Biomass in the United States Energy Economy

International Biomass Conference and Expo

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May 03, 2011 | St. Louis, Missouri

Overview

- The potential for biomass and biofuels
  - Potential biomass supply chain
  - Biofuel corporate landscape
  - US biomass consumption by sector and type
- Electricity sector
  - Reference case power generation projections
  - Alternative cases
- Liquid fuels sector
  - Current state of industry
  - Reference case biofuel projections
  - Effects of fuel efficiency
  - Sensitivity on E15 penetration
- EIA data available to the public
  - Ethanol
  - Biodiesel & renewable diesel
  - Biomass for electricity

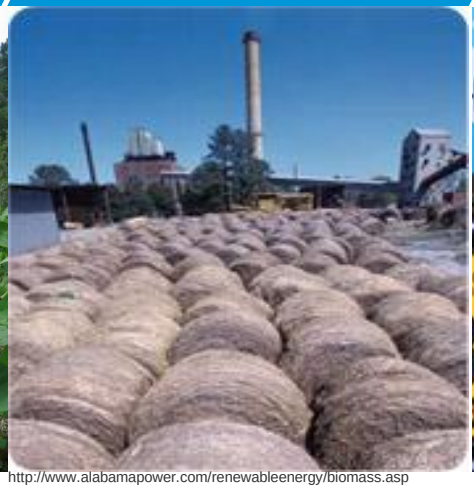
There are many sources and many uses for biomass

Raw inputs
- Corn
- Soy
- Other seed crops
- Livestock
- Forestry
- Energy crops
- Municipal solid waste

Feedstocks
- Virgin oils
- Starch
- Fiber
- Fat & grease
- Lignocellulose

Energy products
- FAME biodiesel
- Renewable diesel
- Ethanol
- Butanol
- Gasoline
- Diesel
- Heat & power

http://www.ranchomastatal.com/img_bank/phpgbb3eY_IMG_0182.JPG



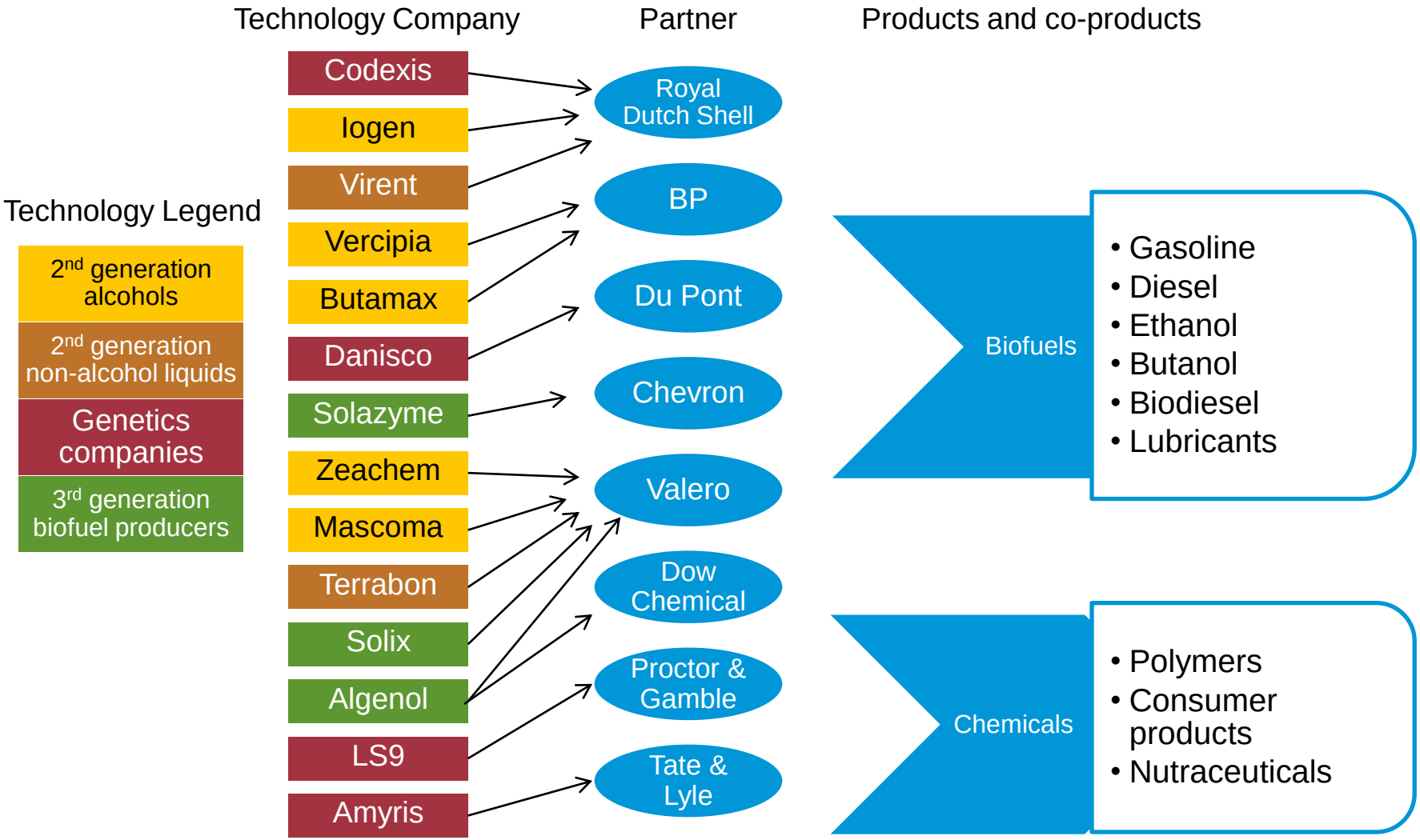
http://www.alabamapower.com/renewableenergy/biomass.asp

http://www.e85fuel.com/images/sized/images/uploads/blender_pump_prices-700x231.jpg

Corporate landscape for 1st generation biofuels

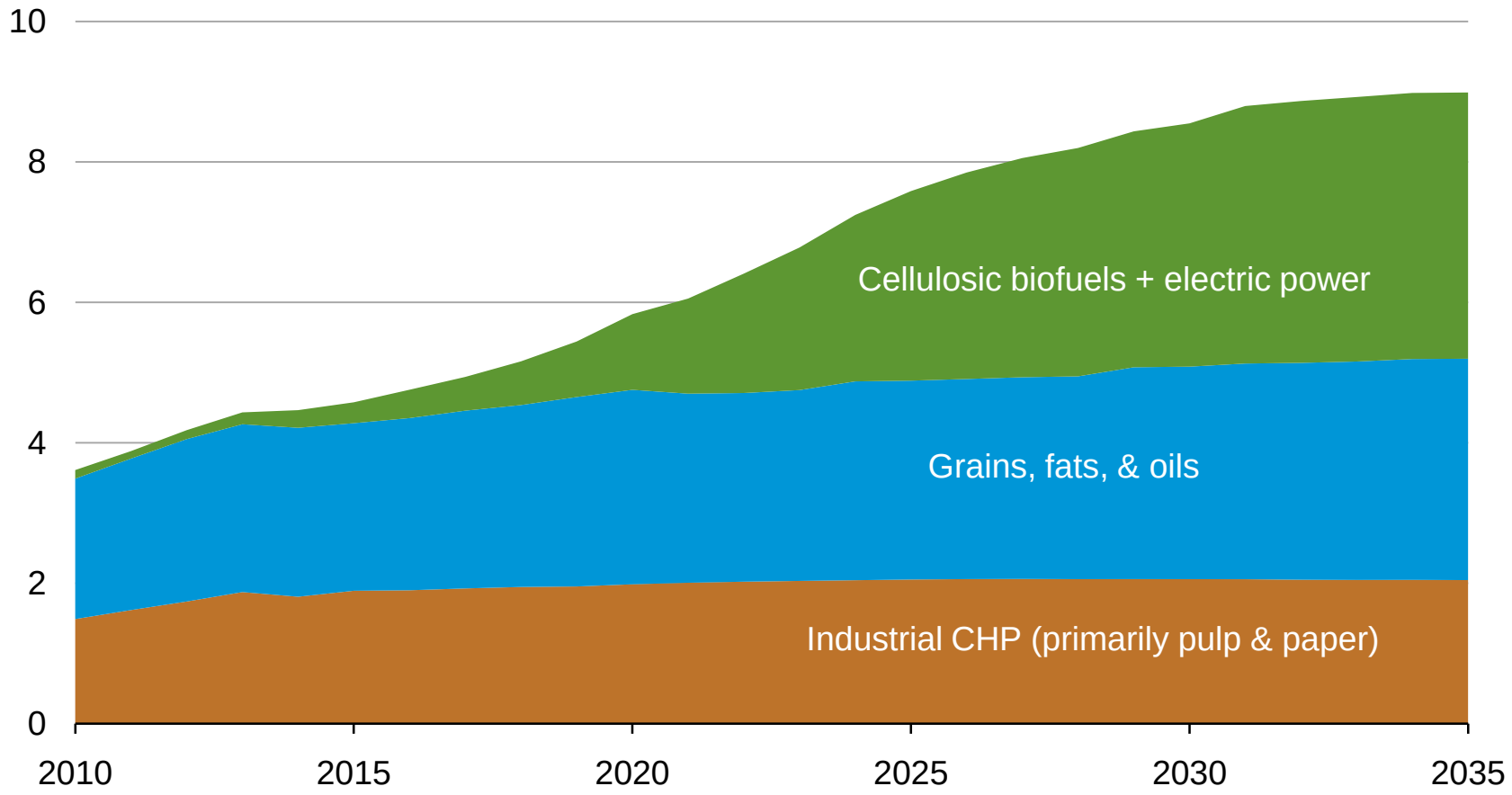
- Alcohol production
  - **Vertically integrated majors:** Archer Daniels Midland
  - **Large refiners:** Poet Ethanol (throughout U.S.), Valero Refining (throughout U.S.), Green Plains Renewable Energy (Midwest), Flint Hills Resources, LLC (IA), Abengoa (KS, IL, NM, NE, IN)
  - **Medium/small refiners:** Big River (East IA, West IL), The Andersons (West OH, IN, South MI), White Energy (TX, KS), Aventine (Central IL, NE), Biofuel Energy (MN, NE)
- Diesel blendstocks
  - **Vertically integrated majors**: Archer Daniels Midland
  - **Large refiners:** Renewable Energy Group, Renewable Biofuels, Imperium Renewables, Biodiesel of Las Vegas, Green Earth Fuels of Houston, Louis Dreyfus, Delta Biofuels, Inc
  - **Medium/small refiners:** Keystone BioFuels, Inc., Fina, LLC, AGP, American Energy Producers, Inc., Owensboro Grain, Lake Erie Biofuels, Delta American Fuel, LLC, Innovation Fuels

