Supplement to: Energy Market and Economic Impacts of S. 280, the Climate Stewardship and Innovation Act of 2007

October 2007

This paper responds to a September 18, 2007, letter from Senators Barrasso, Inhofe, and Voinovich, hereinafter referred to as the BIV request, seeking further energy and economic analysis to supplement information presented in the Energy Information Administration's (EIA) recent analysis of S. 280, the Climate Stewardship and Innovation Act of 2007[1]. The BIV request raises issues that would also apply in the context of EIA analyses of other policy proposals. A copy of the request letter is provided in Appendix A.

To meet the Senators' desire for an expedited response, this paper is organized around the main issues raised in their request. While the discussion of modeling results focuses on areas directly related to the issues raised by the Senators, a full set of standard tables for all modeling runs is available on the EIA web site.[2] The topics addressed in this paper are:

- the realism of scenarios in recent EIA modeling and concerns expressed regarding prospects for building new coal-fired power plants;
- additional requested modeling scenarios that restrict the availability of nuclear, biomass, and coal with carbon capture and sequestration technology;
- the time horizon and State/regional detail in energy modeling; and
- EIA's natural gas analysis.

1. Realism of scenarios in recent EIA modeling and concerns regarding the prospects for building new coal-fired power plants

The reference case in EIA's recent analysis of S. 280, the Climate Stewardship and Innovation Act of 2007, projects 19 gigawatts (GW) of new coal-fired power plants in the 2005-2015 time period.[3] As of August 2006, when the reference case inputs were prepared, 10 GW were already under construction and expected to enter operation by 2012. The latest data reported to EIA show that nearly 12 GW of new coal-fired power plants are now under construction or fully permitted, 11 GW of which are moving forward, with a larger amount of capacity still identified as being in the earlier stages of planning. The gestation period for a significant coal plant is on the order of 5 years, so it is quite possible that some additional capacity identified as "planned" in the EIA electricity data surveys, or even some potential projects that are not even included in the 5-year horizon covered by the surveys,

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[1] Energy Information Administration, *Energy Market and Economic Impacts of S. 280, the Climate Stewardship and Innovation Act of 2007*, SR/OIAF/2007-04 (Washington, DC, July 2007), web site www.eia.doe.gov/oiaf/servicerpt/csia/pdf/sroiaf(2007)04.pdf.

[2] See http://www.eia.doe.gov/oiaf/service_rpts.htm.

[3] The reference case referred to throughout this report is from EIA's recent analysis of S. 280, the Climate Stewardship and Innovation Act of 2007. It is based on the reference case from EIA's *Annual Energy Outlook 2007* (*AEO2007*), with minor modeling changes to accommodate the policies of S. 280.

would enter service by 2015. While EIA does not expect all, or even most, of the plants currently listed as "planned" in its survey responses to be built by 2015, the reference case projections to 2015 appear to be realistic based on current construction activity and the potential for some additional plants to come on line by 2015. The actual amount of coal-fired capacity added by 2015 will, however, likely be reduced if electricity demand grows at a slower rate than projected in the reference case or renewable generation capacity increases at a faster rate. Renewable capacity additions will likely exceed reference case estimates if the tax credit for production of electricity from specified renewable sources, including wind, is extended beyond its currently-scheduled 2008 expiration date.

Between 2015 and 2030, the reference case includes significant amounts of new coal-fired capacity, with total new builds of 133 GW. The significant additions reflect the economic attractiveness of coal-fired baseload generation relative to available alternatives under current laws and policies. The prospects for building that much capacity are necessarily uncertain, as they depend on future demand, fuel price, and technology cost trends, as well as potentially changing policies and public sentiment. The EIA reference case is deliberately designed to reflect only current laws and policies. Because analysis of specific alternative policies at the request of the Congress and/or the Administration is a core part of the EIA mission and because EIA does not take a position or speculate on potential policy changes, such changes are not included in the reference case. If assumptions about "expected" policy changes such as future fuel economy standards, taxes or caps on greenhouse gas (GHG) emissions, or new regulatory requirements for conventional pollutants were included in the reference case, it could not be used as a baseline in assessing the impacts of alternative policy proposals in these areas. For this reason, EIA reference case projections are not directly comparable with private energy forecasts that include estimates of policy change in their scenarios.

Although forecasting policy change is beyond EIA's mandate, a reasonable argument can be made that, all else being equal, public and industry awareness of a major policy issue alone can potentially impact energy investment decisions. For example, the possibility of future action to control GHG emissions during the expected operating lifetime of new power generation facilities could favor investment in no- and low-GHG-emission technologies relative to high-GHG-emission alternatives, even if no specific policy change actually occurred. Such an effect might be incorporated in models by penalizing technologies that are perceived to be risky due to policy concerns. However, applying such adjustments on an *ad hoc* basis is difficult, since the extent of any future disadvantage borne by new high-GHG-emission generators that begin construction prior to the enactment of a new policy will depend heavily on the details of the policy design and implementation. Notably, many major environmental policies over the past 30 years have protected investments made prior to their enactment through regulatory "grandfathering."

