Natural Gas: Supply and Demand Outlook

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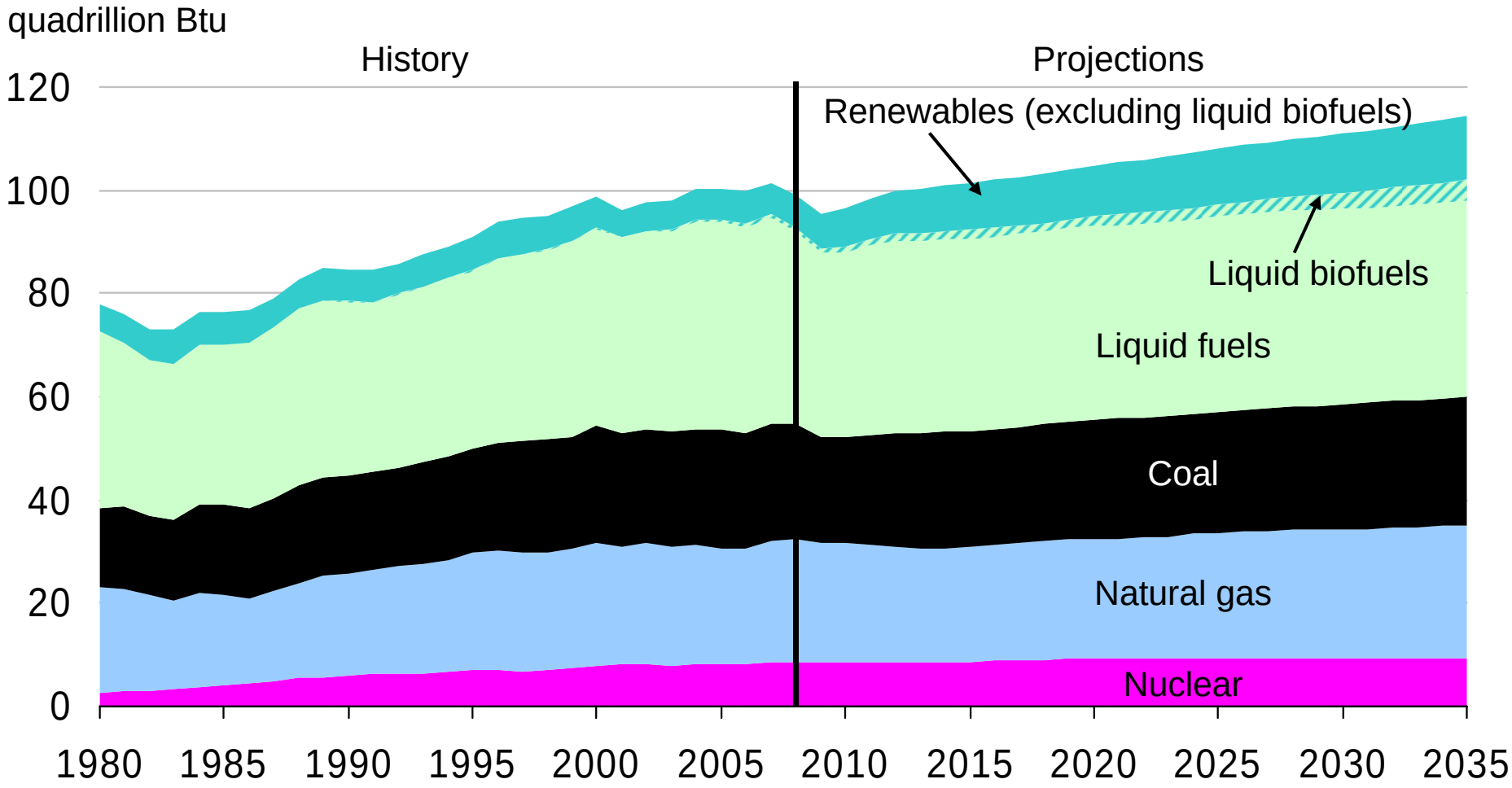
Independent Statistics and Analysis

Key natural gas and electricity updates included in the *AEO2010* reference case

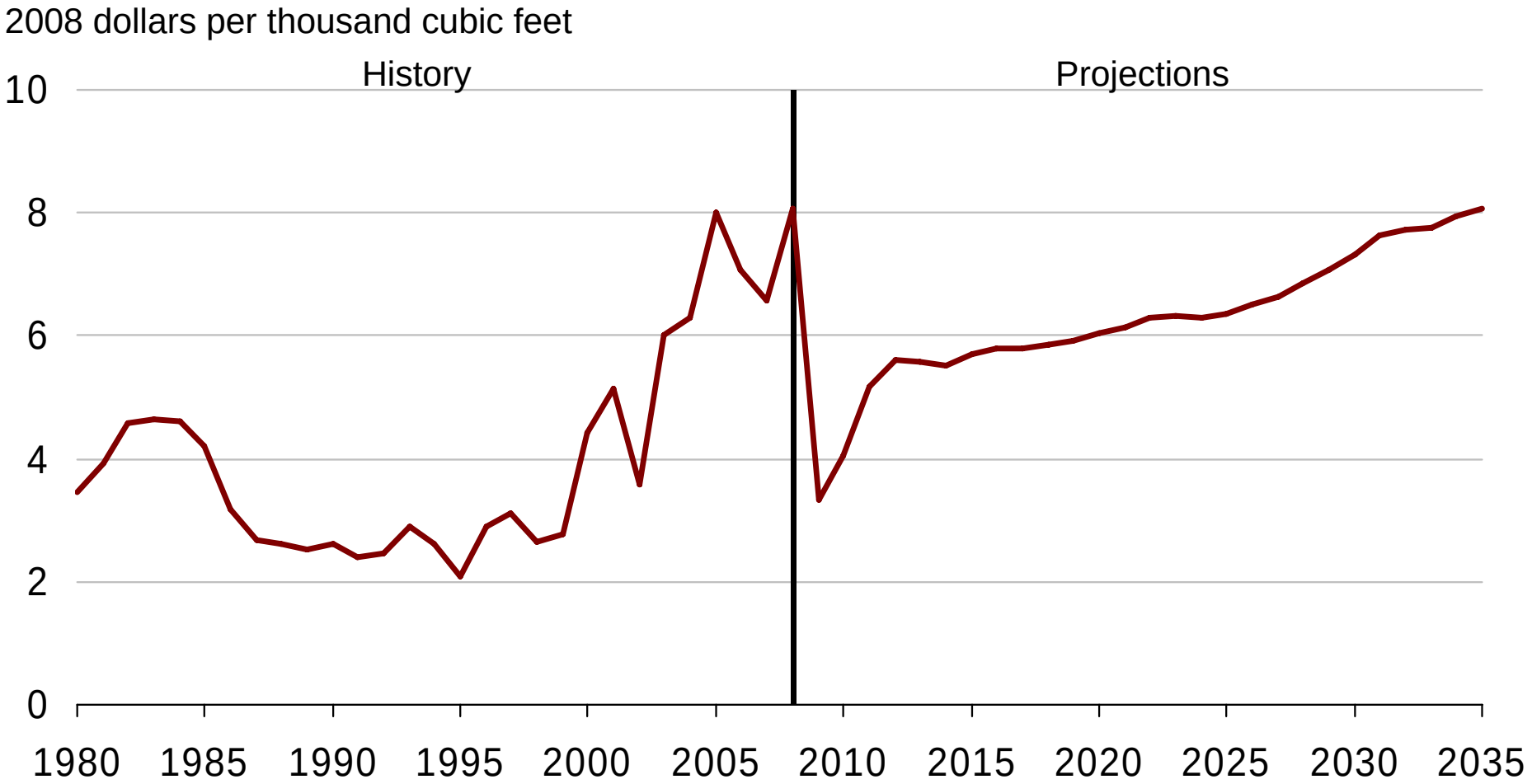
- Extended projection period to 2035
  - assumes permission will be granted to extend existing nuclear power unit operating licenses beyond 60 years
- Revised capital costs for capital-intensive projects
  - overnight costs for nuclear and coal power up 10-20%
- Changes to assumptions about oil and gas resource base
  - updated characterizations reflect evolution of shale gas resources and technology
  - new lower-48 onshore oil and gas supply module

