



## ENVIRONMENTAL DEFENSE FUND

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### Critique of CRA analysis of the impacts of S.2191 on the U.S. economy

Environmental Defense Fund, March 2008

#### Summary

This critique has been updated and expanded to include the recently released assessment of the Lieberman-Warner bill (S.2191) by MIT and the 2050 results for the key economic indicators.

Current legislation proposed by Senators Lieberman and Warner (“America’s Climate Security Act of 2007,” S. 2191) would create a cap-and-trade program to cut greenhouse gas emissions in the United States. A pair of recent analyses by the for-profit consulting firm Charles River Associates International (CRA) presents an alarming view of the economic impacts of such a policy [1, 2, 3]. In this brief paper, we assess CRA’s analysis and reach the following conclusions:

- CRA’s results are a dramatic outlier when compared to a range of economic models maintained by researchers in academia and government. For example, CRA’s estimates for the impact of the bill in 2015 on greenhouse gas emission allowance prices, GDP figures and electricity prices are 75% – 300% higher than those found by researchers at Duke University and Research Triangle Institute. And, CRA’s GDP forecasts are 318% – 419% and 276% – 632% higher in 2015 and 2050, respectively, than those found by all the other models that have assessed the economic impacts of S.2191 to date.
- CRA has a history of presenting extreme views. For example, CRA’s analysis in 2003 of the McCain-Lieberman bill projected household-level costs that were three to four times higher than the upper range of results presented by an MIT study, and 10 to 14 times higher than MIT’s lower range.
- Determining exactly why CRA’s numbers are so high is difficult because the CRA model (despite the release of some technical information in response to Senate requests) remains essentially a “black box.” One reason, however, appears to be that CRA ignores the role of international credits, which under the Lieberman-Warner bill could meet up to 15% of compliance obligations. In addition, their analysis assumes high costs for new coal-fired power plants with carbon capture and sequestration technology.
- Like most “computable general equilibrium” models, CRA’s analysis considers only one side of the ledger: it considers the costs of reducing emissions, but fails to consider the costs of inaction.

