# Annual Energy Outlook 2013
# Natural Gas Projections

*for*
*Council of Industrial Boiler Owners*
*Crystal City Marriott Hotel, Arlington, Virginia*
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*by*
*Philip Budzik, EIA, Office of Petroleum, Natural Gas, & Biofuels Analysis*

# Presentation outline

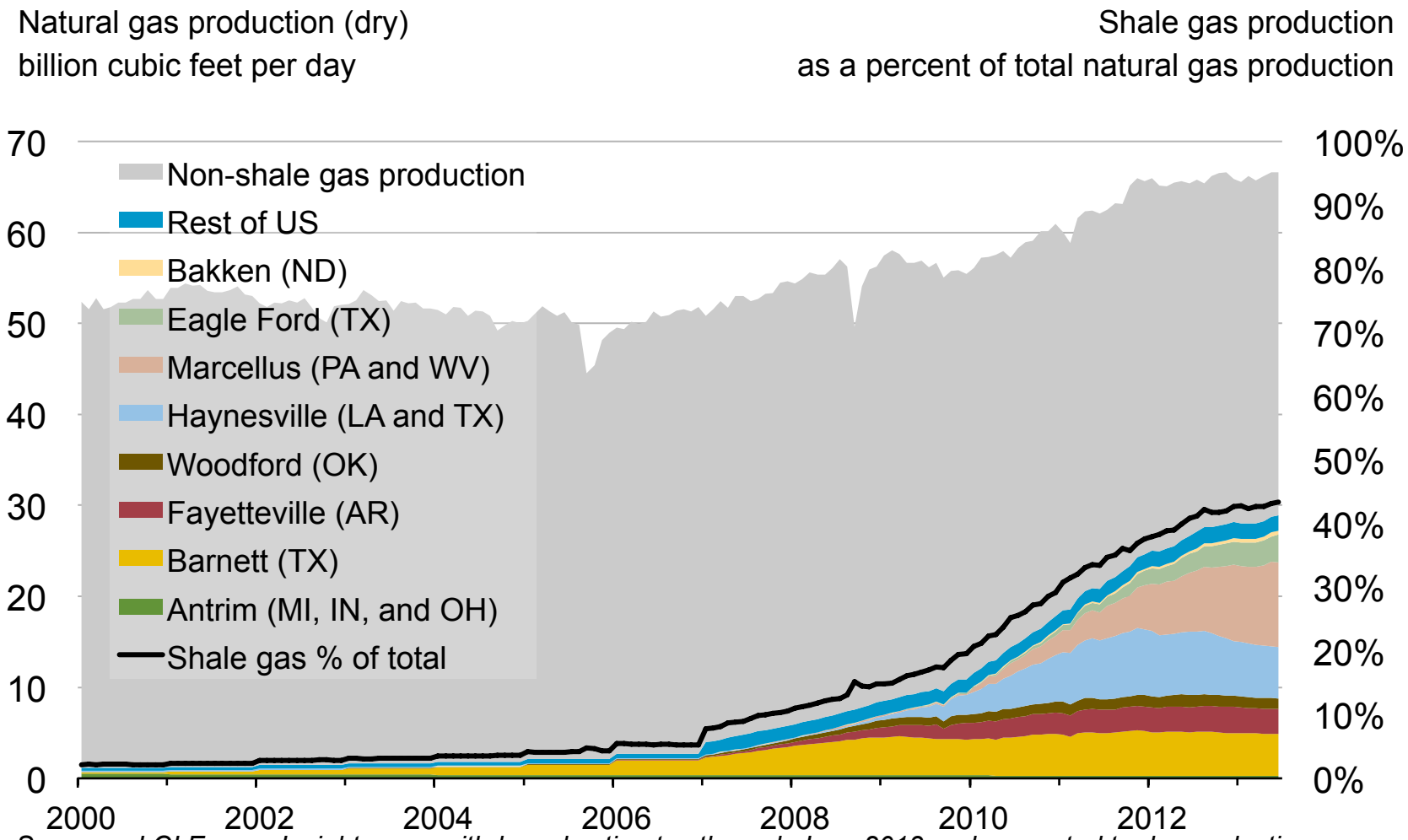
- Current natural gas production trends
- Annual Energy Outlook natural gas production modeling – estimating resources and projecting production
- Annual Energy Outlook 2013 natural gas projections – consumption, exports, production, and prices
- Major projection uncertainties – economically recoverable natural gas resources, LNG exports, future energy policies