Non-fossil energy use grows rapidly, but fossil fuels still provide 78 percent of total energy use in 2035



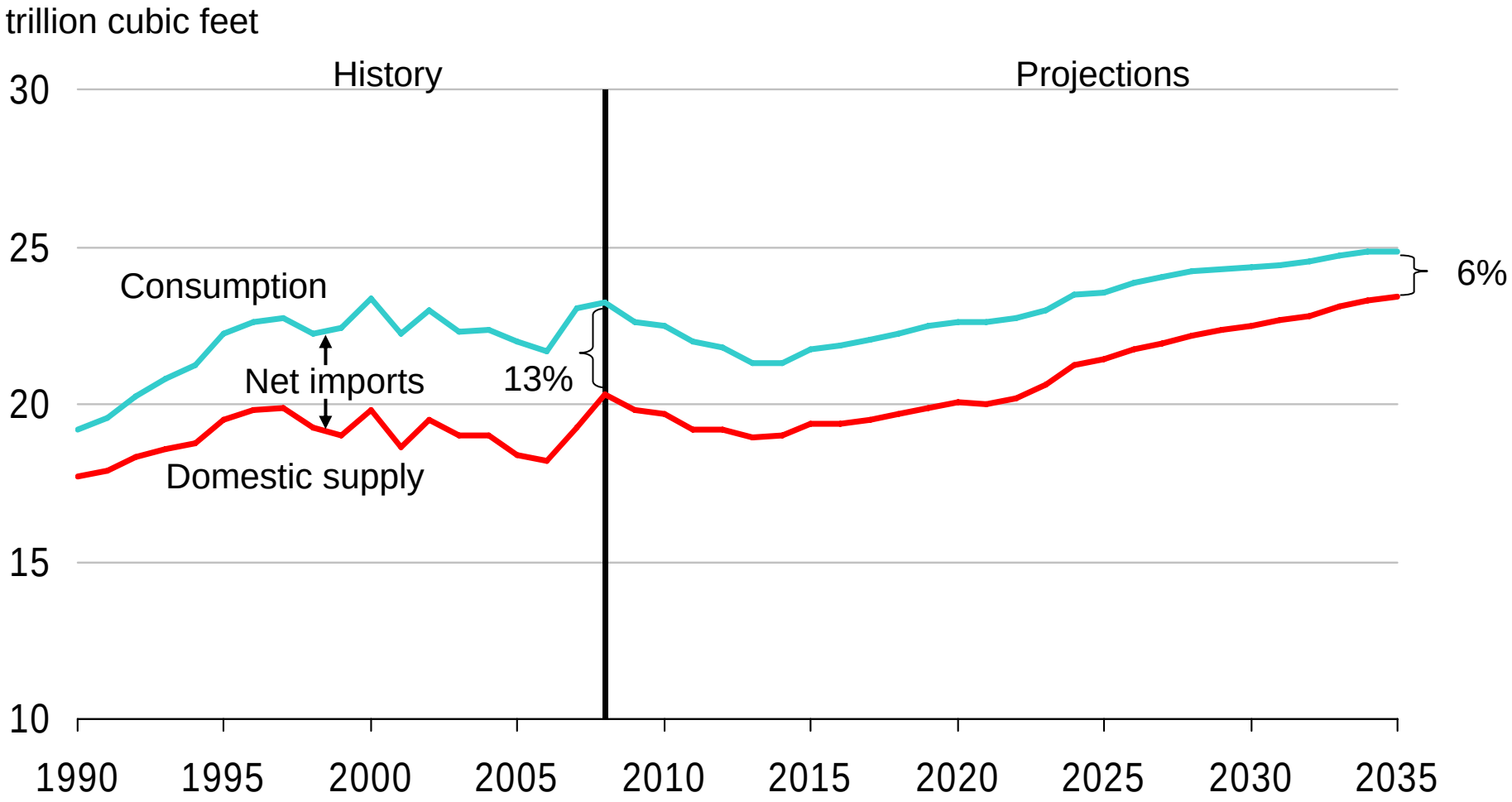
Source: *Annual Energy Outlook 2010*

Natural gas wellhead price is projected to rise from low levels experienced during 2008-2009 recession



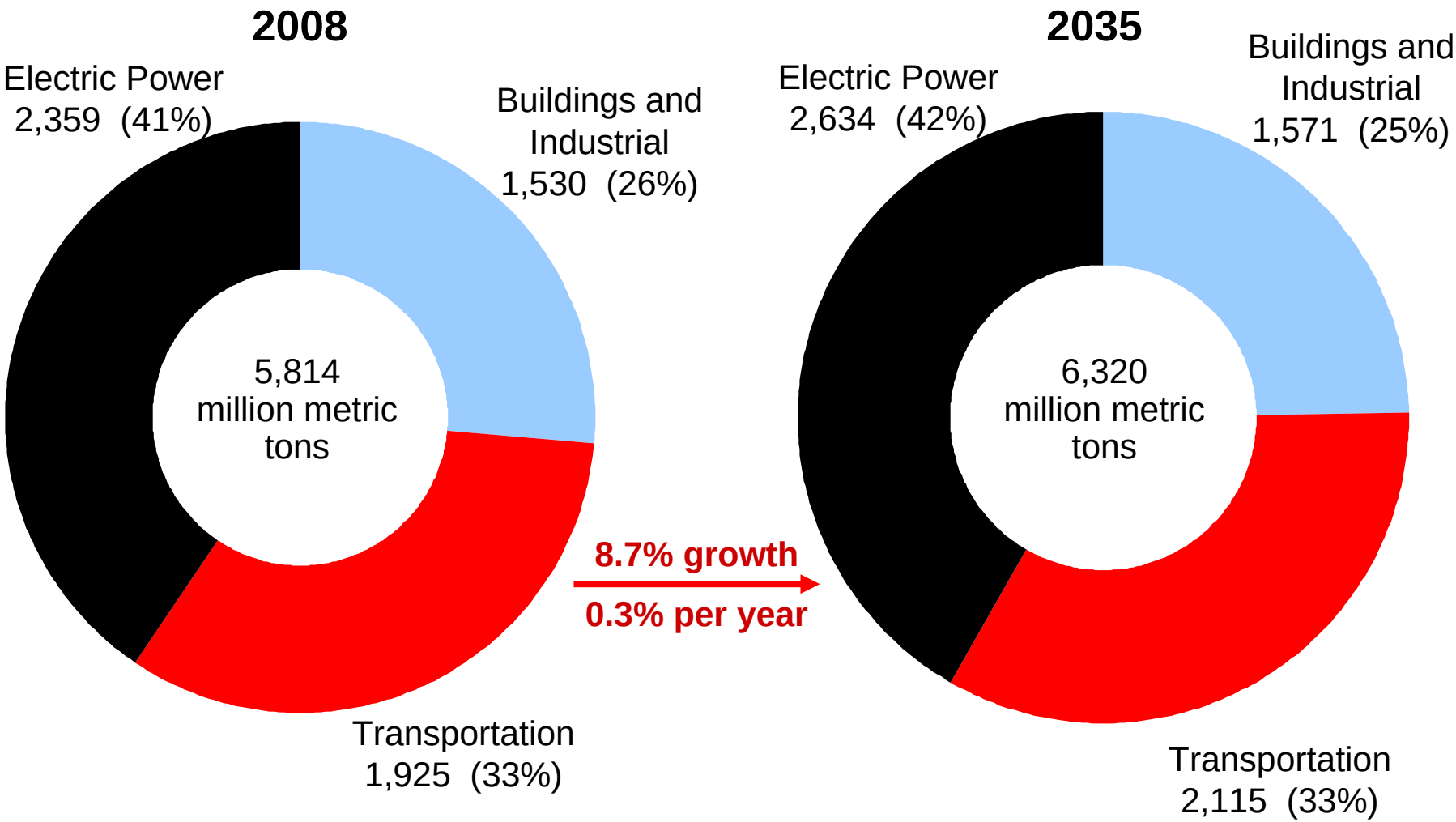
Source: *Annual Energy Outlook 2010*

In AEO2010, demand and supply of natural gas both grow to 2035. Supply grows faster, reducing the role of imports



