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Briefing Memo: Study of Climate Legislation Studies
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As legislative activity around a federal climate and energy bill moves to the fore, so do the public relations activities of those who support and oppose such legislation. We are aware of more than a dozen studies or fact sheets on the economic impacts of carbon cap legislation. These studies offer wildly differing outcomes: "Over 2 million jobs will be lost!" and "Over 1.7 Million jobs will be gained!" Some claim the impact on the household budget may top an annual cost of $3000; others claim household income will be boosted by the measure.

The attached grid outlines several of the best-known studies fueling debate this year. Most analyze either the Waxman-Markey proposal or the actual legislation that passed the U.S. House, H.R. 2454, the American Clean Energy and Security Act of 2009. Several studies that figured prominently in the early stages of discussion actually analyzed last year's climate bill, the Lieberman-Warner proposal that became S.B. 2191 of 2008, and they are included in the grid because the claims still reverberate in the halls of Congress, in kitchen table discussions and in hometown newspaper editorials.

Contrary to the sound and fury, there are more similarities than differences among the outcomes of these studies. Most studies rely on econometric modeling. Most use the projections of the U.S. Department of Energy's statistics division, the Energy Information Administration, as a base. The most commonly used forecast is the so-called "early release" or April 2009 Annual Energy Outlook (AEO). This simply has to do with the timing of the legislation and the studies themselves. The base forecast in the AEO 2009 projections called for moderate economic growth of the United States economy, between about 2.4 percent and 2.6 percent, annually, yielding an expansion of between 70 and 80% by 2030. The impact of the pricing of carbon is uniformly modest, representing an opportunity cost of .1% to 3.4% of total GDP in the years commonly analyzed (2020, 2030 and 2050.)

Differences among the studies may be attributed in part to legitimate differences in perspectives (assumptions) about how the incentives and price impacts of the legislation will reverberate throughout the economy. For example, some predict many nuclear power plants will be built and others, few. The estimated market price of the emission allowances themselves is a major determining factor of impact, and the models project different costs based on a series of assumptions. Whether relatively inexpensive carbon offsets are used or not, particularly on an international basis, are significant factors in whether impacts are light or heavy. These differences are substantive and reflect important concerns of different authors.

Table 1, taken from the EPA's analysis of the impact of H.R. 2454, the American Clean Energy and Security Act of 2009, highlights the range of important differences in economists' assumptions about the proposal:

Table 1: Assumptions of different models analyzing cap & trade:

• Different Models, Different Baselines and Assumptions

	EPA	MIT	CRA	EPRI	PNNL
Model	ADAGE,IGEM	EPPA	MRN-NEEM	MERGE	MiniCAM
Baseline	AEO 2008 Early Release*	AEO 2009 Early Release	AEO 2008 Early Release	Own baseline	Own baseline
Nuclear Assumptions	Capacity grows at 150% 2005 levels	Not permitted to expand in the base case (Advanced Nuclear available in 2020)	Capacity limited but growing over time (3 GW in 2015; 100 GW in 2050)	New capacity in 2020: capacity limited but growing over time subject to uranium supply constraints	Soft constraints in 2020; after 2020 allowed to grow unconstrained (Advanced nuclear case)
CCS Assumptions	Available in 2020	Available in 2020	Available in 2015 but with capacity limits	Available in 2020; allowed to triple each decade	Available in 2020

*** AEO 2008 Early release was used by the EPA models for EMF-22. The baseline in EPA's H.R. 2454 analysis is AEO 2009 (March release).**

Source: EPA Analysis of the American Clean Energy and Security Act of 2009, H.R. 2454 in the 111th Congress, 6/23/09 at http://www.epa.gov/climatechange/economics/pdfs/HR2454_Analysis.pdf

The alphabet soup on the chart is acronyms that show up again and again the debates. The first line of Table 1 gives the names of the institutions sponsoring the study.

- 'EPA is the United States Environmental Protection Agency.'
- 'MIT' is the Massachusetts Institute of Technology.
- 'CRA' is CRA International (Charles River Associates), a private consulting firm.
- 'EPRI' is the Electric Power Research Institute
- PNNL is the Pacific Northwest National Laboratory.

