# Fuels Used in Electricity Generation

*For*

*U.S. Nuclear Infrastructure Council*

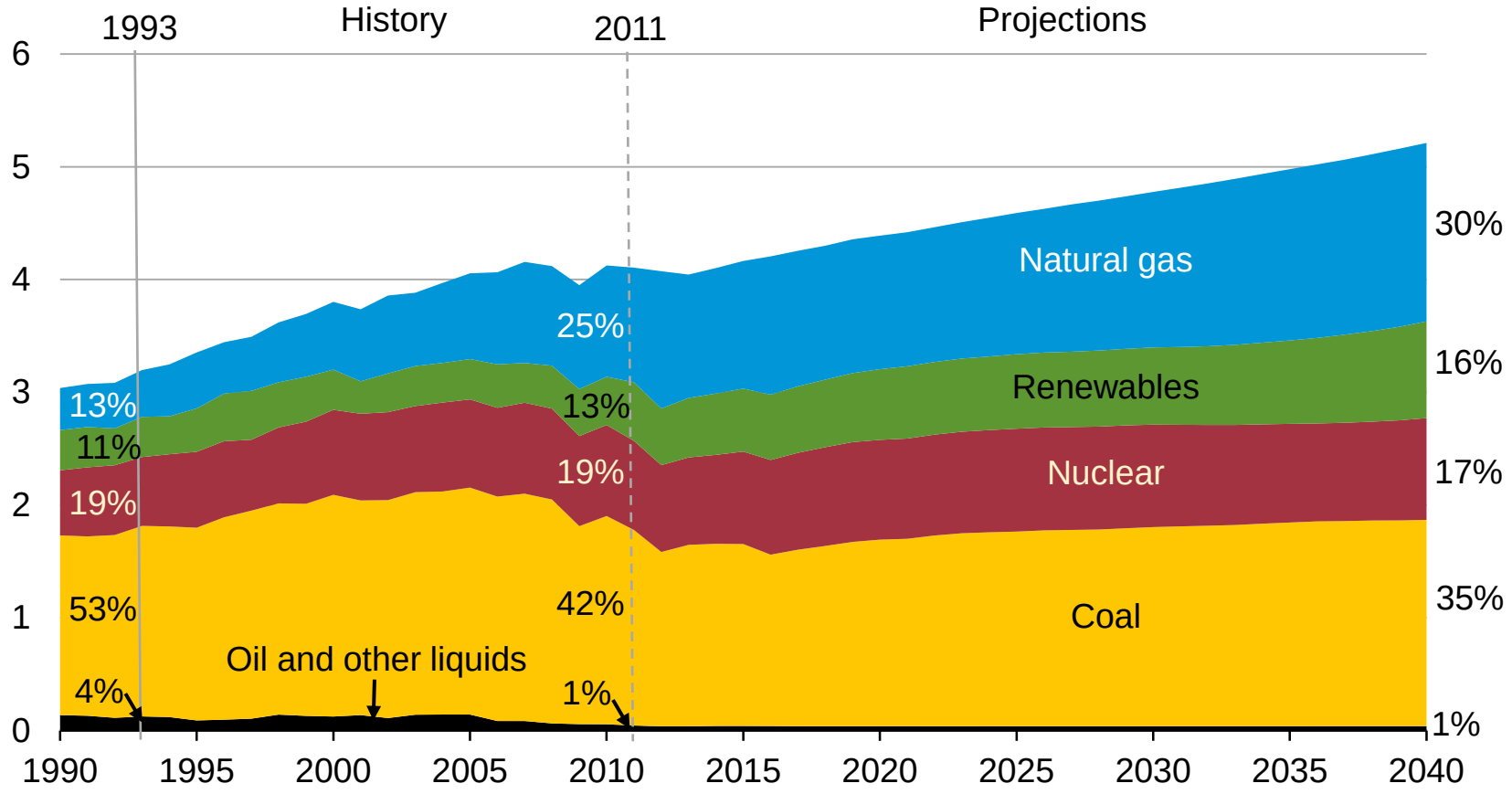
*June 05, 2013 | Washington, DC*

*By*

*Adam Sieminski, Administrator*

# 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*

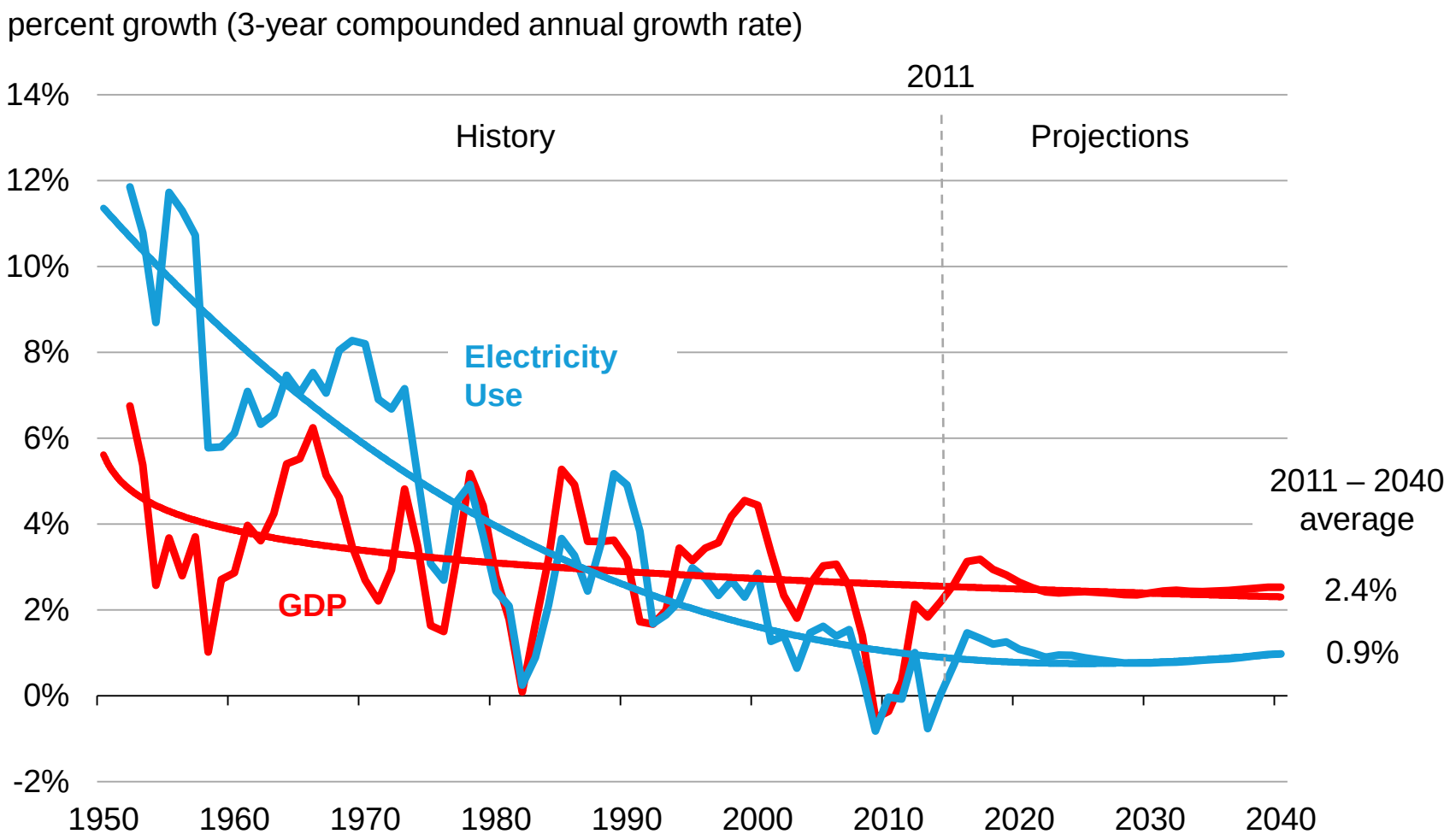
# Key results from the *AEO2013* reference case relating to the electric power sector