Source: *Annual Energy Outlook 2010*

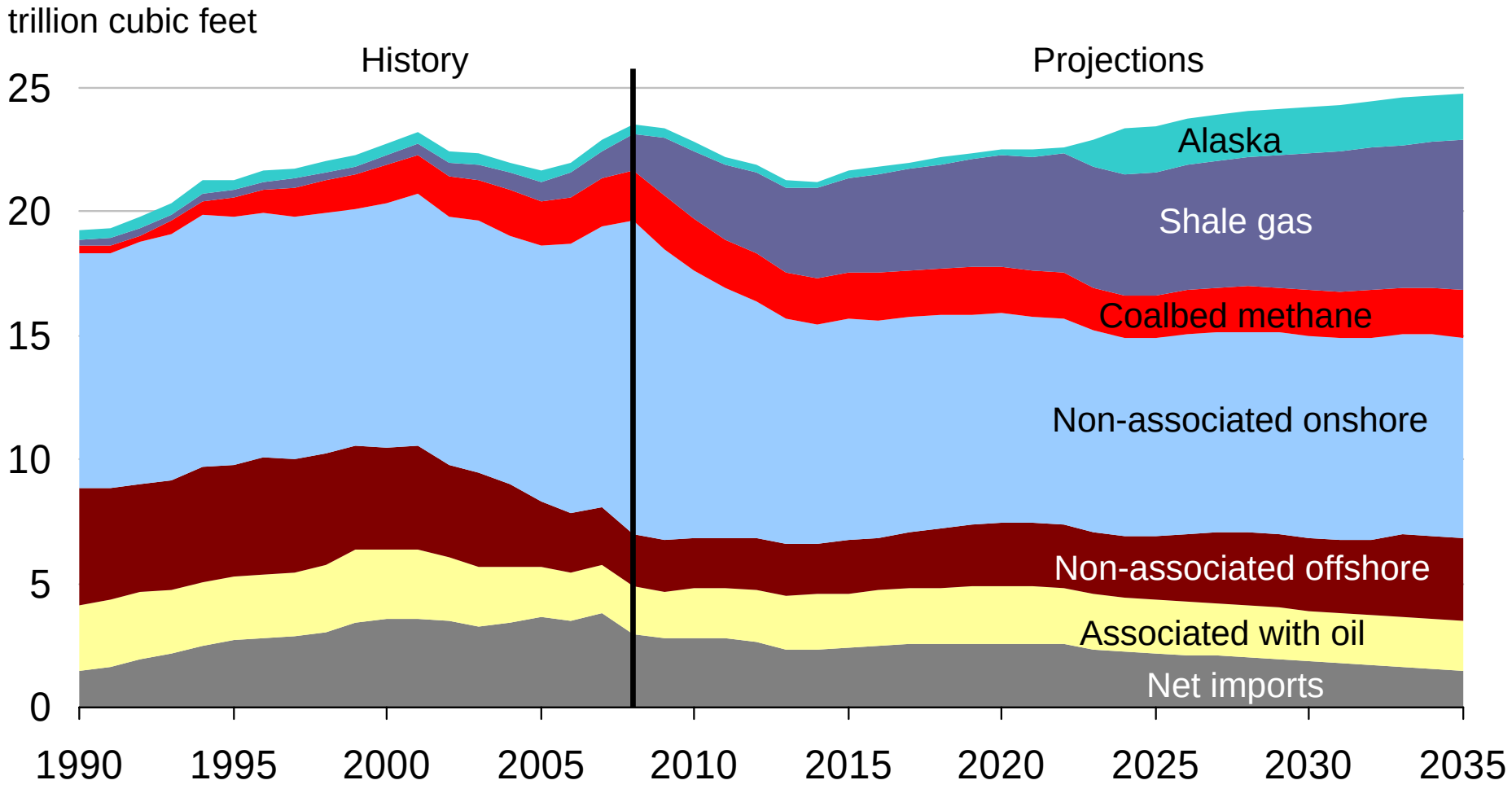
Assuming no new policies, growth in energy-related CO_2 is driven by electricity and transportation fuel use



Source: *Annual Energy Outlook 2010*

Supply

Shale gas and Alaska production offset declines in other supply to meet consumption growth and reduce imports



Source: *Annual Energy Outlook 2010*

The level of shale gas production significantly influences projections of total U.S. natural gas production, imports, consumption, and prices.

- Considerable uncertainty regarding the extent of the low permeability natural gas resource base, particularly shale gas resources.
- In addition, there is concern over the hydraulic fracturing technology that is critical for accessing those resources.
- AEO2010 sensitivity cases address the implications of these uncertainties
  - The No Shale Gas Drilling case allows no new onshore, lower 48 shale drilling after 2009. (no shale)
  - The No Low Permeability Drilling case allows no new onshore, lower 48 shale gas drilling nor drilling from tight sands formations after 2009. (no low perm)
  - The High Shale Gas Resource case increases unproved shale gas resources from 347 tcf to 652 tcf. (high shale)

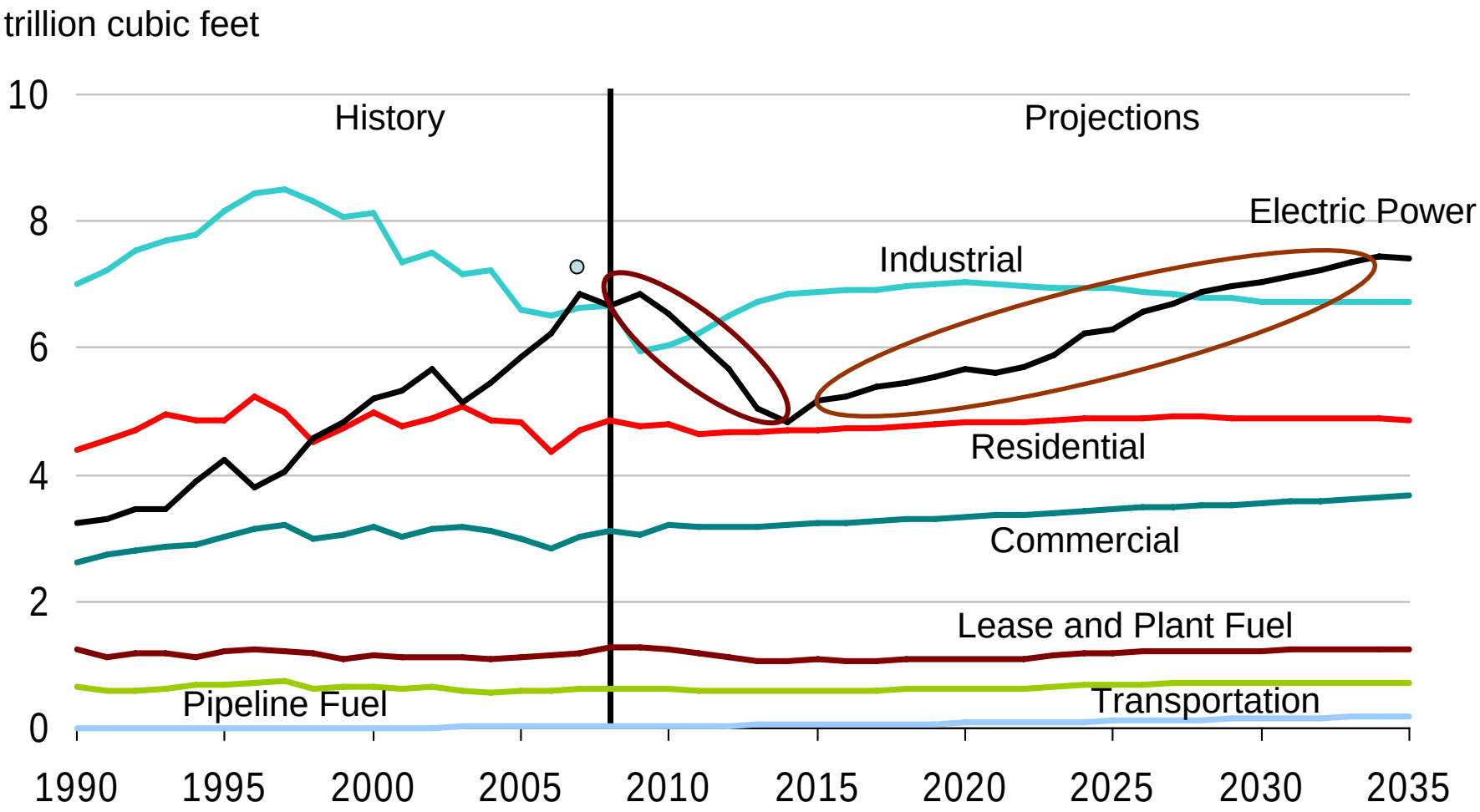
Access to shale gas has major implications for prices, production imports, and the Alaska gas pipeline

