Testimony of

Guy Caruso

Administrator

Energy Information Administration

U.S. Department of Energy

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Mr. Chairman, and members of the Committee, I appreciate the opportunity to appear before you today. As requested in your invitation, my testimony focuses on the Energy Information Administration's (EIA's) outlook for energy markets to 2030, focusing on developments over the next decade to 2017.

EIA is the independent statistical and analytical agency within the Department of Energy. We are charged with providing objective, timely, and relevant data, analyses, and projections for the use of the Congress, the Administration, and the public. While we do not take positions on policy issues, we do produce data and analyses to help inform energy policy deliberations. Because we have an element of statutory independence with respect to this work, our views are strictly those of EIA and should not be construed as representing those of the Department of Energy, the Administration, or any other organization.

My testimony today focuses on the reference case of EIA's *Annual Energy Outlook 2007* (*AEO2007*) that was issued last December. I will also draw some additional insights from the technology sensitivities in the full *AEO2007*, which were released on the Web last week, and from some of our recent reports prepared in response to Congressional requests.

The energy projections in *AEO2007*, which extend through 2030, assume in general that Federal and State laws and regulations in effect as of October 2006 remain in force. There are a few exceptions to this approach – for example, the ethanol tax credit is assumed to continue beyond its scheduled expiration in 2010 in the *AEO2007* reference case. EIA's approach contrasts with that used in most long-term energy projections made in the private sector, which usually incorporate at least the expected value of policy changes that can significantly influence future

energy outcomes, such as higher fuel economy standards beyond 2011 or new actions to limit greenhouse gas emissions. The EIA "current policies" framework was adopted to facilitate the use of our scenarios as the basis for evaluating the impact of policy proposals, so we don't need to explain to a policymaker in the Congress or the Executive Branch that all or part of a policy proposal they are interested in assessing is already reflected in our reference case.

Energy Consumption

As shown in **Figure 1**, delivered energy consumption is expected to grow most rapidly in the transportation sector. Transportation energy use reflects both personal and freight transport. Almost all energy used in the transportation sector is oil. Projected energy growth in the other sectors primarily reflects growing use of electricity. Energy used to generate electricity is expected to grow at an average annual rate of 1.1 percent between 2005 and 2030.

Figure 2 shows energy consumption by fuel. Liquids, predominantly from oil, but also including ethanol and other biofuels, remain the dominant fuel consumed throughout the forecast, maintaining a current market share of just under 40 percent through 2030. Oil, supplemented by ethanol, is used primarily in the transportation sector, which represents more than two-thirds of total oil use, and also in the industrial sector.

Projected coal use increases in both absolute terms and as a share of total energy use through 2030. Initially, increasing coal use primarily reflects higher utilization rates for existing coal-fired electricity generation plants. However, between 2015 and 2030, a significant number of

new coal plants are built and there is some investment in coal-to-liquids (CTL) plants, which are competitive producers of diesel fuel under the world oil prices in the *AEO2007* reference case. Natural gas consumption is projected to grow through 2020, but to remain relatively flat after 2020, as rising natural gas prices encourage reduced reliance on natural gas use for electricity generation, which offsets some continued growth in other sectors.

Nuclear energy consumption is expected to grow in absolute terms, but to decline as a share of total U.S. energy consumption. Use of nonhydroelectric renewable energy use is also projected to grow rapidly but to remain a small share of total energy consumption.

Electricity Generation Sources

Electricity is an energy carrier that can be produced using a wide variety of primary fuels. **Figure 3** shows history and reference case projections for electricity generation by fuel. Expected increases in natural gas prices make alternatives to natural gas increasingly attractive as sources of baseload power generation between 2020 and 2030, leading to an absolute decline in projected natural gas use for electricity generation that offsets some of the growth in natural gas demand in other sectors. As a result, total natural gas consumption remains relatively flat over the 2020 to 2030 period. The natural gas share of electricity generation is projected to increase from 18 percent in 2004 to 22 percent around 2020, before falling to 17 percent in 2030. The coal share is projected to remain relatively flat at about 50 percent of total electricity generation over the next decade before increasing to 57 percent in 2030. Limits on greenhouse gas emissions could significantly change this projection, since coal-fired electric power generation is a major source of energy-related carbon dioxide emissions.

