Annual Energy Outlook 2011
Reference Case

U.S. Energy Information Administration

Spring, 2011 | Washington, DC

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

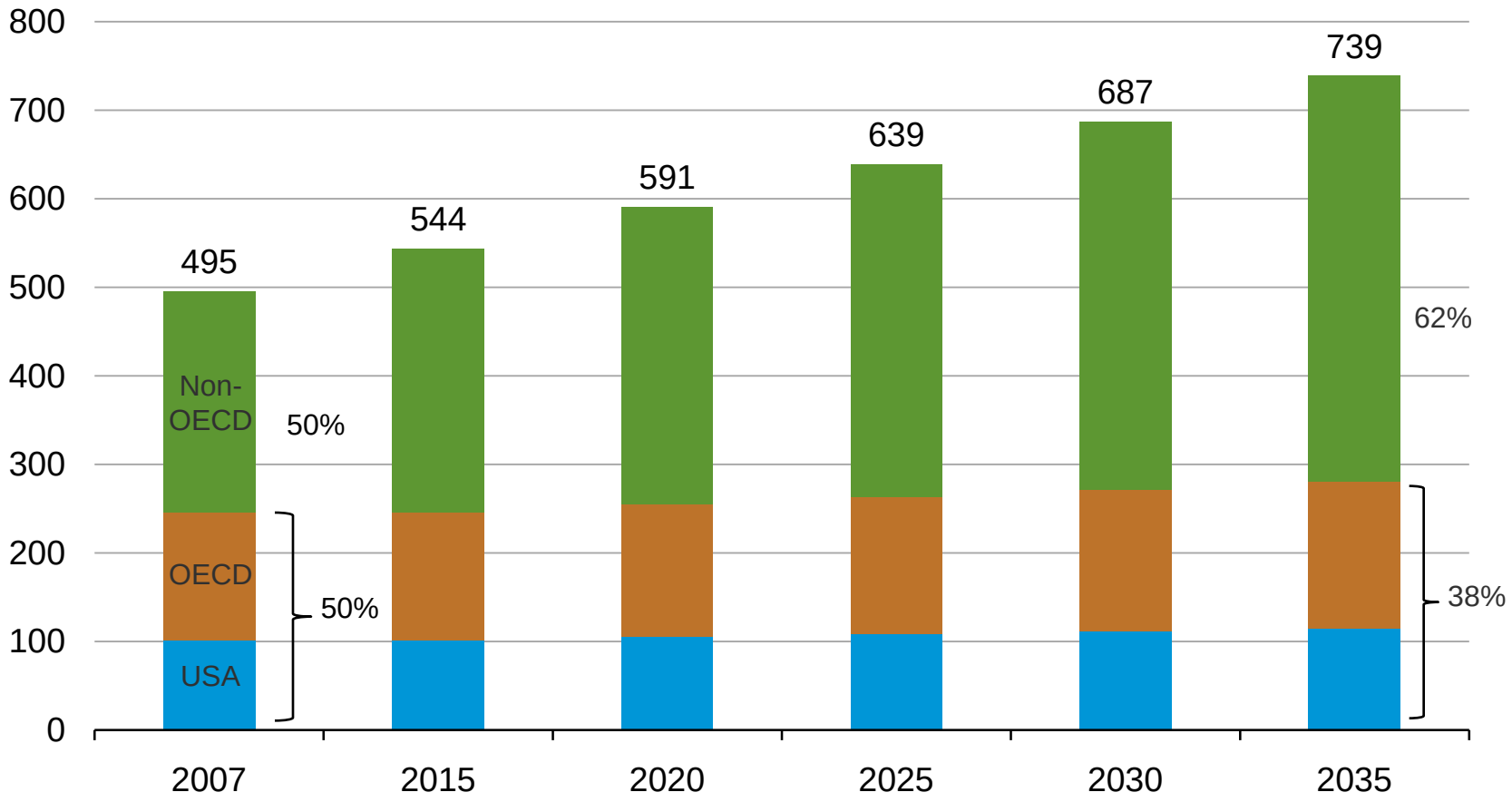
Key updates included in the AEO2011 Reference case

- 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 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
  - 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

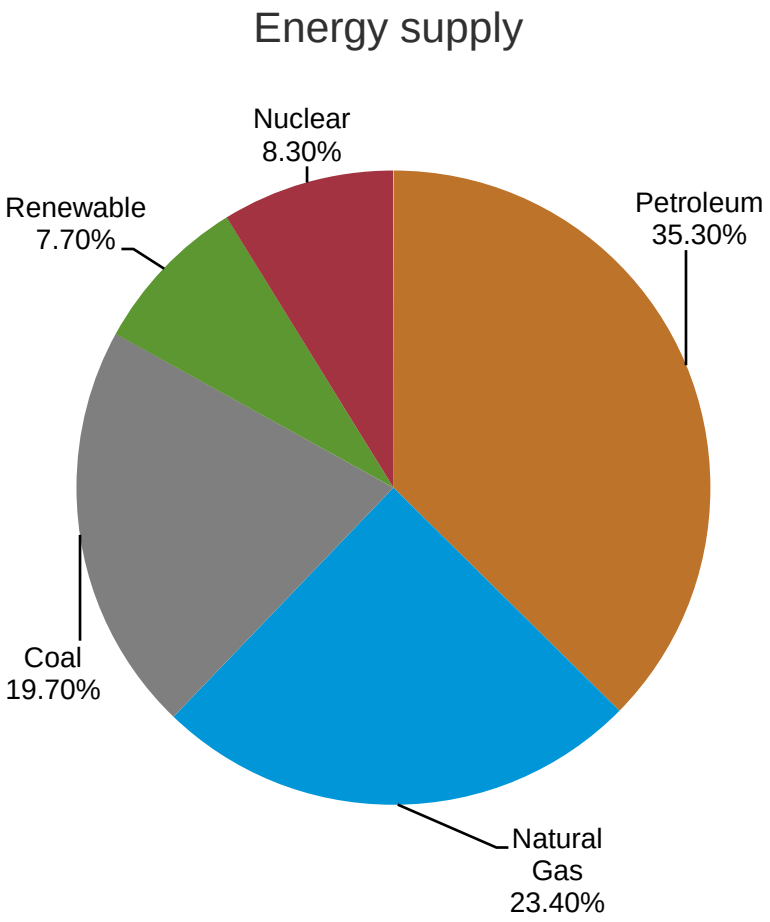


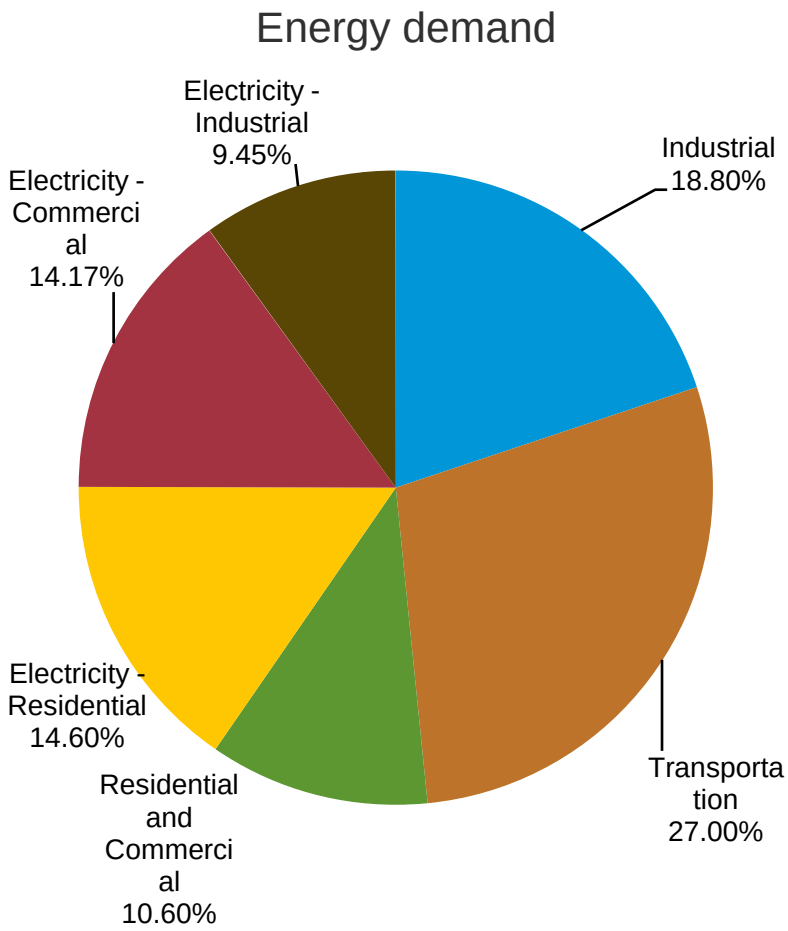
Source: EIA, International Energy Outlook 2010

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

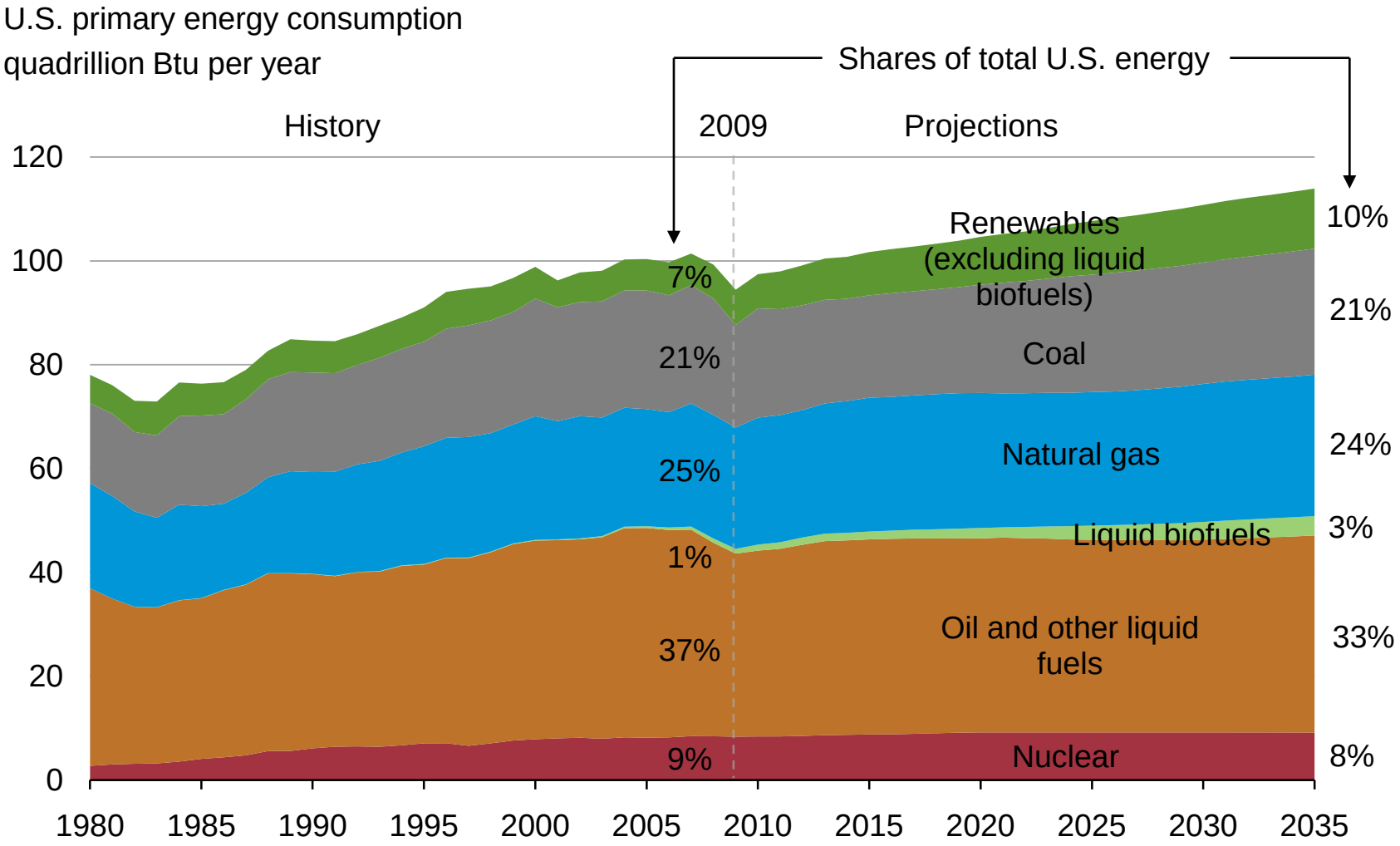
2009 total U.S. energy use = 94.6 quadrillion Btu