# U.S. shale gas and tight oil deposits


Source: Energy Information Administration based on data from various published studies.
Updated: May 9, 2011

http://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/maps/maps.htm

# U.S. shale gas production was 28.9 Bcf/d in June 2013 approximately 43% of total U.S. dry production

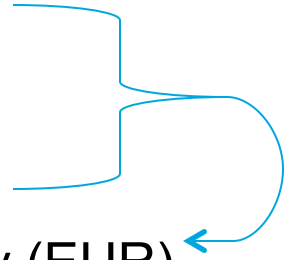



*Sources: LCI Energy Insight gross withdrawal estimates through June 2013 and converted to dry production estimates with EIA-calculated average gross-to-dry shrinkage factors by state and/or shale play.*

*EIA Natural Gas Monthly data through April, and STEO (July 2013)*

# EIA's projections focus on the production timing of resources; the modeling focuses on these parameters

- average initial production (IP) rate per well
- average decline curve (can vary by region and vintage)
- IP & decline curve define the Estimated Ultimate Recovery (EUR) per well, which is directly related to the formation's TRR



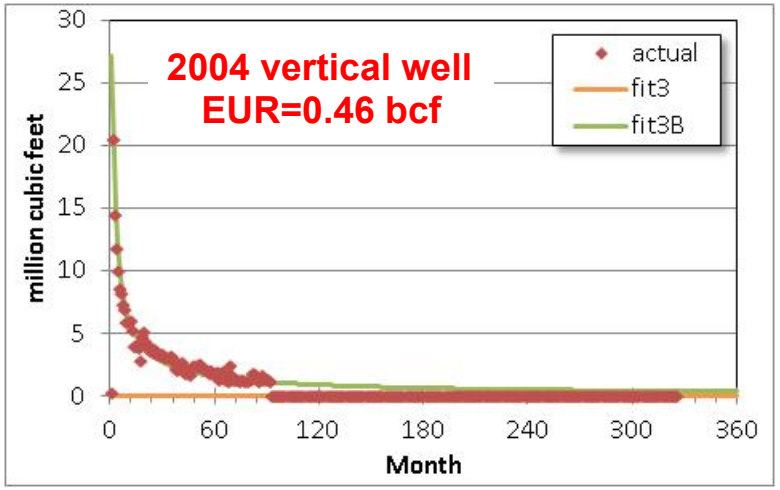
**Other parameters**

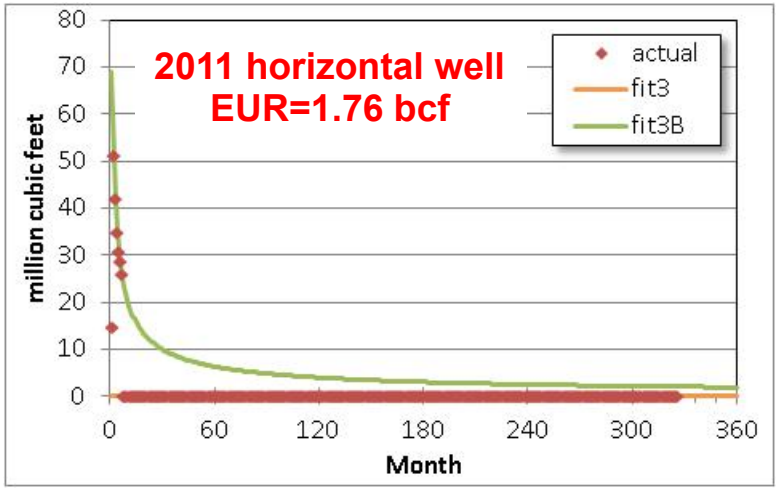
- well drilling, completion, and operating costs
- number of active rigs
- how many wells a rig can drill per year (rig productivity)
- well spacing (acres per well)
- remaining undrilled acreage

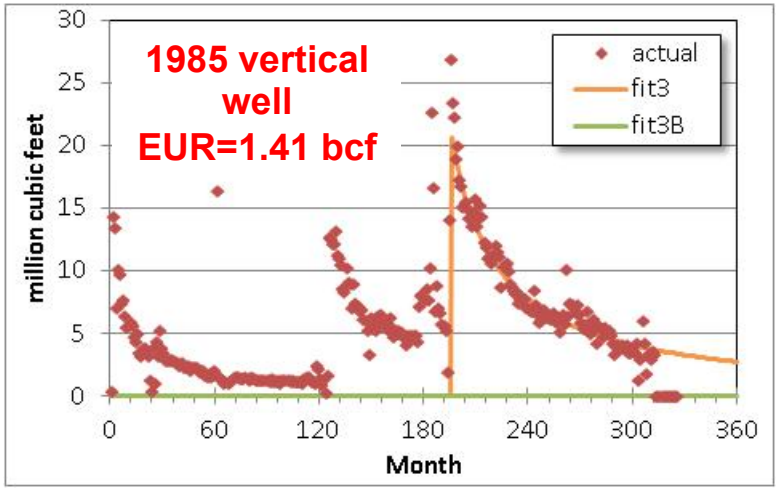
# For the United States, EIA fits well production data to mixed hyperbolic-exponential decline curves to estimate EUR

