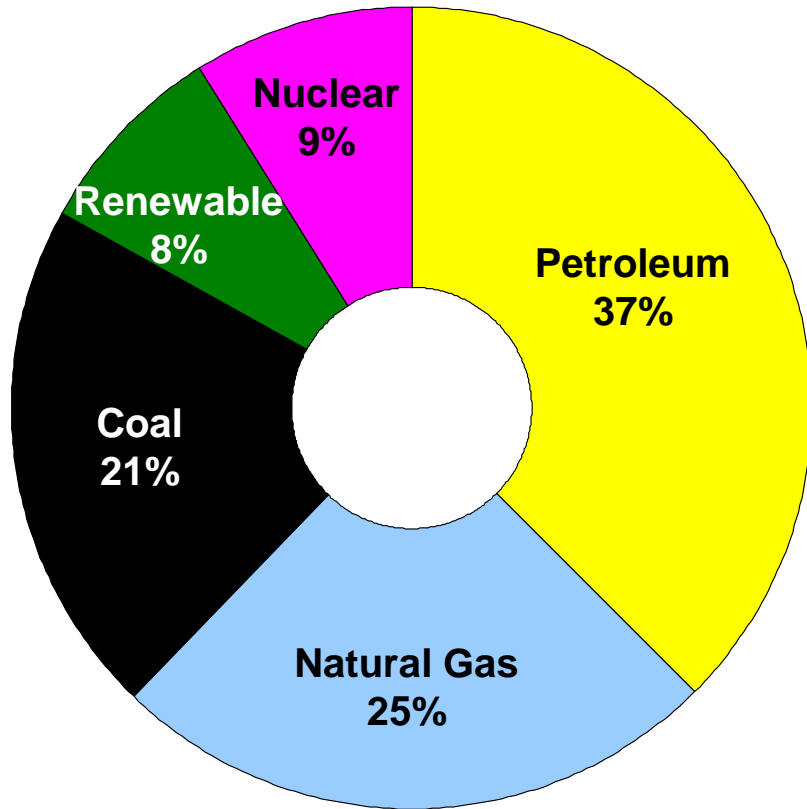


Overview of U.S. energy supply and demand

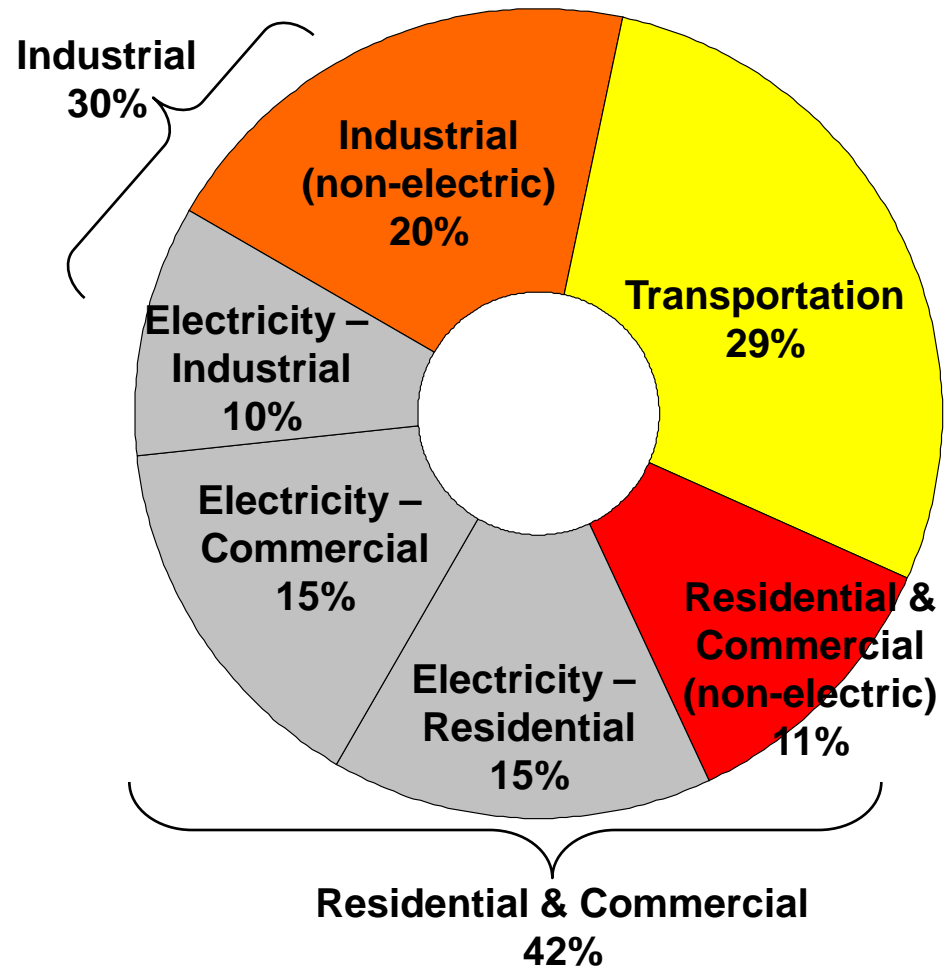
Current U.S. energy supply is 83% fossil fuels; demand is broadly distributed among the major sectors

2009 total U.S. energy use = 94.6 quadrillion Btu

Energy supply

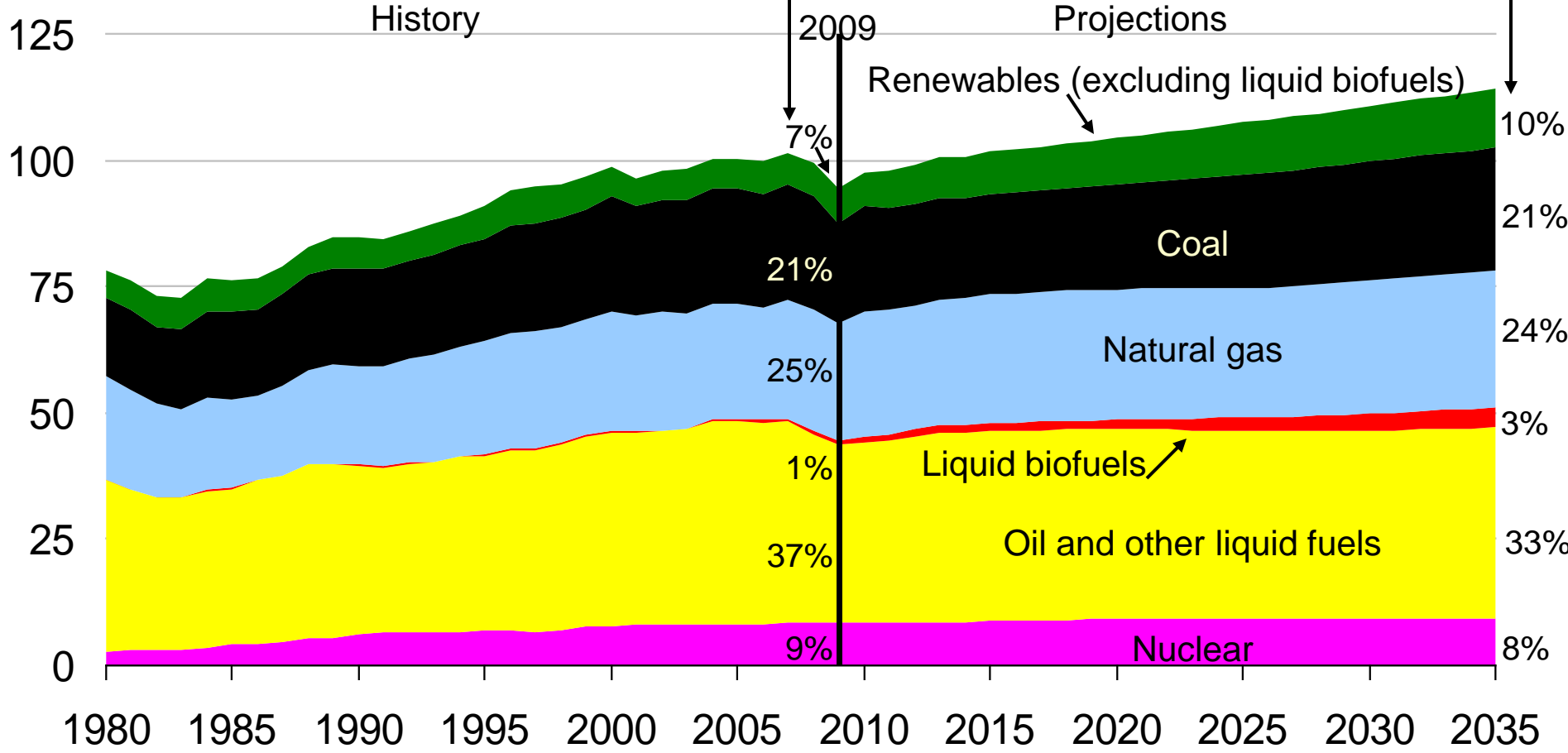


Energy demand

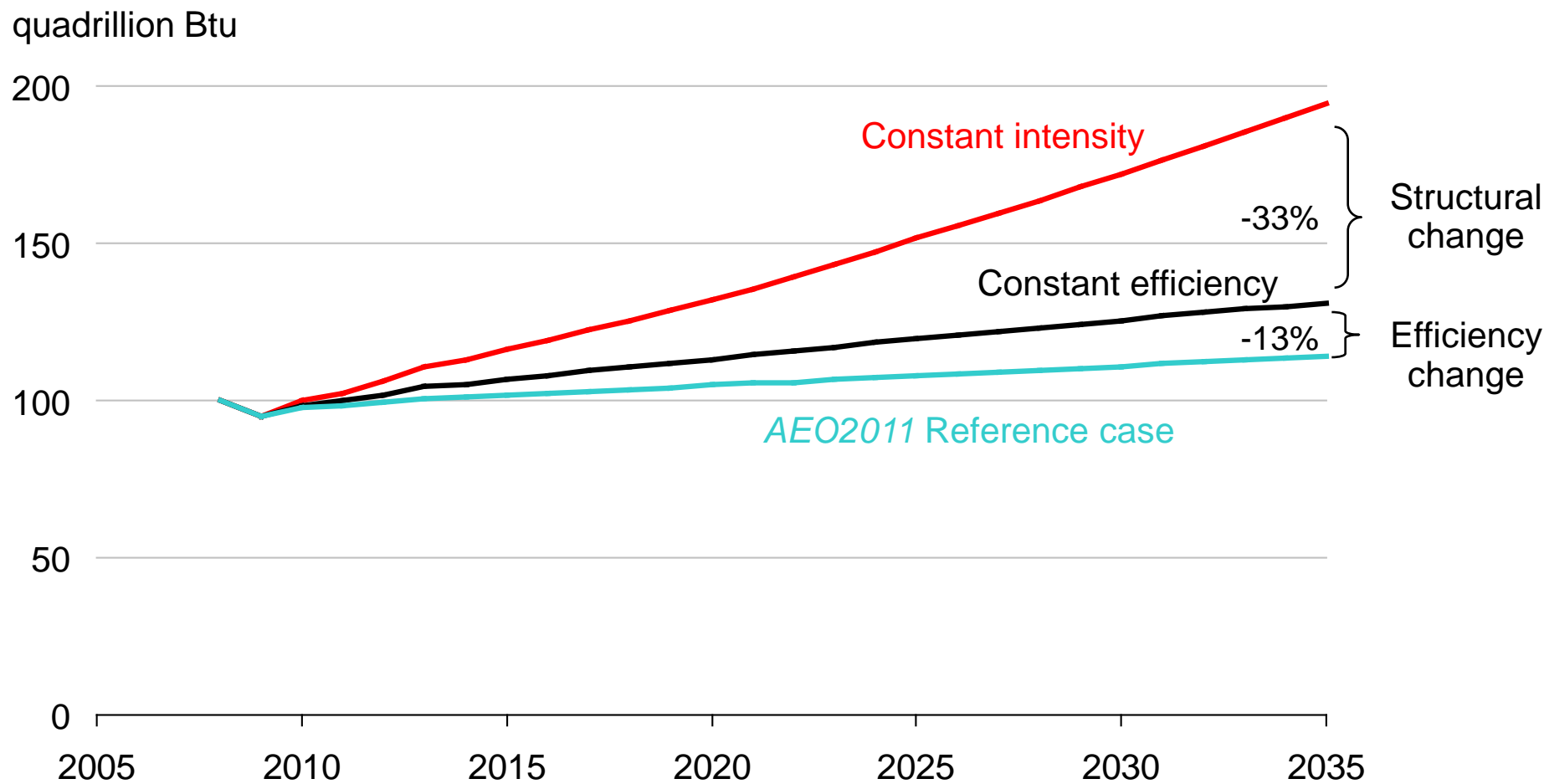


Renewables grow rapidly, but under current policies fossil fuels still provide 78% of U.S. energy use in 2035