- While coal still remains the largest single source of U.S. electricity generation, it's role declines as natural gas and renewables pick up increasing market share
- Natural gas production is higher throughout the reference case projection than it was in AEO2012, serving the industrial and power sectors and an expanding export market
- Role of nuclear power in the U.S. generation mix stays relatively steady
- The U.S. becomes a larger exporter of natural gas and coal than was projected in the AEO2012 reference case
- U.S. energy-related carbon dioxide emissions remain more than five percent below their 2005 level through 2040, reflecting increased efficiency and the shift to a less carbon-intensive fuel mix

# Why we ~~might~~ ~~could~~ will be wrong?

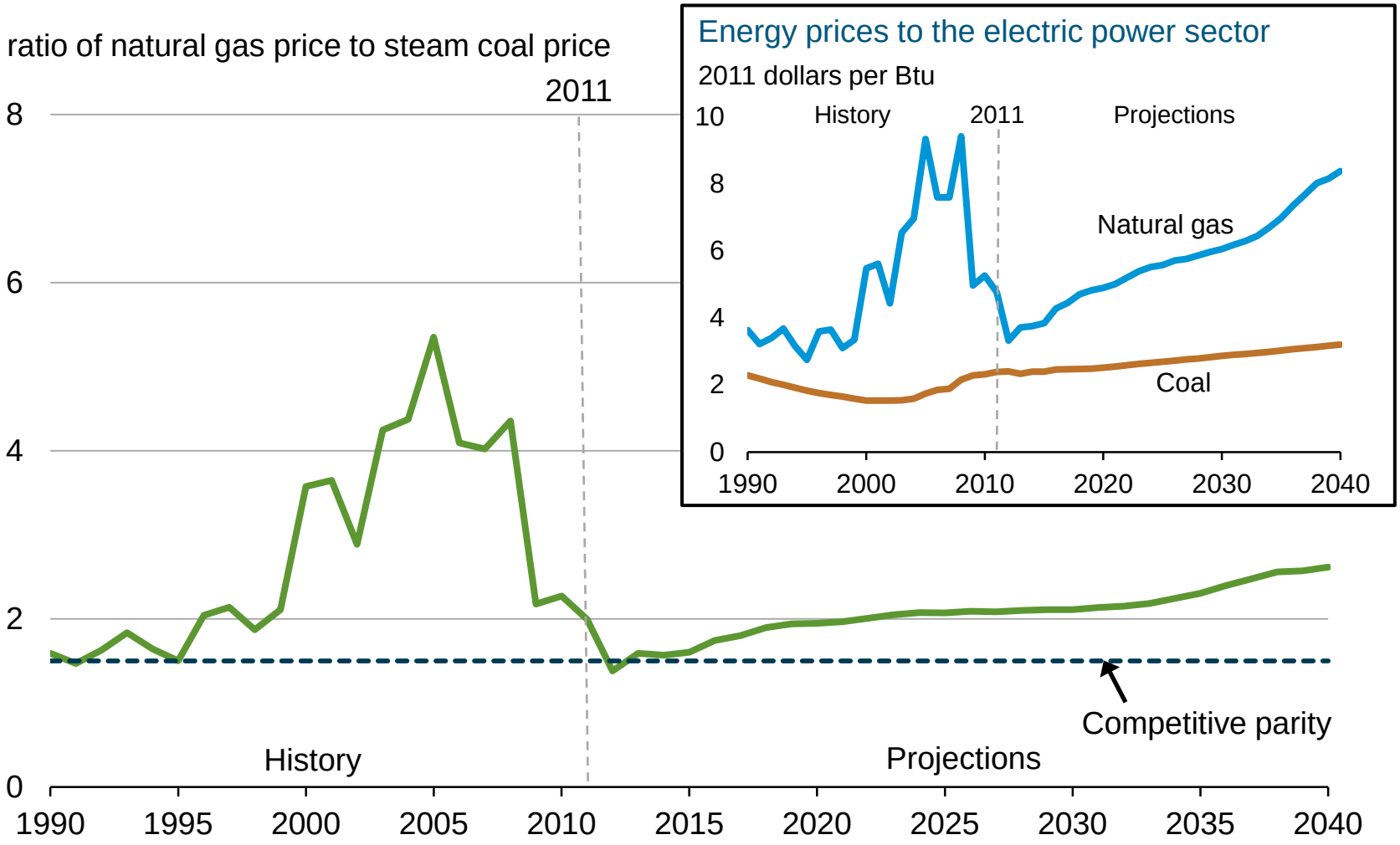
- Changing policies and regulations
- Changing consumer preferences
- Faster / slower economic growth
- Faster / slower technological progress
- Different relative fuel prices
- Technological breakthroughs