Classic hyperbolic decline curve (Arps 1945):

$$Q_t = \frac{Q_i}{(1 + b \times D_i \times t)^{1/b}}$$




*Source: HPDI data from horizontal wells in the Newark East field in the Barnett Shale; EIA analysis*

# Unproved technically recoverable resources (TRR) result from the well analysis and are updated every year

Area (acres)

÷ drainage area of a well

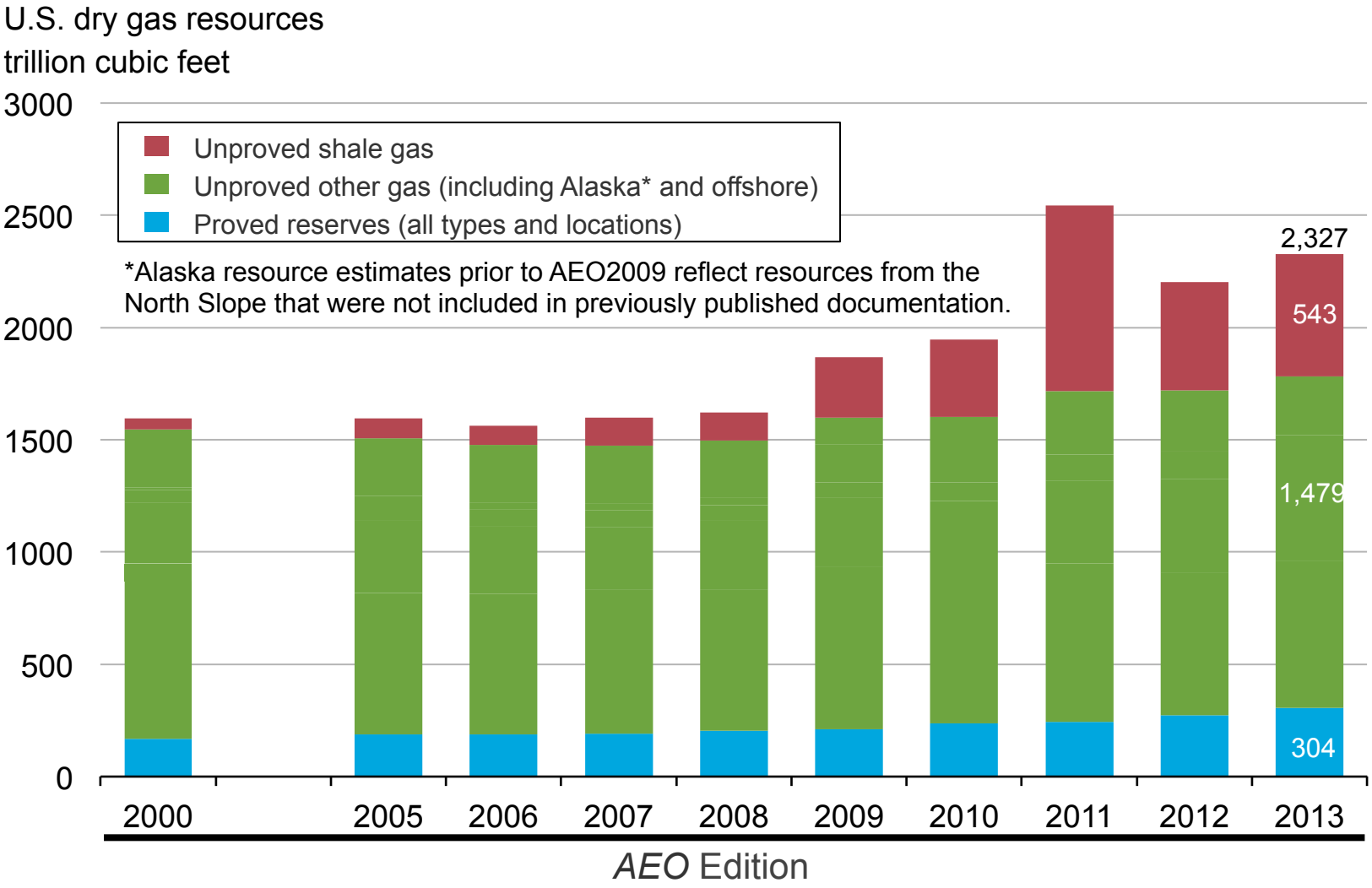
× distribution of EUR/well

× % of area not yet drilled

× % area with potential

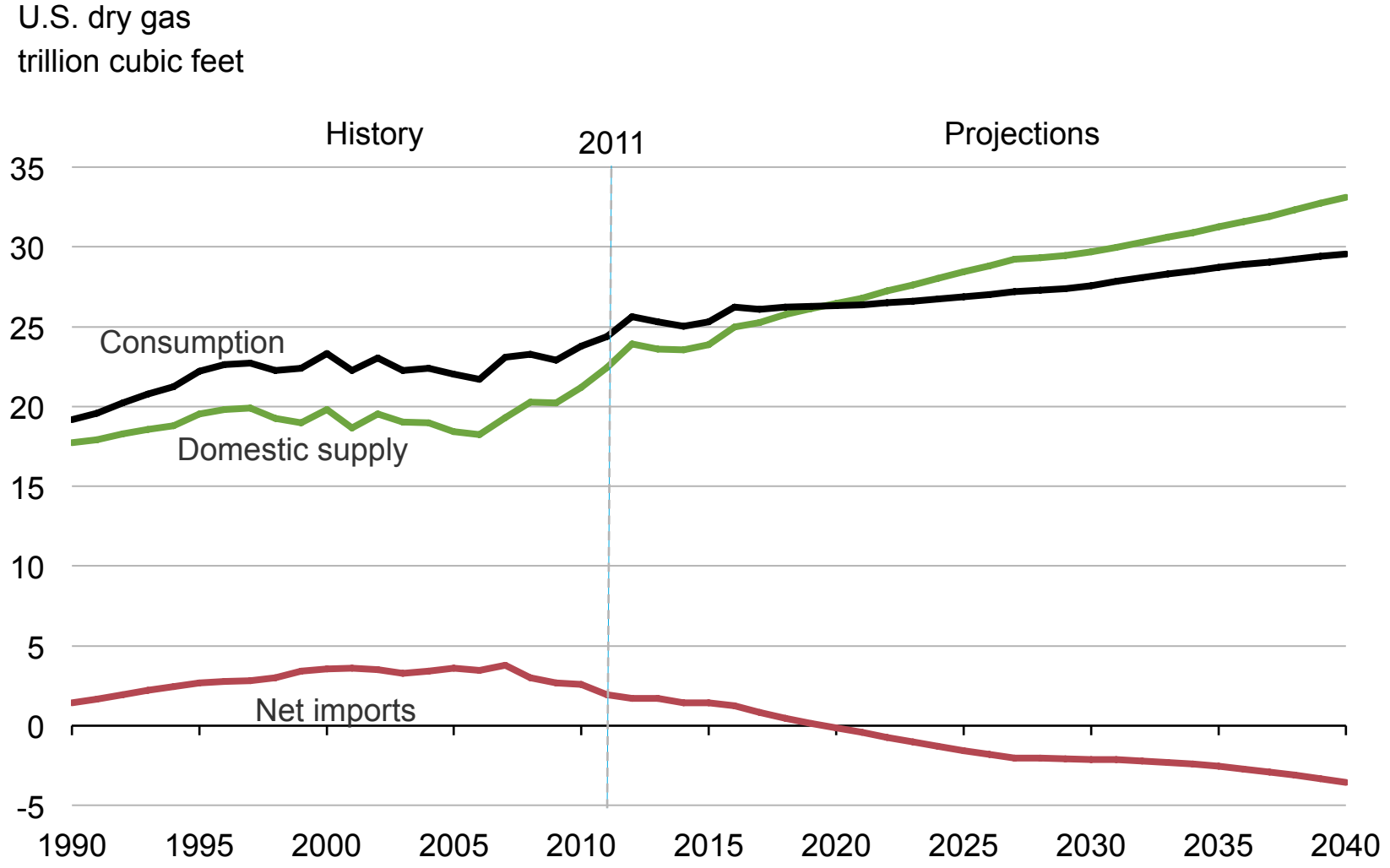
= unproved TRR

# Technically recoverable natural gas resources reflect