Natural gas prices, supply, and consumption in four cases, 2035

Projection	Reference	No Shale Gas Drilling	No Low-Permeability Gas Drilling	High Shale Gas Resource
Henry Hub spot price (2008 dollars per million Btu)	8.88	10.37	10.88	7.62
Total U.S. natural gas production (trillion cubic feet)	23.3	19.1	17.4	25.9
Onshore Lower 48	17.1	12.5	10.4	20.0
Offshore Lower 48	4.3	4.7	5.1	4.0
Alaska	1.9	1.9	1.9	1.9
First year of operation for the Alaska natural gas pipeline	2023	2020	2020	2030
Total net U.S. imports of natural gas (trillion cubic feet)	1.5	3.7	4.5	0.8
Canada	1.7	2.5	2.7	1.4
Mexico	-1.0	-0.7	-0.5	-1.3
Liquefied natural gas	0.8	1.8	2.4	0.8
Total U.S. natural gas consumption (trillion cubic feet)	24.9	22.9	22.0	26.8
Electric power sector	7.4	6.1	5.5	8.7
Residential sector	4.9	4.8	4.7	5.0
Commercial sector	3.7	3.6	3.5	3.8
Industrial sector	6.7	6.5	6.4	7.0
Other	2.2	1.9	1.8	2.3

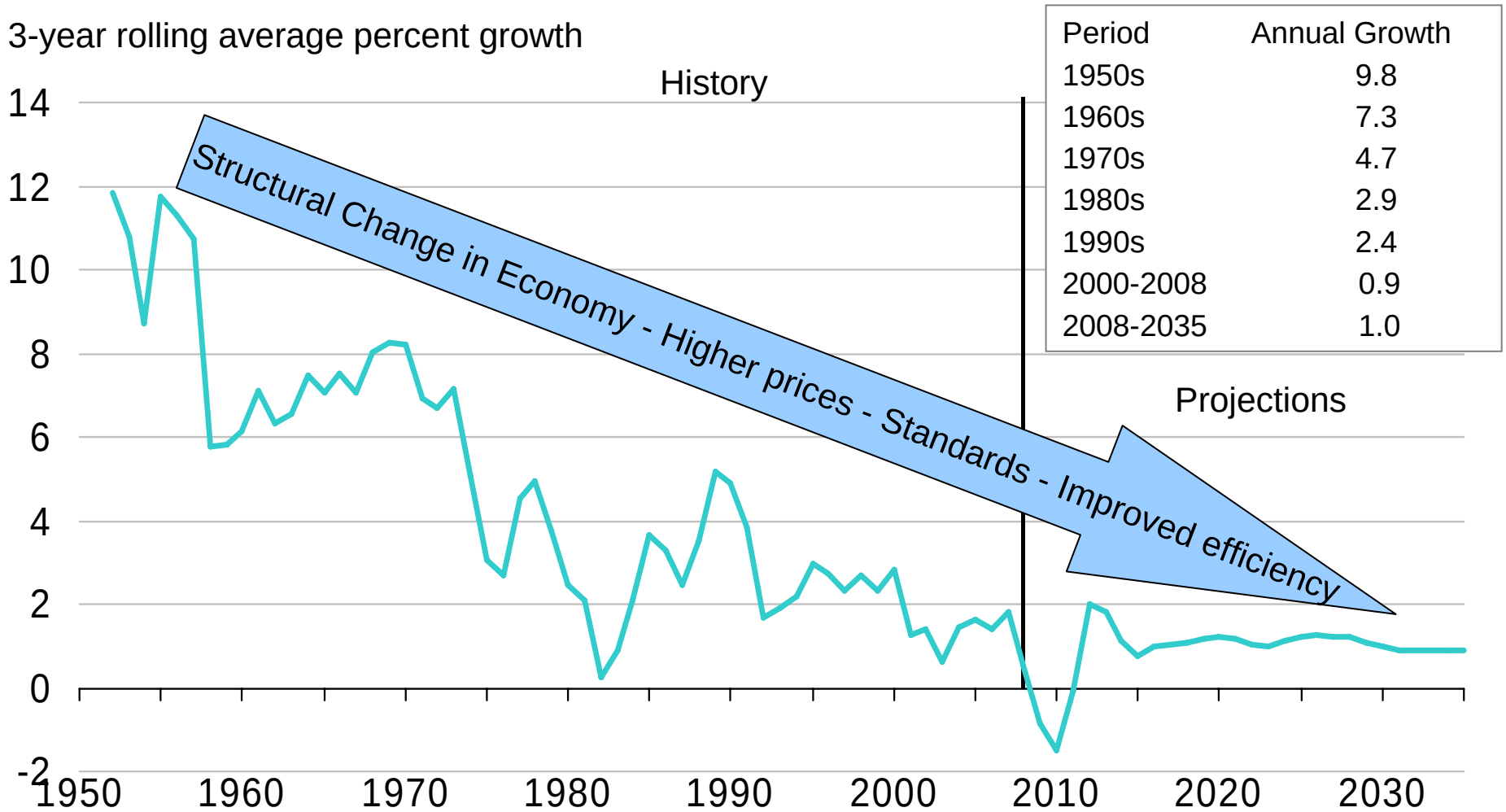
Demand

As over the past decade, developments in the electricity sector drive changes in overall demand for natural gas