Next generation biofuel companies are developing numerous strategic relationships



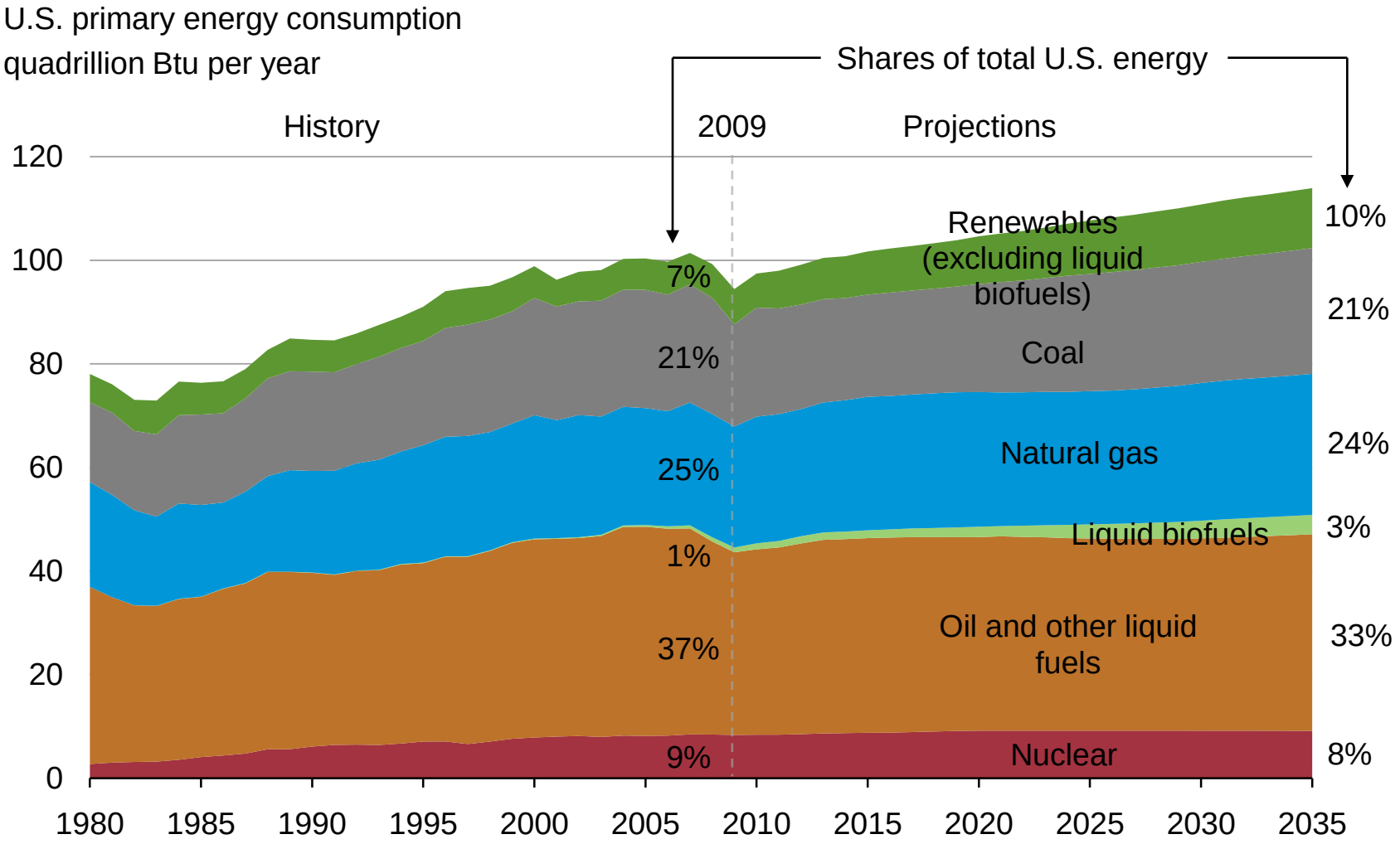
EIA projects that consumption of biomass for liquid fuels and power will increase significantly, driven primarily by cellulosic biofuels

US biomass supply
quadrillion Btu per year



Source: EIA, Annual Energy Outlook 2011

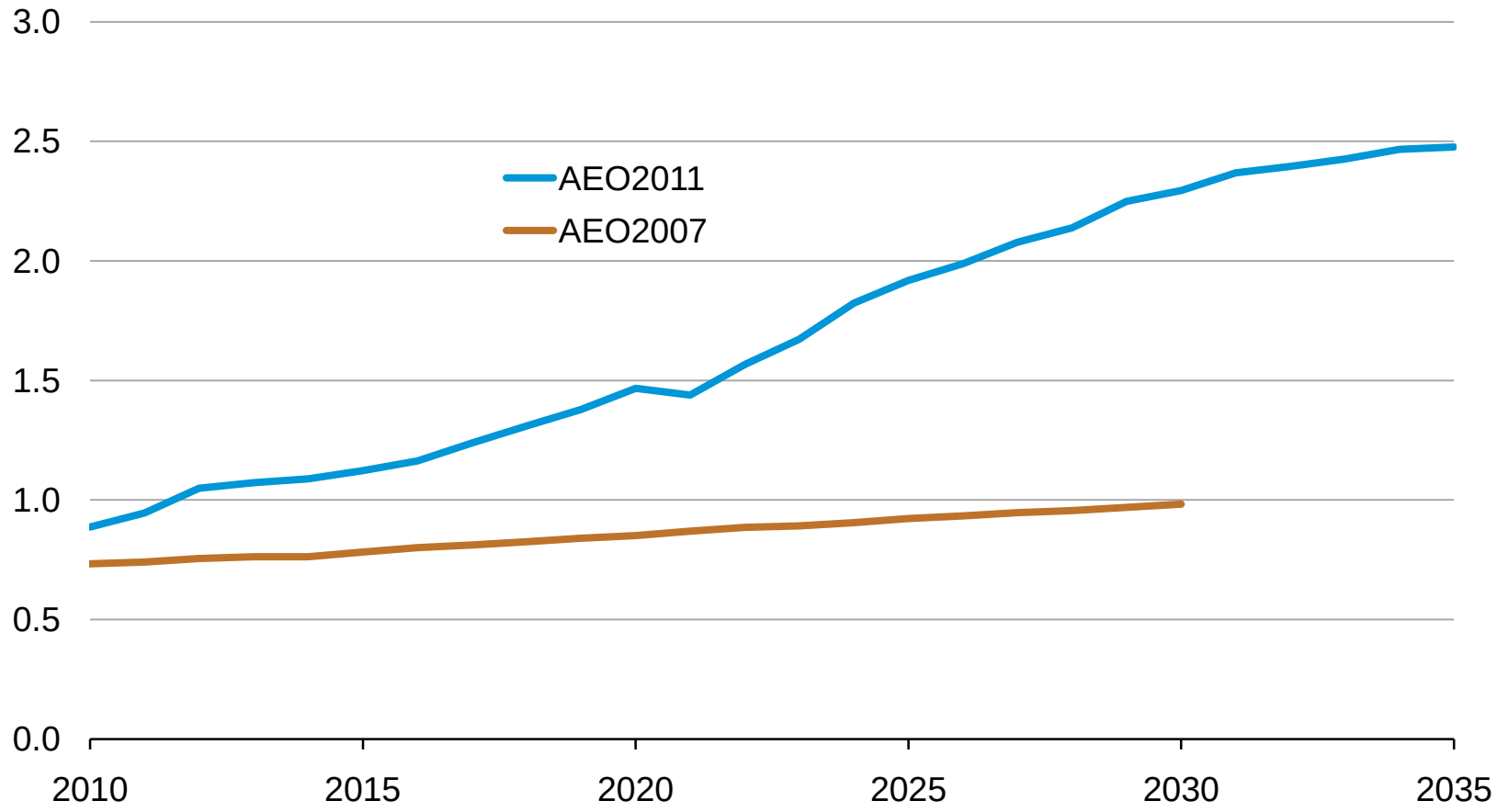
Despite this rapid growth, under current policies, fossil fuels still provide 78% of U.S. energy use in 2035



