STATEMENT OF

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HEARING ON CURRENT U.S. ENERGY TRENDS

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Mr. Chairman and Members of the Committee:

I appreciate the opportunity to appear before you today to discuss the near- and long-term outlook for energy markets in the United States.

The Energy Information Administration (EIA) is an autonomous statistical and analytical agency within the Department of Energy. We are charged with providing objective, timely, and relevant data, analysis, and projections for the use of the Department of Energy, other government agencies, the U.S. Congress and the public. We do not take positions on policy issues, but we do produce data and analysis reports that are meant to help policy makers determine energy policy. Because we have an element of statutory independence with respect to the analyses that we publish, our views are strictly those of EIA. We do not speak for the Department, nor for any particular point of view with respect to energy policy, and our views should not be construed as representing those of the Department or the Administration. However, EIA's baseline projections on energy trends are widely used by government agencies, the private sector, and academia for their own energy analyses.

Each month, EIA updates its *Short-Term Energy Outlook*, which contains quarterly projections through the next two calendar years, taking into account the latest developments in energy markets. The *Annual Energy Outlook* provides projections and analysis of domestic energy consumption, supply, prices, and energy-related carbon dioxide emissions through 2020. The projections in this testimony are from the *Short-Term Energy Outlook March 2001* (*STEO*) and from the *Annual Energy Outlook 2001* (*AEO2001*), published by EIA in December 2000. These projections are not meant to be exact predictions of the future, but represent a likely energy future, given technological and demographic trends, current laws and regulations, and consumer behavior as derived from known data. EIA recognizes that projections of energy markets are highly uncertain, subject to many random events that cannot be foreseen, such as weather, political disruptions, strikes, and technological breakthroughs. In addition to these short-term phenomena, long-term trends in technology development, demographics, economic growth, and energy resources may evolve along a different path than assumed in the *AEO2001* reference case. Many of these uncertainties are explored through alternative cases in both the *STEO* and *AEO*.

The Outlook to 2002

Energy markets in the United States today are characterized by high prices for both petroleum and natural gas, due in large part to tight supplies of both fuels. Reductions in oil production by OPEC and several non-OPEC petroleum-exporting nations have contributed to low oil stocks. Tight natural gas supplies are also contributing to high electricity prices in California, along with high electricity demand relative to capacity, high generation outage rates, and low hydroelectric resources.

Crude Oil. At its March 17 meeting, OPEC members agreed to reduce production quotas an additional 1 million barrels per day effective April 1, 2001. This follows an

earlier production quota cut of 1.5 million barrels per day announced in January that was effective February 1, 2001. OPEC has scheduled an extraordinary meeting for June 5-6, 2001 to review their production quotas. The monthly average U.S. imported crude oil price for February 2001 is estimated to be about $26.40 per barrel, slightly higher than the estimate of $25.75 per barrel in January. EIA's current forecast reflects our belief that the January production cut by OPEC 10 (OPEC, excluding Iraq) would maintain the world oil price within and toward the high end of OPEC's target range of $22 to $28 per barrel in 2001 and 2002 (Figure 1). Prior to the March 17 meeting, average imported prices were projected to fall slightly from the estimated value of $27.70 per barrel in 2000 to about $26.60 per barrel in 2001 and about $25.40 in 2002, all prices being expressed in nominal dollars. EIA expects that oil stocks in the OECD countries will continue to be tight compared to normal levels, preventing prices from falling significantly (Figure 2). With the new production cuts, further uncertainty has now been introduced.

Motor Gasoline. The retail price for regular unleaded motor gasoline has fallen about 10 cents per gallon since September. However, with crude oil prices increasing by about $1.20 per barrel from their December low of $25.19 per barrel combined with lower than normal stock levels, EIA's most recent *Short-Term Energy Outlook* (March 2001) projected that prices would rise to about $1.49 per gallon during the peak months of the 2001 driving season. Motor gasoline stocks are expected to be slightly lower during this year's driving season compared to last year; however, crude oil prices were also expected to be lower in the most recent forecast, which was prepared prior to the March 17 OPEC meeting that cut crude oil production quotas by 1 million barrels per day. As a result of that action, EIA is re-evaluating its crude oil and petroleum product price projections for the remainder of 2001 and 2002, and the April projections are likely to show an increase. (This paragraph was updated from the original testimony.)

Heating Oil. The heating season of October through March is nearly over, so retail heating oil prices have seen their seasonal peak. Warm spells in January and February and declining crude oil prices in December and January helped to ease heating oil prices, which have been declining from their winter peak of $1.41 per gallon in December. Nevertheless, heating oil prices remain high compared to history. The average price for October through December 2000 was almost 40 cents per gallon higher than the same period in 1999. Due to the relatively warm weather in the Northeast during the last half of January and parts of February and heating oil production that is several hundred thousand barrels per day more than last year's level, heating oil stock levels have remained fairly steady over the past two months. For the first time since November 1999, U.S. distillate stocks are within the normal range. With crude oil prices expected to be lower in 2001 than in 2000, lower heating oil prices are projected as well. Retail heating oil prices are expected to be $1.28 per gallon in October through December 2001 compared to $1.40 per gallon in the same period for 2000, in nominal dollars. The annual average retail price of heating oil is expected to decline slightly from $1.31 per gallon in 2000 to $1.28 per gallon in 2001 to $1.22 per gallon in 2002, with all prices in nominal dollars.

Natural Gas. Natural gas prices began increasing last summer, primarily due to low levels of natural gas storage (Figure 3), with spot prices increasing more than $4 per thousand cubic feet since late June. During the heating season from October 2000 through March 2001, the wellhead price of natural gas is currently estimated to have more than doubled from the price during the previous season, averaging about $5.60 per thousand cubic feet, in nominal dollars (Figure 4). When the heating season ends, average wellhead prices are projected to decline, averaging about $4.05 per thousand cubic feet for the spring and summer. Due to projected high levels of demand growth for natural gas, particularly for electricity generation but also in the industrial sector, it is highly unlikely that wellhead prices will decline to the level of $2 per thousand cubic feet of one year ago. In 2001, the average wellhead price is projected to be about $4.70 per thousand cubic feet, compared to an annual average of about $3.60 per thousand cubic feet in 2000, in nominal dollars. However, hot summer weather in regions with high levels of natural gas-fired electricity generation could reduce storage injections for next year's heating season and lead to higher seasonal price increases. In 2002, we expect the storage situation to improve somewhat with increases in production and imports, leading to a modest decrease in the average annual wellhead price to about $4.30 per thousand cubic feet, in nominal dollars. Domestic natural gas production for 2001 and 2002 is expected to rise as production responds to the high rates of drilling experienced over the past year. In 2000, drilling for natural gas in the United States increased by 45 percent over the 1999 level of 10,500 wells, in response to a 66-percent increase in the average natural gas wellhead price from 1999 to 2000 (Figure 5). Production is estimated to have risen by 3.1 percent in 2000 and is projected to increase by rates of 3.3 percent in 2001 and 2.5 percent in 2002 as higher natural gas prices are expected to encourage a moderate growth in supply. In contrast, natural gas production declined slightly from 1997 to 1998 and from 1998 to 1999.

Electricity. Electricity demand is expected to grow at a rate of about 2.2 percent in 2001 and 2.3 percent in 2002, compared to a estimated growth rate of 3.6 percent between 1999 and 2000. Slower growth is expected in part due to slower projected economic growth. Electricity demand for this winter is expected to be 4.6 percent higher than the previous winter, due to higher residential and commercial demand and the cold temperatures in November and December. Natural gas deliverability problems in California have helped to increase natural gas prices and have frequently caused interruptible customers, including electricity generators, to be cut off in that State. The current situation in California is characterized by low natural gas storage, natural gas pipeline bottlenecks, high electricity demand, and low availability of hydropower resources, combined with no significant capacity additions in the last ten years. In addition, the San Onofre 3 nuclear unit is currently offline due to a fire in early February and may not return to service for several months. The average residential price of electricity in the United States is projected to increase from 8.2 cents per kilowatthour in 2000 to 8.3 and 8.4 cents per kilowatthour in 2001 and 2002, respectively, in nominal dollars, largely due to fuel costs.

