OUTLOOK FOR NATURAL GAS MARKETS

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INTRODUCTORY COMMENTS

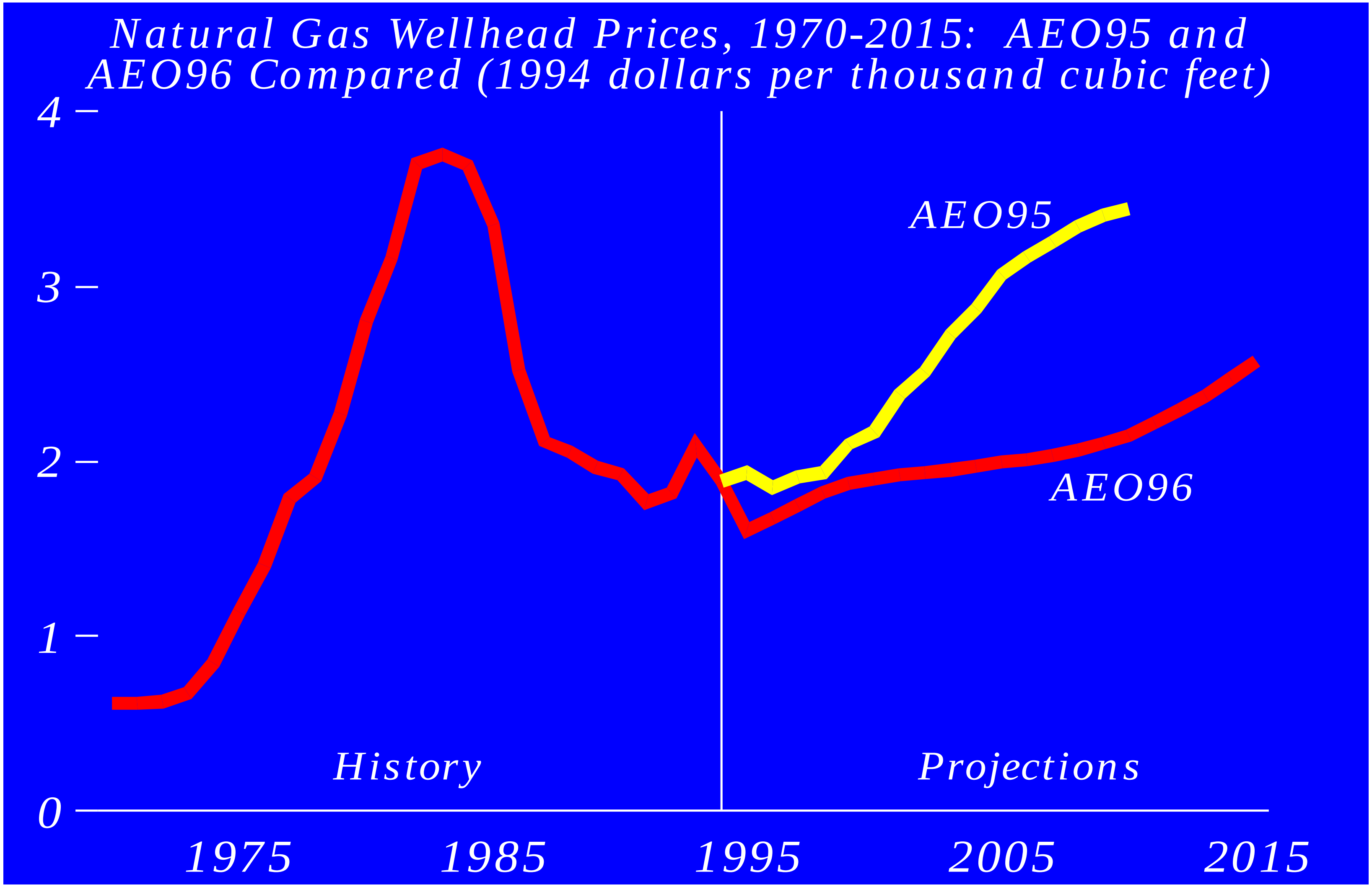
This is the first time EIA has published an outlook that provides projections to 2015.

The Annual Energy Outlook 1996 (AEO96) is also the first time EIA published the annual results (1993 - 2010, and 2015) in the tables included in the publication. EIA did this in response to customer feedback.

AEO96 is the third time EIA used the National Energy Modeling System (NEMS) to produce an AEO.

EIA welcome your suggestions, questions, and comments. EIA has a continuing dialog with many of its customers and we hope to broaden that dialog to include many of you at this meeting.

The industry has seen a lot of change in the last decade. There has been significant regulatory reform in response to competitive market pressures. In looking ahead EIA sees more change. Regulatory reform will continue to play out in the pipeline segment of the industry and competitive pressures will shift the regulatory reform agenda to the distribution segment of the industry, EIA also projects demographic changes that could have important implications for natural gas markets.


Natural Gas Wellhead Prices, 1970-2015: AEO95 and AEO96 Compared (1994 dollars per thousand cubic feet)
4
3
2
1
0
AEO95
AEO96
History
Projections
1975
1985
1995
2005
2015

Wellhead prices, AEO95 v. AEO96

The AEO96 natural gas wellhead price is 38 percent lower in 2010 than the AEO95 price in 2010.

The natural gas wellhead price is projected to be $2.15/mcf in 2010 and $2.57/mcf in 2015. It was projected to be $3.46 in 2010 in AEO95. (All dollars are 1994 dollars.)

The current projection is very different from other earlier EIA projections. Four years ago, EIA projected the wellhead price to be $5.18 for 2010 in AEO92. The current projection is 58 percent lower than AEO92.

The natural gas wellhead price is projected to increase at an average annual rate of 1.5 percent per year from 1994-2015. This growth rate is compared to 3.1 percent per year for the 1993-2010 period in AEO95.

Major Reasons for Lower Natural Gas Wellhead Prices in AEO96 vs. AEO95

- Inferred Reserve Base Increased: EIA's inferred reserve base for lower-48 onshore conventional nonassociated gas doubled from 114 trillion cubic feet to 232 trillion cubic feet, in response to a reassessment by the U.S. Geological Survey of ultimate recovery from known fields (which tripled from the earlier USGS assessment).

- Finding Rates Higher: Higher inferred reserves resulted in higher average reserve additions per well (finding rate) for lower-48 gas reserves, supporting higher levels of production and reducing wellhead prices.

- Drilling Costs Dropped: Updated assessments of industry conditions and rates of technological progress contributed to lower drilling costs throughout the forecast period, resulting in increased cumulative drilling and production, particularly offshore production.

- Drilling Methodology Revised: Levels of drilling activity were determined separately for oil and gas at a regional level, based on the economics of each fuel, contributing to higher production and lower prices for natural gas.