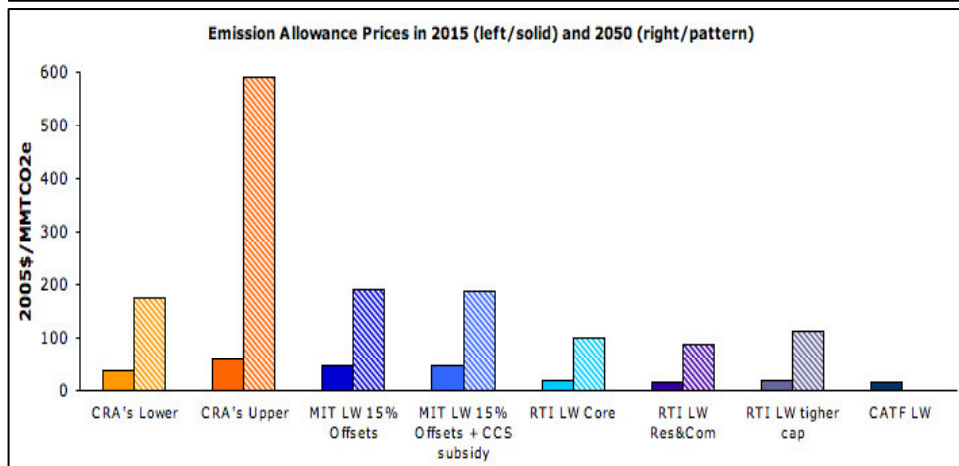
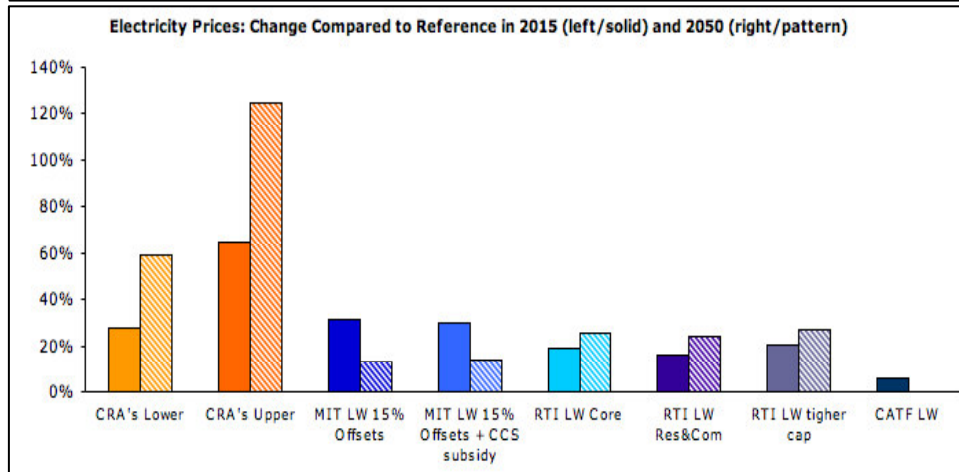
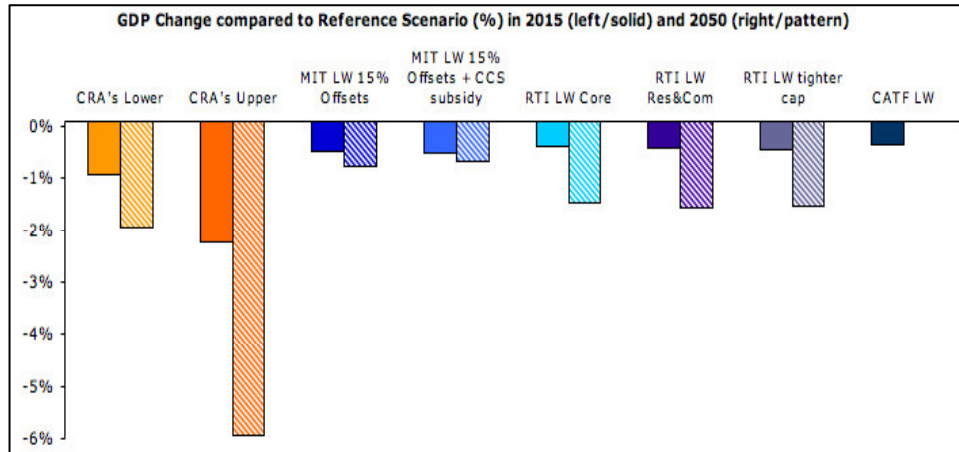
Our analysis is based on testimony by CRA Vice President Anne Smith before the Senate Environment and Public Works Committee in November 2007, documentation supporting that testimony, and CRA’s recent update to their analysis, prepared for the Edison Electric Institute. We compare CRA’s analysis to analyses using economic models maintained by researchers at MIT, Research Triangle Institute (RTI), and the U.S. Department of Energy. (References are presented in brackets and listed at the end of this paper.)

**CRA’s analysis is a distinct outlier when compared to widely respected models of the impacts of climate policy on the U.S. economy.** CRA’s estimates for the economic costs of climate policy are consistently higher than other models. This has been true for past legislation, and remains true in their analysis of S.2191.

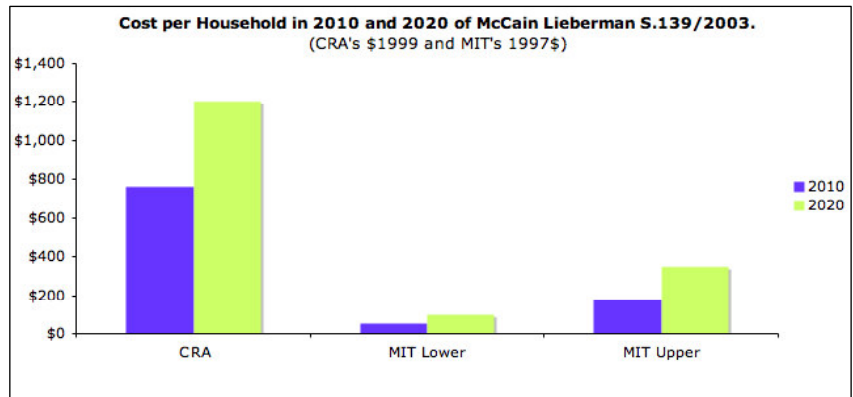
The charts on the next page show the divergence for the most politically salient numbers: forecasts of the impacts of climate policy in the year 2015 on U.S. economic output (GDP), the price of greenhouse gas allowances, and residential electricity rates. The bars on the left of each chart show CRA’s higher and lower estimates, along with forecasts from three other analyses of the Lieberman-Warner bill: a report by MIT [4], a report by Duke University’s Nicholas Institute using an economic model maintained by RTI [5], and an analysis commissioned by the Clean Air Task Force using the government’s own “in-house” economic model maintained by the U.S. Energy Information Administration [6]. (The numbers for CRA represent a composite of the projections in Smith’s EPW testimony and the update prepared for EEI.)