The Outlook to 2020

AEO2001 provides an integrated projection of U.S. energy market trends for the next two decades on an annual basis. The following discussion highlights the major categories of domestic energy demand and supply.

Consumption. Total energy consumption is projected to increase from 96.1 to 127.0 quadrillion British thermal units (Btu) between 1999 and 2020, an average annual increase of 1.3 percent. Transportation energy demand is expected to increase at an average annual rate of 1.8 percent to 38.5 quadrillion Btu in 2020 and is the fastest growing end-use sector. The growth in transportation use is driven by 3.6-percent growth in air travel, the most rapidly increasing transportation mode, and 1.9-percent annual growth in light-duty vehicle travel, the largest component of transportation energy demand, coupled with slow growth in vehicle efficiency.

Residential and commercial energy consumption is projected to increase at average annual rates of 1.2 and 1.4 percent, respectively, reaching 24.4 quadrillion Btu in 2020 for residential demand and 20.8 quadrillion Btu for commercial demand. In both sectors, the growth in demand is led by electricity consumption for a variety of equipment—telecommunications, computers, office equipment, and other appliances. Electricity use is projected to increase at annual rates of 1.9 and 2.0 percent, in the residential and commercial sectors, respectively. Industrial energy demand is projected to increase at an average rate of 1.0 percent per year, reaching 43.4 quadrillion Btu in 2020, as efficiency improvements in the use of energy help to offset growth in manufacturing output. The projections incorporate promulgated efficiency standards for new energy-using equipment in buildings and for motors, as authorized by the National Appliance Energy Conservation Act of 1987 and the Energy Policy Act of 1992. Since *AEO2001* included only those laws, regulations, and standards in effect as of July 1, 2000, the new standards for residential clothes washers, water heaters, and central air conditioners and heat pumps and commercial heating, cooling, and water heating equipment issued in January 2001 are not included. In addition to the impact of efficiency standards, improvements in efficiency are projected as a result of expected technological improvement and market forces.

Petroleum demand is projected to grow at an average rate of 1.4 percent per year through 2020, led by the growth for transportation, which uses about 70 percent of the total (Figure 6). Growth in travel more than offsets efficiency gains, and economic growth increases petroleum use for freight and shipping through 2020. Natural gas consumption is expected to increase at an average rate of 2.3 percent per year. Increases are expected in all sectors, but the most rapid growth is for electricity generation, where natural gas use (excluding cogenerators) is projected to grow from 3.8 to 11.3 trillion cubic feet between 1999 and 2020. Total coal consumption is expected to increase from 1,035 to 1,297 million tons per year between 1999 and 2020, an average annual increase of 1.1 percent. About 90 percent of the coal is used for electricity generation. Coal remains the primary fuel for generation, although its share of generation is expected to decline from 51 to 44 percent between 1999 and 2020. Electricity consumption overall is projected to grow by 1.8 percent per year through

2020. Efficiency gains in the use of electricity partially offset the growth of new electricity-using equipment. Renewable fuel consumption, including ethanol used in gasoline, is projected to increase at an average rate of 1.1 percent per year through 2020. In 2020, about 55 percent of renewable energy is used for electricity generation and the rest for dispersed heating and cooling, industrial uses, and fuel blending.

Energy Intensity. Energy intensity, measured as energy use per dollar of gross domestic product (GDP), has declined since 1970, most notably when energy prices have increased rapidly (Figure 7). Between 1970 and 1986, energy intensity declined at an average rate of 2.3 percent per year as the economy shifted to less energy-intensive industries and more efficient technologies. Without significant price increases and with the growth of more energy-intensive industries, intensity declines moderated to an average of 1.3 percent per year between 1986 and 1999. Through 2020, energy intensity is projected to decline at an average rate of 1.6 percent per year as efficiency gains and structural shifts in the economy offset growth in demand for energy services. Energy use per person generally declined from 1970 through the mid-1980s, and then tended to increase as energy prices declined. Per capita energy use is expected to increase slightly through 2020, as efficiency gains only partly offset higher demand for energy services.

Electricity Generation. Generation from both natural gas and coal is projected to increase through 2020 to meet growing demand for electricity and offset the decline in nuclear power expected from retirements of some existing facilities (Figure 8). As noted above, the share of coal generation is expected to decline through 2020 because assumptions about electricity industry restructuring, such as higher cost of capital and shorter financial life of plants, favor the less capital-intensive and more efficient natural gas generation technologies. The natural gas share of total generation is expected to increase from 16 to 36 percent between 1999 and 2020. The use of renewable technologies for electricity generation, including cogeneration, is projected to increase slowly at an average rate of 0.7 percent per year, primarily due to moderate fossil fuel prices. State renewable portfolio standards are the cause of a significant amount of the expected penetration. Hydropower is expected to decline slightly by 2020 as regulatory actions limit capacity at existing sites, and no large new sites are expected to be available for development.

Supply. Total domestic petroleum supply, including refinery gain and natural gas plant liquids, is projected to remain nearly flat through 2020 (Figure 9). Domestic crude oil production is projected to decline at an average rate of 0.7 percent per year, from 5.9 million barrels per day in 1999 to 5.1 million barrels per day in 2020. As a result, net petroleum imports are expected to rise through 2020, to meet growing demand (Figure 10). Between 1999 and 2020, net imports of petroleum are projected to increase from 51 percent to 64 percent of domestic petroleum demand. In 2020, the United States is expected to require net imports of crude oil and petroleum products totaling 16.5 million barrels per day.

Unlike oil, domestic natural gas production, with its larger and more accessible resource base, is expected to increase from 18.7 trillion cubic feet in 1999 to 29.0 trillion cubic feet in 2020. Increased production comes primarily from lower 48 onshore conventional nonassociated sources, although onshore unconventional production is expected to increase at a faster rate than other sources. In order to fill the gap between domestic production and consumption, net natural gas imports are expected to increase from 3.4 trillion cubic feet in 1999 to 5.8 trillion cubic feet in 2020, mostly pipeline natural gas imports from Canada. Net liquefied natural gas imports are projected to increase from 0.1 to 0.7 trillion cubic feet by 2020.

Coal production is expected to increase from 1,105 million tons in 1999 to 1,331 million tons in 2020, an average of 0.9 percent per year, to meet rising domestic demand. From 1999 to 2020, low-sulfur coal production is expected to increase while the production of high- and medium-sulfur coal declines, due to the need to reduce sulfur dioxide emissions from coal-fired electricity plants. As a result, western coal production—the primary source of new low-sulfur coal—is expected to continue its historic growth, reaching 787 million tons in 2020, an annual growth rate of 2.2 percent. Western coal is surface mined and less costly to produce than eastern coal.

Carbon Dioxide Emissions. Energy-related carbon dioxide emissions are projected to increase at an average of 1.4 percent per year from 1999 to 2020, reaching 2,041 million metric tons of carbon equivalent, 35 percent higher than in 1999 and 51 percent higher than in 1990 (Figure 11). Projected increases in carbon dioxide emissions primarily result from continued reliance on coal for electricity generation and on petroleum fuels in the transportation sector.

Alternative Cases. In order to show the impact of alternative assumptions concerning the key factors driving energy markets, we include a number of alternative cases in *AEO2001*. Two sets of these cases illustrate the impacts of improved technology in energy-consuming equipment and in the production of oil and gas.