It is also important to recognize that any modeling adjustment that is made in the current reference case to reflect the influence of an unresolved policy issue, while raising costs vis-a-vis the reference case, would generally reduce the estimated impact resulting from the implementation of a given policy response. For example, to the extent that concern over the climate change issue serves to significantly depress investment in new coal-fired power plants, the primary effect would be most evident in the reference case, where significant coal builds are projected after 2015, and not in policy cases reflecting a significant tax or cap-and-trade program for GHG emissions, where few if any conventional coal-fired power plants are projected to be built. Since policy impacts are measured in terms of the difference between cases that incorporate policy changes and the reference case baseline, the impact of modeling adjustments to reflect the impact of unresolved policy issues would generally be to reduce, rather than increase, the estimated impact of a given policy response on delivered energy costs.

Another aspect of the "realism" issue relates exclusively to modeling responses to policy change, as many of the policy cases considered in recent studies of GHG require the rapid uptake of technologies, such as nuclear, that are controversial, or others, such as biomass generation, that have not yet been widely deployed. The technology penetration schedules in recent EIA policy cases incorporate cost penalties for rapid deployment as well as learning effects. EIA's recent analyses of GHG limitation policies also include prominent reminders of the sensitivity of analysis results that depend on a dramatic increase in the use of technologies that play a relatively small role in today's energy markets[4] and sensitivity cases that examine the implications of restricting deployment of particular technologies.

EIA has clearly recognized that allowance prices and energy and economic impacts can increase well beyond the levels projected in the main analysis cases of our recent report on S. 280 if barriers to the deployment of multiple technologies occur simultaneously. EIA has also pointed out that the level of barriers to key technologies may be directly influenced by policy design choices.[5] For example, inclusion of a mechanism to relax compliance pressure that is tied to the level of compliance costs or other measures of economic impact is likely to discourage efforts by some stakeholders to raise barriers to technologies, such as nuclear power, that are attractive from a GHG emissions perspective but are controversial for other reasons. With such a mechanism in place, these stakeholders will recognize that success in impeding nuclear power would increase the chances of triggering the mechanism and compromising the GHG target. In the absence of such a mechanism, these stakeholders might be more inclined to press their opposition to nuclear, because they know the allowance price will increase to whatever higher level may be required to encourage deployment of other emission reduction options without compromising the GHG target.

Other aspects of the "realism" issue are also recognized in EIA analysis reports. Beyond changing the mix of new generation technologies deployed, GHG emission limitations that result in the retirement of existing coal-fired generation capacity are likely to increase the total amount of new capacity additions required. The increase in the total requirement for new capacity could put a strain on specialized resources for capital-intensive projects even without any barriers to specific technologies.

In summary, EIA believes that its recent analysis reports on GHG limitation policies and proposals for a "25 by 25" mandate or a renewable portfolio standard for electric power generation provide useful and appropriately-caveated results. Any given analysis, however, can not consider all possibilities, and we are always prepared to provide further work where it can be helpful.

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[4] This point is made in the Executive Summaries of the recent S. 280 and "25 by 25" Service Reports, for example, SR/OIAF/2007-04, page xiii, and SR/OIAF/2007-05, page ix, as well as in the body of those reports.

[5] These two points are also made in the Executive Summary of the recent S. 280 report. See SR/OIAF/2007-04, page xiii.

2. Additional requested modeling cases that restrict the availability of nuclear, biomass, and coal with carbon capture and sequestration technology

Recent EIA analyses suggest that the electricity sector is likely to be the source of the vast majority of domestic energy-related GHG emissions reductions prior to 2030 if either a tax on GHG emissions or an economy-wide cap-and-trade program is adopted as the primary policy instrument to reduce GHG emissions. Almost all other analyses that we are familiar with reach a similar result.