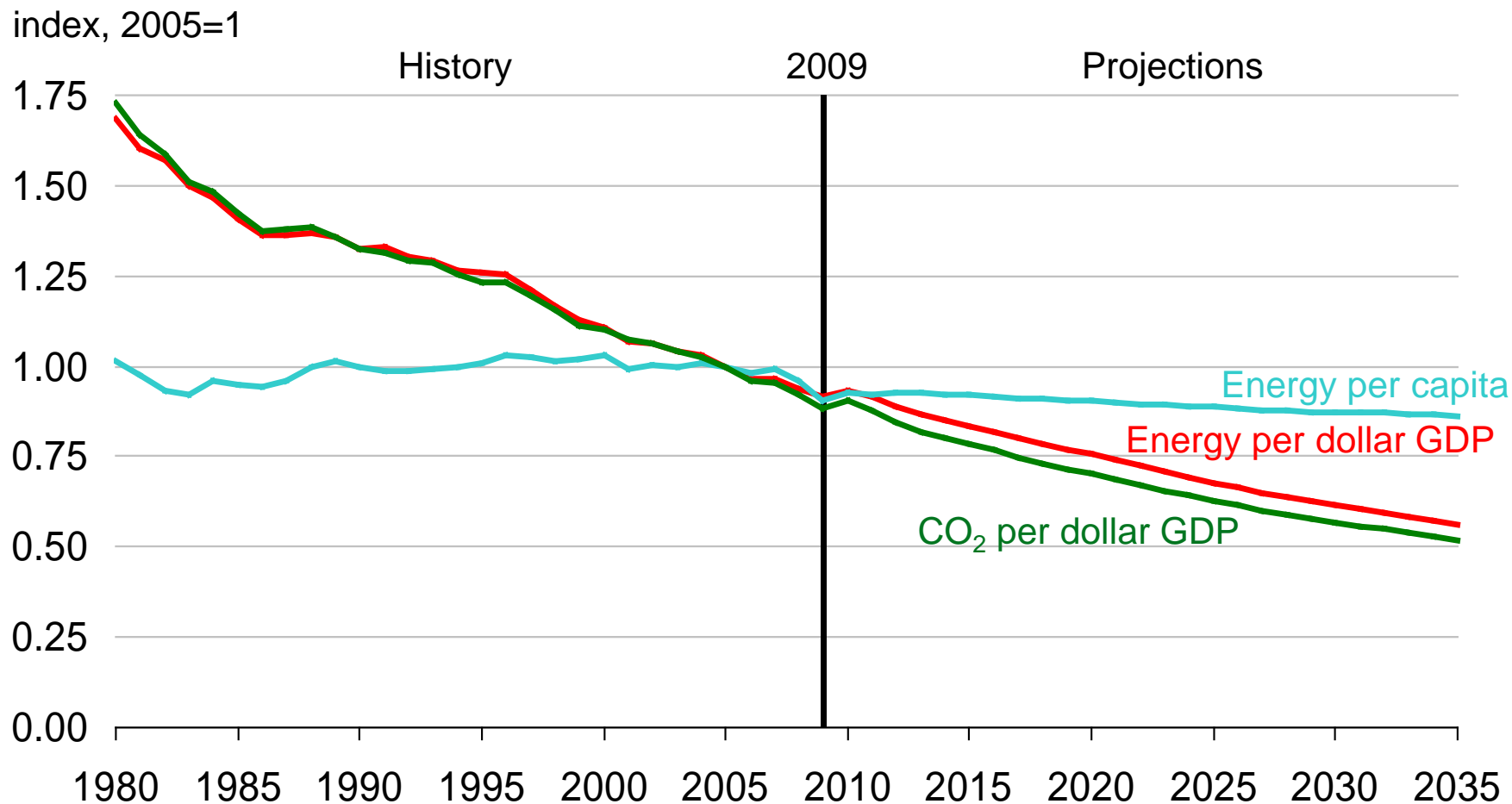
U.S. primary energy consumption
quadrillion Btu per year



Energy efficiency gains reduce consumption 13% from where it would otherwise be; structural change is even larger

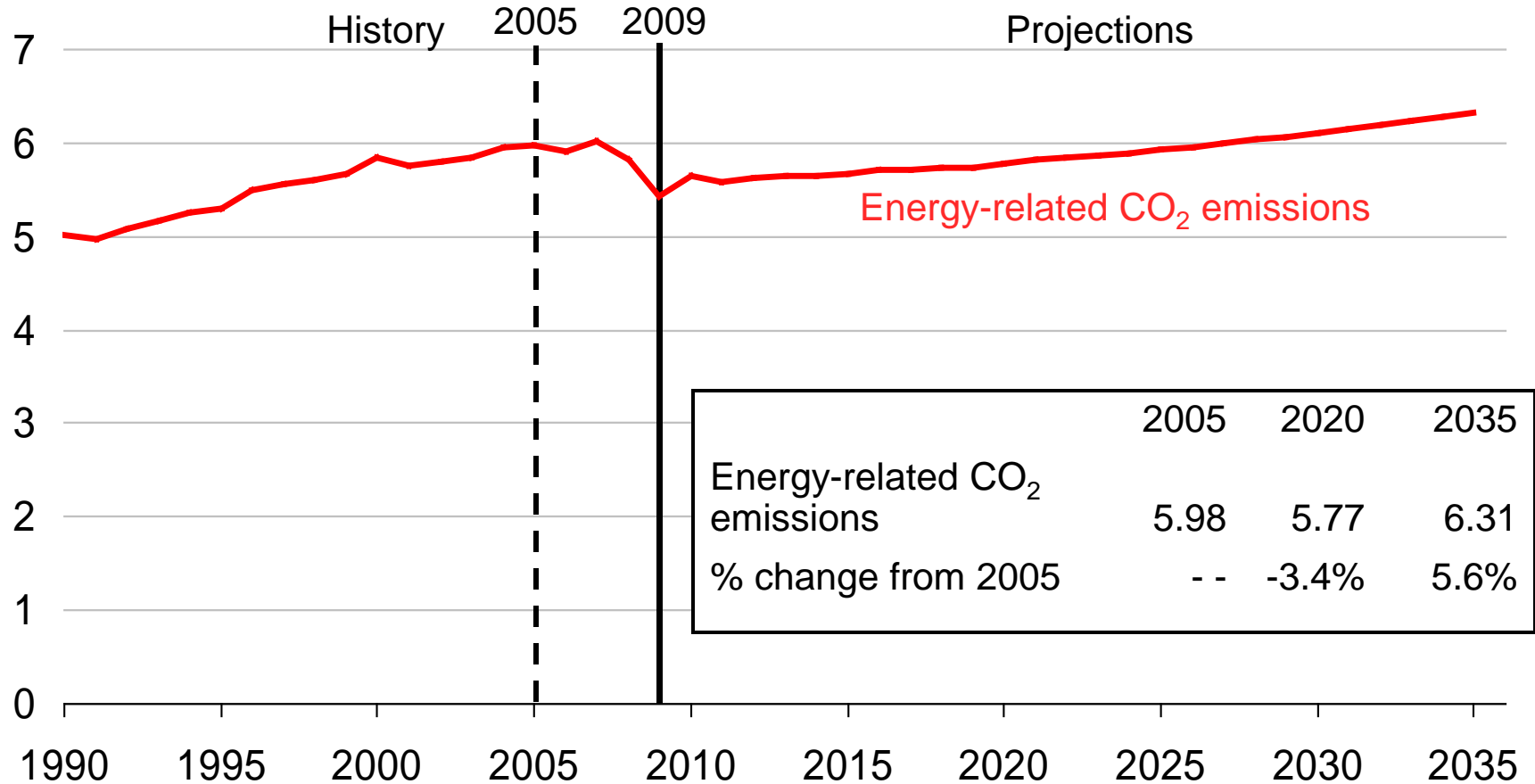


Energy and CO₂ per dollar of GDP continue to decline; per-capita energy use also declines



In the *AEO2011* Reference case, energy-related CO₂ emissions grow almost 6% over 2005 levels by 2035