Nuclear power generation is projected to grow in absolute terms, but nuclear's share of total generation falls from 20 percent in 2004 to about 15 percent in 2030.

Overall renewable generation also grows in absolute terms, but its share of total generation is projected to remain flat under current laws and policies.

Figure 4 shows that nonhydroelectric renewable generation grows rapidly. Hydropower accounts for over 80 percent of renewable electricity generation today, but there are limited prospects for significant growth over the next 25 years. Hydropower production will likely be driven by weather trends that EIA does not attempt to predict or by policy changes that might affect current hydropower operations.

Wind generation is projected to grow rapidly through 2008, driven significantly by the existing production tax credit (PTC) of 1.9 cents per kilowatthour for power produced during the first 10 years of operation by wind projects that enter service before the end of 2008. (Note that the graph shows rapid growth only through the end of 2007 because the analysis was done before the December 2006 action to implement a 1-year extension of the PTC.)

Reliance on Energy Imports

Figure 5 shows overall U.S. reliance on energy imports. Oil is by far the largest U.S. energy import. In 2006 net imports of crude oil and finished petroleum products averaged 12.6 million barrels per day, providing roughly 60 percent of U.S. consumption of petroleum products. The share of imports in U.S. petroleum consumption is expected to decline to about 55 percent over

the next decade, then rise to slightly more than its current level of 60 percent by 2030. In absolute terms, the volume of net imports is expected to grow slowly over the next decade, even as consumption continues to grow, but is expected to increase more quickly between 2015 and 2030.

Turning to natural gas, net imports provided about 15 percent of U.S. natural gas supply in 2006, with imports via pipeline from Canada accounting for over 90 percent of total natural gas imports. Over time, imports from Canada are expected to decline, while overall imports rise. Imports of liquefied natural gas (LNG) are expected to grow, although that growth should flatten if overall natural gas consumption flattens between 2020 and 2030 as projected in the *AEO2007* reference case.

U.S. Energy Production by Fuel

Figure 6 shows U.S. energy production. Coal and non-hydroelectric renewables are expected to experience the fastest production growth under current policies over the next 25 years. Nuclear power production is also expected to grow steadily.

Petroleum production is expected to grow for the next decade, then decline, while natural gas production grows to 2020, and then remains relatively flat. Petroleum and natural gas production are highly sensitive to future price developments.

Alternative Technology Assumptions

While the EIA reference case incorporates significant improvements in technology cost and performance over time, it may either overstate or understate the actual future pace of improvement since the rate at which the characteristics of energy-using and producing technologies will change is highly uncertain. EIA does not attempt to estimate how increased government spending might specifically impact technology development. However, to illustrate the importance of future technology characteristics, EIA does develop sensitivity cases with alternative technology assumptions. Relative to the reference case, EIA's integrated high technology case generally assumes earlier availability, lower costs, and higher efficiencies for end-use technologies and new fossil-fired, nuclear, and nonhydroelectric renewable generating technologies. **Figure 7** shows that using the integrated high technology assumptions in place of the reference case technology assumptions results in lower projected levels of energy use and energy-related carbon dioxide emissions through 2030. Generally, the difference between the projections for the two cases grows over the forecast horizon, reflecting the greater opportunity for advanced technologies to enter the market as the Nation's energy producing and consuming capital stock is replaced and expanded over time.

Projected Greenhouse Gas Emissions and Impacts of Greenhouse Gas Limitation

Energy-related carbon dioxide emissions, which account for roughly 80 percent of overall U.S. greenhouse gas (GHG) emissions, are projected to grow through 2030 under existing policies. As shown in **Figure 8**, growth in the use of electric power and transportation fuels and the start of CTL production accounts for nearly all of the projected growth in energy-related carbon dioxide

emissions to 2030. The growth in emissions from electricity generation reflects the growing use of coal in the reference case projections.