Source: EIA, Annual Energy Outlook 2011

Policy and crude oil prices have worked in favor of biofuels

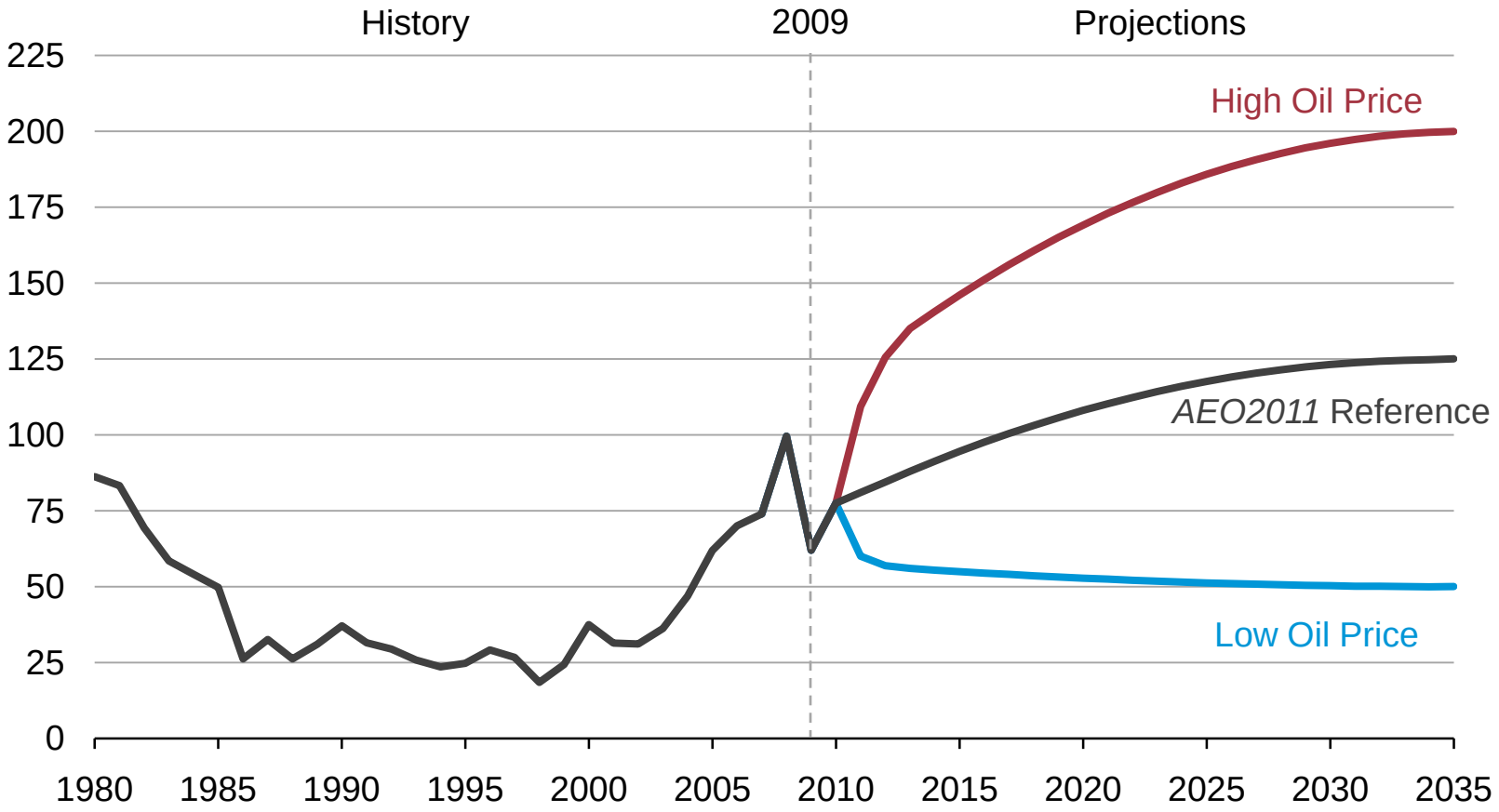
US biofuels consumption
million barrels per day



Source: EIA, Annual Energy Outlook 2007 and 2011

The future market for biofuels depends on the world oil price path, which is highly uncertain

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

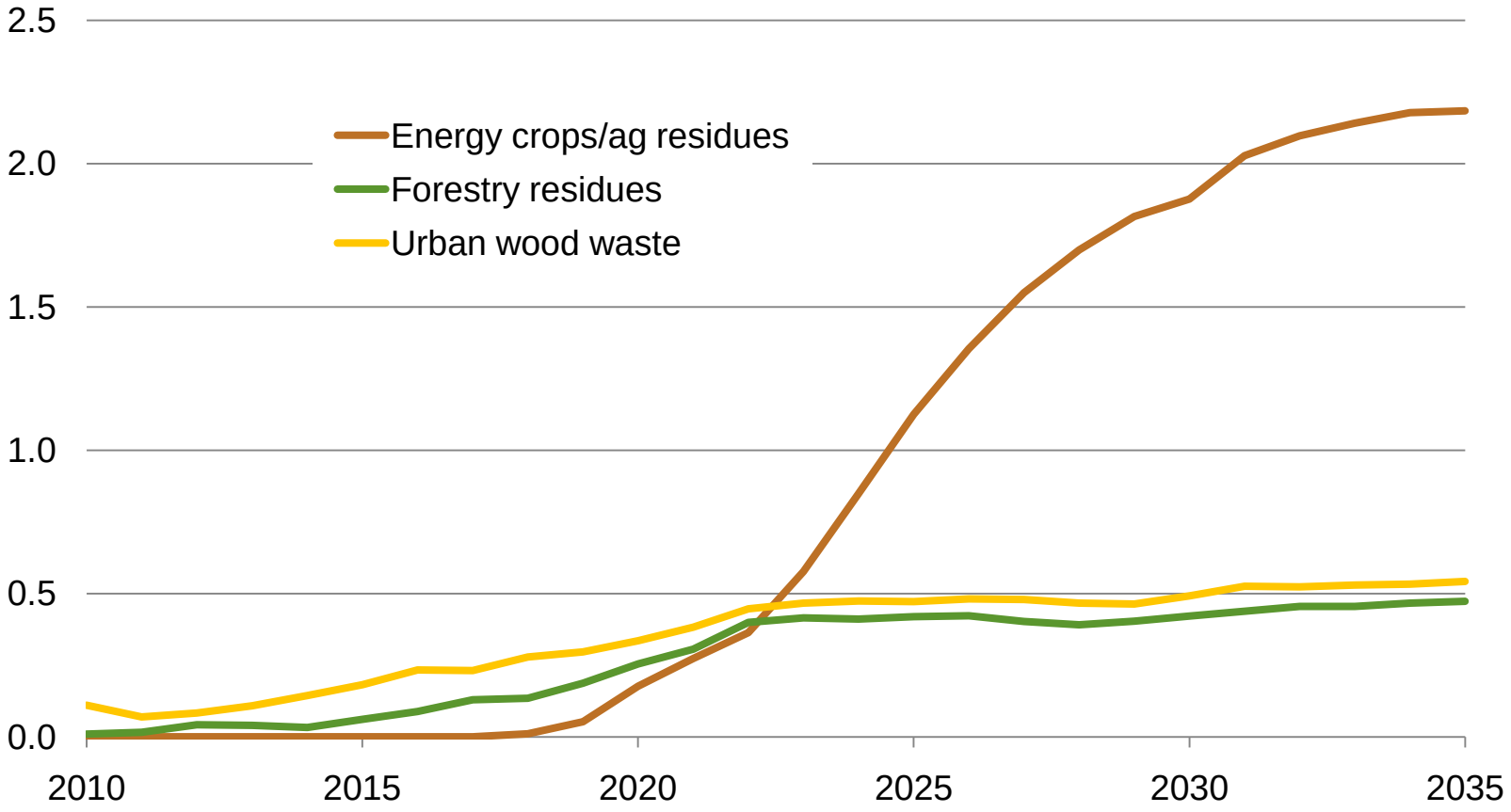


Source: EIA, Annual Energy Outlook 2011

In EIA projections, cellulosic biomass of three different types is consumed in liquid fuels and for power production