One alternative case assumes more rapid improvement in new technologies for end-use demand, through lower costs, higher efficiencies, and earlier availability for new technologies, relative to the reference case, as well as more rapid improvement in the costs and efficiencies of advanced fossil-fired and new renewable generating technologies. As a result, projected energy demand in 2020 is 8 quadrillion Btu lower than in the reference case, reducing carbon dioxide emissions to 1,875 million metric tons carbon equivalent in 2020, compared to 2,041 million metric tons carbon equivalent in the reference case (Figure 12). Such technology improvements could result from increased research and development, but should not be considered the most optimistic improvements that could occur with a very aggressive program of research and development. The *AEO2001* reference case assumes continued improvements in technology for both energy consumption and production; however, it is possible that technology could develop at a slower rate. In the 2001 technology case, it is assumed that all future equipment choices will be made from the equipment and

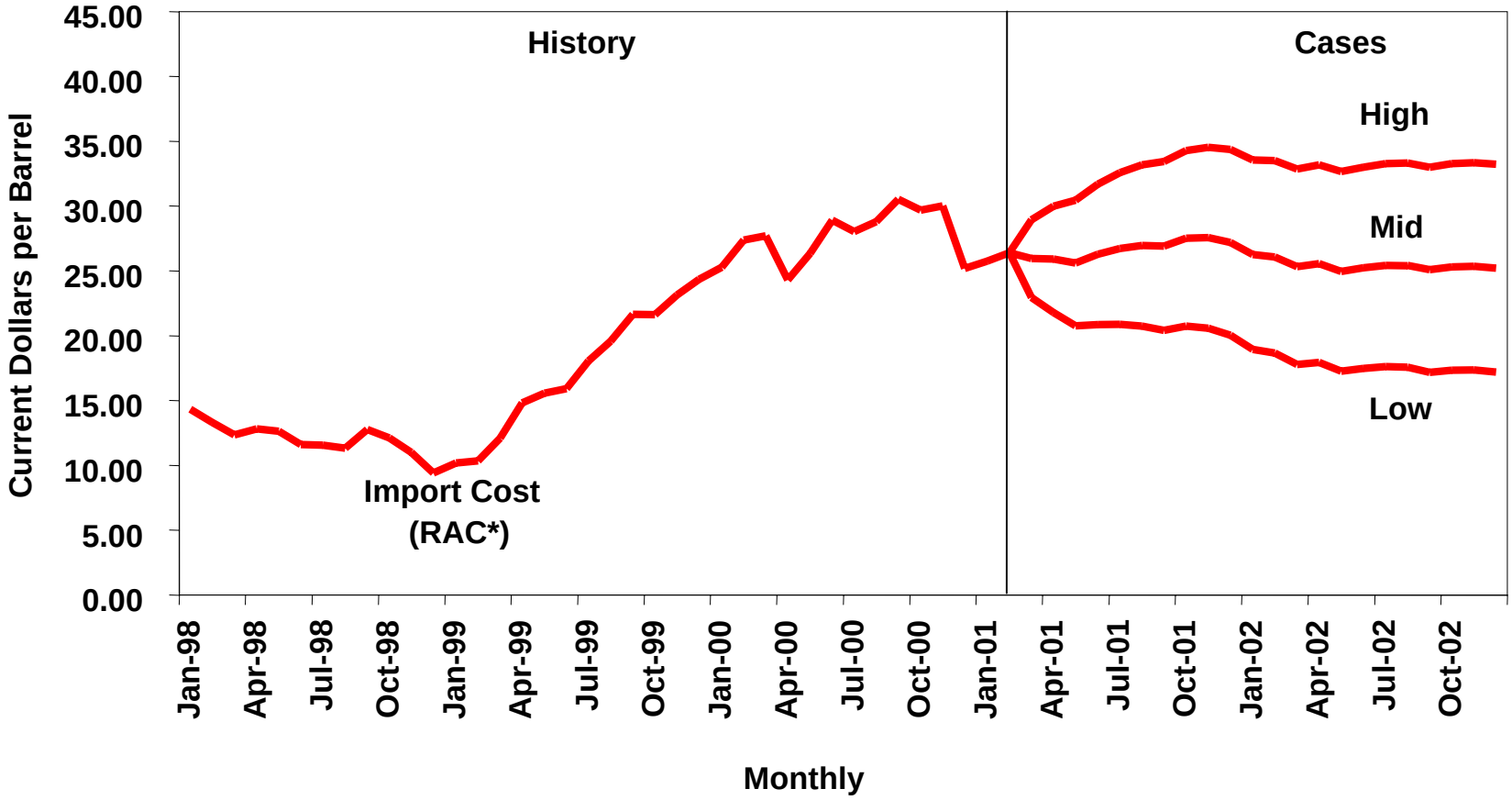
vehicles available in 2001, with new building shell and industrial plant efficiencies frozen at 2001 levels. Also, new generating technologies are assumed not to improve over time. In this case, efficiencies improve over the forecast period as new equipment is chosen to replace older stock and the capital stock expands; however, projected energy demand in 2020 is 6 quadrillion Btu higher than in the reference case, increasing carbon dioxide emissions to 2,157 million metric tons carbon equivalent.

Another alternative case assumes more rapid technological improvement in the exploration and production of petroleum and natural gas. By 2020, these assumed improvements are expected to raise natural gas production by 1.1 trillion cubic feet and raise lower 48 crude oil production by nearly 300 thousand barrels per day compared to the reference case. The more rapid technology progress would also be expected to reduce the average wellhead price of natural gas in the United States from $3.13 per thousand cubic feet (1999 dollars) in the reference case to $2.50 per thousand cubic feet in 2020 (Figure 13). Conversely, slower technological improvements are assumed in another case, which reduce natural gas production by 1.9 trillion cubic feet and reduce lower 48 crude oil production by nearly 400 thousand barrels per day in 2020 relative to the reference case. In this slow technology case, the average wellhead price of natural gas in 2020 reaches $4.23 per thousand cubic feet.

Conclusion. In the near term, we expect crude oil and petroleum prices to decline slightly from their current levels by the end of the year and to decline further next year. Stock levels of both petroleum and natural gas remain tight. In the long term, continuing growth in the U.S. economy is expected to stimulate more energy demand, with fossil fuels remaining the dominant source of energy. As a result, our dependence on foreign sources of petroleum is expected to increase and domestic natural gas production and natural gas imports are expected to grow significantly. These forecasts incorporate an expectation of efficiency improvements in both demand and supply although different paths for technological development could lead to slower or more rapid efficiency gains.

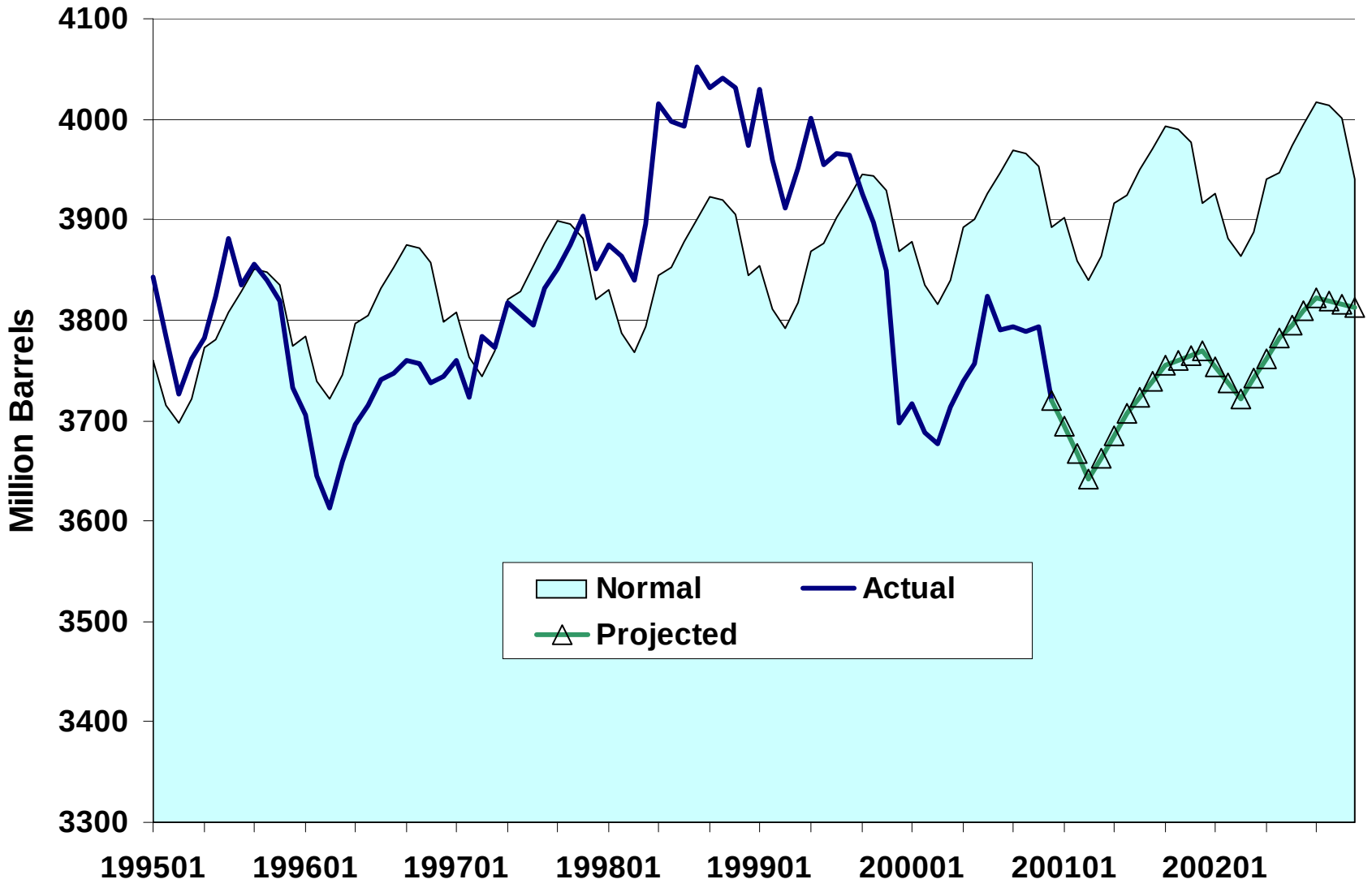
Thank you, Mr. Chairman and members of the Committee. I will be happy to answer any questions you may have.