Concern over global warming due to increased atmospheric concentrations of GHGs has led to consideration of policies to limit emissions. In several recent studies done at the request of the Congress, EIA has examined the energy and economic impacts of possible limits on greenhouse gas emissions. An analysis of the draft proposal of Chairman Bingaman and five other senators was issued in January 2007. It shows that emissions are initially reduced below the target level, allowing sources to bank allowances that can be used to comply when the GHG intensity reduction target is strengthened beginning in 2021. Beginning in 2026, the proposal's safety-valve feature is expected to come into force, as emissions sources elect to buy additional allowances at the pre-specified safety-valve price.

Several other results from EIA's analysis of this draft proposal may also be of interest to the Committee. First, the projected impact of the proposal on delivered coal prices is significantly larger than those expected for petroleum products and natural gas. This result reflects coal's higher carbon content per unit of energy and its lower base price compared to both oil and natural gas.

Second, impacts on projected oil and natural gas use are limited by the modest changes in their delivered prices and the limited availability of economical substitute fuels in key applications for those fuels, including transportation. However, projected coal consumption is reduced relative to the reference case by 4 percent in 2020 and by 20 percent in 2030, due to the shift towards greater reliance on nuclear and renewables in the generation fuel mix and the reduced economic

attractiveness of CTL conversion that are driven by higher delivered coal prices. However, coal use is still projected to remain above its 2004 level through 2030.

Third, by 2030, real gross domestic product (GDP) is projected to be 0.26 percent ($59 billion in year-2000 dollars) below the reference case levels. The total reduction in discounted real GDP over the 2009 to 2030 period is 0.10 percent ($232 billion in year-2000 dollars) relative to the reference case. Impacts on projected real consumption are somewhat larger.

Finally, sensitivity analyses included in previous EIA studies of GHG mitigation show that, in addition to lowering the projected trajectory of energy use and energy-related carbon dioxide emissions before policies are applied, adoption of improved technology also tends to lower the cost of reducing emissions.

Within the limits of available resources, EIA will be developing analyses of other policy proposals in response to requests from both houses of the Congress.

Conclusion

Mr. Chairman and members of the Committee, one of EIA's most important missions is to supply reliable energy data and policy-neutral analysis to support the work of decisionmakers in the Congress and the Administration. The context of the Nation's current energy situation and the dynamics of our energy system exert an important influence over our baseline projections. We certainly recognize that all projections are subject to considerable uncertainty, and we try to reflect that uncertainty in our analyses. We also recognize that programs to advance

improvements in future energy technologies and possible changes in energy policies, both of which are generally beyond EIA's purview, can also have an important impact on our energy future, particularly over an extended time horizon. EIA stands ready to provide the Committee whatever assistance we can.

This concludes my testimony, Mr. Chairman. I would be pleased to answer any questions you may have.

FIGURE 1. Delivered Energy Consumption by Sector, 1980-2030 (quadrillion Btu)

