Testimony of

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Mr. Chairman and members of the committee, I appreciate the opportunity to appear before you today to discuss the Energy Information Administration's (EIA) recent analyses of greenhouse gas reduction policies.

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 Congress, the Administration, and the public. We do not take positions on policy issues, but we do produce data, analyses, and forecasts that are meant to assist policy makers in their 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 will focus on EIA's recent assessment of the impacts on energy supply, demand, and the economy that would result from the recommendations proposed in a December 2004 report entitled *Ending the Energy Stalemate: A Bipartisan Strategy to Meet America's Energy Challenges*, prepared by the National Commission on Energy Policy (NCEP), a nongovernmental privately-funded entity. EIA's report, *Impacts of Modeled Recommendations of the National Commission on Energy Policy*, released in April 2005, compares cases incorporating the NCEP recommendations to the projections of domestic energy consumption, supply, prices, and energy-related carbon dioxide emissions through 2025 in the reference case of the *Annual Energy Outlook 2005* (*AEO2005*). *AEO2005* is based on Federal and State laws and regulations in effect on

October 31, 2004. The potential impacts of pending or proposed legislation, regulations, and standards—or of sections of legislation that have been enacted but that require funds or implementing regulations that have not been provided or specified—are not reflected in the projections. *AEO2005* explicitly includes the impact of the American Jobs Creation Act of 2004, the Military Construction Appropriations Act for Fiscal Year 2005, and the Working Families Tax Relief Act of 2004. *AEO2005* does not include the potential impact of energy legislation that is now being considered by the Congress or regulations such as the Environmental Protection Agency's (EPA) Clean Air Interstate and Clean Air Mercury rules that were promulgated earlier this year.

The projections in the *AEO2005* and our analysis of the impacts of the NCEP policy recommendations are not meant to be exact predictions of the future but represent likely energy futures, 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 and subject to many random events that cannot be foreseen such as weather, political disruptions, and technological breakthroughs. In addition to these phenomena, long-term trends in technology development, demographics, economic growth, and energy resources may evolve along a different path than expected in the projections. Both the *AEO2005* and our report on the NCEP policy recommendations include a number of alternative cases intended to examine these uncertainties.

Since EIA's report has been provided to the committee and is available to the public on EIA's web site, my testimony presents only a summary of its key findings. My testimony

focuses on the NCEP case in our report, which includes all of the NCEP recommendations that EIA was able to model. However, I will also discuss some results for individual recommendations modeled separately, such as the proposed cap-and-trade program (CAP-TRADE case) linked to an intensity target for greenhouse gas (GHG) emissions, the proposed fuel economy standards (CAFE case), and the deployment incentives (INCENT case). Then, I will turn to sensitivity cases that highlight the effect of alternative technology assumptions on our results. Lastly, I will offer some comparisons to findings from some previous EIA analyses of policies to limit GHG emissions.

Main Results of the EIA Analysis

The December 2004 NCEP report outlined a broad array of policy measures, not all of which were amenable to analysis using the EIA model of U.S. energy markets, the National Energy Modeling System (NEMS). Our analysis focused on the recommendations that could be modeled and which were thought to have a significant potential to affect energy consumption supply and prices. Where the NCEP recommendations required further specification, specific assumptions were developed in consultation with staff of the requesting committee.

Our results show that the largest projected impacts on emissions, energy production, consumption, prices, and imports result from three of the NCEP recommendations: the cap-and-trade program linked to an intensity target for GHG emissions beginning in

2010, a major increase in corporate average fuel economy (CAFE) standards for cars and light trucks, and the new building and appliance efficiency standards. Other recommended policies generally affect specific fuels or technologies but do not have large overall market or emissions impacts.

The impacts of the modeled NCEP recommendations, analyzed together unless otherwise noted, relative to the *AEO2005* reference case, are discussed below.

Energy Consumption

Primary energy consumption is 2.26 quadrillion Btu (1.9 percent) lower in 2015 and 6.73 quadrillion Btu (5 percent) lower in 2025 as the combination of efficiency programs and new CAFE standards reduces energy demand. Fossil fuel energy consumption is 2.5 quadrillion Btu (2.4 percent) lower in 2015 and 8.1 quadrillion Btu (6.9 percent) lower in 2025. In absolute terms, the use of all fossil fuels is projected to grow from 2003 levels through 2025.