The "Models" are acronyms that stand for the names of the econometric model used in the analysis:

- ADAGE stands for Applied Dynamic Analysis of the Global Economy
- IGEM stands for Intertemporal General Equilibrium Model
- EPPA stands for MIT's 'Emissions Prediction and Policy Analysis' model.
- NRM stands for Natural Resource Management model
- NEEM stands for the 'Energy and environmental Model of the NEMISIS system (New Econometric Model for Environmental and Sustainable development and Implementation Strategies); this is a model developed by European consortium and covers EU-15 countries plus Norway and 8 pollutants.

- MERGE stands for a model used by the Electric Power Research Institute and is described as an integrated assessment model for global climate change.
- MiniCAM stands for Mini-Climate Assessment Model of the Joint Global Change Research Institute of the University of Maryland[1]

In Table 1, "AEO" stands for Annual Energy Outlook, which is the forecast provided by the U.S. Department of Energy's statistical division, the Energy Information Administration. This is the source of baseline economic and energy cost data for many studies of climate change.

Finally, 'CCS" in Table 1 stands for 'Carbon Capture and Sequestration.' A critical difference among studies involves how much time and money it may take to adapt our existing, coal-based power infrastructure to clean coal technology.

Table 2: "Opportunity Costs" of Cap and Trade in Analysis of Warner-Lieberman

TABLE 11

Comparison of alternative U.S. GDP growth forecasts under baseline scenario and with cap and trade

Figures are average annual growth rate forecasts for specified time periods

	1) Baseline GDP forecast	2) GDP forecast under Lieberman-Warner cap and trade	3) Difference between baseline and cap-and-trade growth forecasts (columns 1-2)
A) Forecasts based on Lieberman-Warner cap and trade			
MIT (2005 to 2050)	2.94%	2.93%	0.01%
Energy Information Administration (2005 to 2030)	2.47%	2.45%	0.02%
Clean Air Task Force (2005 to 2030)	2.89%	2.86%	0.03%
Environmental Protection Agency (2005 to 2050)	2.78%	2.72%	0.06%
ACCF/NAM—"High Cost Case" (2007 to 2030)	2.56%	2.45%	0.11%
B) Forecasts based on ACESA cap-and-trade			
EPA-1 (ADAGE model—2015–50)	2.41%	2.36%	0.05%
EPA-2 (IGEM model—2015–50)	2.35%	2.30%	0.05%