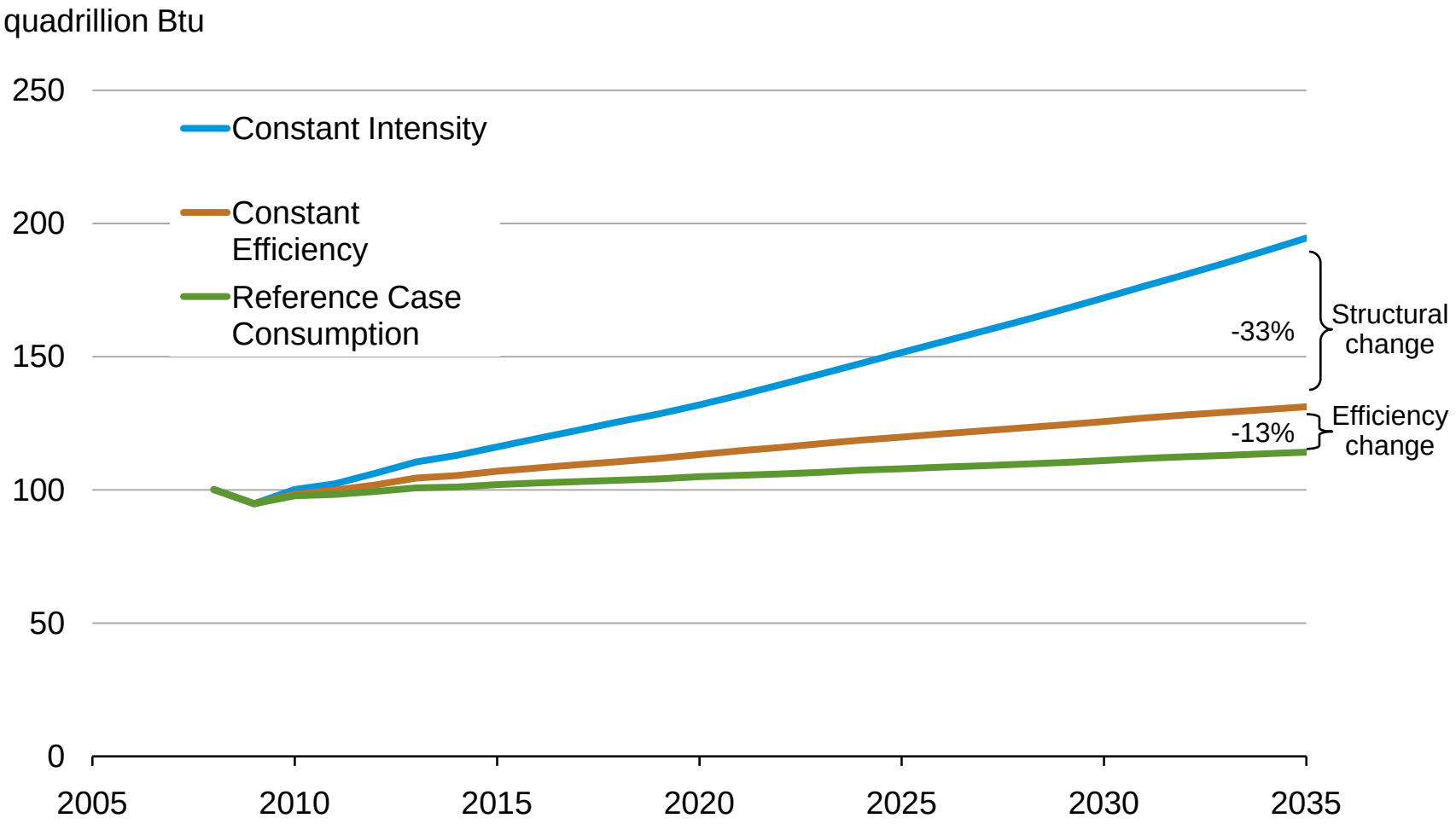
Source: EIA, Annual Energy Review 2009

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



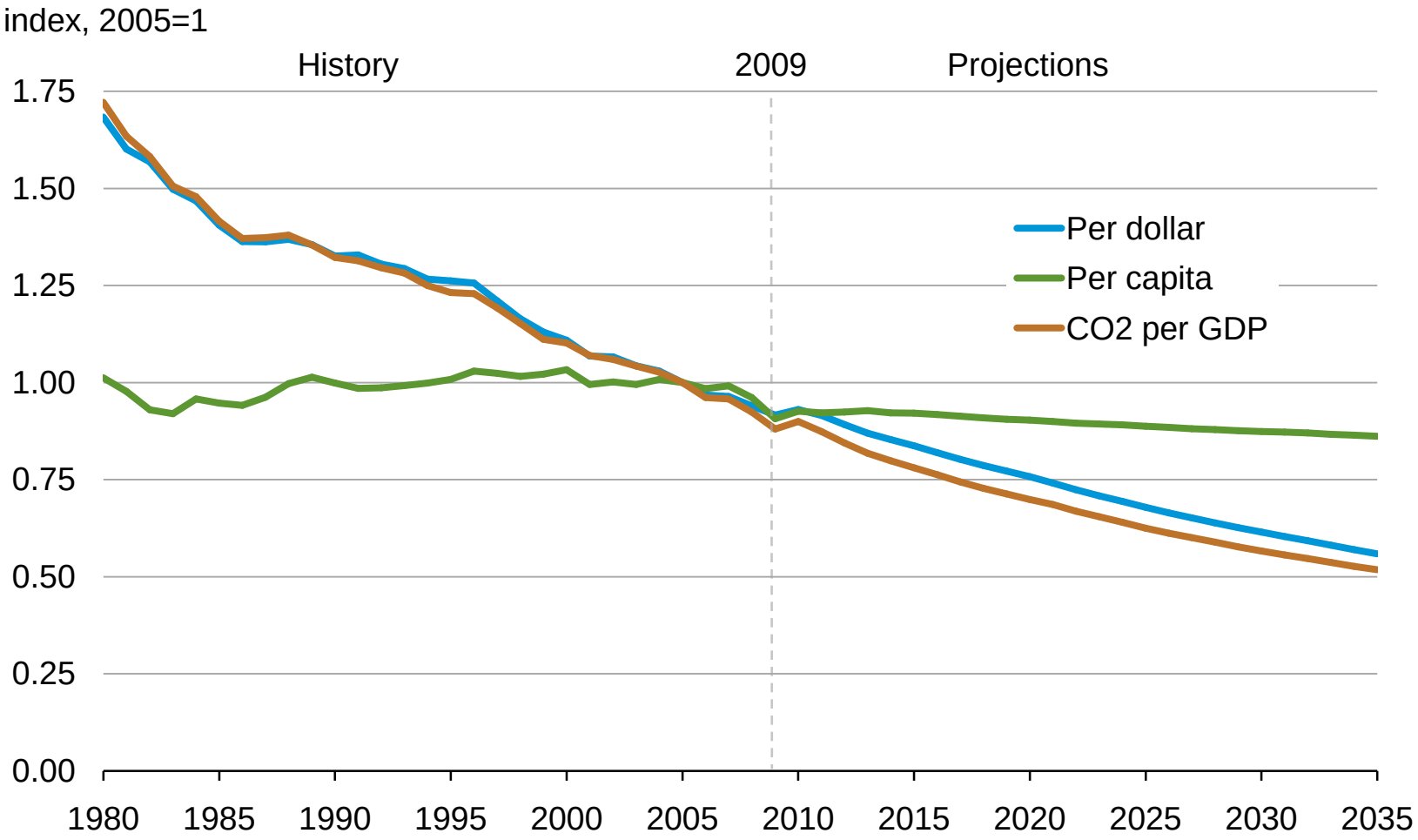
Source: EIA, Annual Energy Outlook 2011

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



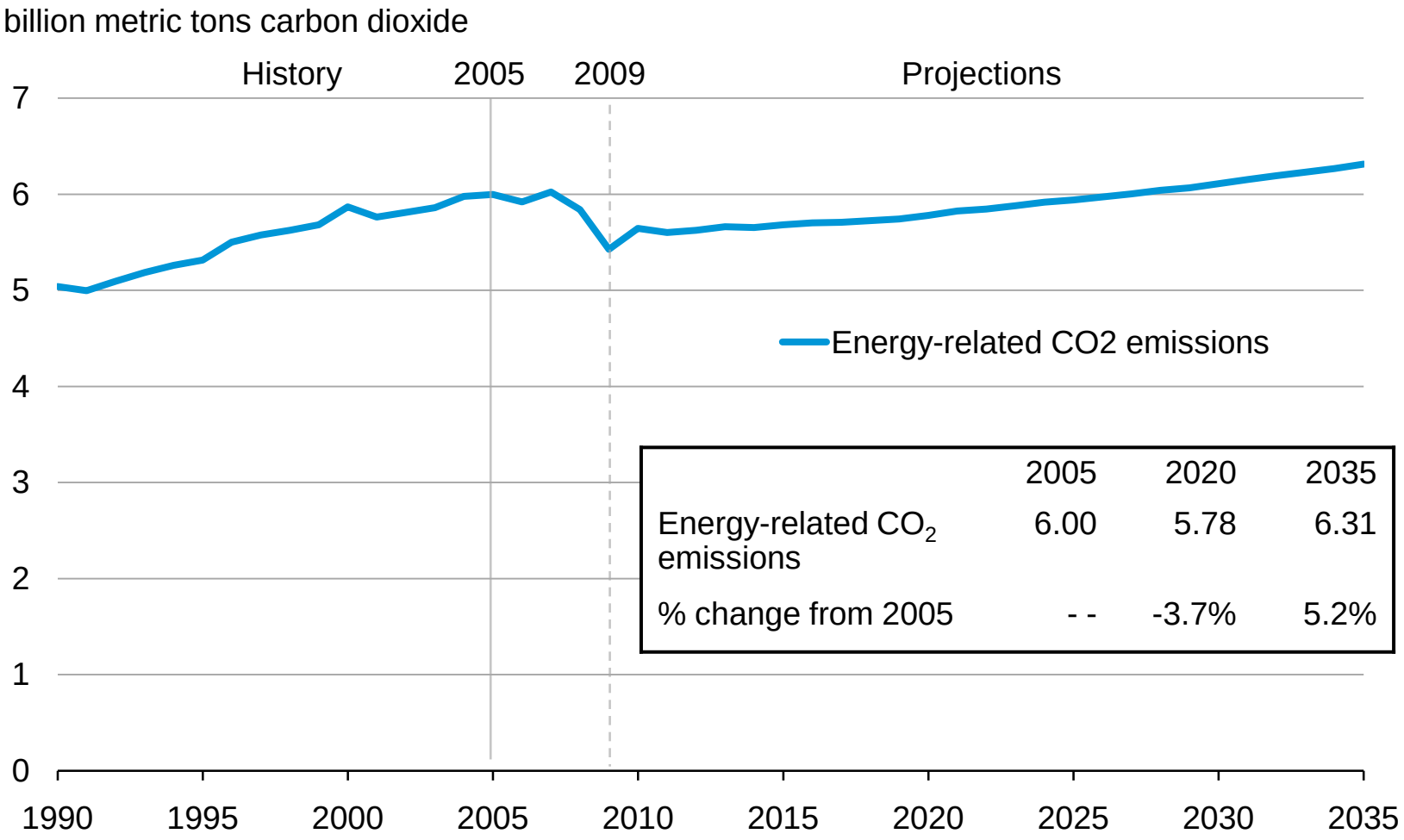
Source: EIA, Annual Energy Outlook 2011

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



Source: EIA, Annual Energy Outlook 2011

In the AEO2011 Reference case, energy-related CO_2 emissions grow 5% over 2005 levels by 2035

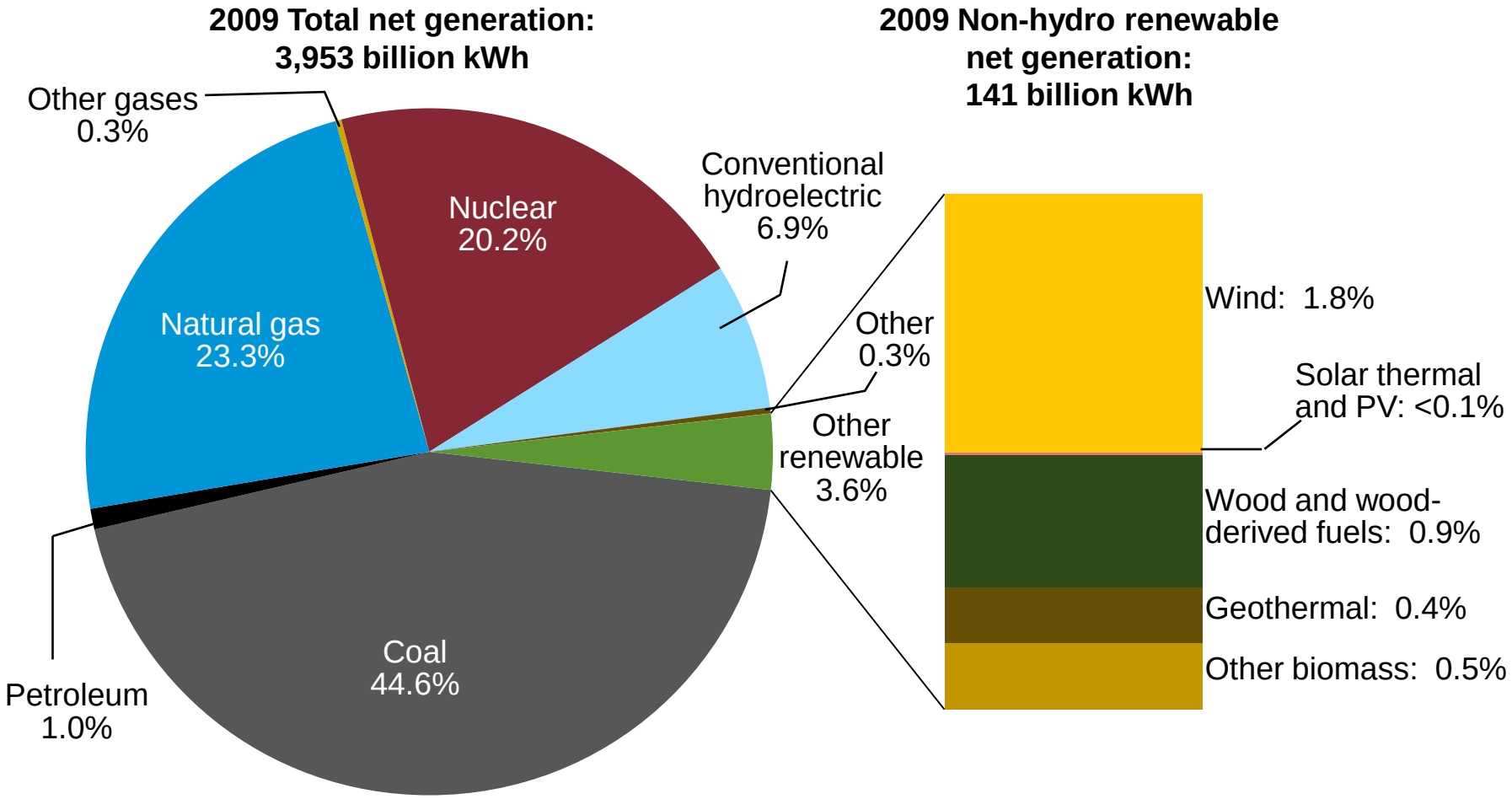


	2005	2020	2035
Energy-related CO_2 emissions	6.00	5.78	6.31
% change from 2005	- -	-3.7%	5.2%