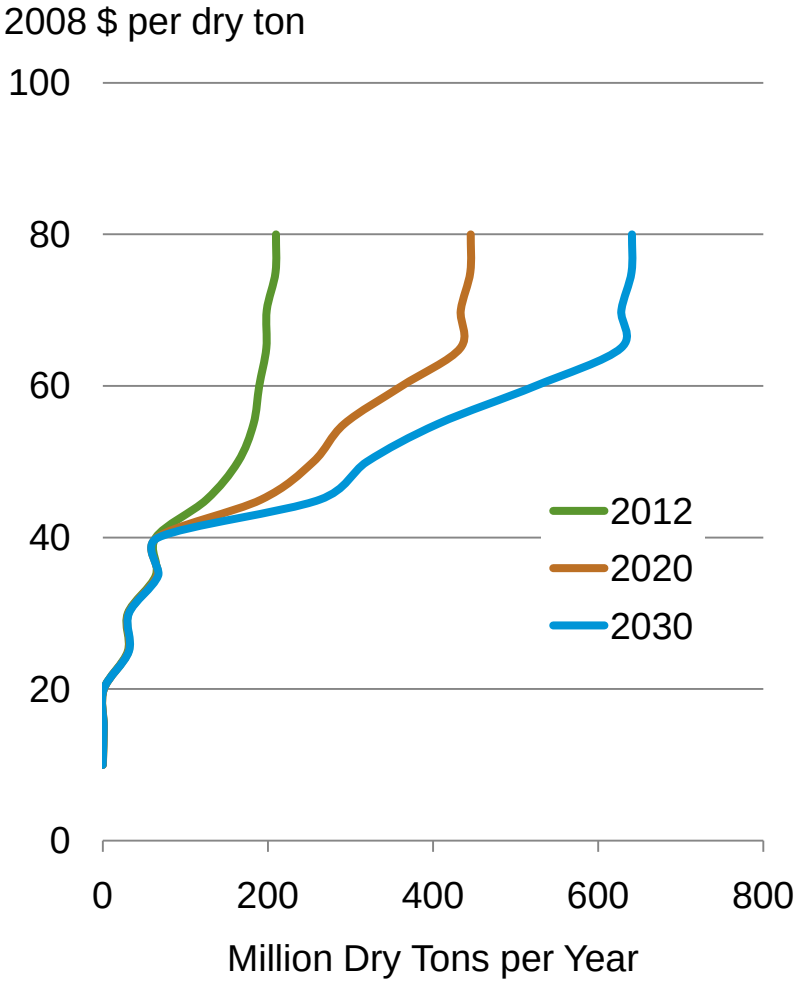
cellulosic biomass consumption

quadrillion Btu per year



Source: EIA, Annual Energy Outlook 2011

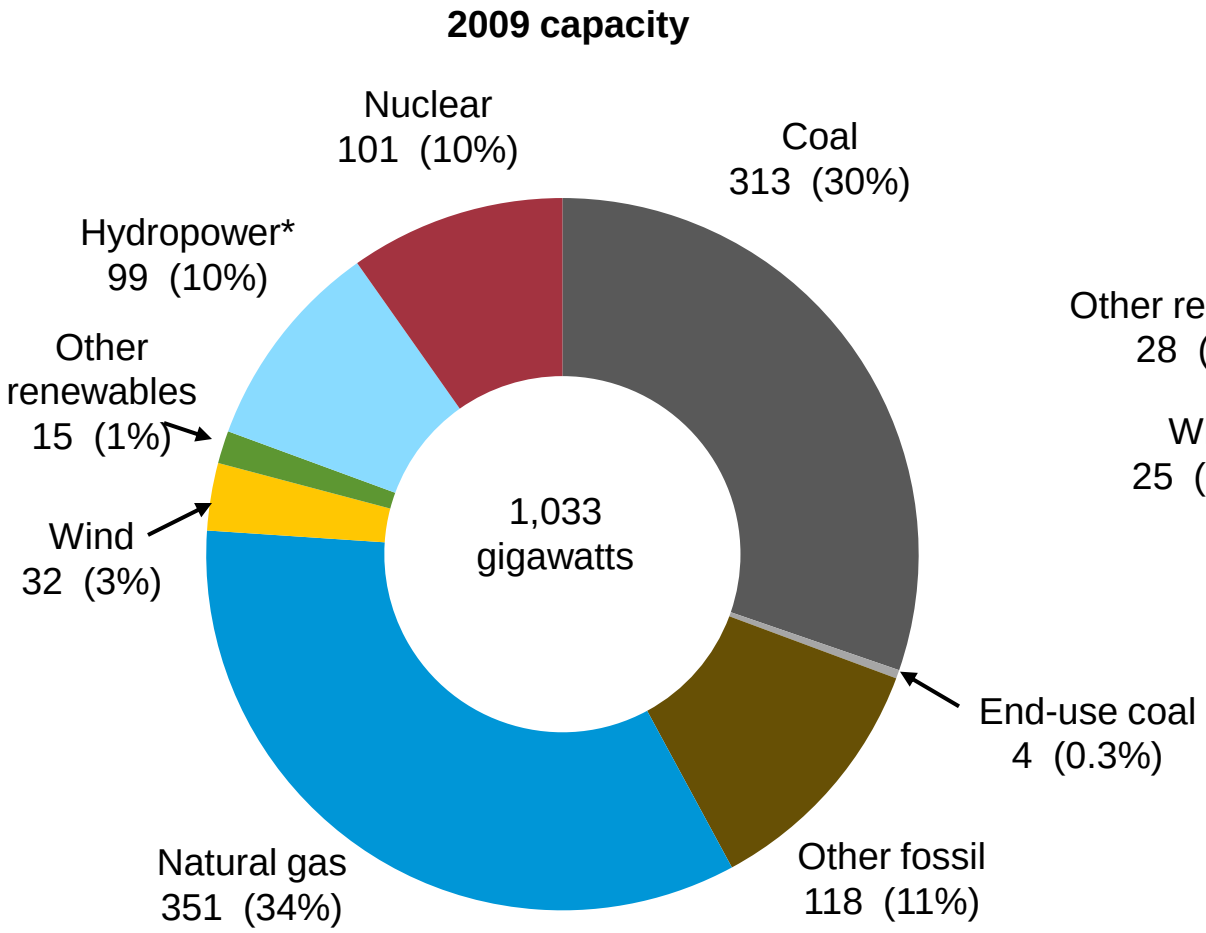
Liquid fuels markets and electric power compete for the same biomass supply in EIA projections

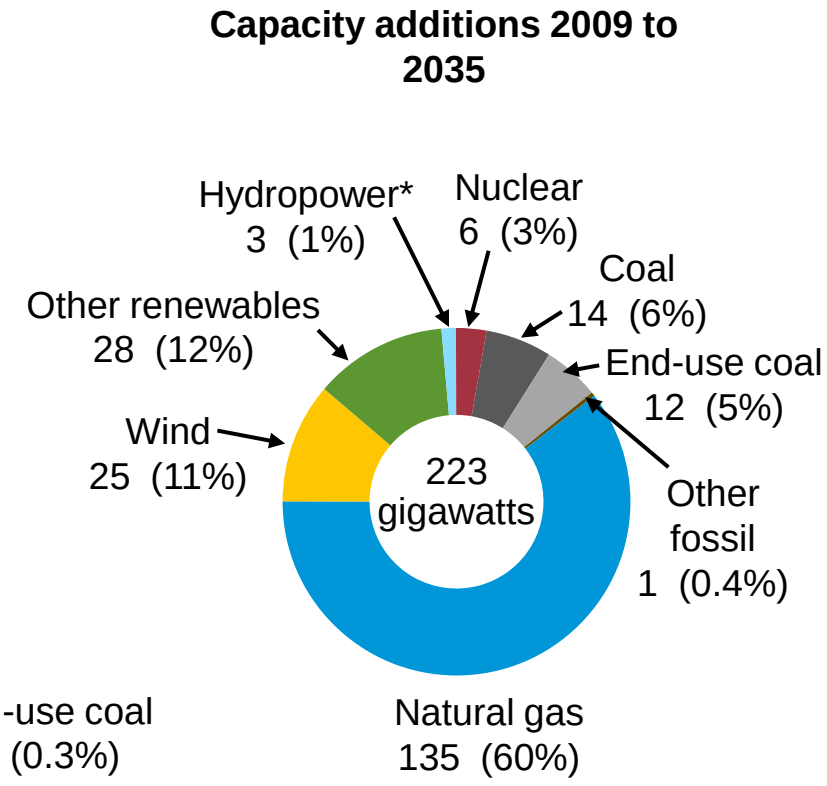


- Behind the projection, EIA has a large biomass potential supply over a range of prices
- As crop yields and other farm management practices improve, biomass available in a given year increases
- But the liquid fuel sector does not have access to urban/mill residues and forestry residues from Federal lands, which limits some of the growth