Figure 1 illustrates the impacts of the NCEP policies on oil consumption. Oil consumption in the NCEP case is 0.83 million barrels per day (3.4 percent) lower in 2015 and 2.1 million barrels per day (7.4 percent) lower in 2025. The import share of petroleum product supplied declines from 62.4 percent to 61.3 percent in 2015 and from 68.4 percent to 66.8 percent in 2025. As shown in **Figure 1**, almost all of the projected reduction in oil consumption results from the recommendation to increase fuel economy

standards (CAFE case). More than two-thirds of oil consumption is currently used in the transportation sector, and the transportation share of total oil use is projected to grow to 71 percent in 2025 in the reference case. Because of the GHG permit safety valve, which caps the price of traded permits at $6.10 per metric ton of carbon dioxide (CO_2) in 2010 rising to $8.50 per metric ton in 2025 (2003 dollars), the maximum direct effect of the cap-and-trade policy on the delivered price of gasoline, diesel, or jet fuel is roughly 7 cents per gallon (2003 dollars). Taken alone, a 7-cent price increase is not expected to spur either a switch to alternative fuels or prompt a significant increase in fuel efficiency (CAP-TRADE case).

Figure 2 illustrates the impacts of the NCEP policies on natural gas consumption. Natural gas consumption in the NCEP case is slightly lower (0.45 quadrillion Btu or 1. 6 percent) in 2015 and 1.1 quadrillion Btu (3.6 percent) lower in 2025, due mainly to lower electricity demand from the building standards recommendation and the incentives provided for deployment of renewable, coal-fired integrated gasification combined-cycle (IGCC), and nuclear power plants that further reduce the size of the market for natural-gas-fired electricity generation. In contrast, when the cap-and-trade program is considered alone (CAP-TRADE case), projected natural gas consumption rises above the reference case level as natural gas replaces coal in electricity generation.

Figure 3 illustrates the impacts of the NCEP policies on coal consumption. Coal consumption in the NCEP case is slightly reduced (0.46 quadrillion Btu or 1.8 percent) in 2015 and more significantly reduced (3.0 quadrillion Btu or 9.8 percent) in 2025, due

mainly to the lower electricity demand and shifts in the generation fuel mix that are caused by the cap-and-trade program. The technology incentives and building standards packages have offsetting effects on coal use, by encouraging IGCC plants while reducing electricity generation, so the net effect on coal use of the cap-and-trade program alone (CAP-TRADE case) is similar to that of the combined NCEP policy case.

Figure 4 shows how the NCEP policies affect projected electric generation capacity additions over the 2004 to 2025 period. Because of the early deployment incentives (INCENT case) and the cap-and-trade proposal, projected IGCC capacity additions more than double, and renewable generation increases by 23 percent relative to the reference case. However, the projected capacity additions of conventional coal-fired technology decline to less than 25 percent of the reference case level. The shift from conventional coal-fired plants to more efficient IGCC plants results in an increase in the amount of generation per ton of coal consumed.

Energy Prices

The NCEP policy recommendations generally reduce the demand for fossil fuels, which tends to lower wellhead or minemouth prices. However, the cost of permits required under the cap-and-trade program tends to increase the delivered price of fossil fuels. When these effects are taken together, the cost of permits tends to dominate even with the safety-valve limit on permit prices in place, so the energy prices paid by end users generally rise.

The average petroleum price to all users (including the price of emissions permits) is 2.2 percent higher in 2015 and 1.4 percent higher in 2025 than in the reference case, with the permit prices more than offsetting the lower crude oil prices resulting from the new CAFE standard. When the cap-and-trade (CAP-TRADE) program is considered without new fuel economy standards, the reduction in oil demand is much smaller, so the expected impact on delivered petroleum prices is larger.

The average delivered natural gas price in our NCEP case is $0.17 per thousand cubic feet (2.7 percent) lower in 2015, with the wellhead cost reduction partially offset by the increased GHG permit price, and $0.52 per thousand cubic feet (7.6 percent) higher in 2025, largely because of the permit price which is added to the delivered fuel costs. The 2015 result reflects the impacts of building and appliance standards, which reduce residential electricity demand, and incentives for IGCC, which favor coal-fired generation relative to natural gas.

When the costs of emissions permits are included, the average delivered coal price is $0.54 per million Btu (43 percent) higher in 2015 and $0.74 per million Btu (56 percent) higher in 2025 than in the reference case because of the high carbon content of coal. The much higher percentage change in delivered coal prices compared to the other fossil fuels reflects both its high carbon content per unit of energy and its relatively low price in the reference case.

The average delivered electricity price is projected to be unchanged in 2015 but is 0.4 cents per kilowatthour (5.8 percent) higher in 2025 because of the mandatory cap-and-trade program. EIA's electricity price estimates reflect the assumption that consumers capture the economic benefits of the allocation of GHG permits to regulated utilities in areas of the country where electricity rates are set under cost-of-service regulation.