Source: EIA, Annual Energy Outlook 2011

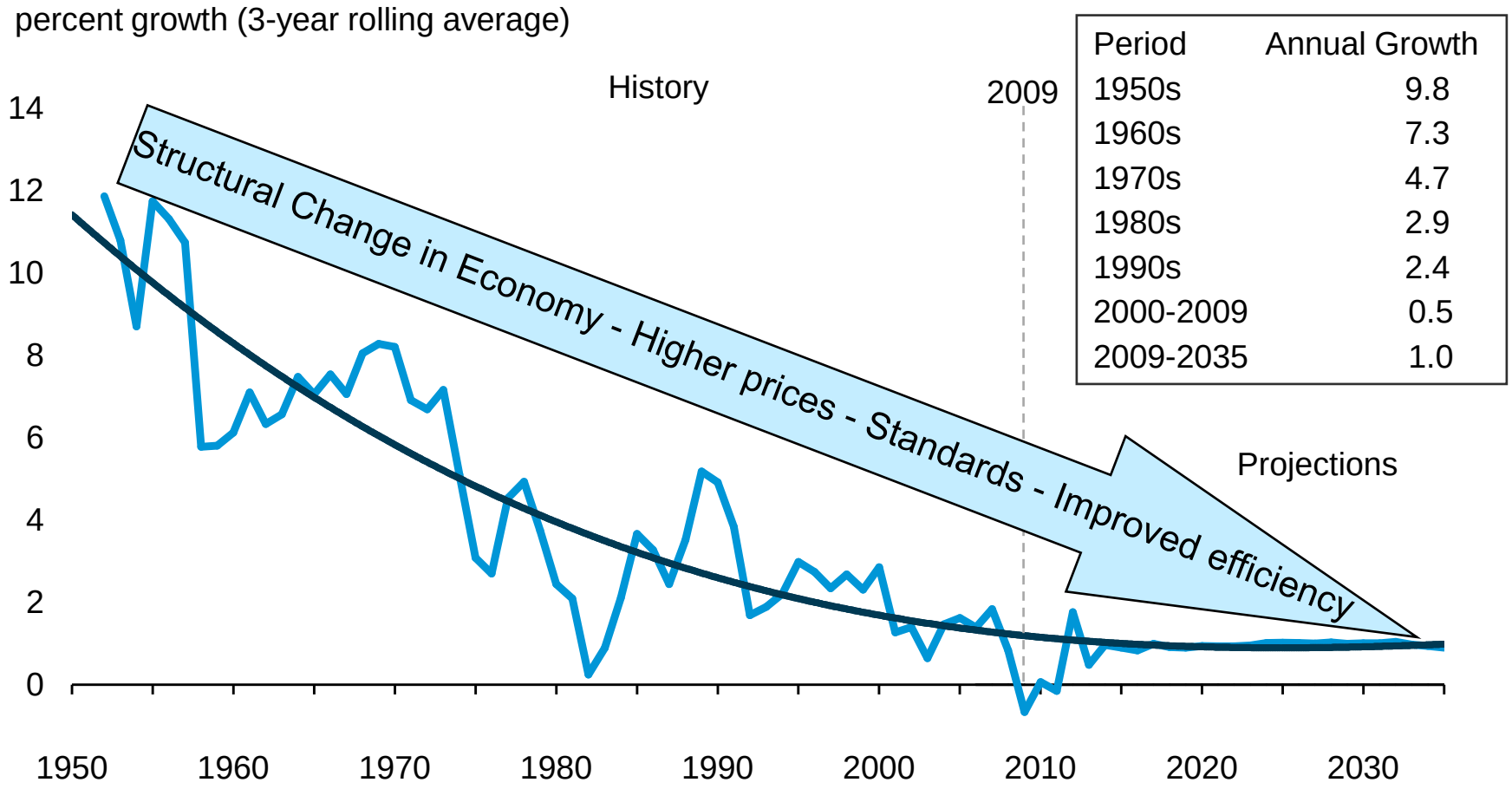
Electricity

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



Source: EIA, Electric Power Monthly, October 2010

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



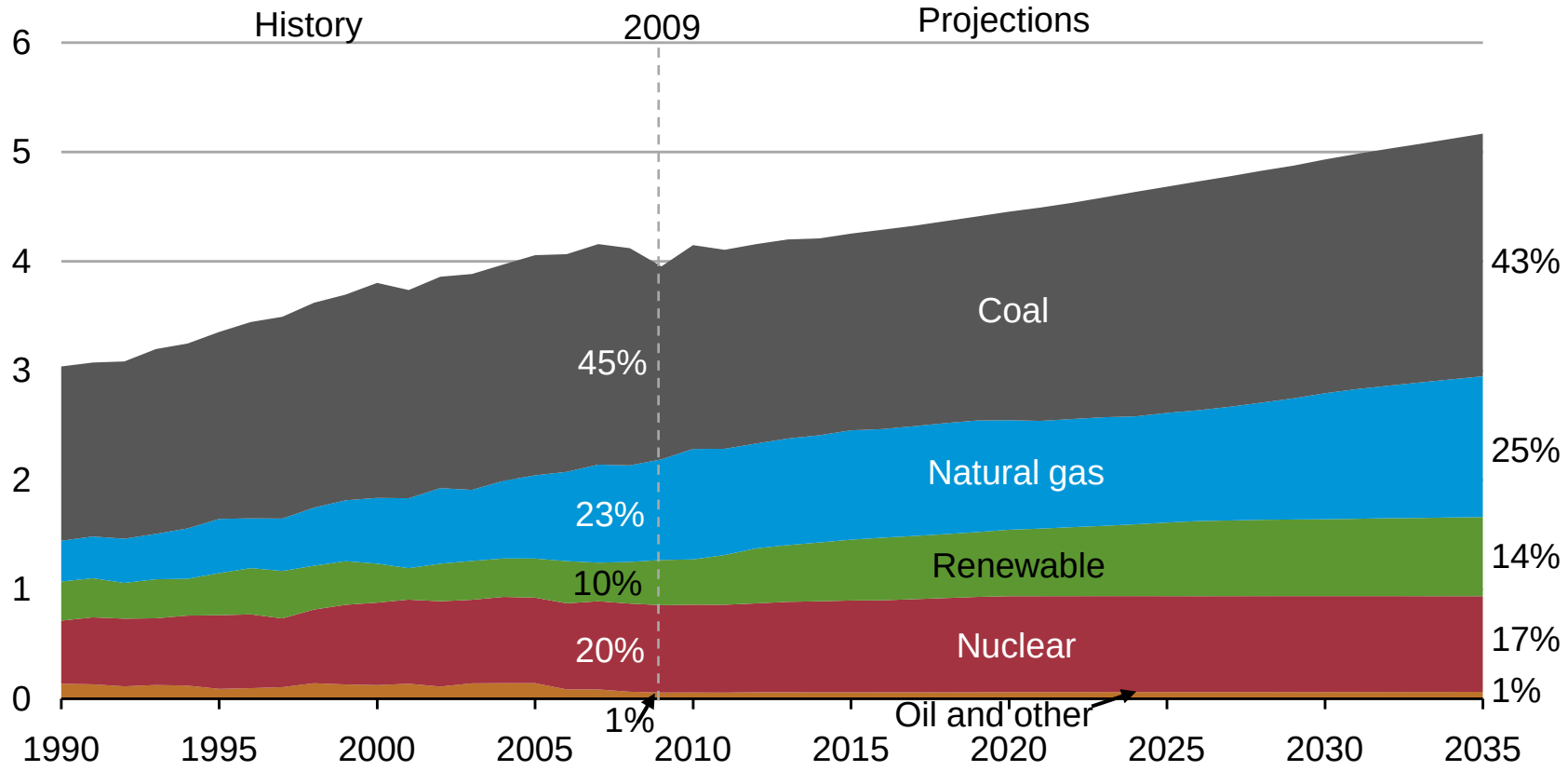
Period	Annual Growth
1950s	9.8
1960s	7.3
1970s	4.7
1980s	2.9
1990s	2.4
2000-2009	0.5
2009-2035	1.0

Source: EIA, Annual Energy Outlook 2011

The Reference case electricity mix in AEO2011 gradually shifts to lower-carbon options, with generation from natural gas rising 40% and renewables rising 75%