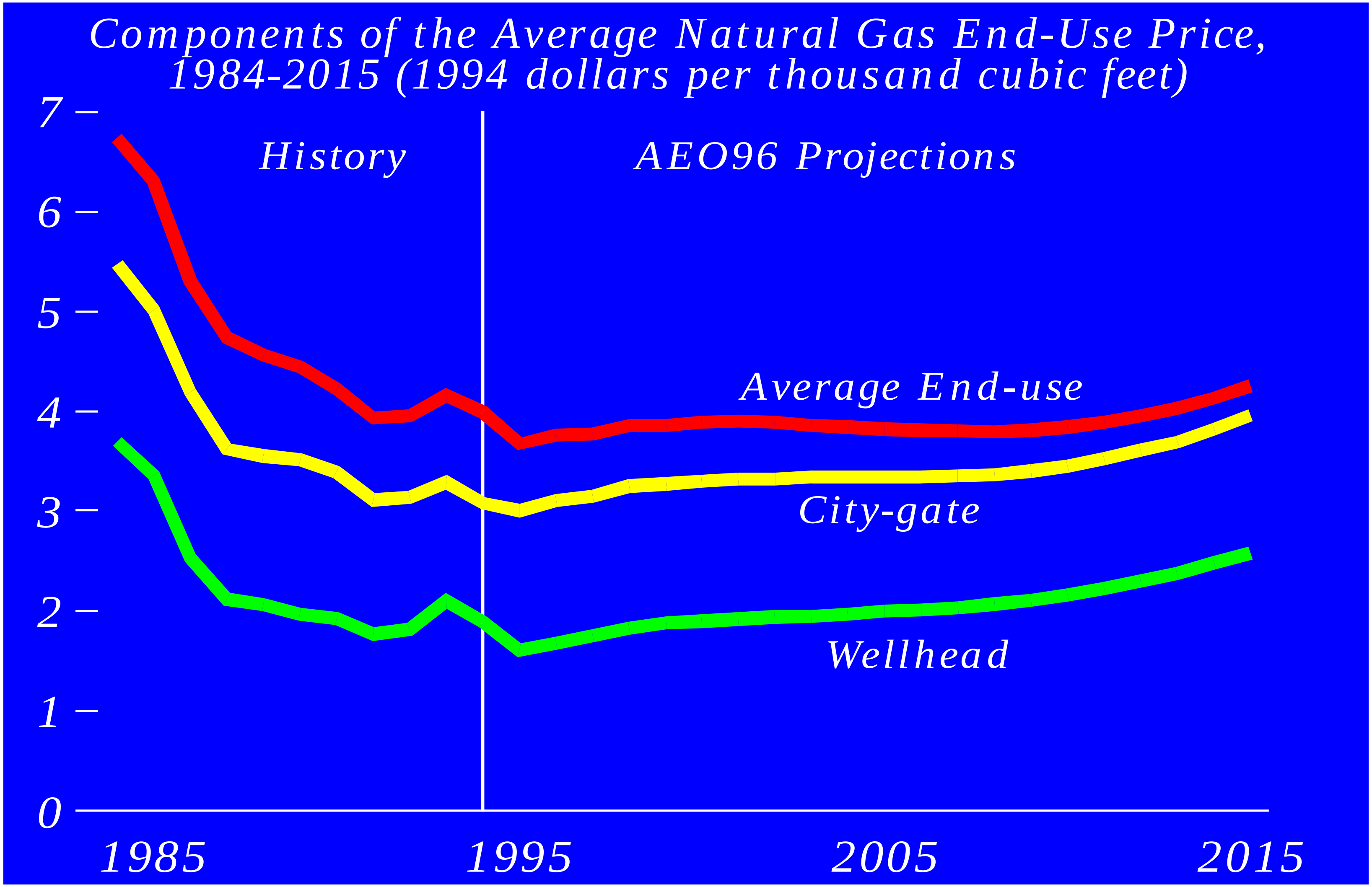
Major Reasons for Lower Natural Gas Wellhead Prices

EIA made three major change in AEO96 which caused the drop in wellhead prices:

- Based on new data from the United States Geological Survey, EIA doubled the level of inferred reserves in the resource base. This change led to higher finding rates. The AEO96 finding rates are on average about 16 percent greater than those in AEO95.

- EIA reduced the drilling costs. Both onshore and offshore drilling costs are 37 percent lower than AEO95.

- EIA revised the drilling methodology used in the modeling system. The methodology change reflects changes in the real world, where we've seen that (1) gas is no longer a byproduct of oil and natural gas drilling occurs on its own merits, and (2) wellhead decontrol, open access to the pipeline system, industry restructuring, and technological change have shifted drilling away from the Appalachian areas back to the Gulf Coast and the Southwest. In 1985, approximately 48 percent of the drilling activity was in the "Gas Patch" (Texas, Louisiana, and Oklahoma), while in 1994 64 percent of the drilling activity was in this region.


Components of the Average Natural Gas End-Use Price, 1984-2015 (1994 dollars per thousand cubic feet)
7
6
5
4
3
2
1
0
History
AEO96 Projections
Average End-use
City-gate
Wellhead
1985
1995
2005
2015

The average delivered price of natural gas is projected to be relatively flat

The average end-use price of natural gas is expected to decline slightly through 2008 for several reasons:

(1) Market growth is predominately in the industrial and electric generation markets which have lower prices because of their large volumes and relatively level loads.

(2) Growth in these two sectors provides for greater load diversity.

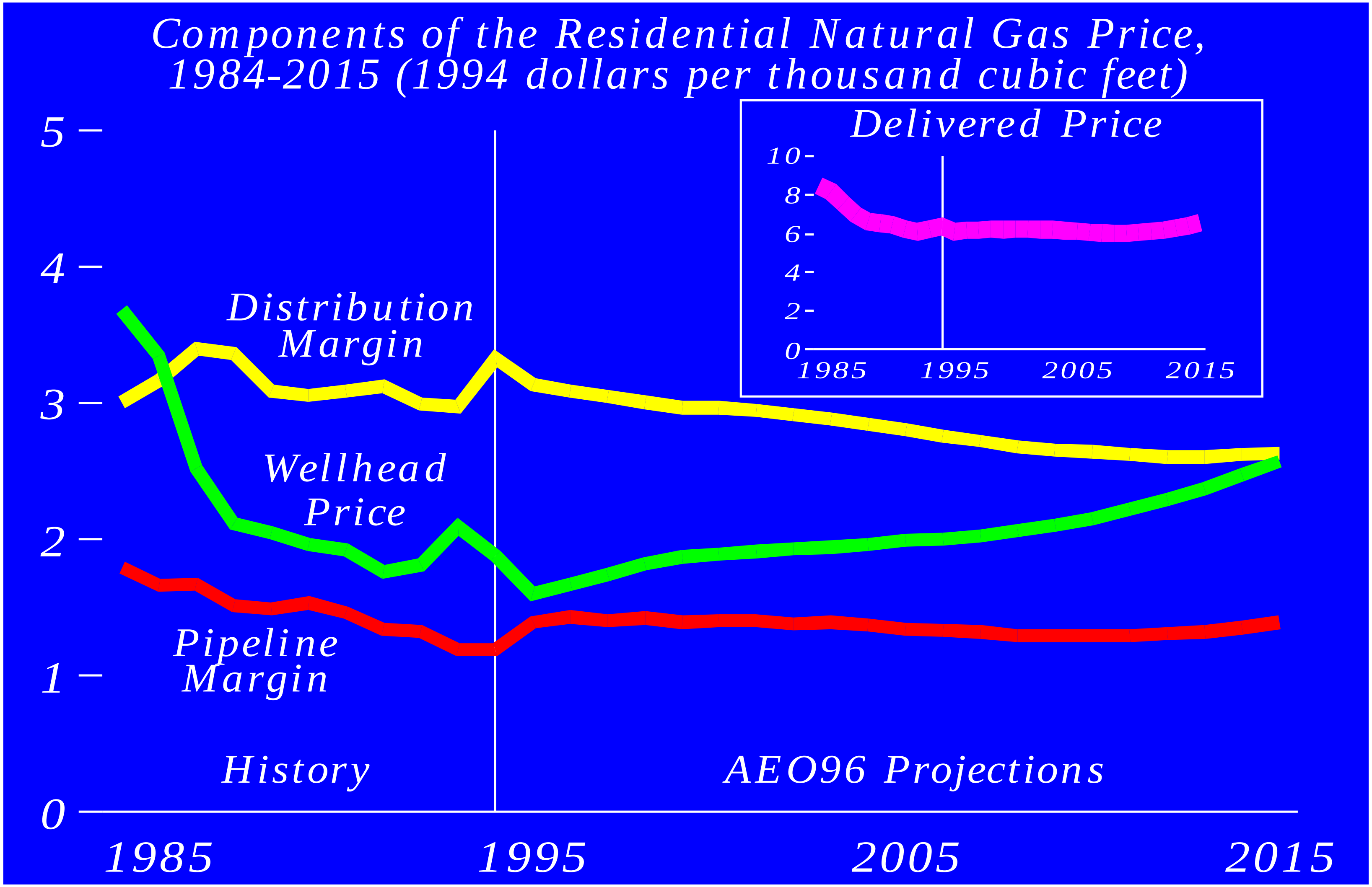
(3) Recent pipeline and storage construction gives the industry ample opportunity to absorb load growth through better (increased) utilization of existing infrastructure. The AEO96 Reference Case projections show a 10 percent improvement in pipeline utilization by 2010.