new information, a combination of assessments and EIA updates



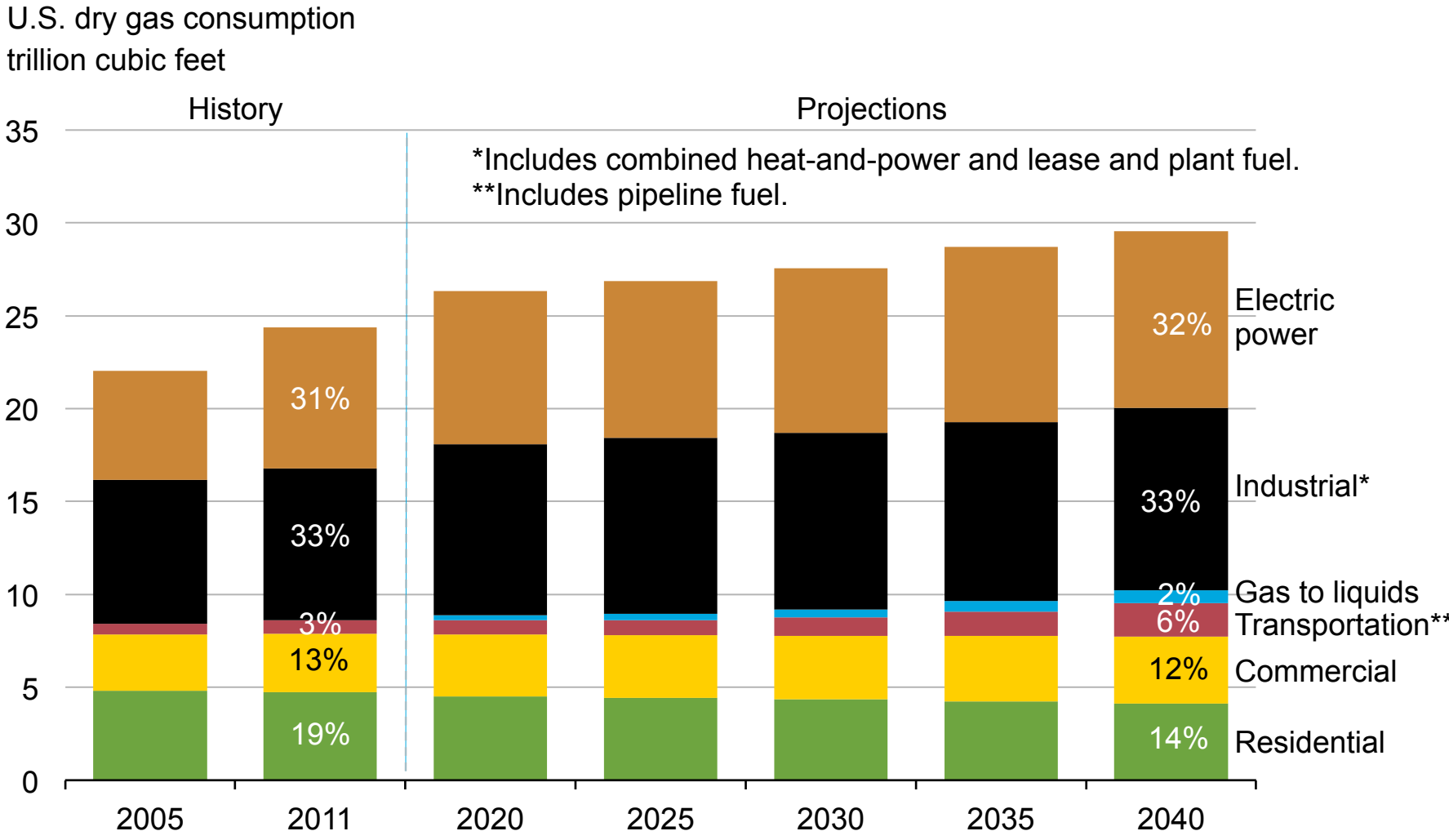

*Source: EIA, Annual Energy Outlook 2013 Reference Case*

# Domestic natural gas production grows faster than consumption and the U.S. becomes a net exporter of natural gas around 2020