electricity net generation

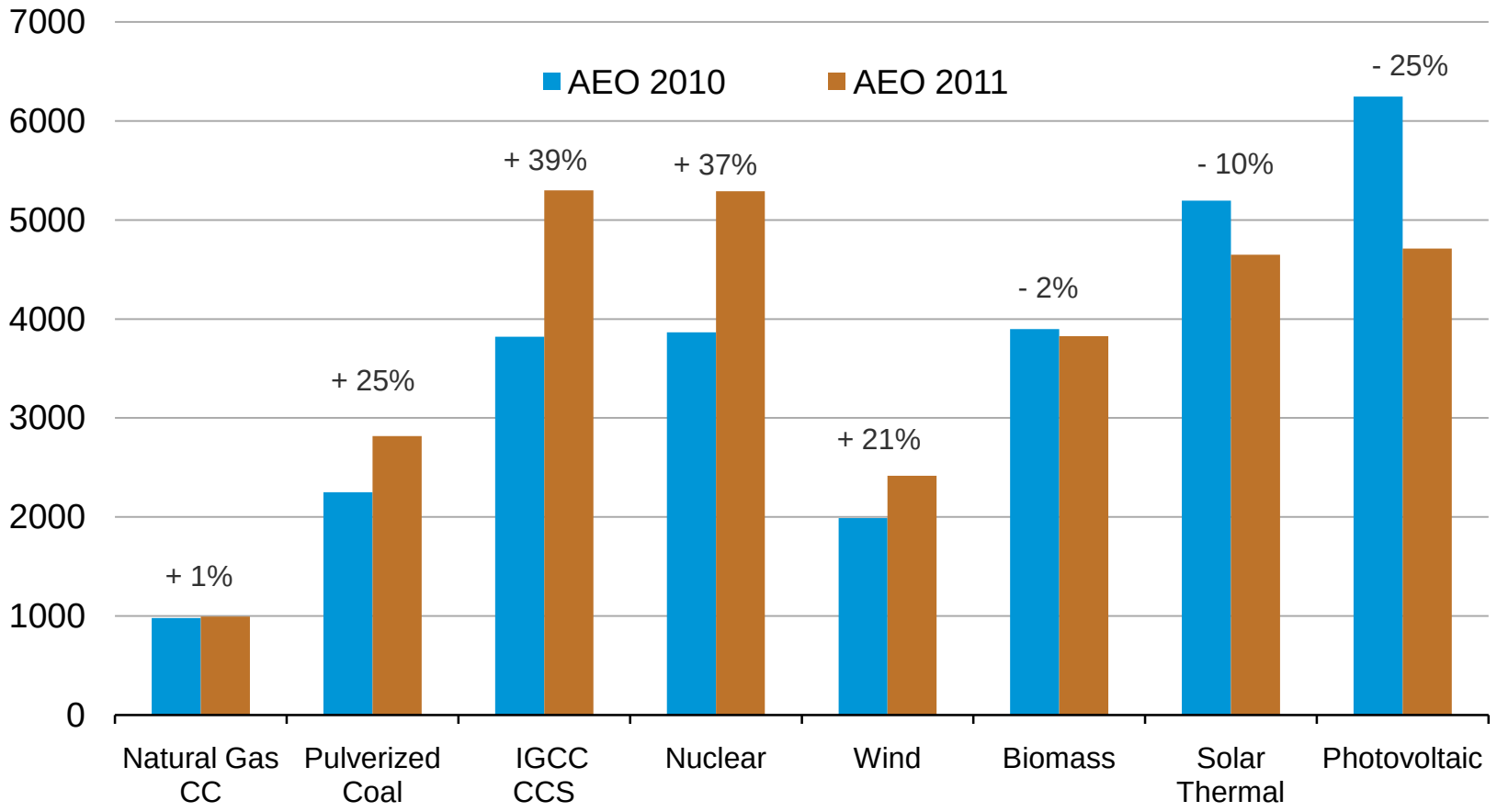
trillion kilowatthours per year



Source: EIA, Annual Energy Outlook 2011

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

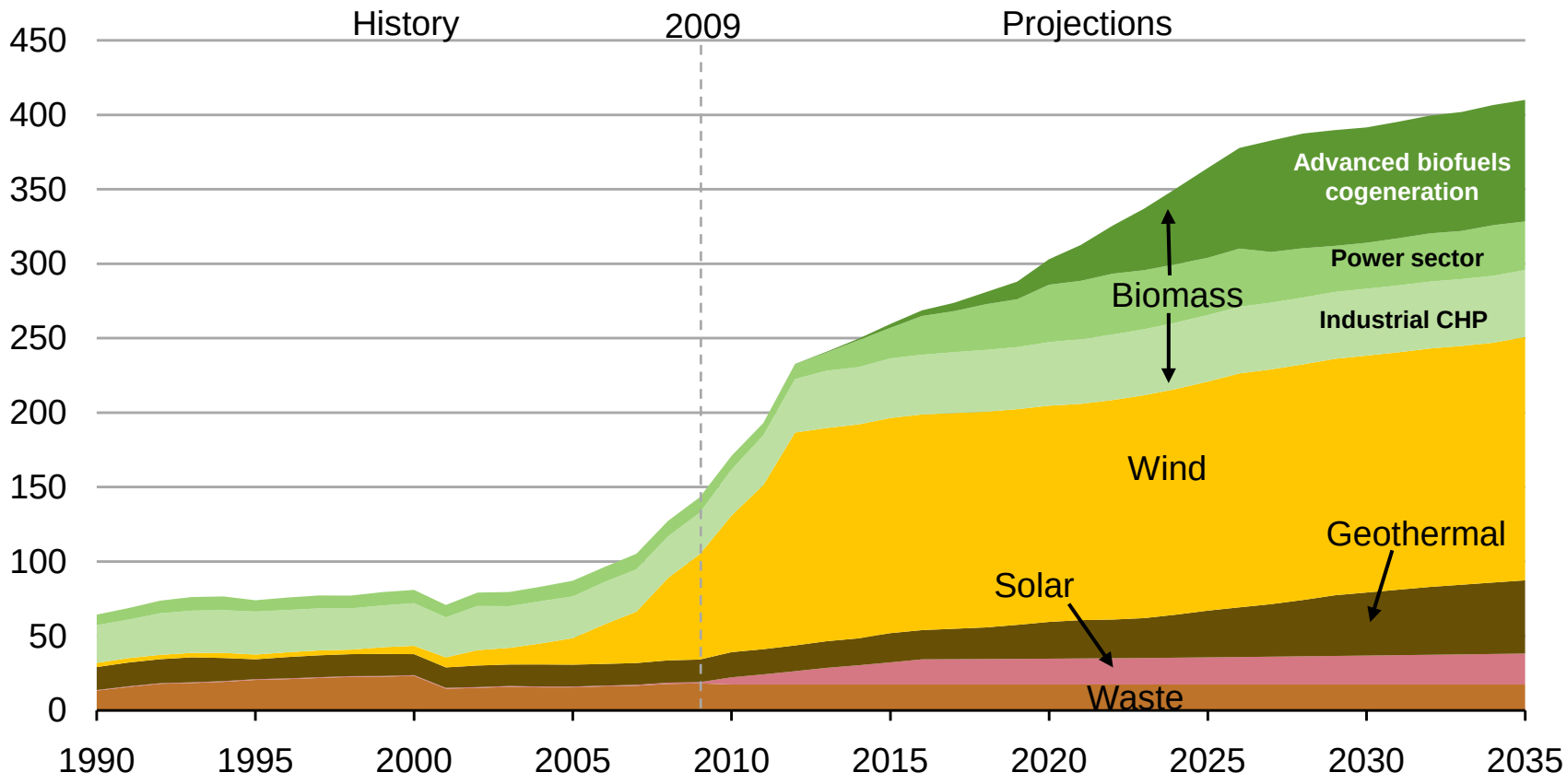
overnight capital cost
2009 dollars per kilowatt



Source: EIA, Annual Energy Outlook 2011

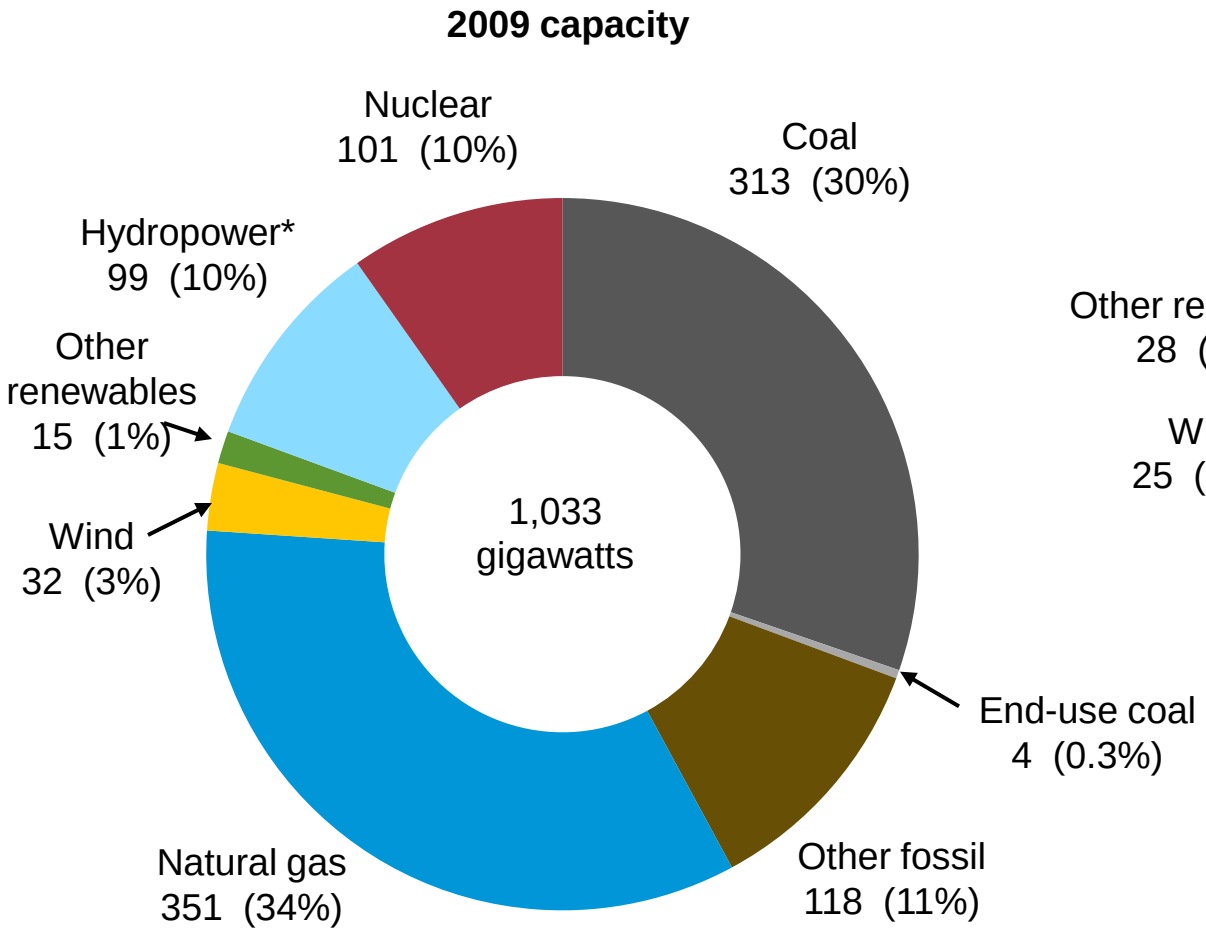
Non-hydro renewable sources grow nearly three-fold, meeting 22% of projected electricity generation growth

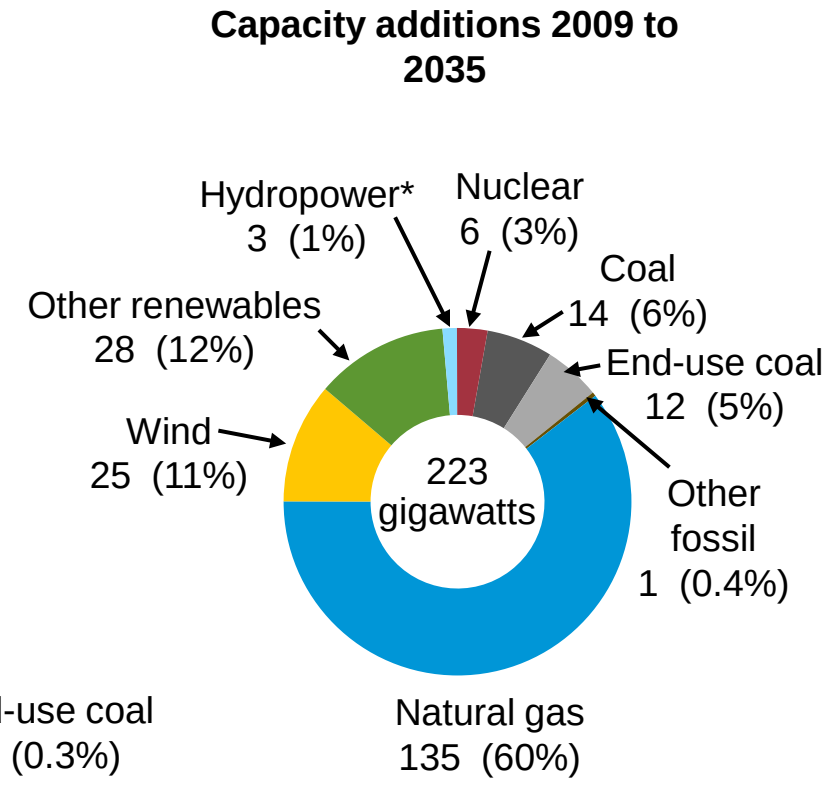
non-hydropower renewable generation
billion kilowatthours per year



Source: EIA, Annual Energy Outlook 2011

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





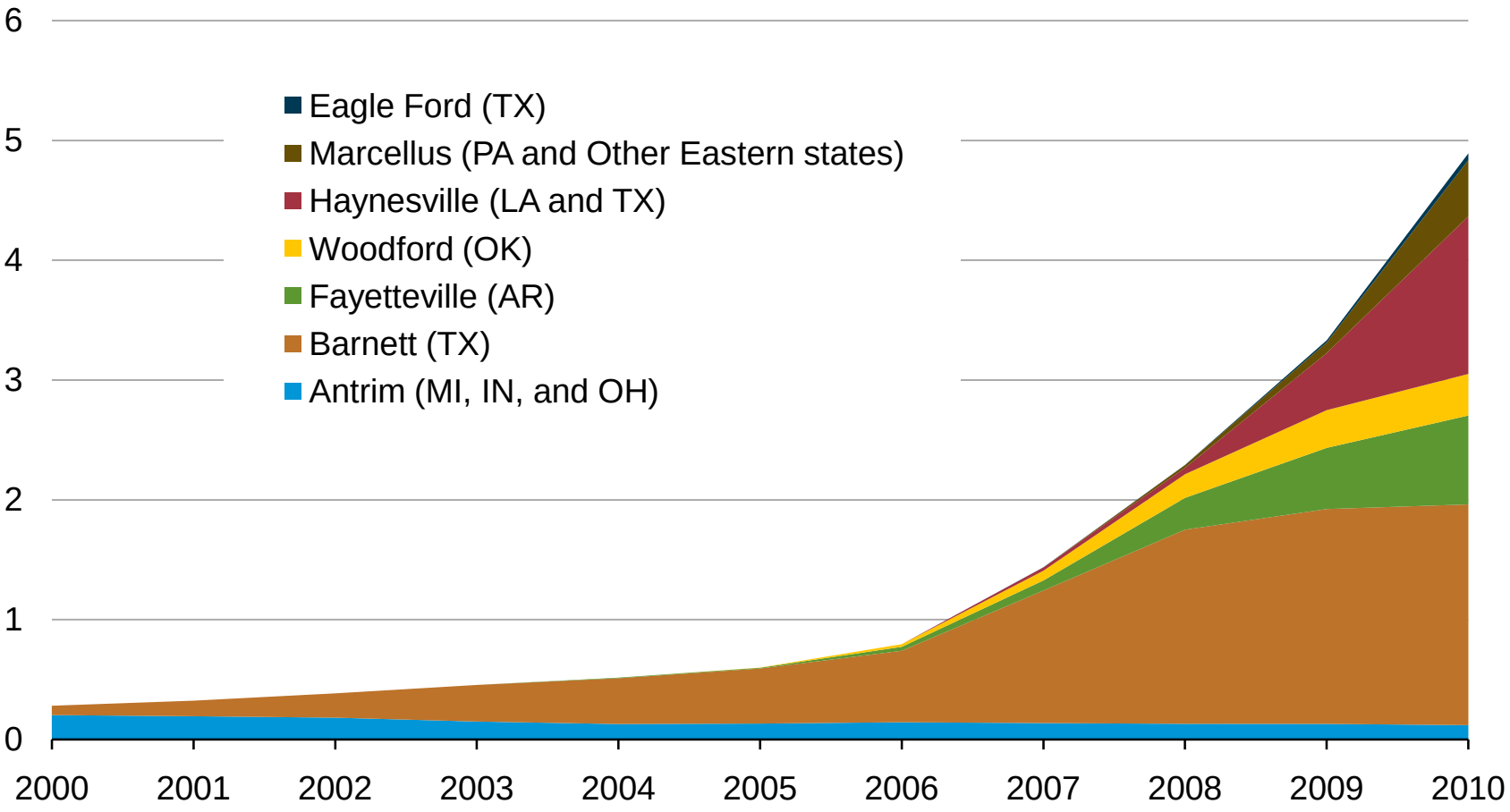
* Includes pumped storage

Source: EIA, Annual Energy Outlook 2011

Natural Gas

Over the last decade, U.S. shale gas production has increased 14-fold and now comprises about 22 percent of total U.S. production