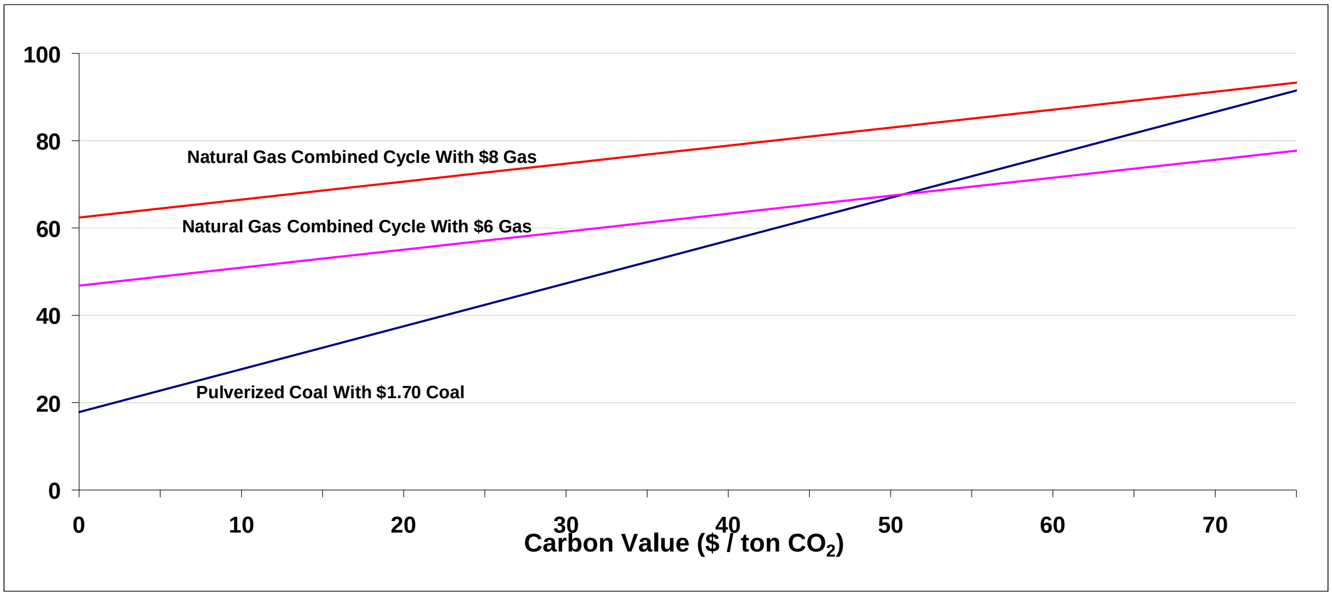
This finding reflects the availability of many alternative electricity generating technologies; the relatively high carbon content and low market value of coal per unit of energy content, which together make the cost of using coal sensitive to the placement of an implicit or explicit value on carbon; and the ability to accommodate a different generation mix without major changes in the electricity distribution infrastructure and no change in electricity-using equipment in end-use sectors. It also reflects the significantly higher technical and market barriers to major changes in the other major sources of energy-related GHG emissions, notably transportation.

In the electricity sector, demonstrated generation technologies that emit no or extremely low net GHGs include nuclear, biomass, wind, and other renewable sources. There are also likely to be some, albeit inherently uncertain, opportunities for refinements and cost reductions in these technologies and for the development of other prospective low-emission technologies, notably coal with carbon capture and sequestration.

Fuel switching from coal to natural gas is another option for reducing GHG emissions in power generation, but its attractiveness depends on the prices of coal and natural gas, the implicit price of carbon, and the costs of other low-carbon options. Taking account of both the difference in carbon content per unit energy between coal and natural gas and the lower heat rate (greater thermal efficiency) of natural-gas-fired generation, the carbon dioxide emission rate for natural-gas-fired generation is about one-third that of new coal-fired generation. In an emissions-constrained world, the lower amount of emissions per unit of electricity is an advantage for natural gas relative to coal, but natural gas is still significantly disadvantaged relative to no-emission generation options. In addition to emissions costs, fuel costs and the costs of constructing new capacity also affect the choice of electricity generation technology.

In the reference case, where there is no explicit or implicit value placed on the carbon content of fuels, natural gas delivered to electricity generators is significantly more expensive than coal. The fuel cost per megawatthour for typical existing pulverized coal plants and combined-cycle natural-gas-fired plants is illustrated along the vertical axis of Figure 1. The upward slope of the lines reflects the impact of increasing carbon dioxide (CO_2) allowance costs along the horizontal axis. As shown, with coal assumed to cost $1.70 per million Btu and natural gas assumed to cost $6 per million Btu, the combined cost of fuel and CO_2 allowances per megawatthour generated is much lower for existing coal plants than for existing combined-cycle natural-gas-fired plants when there is no CO_2 allowance fee. As the CO_2 allowance fee increases along the horizontal axis, the gap between the two lines narrows, but, with natural gas at $6 per million Btu, they do not cross until the allowance fee exceeds $50 per metric ton. If the reference case natural gas projections understate natural gas prices and demand, as has been suggested by some, the crossing point would occur at a higher emissions value, as illustrated by the line where $8-per-million-Btu natural gas prices are assumed.

Figure 1: Combined Fuel and Allowance Costs
(2005 dollars per megawatthour)