*Source: EIA, Annual Energy Outlook 2013 Reference Case*

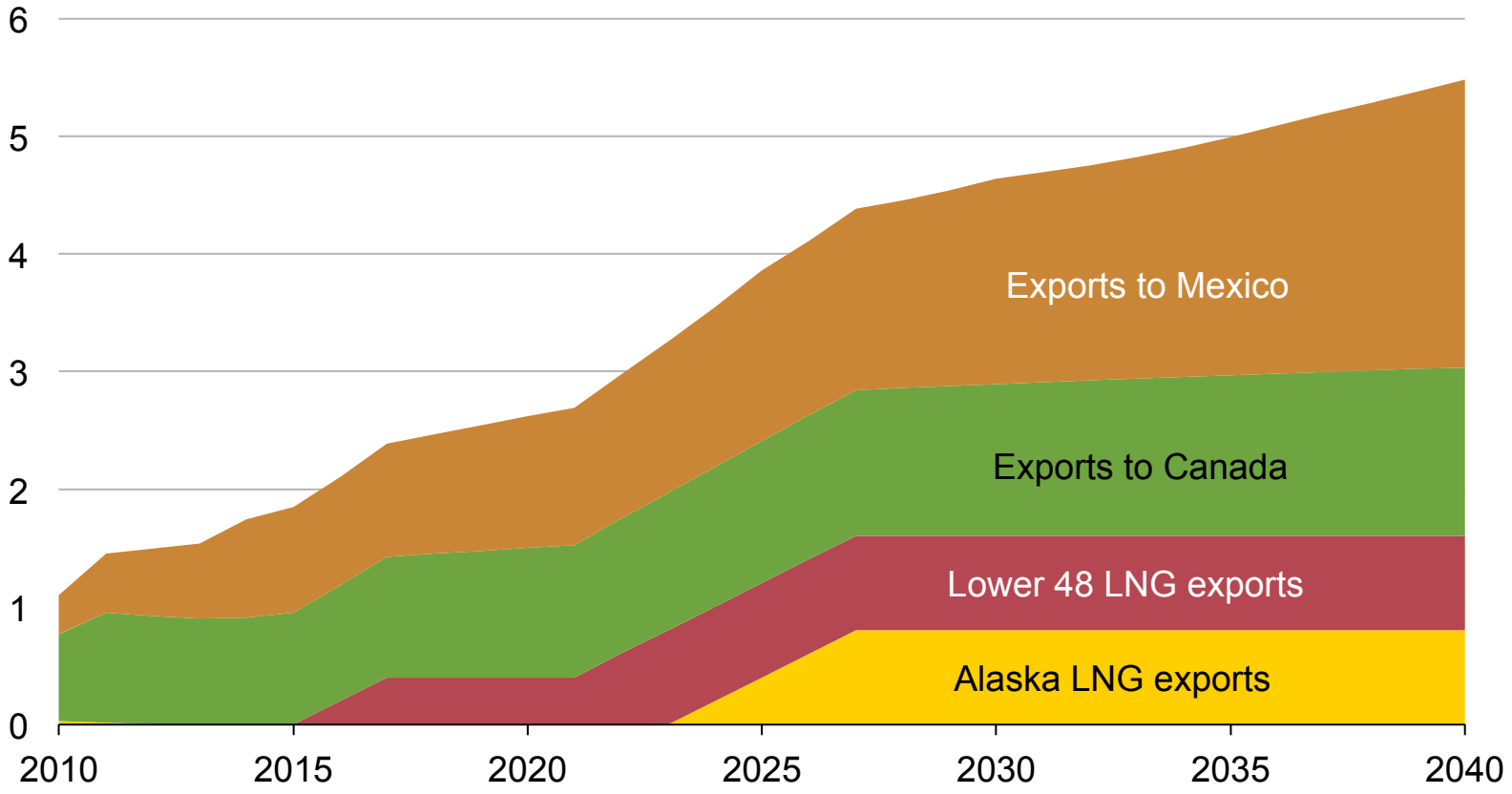
# Natural gas consumption is quite dispersed with electric power, industrial, and transportation use driving future demand growth