billion metric tons carbon dioxide

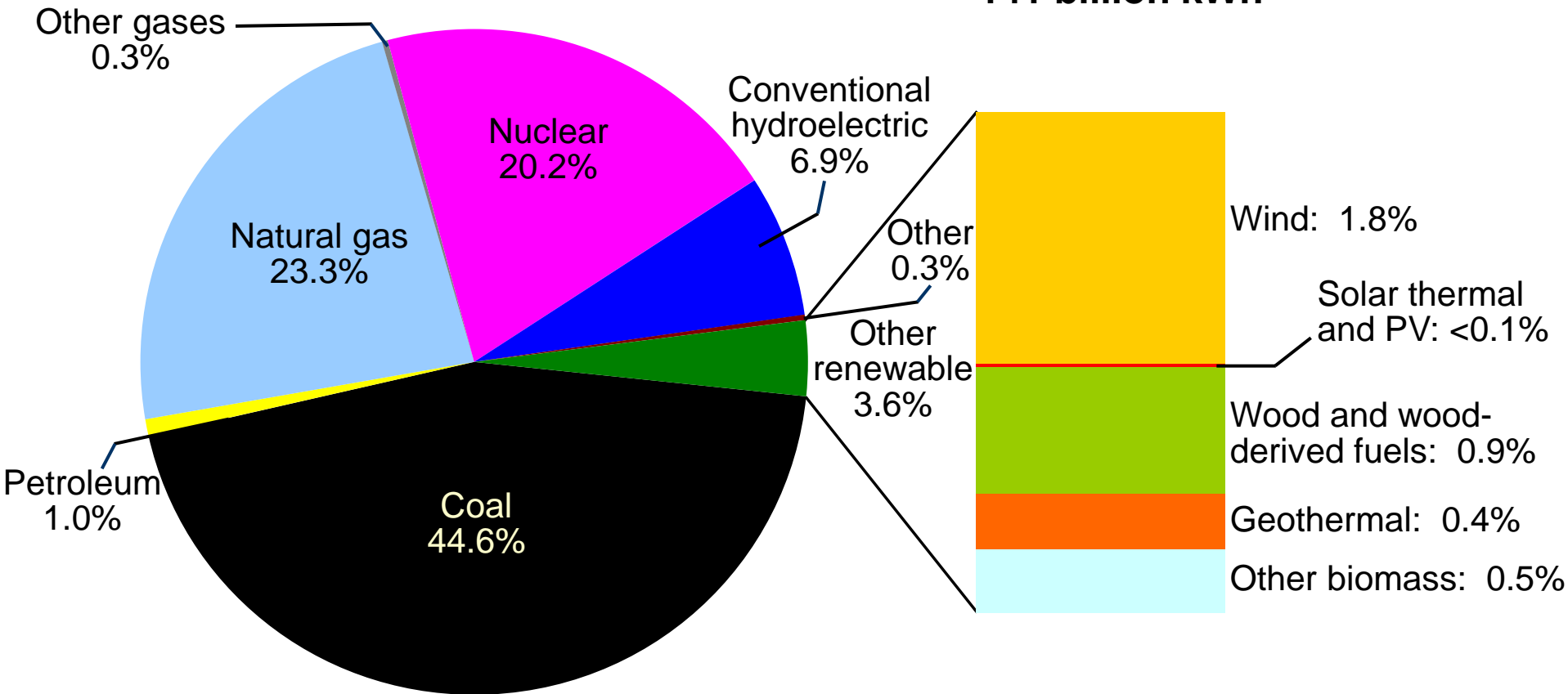


Electricity

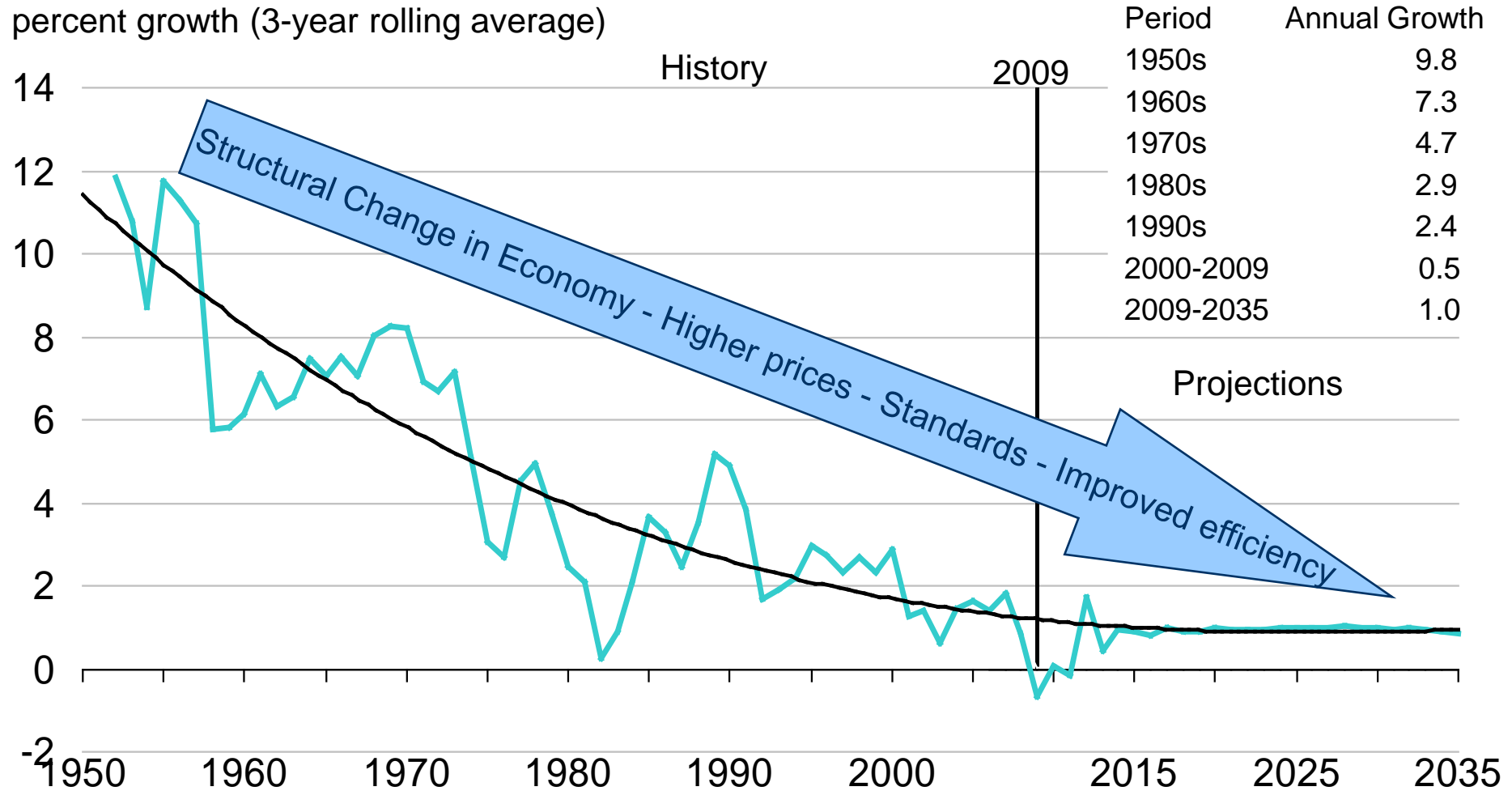
In 2009, electricity generation was 70% fossil fuels, 20% nuclear, and 10% renewable

**2009 Total net generation:
3,953 billion kWh**

**2009 Non-hydro renewable
net generation:
141 billion kWh**

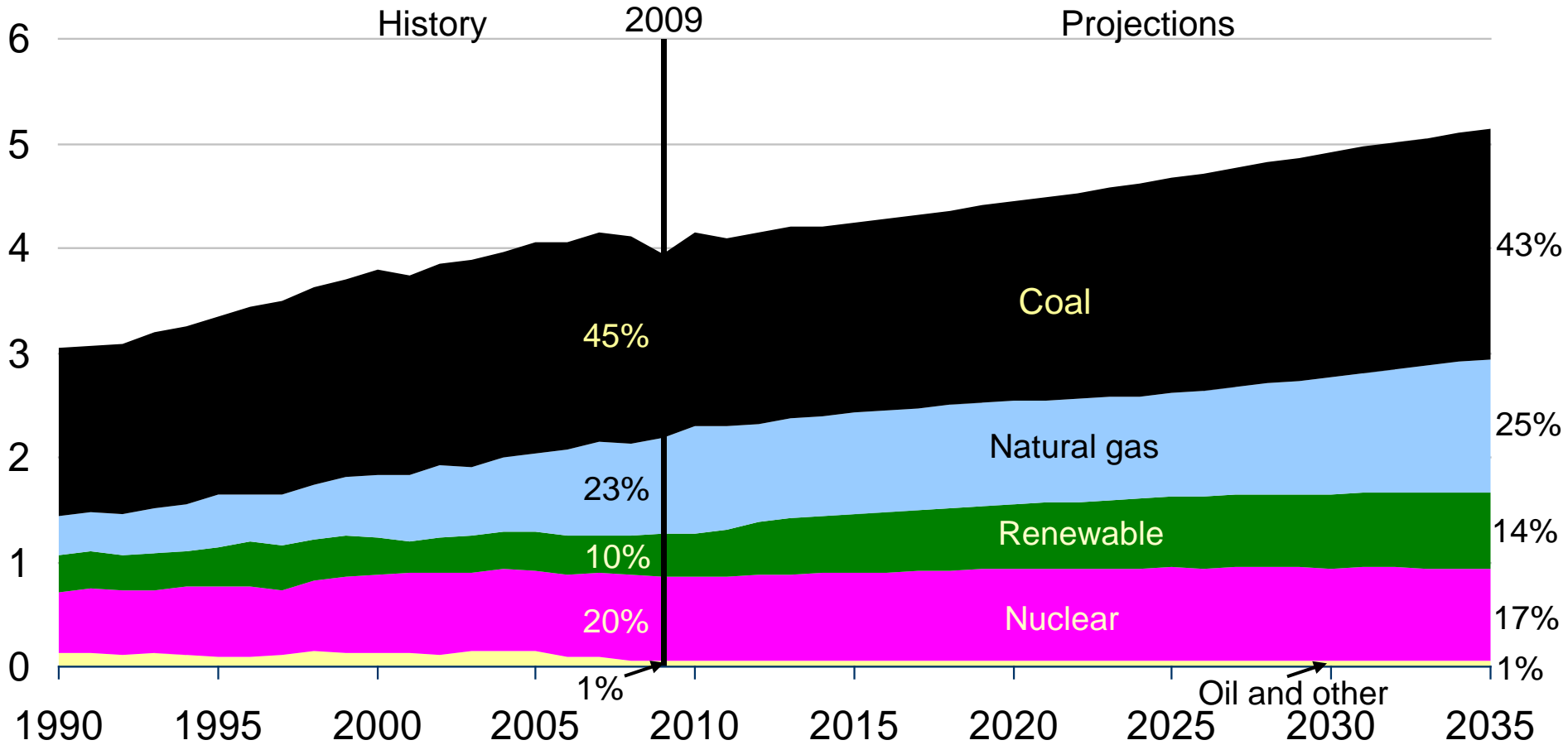


While projected electricity consumption grows by 30%, the rate of growth has slowed



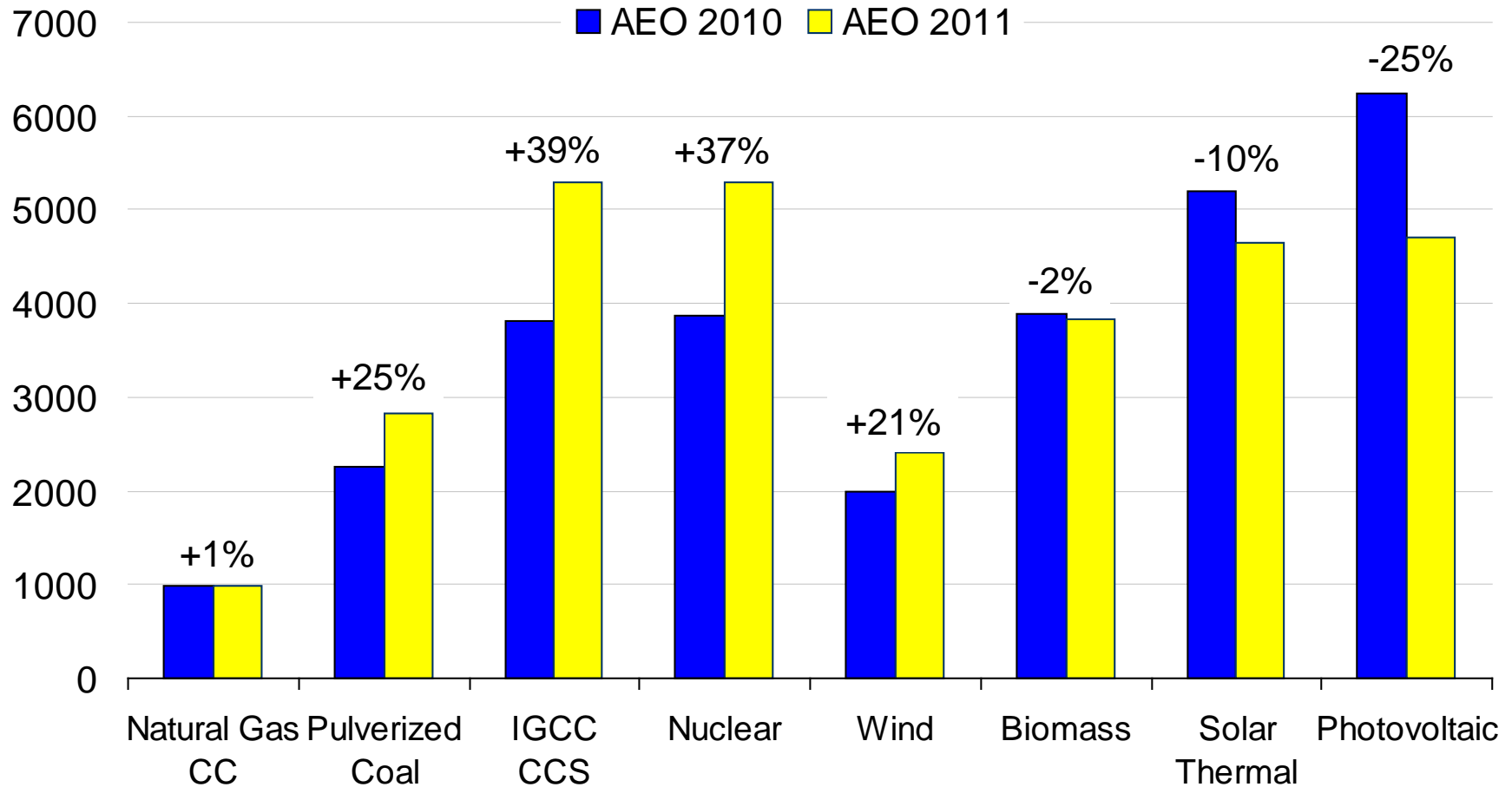
The projected electricity mix gradually shifts to lower-carbon options, with generation from natural gas rising 37% and renewables rising 73%