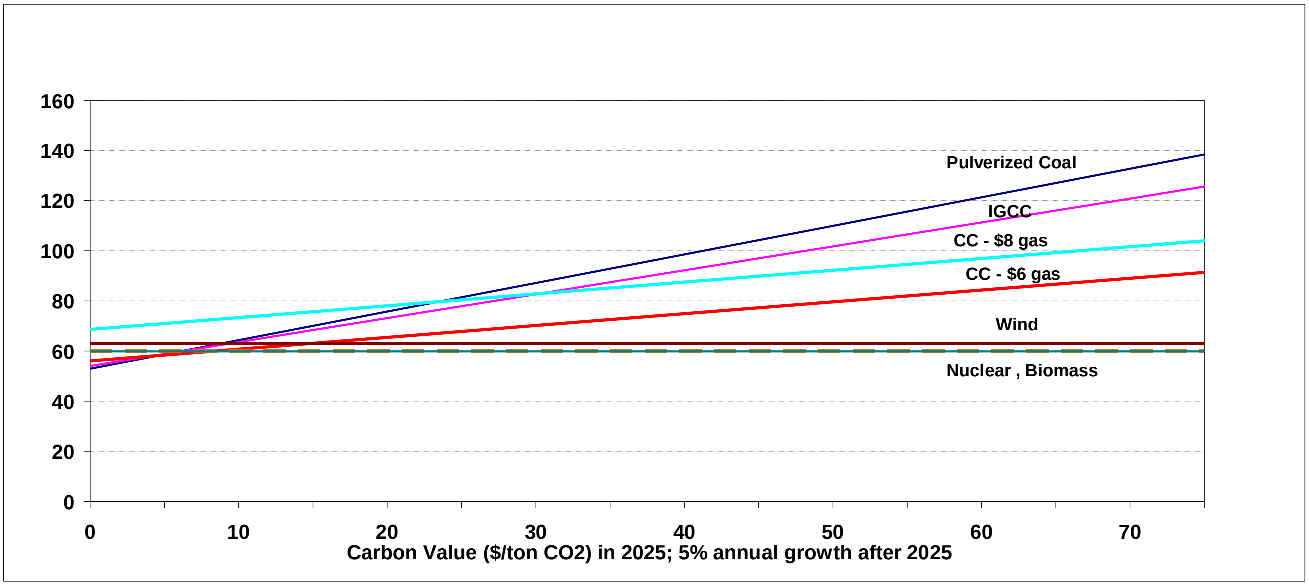


Source: Energy Information Administration, Office of Integrated Analysis and Forecasting.

Of course, when comparing the economics of new plants rather than existing ones, capital costs and other non-fuel-cost factors also affect the choice among generation technologies. To capture these additional factors, Figure 2 shows levelized generation costs in 2025 for several generation technologies as a function of the CO_2 allowance cost. Since GHG policies are likely to have the largest potential impact on the choice of technology for baseload generation, the primary market served by coal-fired generation, the levelized costs shown in Figure 2 are developed using capacity factors consistent with the expected performance of each technology when applied to that load segment.

While coal and natural gas are closer together on the vertical axis in Figure 2 than in Figure 1, mainly reflecting the significantly higher capital costs of pulverized coal plants compared to combined-cycle natural-gas-fired plants, changes in the emissions value have a similar impact on generation costs for coal and natural gas in Figures 1 and 2. Levelized generation costs for non-fossil technologies such as nuclear, biomass, and wind are shown as horizontal lines in Figure 2, since they are not impacted by changes in the value placed on GHG emissions. While a very high price of emissions makes it more likely that natural gas will be more attractive than coal for baseload generation, it also increases the advantage of non-emitting generating technologies relative to both coal and natural-gas-fired generation.

Figure 2: Levelized Generation Costs
(2005 dollars per megawatthour)



Source: Energy Information Administration, Office of Integrated Analysis and Forecasting.

The BIV request asks for two new modeling scenarios in which several of the most economically attractive no-emission alternatives to coal-fired generation are restricted. The Reference Nuclear and Biomass (RefNB) Case holds nuclear and biomass to their reference case level through 2030. The Reference Nuclear and Biomass plus no Carbon Capture and Sequestration (CCS) Case (RefNB+noCCS) adds the limitation that coal with CCS cannot be deployed before 2030.

As expected, the restrictions on these alternatives greatly increase the amount of natural-gas-fired generation in policy cases that implement the S. 280 cap-and-trade system. Table 1 compares projections for natural-gas-fired generation; natural gas used for generation; total natural gas consumption; liquefied natural gas (LNG) supply; and electricity, natural gas, and CO_2 permit prices for these two new cases to results for the main S. 280 policy case from EIA's August 2007 report and the reference case.

Table 1. Key Natural Gas Indicators, Reference Case and Alternative S. 280 Cases

	2005	2020					2030				
		Refer-ence	S. 280 Core	RefNB	RefNB + noCCS	RefNBL NG + noCCS	Refer-ence	S. 280 Core	RefNB	RefNB + noCCS	RefNBL NG + noCCS
Natural Gas Generation (bkwh)	752	1050	1056	1216	1292	1266	919	794	1259	1671	1540
Total Natural Gas Use (tcf)	22.0	26.3	25.5	26.4	26.8	26.7	26.1	24.3	27.1	29.5	28.4
Natural Gas for Generation (tcf)	5.8	7.1	6.5	7.5	8.0	7.8	5.8	4.1	6.8	9.3	8.5
LNG Supply (tcf)	0.6	3.7	3.4	3.7	4.0	3.7	4.6	3.5	5.1	6.3	4.5
CO_2 Permit Price ($/ton)	n/a	n/a	22.20	24.60	28.30	28.60	n/a	47.90	53.10	61.20	61.80
Natural Gas Price at Henry Hub ($/mmbtu)	8.60	5.71	5.46	5.72	5.79	5.81	6.44	6.12	6.73	7.17	7.55
Natural Gas Price to Generators[6] ($/mmbtu)	8.17	5.75	6.54	7.03	7.37	7.40	6.24	8.15	9.30	10.44	10.75
Residential Natural Gas Prices ($mmbtu)	12.43	10.51	10.31	10.53	10.62	10.64	11.32	11.00	11.63	12.03	12.41
Electricity Price (cents/kwh)	8.1	7.9	8.7	9.0	9.3	9.3	8.0	9.7	11.0	11.4	11.6