Emissions

Projected reductions in energy-related CO_2 emissions, which are concentrated in the electric power and transportation sectors, are 2.8 percent in 2015 and 7.7 percent in 2025. These reductions are larger than the corresponding reductions in primary energy use (1.9 and 5.1 percent, respectively for 2015 and 2025), as the NCEP policy recommendations promote a less CO_2 –intensive energy mix.

Covered GHG emissions are 393 million metric tons equivalent (5.2 percent) lower in 2015 and 964 million metric tons CO_2 equivalent (11 percent) lower in 2025. Covered GHG emissions intensity decreases by 5.1 percent in 2015 and by 10.6 percent in 2025. The absolute level of covered GHG emissions is projected to grow at an annual average rate of 1.1 percent over the 2003 to 2025 period, compared to annual average growth of 1.5 percent in the reference case.

As shown in **Figure 5**, reductions in emissions of non-CO_2 GHG emissions, which are not represented in a detailed fashion in NEMS, account for over 50 percent of the covered

GHG emissions reductions in 2015 and 35 percent of the covered GHG emissions reductions in 2025. Estimates for non-CO_2 GHG emissions were developed using emissions baselines and abatement cost curves based on engineering cost estimates that were supplied by EPA. Real-world factors affecting the behavior of decisionmakers and the use of incomplete cost information may result in an overstatement of the actual level of non-CO_2 abatement achieved at each level of the permit price. However, as discussed below, due to the safety-valve feature of the proposed cap-and-trade program, the projected energy sector and economic impacts of the NCEP policy recommendations would not change significantly even if the assumptions used regarding the supply of GHG abatement opportunities were too optimistic.

Because of the safety-valve price mechanism in the cap-and-trade program for GHGs, the GHG intensity targets specified by the NCEP are not reached. EIA projects that total emission reductions fall short of the emission target by 557 million metric tons CO_2 equivalent in 2025.

Economic Impacts

Figure 6 shows the projected effect of the NCEP policy recommendations and the cap-and-trade policy considered separately on the projected level of real gross domestic product (GDP). By 2025, real GDP in the NCEP and CAP-TRADE cases are, respectively, 0.4 percent ($79 billion dollars) and 0.13 percent ($27 billion dollars) below the reference case levels. These changes do not materially affect average economic

growth rates for the 2003 to 2025 period. Real consumption is also reduced over the 2010 to 2025 period relative to the reference case, with the impact reaching about 0.55 percent in 2025 ($74 billion in year 2000 dollars).

Cap and trade systems or emissions taxes are generally considered the most economically efficient approach for reducing emissions, since they allow reductions to be made where they can be achieved at the lowest cost. In a pure cap-and-trade program, the price of emissions permits, which generally rises as the cap is made more stringent, is a good indicator of economic impacts. However, in a program that combines a cap-and-trade program with regulatory measures, a lower permit price does not imply lower economic impacts. Although the regulatory measures included in the NCEP case result in a lower projected price of emissions permits than would be expected if the cap-and-trade policy was implemented alone, the projected economic impacts in the NCEP case are higher than for the cap-and-trade only case in our analysis.

Technology Sensitivities

While the *AEO2005* reference case used as the basis for comparisons in our analysis 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. Relative to the reference case, EIA's high technology case generally

assumes earlier availability, lower costs, and higher efficiencies for end-use technologies and new fossil-fired, nuclear, and nonhydropower renewable generating technologies.

Although the NCEP recommends increases in the funding for research and development, EIA, consistent with its established practice in other recent studies, did not attempt to estimate how increased government spending might specifically impact technology development. Instead, to illustrate the importance of technology characteristics in assessing the impacts of the NCEP recommendations, EIA prepared a set of NCEP policy cases using its high technology assumptions. **Figure 7** shows how the use of high technology assumptions tends to reduce projected energy use with or without the recommended NCEP policies. Relative to the *AEO2005* high technology case, the high technology case combined with the NCEP recommendations reduces fossil fuel use by 1.46 quadrillion Btu (1.5 percent) in 2015 and 4.48 quadrillion Btu (4.1 percent) in 2025.

Under the high technology assumptions, the NCEP's greenhouse gas intensity goals are met, reducing covered GHG emissions intensity from 480 to 463 metric tons CO_2 equivalent per million dollars of GDP in 2015 (3.5 percent) and from 405 to 373 metric tons CO_2 equivalent per million dollars in 2025 (7.9 percent). Attainment of the emissions intensity goal depends heavily on estimated reductions of non-CO_2 GHG emissions, subject to the caveats above and on the use of banked GHG emissions permits that are exhausted in 2025, at the end of the forecast horizon for this analysis.