Electricity

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





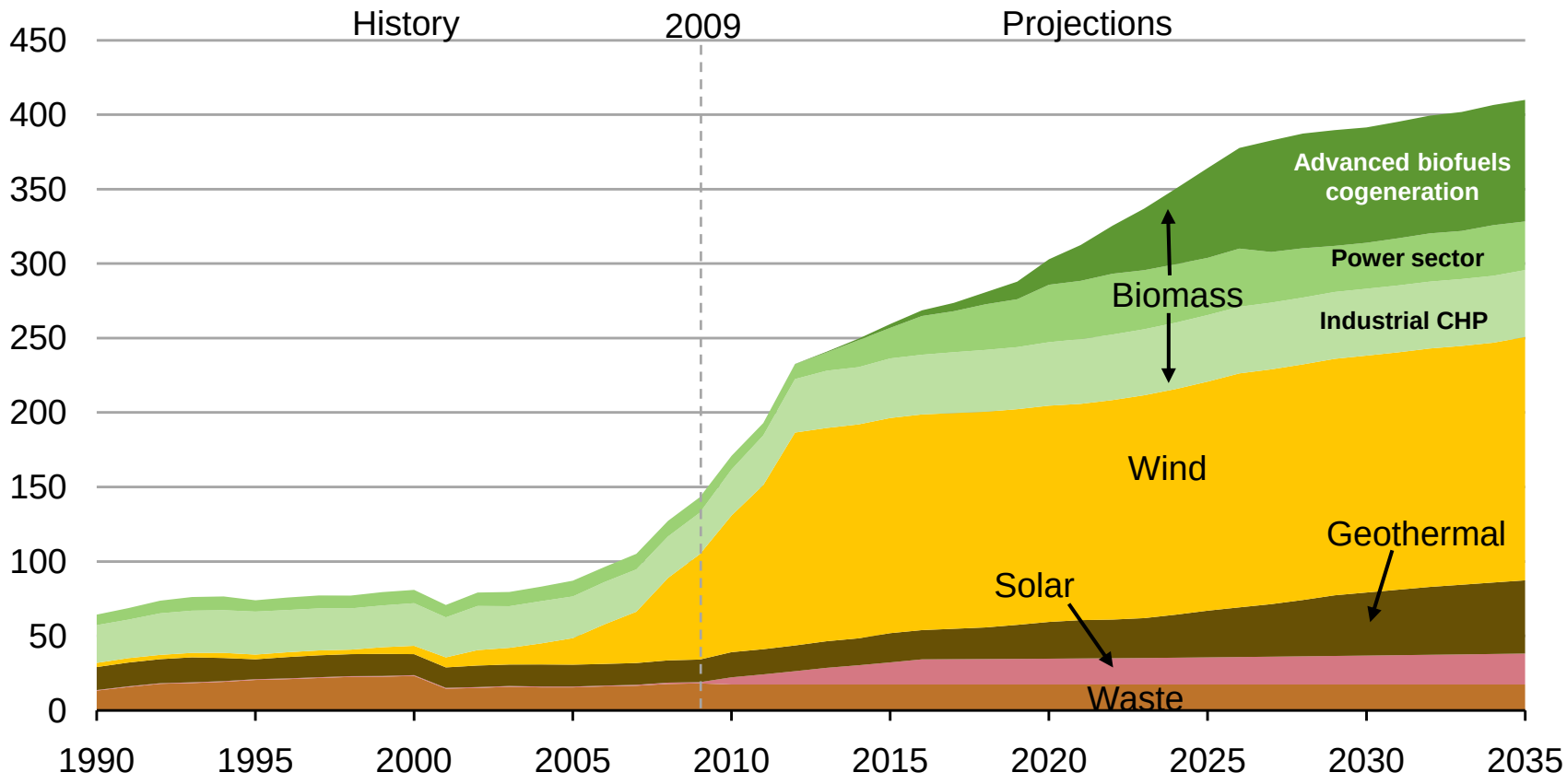
* Includes pumped storage

Source: EIA, Annual Energy Outlook 2011

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

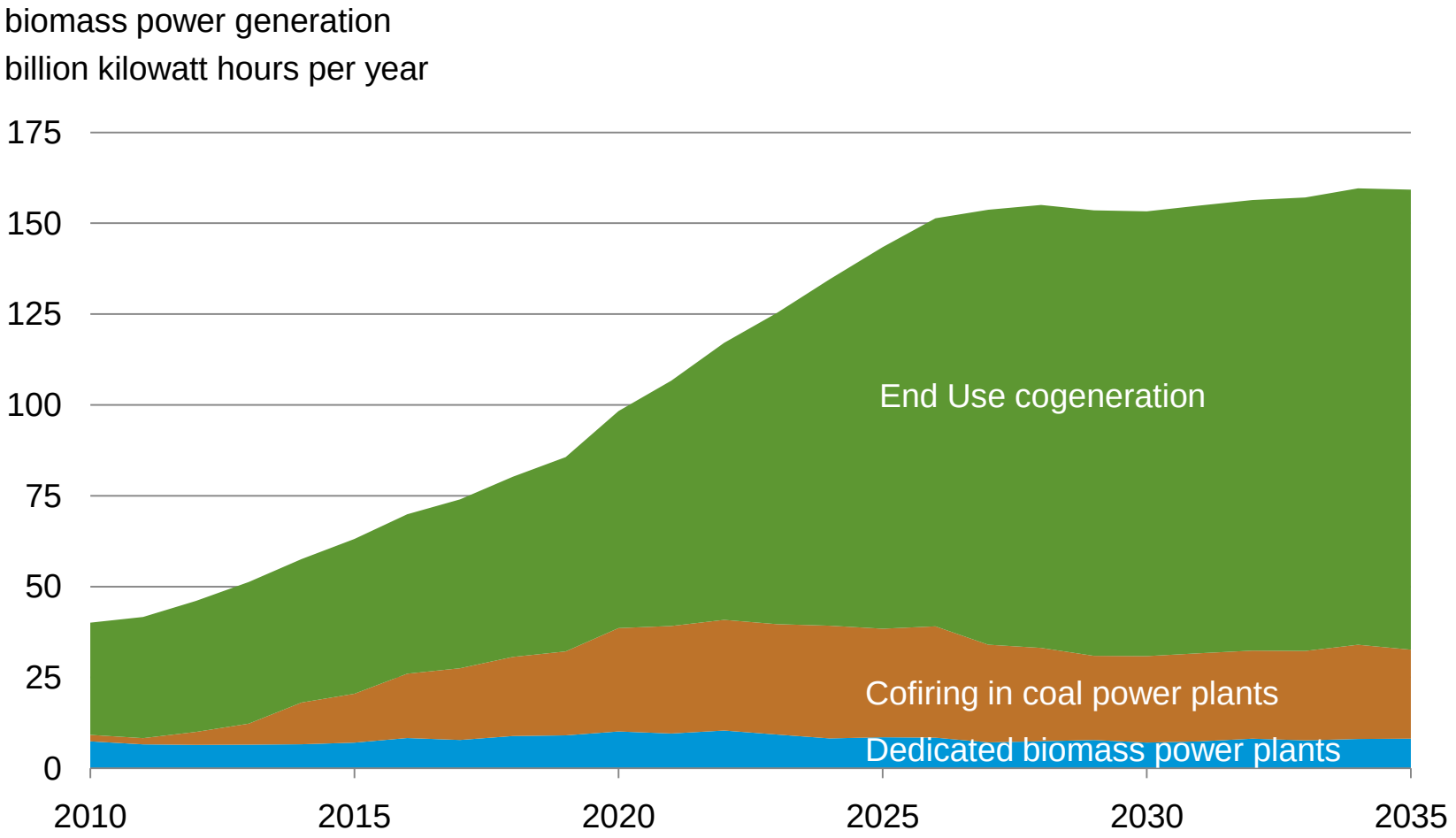
non-hydropower renewable generation

billion kilowatthours per year



Source: EIA, Annual Energy Outlook 2011

In the Reference Case, power generation from biomass sources is limited in the electricity sector; main growth in co-generation