(4) Efficiency improvements in the transmission segment of the industry will continue holding down the city-gate price.

(5) Increased retail competition and projected lower costs of capital will contribute to declines in the price of distribution services lowering the margin between the city-gate and end-use price .

After 2008, wellhead price increases exceed declines in transmission and distribution margins resulting in a small increase in the average end-use price of natural gas.

It is important to look at what is happening to prices in each end-use sector because average prices can mask important changes in the natural gas value chain.

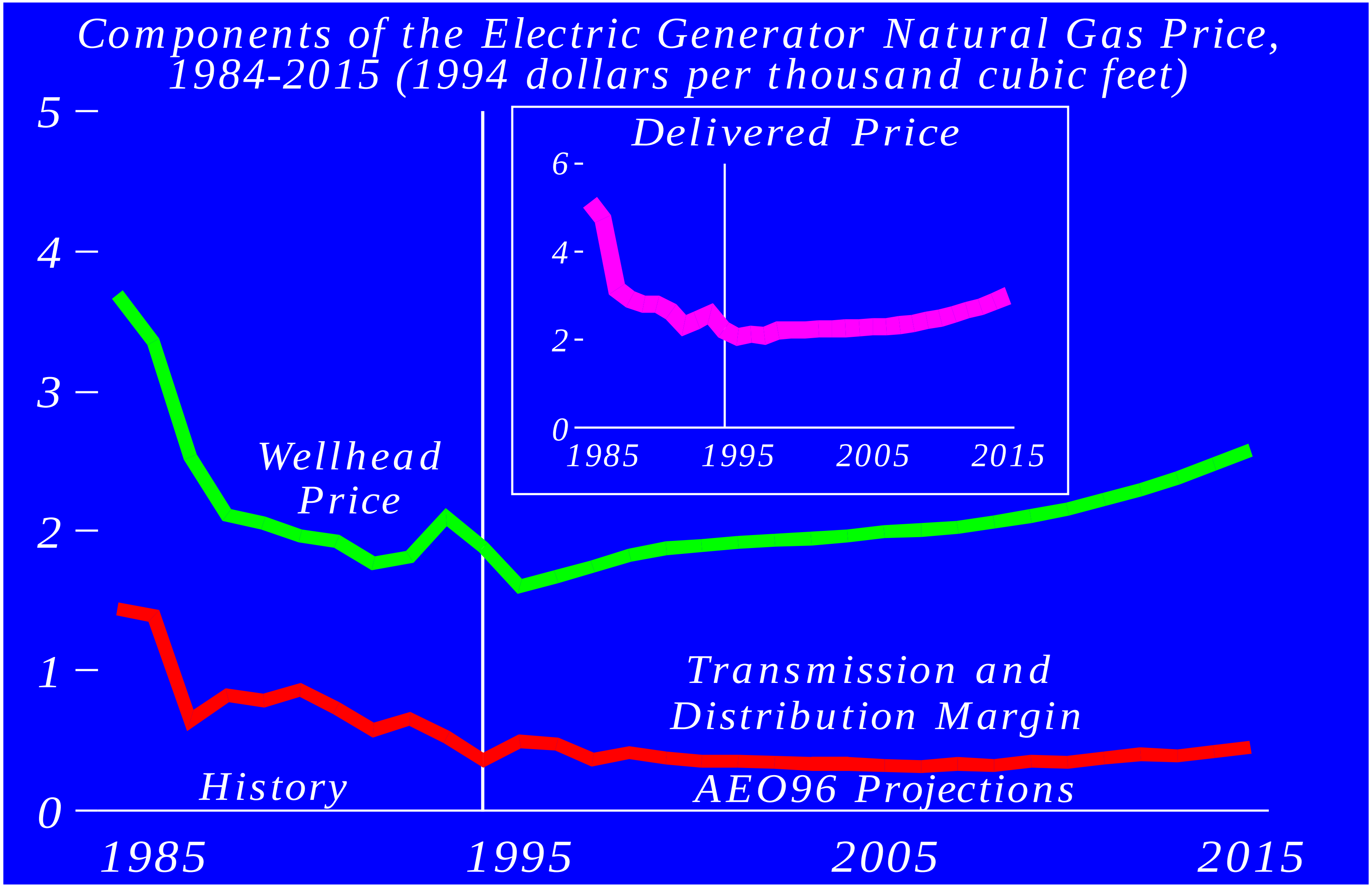

Components of the Residential Natural Gas Price,
1984-2015 (1994 dollars per thousand cubic feet)
Delivered Price
10
8
6
4
2
0
1985
1995
2005
2015
5
4
3
2
1
0
Distribution
Margin
Wellhead
Price
Pipeline
Margin
History
AEO96 Projections
1985
1995
2005
2015

Residential prices largely remain stable because of reductions in the margin for distribution services.

The residential distribution margin is projected to decline from $3.20 per mcf in 1994 to $2.63 per thousand cubic feet (mcf) in 2015.   These declines largely offset the projected $0.70 per mcf increase in the wellhead price.

Distribution margins are projected to decline as a result of anticipated unbundling of distribution services and increased retail competition among companies providing natural gas services and among fuels competing for end-use markets (particularly electricity).