Notes: bkwh = billion kilowatthours, tcf = trillion cubic feet, $/ton = 2005 dollars per ton CO_2, $/mmbtu = 2005 dollars per million Btu, cents/kwh = 2005 cents per kilowatthour.
Source: Energy Information Administration, National Energy Modeling System runs: S280BASE.D060107A, S280.D060107A, S280NUCBIO.D092807A, and S280CCS.D092807A.

[6] Natural gas prices to generators include the costs of greenhouse gas allowances because they are a covered sector.

The BIV request then asks that the RefNB+noCCS case be used as the basis for a modeling run incorporating additional emissions limitations in developed countries (the Beyond Kyoto case). However, as shown in Table 2, the 2020 assumption for the developed countries in Group 1 used in the S. 280 analysis already adopts the 20-percent-below-1990 reduction[7] for Europe, which constitutes the bulk of Annex 1 emissions and is therefore already fairly representative of the Beyond Kyoto assumptions through 2030, the current time horizon of EIA's National Energy Modeling System (NEMS). Given this time horizon, the proposed reduction in the BIV request of 80 percent for 2050 cannot be implemented in the model.

Table 2. International Emissions Baseline, Abatement Commitments, and Assumed Abatement Demand, 2010-2030

(million metric tons carbon dioxide equivalent)

	Emissions Baseline		Abatement Commitment		Cap		Abatement Demand		
	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Total
1990	8,188	16,268	Baseline	Baseline	8,188	16,268	0	0	0
2010	9,027	24,463	5.0 % below 1990	Baseline	7,778	24,463	1,248	0	1,248
2015	9,184	27,389	8.2 % below 1990	Baseline	7,516	27,389	1,667	0	1,667
2020	9,317	30,289	16.4 % below 1990	Baseline	6,845	30,289	2,472	0	2,472
2025	9,412	32,856	16.4 % below 1990	2020 level	6,845	27,389	2,567	2,567	5,134
2030	9,520	35,527	26.4 % below 1990	2020 level	6,026	27,389	3,494	5,238	8,732

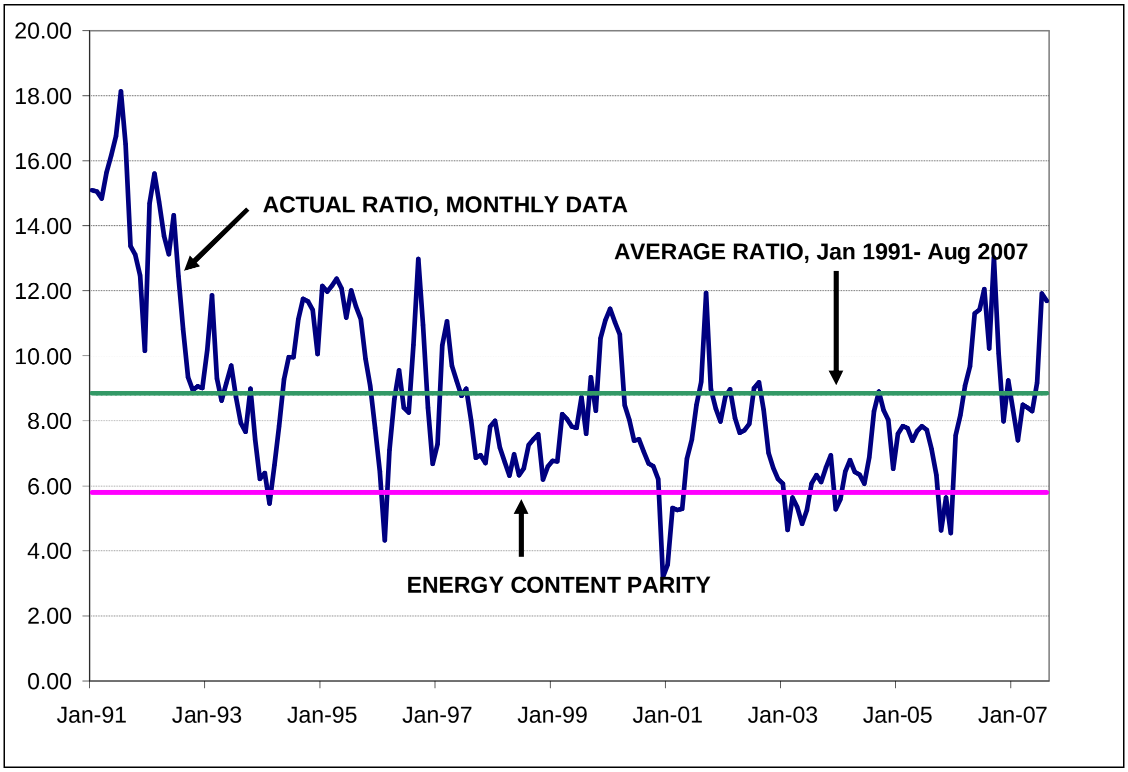
Source: Energy Information Administration, Office of Integrated Analysis and Forecasting.