electricity net generation
trillion kilowatthours per year



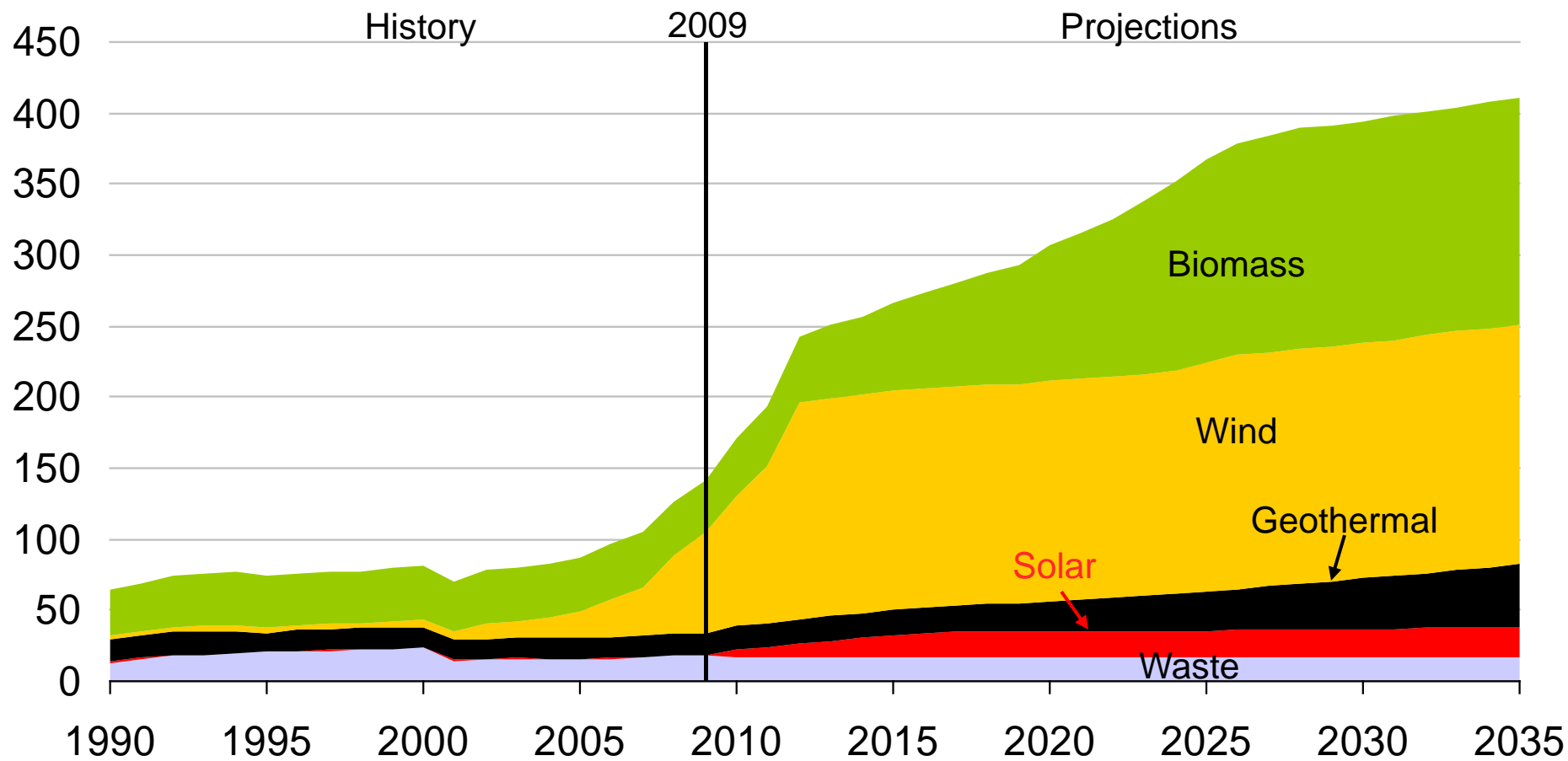
Updated electric power plant capital costs show increases for nuclear, coal, and wind, while solar costs decline

overnight capital cost
2009 dollars per kilowatt

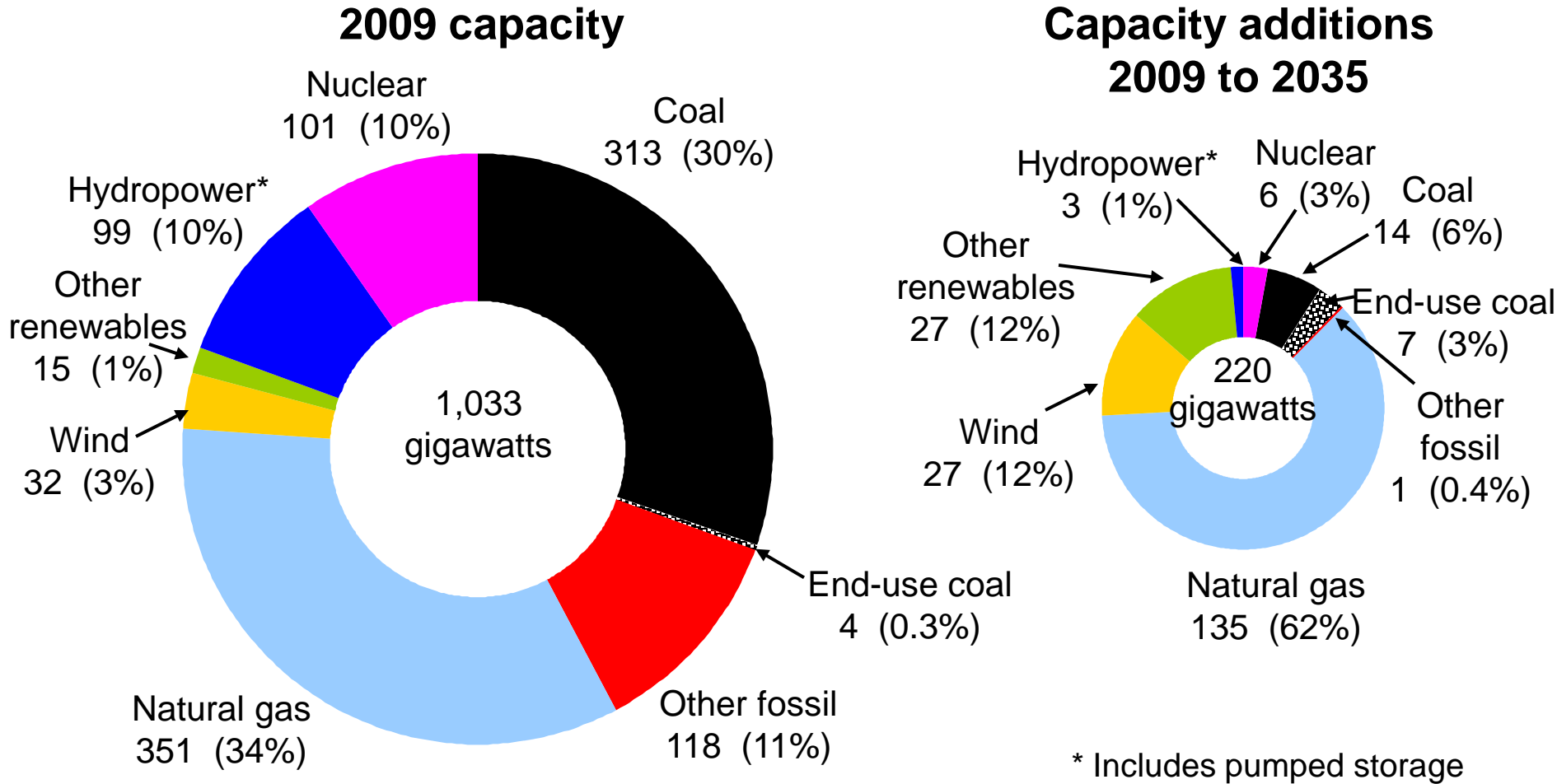


Non-hydro renewable sources grow nearly three-fold, meeting 23% of projected electricity generation growth

non-hydropower renewable generation
billion kilowatthours per year



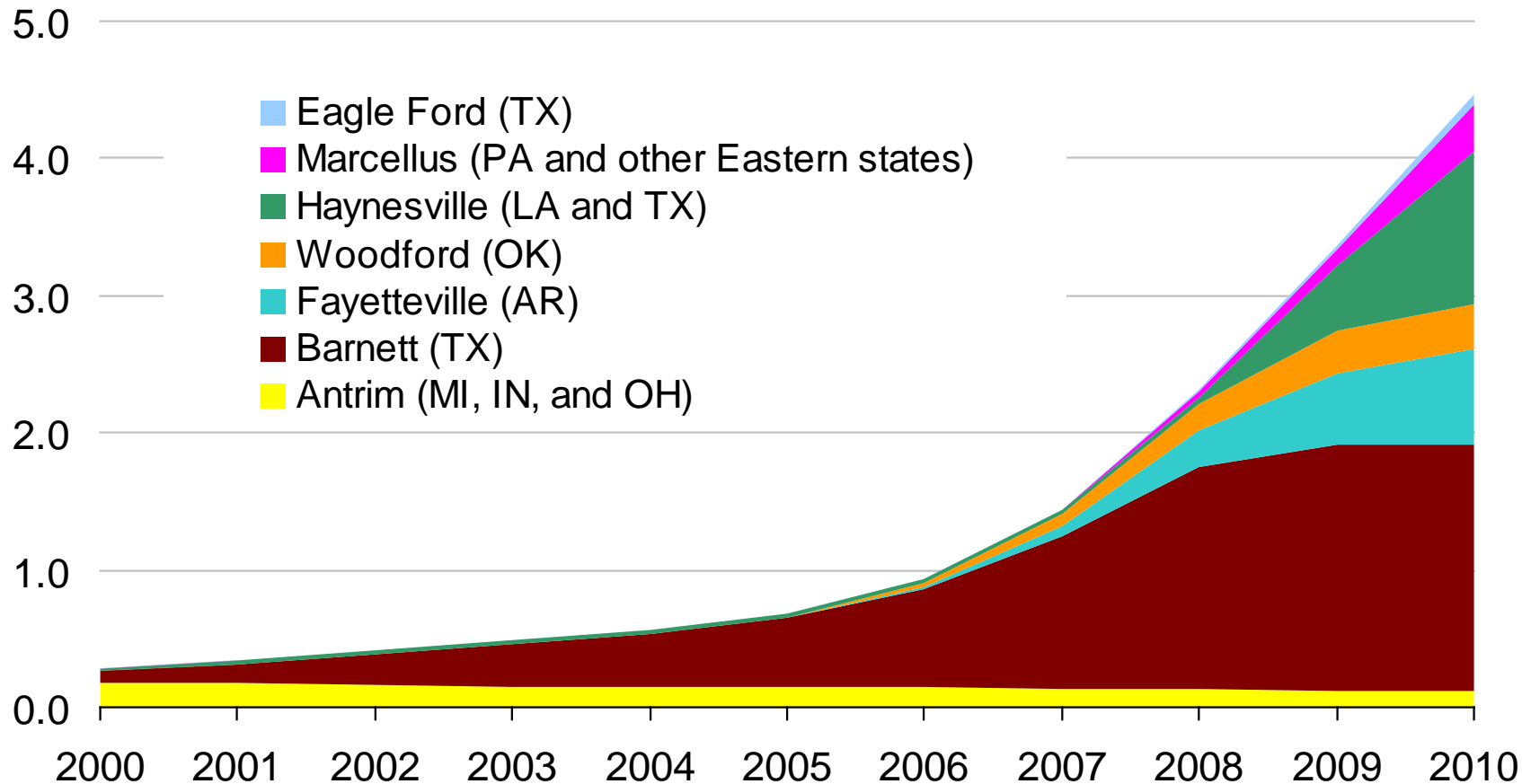
Natural gas, wind and other renewables account for the vast majority of capacity additions from 2009 to 2035



Natural gas

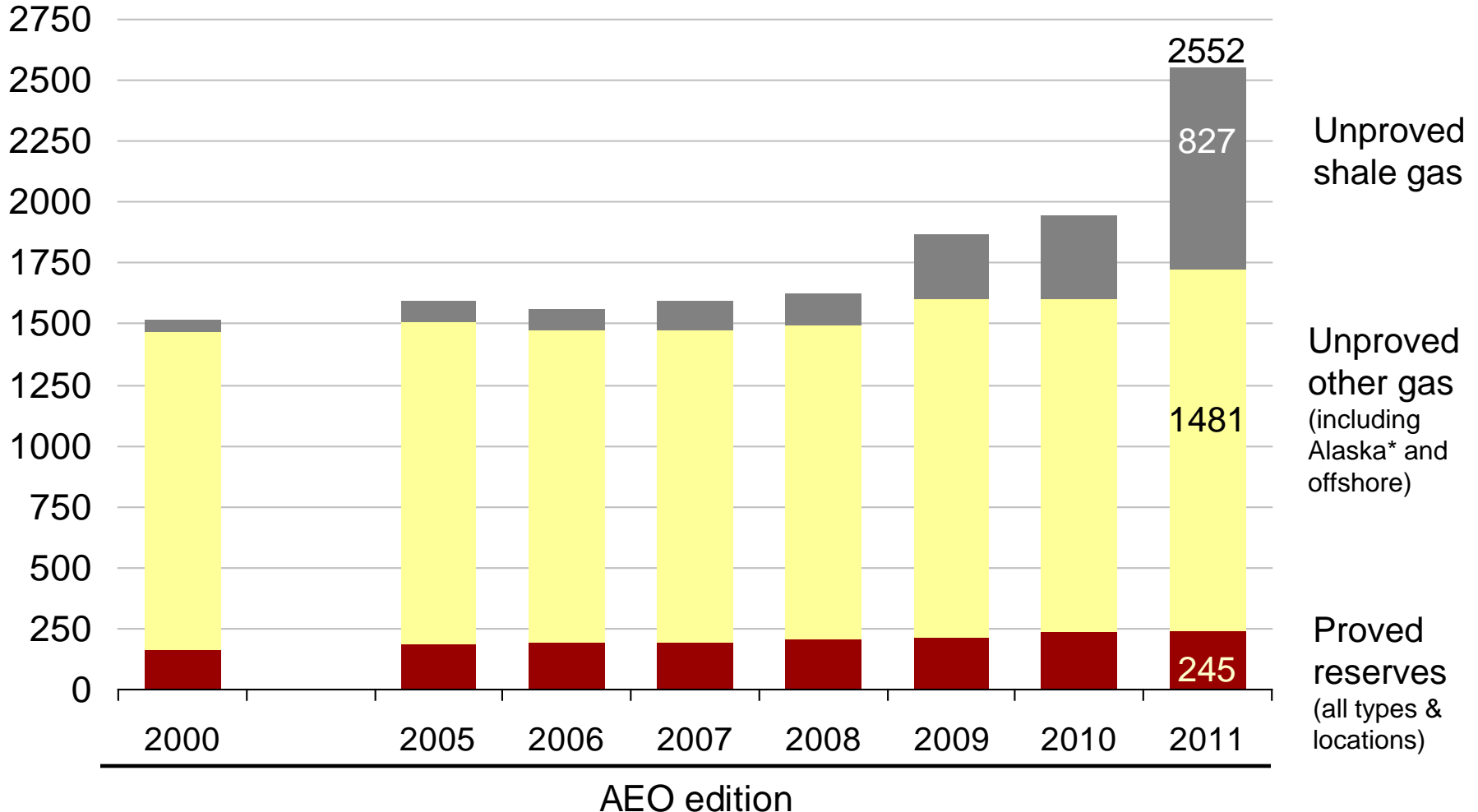
U.S. shale gas production increased 14-fold over the last decade; reserves tripled over the last few years

annual shale gas production
trillion cubic feet per year



Shale gas has been the primary source of recent growth in U.S. technically recoverable natural gas resources