Because energy consumption is already lower in the high technology case than in the reference case, the NCEP recommendations have a smaller relative impact to the high technology case. However, due the lower baseline consumption, the GHG intensity goals are easier to attain.

Relationship to Previous EIA Greenhouse Gas Analyses

EIA has completed several other reports on policy proposals to limit or reduce GHG emissions. EIA's previous analyses of emission reduction proposals indicate that the economic impacts are largely determined by the *size of the energy market change* required to satisfy the policy *and the speed* with which the change must occur. In 2003, EIA considered the original version of the Climate Stewardship Act (S.139), which would cap GHG emissions at the 2000 level in 2010 and the 1990 level in 2016 and beyond. In 2004, EIA considered an amended version of that bill (S.A.2028) that removed a provision for a tightening of the emissions cap beginning in 2016. The NCEP proposal, S.A.2028, and S.139 all have a 2010 start date for their cap-and-trade systems. The NCEP proposal is less stringent than the others because it is expressed in terms of GHG emission intensity, starts from the 2010 level, and includes a safety valve.

These earlier reports suggest that either version of the Climate Stewardship Act is projected to provide larger reductions in emissions from the energy sector than the NCEP policy recommendations. To achieve this, higher permit prices (**Figure 8**) and larger energy system changes, particularly for electricity generation and demand, are required.

That is, S.A.2028 and S.139 would require more significant changes in the U.S. energy system and larger increases in delivered energy prices than the NCEP recommendations, resulting in larger estimated economic impacts. As permit prices increase, electricity prices typically increase and reduce demand while electricity generation tends to shift away from coal technologies because of the high carbon content of the fuel and toward low or no-carbon emitting technologies like renewable, natural gas, and nuclear power generation (**Figure 9**).

Finally, while all baseline and policy projections are inherently uncertain, differences in policy design can affect the impacts on the energy system and the level of GHG emissions. The safety-valve feature of the NCEP cap-and-trade proposal would allow GHG emissions to rise above the level projected in our report in the event that emissions reduction inside or outside the energy sector proves to be more costly than we expect, while protecting against the prospect of larger energy system and economic impacts in these circumstances. In contrast, policies that impose a "hard" cap on emissions without a safety-valve price for GHG credits, would force the GHG emissions target to be met through higher GHG prices, regardless of the cost to the economy.

This concludes my testimony, Mr. Chairman and members of the Committee. I would be pleased to answer any questions you may have.

Figure 1. Oil Consumption in Four Cases, 2003-2025 (million barrels per day)

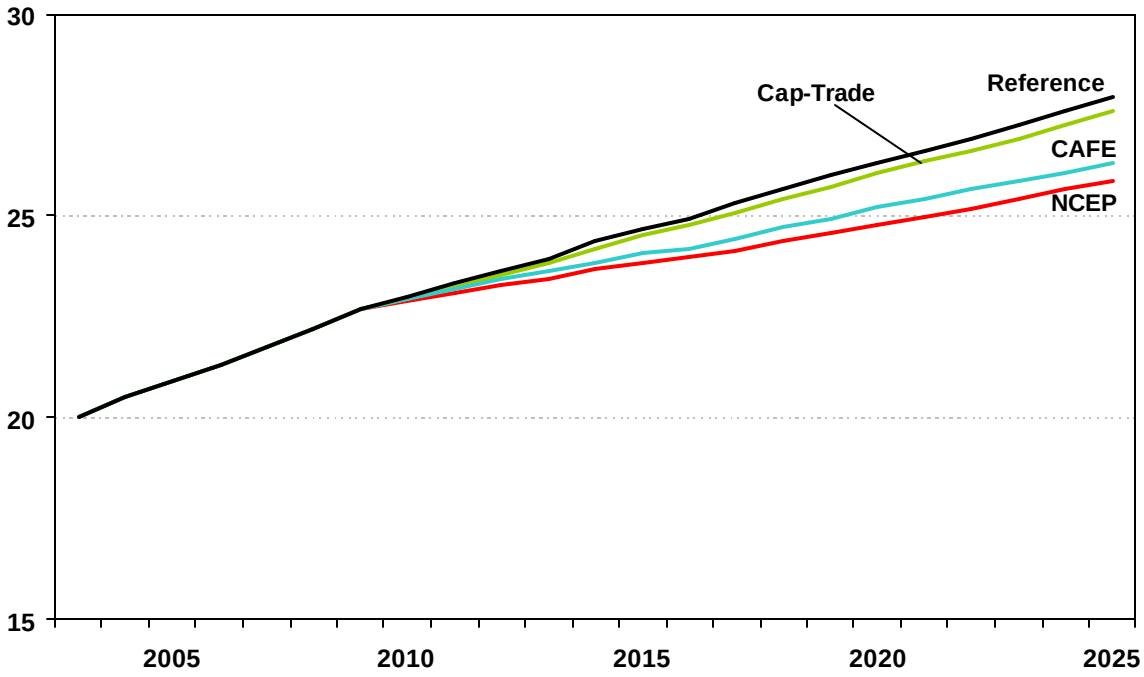

Figure 2. Total Natural Gas Consumption in Three Cases, 2003-2025 (quadrillion Btu)