annual shale gas production
trillion cubic feet

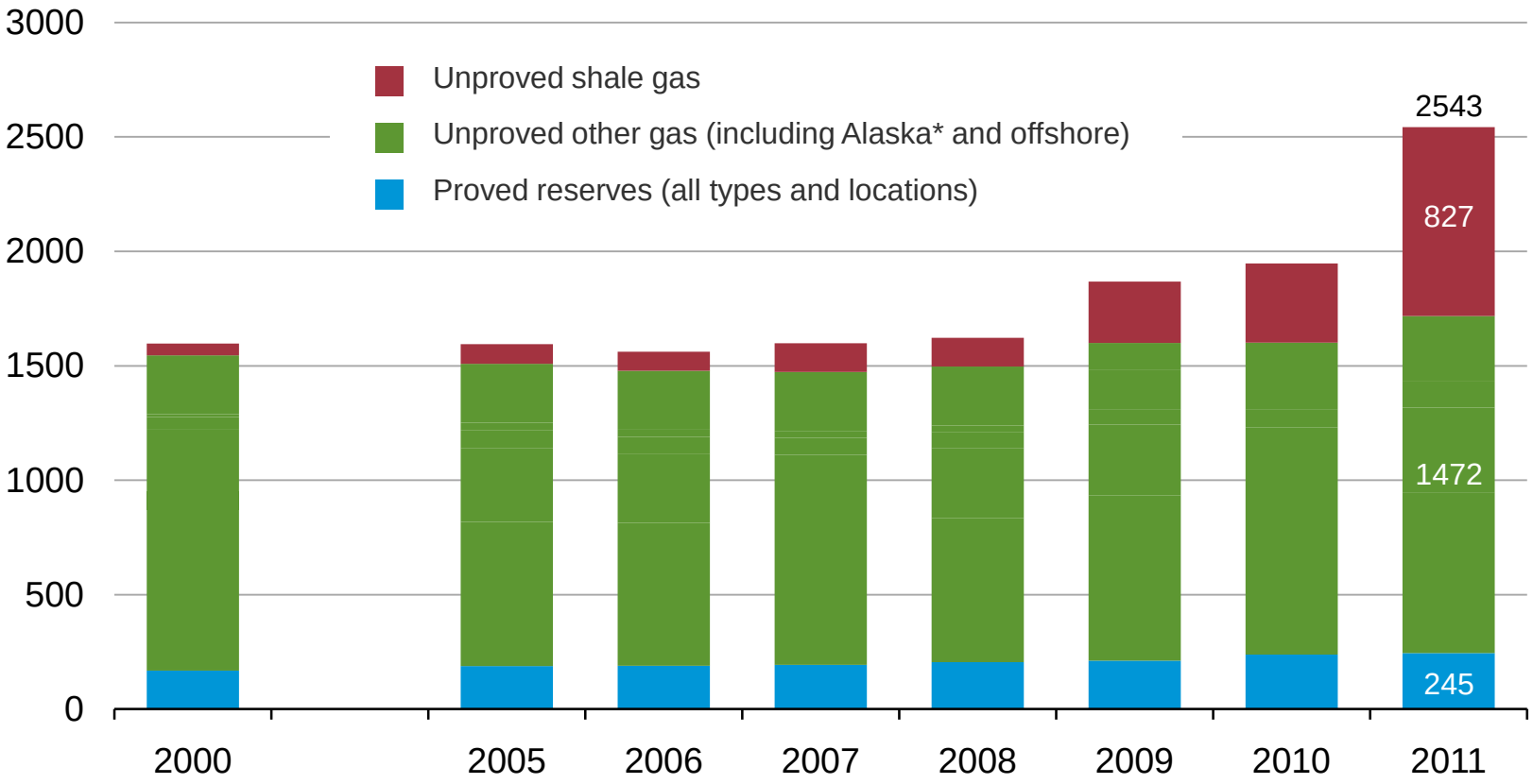


Sources: EIA, Lippman Consulting

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



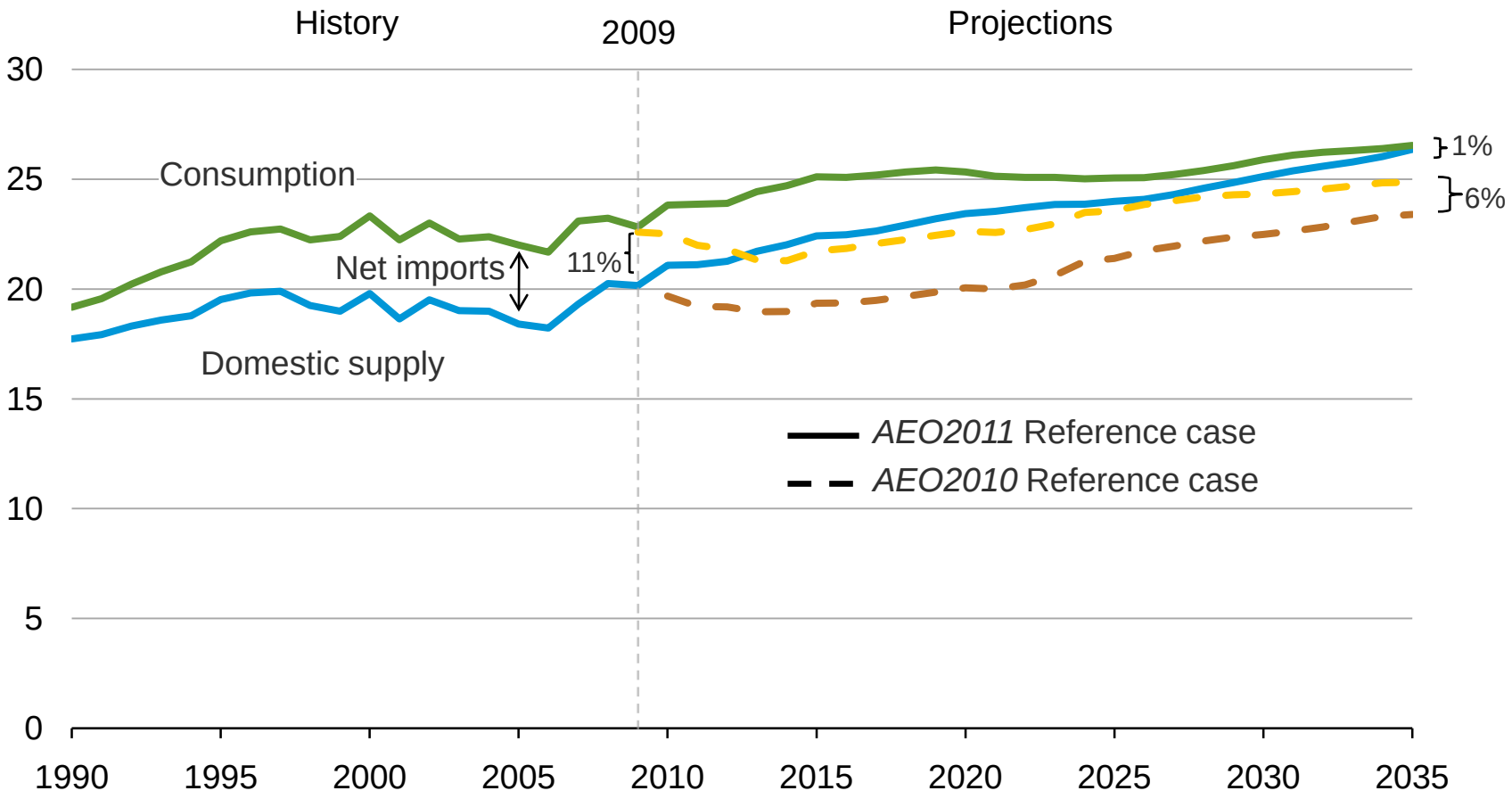
**Alaska resource estimates prior to AEO2009 reflect resources from the North Slope that were not included in previously published documentation.*