Per the BIV request, EIA then considered the impact of additional restrictions on global natural gas supply (the Beyond Kyoto Plus Natural Gas Cartel Case) using the same basic modeling approach that is applied in EIA assessments of the Organization of Petroleum Exporting Countries (OPEC) operations. The historical experience has been for natural gas prices to be well below parity with oil on an energy-content basis. As illustrated in Figure 3, the average ratio of West Texas Intermediate crude oil prices, in dollars per barrel, to Henry Hub natural gas prices, in dollars per million Btu, from January 1991 through August 2007 is 8.85, more than 50 percent above the energy-content parity level.

An extremely effective cartel conceivably might be able to maintain natural gas prices at the oil-equivalent level; however, it is unlikely to be as successful as an oil cartel due to the geographic distribution and relative abundance of natural gas resources compared to oil. To simulate such a price scenario, a modeling case was developed that, in addition to the generation technology restrictions in the RefNB+noCCS case, held LNG imports to their reference case level. This RefNBLNG+noCCS case results in average real Henry Hub prices over $7.50 per million Btu, prices that are close to real long-term reference case oil prices on an energy-equivalent basis.

[7] The 16.4-percent abatement commitment for Group 1 countries shown in Table 2 is the weighted average of a 20-percent commitment for the European Union (EU) and lesser commitments for non-EU countries in Group 1.

Figure 3. Ratio of West Texas Intermediate Crude Oil Price to Henry Hub Natural Gas Price, January 1991 – August 2007



Source: EIA, *Short-term Energy Outlook* Query System, accessed October 2007.

In summary, the additional modeling cases discussed in this section show that restricting the use of multiple low- or no-emission electricity generation technologies increases the use of natural gas for power generation and raises natural gas prices, electricity prices, and CO_2 permit prices. For example, in the alternative cases examined, natural gas use in 2030 is between 2.9 (12 percent) and 5.2 trillion cubic feet (22 percent) higher than in the S. 280 Core Case from our earlier analysis. The higher natural gas use in the alternative cases in this analysis leads to 10-to-23-percent higher natural gas prices and 11-to-29-percent higher CO_2 permit prices in 2030 than were projected in the S. 280 Core Case. Electricity prices in 2030, which reflect the combined effect of higher natural gas prices, higher CO_2 permit prices, and a larger share of relatively high-cost natural-gas-fired power in the overall generation mix, are between 13 to 19 percent higher than in the S. 280 Core Case. At the high end of this range, the additional 1.8-cent-per-kilowatthour increase in the projected electricity price represents a doubling of the modeled electricity price impact in the S. 280 Core Case.

3. Time, scope, and credibility of EIA modeling activity

The BIV request stresses policymakers' need for a breakdown of regional and State effects as part of EIA's analytical results and an analysis time horizon that extends to 2050. EIA's current model can provide some regional results; for example, electricity supply and demand results are currently presented for 13 distinct regions. Many other variables are available for the 9 Census regions. EIA is also actively seeking to extend its regional capabilities. For example, we are adding a regional representation of transportation fuel markets to better reflect regional market and policy factors that increasingly arise in this area. However, the ability to provide regional and State information is constrained by data limitations and the need to assure the tractability and credibility of the model, another concern raised in the BIV request.

Where regional results are available, EIA's analysis reports must also reconcile the twin virtues of conciseness and completeness, which often conflict. For example, the S. 280 analysis report included regional electricity price impacts. EIA has also responded to multiple inquiries regarding regional electricity generation impacts in its June 2007 analysis of a 15-percent Renewable Portfolio Standard by posting the regional renewable generation results on its web site. Even when regional results are not presented in the body of our service reports, EIA staff can draw upon available regional detail in responding to specific inquiries. The same practice would, of course, continue to apply as additional regional modeling detail is developed over time.

The BIV request also asks that EIA provide modeling results to 2050. Unfortunately, presentation of credible model results to 2050 at the level of detail in EIA's energy model is not currently possible. EIA's model deliberately incorporates a technology-rich representation and reflects the interaction across different energy sectors. As technology futures become more uncertain beyond the 20- to 25-year horizon, extending a technology-rich model beyond 2030 while maintaining credibility represents a major challenge. Energy and economic models with longer time horizons are generally far less detailed than the EIA model. Such models also operate in 5-, 10-, or 15-year increments, while EIA's NEMS provides a year-by-year representation. An annual, technology-rich model is needed for many of the analyses that EIA provides for policymakers, including those analyses involving comparisons of alternative implementation schedules for regulation of conventional pollutants, fuel economy standards, and extensions of energy-related tax provisions. While consideration of the threat of climate change and policies to limit GHG emissions necessarily involves a time scale of decades to a century or more, transition issues in the energy system over the next 20 to 25 years are an important concern in the policy process that is readily addressed using EIA's model.