# Electricity demand: growth in electricity use slows, but still increases by 28% from 2012 to 2040




*Source: EIA, Annual Energy Outlook 2013*

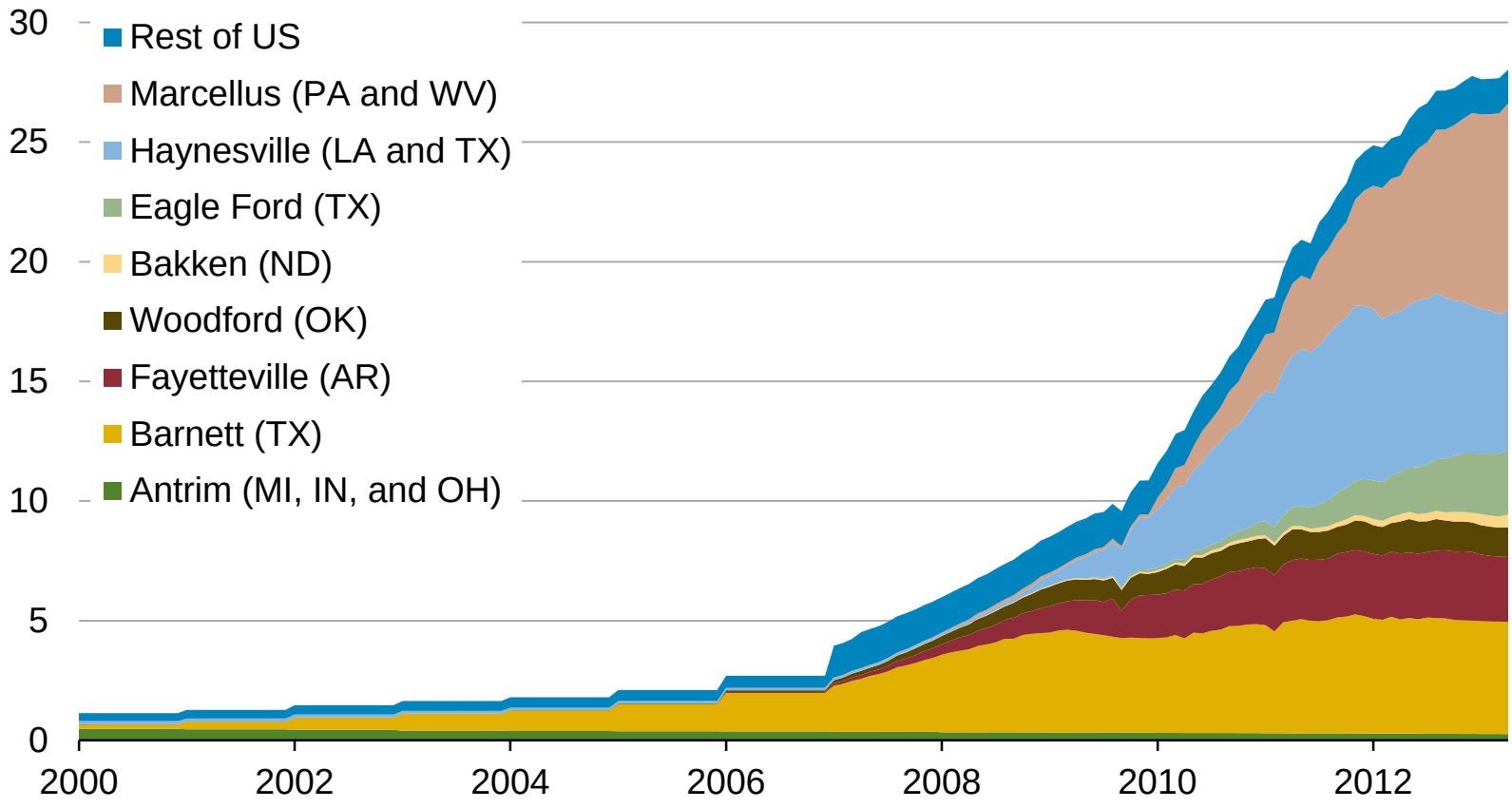
# Natural gas and coal prices: coal regains competitive advantage relative to natural gas over time on a national average basis




*Source: EIA, Annual Energy Outlook 2013*

# Domestic production of shale gas has grown dramatically over the past few years

shale gas production (dry)
billion cubic feet per day

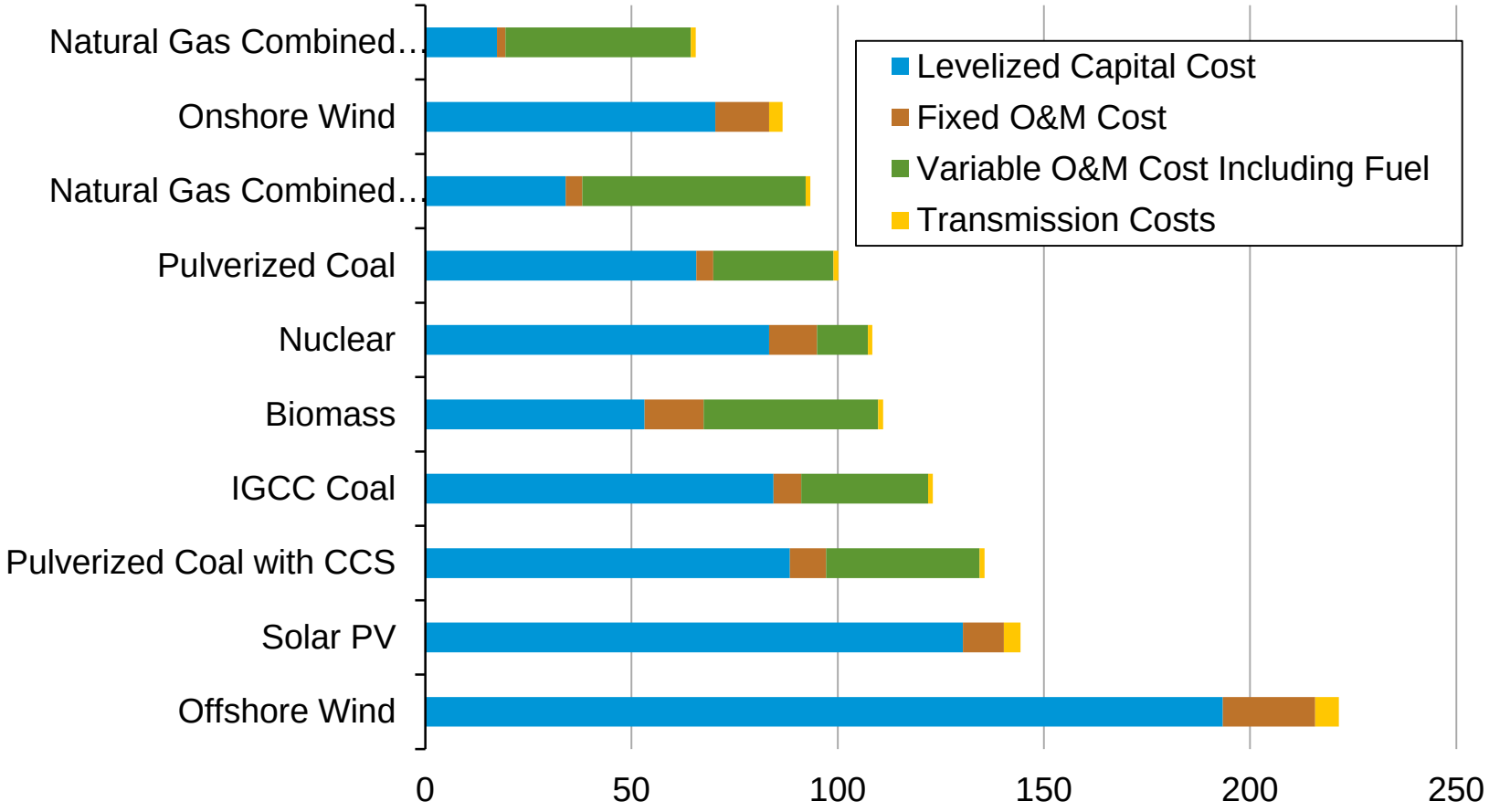



*Sources: LCI Energy Insight gross withdrawal estimates as of April 2013 and converted to dry production estimates with EIA-calculated average gross-to-dry shrinkage factors by state and/or shale play.*