Figure 1. Projected Refiner Acquisition Costs of Imported Crude Oil



* Average U.S. refiner acquisition cost of imported crude oil.

Figure 2. Total OECD Oil Stocks*



*Total includes commercial and government stocks

Figure 3. Working Gas in Storage

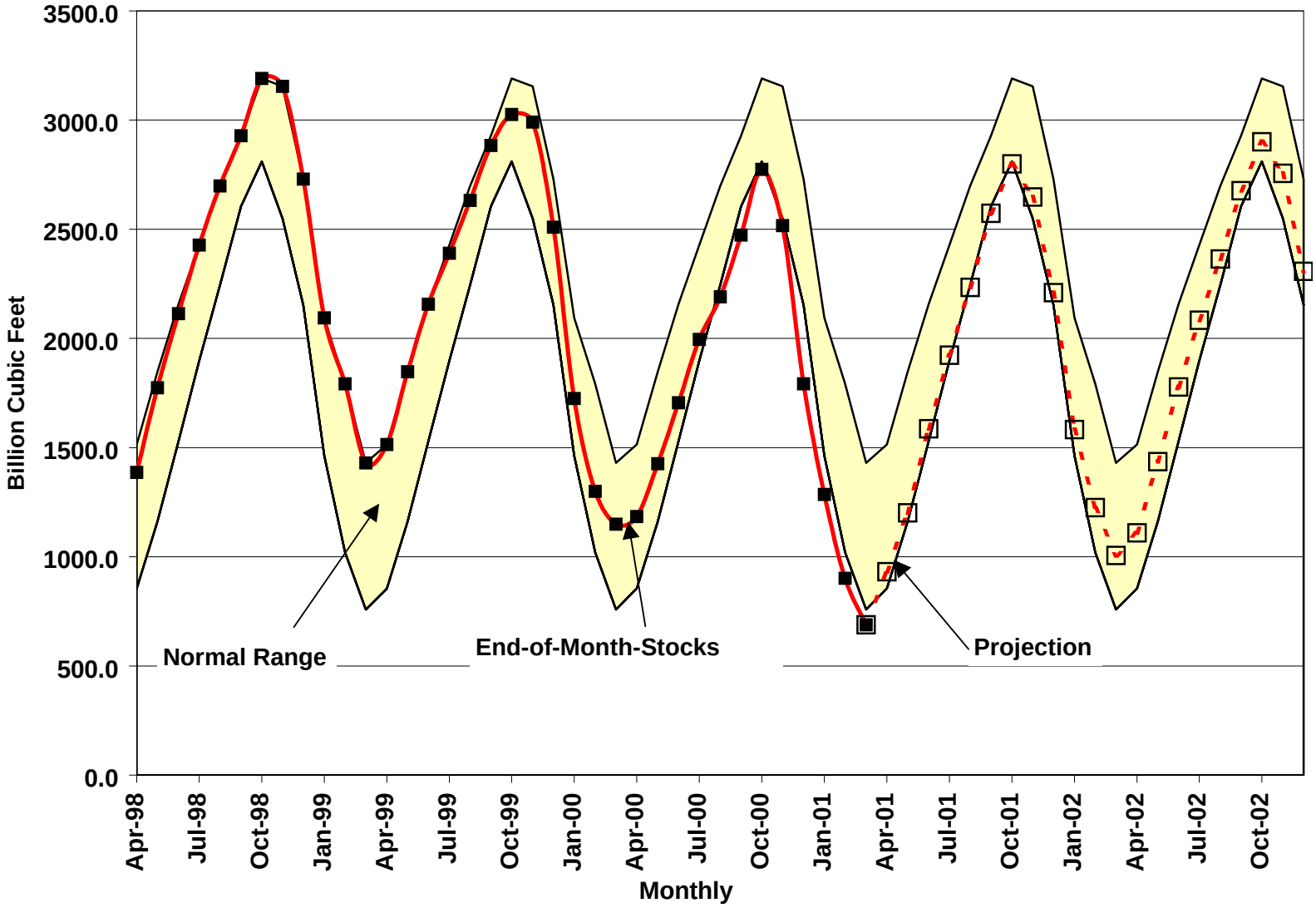


Figure 4. Wellhead Natural Gas Prices