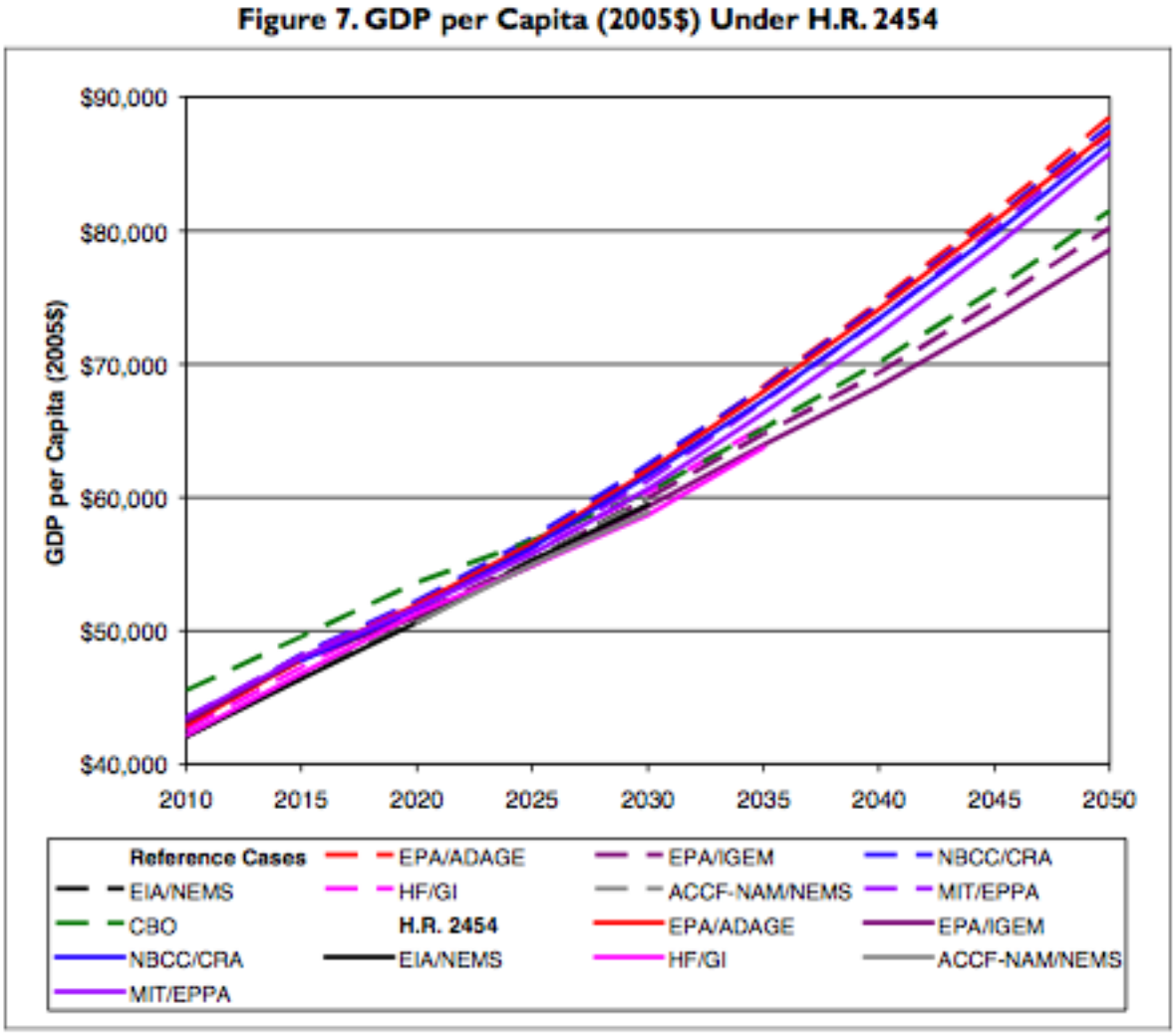
Source: References for models are all at Pew Center on Global Climate Change, "Insights from Modeling Analyses of the Lieberman-Warner Climate Security Act (S. 2191): (May 2008) available at http://www.pewclimate.org/docUploads/L-W-Modeling.pdf; Environmental Protection Agency, *EPA Preliminary Analysis of the Waxman-Markey Discussion Draft*: (April 20, 2009) available at www.epa.gov/climatechange/economics/pdfs/WM-Analysis.pdf.

Differences in the studies may show differences in substantive assumptions. However, the differences in impact are less than could be assumed by the volume of the debate. Table 2, above, taken from a study Political Economy Research Institute of the University of Massachusetts at Amherst[2] standardizes economic impact of proposals for inflation. Projected economic outcomes are similar. However, much of the current debate has to do with how the numbers are presented and how the outcomes are described. This is less substance and more style. Figure 1 and Table 2 on the next pages illustrate the range of impact projected within the context of a growing economy.

[1] The EPA has a good and descriptive page on these various models at http://www.epa.gov/climatechange/economics/modeling.html#minicam. A more technical overview can be found at http://www.google.com/search?client=safari&rls=en&q=EPRI+-+MERGE+econometric+model&ie=UTF-8&oe=UTF-8

[2] Robert Pollin, James Heintz and Heidi Garet-Peltier, The Economic Benefits of Investing in Clean Energy, Political Economy Research Institute, University of Massachusetts at Amherst, June 18, 2009.

