Testimony of

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before the

Committee on Energy and Natural Resources

United States Senate

May 20, 2008

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 analysis of the energy and economic impacts of global climate change legislation.

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. Although 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 focuses on EIA's recent analysis of the Lieberman-Warner Climate Security Act of 2007 (S. 2191), which also includes an updated analysis of the Bingaman-Specter Low Carbon Economy Act of 2007 (S. 1766).

The choice of a baseline is one of the most influential assumptions for any analysis of global climate change legislation. Our analysis uses the reference case of the *Annual Energy Outlook 2008* (*AEO2008*) as its starting point. *AEO2008* is based on Federal and State laws and regulations in effect as of the end of 2007, including the Energy Independence and Security Act of 2007, which became law last December. It does not, however, include State-level greenhouse gas limitation initiatives that are in various stages of development in several regions of the country. The projections included in *AEO2008* and our analysis, which both extend through 2030, are not meant to be exact predictions of the future but represent plausible energy futures given technological and demographic trends, current laws and regulations, and consumer behavior as derived from available data. EIA recognizes that projections of energy markets over

a nearly 25-year period are highly uncertain and subject to many events that cannot be foreseen, such as supply disruptions, policy changes, 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. Generally, differences between cases, which are the focus of our report, are likely to be more robust than the specific projections for any one case.

The Lieberman-Warner bill imposes limits on emissions of energy-related carbon dioxide and other greenhouse gases with a cap-and-trade system that regulates suppliers of oil products and natural gas, owners of plants that burn coal, and suppliers of some industrial gases other than carbon dioxide. EIA's complete report, which includes a full description of the bill, our modeling approach, and our results, as well as a discussion of uncertainties and caveats, has been provided to the Committee and is publicly available on our web site (www.eia.doe.gov).

The projected impacts on energy prices, energy use, and economic activity that are presented in the report and summarized briefly in my testimony suggest several key findings and additional insights. It is important to note that the estimated impacts of the Lieberman-Warner proposal on energy prices, energy use, and the economy are highly sensitive to assumptions about the cost and availability of no- and low-carbon technologies for power generation and international offsets. EIA's report includes five cases that reflect a variety of different assumptions regarding these factors, with the Core Case and Limited Alternatives/No International Offsets Case representing, respectively, the most favorable and least favorable situations for ease of compliance with the Lieberman-Warner targets. We find that allowance prices and economic

impacts through 2030 are roughly three times larger using the least favorable assumptions than using the most favorable ones.

It is well-known that key technologies for reducing emissions, such as nuclear power and coal with carbon capture and sequestration (CCS), face a variety of technical challenges and, in some cases, additional questions regarding public acceptance of their widespread deployment arising from concerns unrelated to global climate change. As noted in EIA's report, both technical and public acceptance barriers to key low- and no-emissions technologies can be directly influenced by policy design choices. For example, both the Lieberman-Warner and Bingaman-Specter bills include incentives for early technology deployment. The "technology accelerator" payment in the Bingaman-Specter bill, which implicitly relaxes emissions targets in the event that a pre-determined compliance cost threshold is exceeded, can help to promote public acceptance of key technologies by stakeholders who view greenhouse gas emissions limitation as the highest priority, but might be inclined to block deployment of these technologies due to non-climate concerns in the absence of such a mechanism.

Our results also suggest that energy and economic impacts are sensitive to whether the recent steep rise in the cost of major energy infrastructure projects reflects a temporary "bubble" or a permanent shift. EIA's analysis generally reflects only a portion of recent infrastructure project cost increases as a permanent shift, with a much larger permanent component assumed in the High Cost Case. Compliance with the Lieberman-Warner emissions targets is expected to result in the rapid retirement of the existing fleet of coal-fired power plants. With a large increase in capacity additions needed to replace these units and also meet rising demand under any of the technology cases, higher costs translate directly into increased energy and economic impacts.

Your invitation letter, Mr. Chairman, asked about the main factors contributing to price uncertainty in analyses. In addition to uncertainty regarding the cost and availability of key no- and low-carbon technologies and international offsets, future energy prices also play an important role in determining the cost and energy price impacts of meeting a fixed emissions target. Policy design is another important factor. For example, the technology accelerator payment provision in the Low Carbon Energy Act of 2007 greatly reduces uncertainty in the cost and energy price impacts of global climate legislation, while adding to uncertainty regarding the amount of emissions reduction achieved in any given year.