Source: EIA, Annual Energy Outlook 2011

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

U.S. dry gas

trillion cubic feet per year

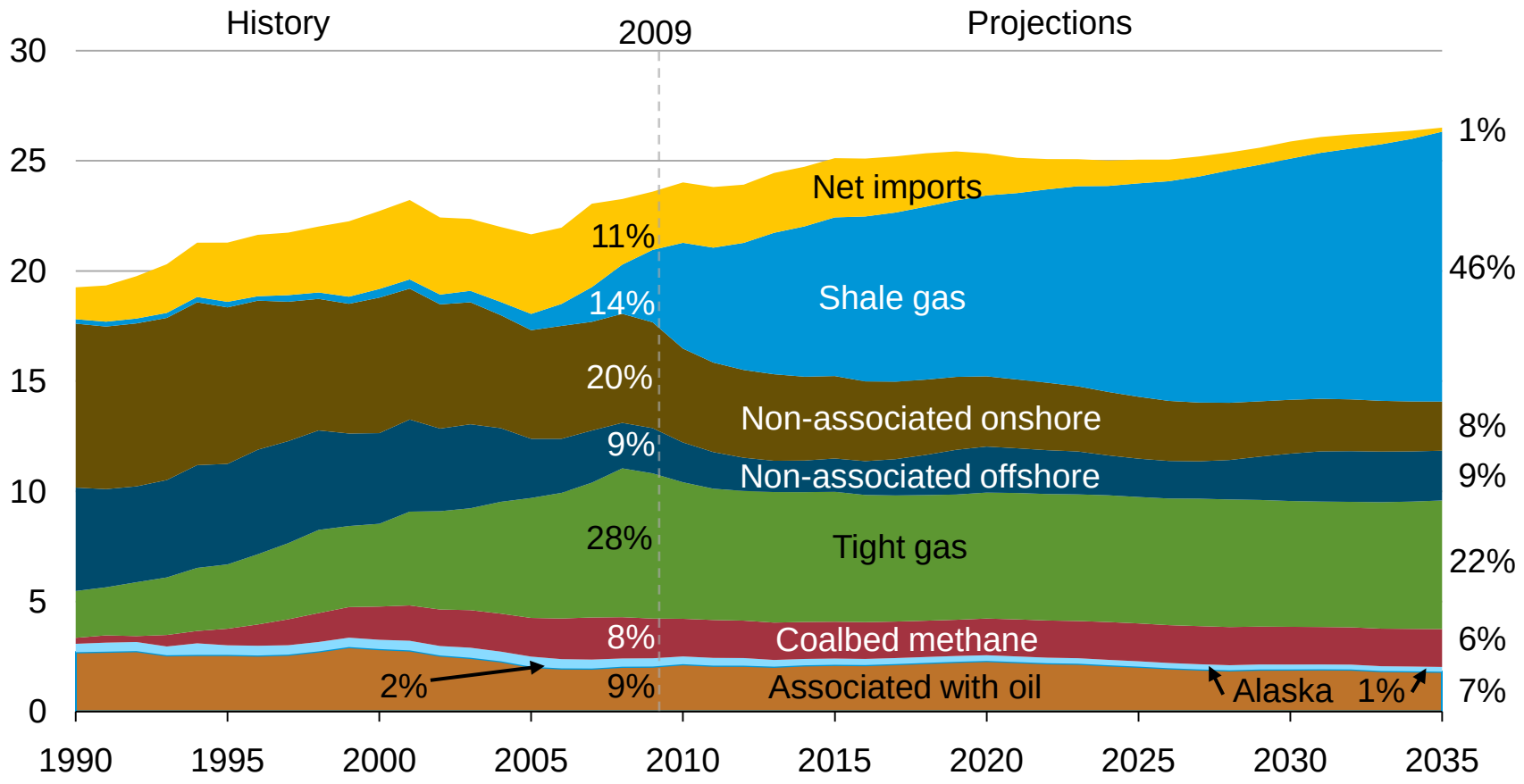


Source: EIA, Annual Energy Outlook 2011

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

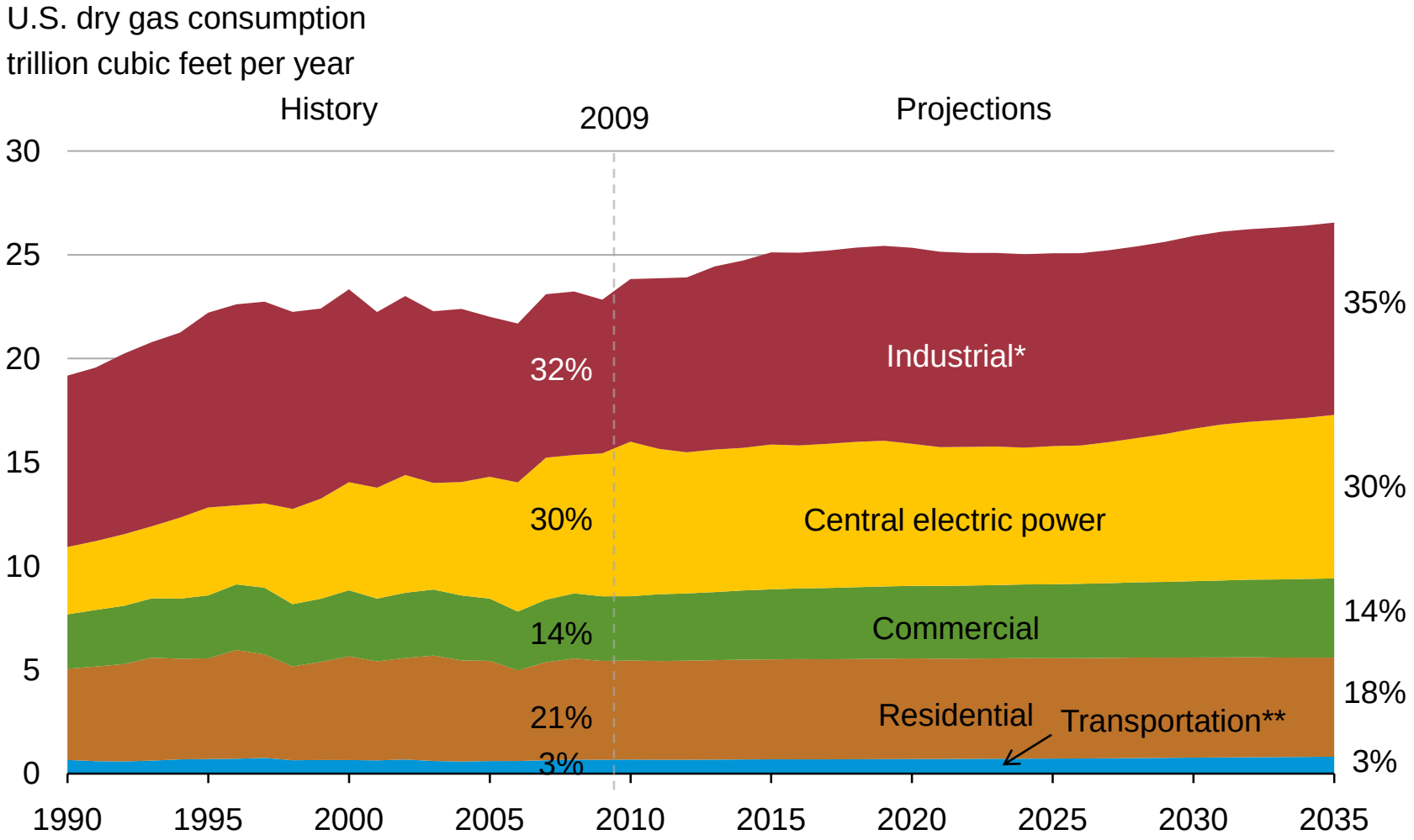
U.S. dry gas

trillion cubic feet per year



Source: EIA, Annual Energy Outlook 2011

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



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

Source: EIA, Annual Energy Outlook 2011

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

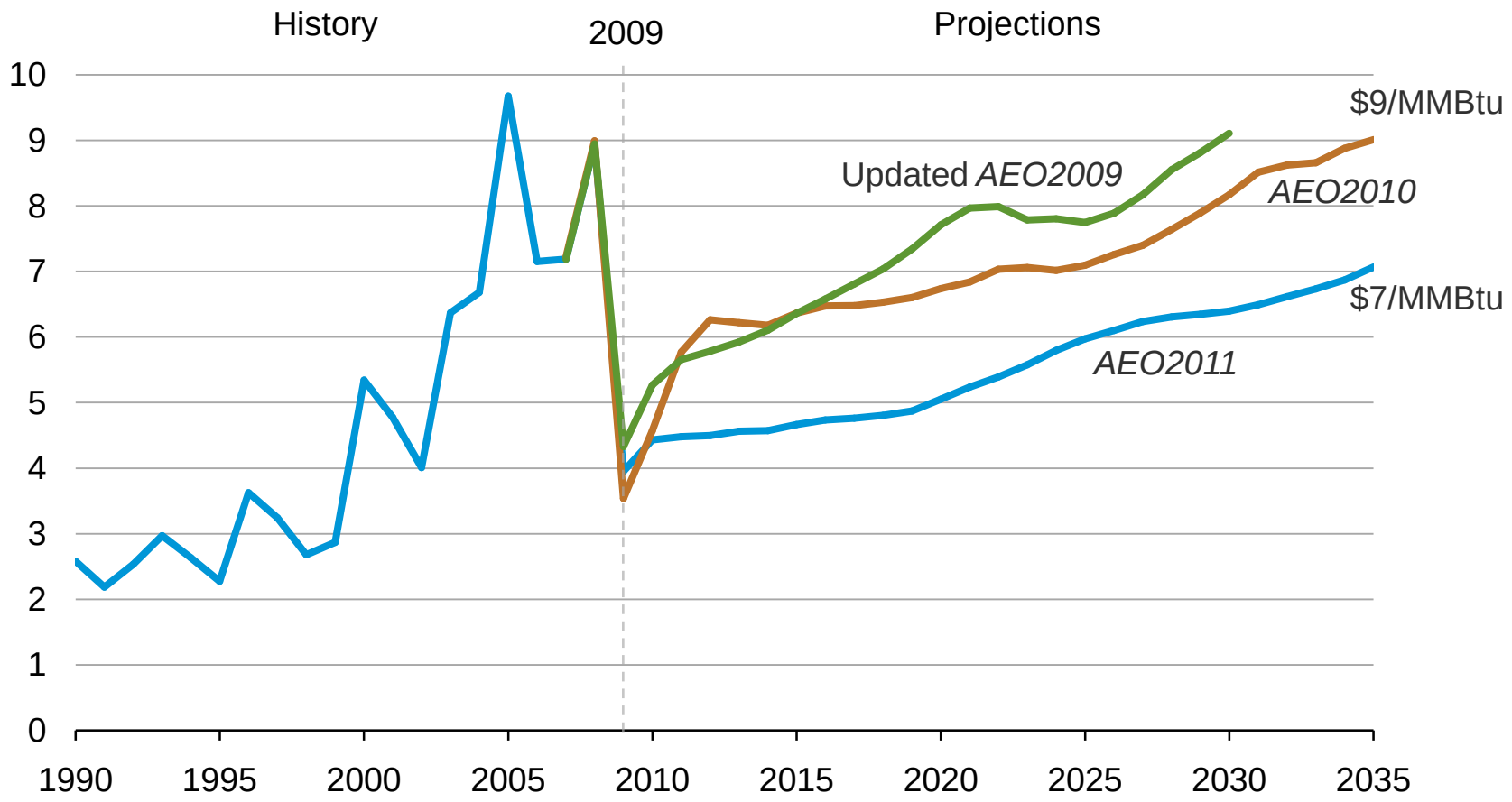
Sector	TCF Gas Consumption		Growth (2009 – 2035)	Key Drivers
	2009	2035		
Industrial, including combined heat-and-power	7.4	9.3	25%	+215% combined heat-and power generation; +30% output of gas intensive industry; lower natural gas prices
Central electric power	6.9	7.9	14%	+30% electricity consumption; lower natural gas prices; offset by +75% renewable generation and +26% coal generation
Commercial	3.1	3.8	23%	+37% commercial floorspace; -4% energy intensity
Residential	4.8	4.8	<1%	+30% number of households; +19% total square footage; -17% energy intensity

Source: EIA, Annual Energy Outlook 2011

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

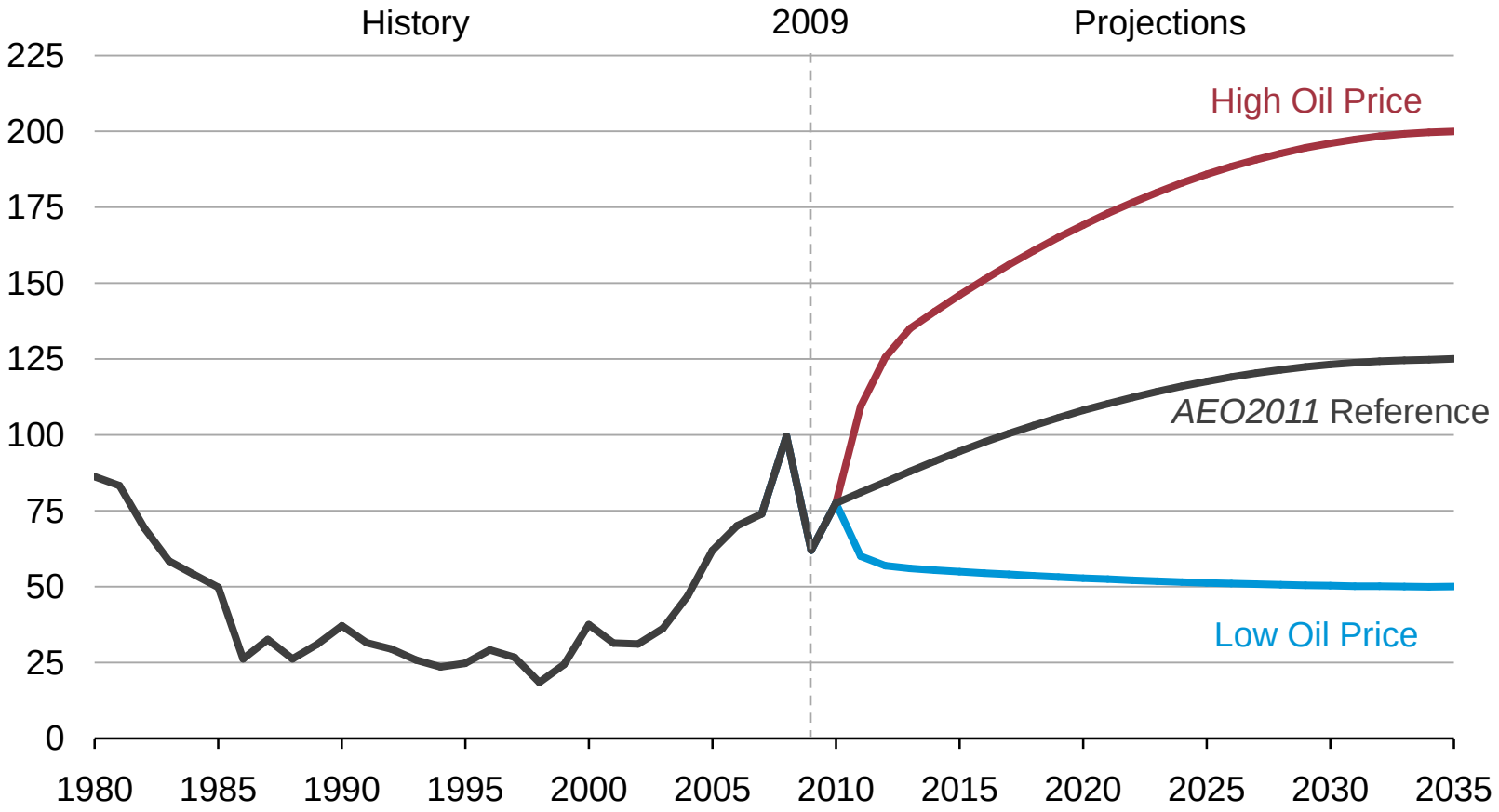


Sources: EIA, Annual Energy Outlook 2011; EIA, Annual Energy Outlook 2010; and EIA, An Updated Annual Energy Outlook 2009 Reference Case