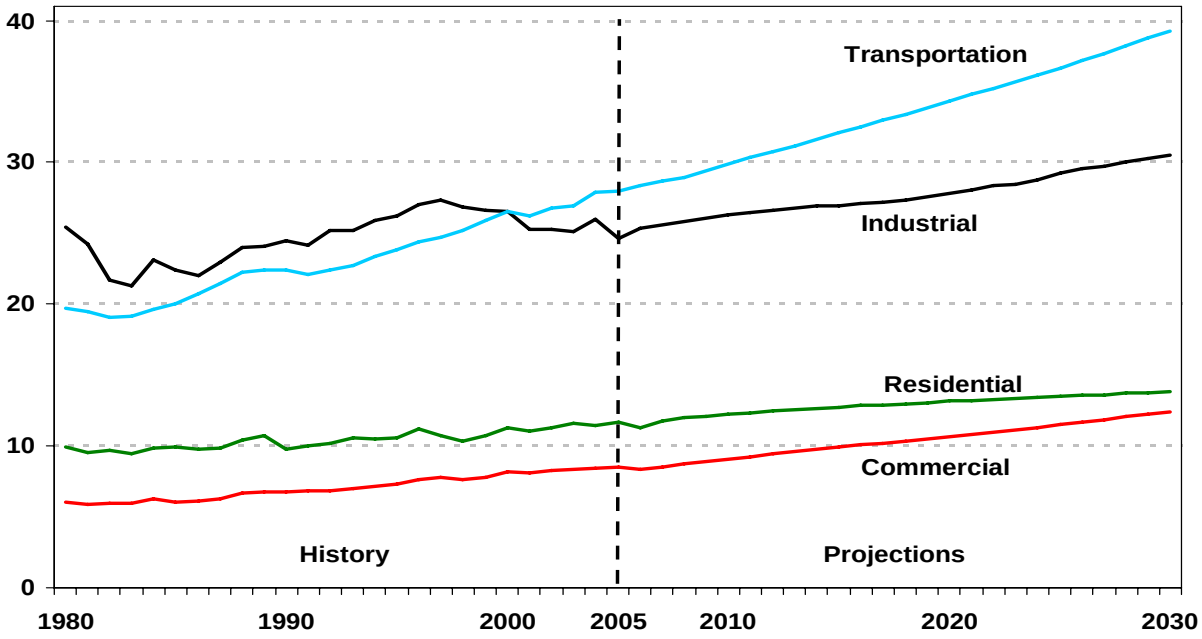

FIGURE 2. Energy Consumption by Fuel, 1980-2030 (quadrillion Btu)

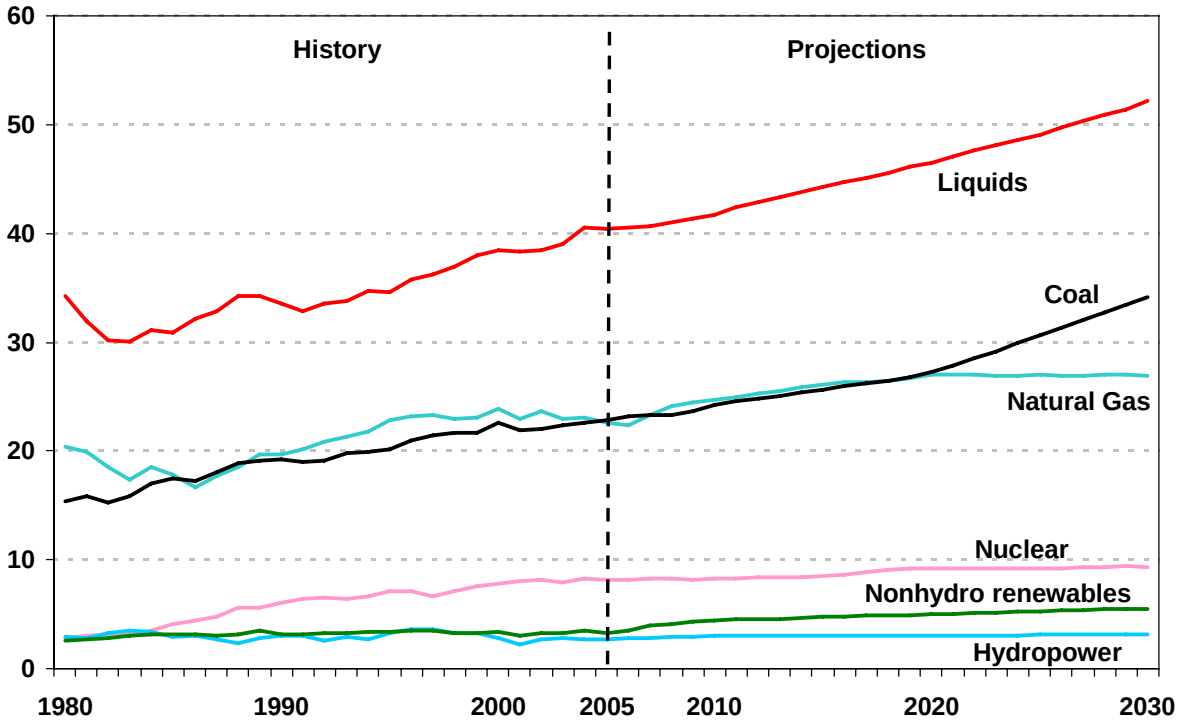

FIGURE 3. Electricity Generation by Fuel, 1980-2030 (billion kilowatthours)