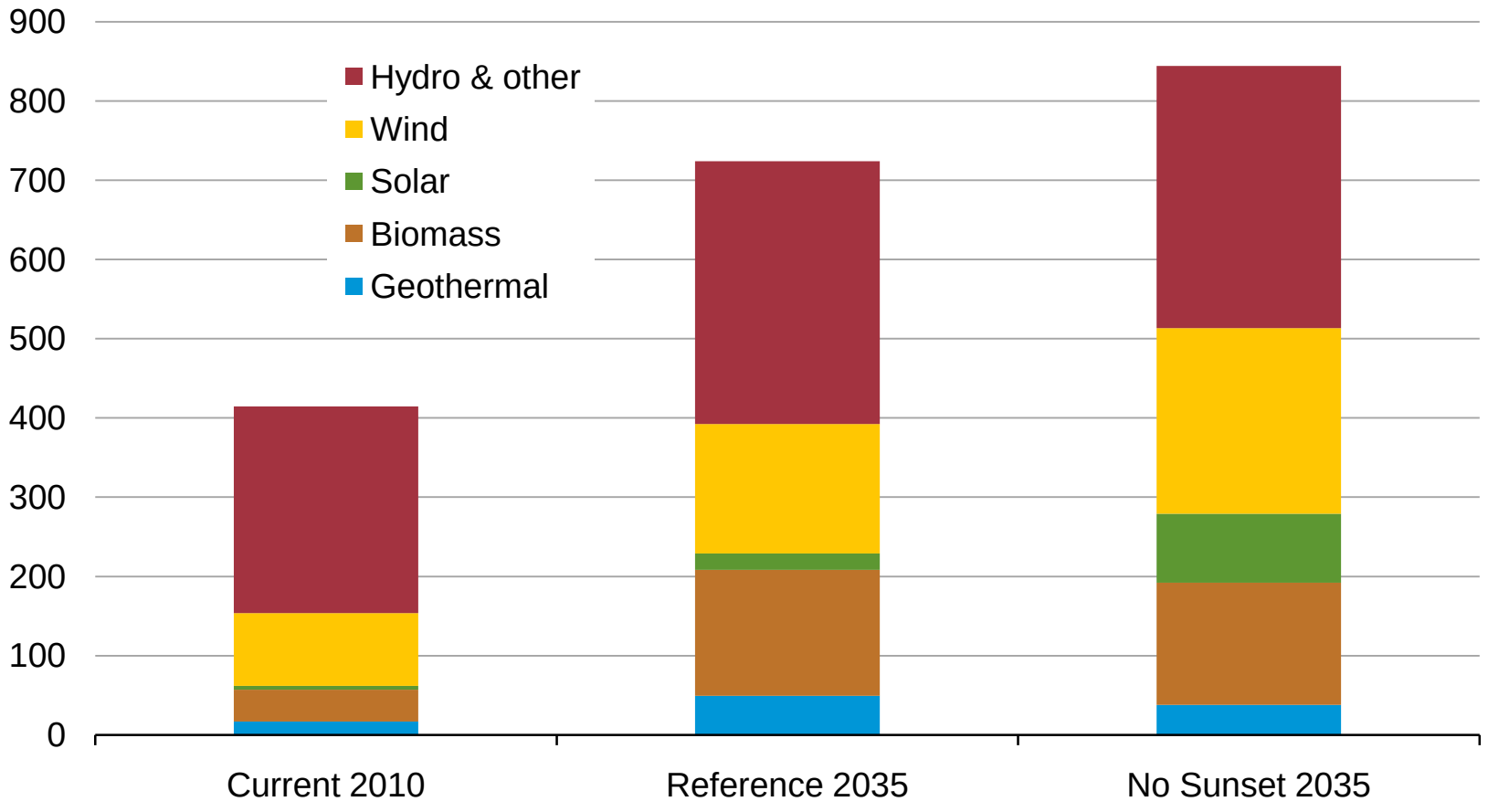


Source: EIA, Annual Energy Outlook 2011

When renewable tax credits are extended indefinitely, wind and solar capture market share at the expense of biomass and geothermal

total electricity generation

billion kilowatt hours per year

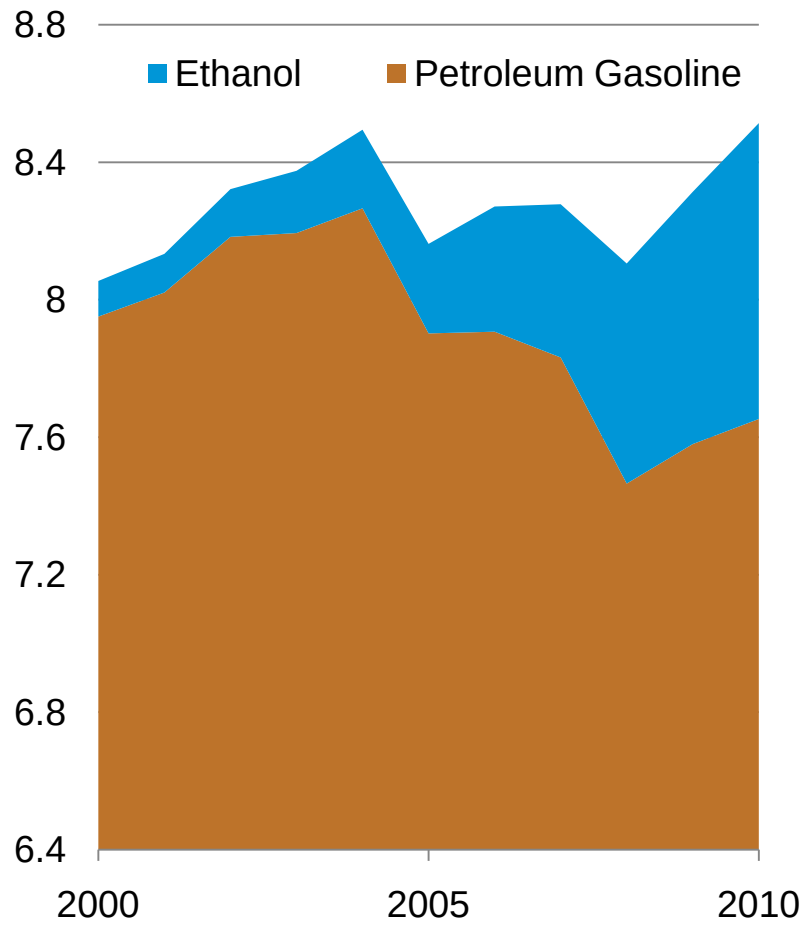


Source: EIA, Annual Energy Outlook 2011

Liquid fuels

The liquid fuels industry landscape has changed rapidly in recent history due to the economy, biofuels, fuel economy, and oil prices

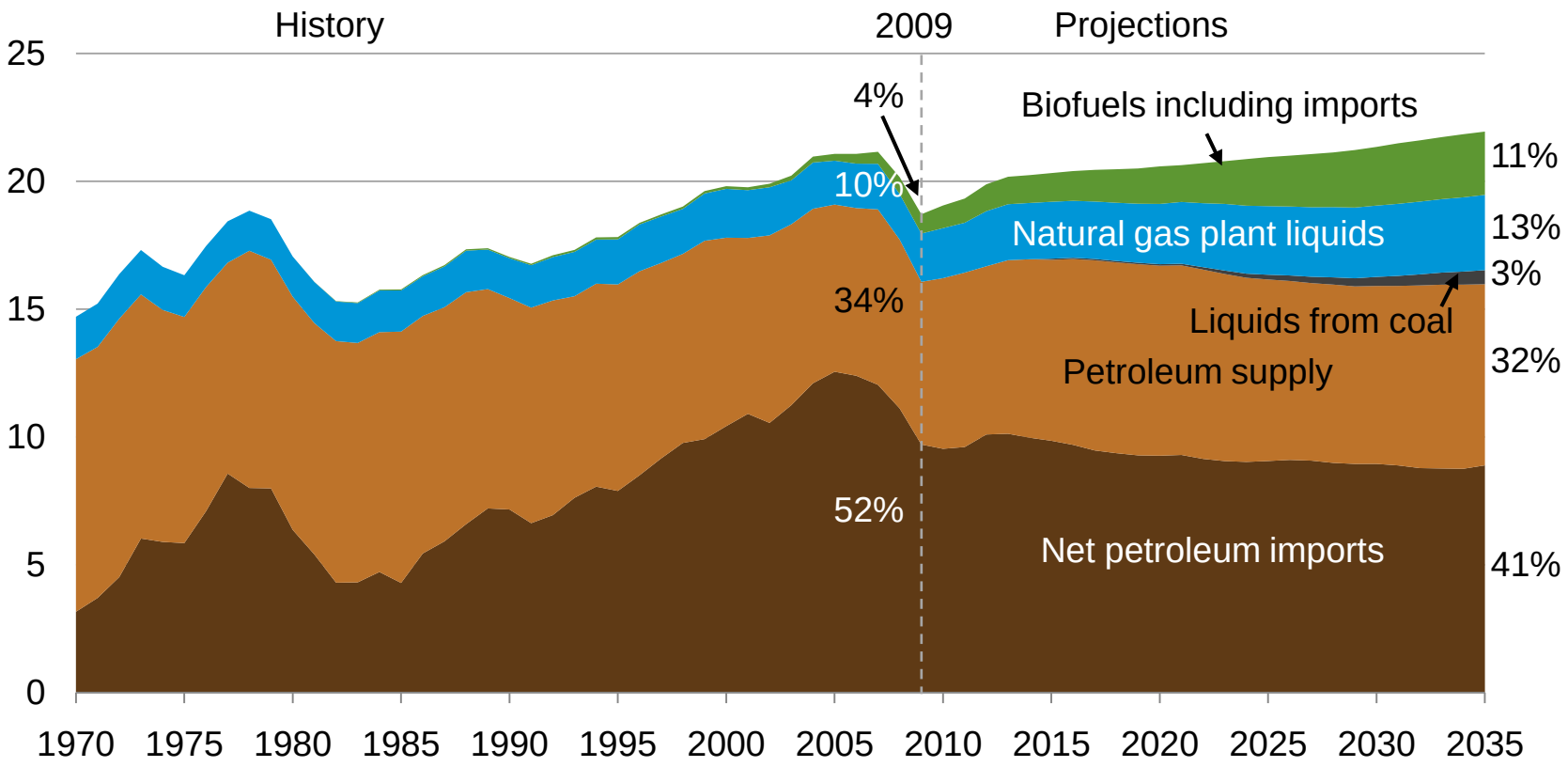
U.S. motor gasoline consumption
million barrels per day