# New power plant costs: levelized cost of electricity

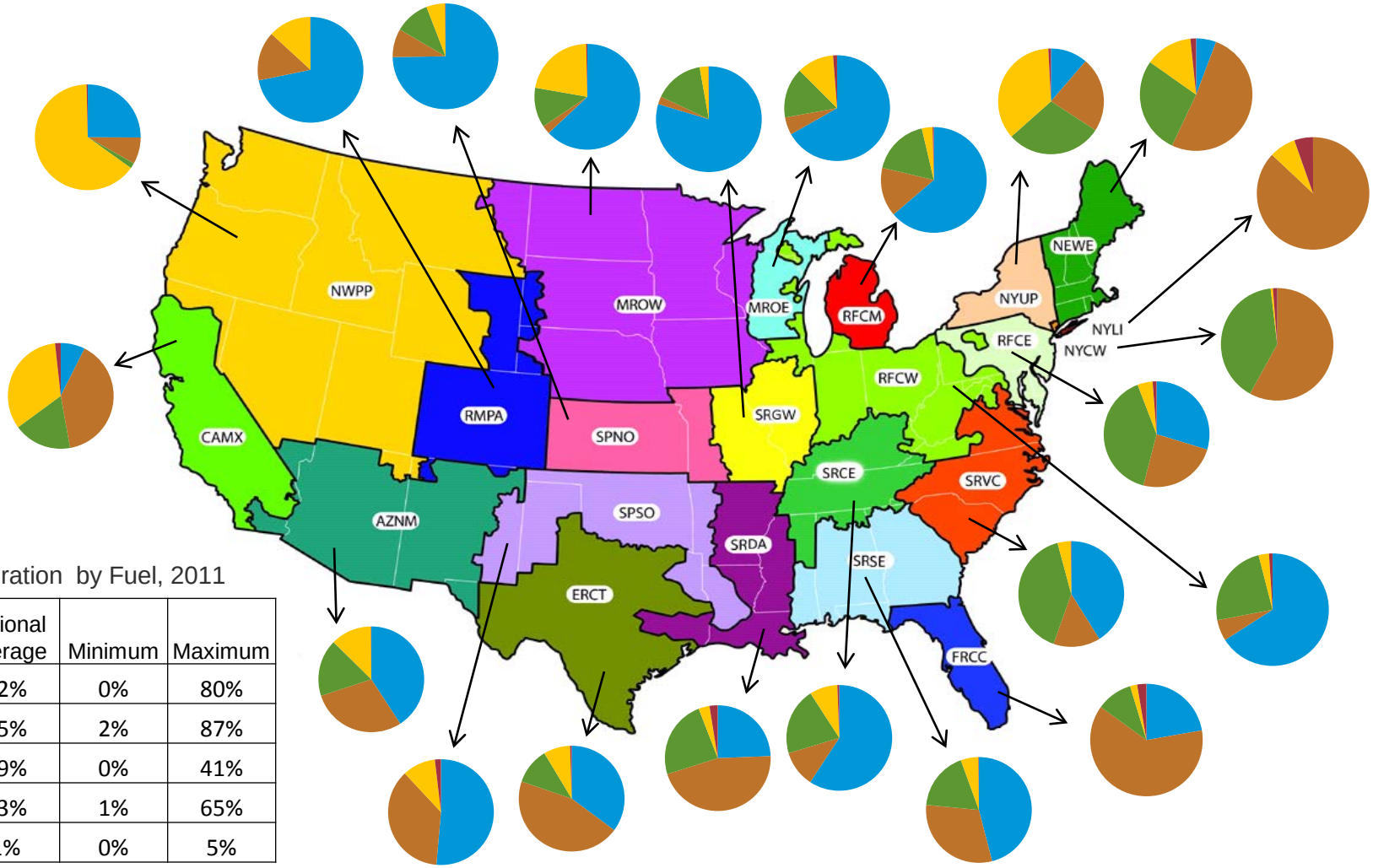
costs for new U.S. electricity power plants in 2018

2011 dollars per megawatthour




*Source: EIA, Annual Energy Outlook 2013*

# The fuel mix for electricity generation varies widely across U.S. regions (2011)

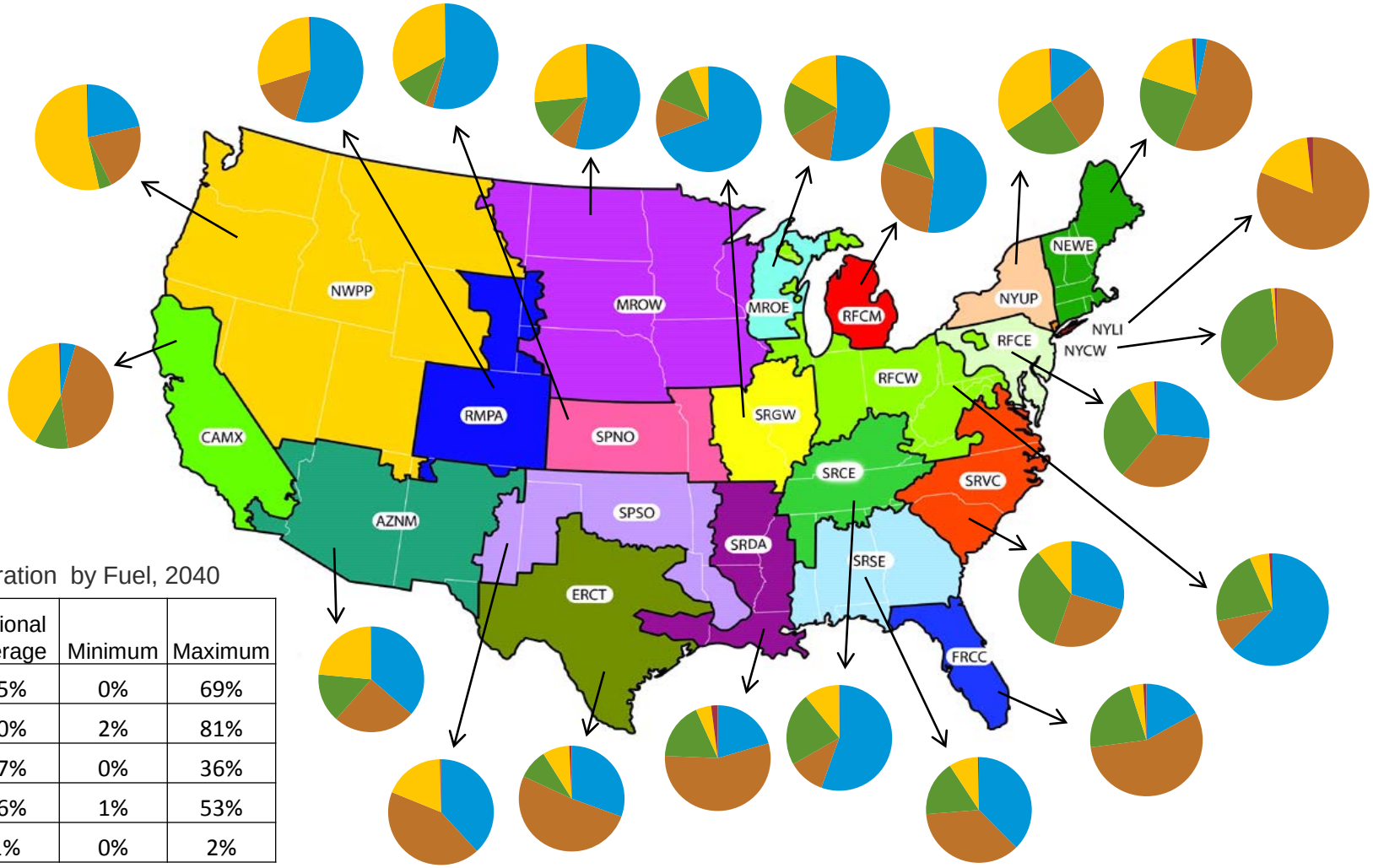



Share of Generation by Fuel, 2011

| | National Average | Minimum | Maximum |
|---|---|---|---|
| Coal | 42% | 0% | 80% |
| Natural Gas | 25% | 2% | 87% |
| Nuclear | 19% | 0% | 41% |
| Renewables | 13% | 1% | 65% |
| Oil / Other | 1% | 0% | 5% |