Source: *Annual Energy Outlook 2010*

Slow growth in electricity use is projected

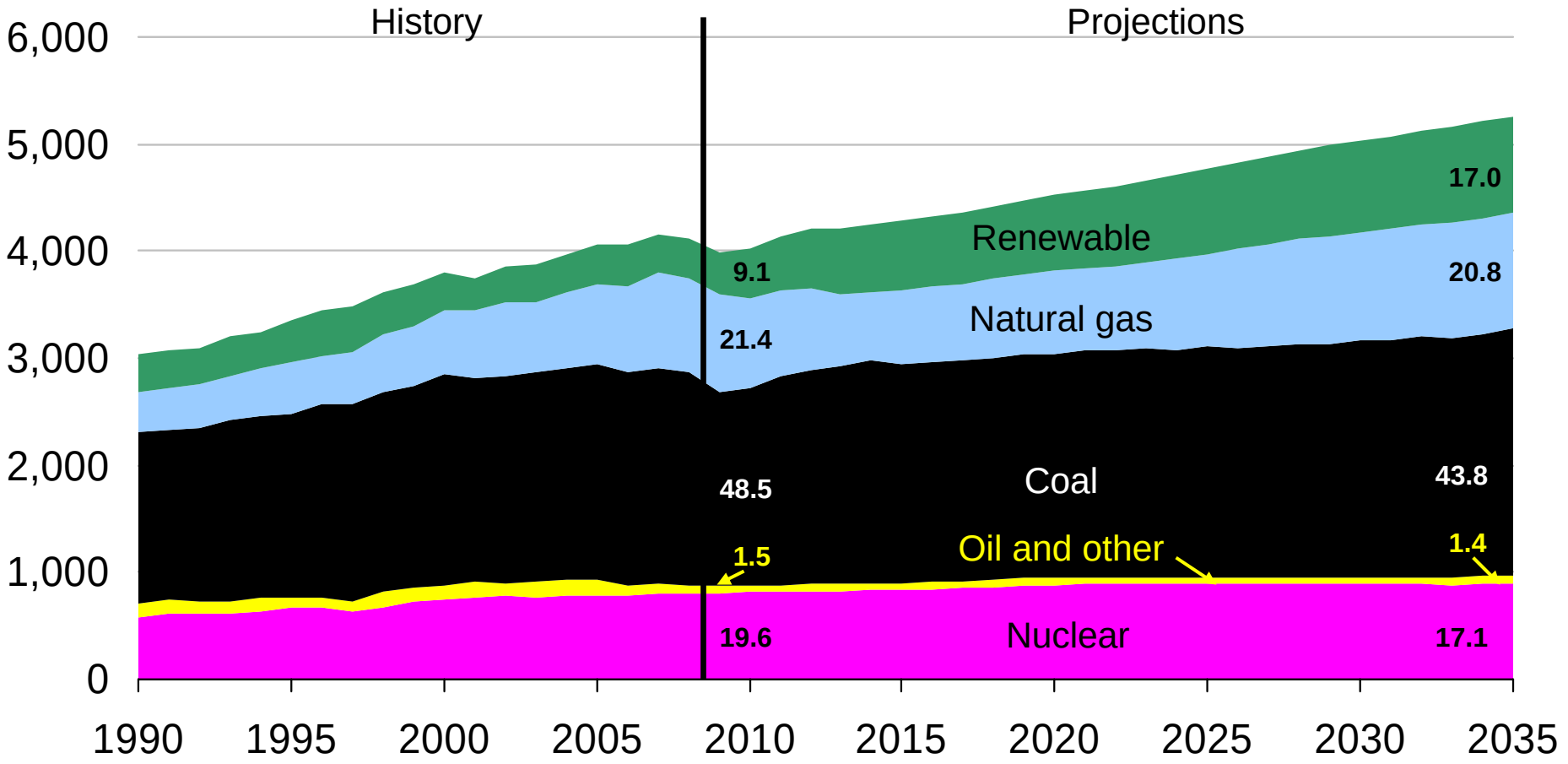


Period	Annual Growth
1950s	9.8
1960s	7.3
1970s	4.7
1980s	2.9
1990s	2.4
2000-2008	0.9
2008-2035	1.0

Source: *Annual Energy Outlook 2010*

Renewables gain electricity market share; coal share declines

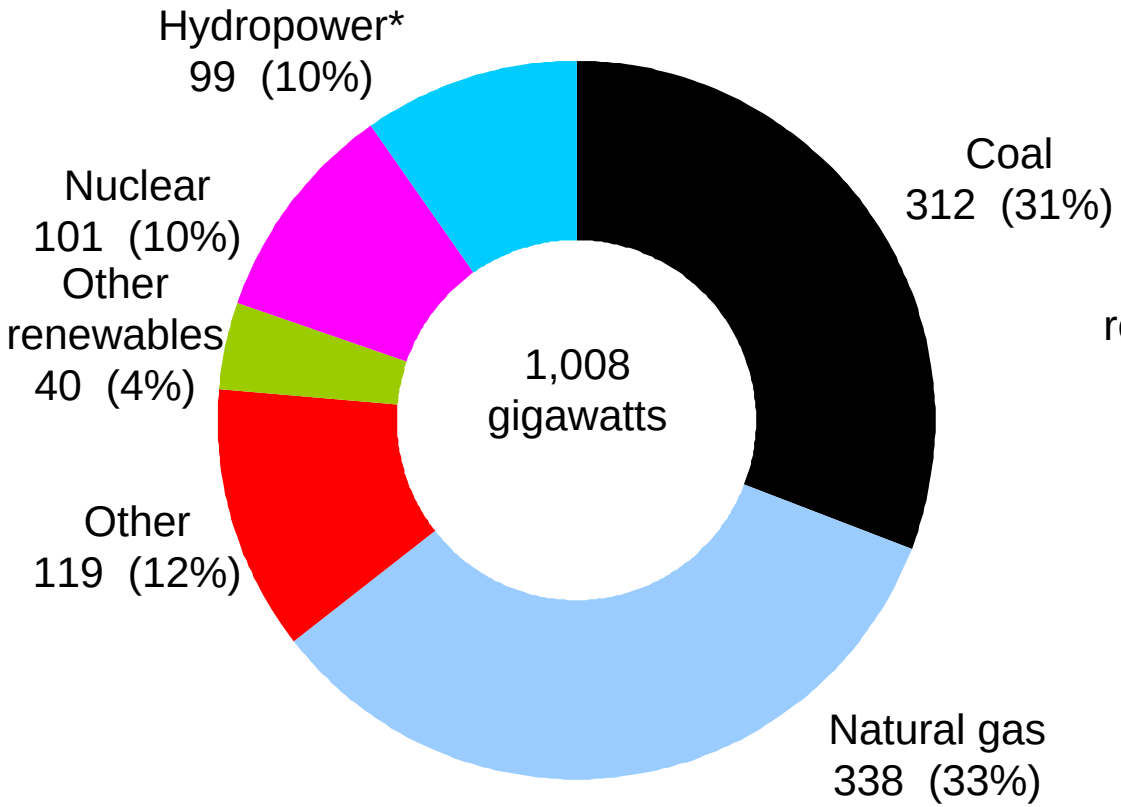
billion kilowatthours and percent shares



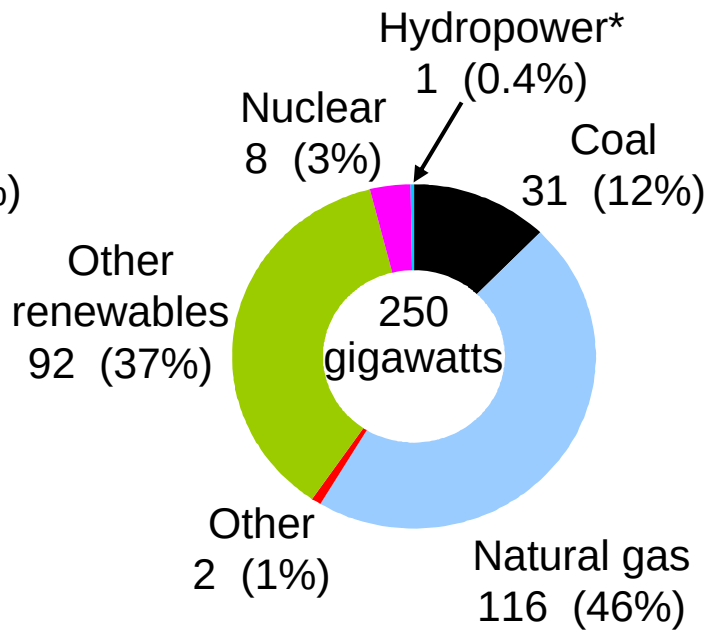
Source: *Annual Energy Outlook 2010*

Natural gas and renewables account for the majority of capacity additions from 2008 to 2035

2008 capacity



Capacity additions 2008 to 2035



* Includes pumped storage

Source: *Annual Energy Outlook 2010*

Implications of retiring existing nuclear plants at age 60

Figure 29. U.S. nuclear power plants that will reach 60 years of operation by 2035

Table 8. Comparison of key projections in the Reference and Nuclear 60-Year Life cases

Projection	Reference	Nuclear 60-Year Life
Nuclear generation capacity in 2035 (gigawatts)	112.9	84.5
Electricity generation from nuclear power in 2035 (billion kilowatthours)	898	671
Electricity price in 2035 (2008 cents per kilowatthour)	10.2	10.6
Natural gas price in 2035 (2008 dollars per thousand cubic feet)	8.69	9.16
Carbon dioxide emissions from electricity generation in 2035 (million metric tons)	2,634	2,714