- Liquid biofuels provide blendable fuels for transportation
- Makes them one of the most straightforward substitutes for petroleum
- But the path has been and remains challenging

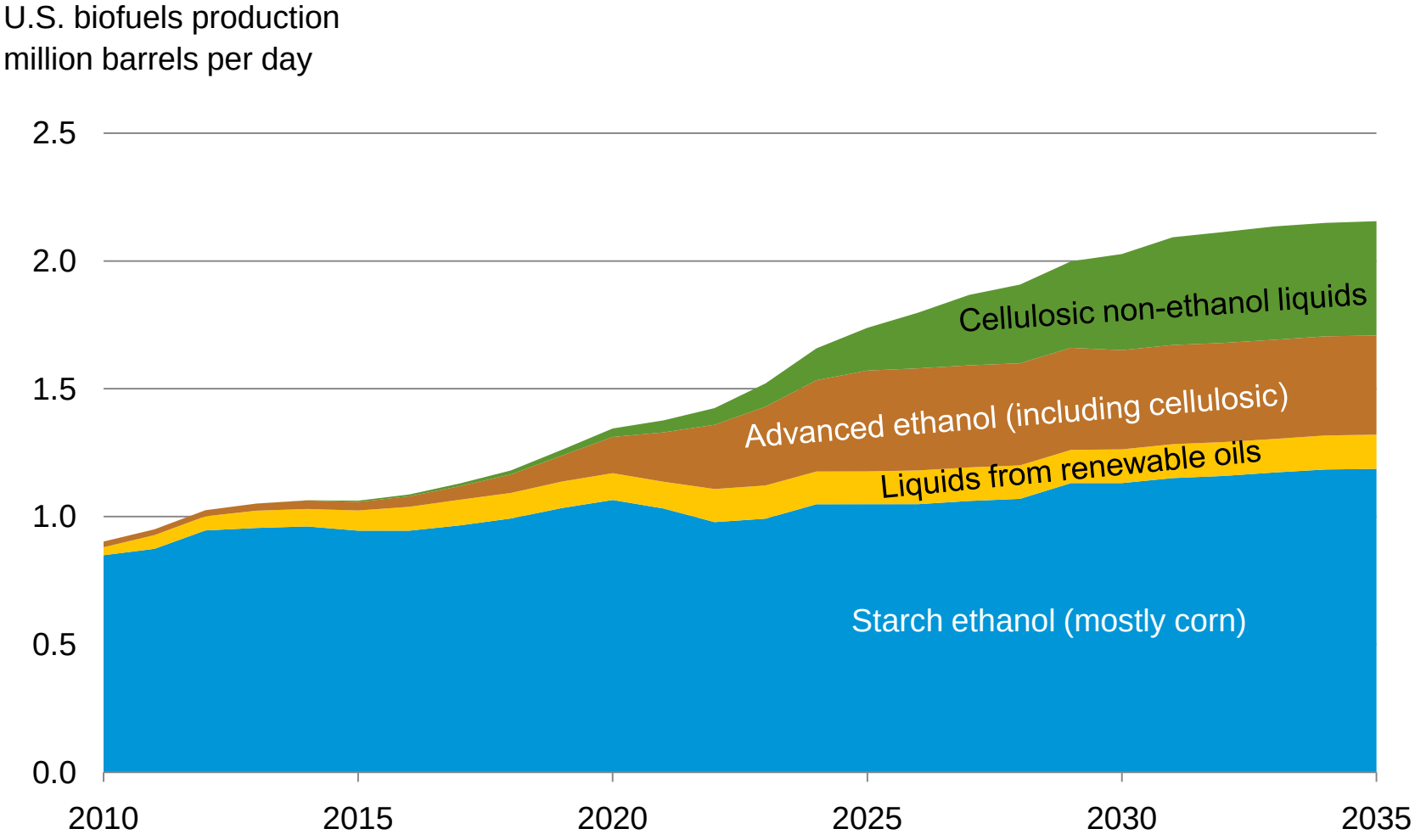
The import share of liquids consumption drops over the projection due in part to increased fuel efficiency and biofuel production

U.S. liquid fuels consumption
million barrels per day



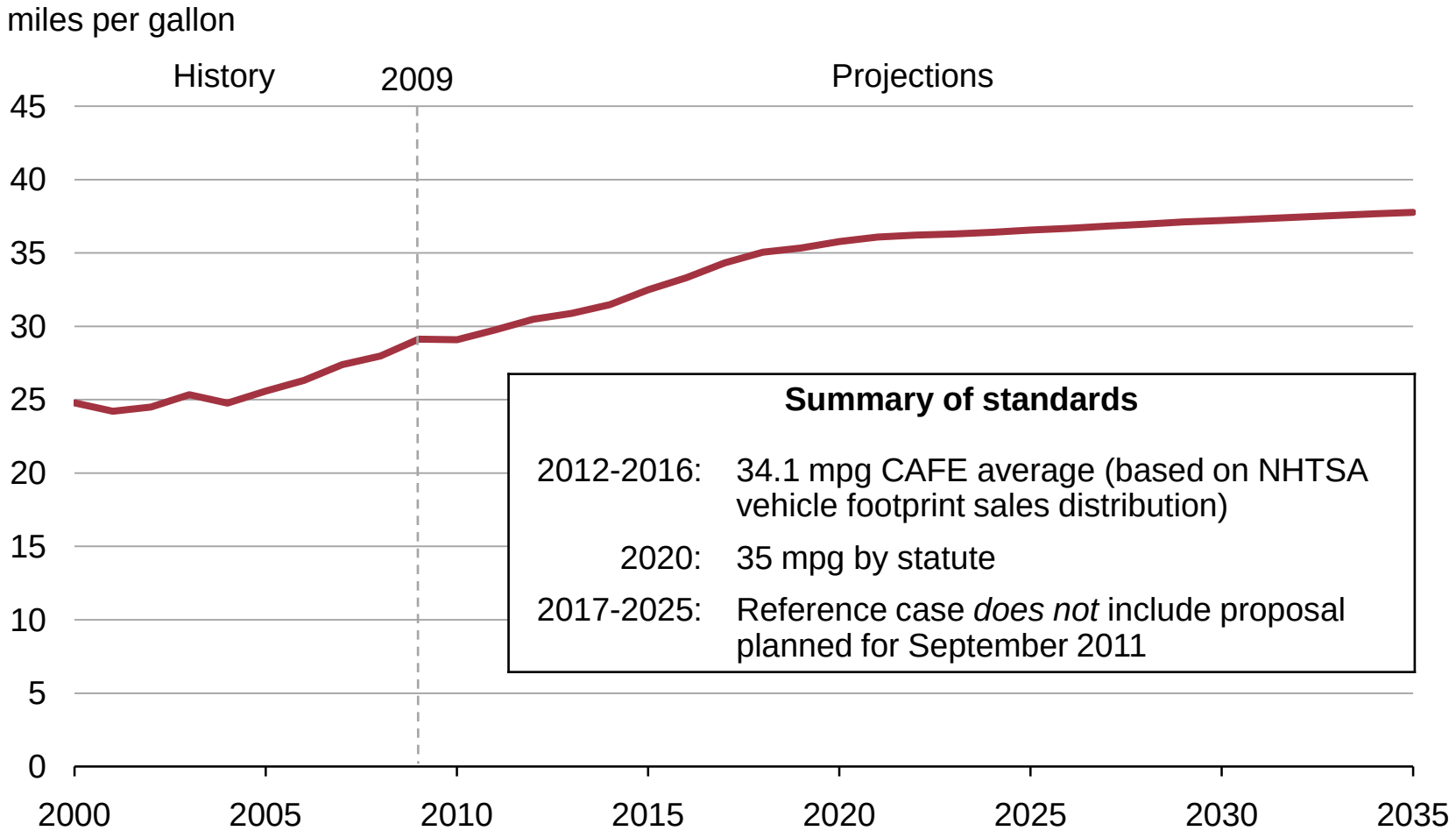
Source: EIA, Annual Energy Outlook 2011

Domestic biofuels production grows rapidly, displacing 1.25 million barrels per day of gasoline and 360,000 barrels per day of diesel by 2035