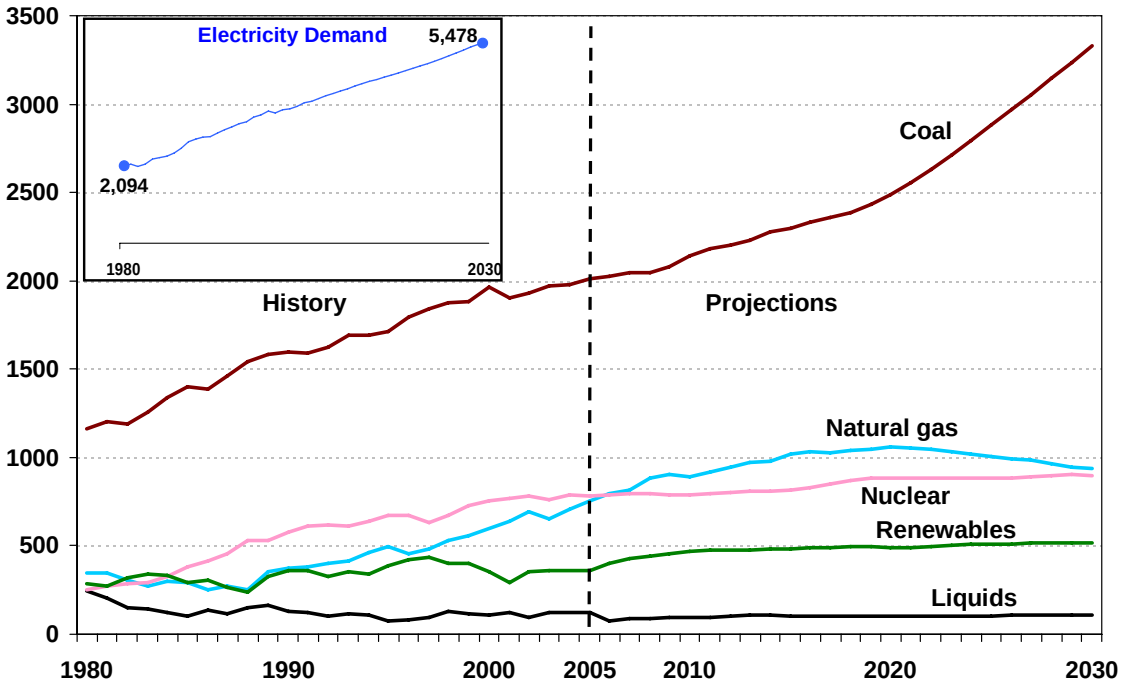

FIGURE 4. Electricity Generation by Renewable Fuel, 1980-2030 (billion kilowatthours)