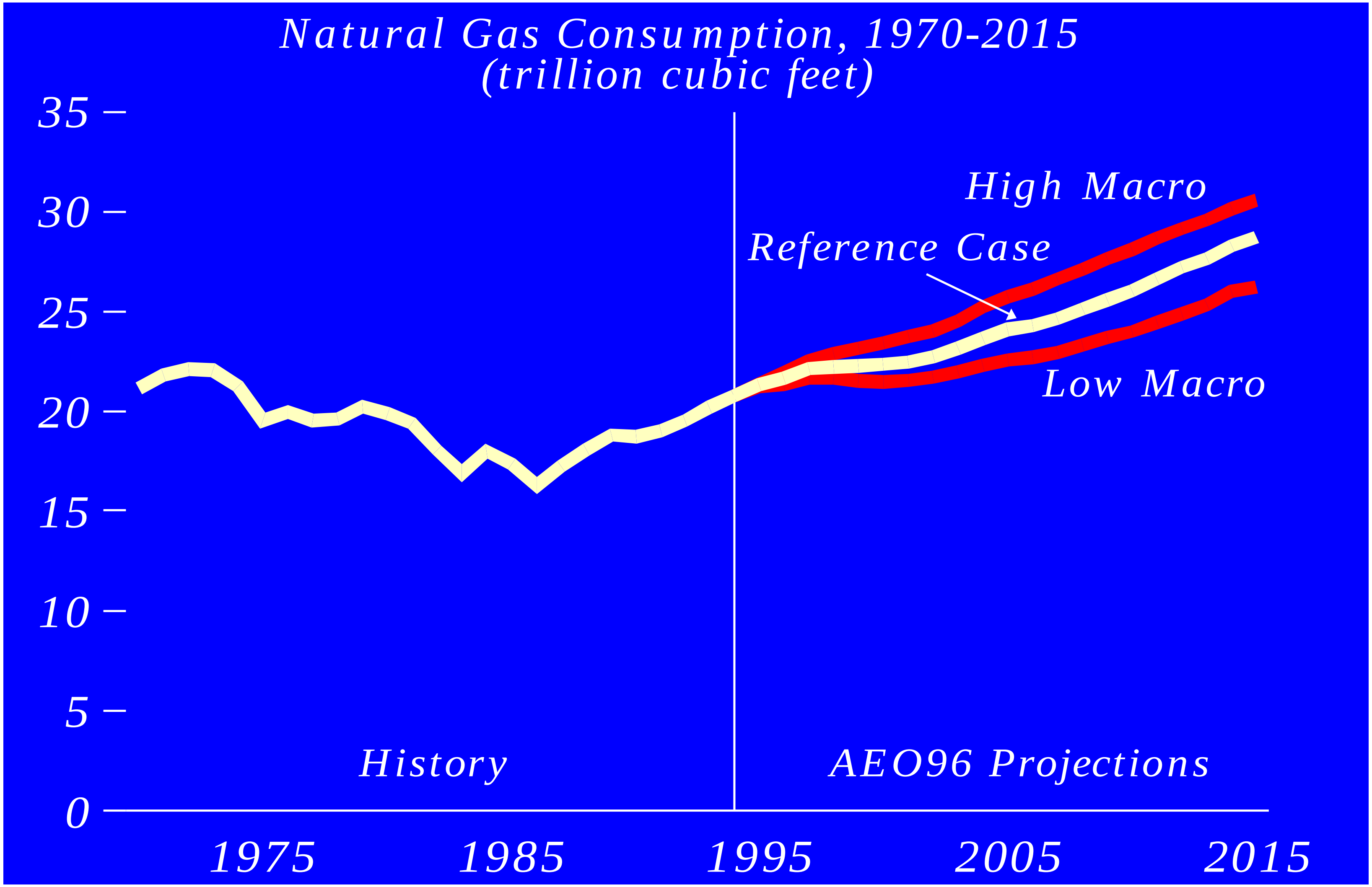
Residential customers, who represent a 23 percent of total natural gas consumption, are projected to see the wellhead share of their delivered natural gas cost rise from 27 percent in 1994, to 35 percent in 2010 and 39 percent in 2015.


Components of the Electric Generator Natural Gas Price, 1984-2015 (1994 dollars per thousand cubic feet)
Delivered Price
6
4
2
0
1985
1995
2005
2015
5
4
3
2
1
0
Wellhead Price
Transmission and Distribution Margin
History
AEO96 Projections
1985
1995
2005
2015

<u>The price of natural gas to electric generators is projected to remain at 1994 levels through 2005 and then rise very gradually through 2015</u>.

Over the forecast, transmission and distribution margins to the electric generator sector decline slightly and then increase. The increase is fully attributable to regional shifts in the power generation market. Gas is moving further from the wellhead than it has in the past. Typically most of the natural gas used for power generation was consumed in the producing regions and California. Over the forecast period, most of the increase in natural gas consumption for power generation occurs in regions that are net consumers of natural gas, particularly the South Atlantic, MidAtlantic, and East North Central regions of the United States.

In 1994, the supply costs represented a 76 percent share of the delivered price to electric generators. For these large customers, we project this share to increase to 84 percent in 2015.



Natural Gas Consumption, 1970-2015
(trillion cubic feet)
35
30
25
20
15
10
5
0
High Macro
Reference Case
Low Macro
History
AEO96 Projections
1975
1985
1995
2005
2015

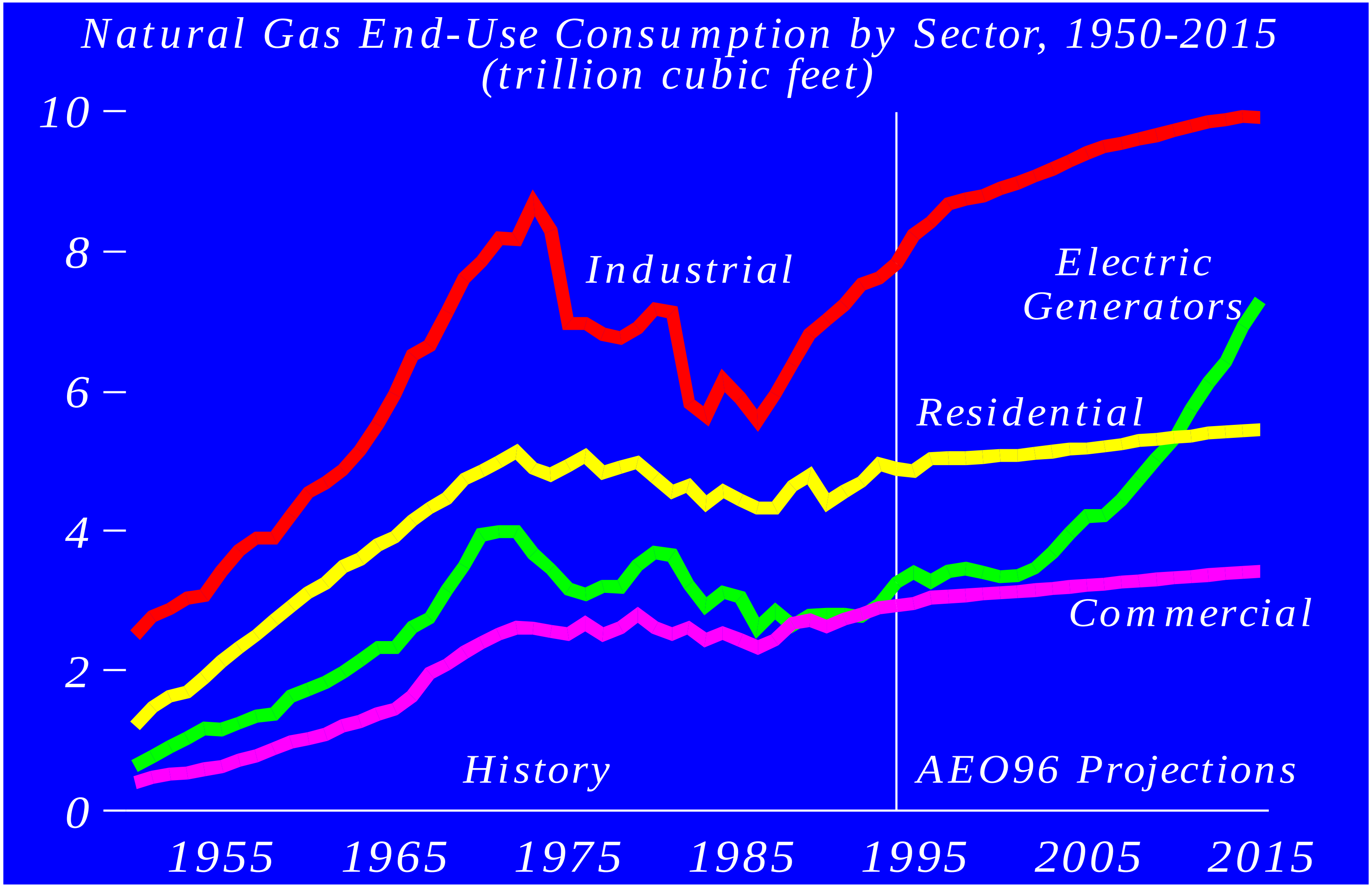
Growth in gas consumption is not expected to be significant for about another 5 years and is highly dependent on economic growth.

Total natural gas consumption in the reference case is projected be 28.7 trillion cubic feet by 2015.

The reference case and low macro-economic growth case (real Gross domestic product at 2.0 and 1.5 percent, respectively) show a significant lag in growth of natural gas consumption. Post 2000, market growth resumes and consumption increases average 1.6 and 1.1 percent per year in the reference and low macro-economic growth cases, respectively.

The timing of the upswing in the power generation market is linked to the level of macro-economic growth.