The bottom line is this: No economic model is a crystal ball, and any given economic projection should be taken with a grain of salt. This maxim applies to CRA, but also to any other model. What sets CRA apart is that its results are always at one end of the spectrum.

- As the charts show, in every case CRA’s upper bound is substantially higher than the next largest estimate. This is almost always the case with CRA’s lower bound too. In particular, CRA’s estimates for the impact of the L-W bill in 2015 on GDP, allowance prices, and electricity prices are 75% to 300% higher than Duke/RTI’s estimates.
- CRA’s GDP forecasts in their update for Edison Electric Institute are 318% – 419% and 276% – 632% higher in 2015 and 2050, respectively, than those found by the rest of the models that have assessed the economic impact of S.2191 to date.



CRA's position at an extreme end of the spectrum, with numbers far larger than those of other analyses, is not a fluke. The same pattern can be observed in CRA's analysis of the original McCain-Lieberman legislation in 2003, as the chart at right shows. In that case, CRA's numbers were three to four times greater than MIT's upper bound, and 10 to 14 times larger than MIT's lower bound.



**CRA's analysis appears to systematically exaggerate the costs of mitigation along a number of dimensions.** In particular, CRA downplays the effects of broader coverage and lower energy demand, ignores the role for international credits, and overstates the potential price volatility that could result from the legislation.

- In its updated analysis of the Lieberman-Warner legislation, CRA assumes that no emission credits from international sources are used for compliance. (The legislation itself allows for up to 15% of compliance obligation to be met by such international credits.) By ignoring this potential source of credits, CRA's analysis drives up the estimated costs of the policy. A similar assumption is made by MIT in their assessment of the Lieberman-Warner bill. As a consequence, the emission allowance prices in the near term are similar to those estimated by CRA and are much higher than those from models that consider international credits as a cost-containment. However, such extraordinarily high emission allowance prices have a moderate impact on MIT's GDP and electricity projections. Furthermore, CRA's emission allowance prices in 2050 are 211% higher than those of MIT.
- CRA's assumptions about the capital costs of coal-fired electricity generation with carbon capture and generation are significantly higher than other published estimates. CRA's estimates range from just over \$3100 per kW of installed capacity to nearly \$4400/kW. In contrast, the Energy Information Administration pegs the capital cost at \$2134/kW [7]. The Intergovernmental Panel on Climate Change, in a survey of the literature, reported a range of \$1414-\$2270/kW [8]. Thus, the CRA estimates are roughly twice as much as those of the IPCC, and 50-100% higher than those of the EIA.
- CRA's updated analysis reflects the inclusion of natural gas upstream (i.e., the residential and commercial use of natural gas under the cap). In CRA's analysis, this extension of coverage increases allowance prices significantly, especially in the long term. In contrast, the analysis of the Lieberman-Warner bill by the Nicholas Institute at Duke University concludes that broadening the cap to include natural gas would lower the allowance prices. This latter result—that a more comprehensive cap will result in lower allowance prices—is in line with standard economic theory. The greater the coverage of a cap-and-trade system is, the more opportunities there are to reduce emissions, and hence the marginal cost of abatement is lower—which is what ultimately drives the price of an allowance.
- CRA's model ignores the effect of decreased demand on world energy prices. A cap on carbon emissions will reduce demand for fossil fuels, resulting in lower energy prices for producers and helping to offset the rise in energy prices to end users. This effect is clearly exhibited in MIT's analysis, which—unlike CRA's model—incorporates demand and supply responses in world energy markets.
- CRA makes arbitrary assumptions about the role of banking that are inconsistent with the legislation and with economic theory. In half of its scenarios, CRA simply assumes that firms will not bank their allowances, despite strong economic incentives to do so. This inflates the long-run cost of emissions reductions since it takes away a key tool that firms will be able to use to smooth their costs over time.