U.S. dry gas resources
trillion cubic feet

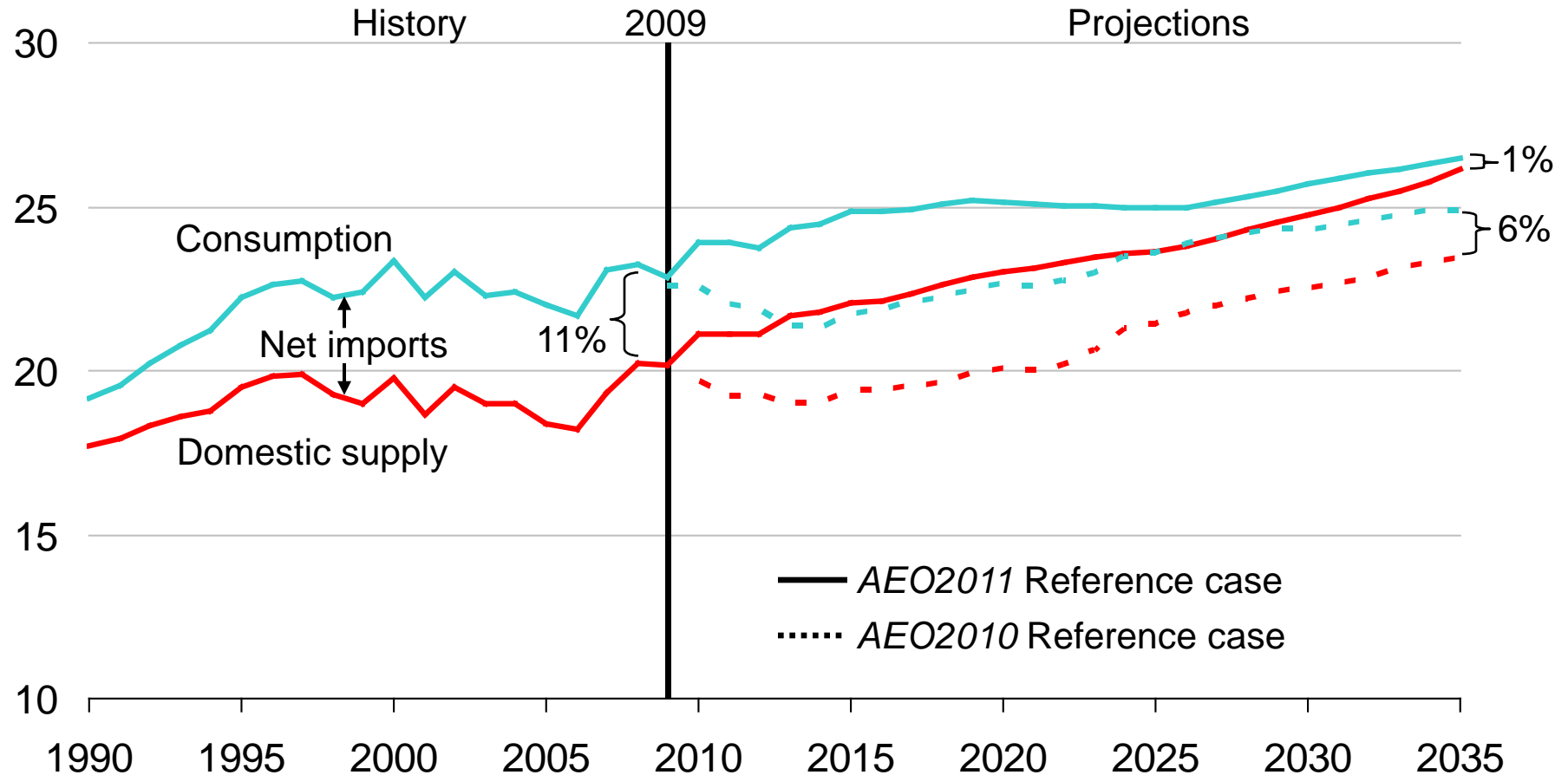


* Alaska resource estimates prior to AEO2009 reflect resources from the North Slope that were not included in previously published documentation.



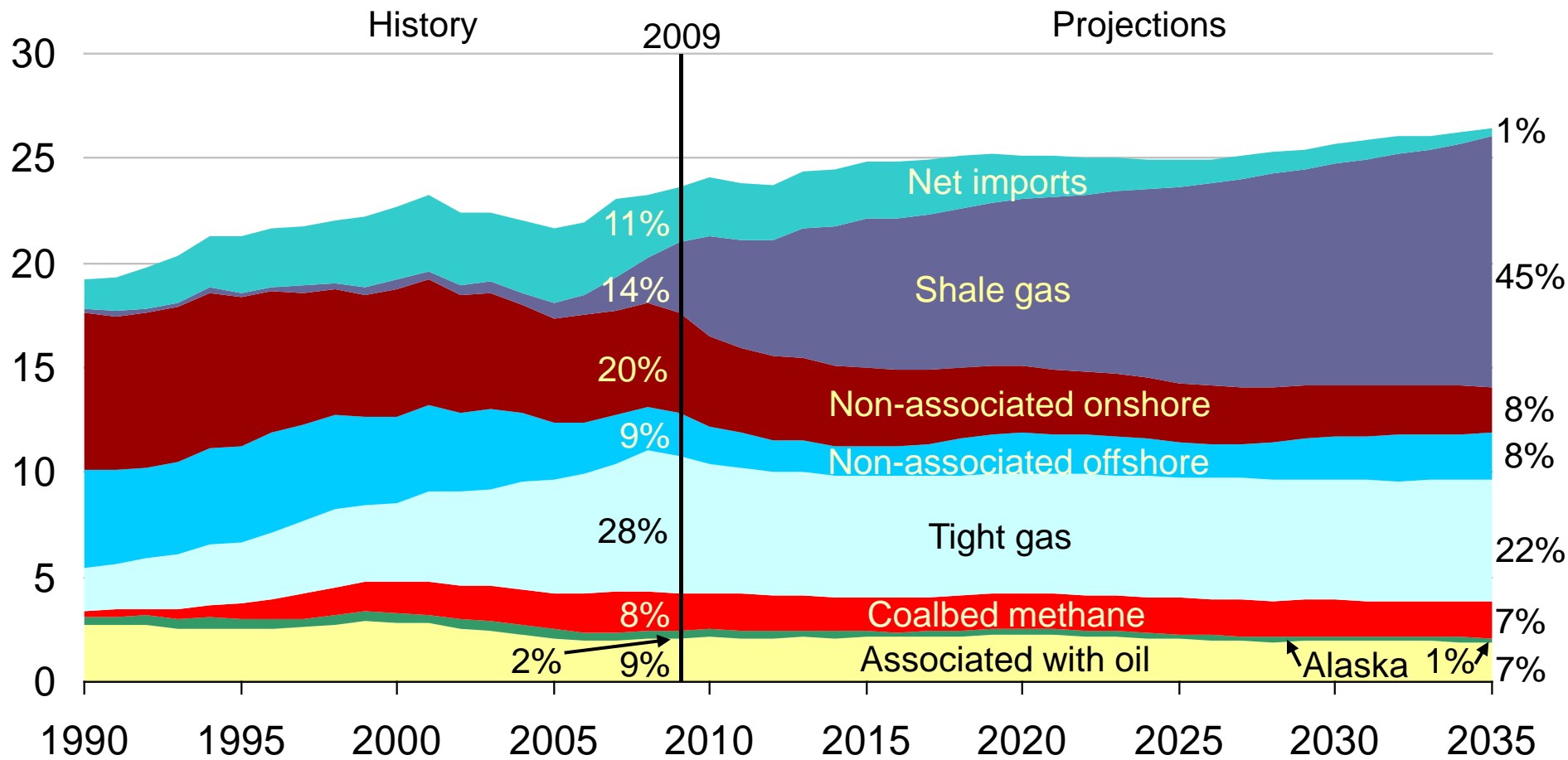
30% domestic gas production growth outpaces 16% consumption growth, leading to declining imports

U.S. dry gas
trillion cubic feet per year



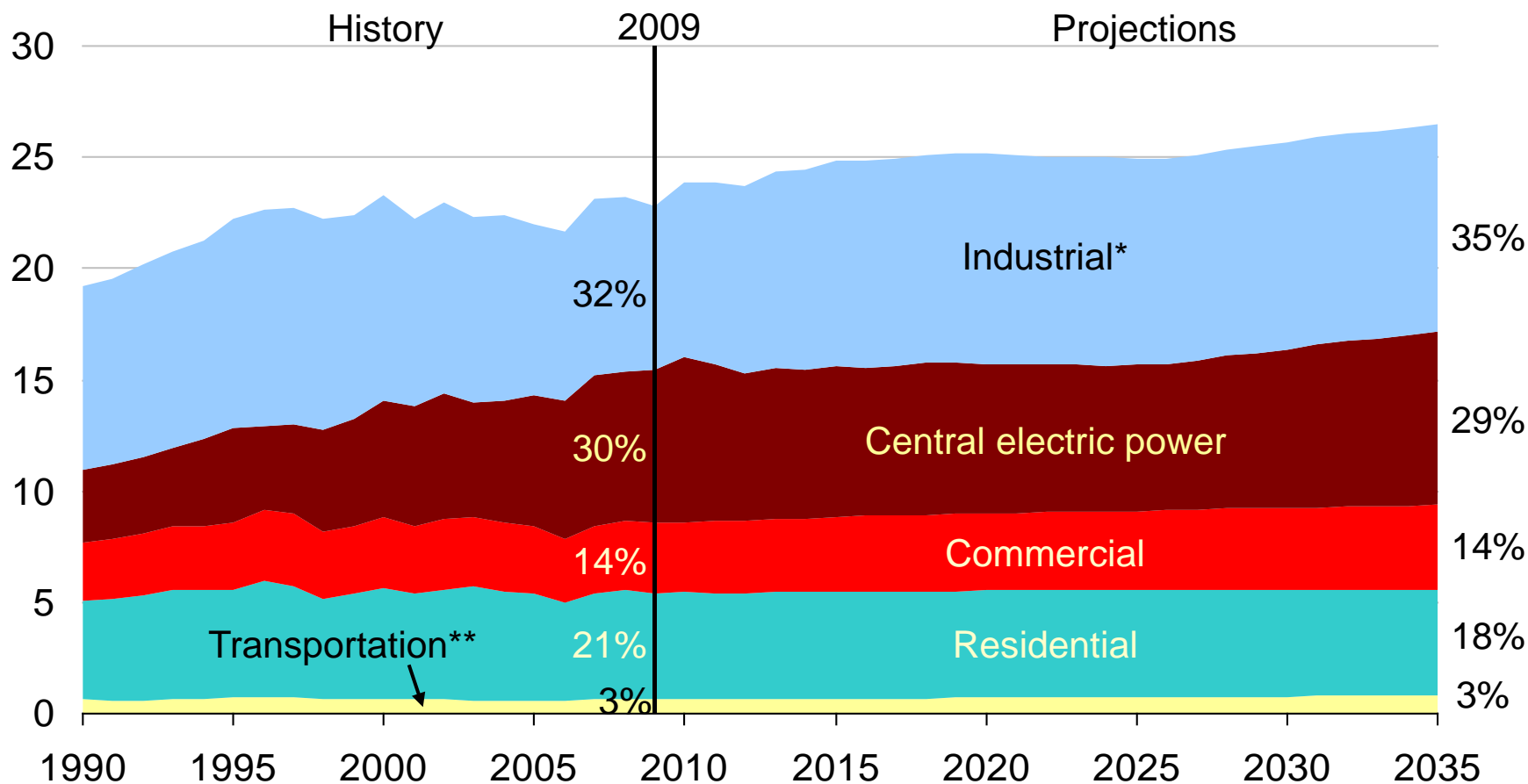
Shale gas offsets declines in other U.S. supply to meet consumption growth and lower import needs