*Source: EIA, Annual Energy Outlook 2013 Reference Case*

# Total natural gas exports nearly quadruple by 2040 in the *AEO2013* Reference case

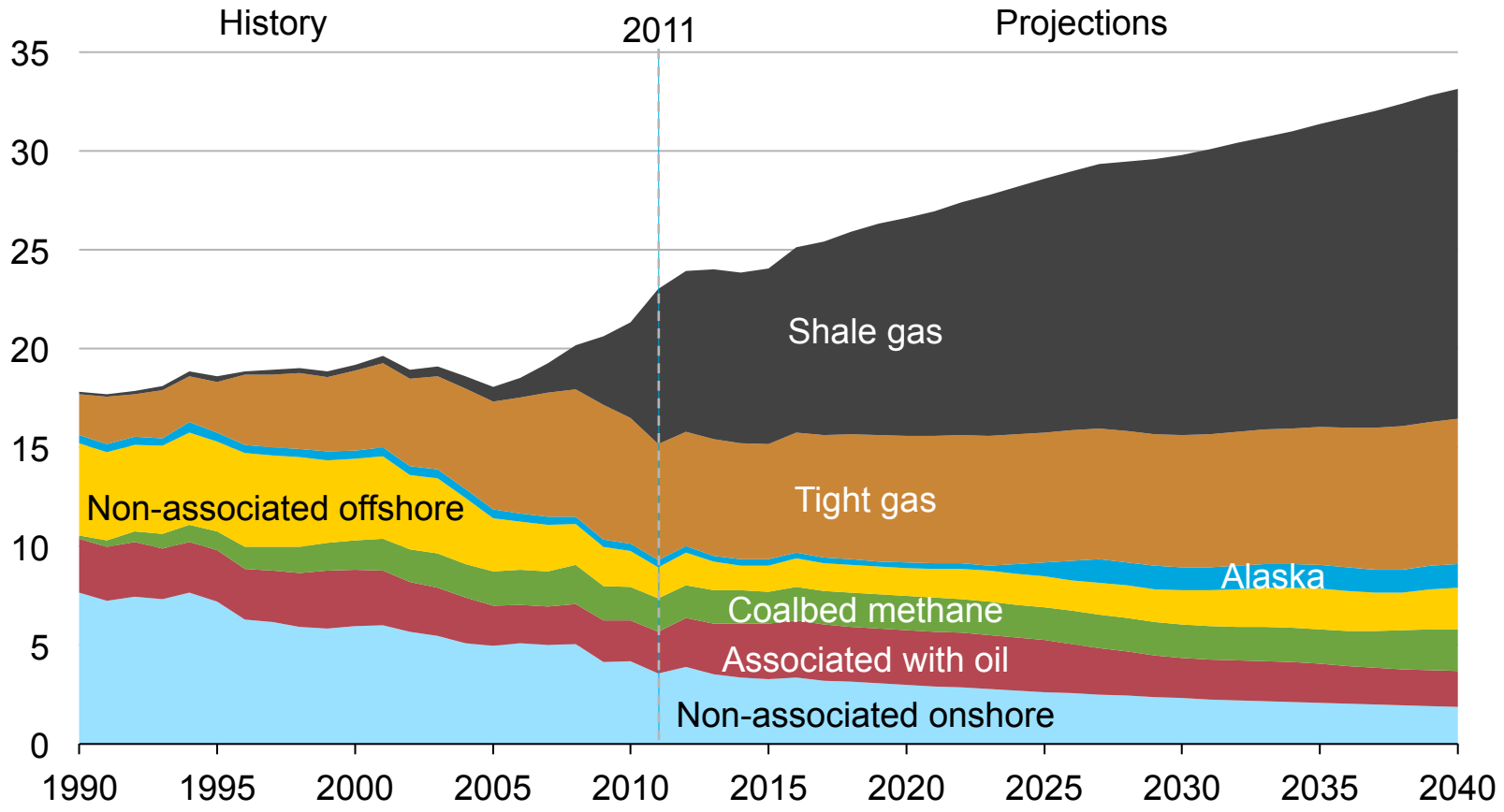
U.S. natural gas exports
trillion cubic feet