*Source: EIA, Annual Energy Outlook 2013, based on Form EIA-923*

# The projected fuel mix for electricity generation by region (2040)




Share of Generation by Fuel, 2040

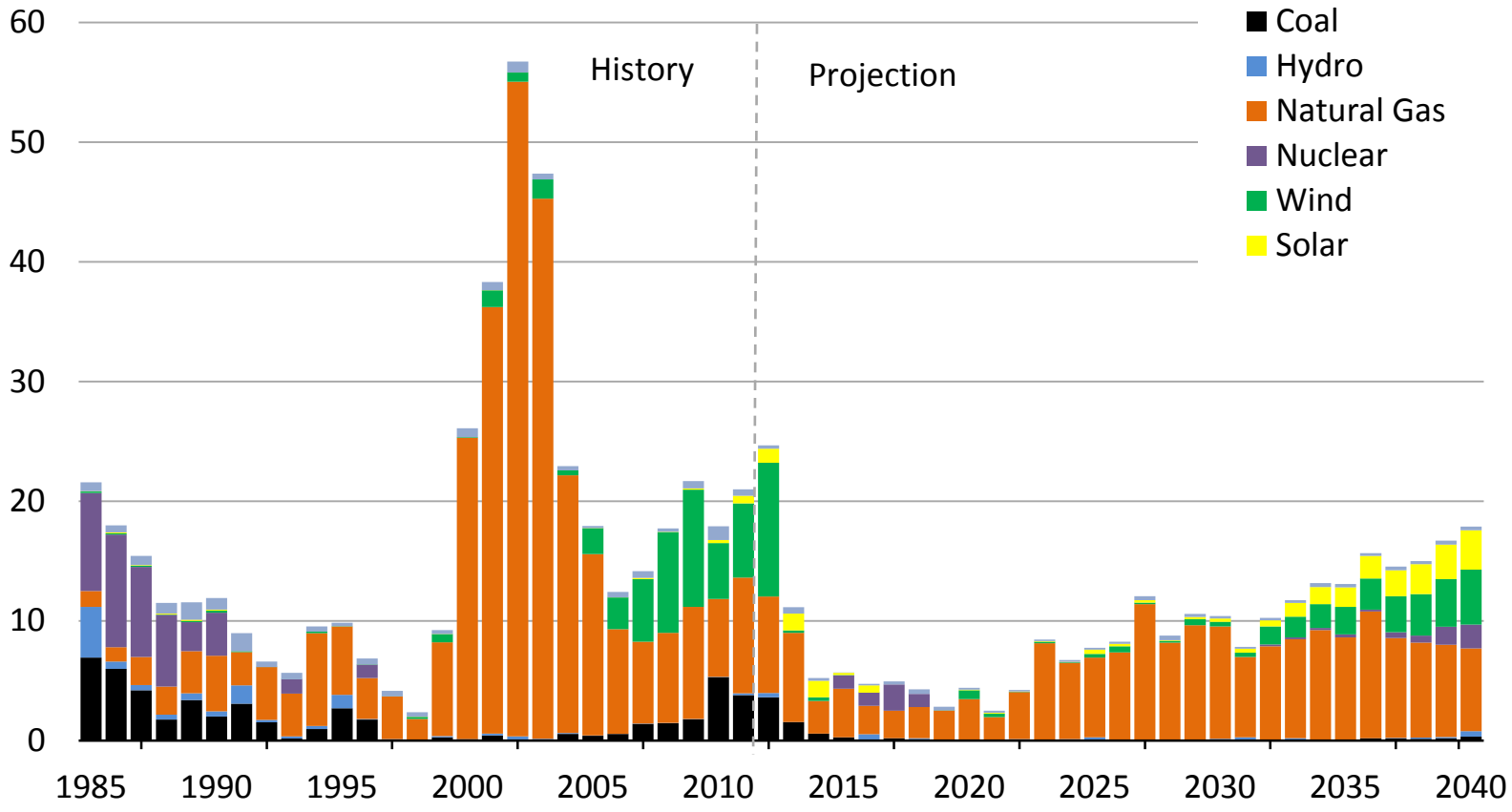
| | National Average | Minimum | Maximum |
|---|---|---|---|
| Coal | 35% | 0% | 69% |
| Natural Gas | 30% | 2% | 81% |
| Nuclear | 17% | 0% | 36% |
| Renewables | 16% | 1% | 53% |
| Oil / Other | 1% | 0% | 2% |

*Source: EIA, Annual Energy Outlook 2013*

# Additions to electricity generation capacity, 1985-2040

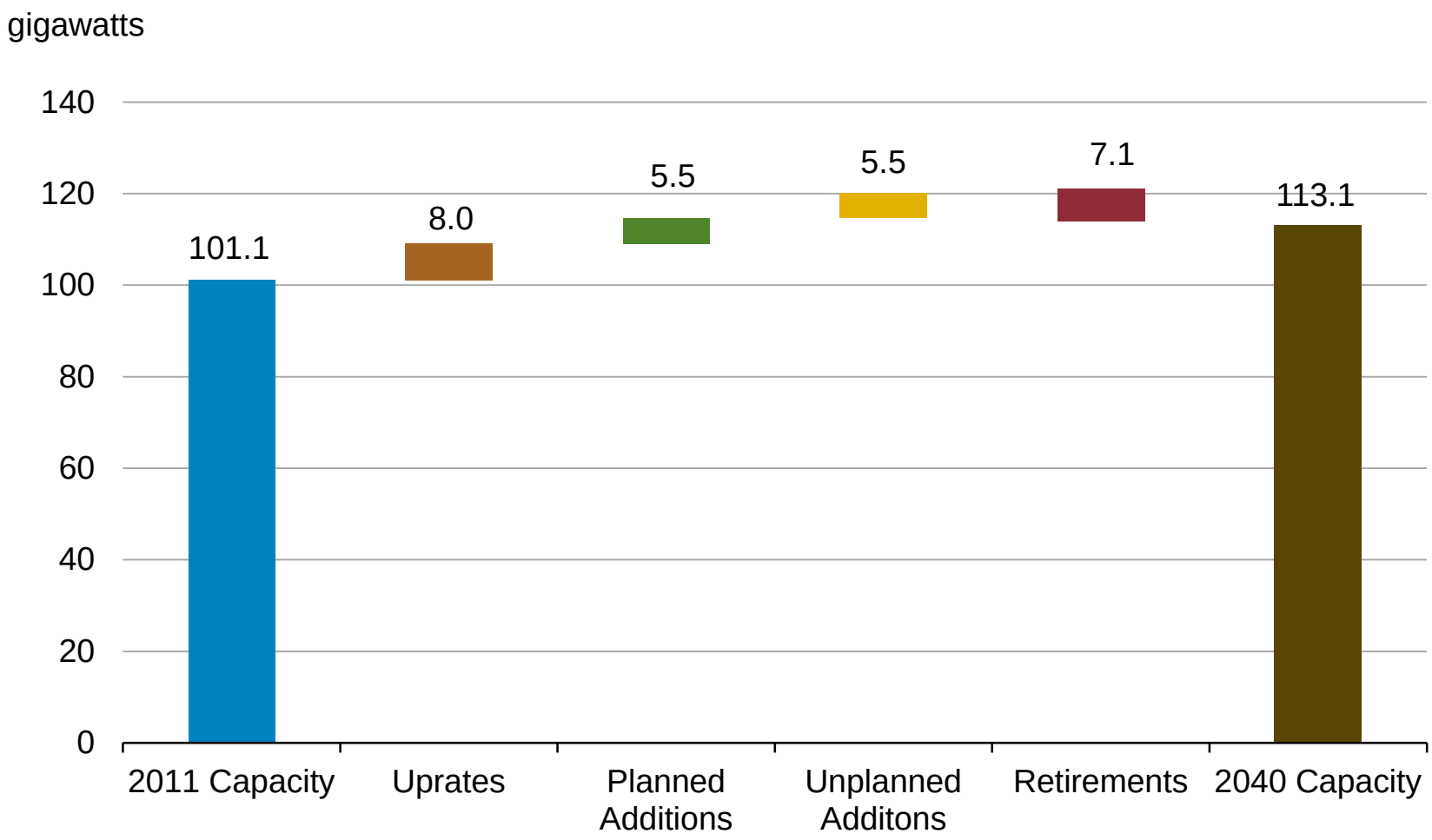
U.S. electricity generation capacity additions