Finally, although EIA model results are provided through 2030, EIA has designed its policy cases to include terminal conditions intended to reflect the impact of emissions limitations beyond the model horizon. For example, in the S. 280 analysis, it was assumed that affected entities would build up a bank of allowances prior to the sharp reduction in the emissions cap in 2030. They would then draw from this allowance bank in 2030 and beyond while they continued to make investments to reduce their emissions to meet the future caps.

4. EIA's Natural Gas Analysis

The BIV request suggests that EIA's natural gas analysis needs to be reviewed. In fact, natural gas markets are already an area of intense scrutiny, both in the development of annual projections and in the longer-run effort to improve the structure of EIA's energy models.

EIA fully recognizes that its reference case price projections for natural gas and oil in some recent editions of the *Annual Energy Outlook* (*AEO*) differ significantly from realized prices. EIA itself publishes annual comparisons of its past projections and current market data to keep its user community informed.[8] However, EIA also points out in every *AEO* that there is substantial uncertainty in oil and natural gas markets and decision makers should consider the full range of *AEO* cases, of which 30 or more are published, rather than just focusing on the reference case. These cases explore numerous areas of uncertainty, including assumptions about oil and natural gas supplies and the role that LNG might play.

While reference case oil and natural gas prices in recent *AEO*s have not closely reflected actual price outcomes in recent years, EIA is not alone in having failed to project rapid price increases over the past 5 years. Comparisons to other contemporaneous projections, rather than hindsight, provide a more appropriate basis for assessing EIA's work. Each edition of the *AEO* includes a section with comparisons to other organizations' projections and forecasts.

Considine and Clemente's finding in the July 2007 edition of *Public Utilities Fortnightly* that EIA's reference case price projections are "biased" is based on a statistical test that depends entirely upon evaluating a carefully selected group of EIA's annual projections and then focusing only on the first 4 years of each projection.[9] As a comment by Fischbeck and Rode published in the September 2007 edition of *Public Utilities Fortnightly* points out, no statistical "bias" is evident when a more complete set of *AEO* reference case projections is considered, in part because the EIA reference case "overprojected" realized market prices during much of the period immediately preceding that considered by Clemente and Considine. This aspect of the *AEO* experience suggests that understanding past discrepancies, rather than seeking to mechanically compensate for them, is required. EIA reviews all comments concerning our projections and will carefully consider the comments made by Professors Considine and Clemente. EIA does not believe that adjusting each forecast to the new level, perhaps as is done with futures contracts, would be advisable. Several of the issues raised by Considine and Clemente as "potential areas for investigation" are extensively described in the NEMS assumptions report (*Assumptions to the Annual Energy Outlook*) and model documentation. One suggestion made is that projections of natural gas use for generation may not be including the permit costs for sulfur dioxide (SO_2) emissions. EIA, however, considers the least-cost approach the power sector may take for meeting SO_2, nitrogen oxide (NO_x), mercury, and other environmental emission requirements in projecting capital expenditures and annual generation dispatch decisions. This approach is described in the assumptions report and the model documentation.

EIA is certainly not complacent regarding its reference case price assumptions and is continually seeking to improve them. While the validity of our recent reference case projections of natural gas prices will not be known for some time, one possible forward-looking comparison can be made between futures' prices, which are currently available through 2012, and projections for natural gas prices at the Henry Hub in the *AEO2007*. Using futures price data as of September 21, 2007, the average Henry Hub futures price for 2008, expressed in 2005 dollars per million Btu, is within 20 cents of the reference case price projection. For years 2009 through 2012, the difference between reference case prices and New York Mercantile Exchange (NYMEX) futures prices are generally within $1 per million Btu. Notwithstanding the relatively close relationship between current NYMEX futures prices and *AEO2007* Henry Hub prices, we are looking carefully at natural gas prices for the forthcoming

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[8] See http://www.eia.doe.gov/oiaf/analysispaper/retrospective/index.html.

[9] EIA also issues a monthly *Short-Term Energy Outlook* (*STEO*) that provides energy projections over a 1.5-to-2-year horizon. The *STEO*, unlike the *AEO* reference case, is intended as a forecast, and EIA advises all users interested in near-term energy market developments to use the *STEO* forecast rather than the *AEO* projections.

AEO. Both demand and supply factors will influence the reference case price projection in the forthcoming *AEO2008*. If natural gas demand is similar to or higher than the level projected in *AEO2007*, we would expect projected reference case natural gas prices to be somewhat higher than those in the current edition.