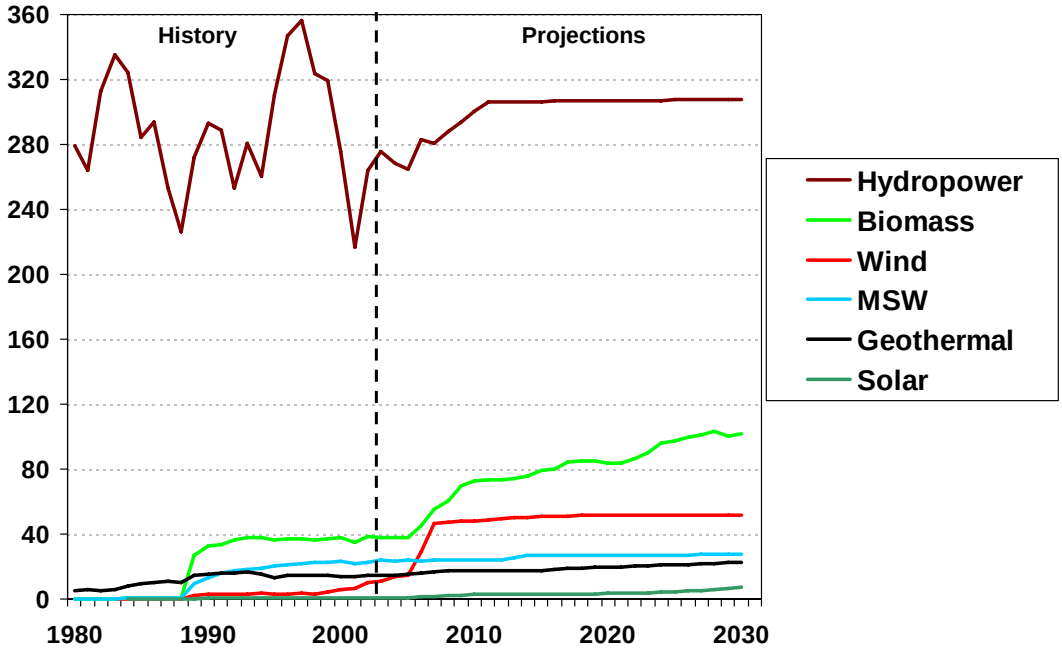

FIGURE 5. Total Energy Production and Consumption, 1980-2030 (quadrillion Btu)

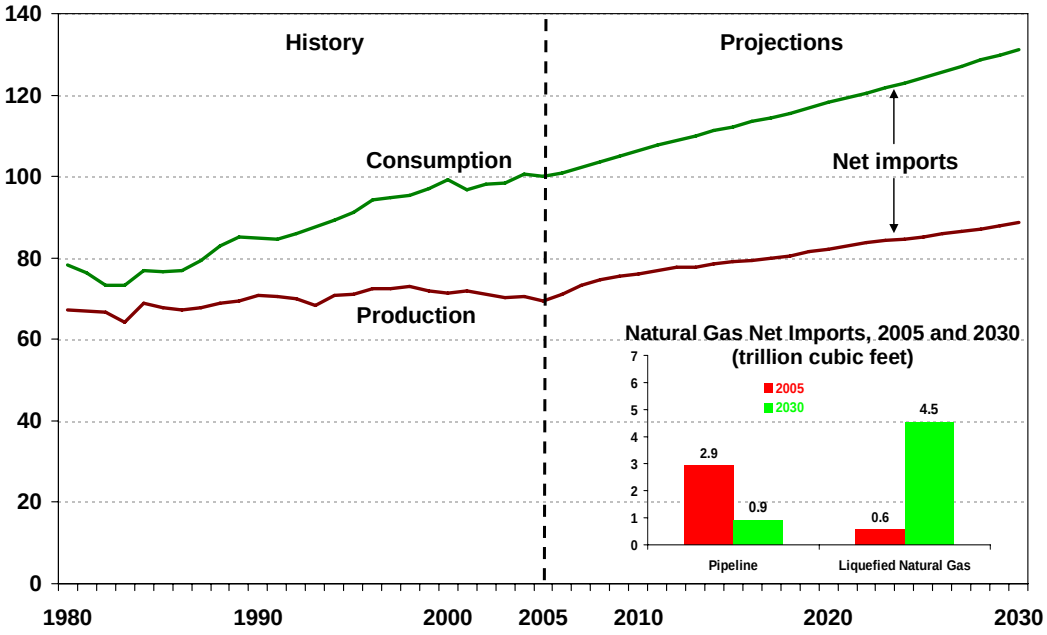

FIGURE 6. Energy Production by Fuel, 1980-2030 (quadrillion Btu)