Oil and other liquid supply

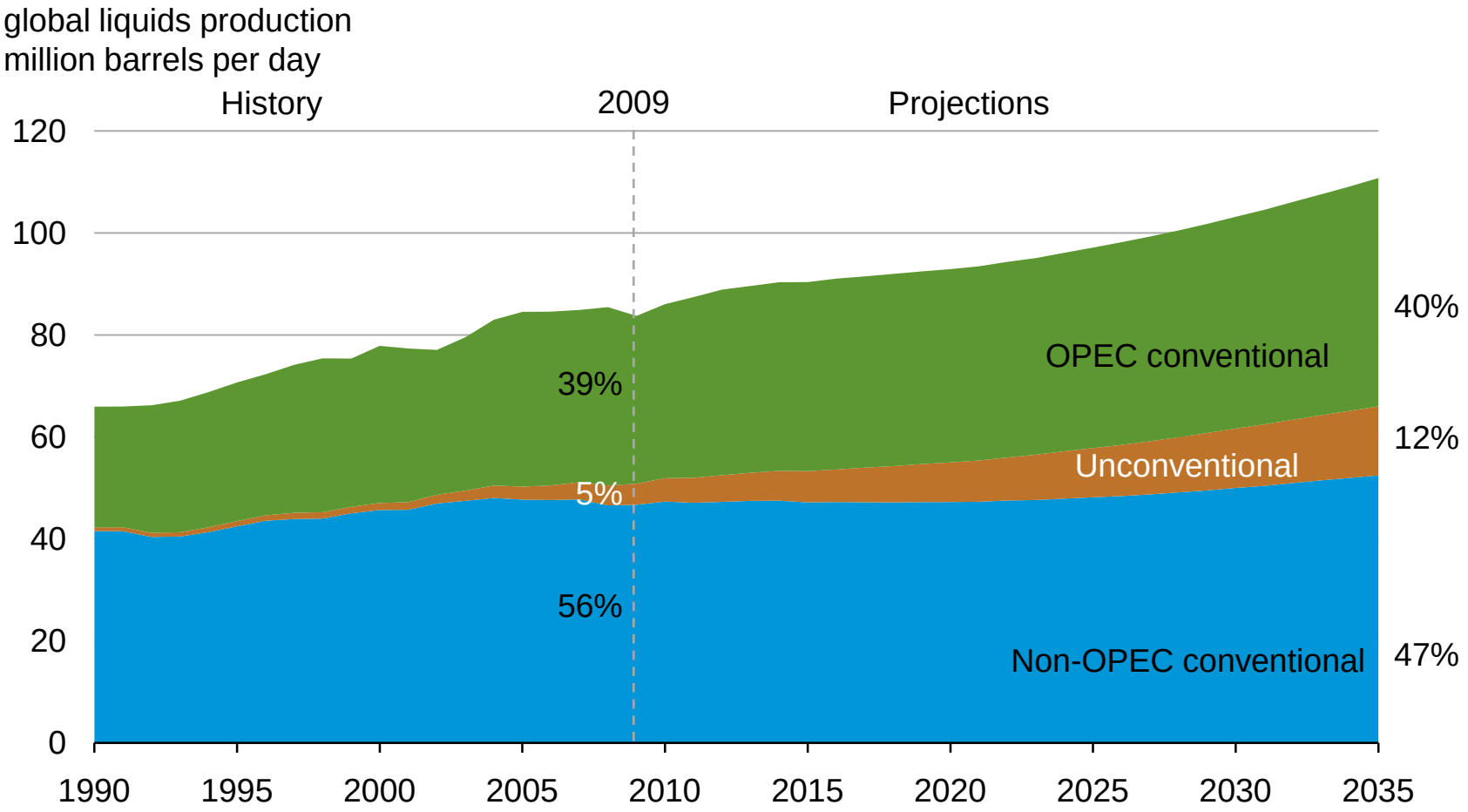
Oil prices in the Reference case rise steadily; the full *AEO2011* will include a wide range of oil prices

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



Source: EIA, Annual Energy Outlook 2011

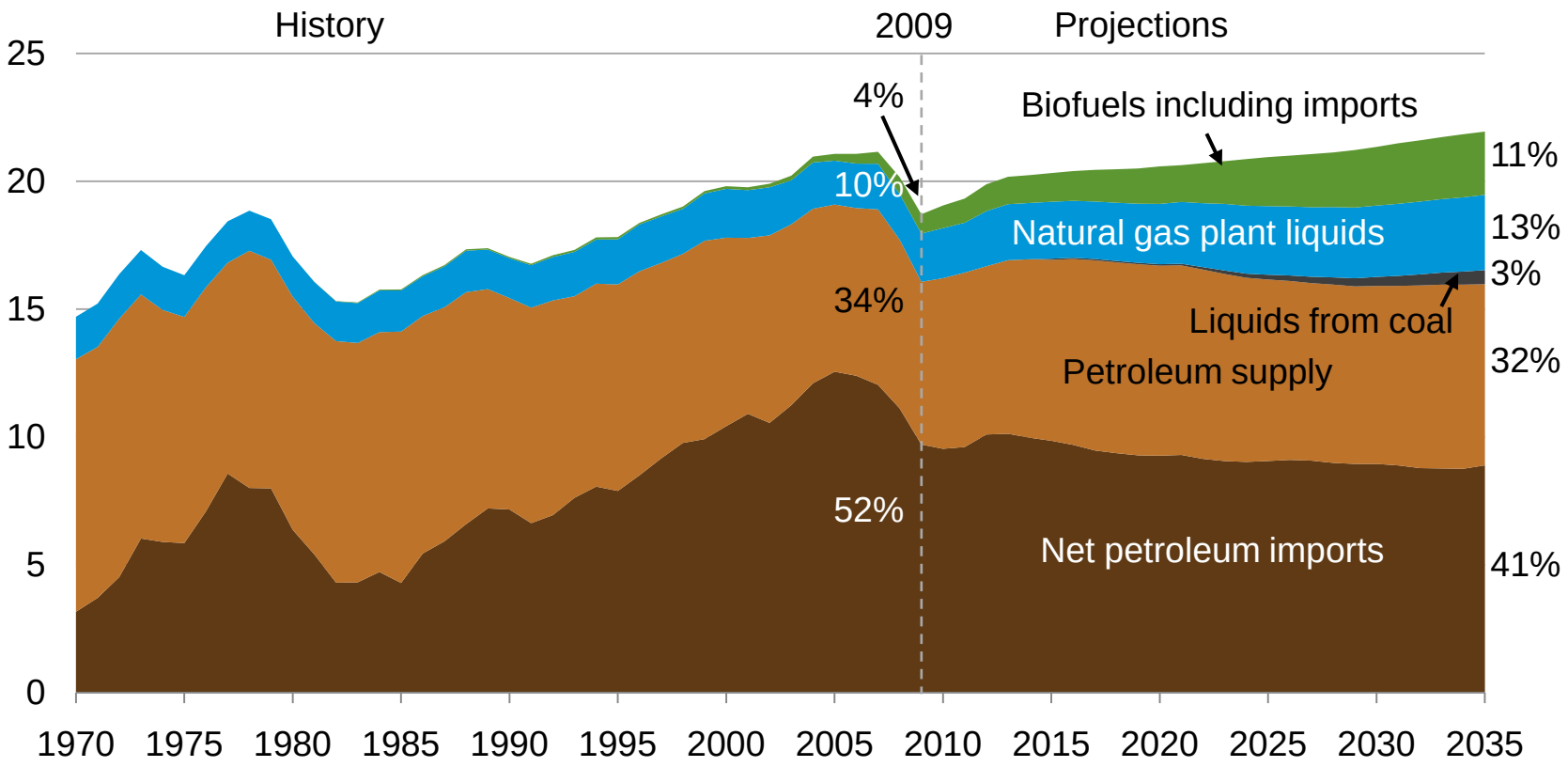
Unconventional sources more than triple globally, but conventional petroleum continues to comprise the vast majority of liquids supply