Appendix A

Analysis Request Letter

United States Senate

WASHINGTON, DC 20510

September 18, 2007

The Honorable Guy Caruso
Administrator
Energy Information Administration
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585

Dear Mr. Caruso:

As Congress considers policies to address global climate change, the need for robust, objective, and well-grounded technical analysis of the impacts those policies will have on the American economy is imperative. We applaud the Energy Information Administration (EIA) for providing credible historical analyses over the years. However, we are concerned that, in its current forecasts, EIA is not considering realistic scenarios of our nation's energy future, and as a result, is not providing an accurate picture of the potential consequences arising from mandatory greenhouse gas emission controls.

As you are well aware, concern about climate change has reinforced opposition in some quarters against certain types of energy production. This seems to be especially true of coal, as the prospects for building new coal-fired power plants look increasingly dire.

The same seems to be true of natural gas, particularly whether producers will have access to domestic supplies. Moreover, opposition to construction of new liquefied natural gas terminals and expansion of domestic production and pipelines, international greenhouse gas mandates, and geopolitical instability also present serious risks for U.S. natural gas supplies. For example, talks of additional carbon reductions beyond those required by the Kyoto Protocol could severely constrain the global natural gas market, while recent news of a possible natural gas cartel between Russia and Iran greatly complicates an already bleak future for U.S. natural gas imports.

In addition, concern about climate change has sparked a renewed interest in nuclear power as a viable alternative to fossil fuels. Yet despite greater acceptance of this important, emissions-free energy resource, nuclear power still faces a host of obstacles and uncertainties that, if unresolved, could inhibit its expansion and prevent the construction of new plants.

These issues raise serious questions as to whether and how this country will meet growing energy demand while complying with constraints on carbon emissions. As such, we are requesting that your agency reanalyze S. 280, "The Climate Stewardship and

Innovation Act of 2007," by taking these realities into account. Moreover, we are requesting that your agency factor these realities into *all future analyses of mandatory climate change legislation you undertake.*

More specifically, your reanalysis of S. 280 and all future analyses of climate legislation must include an assessment of the factors outlined in the three following scenarios:

An Alternative Policy Case assuming:

- Nuclear power does not exceed AEO 2007 Reference Case growth through 2030 (increase of 12.5 GWe);
- Biomass power does not exceed AEO 2007 Reference Case growth through 2030 (increase of 64 Billion kWhrs).

Please refer to this alternative policy case as: Reference Nuclear and Biomass Power.

An Alternative Policy Case assuming the Reference Nuclear and Biomass Power case above and assuming:

- Carbon capture and sequestration technology does not become commercially available until 2030;

Please refer to this alternative policy analysis as: Constrained CCS.

An Alternative Policy Case assuming all of the above (Reference Nuclear and Biomass Power and Constrained CCS) and assuming:

- That GHG caps are implemented for all Kyoto Protocol Annex 1 signatory countries and are reduced to 20% below 1990 levels in 2020 and to 80% below 1990 levels in 2050; and
- A functioning natural gas cartel, using the same basic modeling approach used in your assessments of the Organization of the Petroleum Exporting Countries (OPEC) operations.

Please refer to this alternative policy analysis as: Beyond Kyoto Plus Natural Gas Cartel.

In addition, since the costs of greenhouse gas controls grow over time, EIA's inability to accurately account for the impacts between 2030 and 2050 is a serious analytical shortcoming. The use of discounting further disguises the real impact because of the escalating impacts. Therefore, in your reanalysis of S. 280 and all future analyses, please identify detailed economic impacts beyond 2030, specifying the model you use.

Another important piece missing from your analysis is impacts at the local and regional level. In all of the cases you analyze, EIA should provide natural gas data and electricity data at the regional and local distribution level.

AEO 2008 Analysis

Finally, EIA's natural gas analysis needs to be reviewed. An article in the July 2007 *Public Utilities Fortnightly* ("Betting on Bad Numbers - Why predictions from the Energy Information Administration may contain systematic errors") outlined a devastating critique of the EIA NEMS model and its ability to predict the behavior of domestic natural gas markets. It is imperative that EIA assure that its models be continuously evaluated against data. The conditions in the natural gas markets (domestic supply, imports, prices) since 2001(AEO2002) have changed substantially, and EIA's model must be updated to reflect these changes. Therefore, we are requesting a reevaluation of the NEMS model so EIA can provide a more accurate forecast of natural gas markets in its upcoming AEO2008 report. Information related to this request should be provided when you release preliminary results in December.

Additionally, in your AEO 2008 assumptions for a natural gas side case you should assume the Alaska natural gas pipeline is delayed until 2025 (Low Supply Case) and that no new construction of liquefied natural gas terminals in the U.S. beyond those have permits and are scheduled to become operational in 2008 (Low LNG Case).

An expedited process would be greatly appreciated as a credible analysis is critical to a well-informed debate concerning climate change and related energy policy choices now before Congress. Either Todd Johnston (202-224-9325), or John Shanahan (202-224-8072), is available to work with you to clarify any issues. Thank you for your attention to this.

Sincerely,

James M. Inhofe
United States Senator

George V. Voinovich
United States Senator

John Barrasso
United States Senator