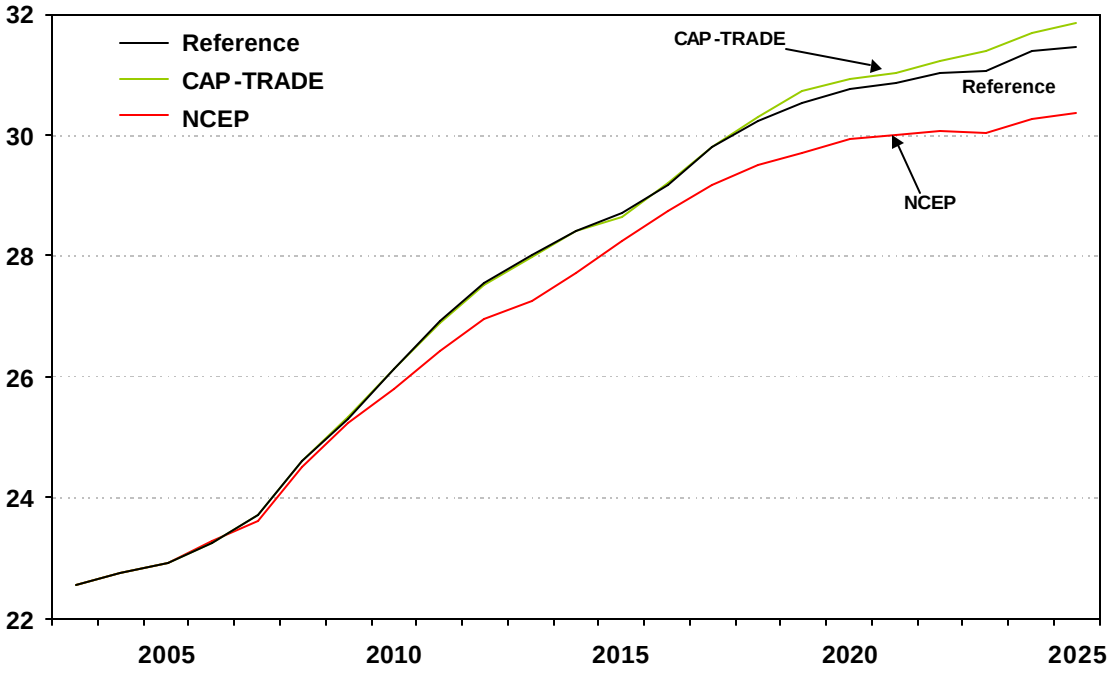

Figure 3. Total Coal Consumption in Three Cases, 2003-2025 (quadrillion Btu)