gigawatts




*Source: EIA Form 860 & EIA, Annual Energy Outlook 2013*

# Changes in nuclear capacity for the *AEO2013* reference case

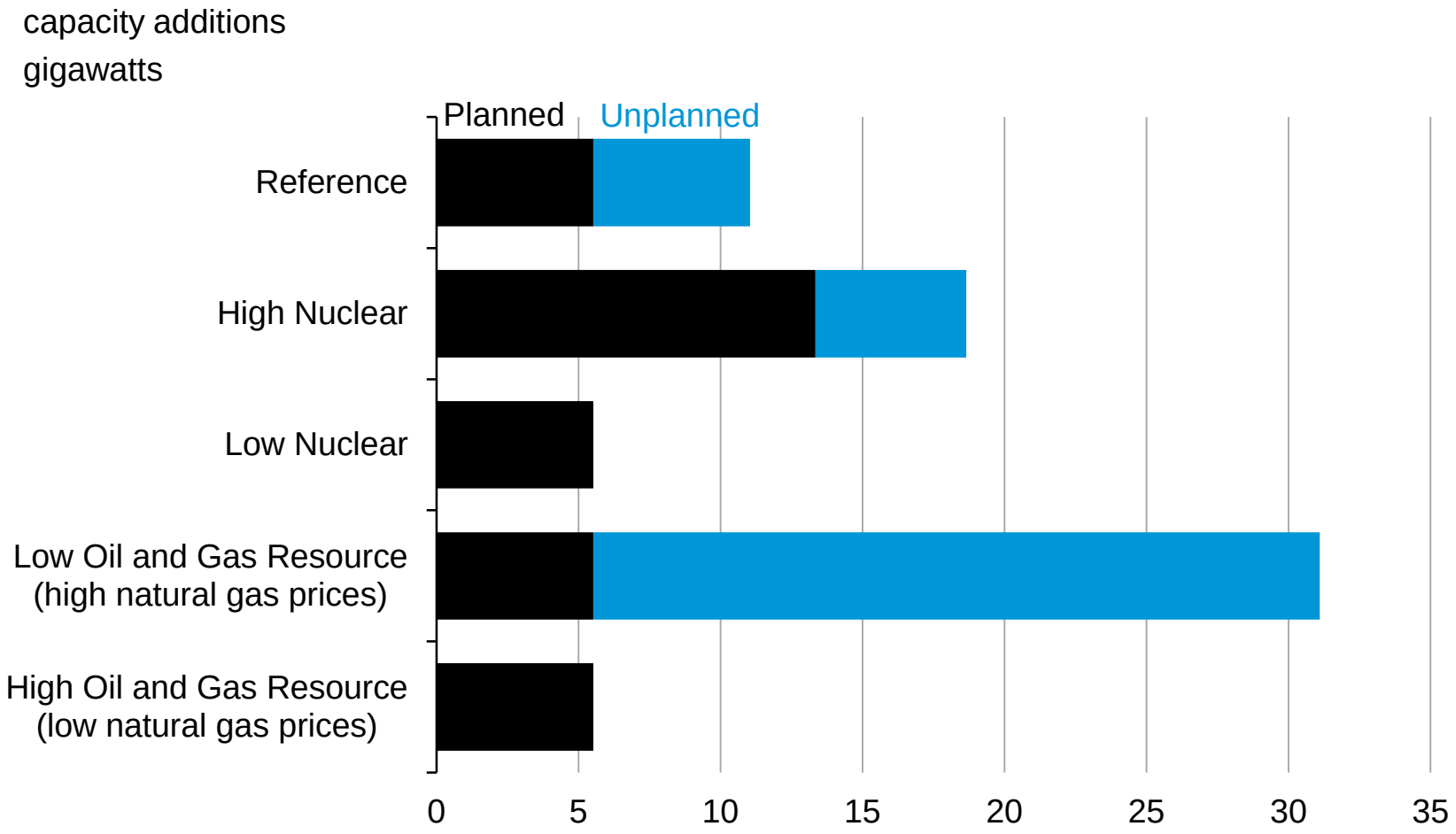



*Source: EIA, Annual Energy Outlook 2013*

# Nuclear relevant side cases in *AEO2013*

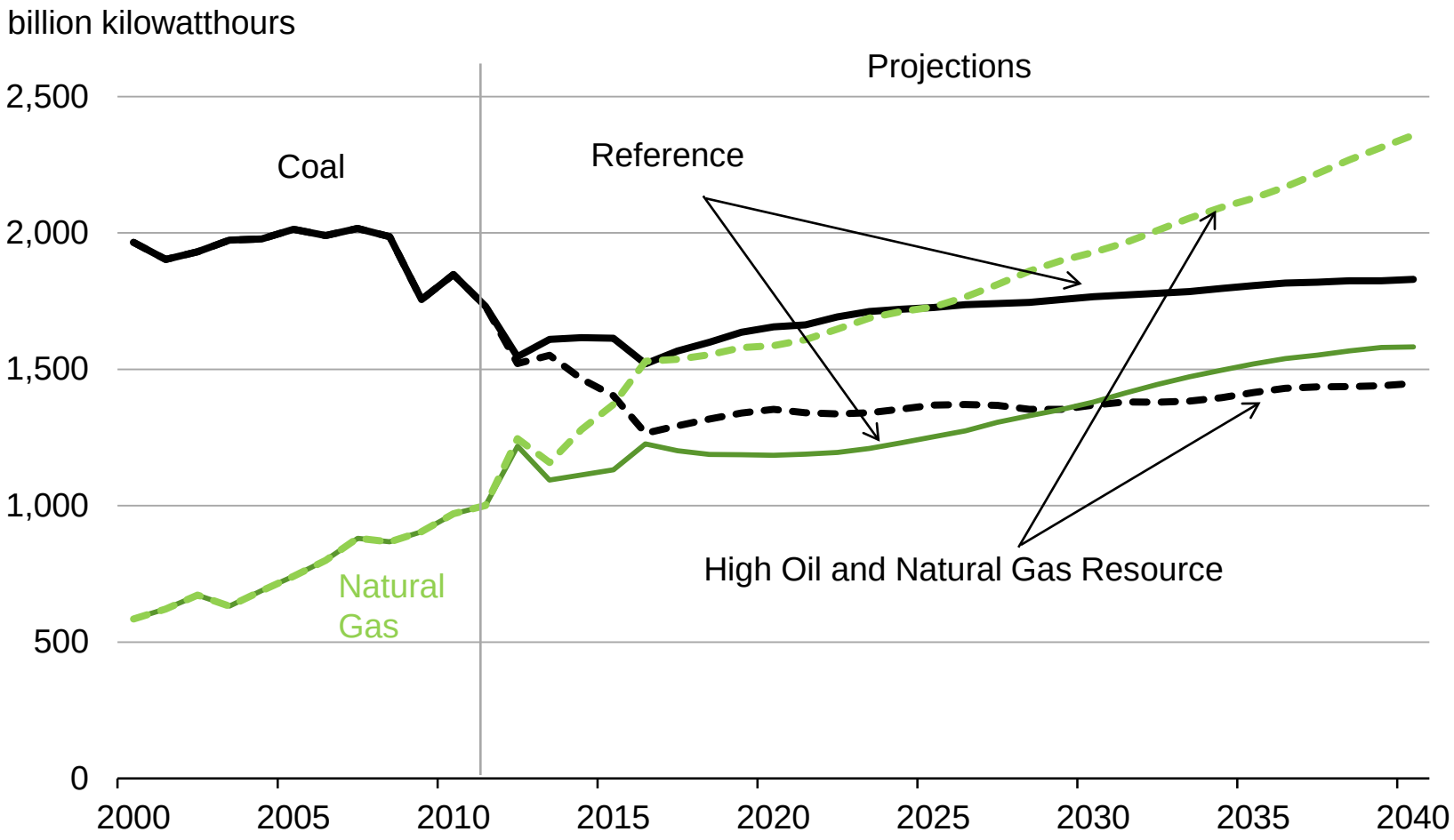
- High/low nuclear
- High/low oil and gas resource
- Small modular reactors (SMRs) ???
- $CO_2$ fee cases

# Nuclear capacity additions in *AEO2013* vary under different assumptions



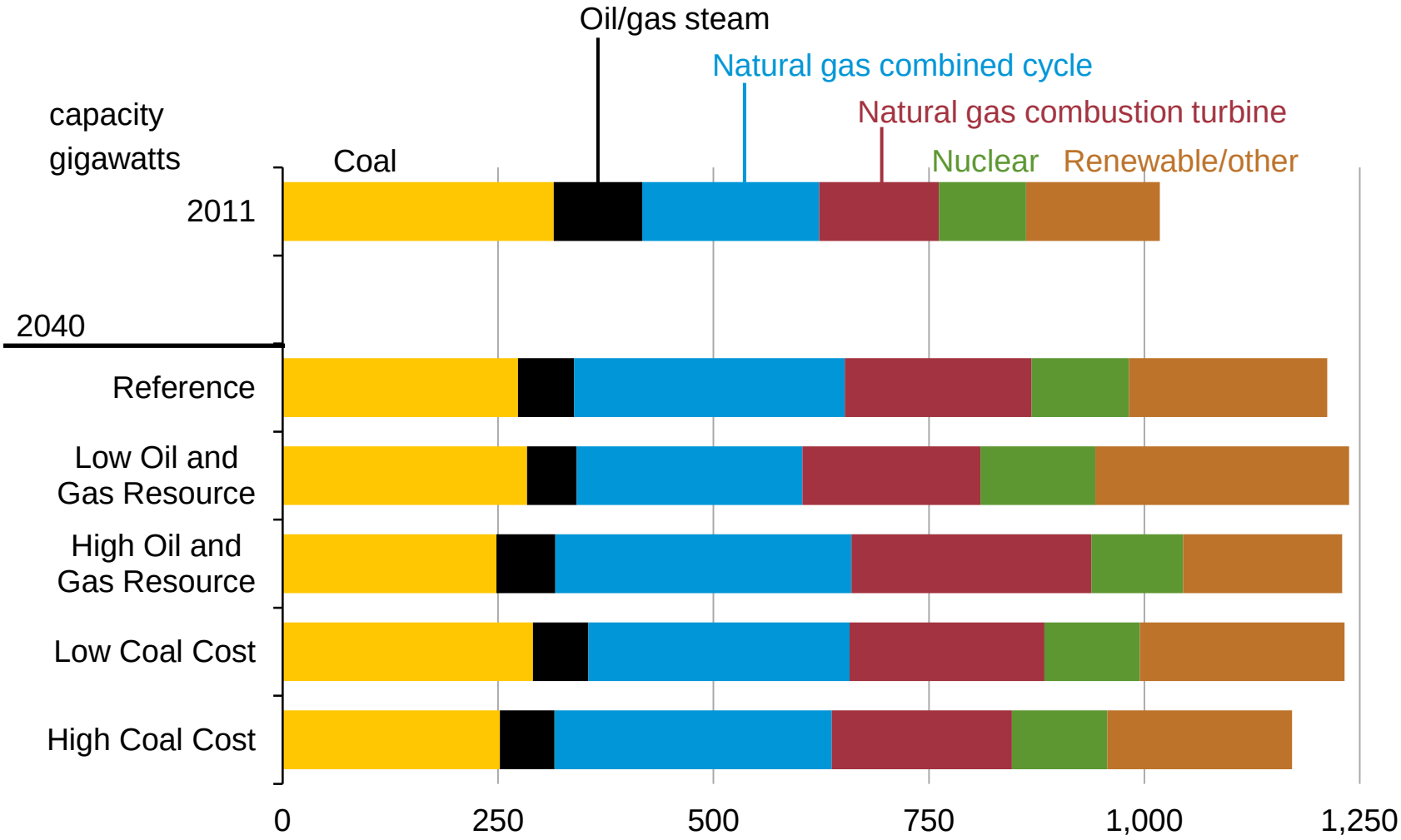

*Source: EIA, Annual Energy Outlook 2013*

# If natural gas prices stay low, coal is permanently displaced as the leading generation source in the near future




*Source: EIA, Annual Energy Outlook 2013*

# Power sector electricity generation capacity by fuel in five cases, 2011 and 2040




*Source: EIA, Annual Energy Outlook 2013*

# Small Modular Reactors (SMR)

- SMR technology differs from traditional, large-scale light-water reactor technology in both reactor size and plant scalability
- EIA conducted a side case to evaluate the effect of a shorter construction period on future nuclear capacity expansion
- The case showed that there are potential cost saving from the shorter construction periods but uncertainty about potential future operations costs remains.