U.S. dry gas
trillion cubic feet per year



Natural gas consumption is quite dispersed; industrial and electric power use drives future demand growth

U.S. dry gas consumption
trillion cubic feet per year



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

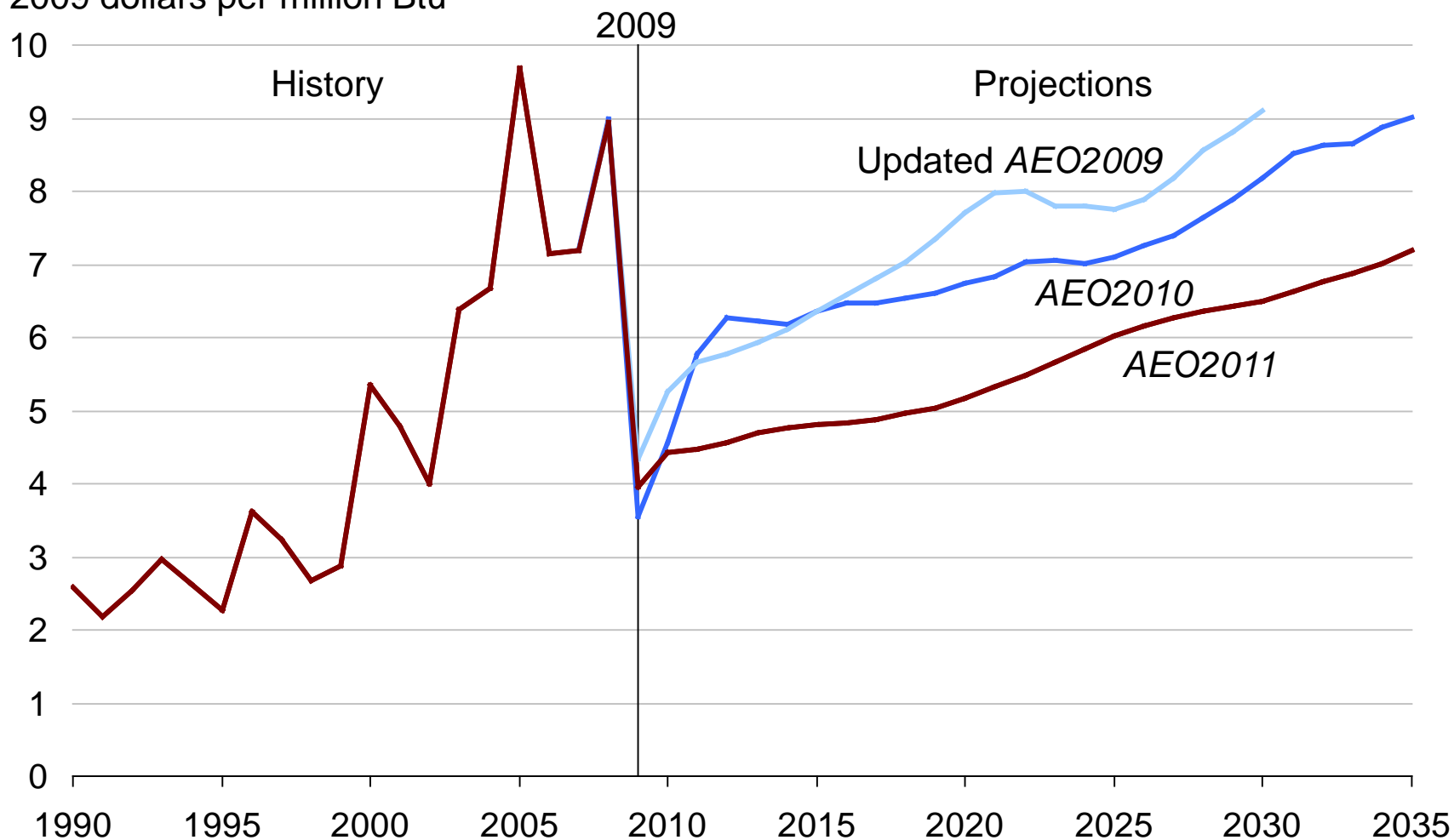


A number of key economic and market drivers underpin natural gas consumption growth

Sector	TCF gas consumption		Growth (2009-2035)	Key drivers
	2009	2035		
Industrial, including combined heat- and-power	7.3	9.3	26%	+187% combined heat-and-power generation; +30% output of gas-intensive industry; lower natural gas prices
Central electric power	6.9	7.8	13%	+30% electricity consumption; lower natural gas prices; offset by +72% renewable generation and +24% coal generation
Commercial	3.1	3.8	22%	+37% commercial floorspace; -3% energy intensity
Residential	4.7	4.8	<1%	+30% number of households; +19% total square footage; -16% energy intensity

Natural gas price projections are significantly lower than past years due to an expanded shale gas resource base

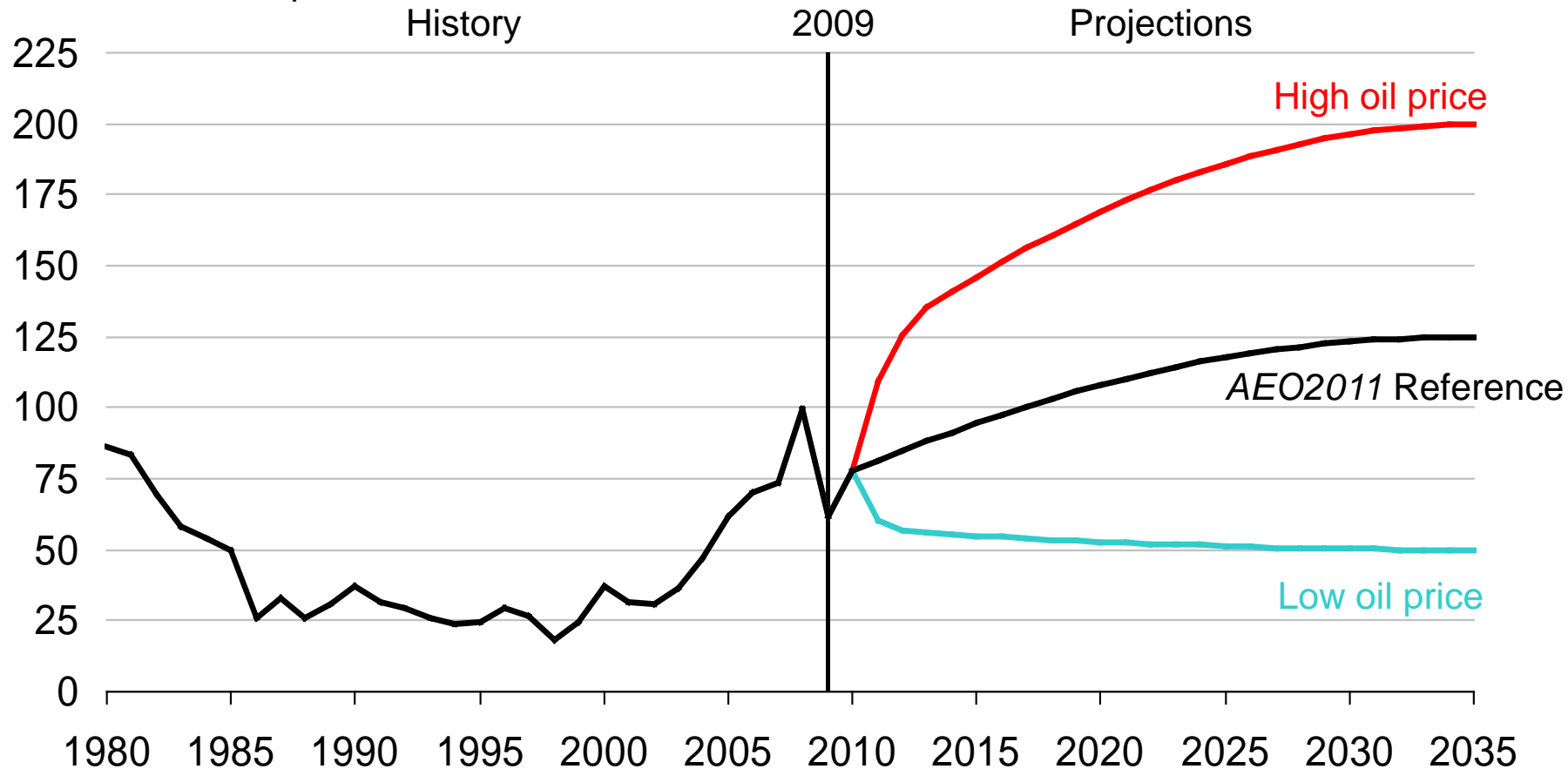
natural gas spot price (Henry Hub)
2009 dollars per million Btu



Oil and other liquid fuels

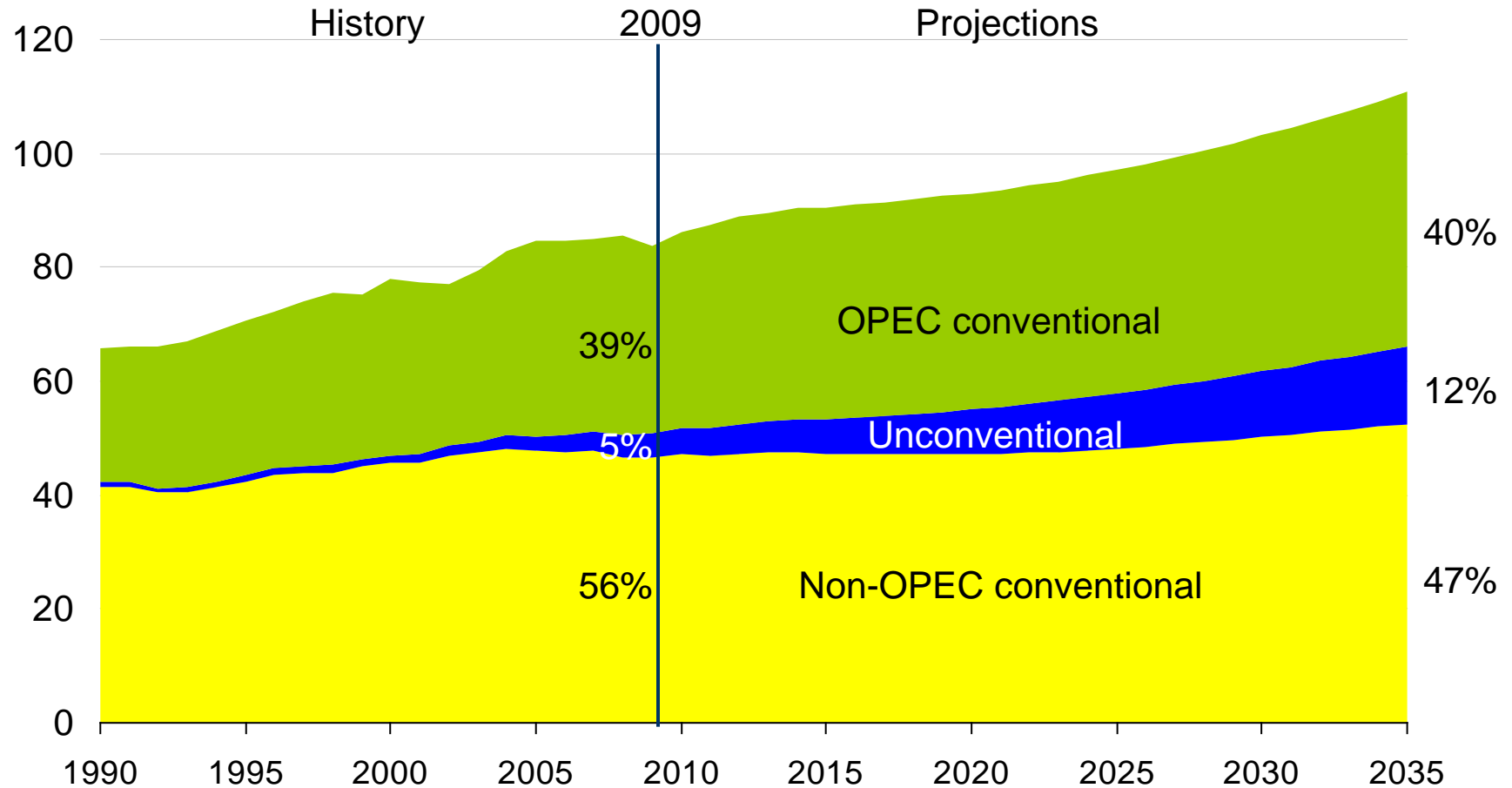
Oil prices in the Reference case rise steadily; the full *AEO2011* will include a wide range of oil prices