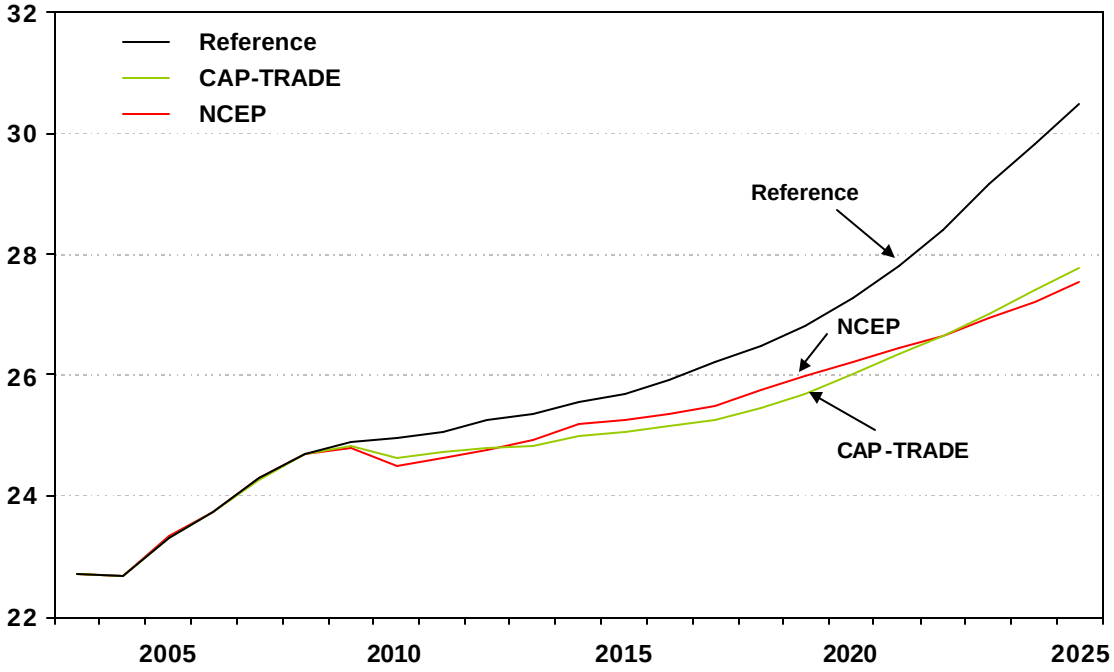

Figure 4. Generating Capacity Additions by Type, 2004-2025 (gigawatts)

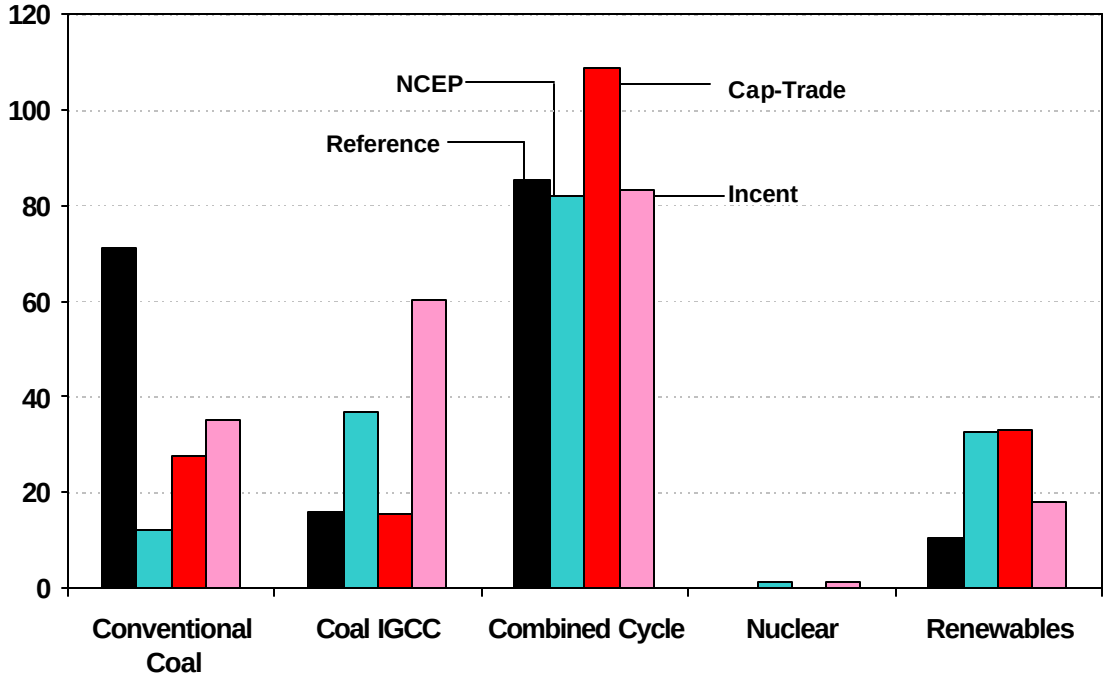

Figure 5. Emission Reductions by Category in Two Cases, 2015 and 2025 (million metric tons)