- CRA also overstates the prospects for price volatility. In her testimony, Smith implied that the price volatility observed in the European Union's Emissions Trading Scheme (ETS) could happen under the Lieberman-Warner bill. This is an apples-to-oranges comparison. Phase I of the EU ETS was explicitly designed as a training period before the binding commitments under the Kyoto Protocol took effect in 2008. The most dramatic price volatility in that system was clearly due to an over-allocation of allowances by individual countries in the EU. Moreover, allowances in the first phase, which lasted three years, could not be banked for later periods—a design problem that guaranteed prices had to fall to zero as the end of the program approached. In contrast, the Lieberman-Warner bill offers a long-term horizon, along with banking and borrowing—all of which will help to dampen price volatility.

**CRA's model does not appear to have been peer-reviewed.** Following standard academic practice, most economic models, including MIT's EPPA model, have been widely analyzed, opened up to criticism and assessment, and rigorously peer-reviewed. However, we cannot find any peer-reviewed journal article drawing on CRA's MRN-NEEM model. This is important because academic peer review is the best assurance of transparency and sound scientific method. CRA is widely perceived—even by other modelers—as a “hired gun” answerable to their clients in industry and the electricity sector.

**CRA's analysis does not address the costs of inaction.** Like most computable general equilibrium models, CRA's model looks at only one side of the ledger: the costs of reducing emissions, but not the damages from letting those emissions continue unchecked. CRA's analysis does not consider the costs of the multitude of consequences scientists warn will result from a warming climate, including rising sea levels; increased drought and disruption of hydrogeological cycles; more severe tropical storms; more frequent wildfires; and widespread species loss, including the coral reefs upon which our fisheries depend.

## References

1. Testimony to the Senate Environment and Public Works Committee by Anne E. Smith, representing CRA International, at the Legislative Hearing on America's Climate Security Act of 2007 (S.2191), November 8, 2007.
2. Documentation of scenarios used in Anne Smith's testimony, in response to a request by Senator Lieberman, December 3, 2007.
3. W. David Montgomery, Anne E. Smith, Sugandha D. Tuladhar, and Mei Yuan, “Economic Modeling of the Lieberman Warner Bill: S. 2191 as reported by Senate EPW,” presentation by CRA International to the Edison Electric Institute, January 31, 2008.
4. Sergey Paltsev, John M. Reilly, Henry D. Jacoby, Angelo C. Gurgel, Gilbert E. Metcalf, Andrei P. Sokolov, and Jennifer F. Holak, “Assessment of U.S. Cap-and-Trade Proposals,” MIT Joint Program on the Science and Policy of Global Change Report No. 146 (April 2007) including appendix D (February 2008).
5. Brian C. Murray and Martin T. Ross, “The Lieberman-Warner America's Climate Security Act: A Preliminary Assessment of Potential Economic Impacts,” Nicholas Institute Policy Brief 07-04 (October 2007).
6. Memorandum from OnLocation Energy Systems Consulting to Clean Air Task Force re: Warner-Lieberman Bill NEMS Modeling Analysis, October 23, 2007; and supporting data from model runs made available by Joe Chaisson, CATF.
7. Energy Information Administration, “Assumptions to the Annual Energy Outlook 2007: Electricity Market Module,” Report # DOE/EIA-0554 (April 2007), pp. 75-91. Table 39 (p. 77) presents capital cost estimates for new IGCC with carbon sequestration.
8. Howard Herzog and Ken Smekens, “Cost and economic potential,” in Bert Metz, Ogunlade Davidson, Heleen de Coninck, Manuela Loos, and Leo Meyer, eds., *IPCC Special Report on Carbon Dioxide Capture and Storage* (Cambridge, UK: Cambridge University Press, 2005), pp. 339-362. Table 8.1 (p. 343) presents capital cost estimates for new integrated gasification combined-cycle power plants with carbon capture. Note that transport and storage costs are not included; but at roughly \$5/tCO<sub>2</sub> these are much smaller than the difference between the IPCC estimates and CRA's cost estimates.