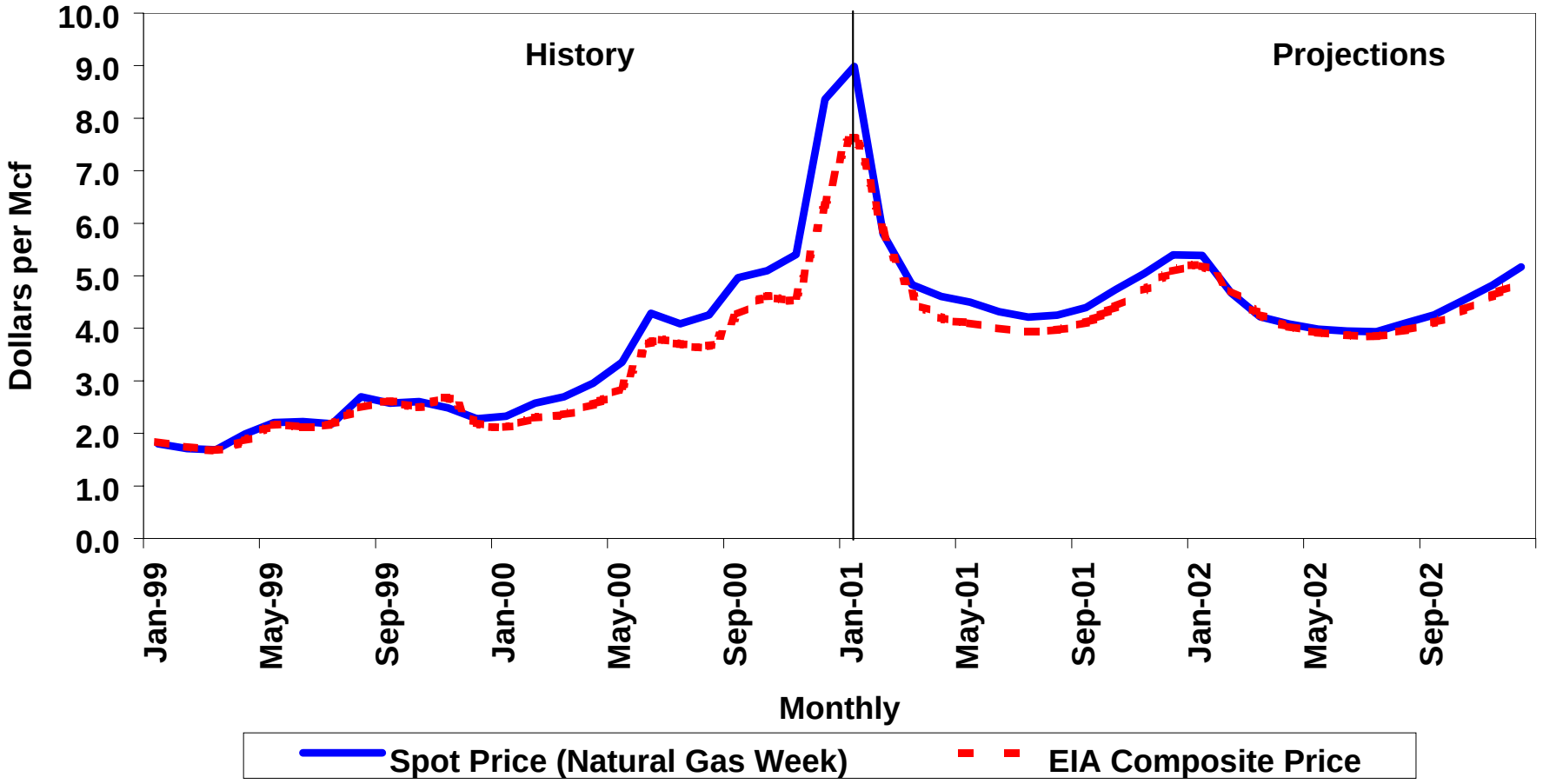


Figure 5. Natural Gas Wells and Prices

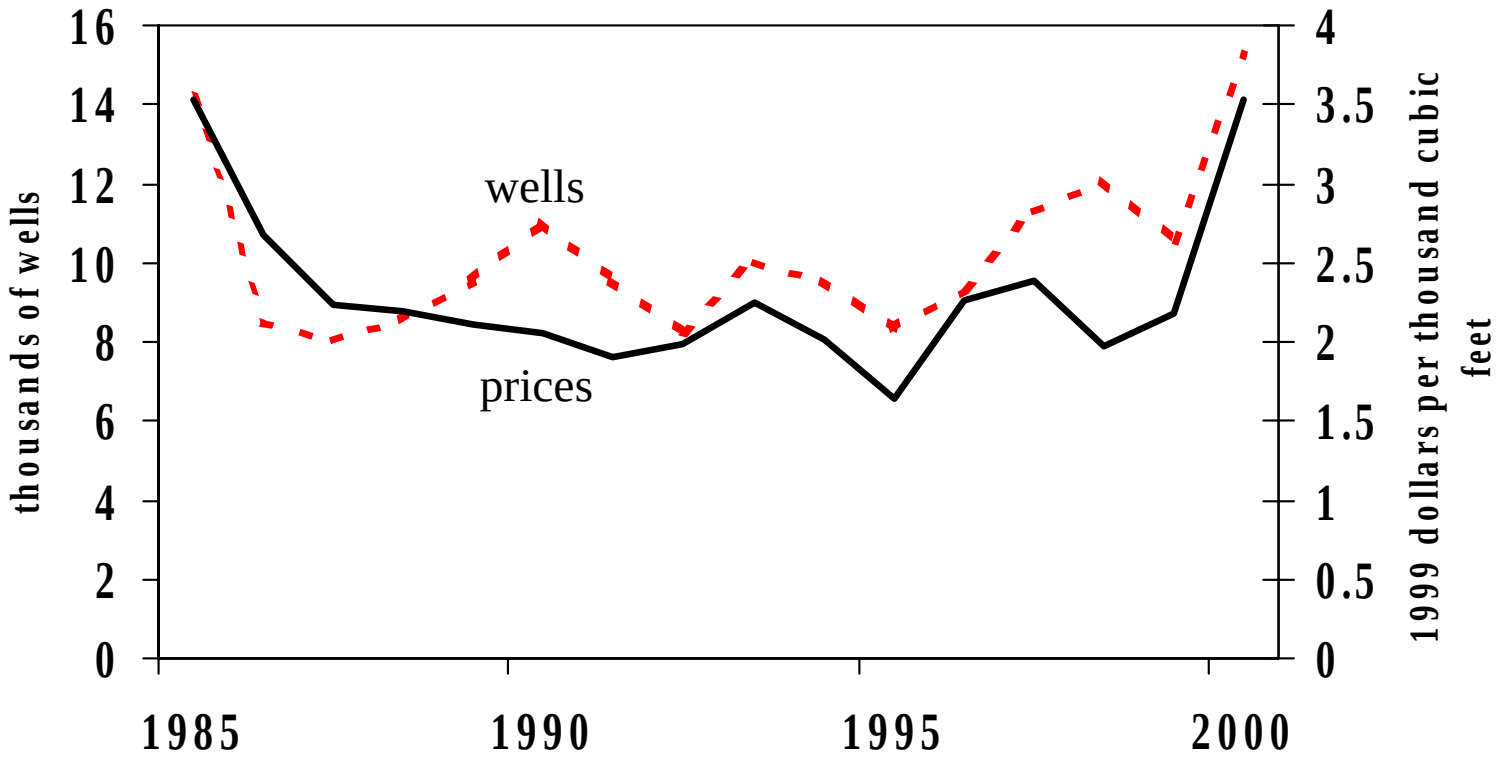


Figure 6. Energy Consumption by Fuel, 1970-2020 (quadrillion Btu)

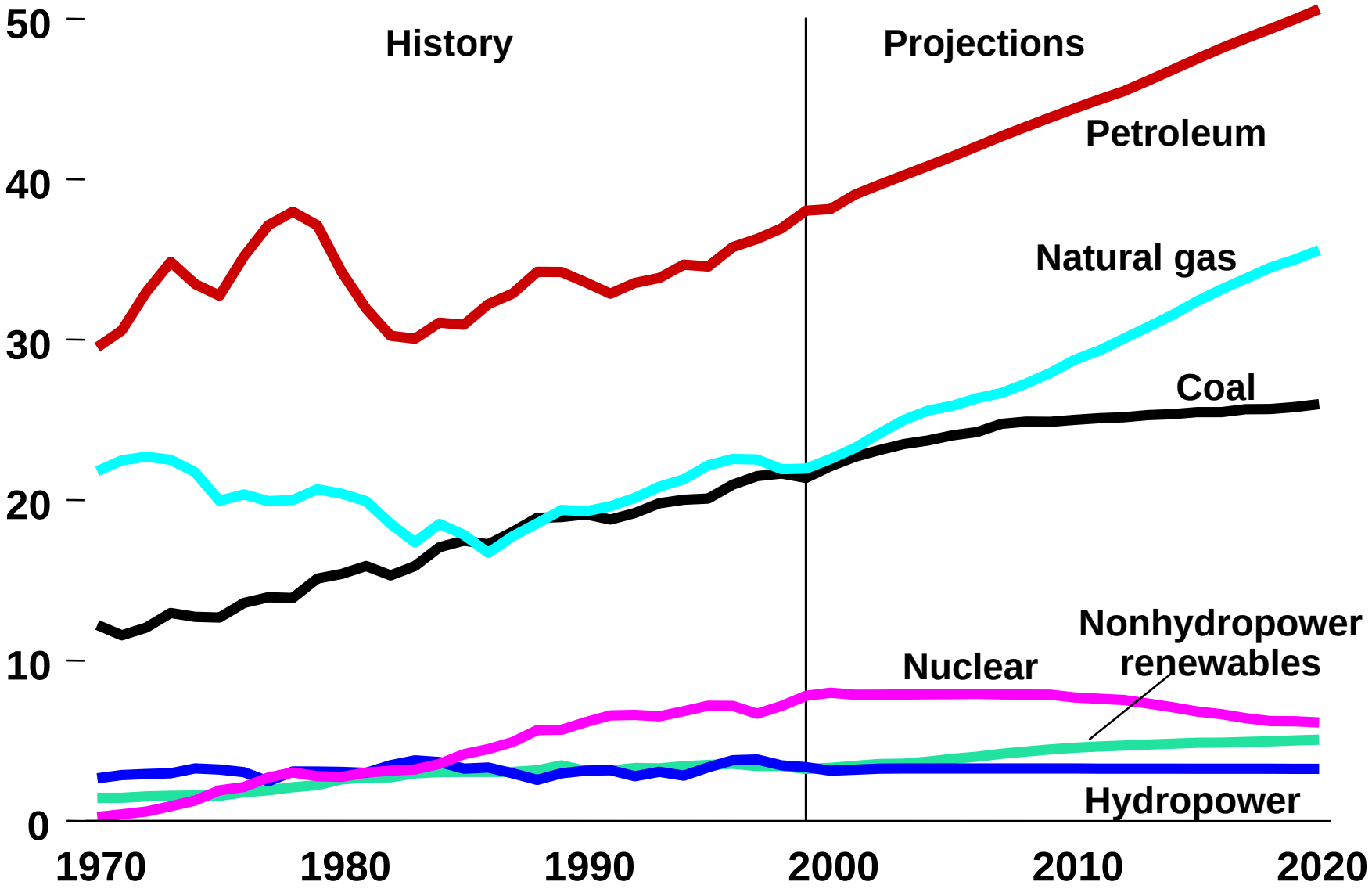


Figure 7. Energy Use per Capita and per Dollar of Gross Domestic Product, 1970-2020 (index, 1970 = 1)