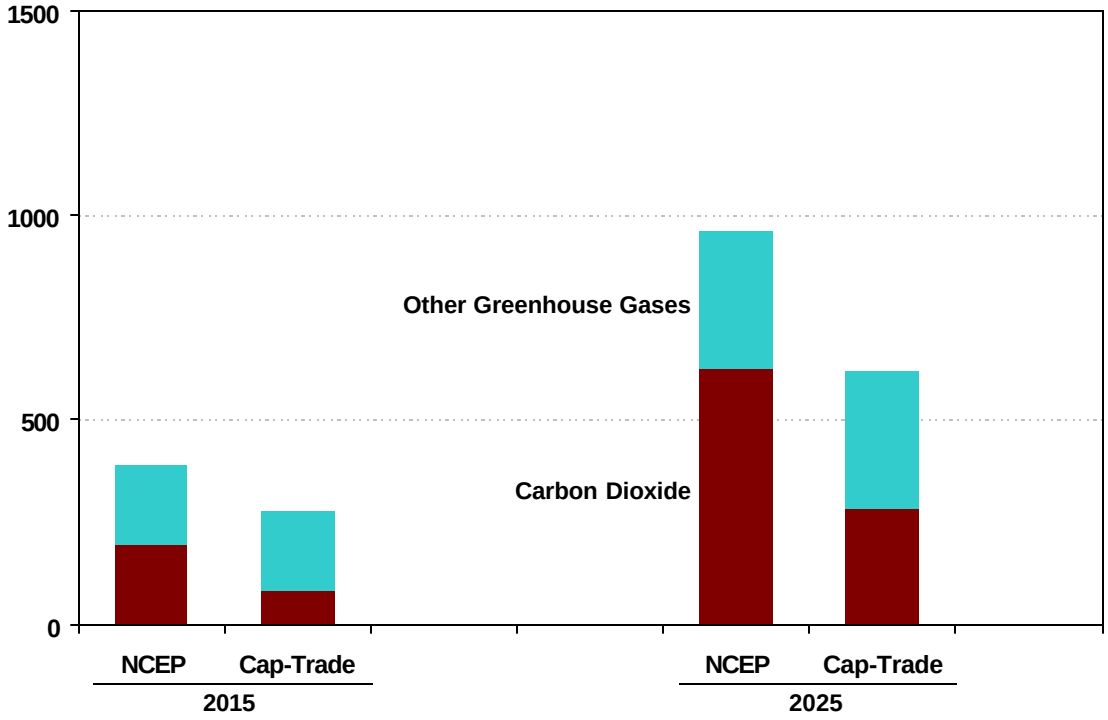

Figure 6. Impacts on Real GDP and Real Consumption (percent change from reference)

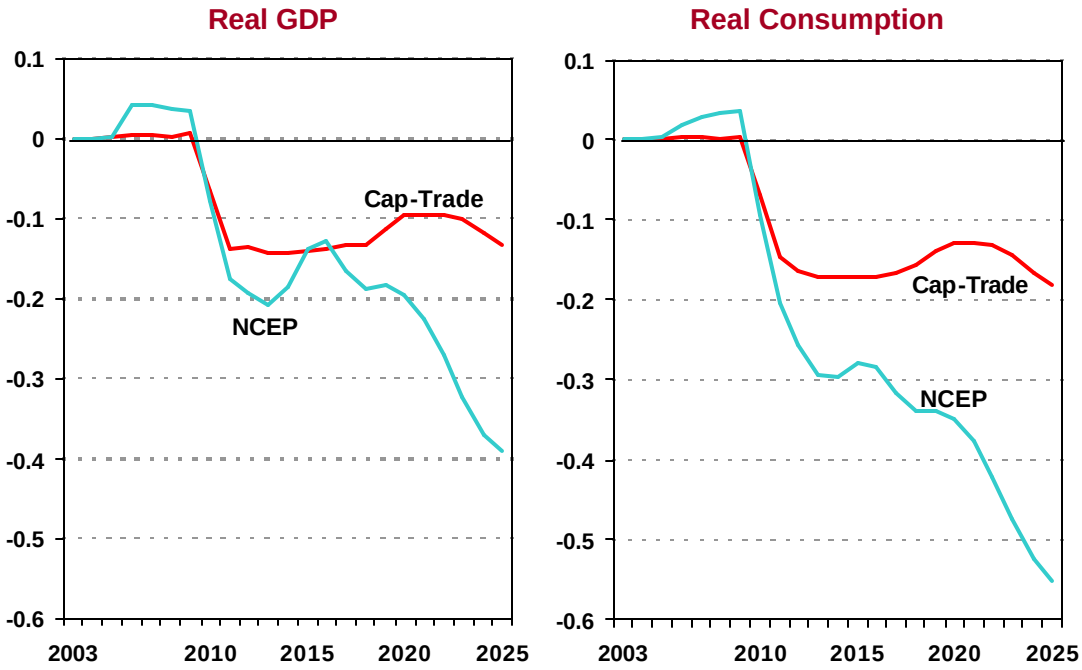

Figure 7. Total Primary Energy Consumption in Four Cases, 2003-2025 (quadrillion Btu)