Let me now turn briefly to the specific results of EIA's recent analysis.

Allowance and Energy Price Impacts

Figure 1 shows that allowance prices, which are the key driver of energy price impacts, vary widely under the Lieberman-Warner cap-and-trade program, depending on assumptions regarding the availability and cost of electricity technologies such as nuclear and coal with CCS, as well as the availability of international offsets.

As shown in the top left-hand panel of **Figure 2**, the effect of the program on the cost of using coal is particularly significant; by 2030, it is between 4 and 8 times higher under Lieberman-Warner than in the reference case. This reflects both the low baseline price of coal on an energy content basis relative to other fossil fuels and its relatively high carbon content per unit of energy. The delivered price of natural gas, shown on the lower left-hand panel of Figure 2, is

also significantly affected, increasing by between 34 and 107 percent above the reference case projection by 2030. In cases where the demand for natural gas is increased as a result of the policy proposed in S. 2191, delivered and wellhead prices both move in the same upward direction. As shown in the top right-hand panel, the price of motor gasoline is also affected, but to a much lesser extent than coal or natural gas prices. In fact, the gasoline price changes anticipated to result from this program through 2030 are smaller than the changes experienced over the past several years.

Electricity is generated using a mix of fuels. Currently, about 50 percent of the Nation's electricity is generated using coal, and coal would be a highly competitive source of additional generation to meet demand growth absent any limits on carbon dioxide emissions. The impact of allowance prices on the cost of using fossil fuels to generate power is reflected in higher electricity prices, but the impact is cushioned by changes in the projected electric generation mix that occur in response to S.2191. As shown in **Figure 3**, national average electricity prices in 2030 are between 1.0 cents to 5.7 cents per kilowatt-hour (11 percent to 64 percent) higher, relative to the reference case. Electricity price impacts vary by region. In general, larger price impacts occur in those regions that are most reliant on coal and have competitive wholesale power markets.

Energy System Impacts

As shown in **Figure 4**, between 82 percent and 91 percent of reductions in energy-related carbon dioxide emissions in 2030 are achieved through the electricity-related reductions, requiring a rapid expansion of low- and no-carbon generation. There are several reasons for this. First,

over 90 percent of coal, the fuel whose price is most heavily impacted by allowance costs, is used in the electricity sector. Second, while coal-fired generation is a major source of current and projected reference case emissions, there are several alternative no- and low-emission technologies already demonstrated, and others are being developed. Third, changes in electricity generation fuels do not require large changes in distribution infrastructure or electricity-using equipment. Thus, the "chicken-and-egg" issues that bedevil major fuel transformations in the transportation sector, where the absence of a robust fuel supply infrastructure--that is precluded by the lack of a sufficient number of dedicated alternative-fueled vehicles to be served--in turn discourages the sale of such vehicles, do not arise. Finally, recent U.S. experience and very high fuel prices over an extended period in Europe and other world regions show that major shifts in transportation energy use are not likely to be induced by the impact of the Lieberman-Warner cap-and-trade program on the price of petroleum fuels.

In addition to changing the projected mix of electricity generation sources, as shown in **Figure 5**, the Lieberman-Warner program significantly increases the total amount of new electric capacity that must be added between now and 2030. The requirement for capacity additions, which poses significant challenges to siting both generation and transmission facilities, reflects the retirement of many existing coal-fired power plants that would be expected to continue operating beyond 2030 absent the limitations on greenhouse gas emissions required by the Lieberman-Warner bill. Over the 2007-to-2030 period, projected electricity generating capacity additions other than natural gas range from 353 to 484 gigawatts (GW) across the five Lieberman-Warner policy cases, as compared to 168 GW in the *AEO2008* reference case. By way of comparison, generating capacity additions other than natural gas have totaled only 55 GW since 1990.