Key results from the *AEO2010*

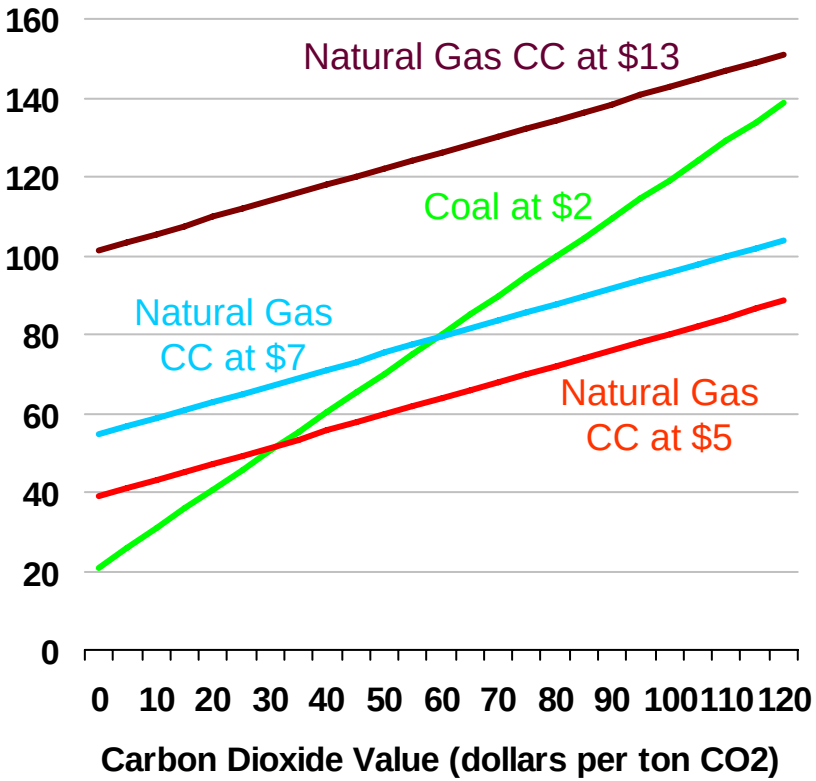
- Shale gas drives growth in U.S. natural gas production and reduces reliance on imported gas
- Electricity consumption grows by 1% per year in the reference case, limiting the need for new capacity
- Growing use of renewables due to recent policies and completion of coal plants currently under construction squeezes near-term gas-fired generation in the AEO2010 reference case
- Generation using natural gas grows steadily beyond 2015
  - Natural gas generation grows even faster if existing nuclear plants cannot be life-extended past age 60.

Climate policy and other drivers affecting the demand for natural gas in electricity generation

Climate policy impact on operating costs: OLD vs. OLD

Fuel Cost for Existing Coal and Combined Cycle Natural Gas Units with a Value Placed on Carbon Dioxide Emissions

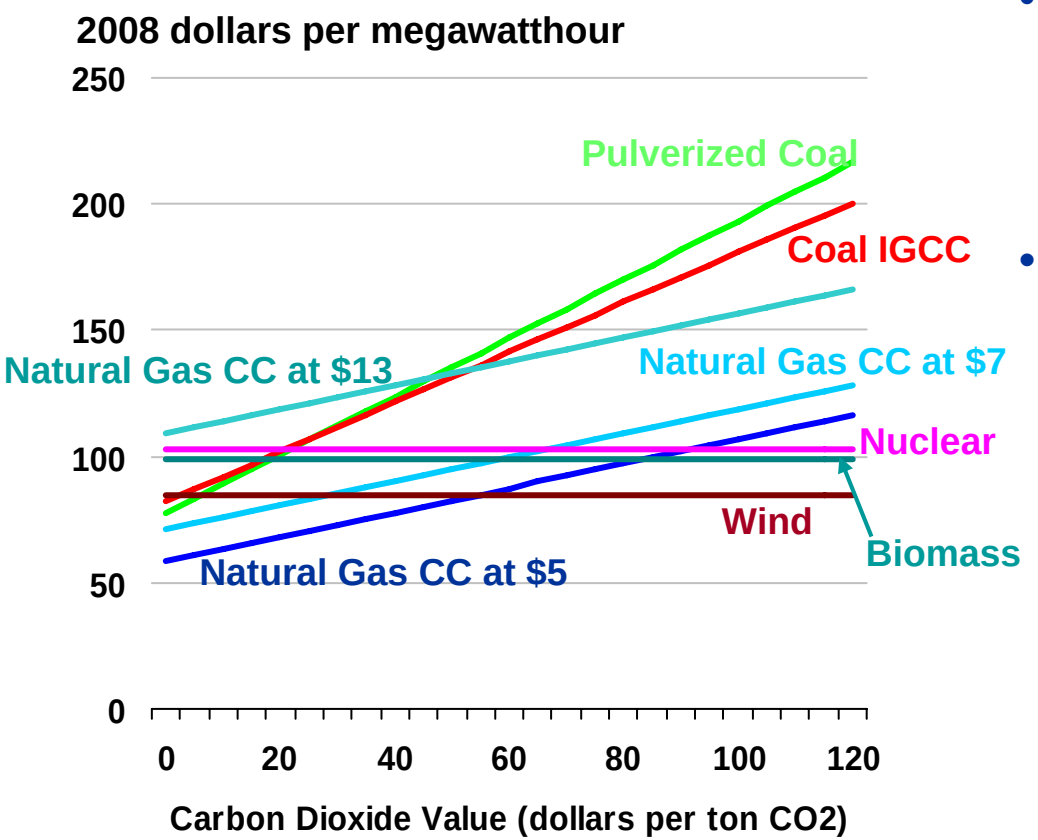
2008 dollars per megawatthour



- Climate policies affect the operating costs of both coal-fired and natural-gas-fired power plants
- OLD vs. OLD: The "crossover point" for least-cost dispatch of coal and natural gas capacity depends on both fuel prices and the carbon value. As natural gas prices increase, the "crossover" occurs at a higher carbon value.
- NEW (not shown) vs. OLD: Carbon values may eventually get high enough to make the capital plus operating costs of new no-carbon generation cheaper than the operating only costs of an existing generation unit. At that point, operators would retire the existing unit.

Climate policy impact on levelized cost: NEW vs. OLD/NEW

Levelized Costs for New Plants in 2025 with a Value Placed on Carbon Dioxide Emissions

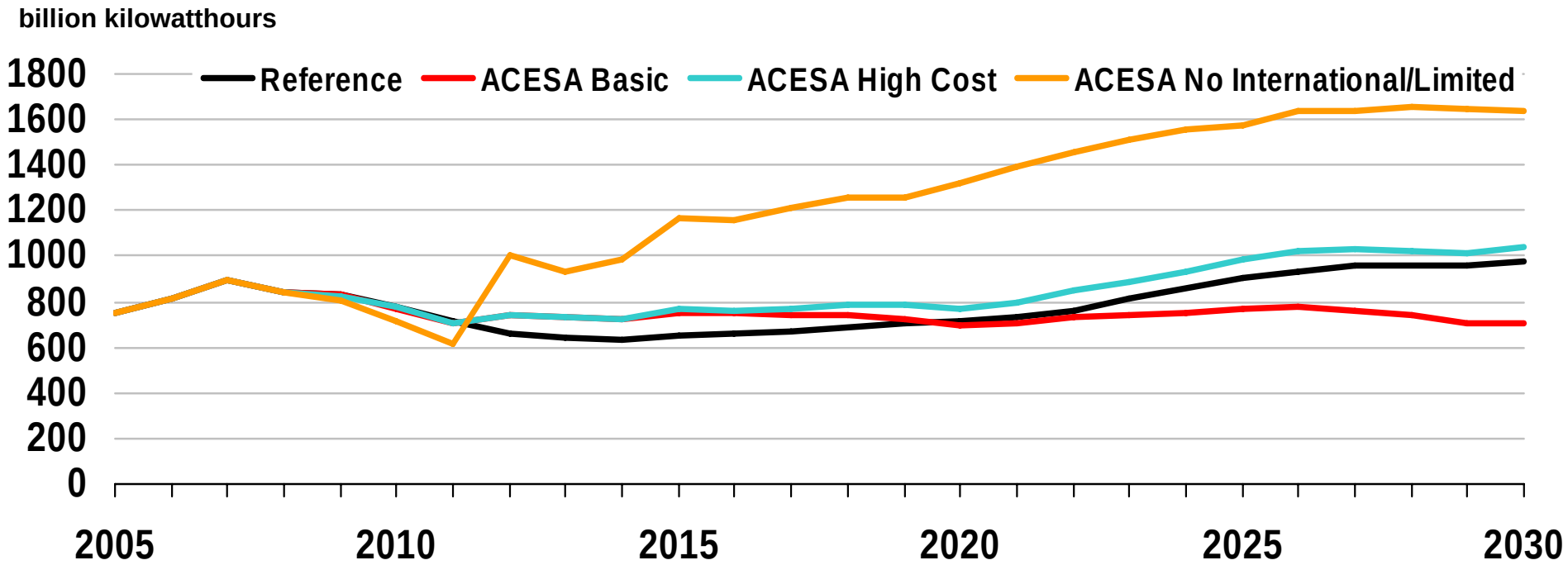


- Levelized cost, which considers both capital and operating costs, is one useful metric for comparing generation technologies.
- The crossing points for tradeoffs among technologies in "NEW vs. NEW" capacity decisions generally occur at lower carbon dioxide values than the crossing points for "OLD vs. OLD" dispatch decisions.