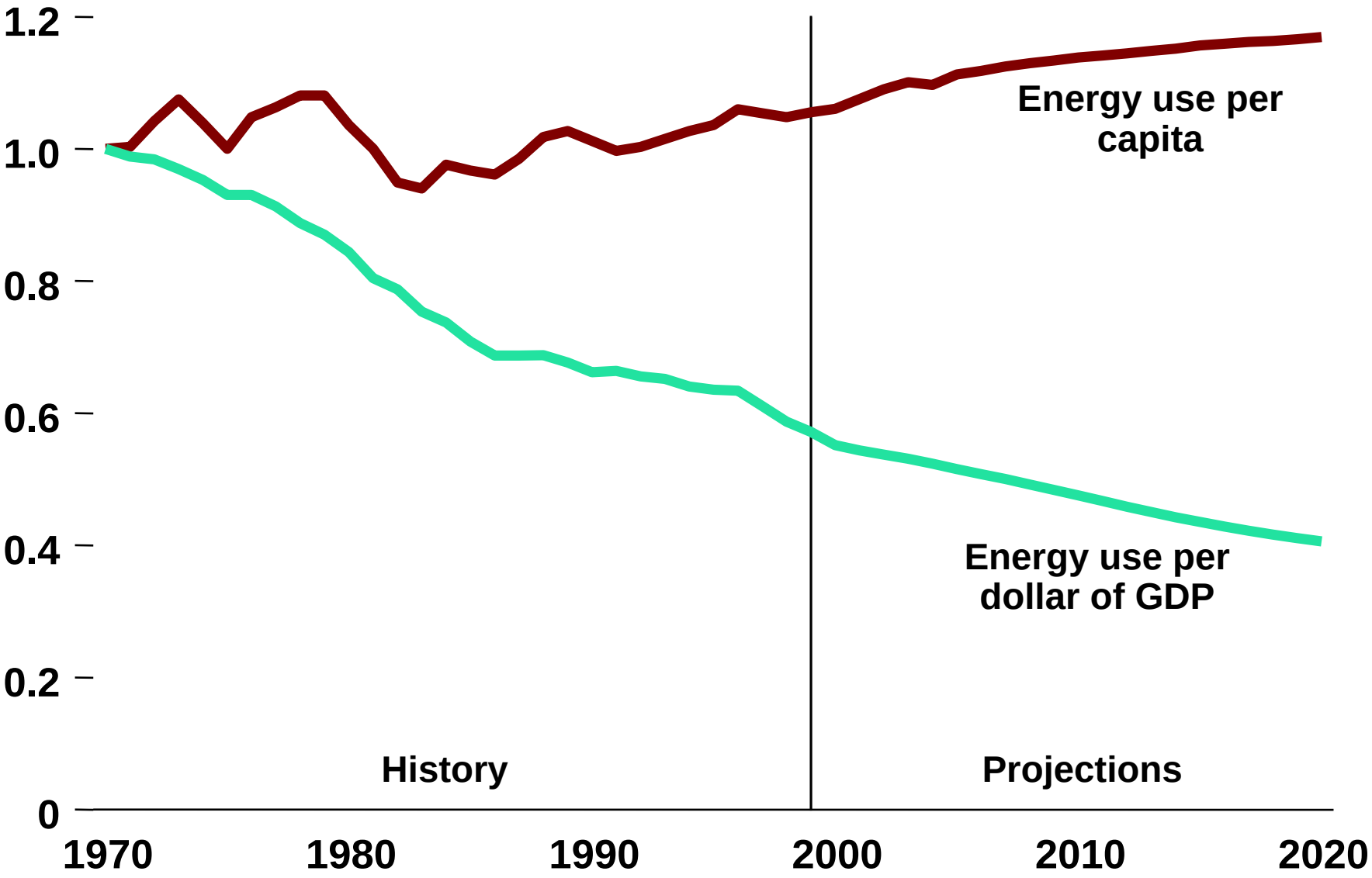


Figure 8. Electricity Generation by Fuel, 1970-2020 (billion kilowatthours)

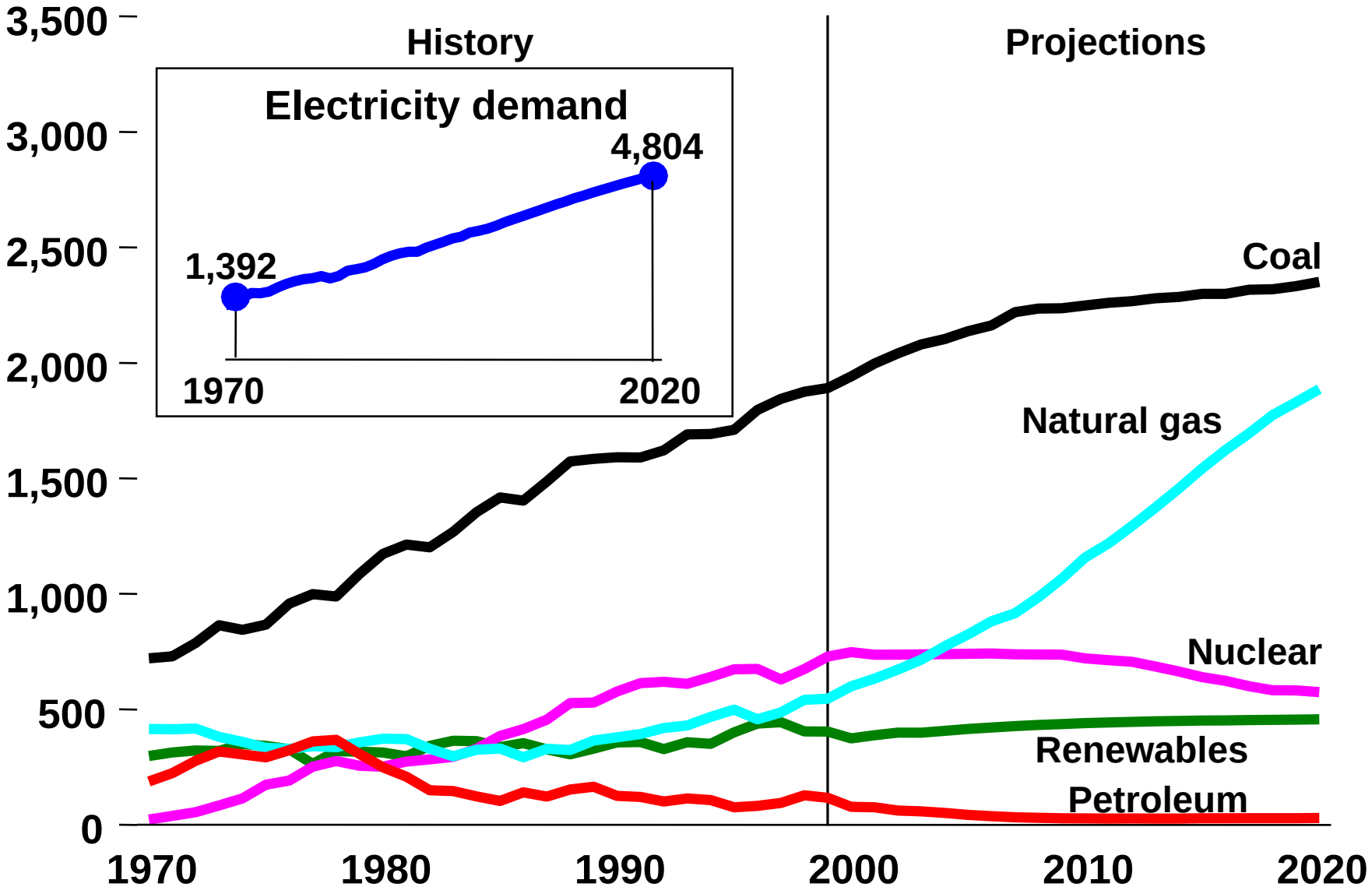


Figure 9. Energy Production by Fuel, 1970-2020 (quadrillion Btu)