Figure 1: Trendline of GDP during Cap and Trade Program, From CRS Assessment of Major Climate Legislation Studies[3]



Sources: EPA/ADAGE and EPA/IGEM: "Data Annex" available on the EPA website at http://www.epa.gov/climatechange/economics/economicanalyses.html. MIT/EPPA: Sergey Paltsev, et al., "Appendix C" of Paltsev et al., *The Cost of Climate Policy in the United States*, MIT Joint Program on the Science and Policy of Global Change (2009). EIA/NEMS: EIA, *Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009*, (August 2009). ACCF-NAM/NEMS: SAIC, *Analysis of The Waxman-Markey Bill "The American Clean Energy and Security Act of 2009" (H.R. 2454) Using The National Energy Modeling System (NEMS)*, report by the ACCF and NAM (2009). NBCC/CRA: CRA International, *Impact on the Economy of the American Clean Energy and Security Act of 2009 (H.R. 2454)* (May 2009). CBO: CBO, *CBO Cost Estimate: H.R. 2454 American Clean Energy and Security Act of 2009 As ordered reported by the House Committee on Energy and Commerce*, (June 5, 2009). HF/GI: The Heritage Center for Data Analysis, *The Economic Consequences of Waxman-Markey: An Analysis of the American Clean Energy and Security Act of 2009* (August 5, 2009).

[3] Larry Parker and Brent Yaccobucci, Climate Change: Costs and Benefits of the Cap-and-Trade Provisions of H.R. 2454, Congressional Research Service, September 14, 2009 , p.34, at http://assets.opencrs.com/rpts/R40809_20090914.pdf

Figure 1, taken from the Congressional Research Service's recent assessment of studies on the effect of cap and trade, illustrates graphically the outcomes of the various studies. While there are slightly different growth projections over time, the range of the consensus trend line is unmistakably positive, without sharp drops or real loss of income. Table 3, below,[4] taken from the CRS study, shows yet another attempt to standardize estimates of impact or limits to growth on people's spending or household income. This table highlights the ways in which estimates differ from each other.

Table 3: Congressional Research Service Comparison of Household Costs in Major Climate Change Studies[5]

Table 18. Estimated 2020 Household Effects Under H.R. 2454 (Adjusted by CRS)

Case	Household Size	Projected Household Effect in 2020 (2005$)	Measure Used in Estimate
EPA/IGEM	2.6	$69	Consumption
EPA/ADAGE	2.6	$86	Consumption
ACCF-NAM/NEMS	2.6	$91	Household Income
EIA/NEMS	2.6	$110	Consumption
CBO	2.6	$156	Net Economy-Wide Cost
MIT EPPA	2.6	$262	Welfare Effects
NBCC/CRA	2.6	$739	Purchasing power
HF/GI Adjusted Household	2.6	$808	Disposable Income
HF/GI	4	$1,262	Disposable Income

Source: CRS analysis of data from: EPA/ADAGE and EPA/IGEM: "Data Annex" available on the EPA website at http://www.epa.gov/climatechange/economics/economicanalyses.html. MIT/EPPA: Sergey Paltsev, et al., "Appendix C" of Paltsev et al., *The Cost of Climate Policy in the United States*, MIT Joint Program on the Science and Policy of Global Change (2009). EIA/NEMS: EIA, *Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009*, (August 2009). ACCF-NAM/NEMS: SAIC, *Analysis of The Waxman-Markey Bill "The American Clean Energy and Security Act of 2009" (H.R. 2454) Using The National Energy Modeling System (NEMS)*, report by the ACCF and NAM (2009). NBCC/CRA: CRA International, *Impact on the Economy of the American Clean Energy and Security Act of 2009 (H.R. 2454)* (May 2009). CBO: Congressional Budget Office, *The Estimated Costs to Households From the Cap-and-Trade Provisions of H.R. 2454*, (June 19, 2009). HF/GI: The Heritage Center for Data Analysis, *The Economic Consequences of Waxman-Markey: An Analysis of the American Clean Energy and Security Act of 2009* (August 5, 2009).

[4] Most models and institutional sponsors are described on pages 2 & 3 herein; some not mentioned above include NEMS, which stands for the National Energy Modeling System, the econometric model of the US DOE's Energy Information Administration (EIA); CBO is Congressional Budget Office; NBCC is Black Chamber of Commerce; HF/GI is Heritage foundation Center for Data Analysis.