Electricity demand is also uncertain

- EIA's reference electricity demand projection is sensitive to:
  - the projected rate of economic growth and its mix: faster growth and more growth in energy-intensive sectors would raise demand
  - the pace of efficiency improvements, both mandated and price-induced
  - residential fuel switching towards electricity and the growth of "other" plug load
- Transportation
  - Electrification (i.e. plug-in hybrids or EVs) of personal transport is not a major source of electricity demand uncertainty over the next decade
    - One million plug-in hybrids with a 40-mile range on grid power (PHEV-40) would raise projected electricity demand in 2020 by only about 5 billion kilowatthours, or one-tenth of 1 percent.

EIA's August 2009 analysis of H.R. 2454 (Waxman-Markey) suggests a near-term increase in gas-fired generation; the long-term effect varies across cases



- Major emissions reductions in electricity generation require EXISTING coal capacity to be retired in favor of new generation capacity. Conventional coal generation declines and renewables grow, in all climate policy cases
- The level of natural gas generation is sensitive to the availability and costs of nuclear power, coal with CCS, biomass, and offsets
- Changes between AEO2009 and AEO2010 could encourage additional use of natural gas -- analysis of the Kerry Lieberman discussion draft is now in progress

So, what is the impact of energy, climate, or other pollution policies on the use of natural gas for electricity generation?

- What is the implicit value of carbon
  - What are the emissions targets?
  - To what extent are offsets allowed or used?
  - Cost, timing, and public acceptance of low/no carbon generation technologies
  - Value of captured CO_2 for enhanced oil recovery operations?
- What is the price of natural gas?
- How much support will renewables, nuclear and CCS get from tax credits, mandates, feed-in tariffs, loan guarantees, depreciation provisions and "bonus" allowance allocations?
- How do end-use efficiency efforts, included in or parallel to climate policies, affect load growth?
- Which competitive margin ("new vs. new," "old vs. old," or "old vs. new") are we looking at in each market?
- How does the prospect of future climate policies affect the willingness to invest in existing plants to meet other pollution control requirements?

For more information

U.S. Energy Information Administration home page	www.eia.gov
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
Monthly Energy Review	www.eia.gov/emeu/mer/contents.html
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U.S. Energy Information Administration
www.eia.gov

Incentives for using natural gas to fuel heavy trucks are under active discussion in Congress

- AEO2010 includes sensitivity cases examine the impact of tax credits aimed at stimulating natural gas use in heavy duty (class 3 through 8) trucks. Based on pending legislation, the credits are provided through either 2019 or 2027 and cover
  - 100 percent vehicle incremental cost (above diesel counterpart)
  - $0.50 per gallon gasoline equivalent fuel credit
  - $100,000 per refueling facility
- The penetration and acceptance of natural gas as a fuel for long-distance trucking faces two significant barriers: limited driving range without refueling and a lack of available fueling infrastructure.
- The best near-term market penetration opportunity for trucks fueled with natural gas is likely in centrally fueled fleets that operate primarily within a limited distance from their base.
  - Impact estimates are very sensitive to assumptions made regarding the size of this market segment.

Despite the expected cost advantage of natural gas relative to diesel, the impact of incentives for natural gas heavy trucks depends primarily on the extent of the market, which is highly uncertain.

Figure 21. Delivered energy prices for diesel and natural gas transportation fuels in the Reference case, 2000-2035 (2008 dollars per gallon of diesel equivalent)

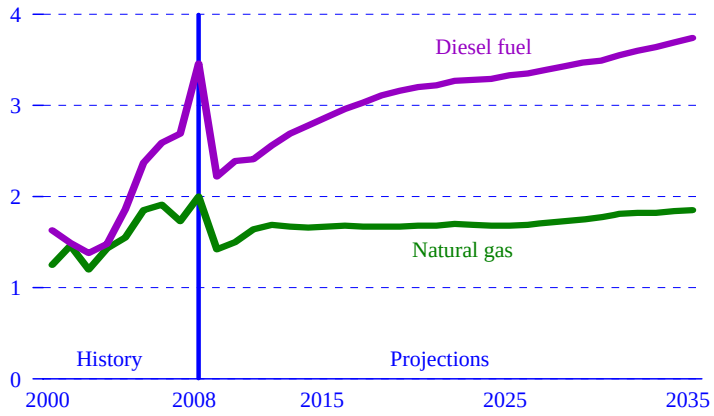


Figure 22. Sales of new heavy-duty natural gas vehicles in Base Market and Expanded Market cases with Reference case world oil prices, 2010-2035 (thousands of vehicles)

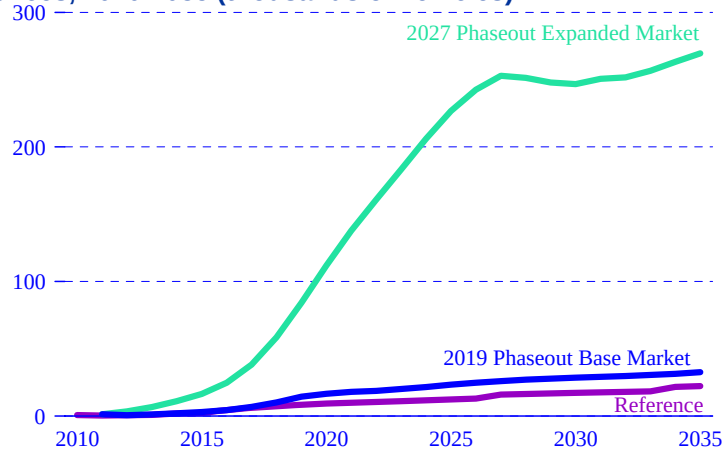


Figure 23. Natural gas fuel use by heavy-duty natural gas vehicles in Base Market and Expanded Market cases with Reference case world oil prices, 2010-2035 (trillion cubic feet)