The high macro-economic growth care (real Gross domestic product grows annually at 2.5 percent) shows a more consistent growth pattern in natural gas consumption for power generation, averaging 4.5 percent per year with growth in total natural gas consumption averaging 1.9 percent per year over the forecast period.



Natural Gas End-Use Consumption by Sector, 1950-2015
(trillion cubic feet)
10
8
6
4
2
0
Industrial
Electric
Generators
Residential
Commercial
History
AEO96 Projections
1955
1965
1975
1985
1995
2005
2015

Gas Consumption increases in all sectors throughout the reference case forecast

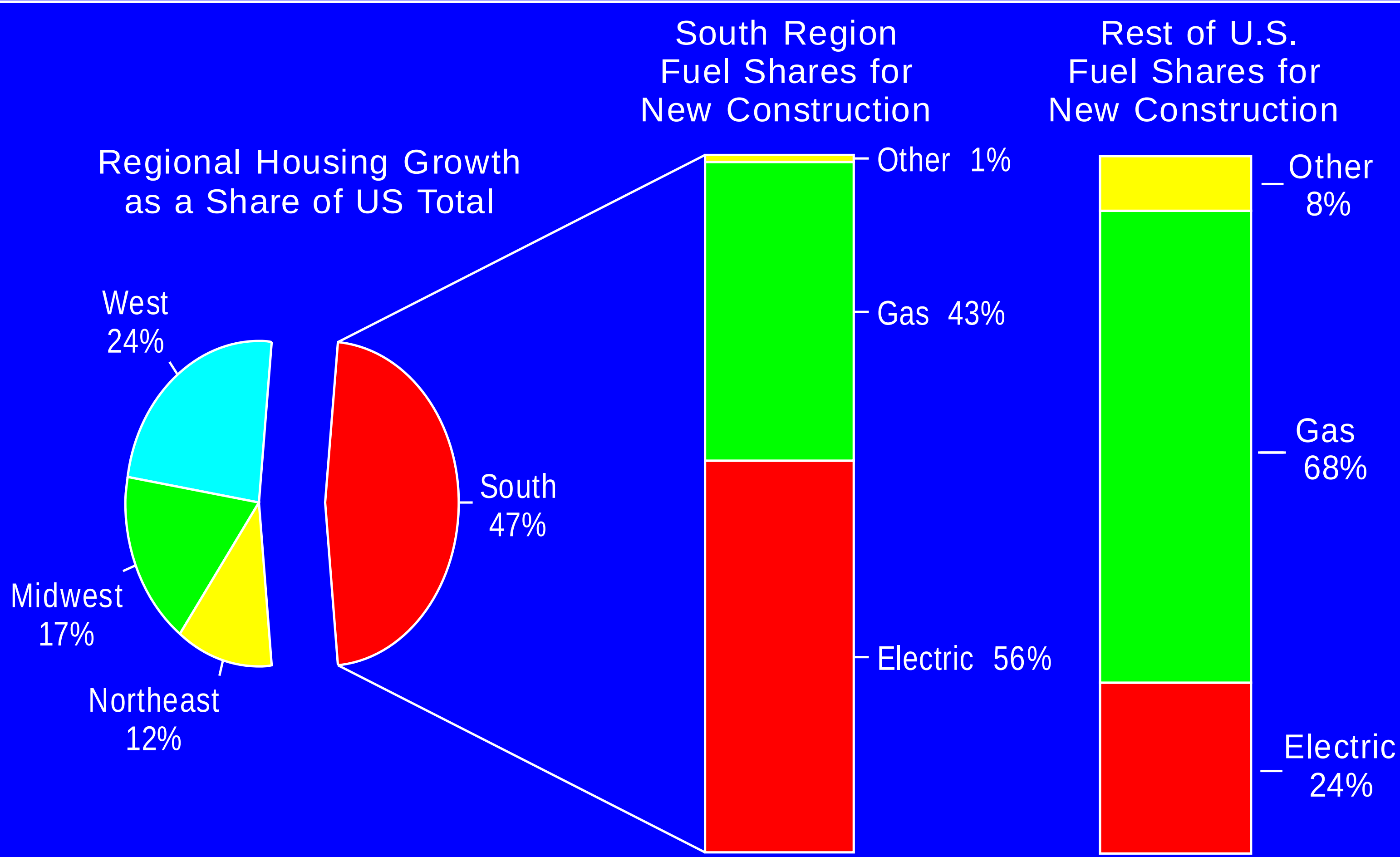
Consumption for electricity generation shows by far the largest growth of any sector and more than doubles from 1994 levels by 2015.

Industrial consumption of natural gas shows more than 25 percent growth, too, over the forecast period.

Commercial consumption of natural gas shows steady increases.

Unlike most earlier editions of the AEO, including AEO95, residential consumption is projected to increase slightly over the forecast period. There are some interesting regional/demographic issues in the residential sector I will develop further in the following slides.

Housing Growth and Heating Fuel Shares, 1994-2015



Source: AEO96.

Housing growth in the South works against growth in natural gas market share.

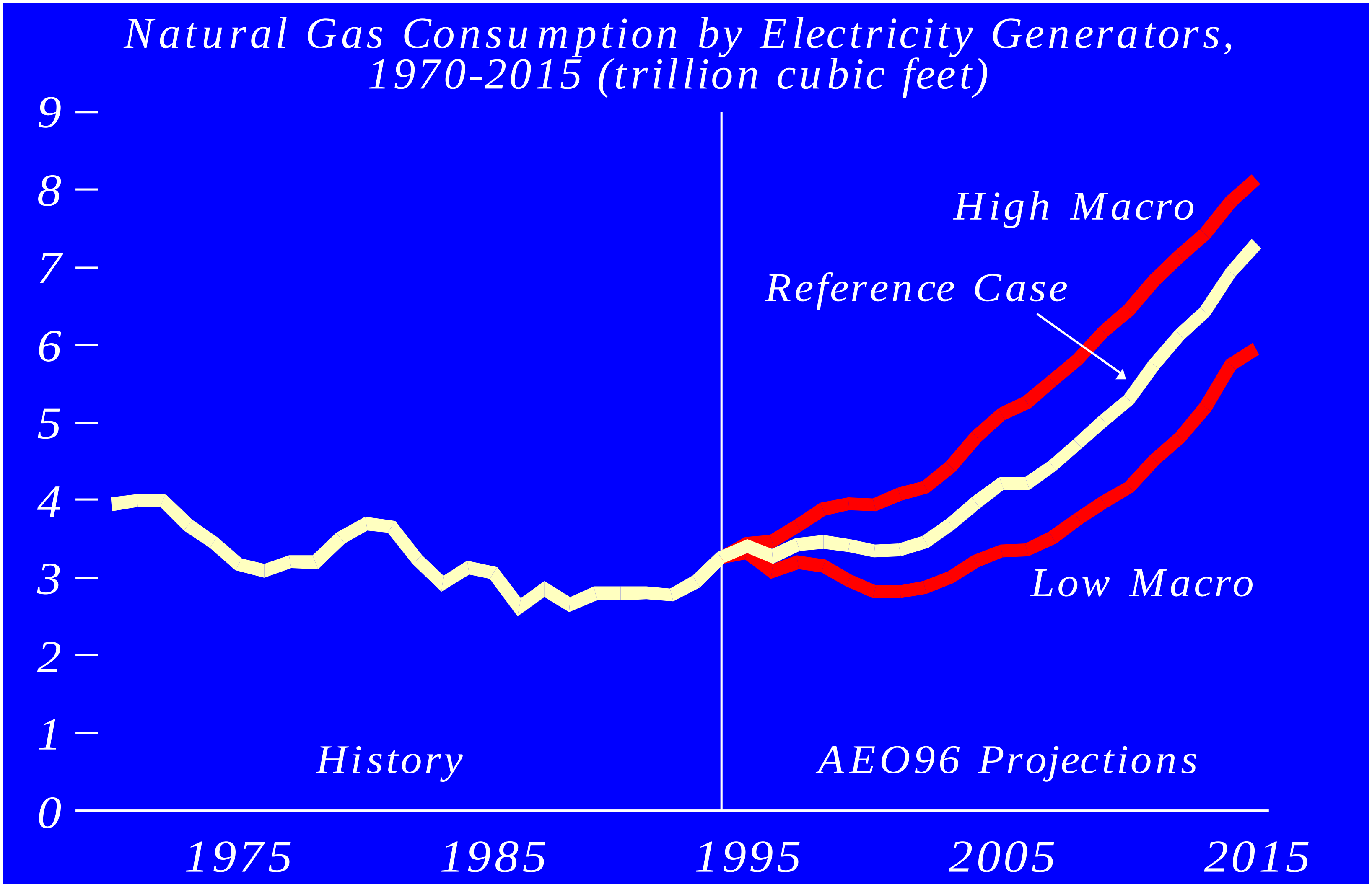
Forty-seven percent of new housing construction (single, multi-family, and mobile homes) is expected to occur in the South Census Region.