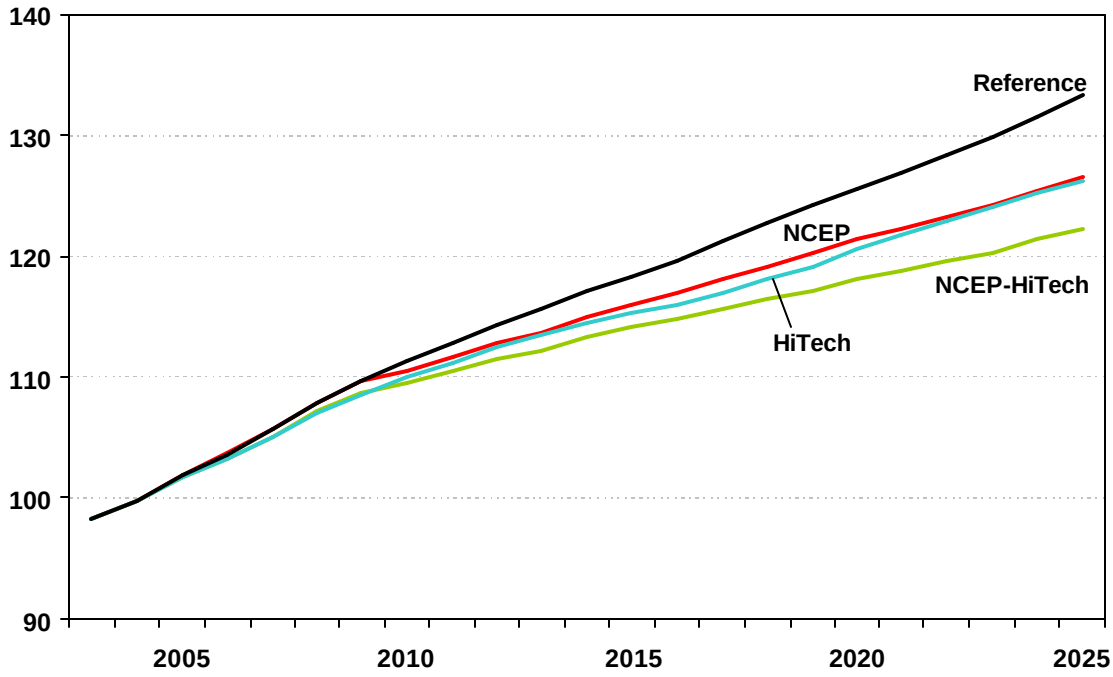

Figure 8. Greenhouse Gas Emission Allowance Price, 2003-2025
(2003 dollars per metric ton carbon dioxide equivalent)

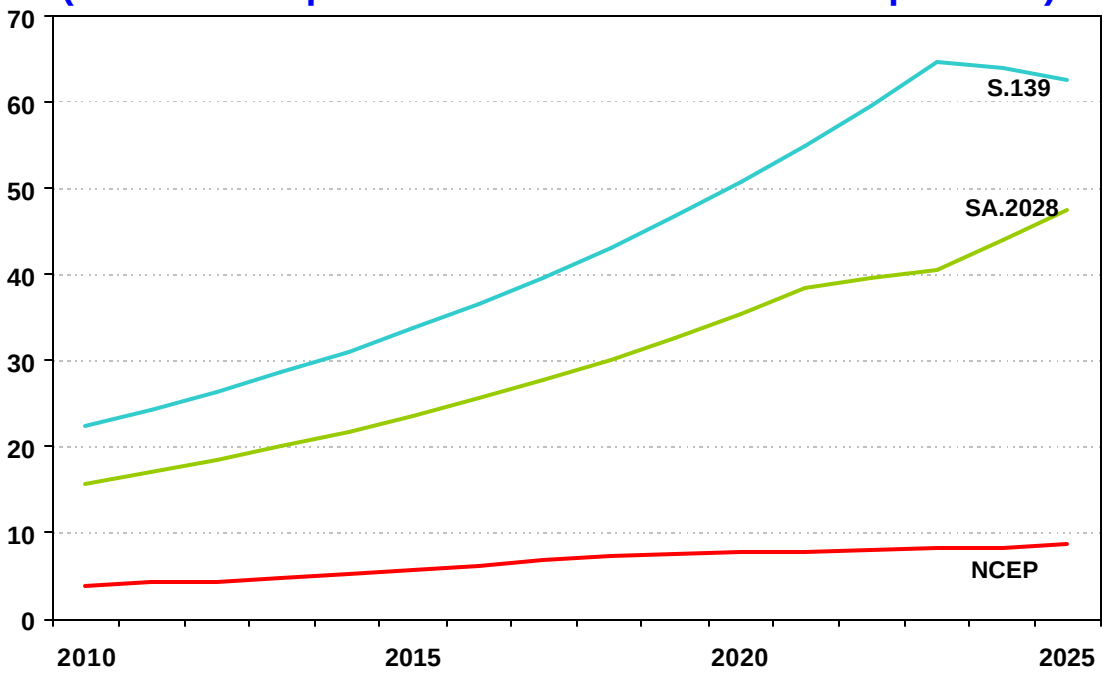

Figure 9. Change in Electricity Generation and Demand from Respective Reference Case, 2025 (percent)