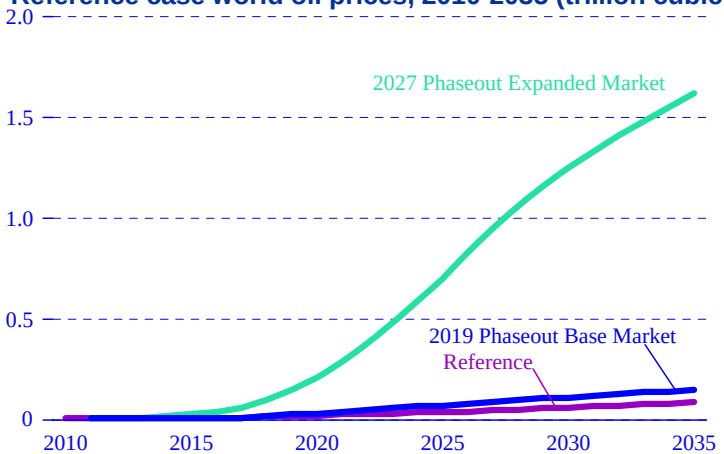
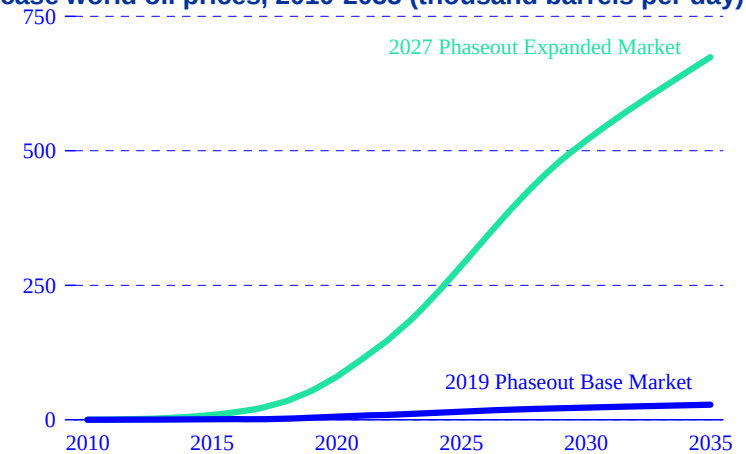
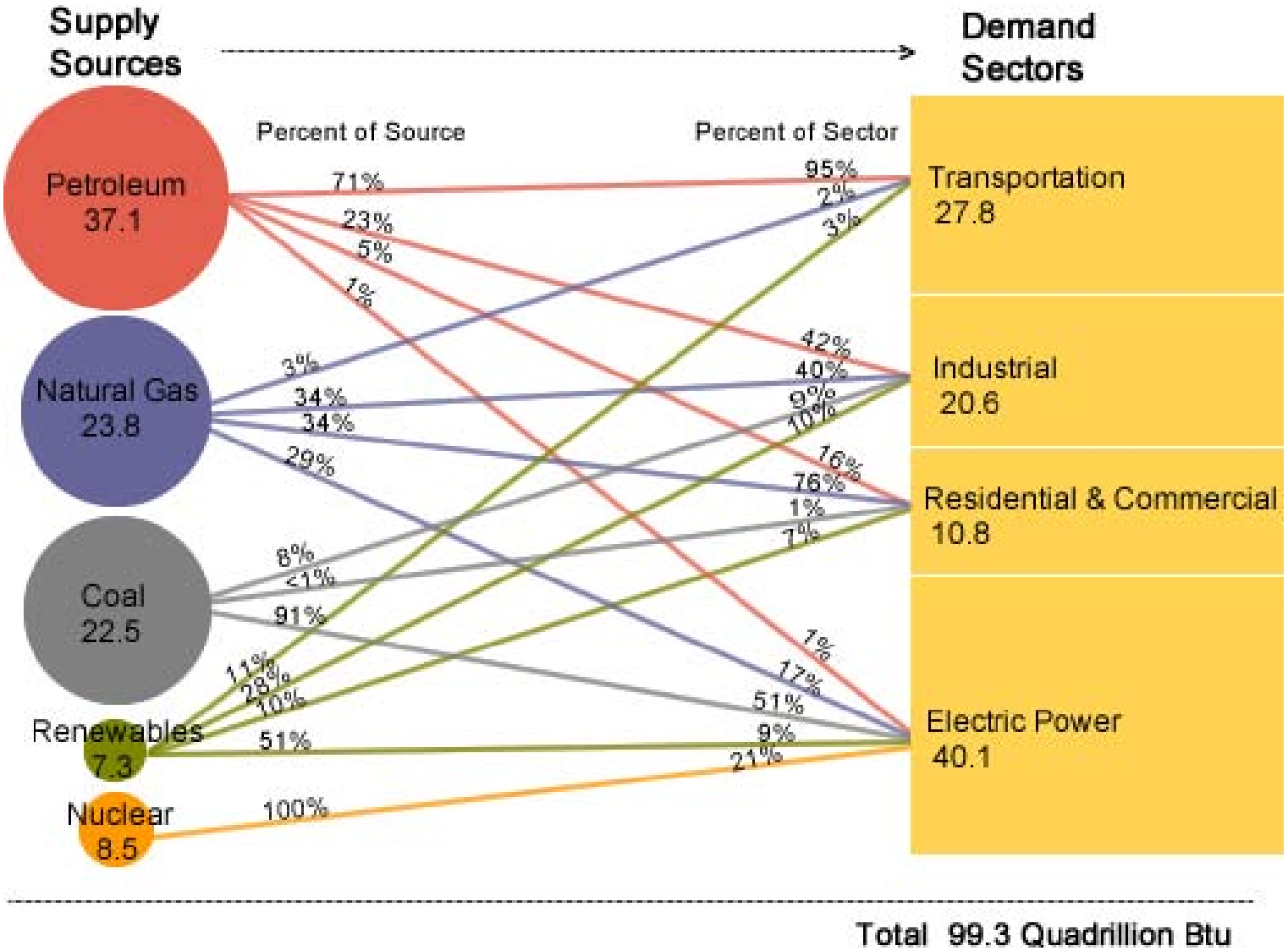


Figure 24. Reductions in petroleum product use by heavy-duty vehicles in Base Market and Expanded Market cases with Reference case world oil prices, 2010-2035 (thousand barrels per day)

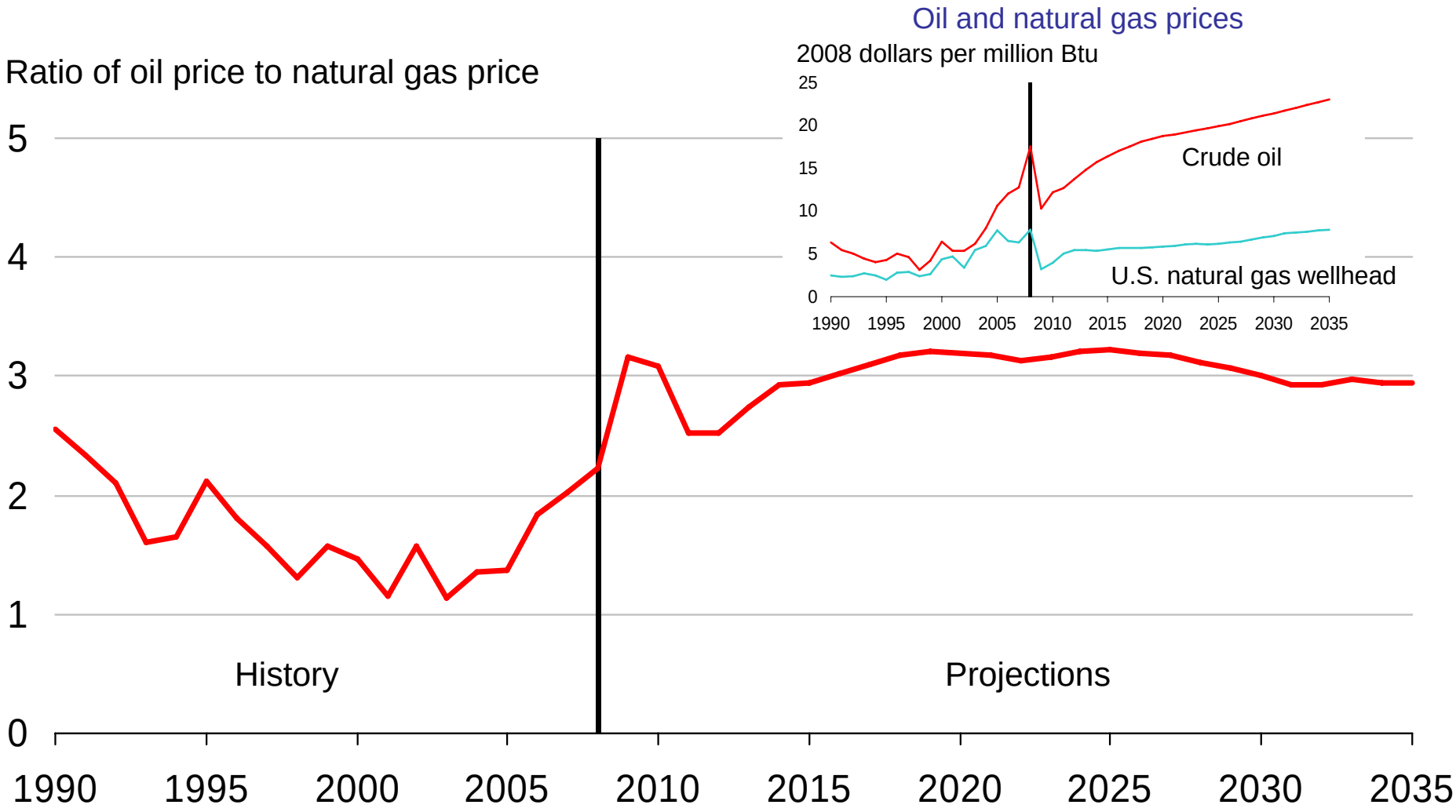


U.S. primary energy consumption was 84% fossil-fueled in 2008



Source: EIA *Annual Energy Review 2008*

Oil to natural gas price ratio remains high over the AEO2010 projection



Source: *Annual Energy Outlook 2010*