The South Census Region is less energy intensive than the other census regions.

The South Census Region is also the region where natural gas has had the lowest market share for space heating.

EIA expects electricity to continue to dominate the space heating market in the South region (56 percent) largely because equipment costs are lower and because the heating loads are less significant in this region.

Nationally, natural gas fares better (at 56 percent of new construction) with the vast majority of new construction in the Northeast, Midwest, and West going to natural gas.


Natural Gas Consumption by Electricity Generators,
1970-2015 (trillion cubic feet)
9
8
7
6
5
4
3
2
1
0
High Macro
Reference Case
Low Macro
History
AEO96 Projections
1975
1985
1995
2005
2015

Underutilized power generation system and slow growth in electricity demand deter growth in gas use for power generation in the reference and low macro-economic growth cases. Market growth opportunities occur sooner with higher macro-economic growth.

Short-term electricity demand growth is sluggish.

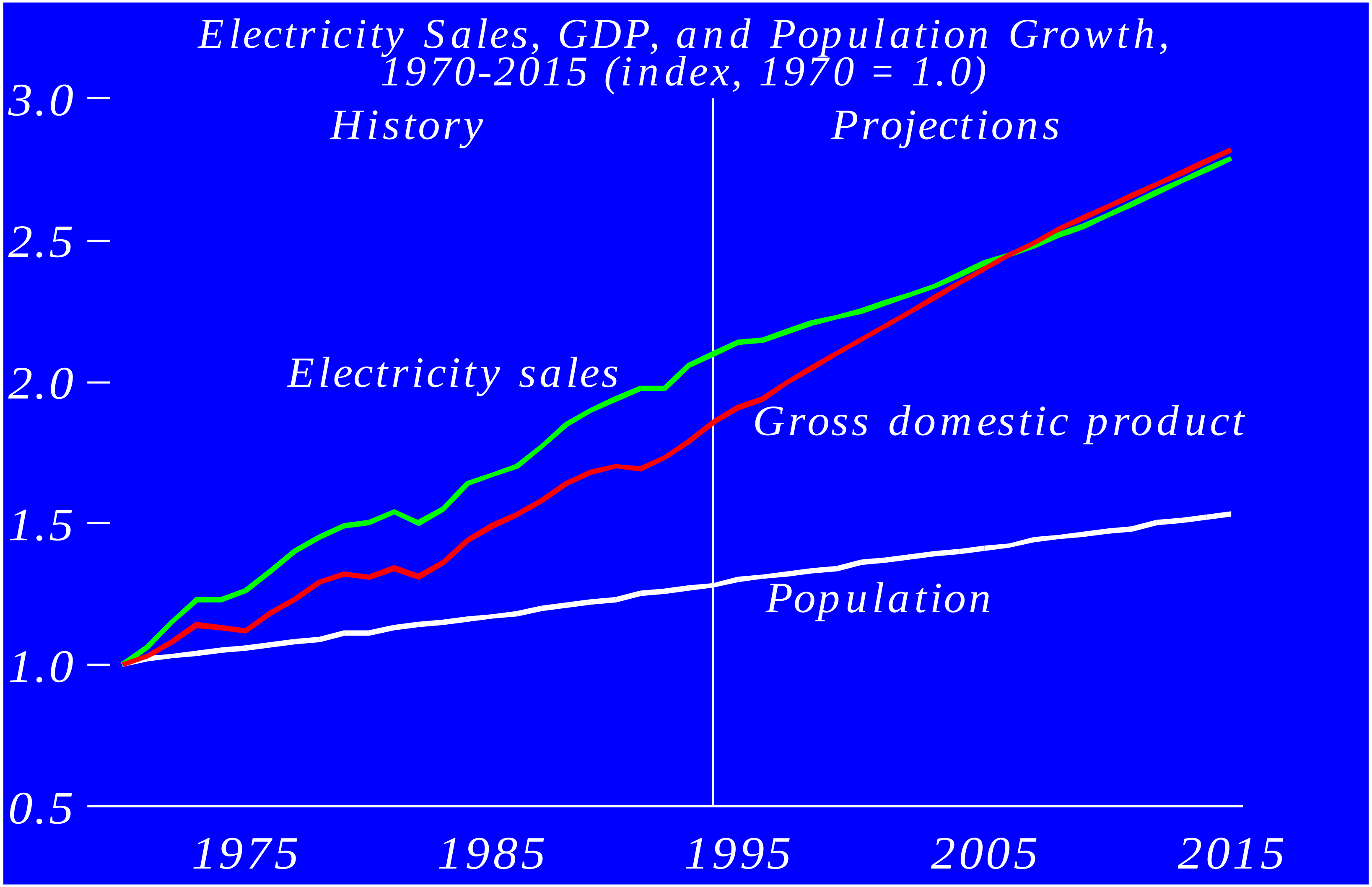
The forecast reflects a short-term increase in the utilization of coal and nuclear units.

After coal and nuclear capacity reach maximum utilization, turbines dominate new construction. Consumption of natural gas in turbines is not a big market because the units operate at very low levels.

Thus, in the reference case EIA projects limited growth opportunities for natural gas in power generation markets until about 2003.

From 2003 to 2010, new construction of combined-cycle plants provides significant market growth opportunities for natural gas.

The retirement of nuclear units accelerates growth in natural gas consumption in the last 5 years of the outlook. Nationwide, there are currently 109 operable nuclear units, (approximately 100 gigawatts) which represent 13 percent of total capacity and provide 20 percent of total electricity generation. By 2015, 49 units (37 gigawatts) are projected to be retired. Nuclear's share of total U.S. generation capacity is projected to drop to 7 percent by 2015 and nuclear's share of total U.S. generation is projected to fall to 10 percent.