annual average price of low sulfur crude oil
real 2009 dollars per barrel



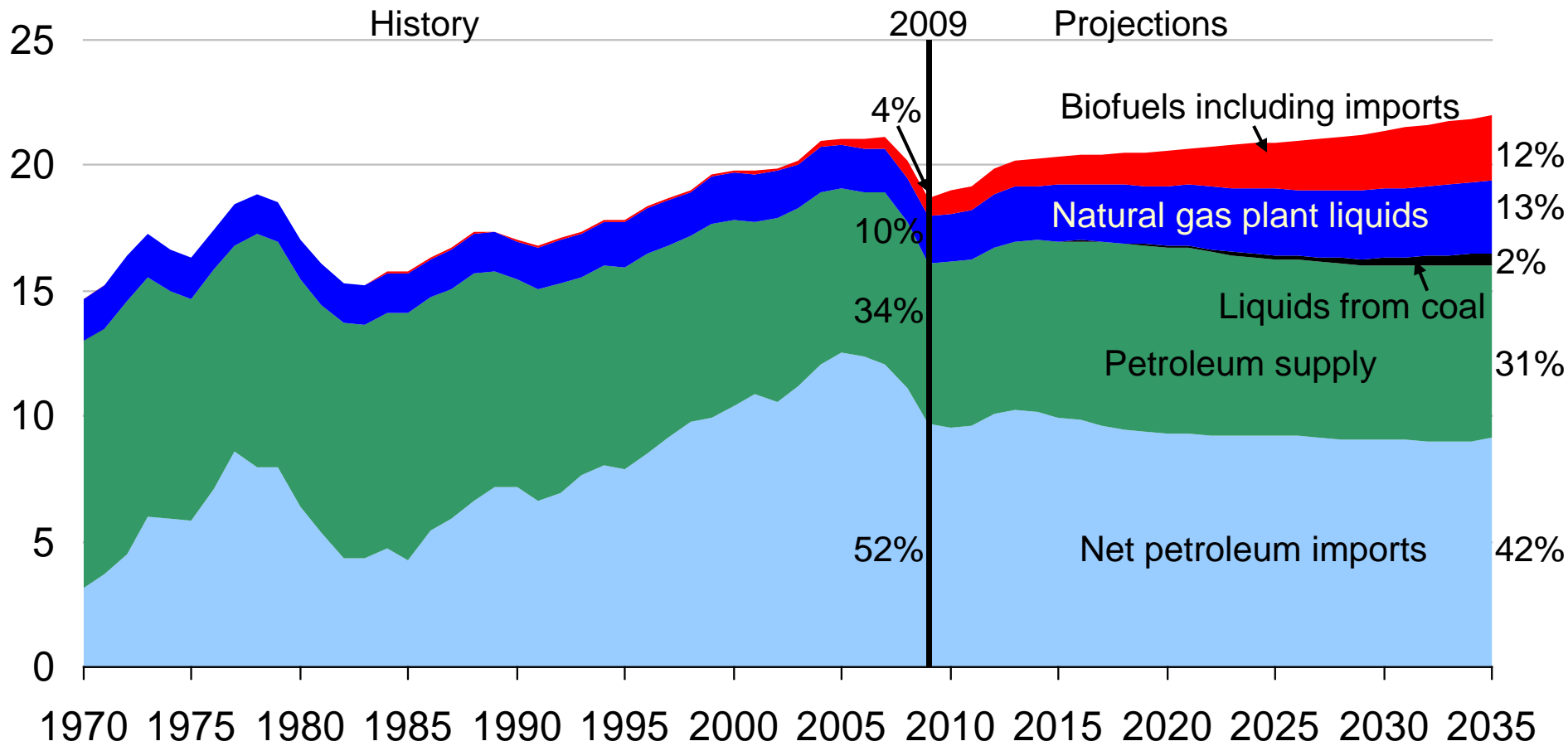
Unconventional sources more than triple globally, but conventional petroleum continues to comprise the vast majority of liquids supply

global liquids production
million barrels per day



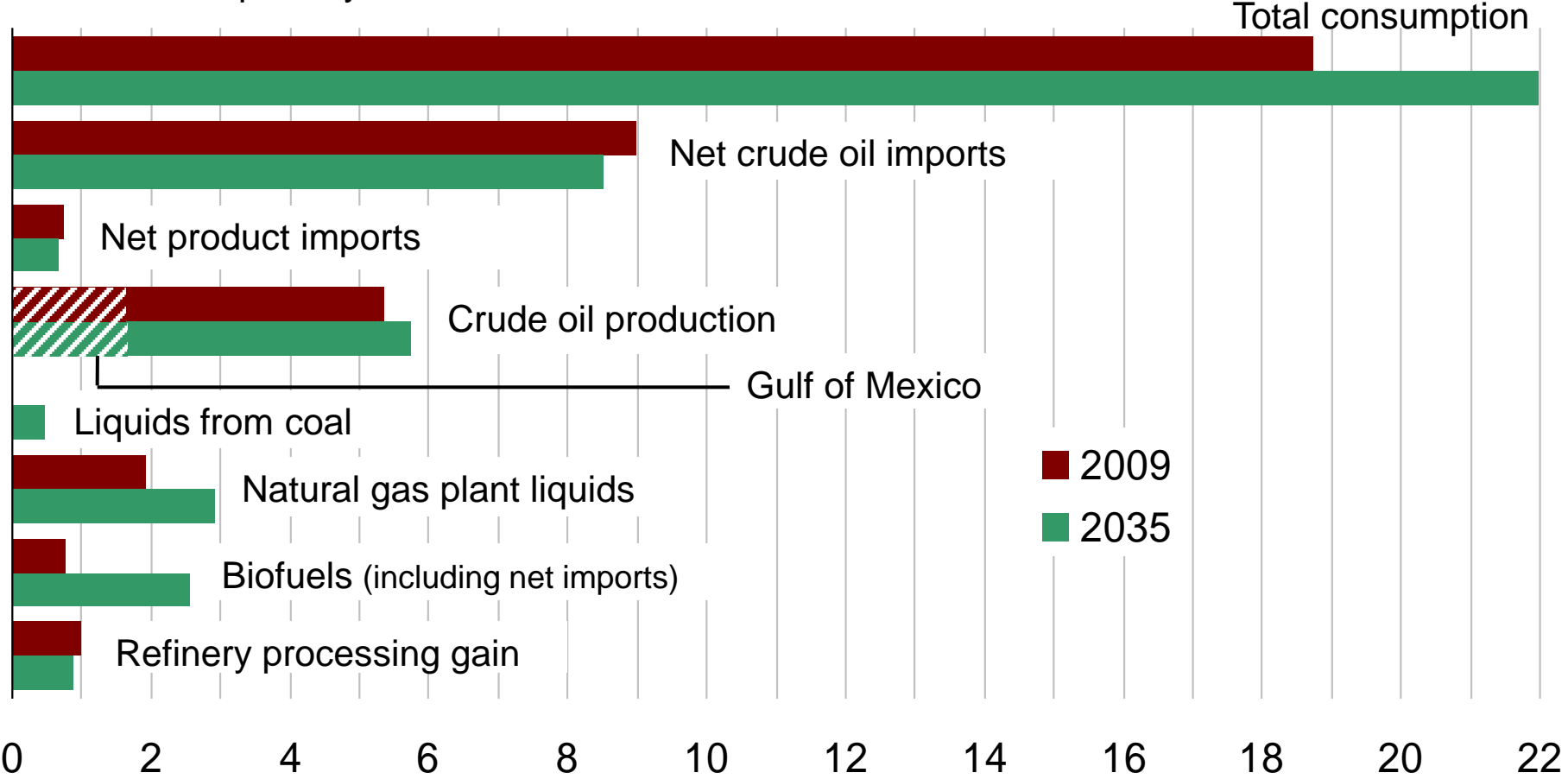
U.S. imports of liquid fuels fall due to increased domestic production—including biofuels—and greater fuel efficiency

U.S. liquid fuels consumption
million barrels per day



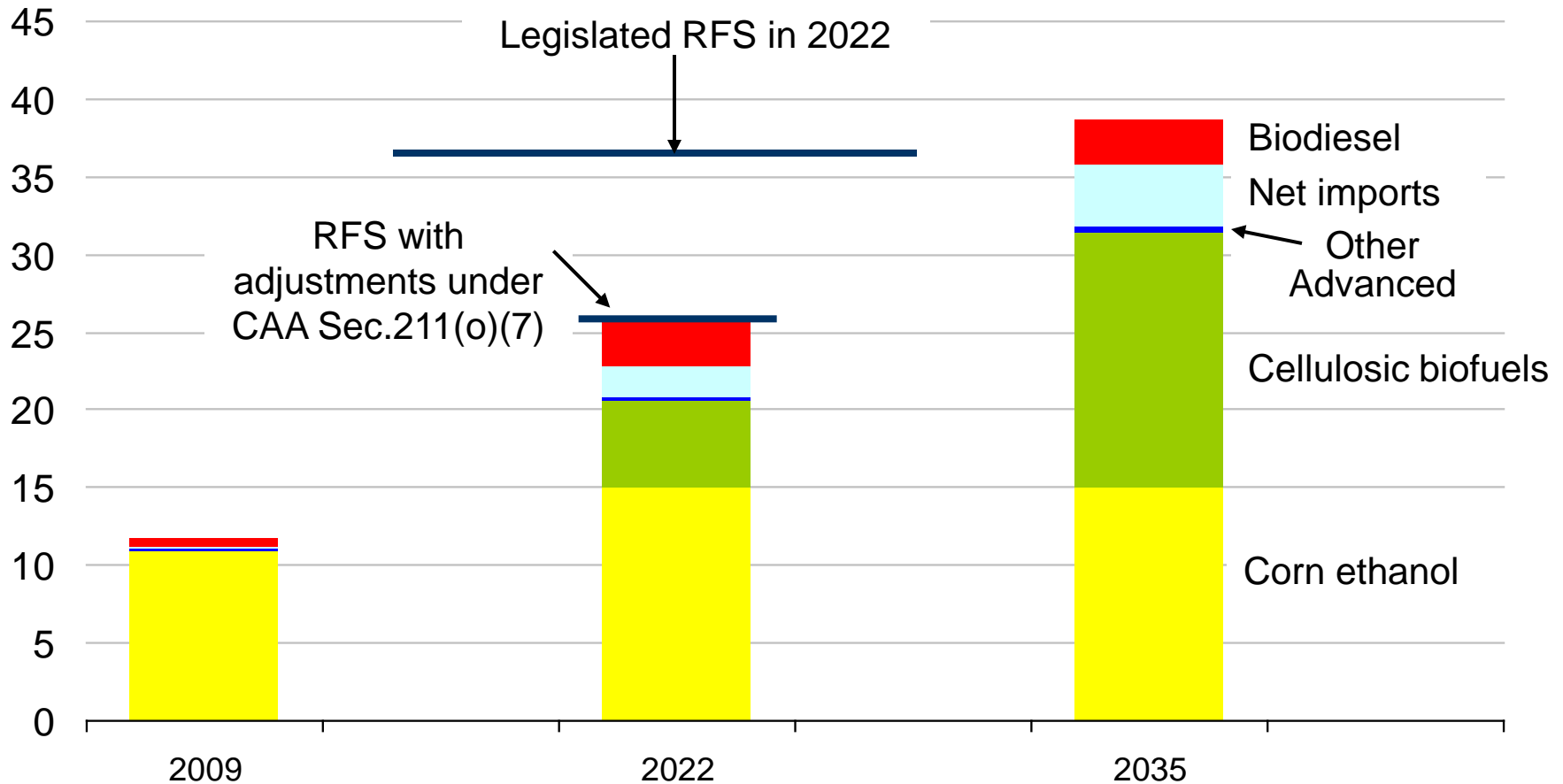
Biofuels, natural gas liquids, and crude oil production are key sources of increased domestic liquids supply