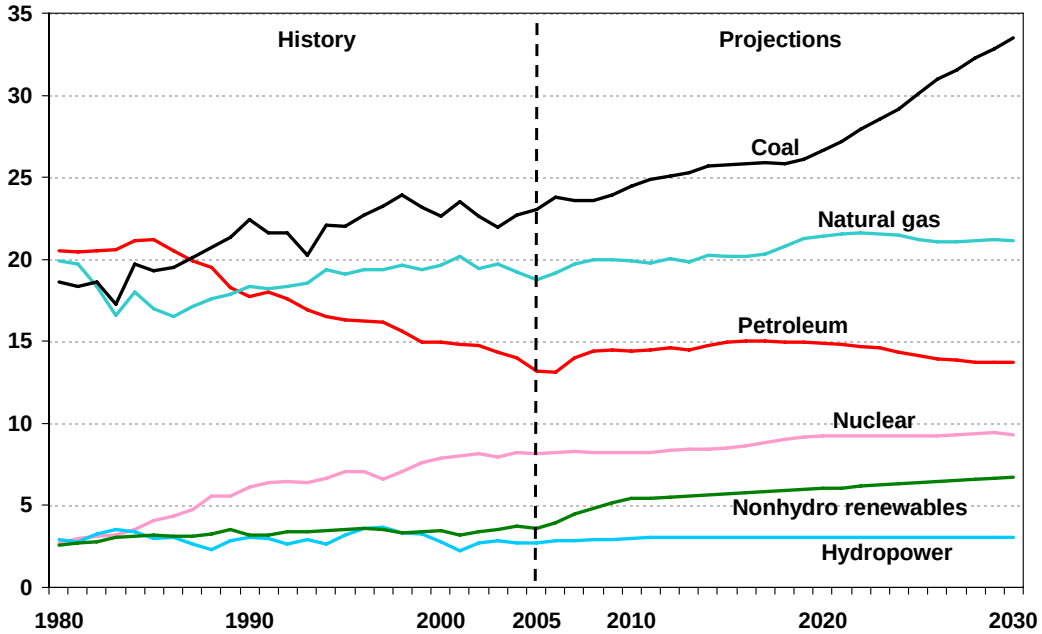

FIGURE 7. U.S. Energy Consumption and Energy-Related Carbon Dioxide Emissions in Two Cases, 1980-2030

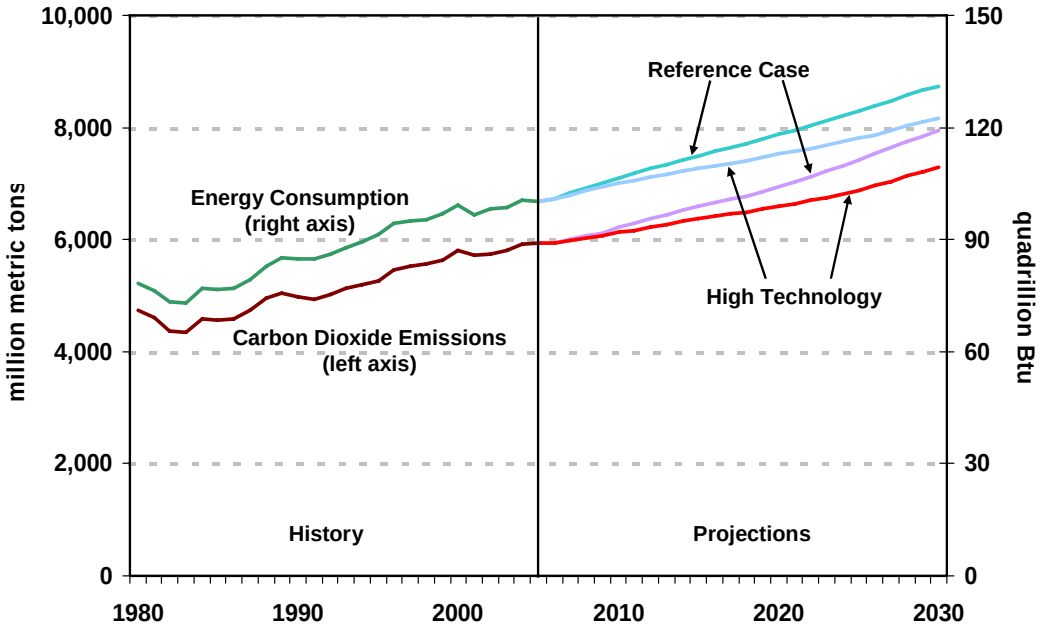

FIGURE 8. U.S. Carbon Dioxide Emissions by Sector and Fuel, 1990-2030 (million metric tons)