Electricity Sales, GDP, and Population Growth,
1970-2015 (index, 1970 = 1.0)
3.0
2.5
2.0
1.5
1.0
0.5
History
Projections
Electricity sales
Gross domestic product
Population
1975
1985
1995
2005
2015

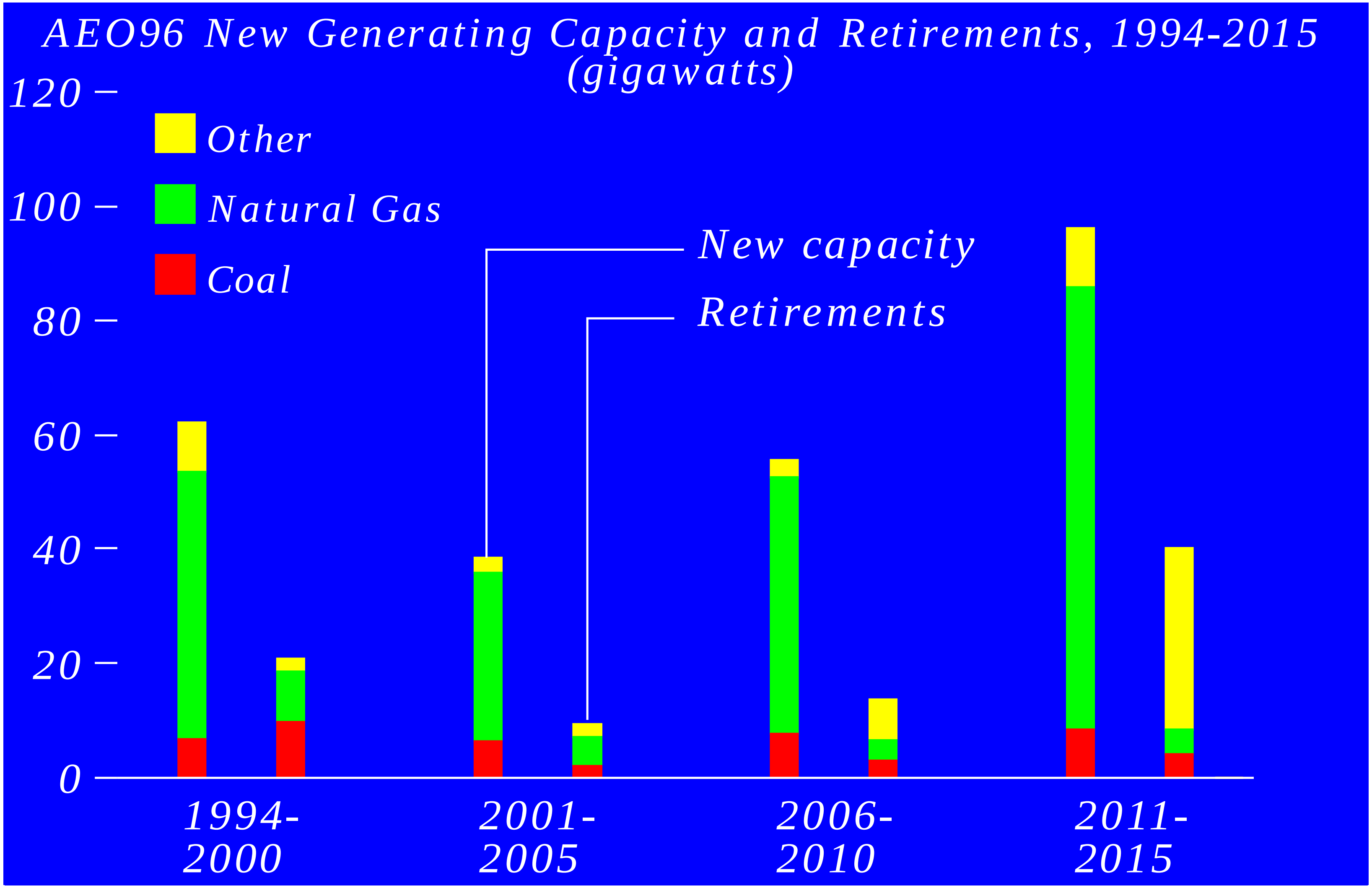
Electricity sales are projected to grow at an annual rate of 1.4 percent per year, significantly lower than real Gross domestic product (at 2.0 percent) but higher than population (at 0.8 percent)

Historically, electricity demand has been associated with economic growth.

During 1970's and 1980's, however, escalating fossil fuel prices and the costs of new construction increased the price of electricity production; consequently, the growth in demand for electricity decelerated.

Even though energy prices remained relatively stable in the first half of the 1990's, increases in appliances efficiency and insulation standards, along with industrial awareness of the impacts of energy costs on production costs, dampened the growth of electricity consumption, and demand growth lagged behind economic growth.

This trend is expected to continue.



AEO96 New Generating Capacity and Retirements, 1994-2015
(gigawatts)
120
100
80
60
40
20
0
Other
Natural Gas
Coal
New capacity
Retirements
1994-
2000
2001-
2005
2006-
2010
2011-
2015

Natural gas-fired generation capacity dominates new electric generator construction throughout the forecast period.

The new capacity is projected to be in “nontraditional” markets .

In 1994, 47 percent of the gas consumed for electric power generation was consumed in the West South Central Region (the “gas patch”) and 23 percent was consumed in the Pacific region (California).

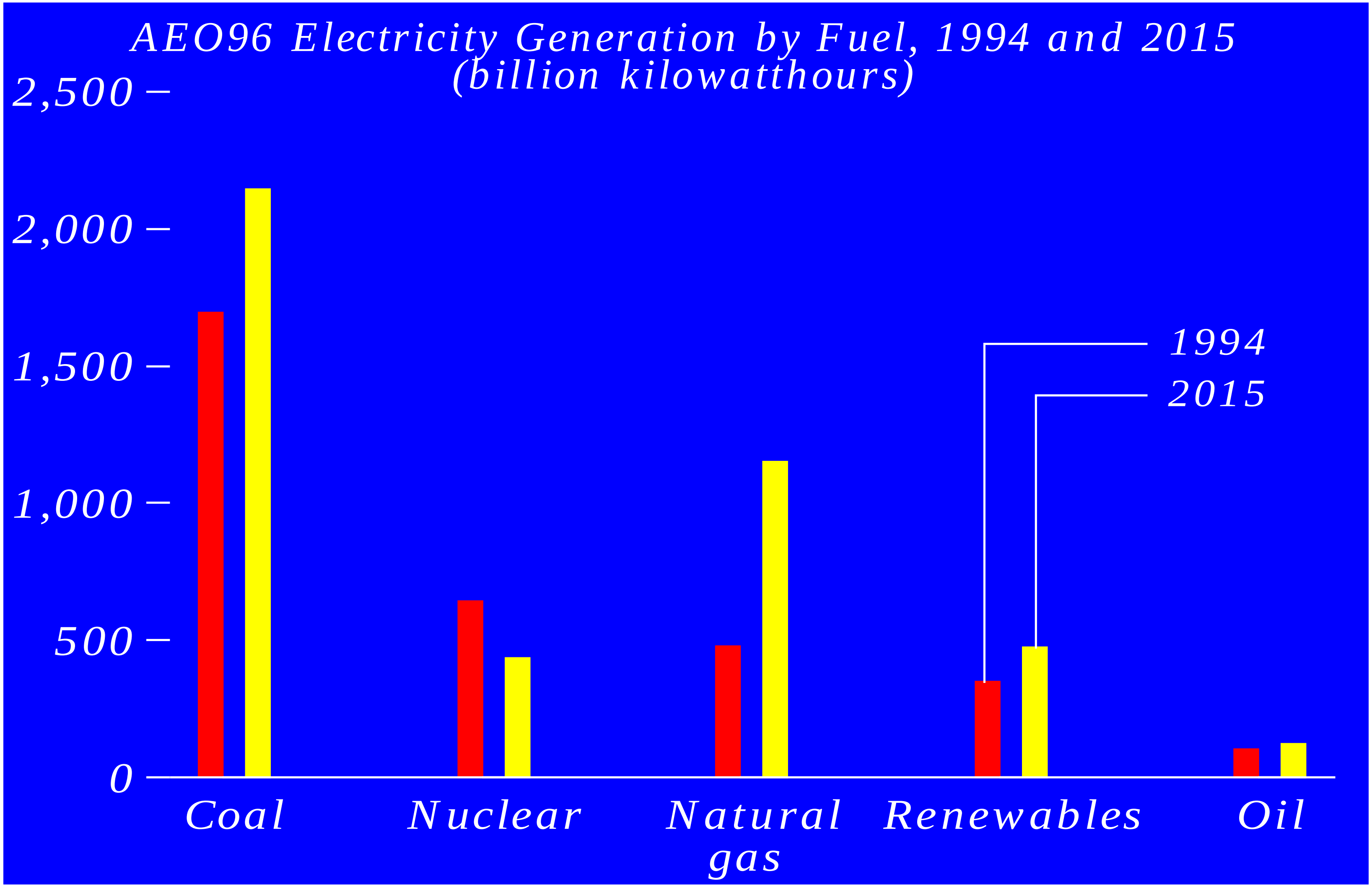
In 2015, the reference case projects that these two regional market shares will be about half of their current level. The West South Central is projected to decline to 25 percent and the Pacific is projected to decline to 13 percent.