Economic Impacts

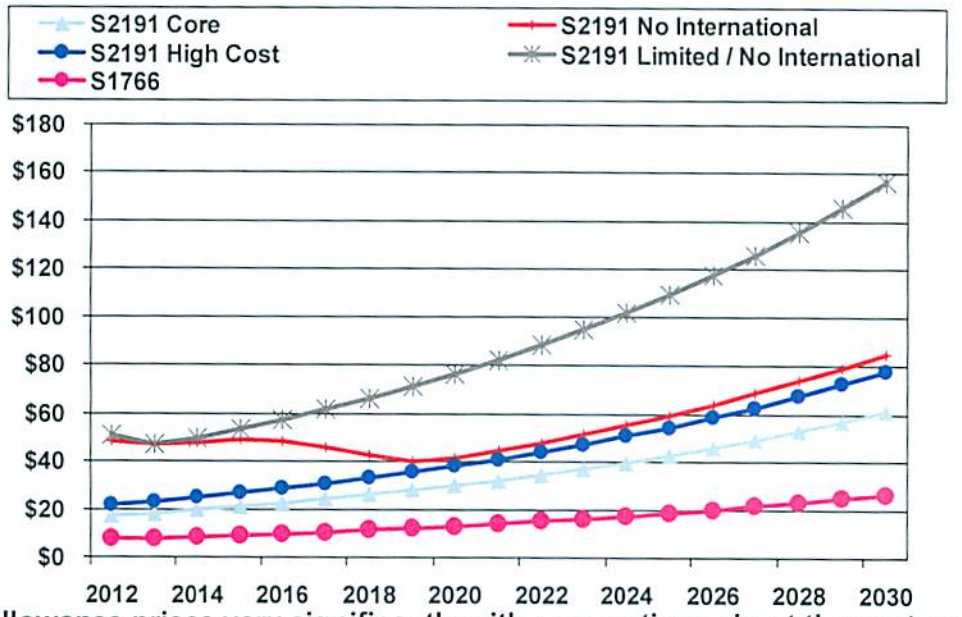
The left-hand panels of **Figure 6** compare the cumulative reductions in gross domestic product (GDP) and consumption over the 2009-through-2030 period across cases. In the Core Case, which has the most optimistic assumptions regarding technology cost and availability and international offsets, the cumulative discounted reductions in GDP and consumption were $444 billion and $558 billion, respectively. In the Limited Alternative/No International Offsets Case, cumulative discounted losses in GDP and consumption are substantially higher, $1.31 trillion and $1.42 trillion, respectively. The reduction in GDP from reference-case levels is between 0.3 percent and 0.9 percent in 2020 and between 0.3 percent and 0.8 percent in 2030. The reduction in real consumption is between 0.4 percent and 1.2 percent in 2020 and between 0.5 percent and 1.1 percent in 2030. Manufacturing impacts, which are not illustrated in the figure, are significantly higher than GDP impacts. Total manufacturing output is 1.5 percent to 5.4 percent lower than in the reference case in 2020 and 3.0 percent to 9.5 percent lower in 2030.

While the greenhouse gas issue is a problem of unprecedented scale in terms of its implications for our energy system, the scale of the economy itself is huge. Therefore, the same estimated economic impacts from any given analysis can be "framed" to sound either large or small. **Figure 6**, which in its right hand panels presents the same results discussed above in terms of the absolute levels of GDP and consumption in 2020 and 2030, shows how framing matters. At EIA, we strive to present our results as neutrally as possible and leave the framing to others.

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

Figure 1: Projected Allowance Prices

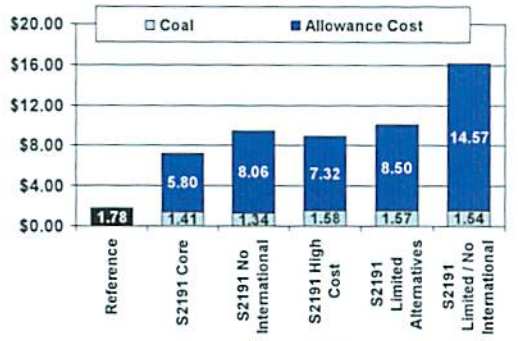
(2006 dollars per metric ton carbon dioxide equivalent)



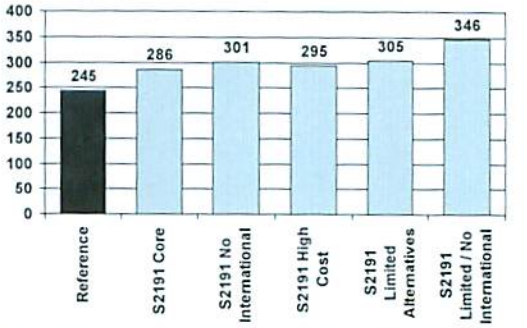
Allowance prices vary significantly with assumptions about the cost and availability of low-carbon generating technologies and offsets