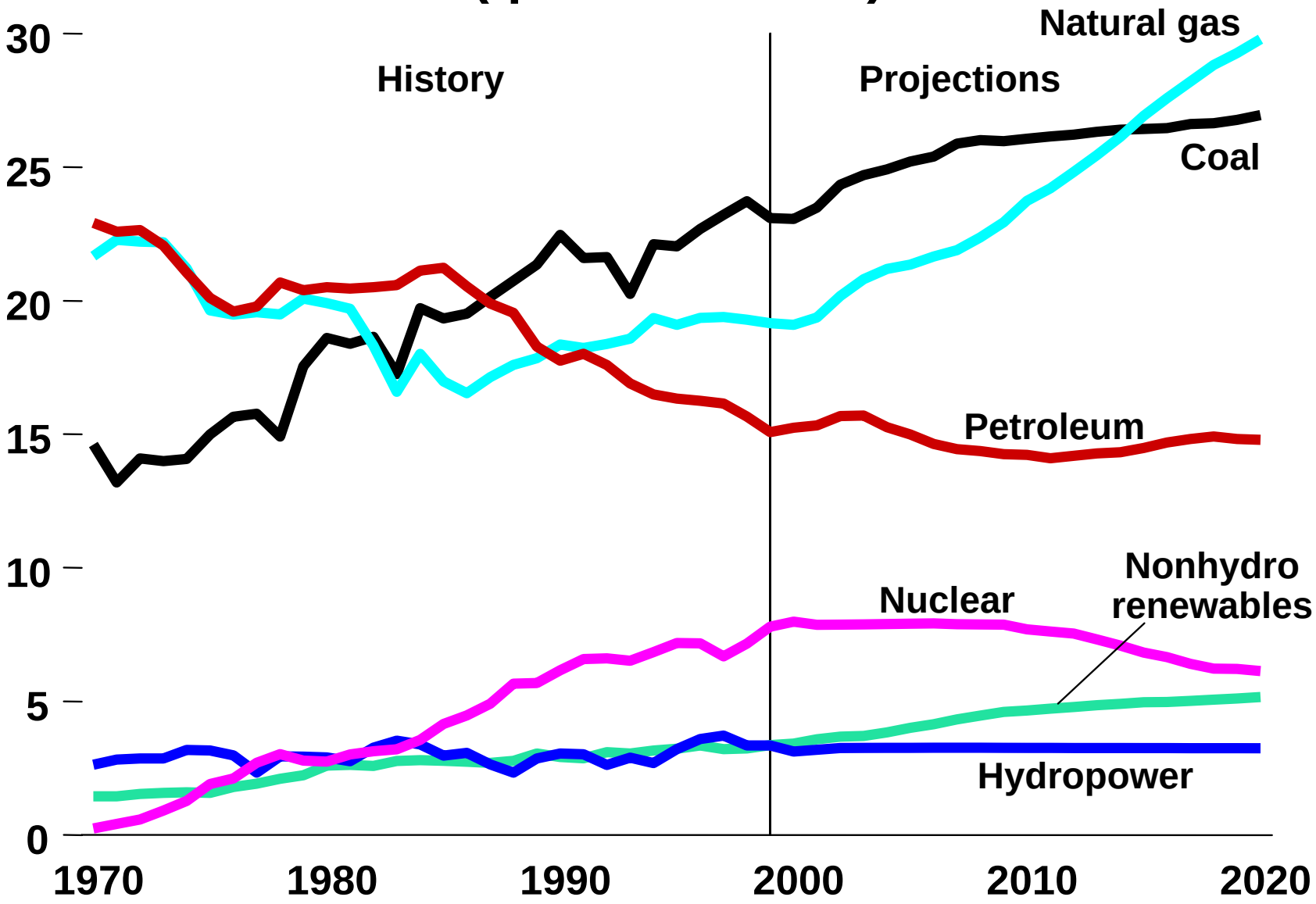


Figure 10. Petroleum Supply, Consumption, and Imports, 1970-2020 (million barrels per day)

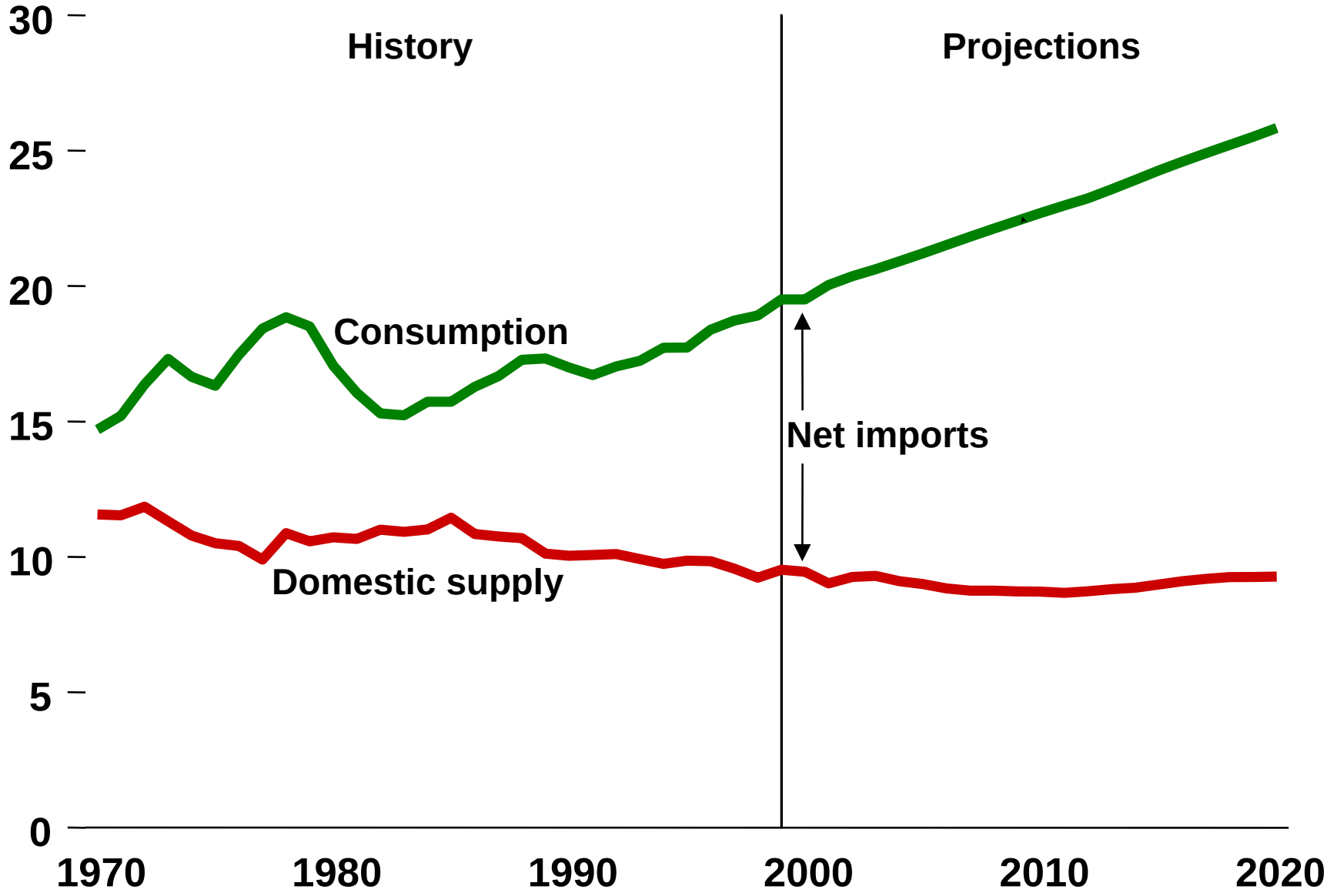


Figure 11. Carbon Dioxide Emissions by Fuel, 2000, 2010, and 2020 (million metric tons carbon equivalent)