# Changing electricity generation mix in *AEO2013* reference case and carbon fee allowance side cases

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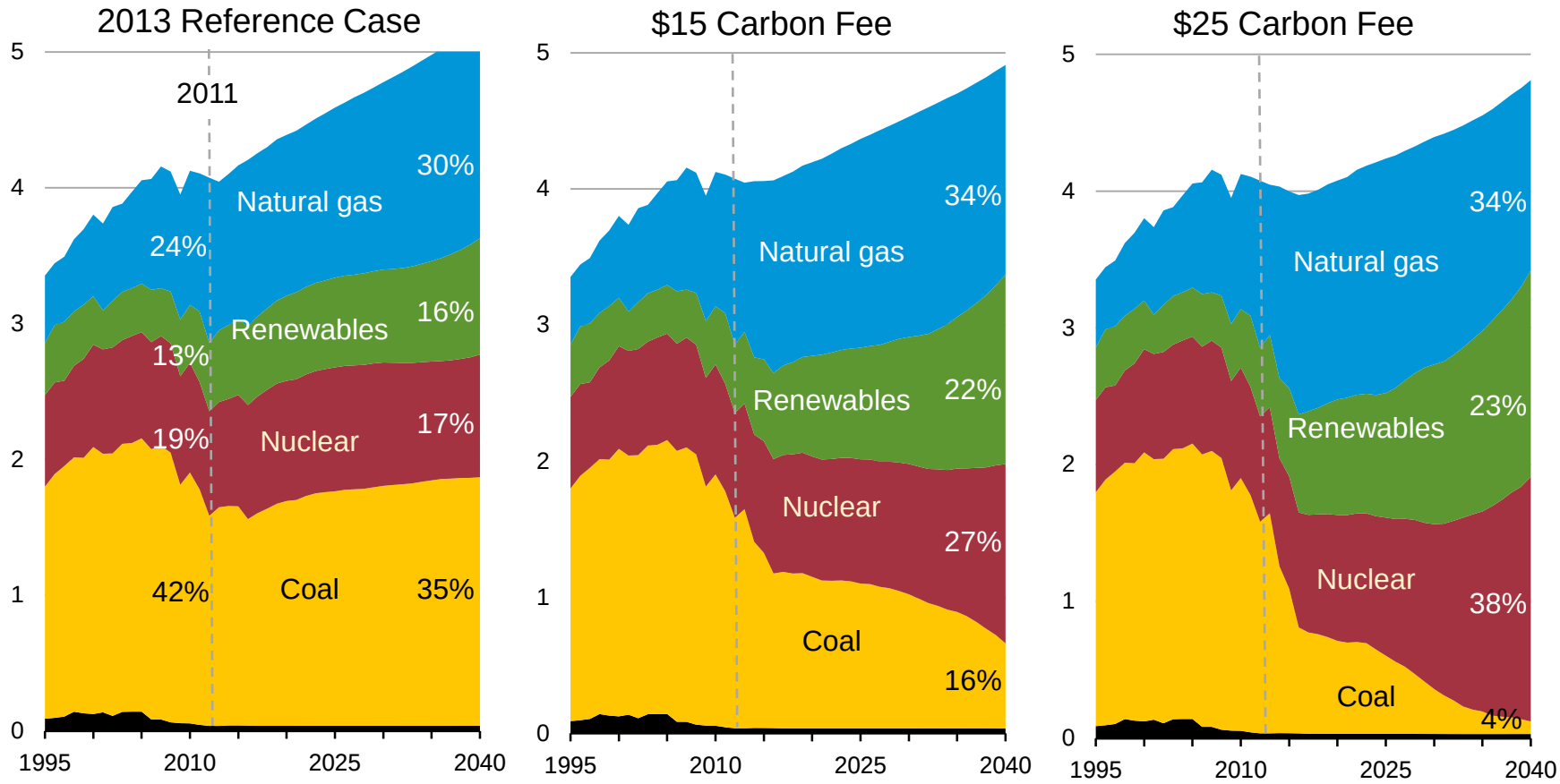
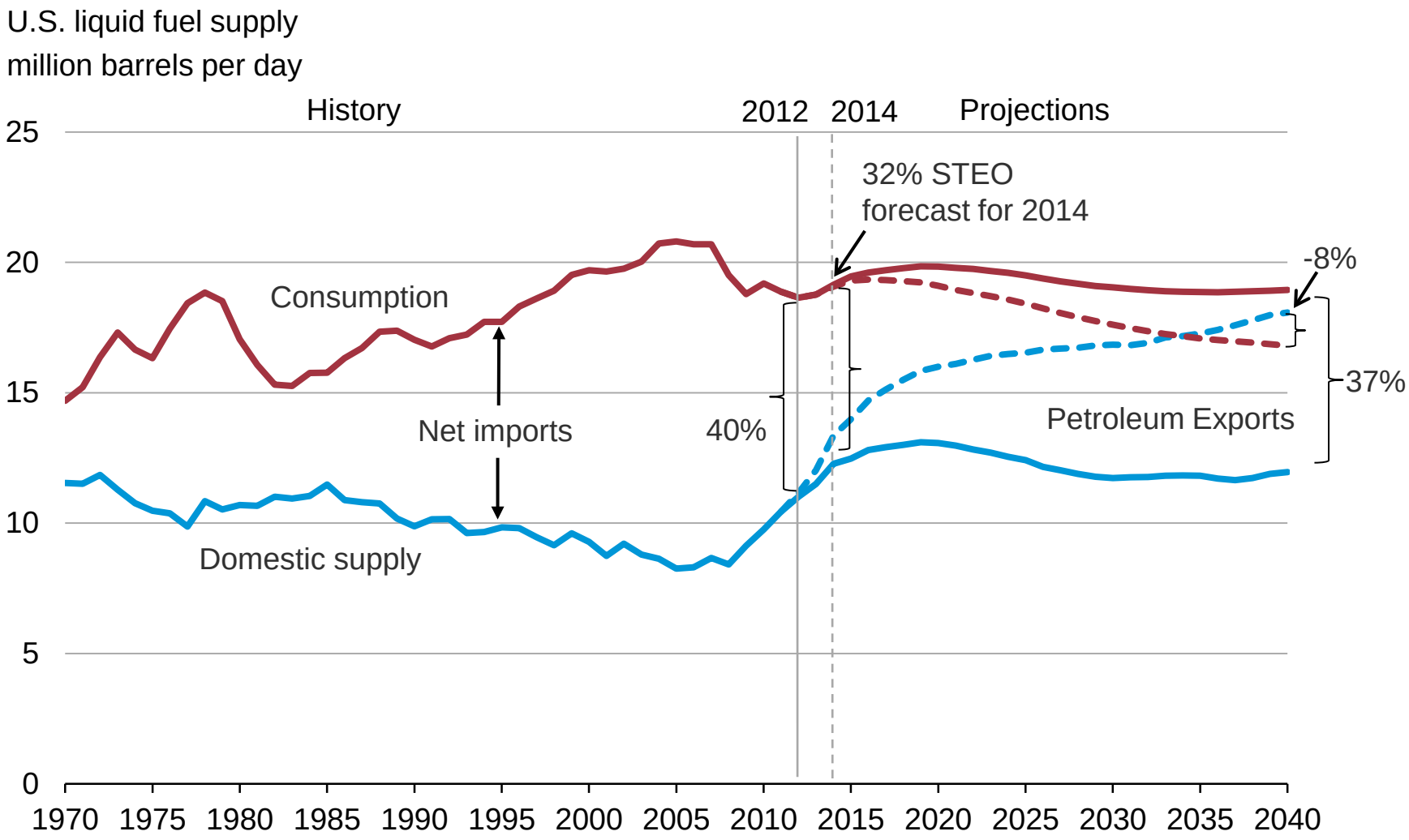



*Source: EIA, Annual Energy Outlook 2013*

# U.S. dependence on imported liquids depends on both supply and demand




*Source: EIA, Annual Energy Outlook 2013 and Short-Term Energy Outlook, April 2013*

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# 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

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