Figure 2: Delivered Energy Prices in 2030

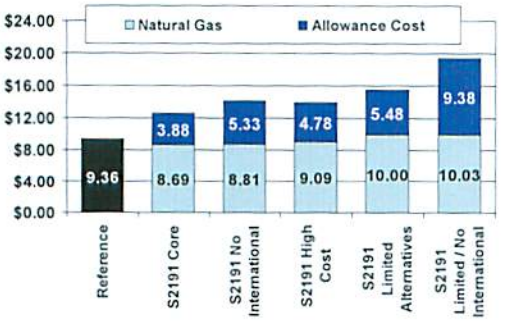
Coal (2006 $ per million Btu)



Motor Gasoline at the Pump (2006 cents/gallon)

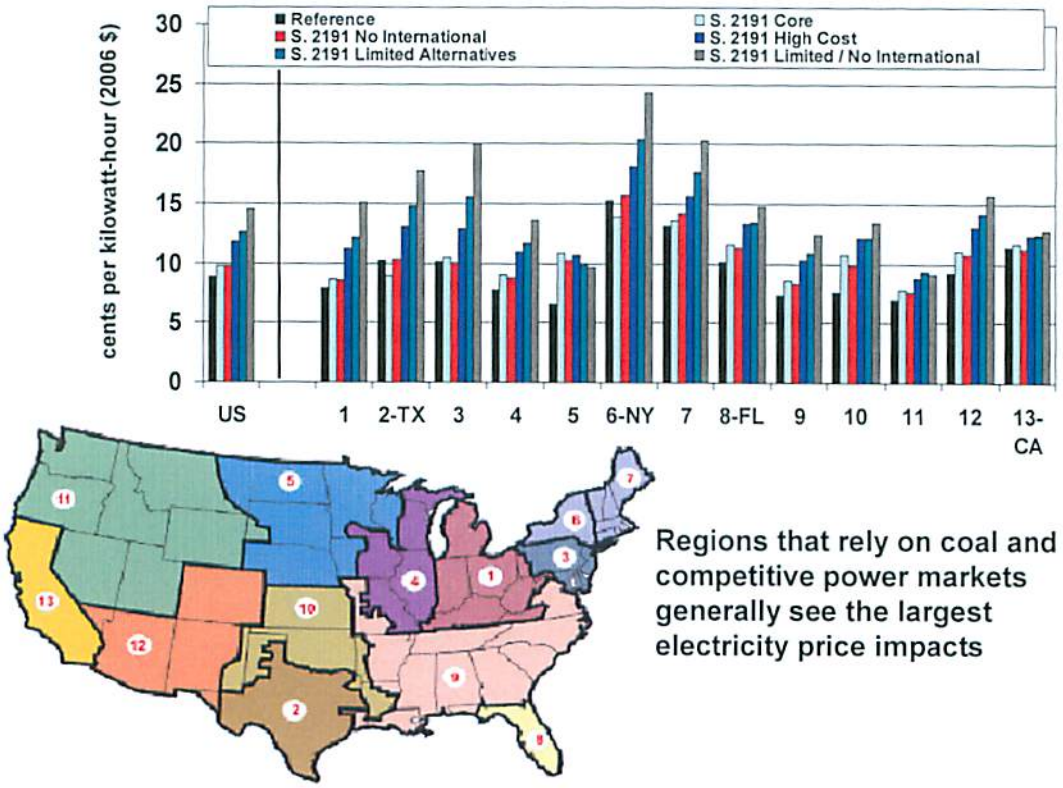


Natural Gas (2006$ per million Btu)



- Among the S. 2191 cases, the delivered price of coal in 2030 in 2006 dollars, including allowances, increases dramatically, with increase ranging from 405 percent to 804 percent.
- The delivered price of natural gas in 2030 in 2006 dollars, including allowances, also increases, with increase ranging from 34 percent to 107 percent.
- The increase in the retail price of gasoline in 2030 in the S. 2191 cases varies from 41 cents per gallon to 101 cents per gallon (17 percent to 41 percent).