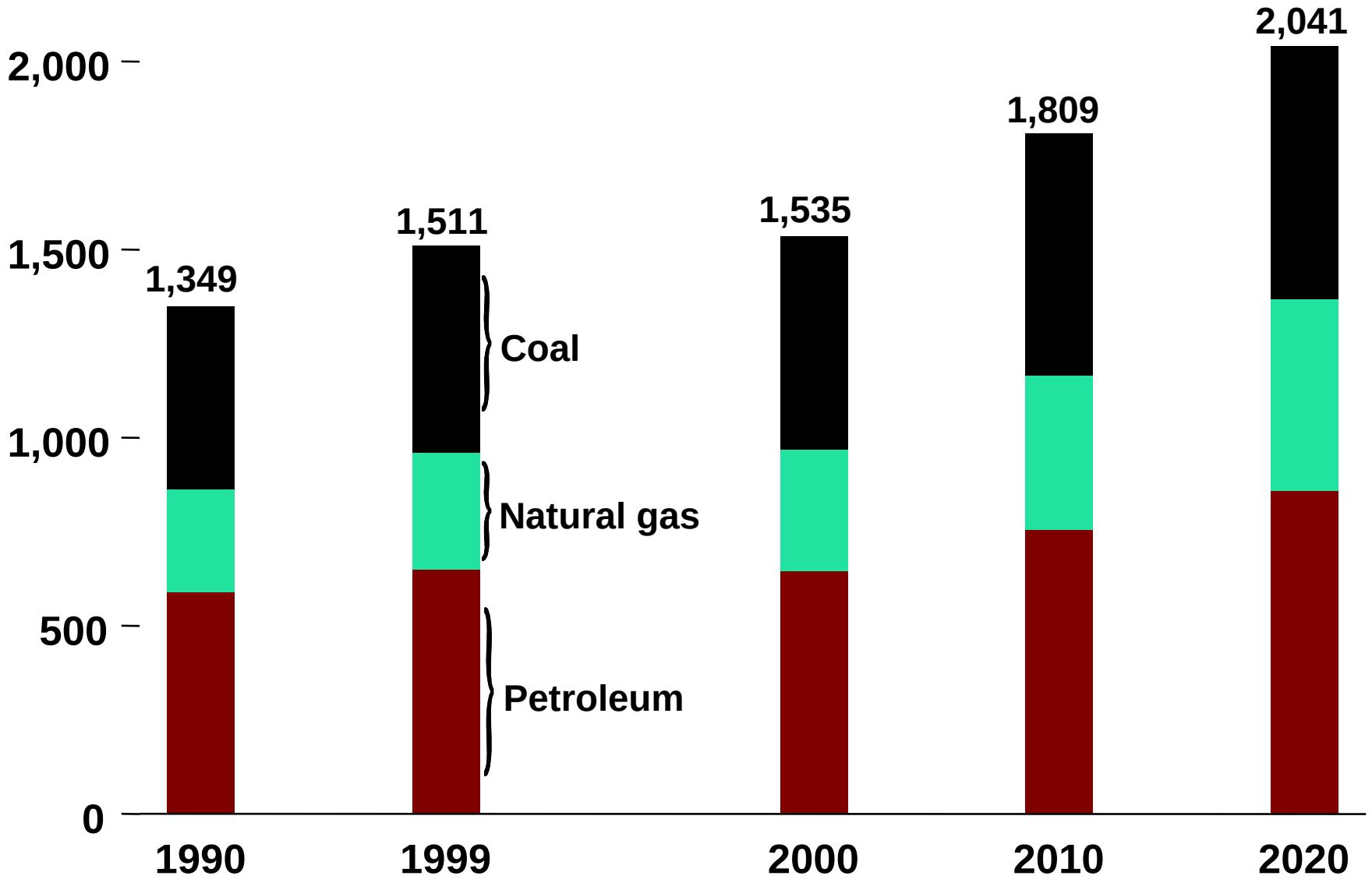


Figure 12. U.S. Energy Consumption in Three Technology Cases, 1990-2020 (quadrillion Btu)

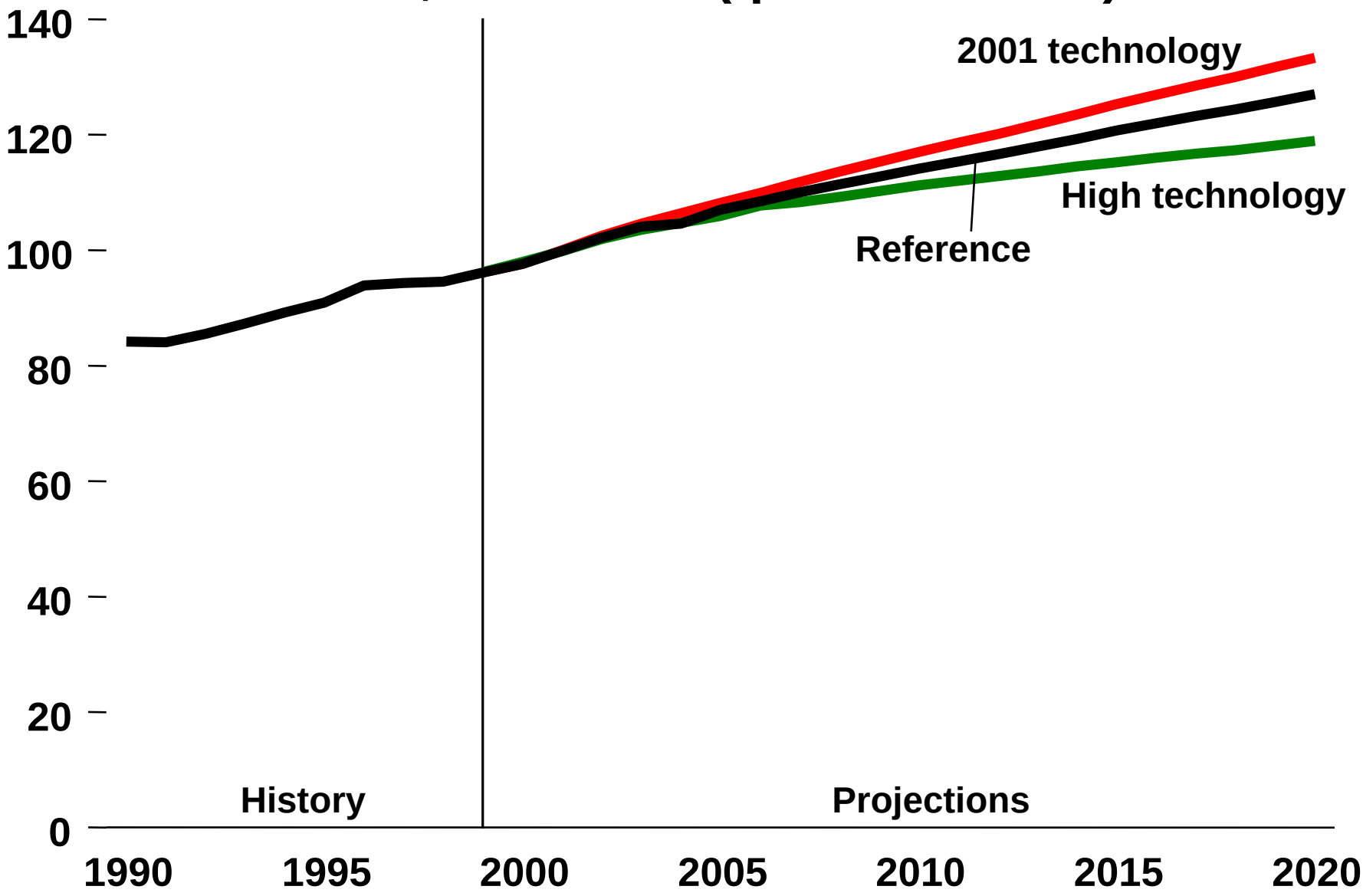


Figure 13. Lower 48 Natural Gas Wellhead Prices in Three Technology Cases, 1970-2020 (1999 dollars per thousand cubic feet)