*Source: EIA, Annual Energy Outlook 2013 Reference Case*

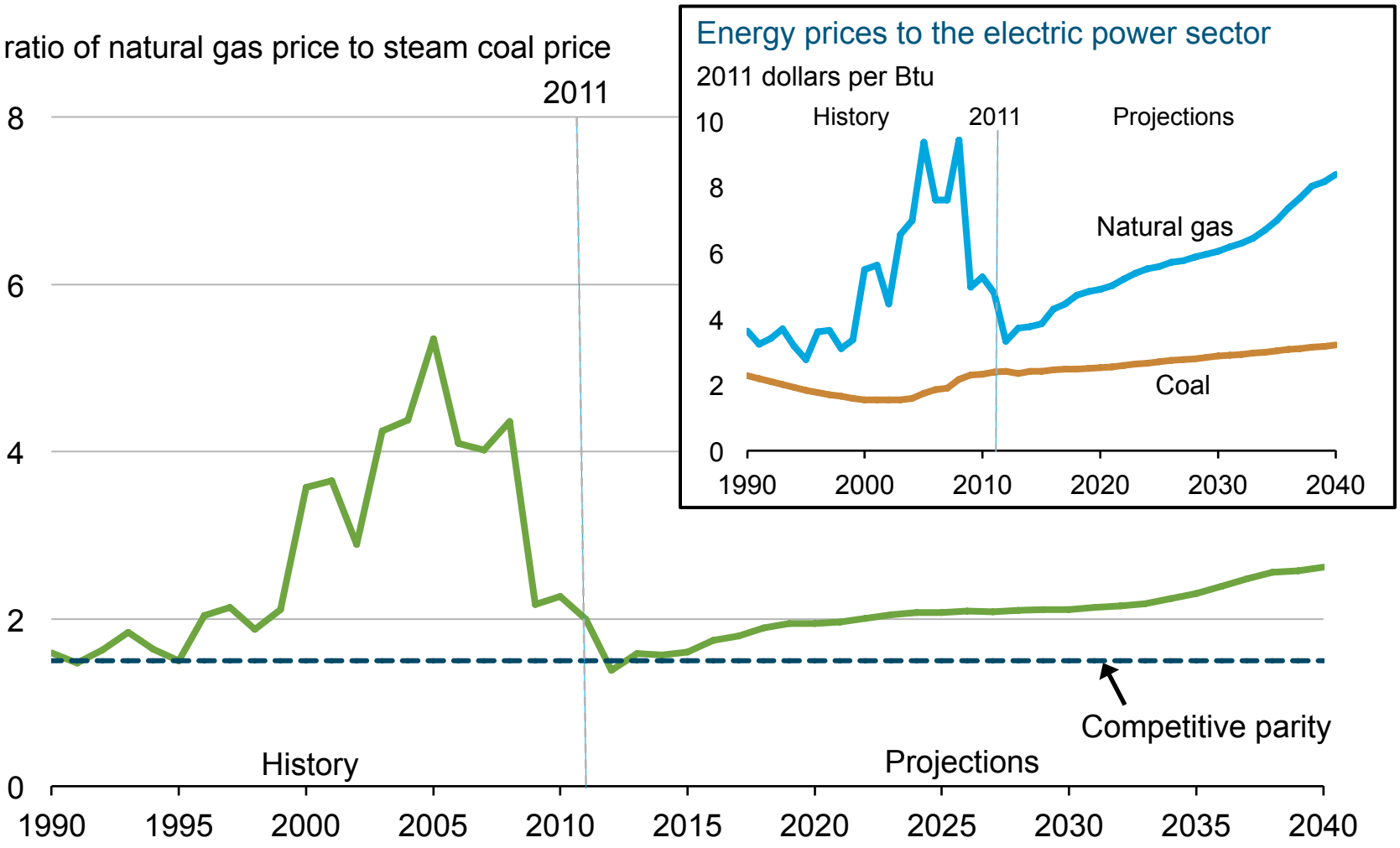
# Shale gas leads growth in total gas production through 2040

U.S. dry natural gas production
trillion cubic feet




*Source: EIA, Annual Energy Outlook 2013 Reference Case*

# Coal regains some competitive advantage relative to natural gas over time on a national average basis




*Source: EIA, Annual Energy Outlook 2013 Reference Case*

# Other considerations

# Recoverable shale gas resources are highly uncertain

- Considerable production variation for neighboring wells.
- No long-term history of production for shale gas wells; will they produce for 30 years?
- Some of the shale gas formations have most of their production coming from wells clustered in a few areas. So a large portion of the formation has not been extensively production tested (e.g., Marcellus shale).
- Significant natural gas volumes are produced from tight oil formations (e.g., Eagle Ford shale).
- Technological progress could make new and existing shale gas wells more productive and less costly in the future.

# U.S. LNG export uncertainties

- Will regional LNG prices converge to a “world” price based on world-wide supply and demand, or will oil-indexed LNG pricing continue into the long-term?
- How quickly will world LNG supplies grow, especially from stranded gas deposits in Australia, east offshore Africa, etc.?
- Will U.S. LNG exports be cost competitive with other LNG suppliers, such, Qatar, Australia, and east offshore Africa?
- Will U.S. LNG terminals be base-loaded running at high constant capacity factors, or intermittent suppliers that react to changing market conditions?

# Final thoughts

- The oil and gas industry reinvents itself every 10 years, which makes the creation of long term projections difficult.
- A corollary to the first point is that oil and gas producers have shown an amazing ability to develop new technologies to profitably produce oil and gas (e.g., deep-water offshore, shale gas and tight oil, enhanced oil and gas recovery).
- National, state, and local energy policies increasingly dictate energy supply and consumption. As a result, current and future energy policies could become more important than the size and production cost of an energy resource.

# 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

Monthly Energy Review | www.eia.gov/mer

Today in Energy | www.eia.gov/todayinenergy