U.S. liquid fuels
million barrels per day

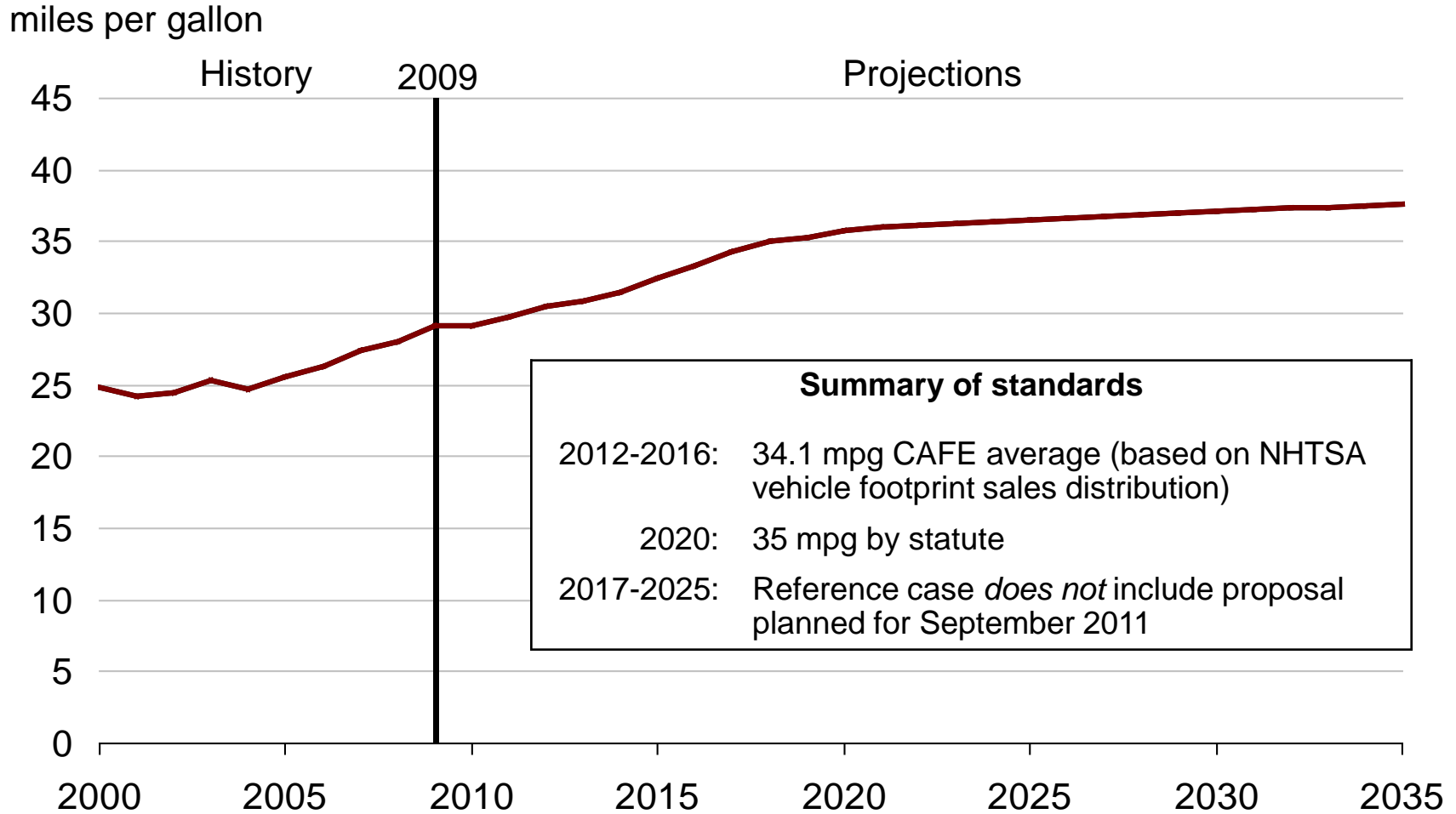


Biofuels fall short of the goal in 2022, but exceed the 36 billion gallon RFS target by 2030

billions ethanol-equivalent gallons

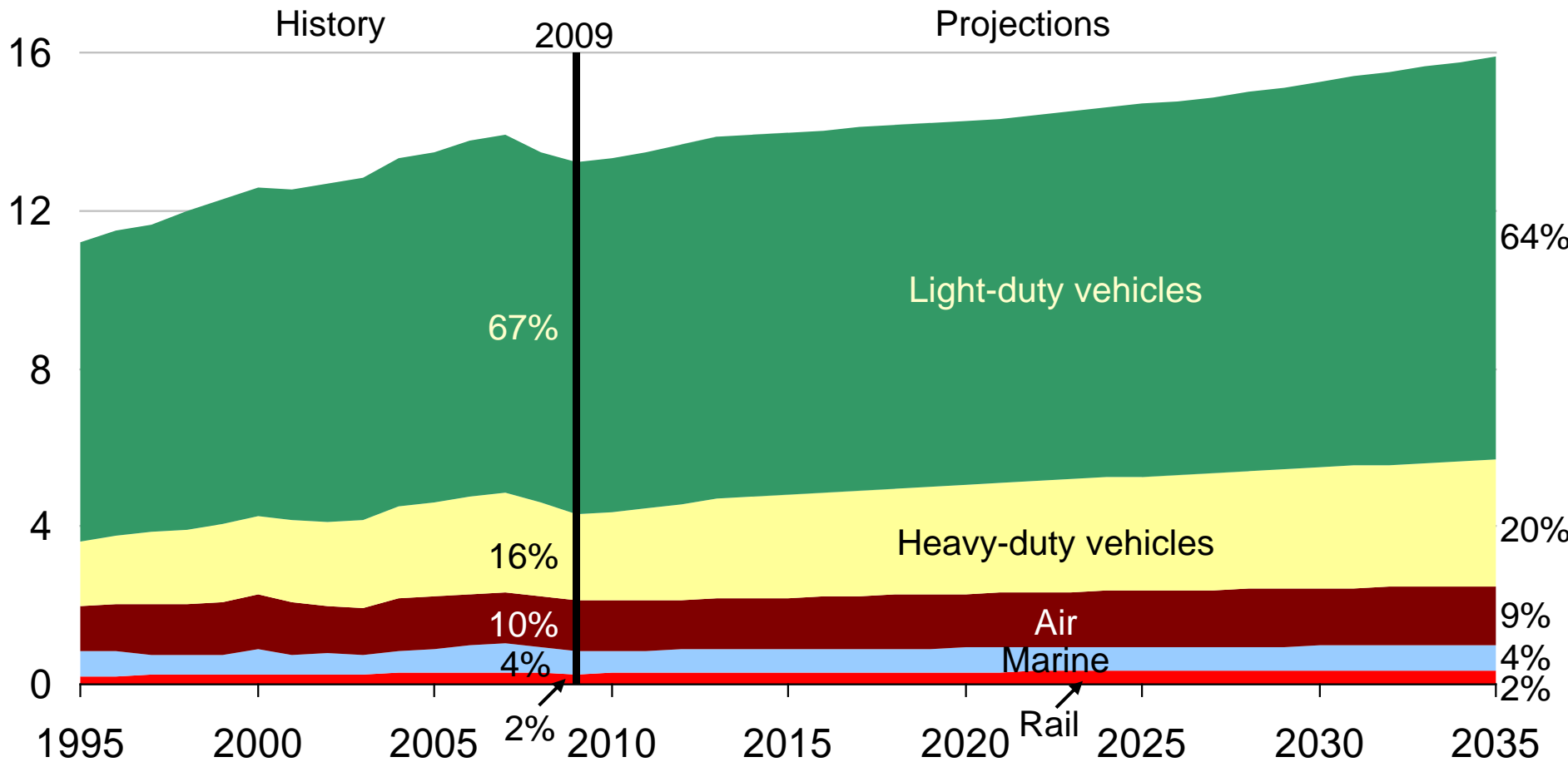


New light duty vehicle fuel economy achieves almost 38 mpg by 2035 in the Reference case



Most transport fuel growth is in light and heavy duty vehicles

U.S. transportation energy consumption
million barrels per day oil equivalent



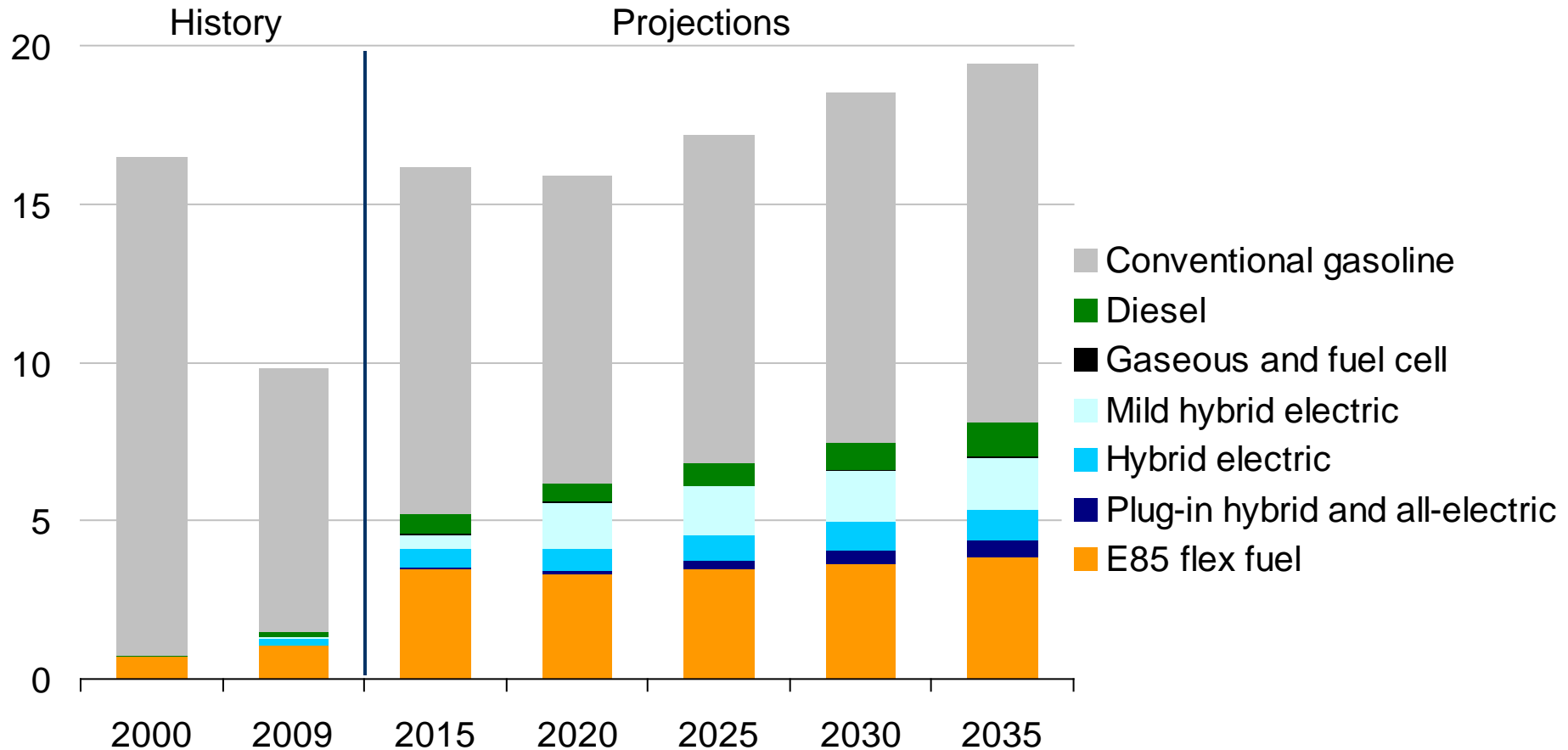
Efficiency improvements partially offset underlying drivers of growth in transportation services

	2009	2035	Growth (2009-2035)
Light duty vehicles			
Fuel consumption (million barrels per day oil equivalent)	8.9	10.2	15%
Number of licensed drivers (millions)	207	265	28%
Miles per licensed driver	13,100	15,300	17%
Efficiency of vehicle stock (mpg)	20.8	27.8	34%*
Heavy duty vehicles			
Fuel consumption (million barrels per day oil equivalent)	2.2	3.2	47%
Manufacturing output (billion 2005 dollars)	4,197	6,761	61%
Number of freight trucks (millions)	8.7	16.6	90%
Miles per vehicle	23,700	20,200	-15%
Efficiency of vehicle stock (mpg)	6.1	6.6	9%**

* Equal to a 25% reduction in fuel use per mile. ** Equal to an 8% reduction in fuel use per mile.

Unconventional vehicles meet over 40% of U.S. light-duty vehicle sales in 2035

U.S. light car and truck sales
millions



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Short-Term Energy Outlook www.eia.gov/emeu/steo/pub/contents.html

Annual Energy Outlook www.eia.gov/oiaf/aeo/index.html

International Energy Outlook www.eia.gov/oiaf/ieo/index.html

2011 EIA Energy Conference — April 26 - 27, 2011

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Monthly Energy Review www.eia.gov/emeu/mer/contents.html

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Some supply sources and demand sectors are strongly linked, while others are more dispersed