In contrast, gas used for electric power generation in the South Atlantic, Middle Atlantic, and East North Central regions is projected to increase significantly. This group of three regions, consumed 18 percent of the natural gas used to generate electricty in 1994. The group is projected to increase its consumption to 49 percent of the natural gas used for power generation in 2015.

The growth in the South Atlantic region is supported by demographic changes and followed by the need to replace retiring nuclear capacity (particularly TVA units).

The growth in the East North Central and Mid-Atlantic regions is not until post-2010 when nuclear capacity retires in those regions.

EIA also sees the New England region following a similar pattern with natural gas backfilling some of the retiring nuclear capacity in the out-years of the forecast.

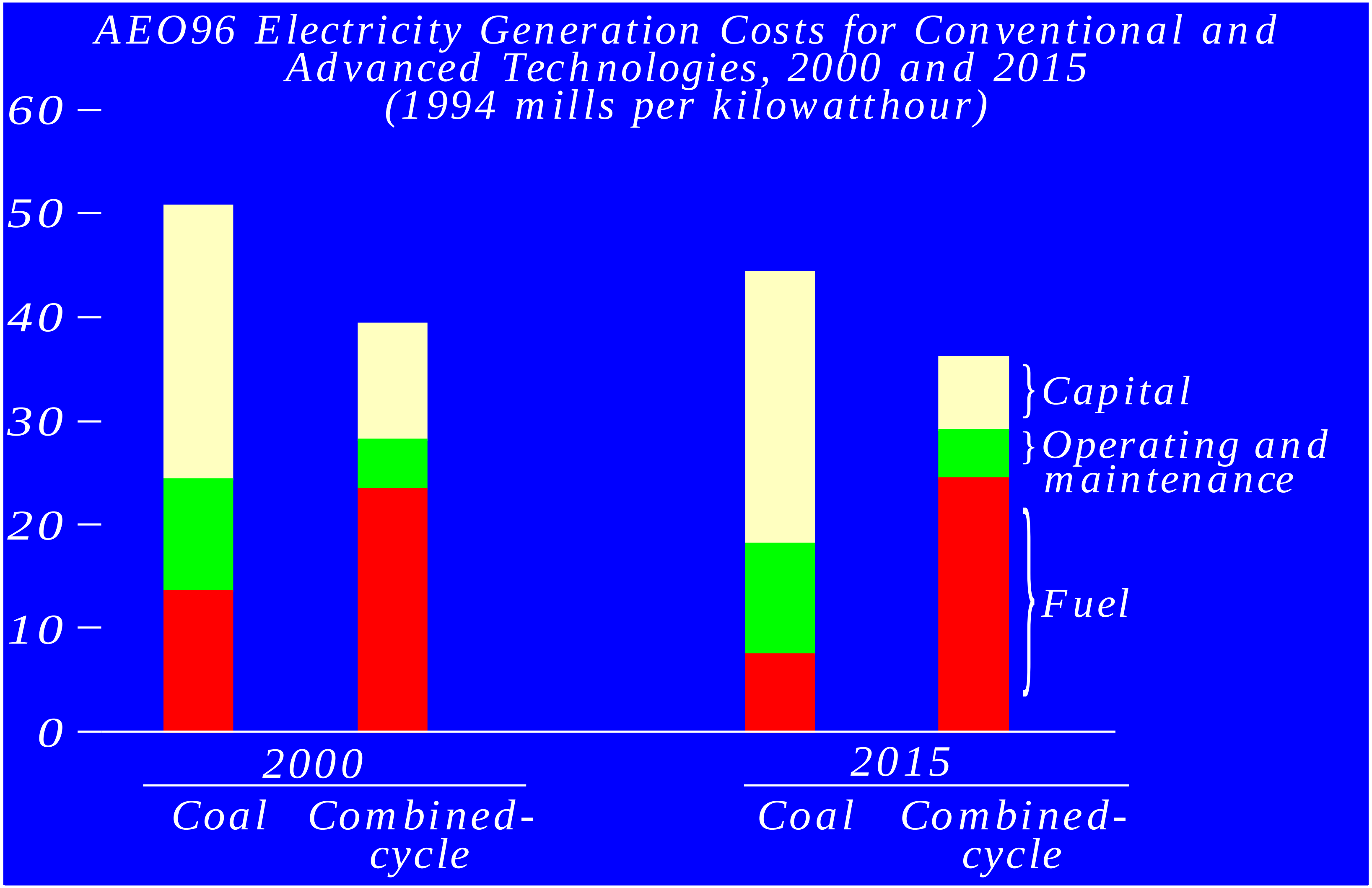

AEO96 Electricity Generation by Fuel, 1994 and 2015
(billion kilowatthours)
2,500
2,000
1,500
1,000
500
0
1994
2015
Coal
Nuclear
Natural gas
Renewables
Oil

Natural gas-fired generation is projected to increase more than any other fuel.

Nuclear generation in 2015 is about one-third less than 1994 levels due to the retirement of capacity at the end of the current operating license (generally assumed to be 40 years).

The increase in renewable generation is much smaller than in previous AEO's because of lower fuel prices in AEO96.

Coal generation increases but at a slower rate than natural gas because of the underlying economics of the cost of electricity at the busbar.


AEO96 Electricity Generation Costs for Conventional and Advanced Technologies, 2000 and 2015
(1994 mills per kilowatthour)
60
50
40
30
20
10
0
Capital
Operating and maintenance
Fuel
2000
2015
Coal
Combined-cycle
Coal
Combined-cycle

<u>Use of natural gas for electric power generation is expected to grow despite diverging coal and natural gas prices delivered to electric generators</u>.

Technological progress in both coal and natural gas generation technologies reduces capital and fuel components of generation costs.

The projected increase in natural gas fuel costs is almost fully offset by heat rate improvements in combined-cycle technology.

Some improvement in coal heat rates reduces fuel costs for coal-fired units.

In 2000, EIA projects the thermal conversion efficiency of a conventional pulverized coal plant to be about 35 percent with the conversion efficiency increasing to 42 percent by 2015. For a natural gas advanced combined-cycle plant, EIA projects the conversion efficiency in 2000 to be 47 percent. It increases to approximately 60 percent by 2015.

In addition to heat rate improvements, coal fuel costs decline because of projected reductions in coal prices (averaging 0.5 percent per year reduction in the minemouth price over the forecast). This represents approximately a 30 percent reduction in the 2010 coal minemouth price relative to AEO95. The declining coal price reflects continued increases in productivity resulting from an anticipated shift to more productive Western mines, more rapid opening of new mines, assumed flat coal miner wage rates, and lower increases in transportation costs for coal originating in Western States.

Combined-cycle retains a significant advantage over coal in operations and maintenance costs while significantly increasing its advantage relative to coal in capital costs.

At the busbar, the advantages for natural gas relative to coal do narrow over the forecast period. The costs in the graph are representative of a plant operating at a 65 to 70 percent capacity factor.

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- Subscribe to the CD-ROM Energy InfoDisc (STAT-USA, 202/482-1986)
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- Purchase diskettes from the Office of Scientific and Technical Information (OSTI)

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- Participate in topical workshops
- Call, write, or E-mail (see "For Further Information..." inside front cover of the *AEO*)