Source: EIA, Annual Energy Outlook 2011

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

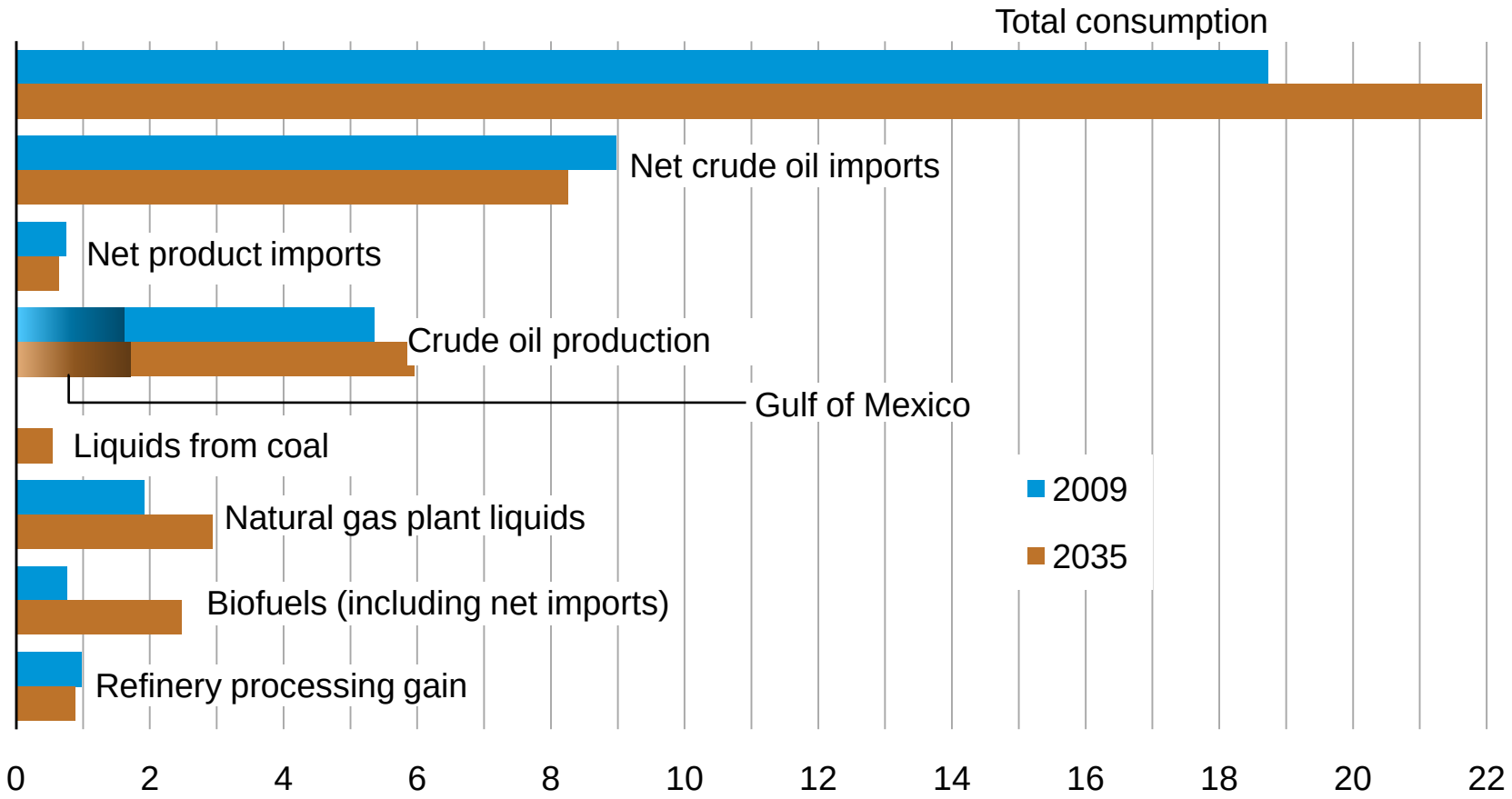


Source: EIA, Annual Energy Outlook 2011

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

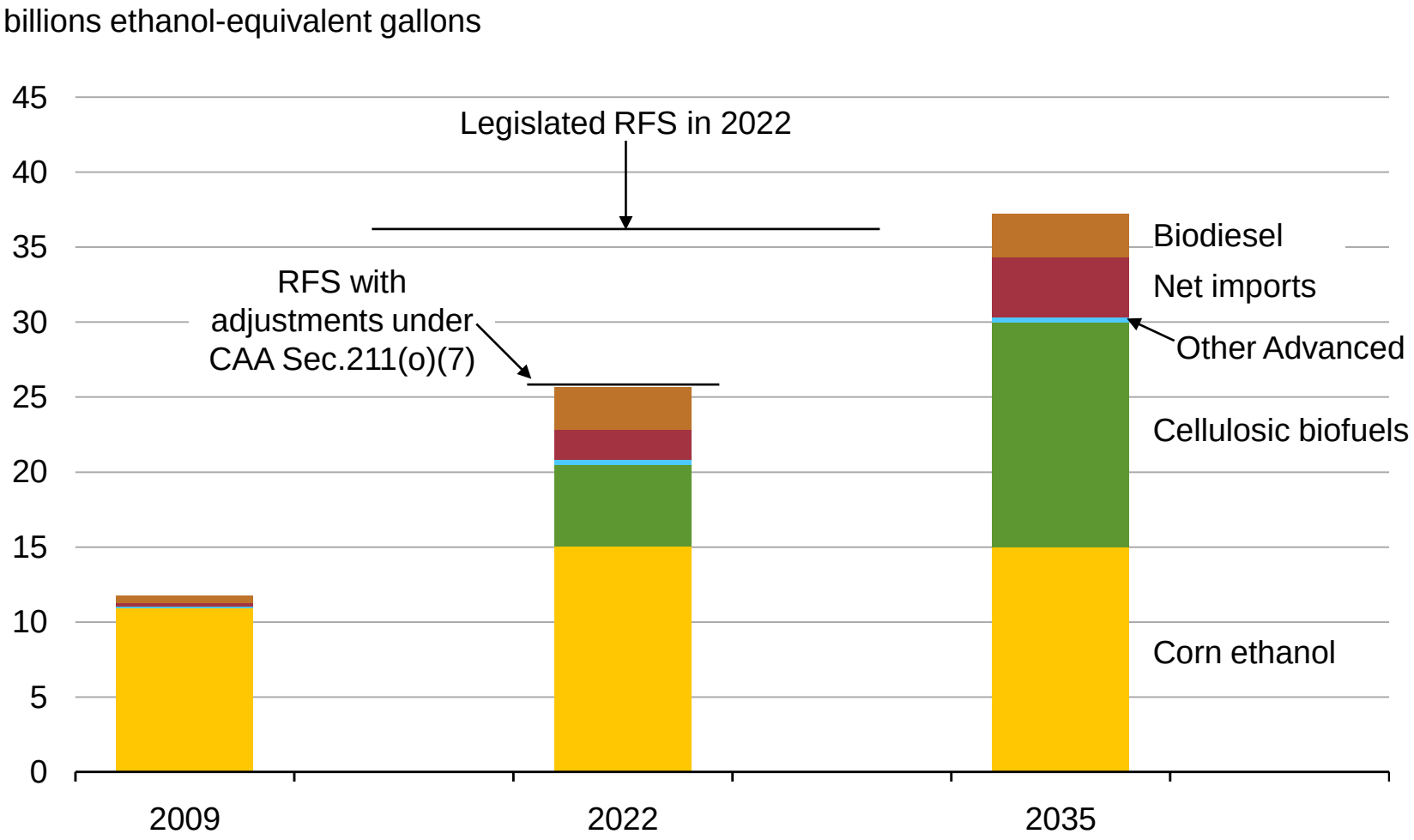
U.S. liquid fuels

million barrels per day



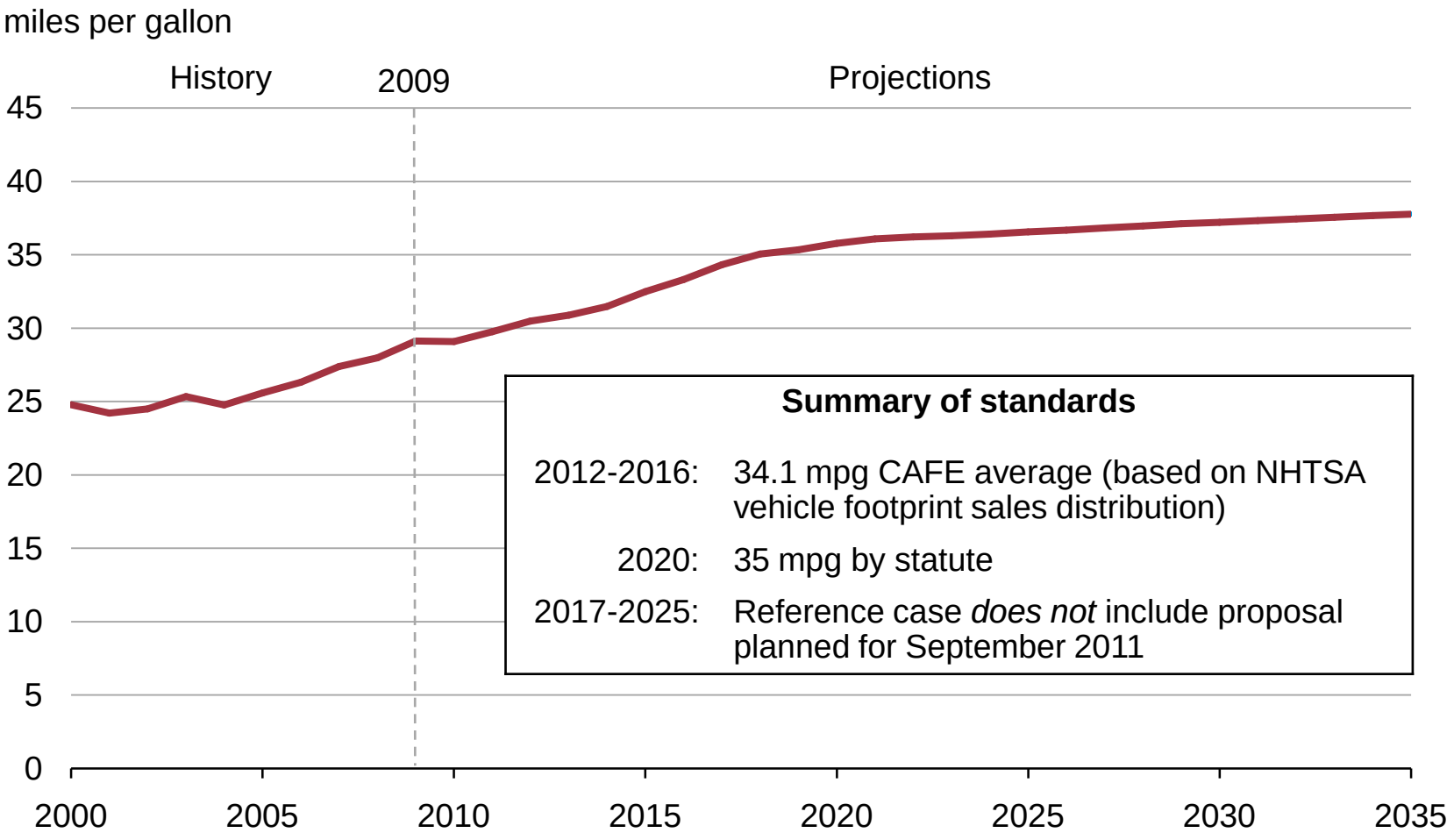
Source: EIA, Annual Energy Outlook 2011

Biofuels fall short of the goal in 2022, but exceed the 36 billion gallon RFS target by 2031



Source: EIA, Annual Energy Outlook 2011

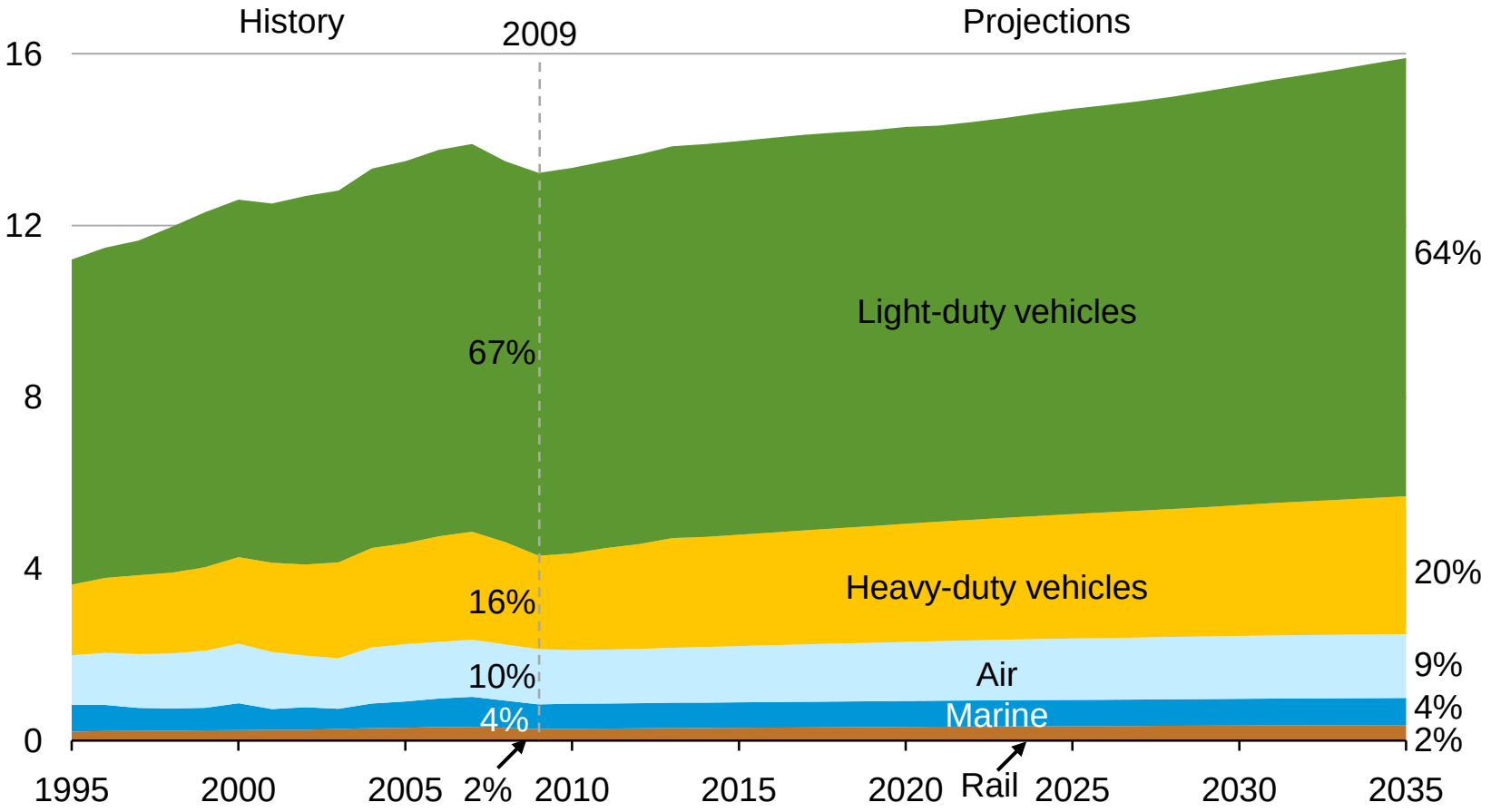
New light duty vehicle fuel economy achieves almost 38 mpg by 2035 in the Reference case



Source: EIA, Annual Energy Outlook 2011

Most transport fuel growth is in light and heavy duty vehicles

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



Source: EIA, Annual Energy Outlook 2011

Efficiency improvements partially offset underlying drivers of growth in transportation services

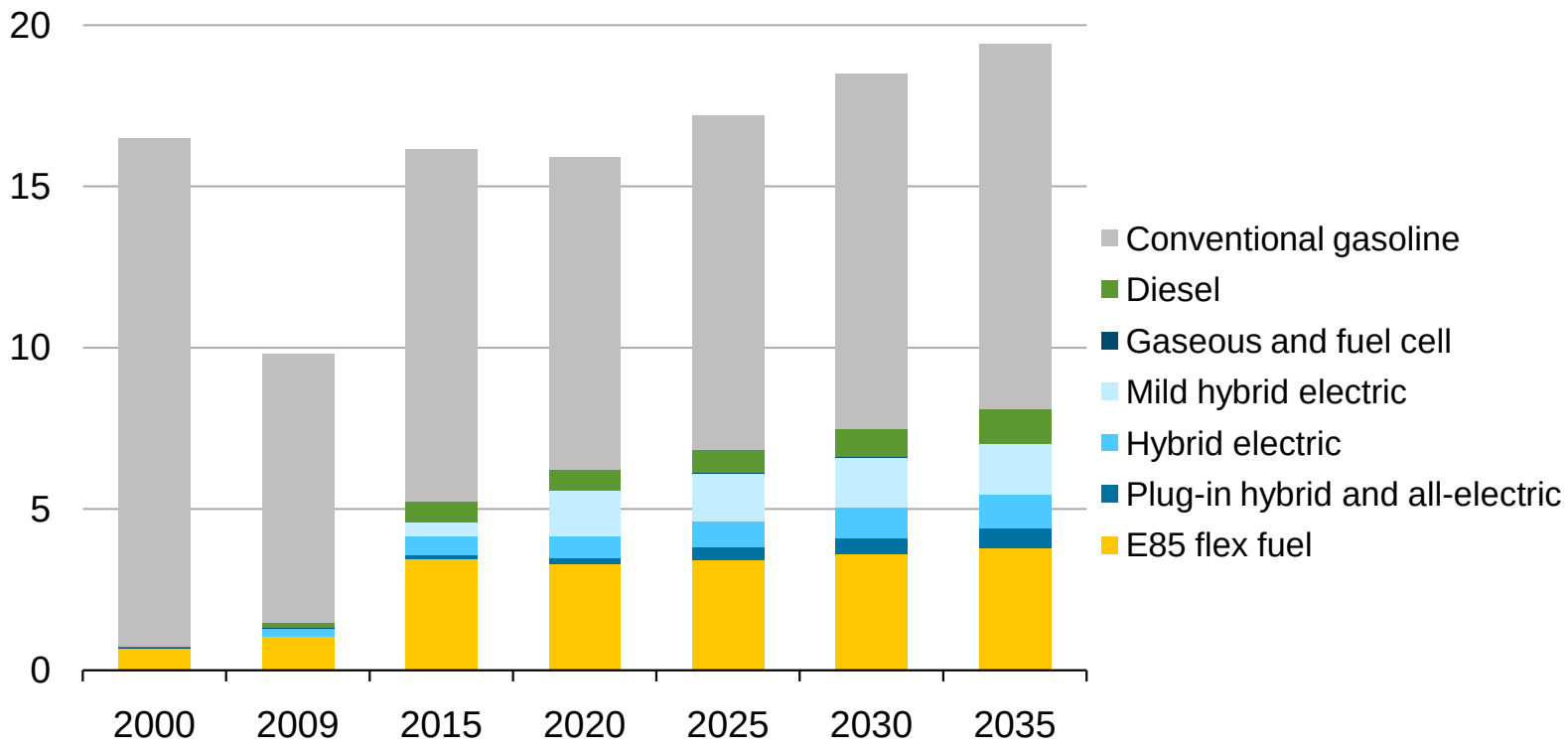
	2009	2035	Growth (2009-2035)
Light duty vehicles			
Fuel consumption (million barrels per day oil equivalent)	8.9	10.2	14%
Number of licensed drivers (millions)	207	265	28%
Miles per licensed driver	13,100	15,300	17%
Efficiency of vehicle stock (mpg)	20.8	27.9	34%*
Heavy duty vehicles			
Fuel consumption (million barrels per day oil equivalent)	2.2	3.2	47%
Manufacturing output (billion 2005 dollars)	4,197	6,770	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.*

Source: EIA, Annual Energy Outlook 2011

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

U.S. light car and truck sales
millions



Source: EIA, Annual Energy Outlook 2011

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