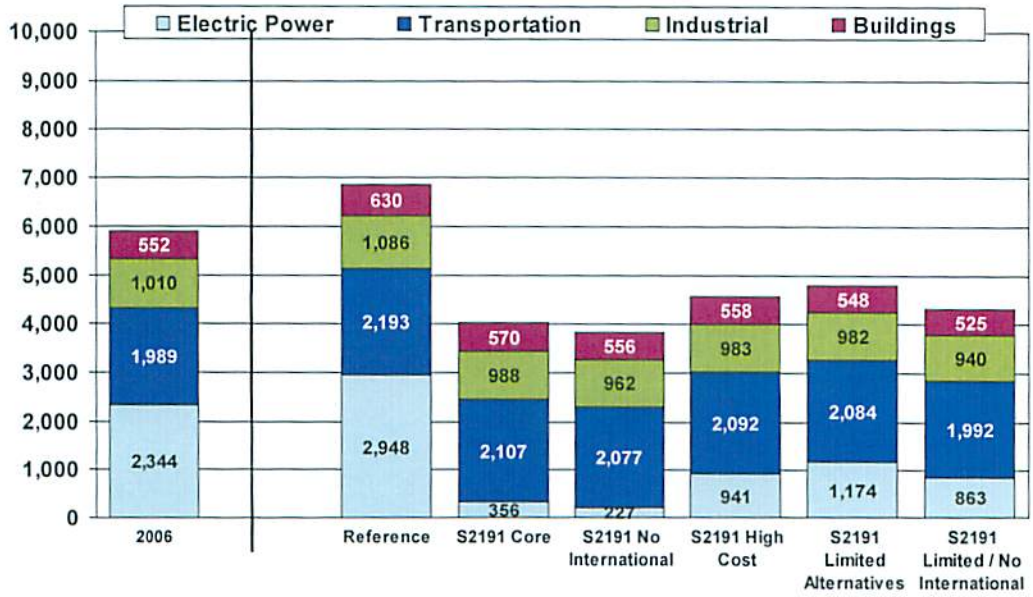
Figure 3: 2030 National and Regional Electricity Price Impacts



Regions that rely on coal and competitive power markets generally see the largest electricity price impacts

Figure 4: 2030 Energy-Related CO_2 Emissions

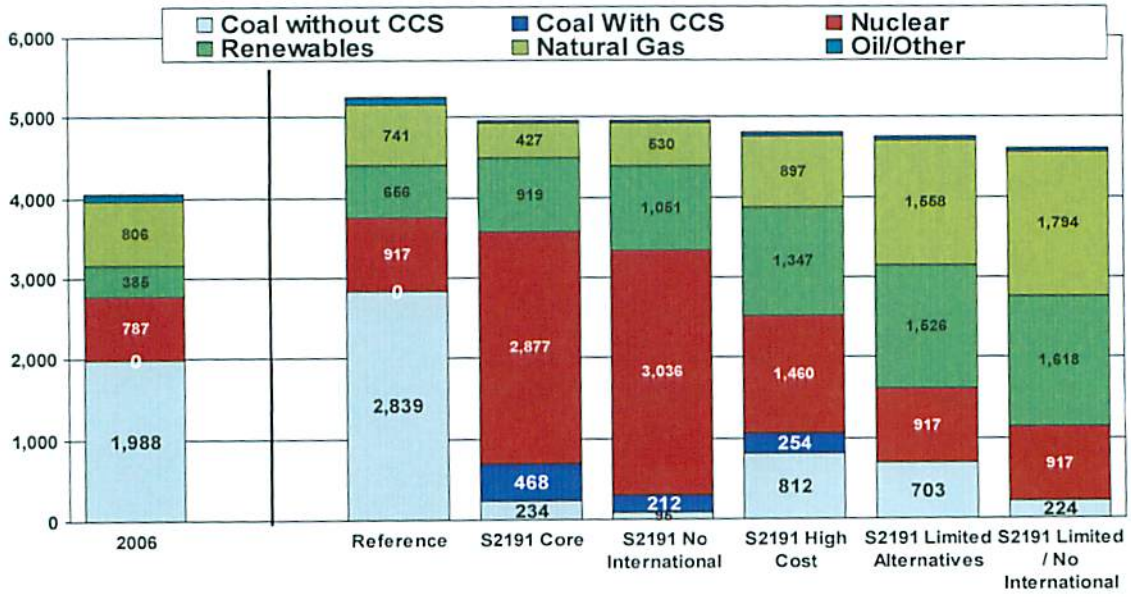
(million metric tons)



- The electric power sector dominates energy-related CO_2 emission reductions in all S.2191 cases.
- Other sectors play a relatively small role, except in cases with the highest allowance prices.

Figure 5: 2030 Electricity Generation by Fuel

(billion kilowatthours)



- Coal generation declines significantly in all cases, while nuclear, renewables, and coal with CCS grows.
- Natural gas generation more than doubles if nuclear, renewables and coal with CCS are limited.

Figure 6: Real GDP And Consumption