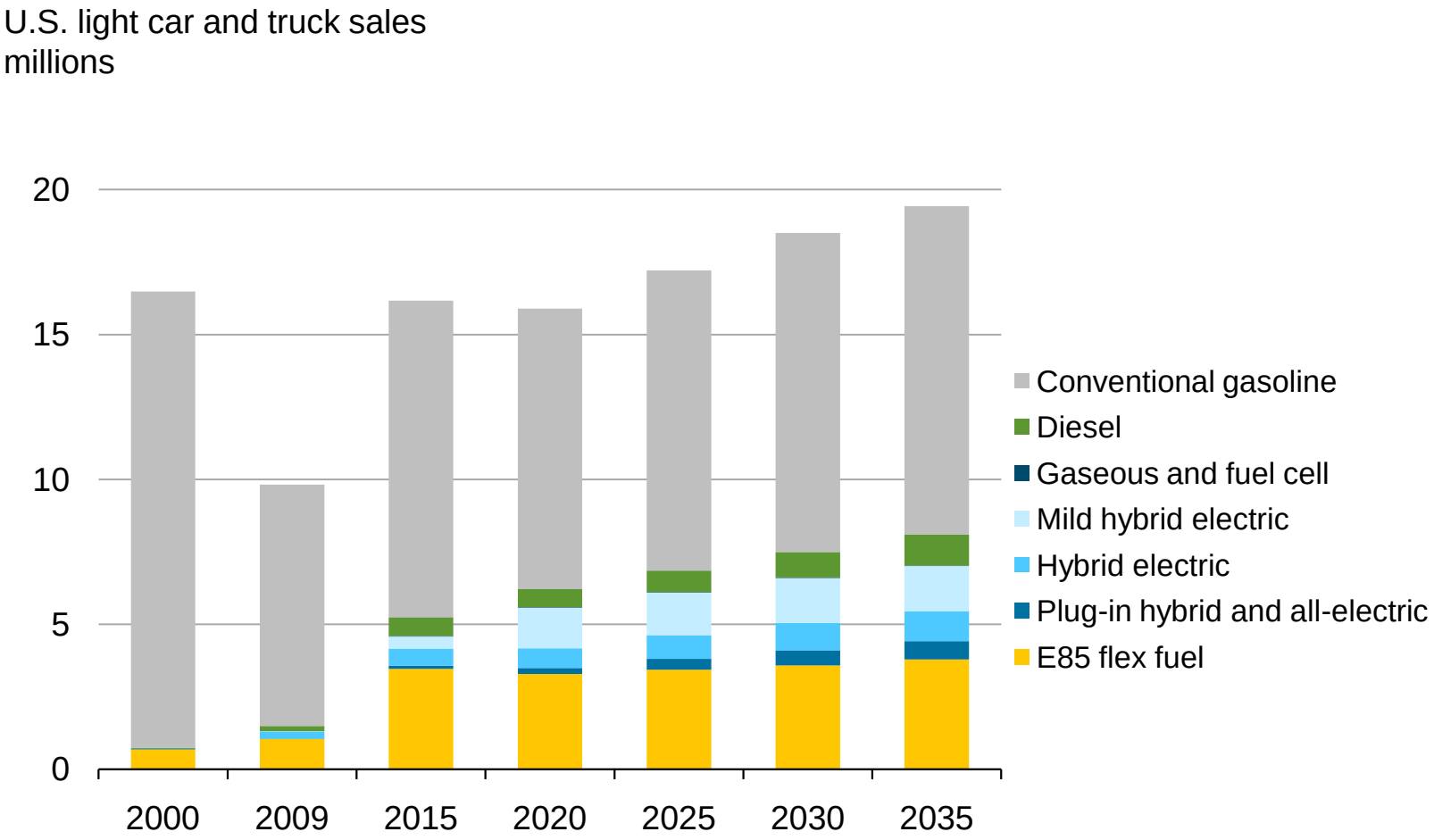
Source: EIA, Annual Energy Outlook 2011

New light duty vehicle fuel economy achieves almost 38 mpg by 2035 in the Reference case, slowing the growth of fuel demand



Source: EIA, Annual Energy Outlook 2011

FFVs make up the largest share of unconventional vehicles, which account for 40% of U.S. light-duty vehicle sales in 2035

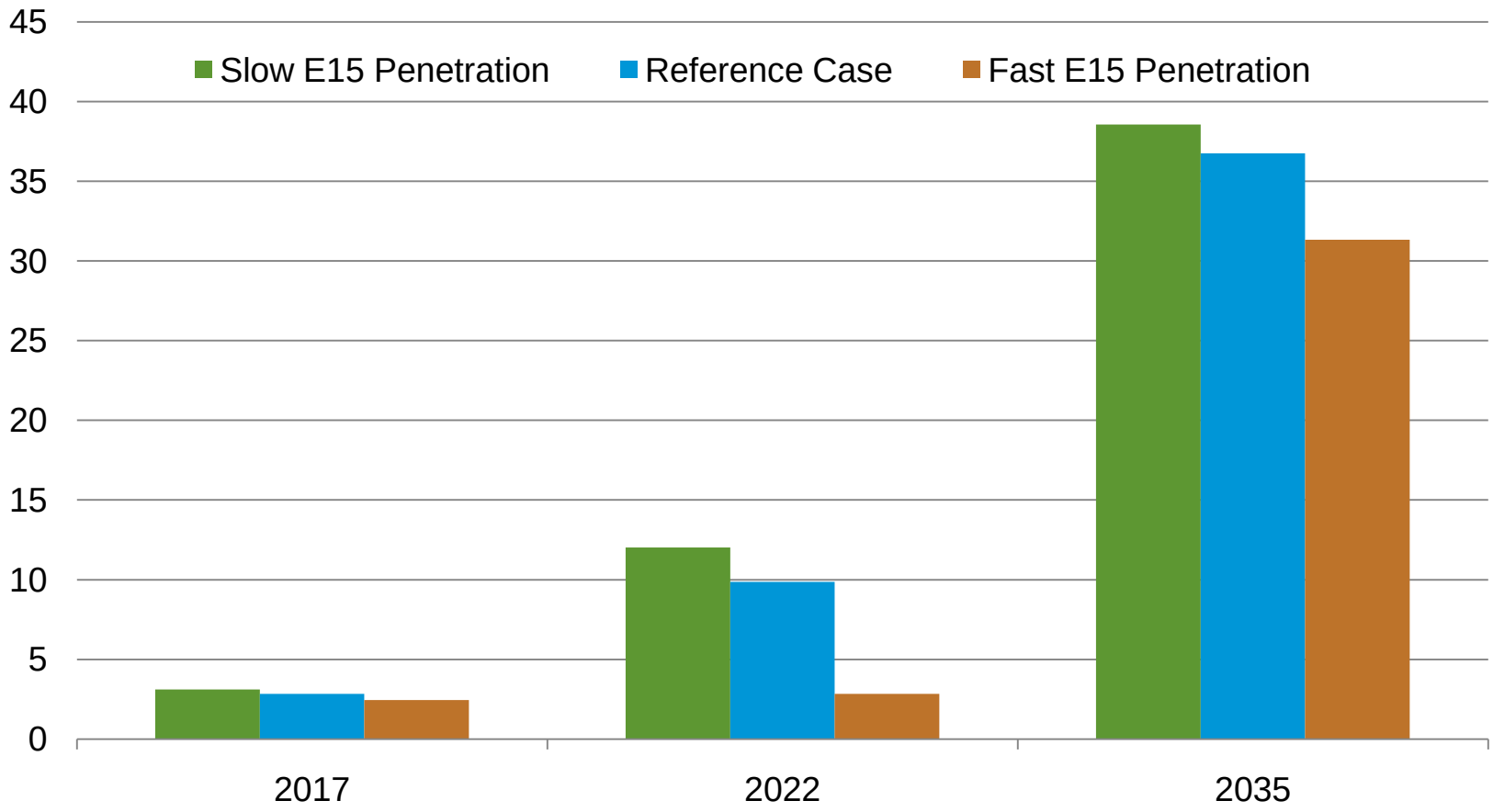


Source: EIA, Annual Energy Outlook 2011

E85 infrastructure needs for meeting the RFS depend on the penetration of E15 into the marketplace

Ethanol blending into E85

1000s of stations



Source: EIA, Annual Energy Outlook 2011

Summary and view to the future

- Policy changes and higher oil prices are moving the United States to more use of biofuels
- Uncertainties still lie ahead
  - Land use
  - Infrastructure changes
  - Technology development
  - Political and market uncertainties

For more information

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

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

Annual Energy Outlook | www.eia.gov/aeo

International Energy Outlook | www.eia.gov/ieo

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