[5] Parker and Yaccobucci, Op.Cit.,

Table 3 highlights the places where the numbers may look like they are saying the same thing, but the measurement is different. Understanding the presentation of impact may be tricky, due to the following factors:

1) Some authors discount their projections for inflation, some don't.
2) Discount rates vary from study to study.
3) Base years for discounting vary (some studies discount to 2005 dollars; others to 2007 dollars, at least one to 2008 dollars).
4) Timeframes vary. Some look at a snapshot in time, others at a moving target. Some look at a moment in time in 2020; others look at 2030, 2050 or all three years.
5) Different studies include or exclude different provisions of the climate legislation they are modeling. For example, energy efficiency may or may not be included; in one study the renewable energy standard was omitted.
6) Household size differs from study to study.
7) Measure of impact ranges from consumption to purchasing power, household income, or disposable income, or even total economy wide effect.

Finally, some studies used techniques other than econometric modeling. The American Council for an Energy Efficient Economy focuses on the energy efficiency provisions of the legislation and finds a net benefit accruing to households. The Political Economy Research Institute of the University of Massachusetts at Amherst uses input output modeling of US Department of Commerce Business Surveys and projects forward in a linear model based on employment.

These studies do not highlight the cost of doing nothing, which is also projected to constrain economic growth and cause harm, both economic and social. In 2006, Lord Nicholas Stern, whose work underpinned the cap and trade initiative of the European Union, found that failure to deal with rising carbon emissions would present a cost per ton that exceeds many of the projected estimates for emissions allowances even during the later years of the cap and trade program.

Table 3: Cost per Ton of GHG Emission [6]

Table 20. *The Stern Review* Estimates of Social Cost of Carbon for Three Emissions Paths

Stabilization Scenario	Social Cost of Carbon (per metric ton, 2005$)
Business-as-usual (no effort to stabilize emissions beyond basecase levels)	$95
On a path to stabilize GHG concentrations at 550 ppm	$34
On a path to stabilize GHG concentrations at 450 ppm	$28

Source: Sir Nicholas Stern, *The Economics of Climate Change: The Stern Review* (2006) p. 304. Estimates converted to 2005$ using the GDP implicit price deflator.

[6] Parker and Yaccibucci, Op.Cit., p.89

The Congressional Research Service report notes that attempts to quantify the social costs of climate change itself are as difficult as attempts to quantify the cost of controlling them through cap and trade:

> *As illustrated with the long-term cost estimates presented in this report, attempts to monetize climate-related benefits currently reflect much about the philosophies and assumptions of the people doing the estimating. As stated in The Stern Review: "It is very important ... to stress that such estimates [NPV of climate change policy benefits] reflect a large number of underlying assumptions, many of which are very tentative or specific to the ethical perspectives adopted."125 Likewise, these modeling exercises may be useful for conducting sensitivity analysis to gage the potential impact of various policy options and assumptions.*[7]

Under all scenarios, "business as usual" or a regimen of "cap and trade," costs associated with control of carbon – or lack thereof - will rise. The impacts of doing nothing bring disproportionate economic costs to bear on some businesses, communities and individuals. Better reflection of the actual costs of carbon emissions has economic costs that affect other businesses and communities. Studies vary in what they calculate in terms of costs but there will be costs, whether from failure to price carbon or from pricing carbon.

In sum, all studies out there on this topic show economic growth under a cap and trade program. Many show some moderation of that growth – "opportunity costs" - due to cap and trade, but within the context of overall growth. The conclusions that may emerge from evaluating the studies as a group include that there is going to be some impact of the pricing of carbon; that many studies calculate that there will be a dampening of national economic growth compared to growth without carbon constraints, but that the opportunity cost occurs within the context of rising employment and income; and that most studies that evaluate fiscal impact by income level find a modestly progressive outcome in distribution of income, with people at the bottom end of the income scale impacted less than those on the upper end of the scale.

We conclude that the costs of not pricing carbon should be understood, as should the costs of pricing carbon. Whatever action we take – and we advocate imposing costs on pollution – we should understand the costs, and attempt to help communities and employers take action to reduce the costs. One virtue of the carbon cap and trade (or cap and invest) program is that the revenues we raise from pricing carbon can be used in part to help increase use of renewable energy, improve efficiency, and reduce emissions. Those investments can help generate jobs in other parts of the economy, while making our economy more efficient and cleaner.

[7] Ibid, p.90