Assessment of U.S. Cap-and-Trade Proposals

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SUMMARY

In 2007 the U.S. Congress is considering a set of bills designed to limit the nation's greenhouse gas (GHG) emissions. Several of these proposals call for adoption of some form of a cap-and-trade system. Under such a system national targets are set over a period of years, and emissions permits or "allowances" are distributed in the economy in an amount equal to the national target. Entities covered by the program (usually firms) are then required to submit permits to equal to their emissions, and trading in the permits establishes a common emissions price across controlled sources, thereby directing abatement to the least-cost opportunities. The current proposals fall into two groups according to their stringency. The Bingaman-Specter and Udall-Petri bills would keep the U.S. emissions near current levels; the Lieberman-McCain, Feinstein, Kerry-Snowe, Sanders-Boxer, and Waxman bills specify emissions reductions goals of 50% to 80% below the 1990 level by 2050. Current U.S. emissions are about 15% above their 1990 level (**Table S-1**).

The MIT Integrated Global System Model (IGSM)—and its economic component, the Emissions Prediction and Policy Analysis (EPPA) model—were used to assess these proposals. The EPPA model is designed to represent key elements of the U.S. economy, emissions abatement alternatives, and trade interactions with other countries. As with any model, it is necessarily a simplified representation of the economy, and the nature of the solution is the least-cost abatement that might be associated with a highly effective implementation of a cap-and-trade system. Uncertainty pervades both economic conditions and possible climate response over a period of 50 to 100 years, so these results represent one plausible scenario of the potential outcomes—valuable not for the precise numerical estimates but for insights about the general direction of changes in the economy, the potential climate consequences of different emissions paths, and the rough magnitude of the price and welfare effects to be expected under alternative features of cap-and-trade design.

The EPPA model projects a doubling of U.S. greenhouse gas emissions by 2050 if no further mitigation measures are implemented. Global emissions, driven by growth in developing counties, are projected to increase even more. Unrestrained, these emissions would lead to an increase in global CO_2 concentration from a current level of 380 ppmv to about 550 ppmv by 2050 and to near 900 ppmv by 2100, resulting in a year 2100 global temperature 3.5°C to 4.5°C above the current level. The more ambitious of the Congressional proposals could limit this increase to around 2°C, but only if other nations, including developing countries, also strongly controlled greenhouse gas emissions.

Under the more aggressive reductions, the economic cost measured in terms of changes in total welfare in the U.S. could reach from 1.5% to almost 2% by the 2040-2050 period, with 2015 CO_2-equivalent prices of between about \$30 to \$55, rising to \$120 to \$210 by 2050. If emission

allowances were auctioned, these systems could produce revenue between $100 billion and $500 billion per year (5% to 19% of Federal tax revenue) depending on the case. One use of this revenue could be a cut in existing taxes, say on labor or capital, which would lower the national economic cost of the targets.

This level of cost would not seriously affect GDP growth, but would imply large-scale changes in the U.S. energy system. For example, even with strong growth in wind, solar and other renewable sources the required removal of CO_2 emissions from the electric sector would require on the order of 500 new no- or low-carbon power plants to be built by 2050. If all of these were nuclear power plants that would be a six-fold increase from the 100 now in place. If nuclear power is constrained by safety and siting concerns about the same number of new coal-fired powerplants with CO_2 capture and storage would be required. Similar large-scale change is required in the transport sector, with biofuel perhaps offering the most effective alternative to fossil fuel in the period to 2050. However, the implications for land use and food production of the implied level of biofuel use are staggering. With unrestrained biomass trade the U.S. would be a major importer of these fuels and U.S. farmland would continue to be used to produce food for domestic consumption and export. If on the other hand U.S. biofuel use were restricted to domestically-produced feedstock, on the order of 500 million acres of U.S. land would be required, more than the total of current U.S. cropland. In this case, the U.S. would become a net importer food, fiber, and forest products. The U.S. can either eat or drive on its domestic agricultural resources, but not both.

The less stringent proposals are designed to cap the CO_2 price, set to be no higher than $7 per ton of CO_2-e in 2015 and rising to $39 by 2050. This feature also limits the welfare cost to be no more than about 0.5%. These policies also limit the transformation of the energy sector, but do not place an absolute cap on emissions which could rise depending on policies implemented abroad.

The proposals differ in the points in the economic system where the cap is applied: upstream (oil refineries, coal mines, gas gathering points, import terminals, etc.) or downstream (electric power generators, firms and/or individuals consuming oil and gas, etc.). Unless restrained by regulation the ultimate distribution of the costs of emissions abatement under such a system is determined not by the choice of upstream or downstream implementation but by market forces. Policymakers are thus free to implement such systems at the stage of production where implementation costs are lowest. Naturally, distributional issues arise if allowances are given away for free, as suggested by the magnitude of the revenue if they were auctioned.

The cost and effectiveness of mitigation policy in the U.S. is significantly affected by measures taken in other countries. A stringent policy elsewhere reduces global oil and gas prices and confers an advantage to the U.S. in that the prices of our imports fall in relation to the prices of goods we export—an improvement in the so-called terms of trade. On the other hand, such a policy abroad also raises the international price of biomass energy, conferring a terms-of-trade loss when the U.S. has a strong mitigation policy.

Though likely helpful in smoothing out fluctuations, international emissions trading would not lead to substantial long-term economic efficiency gains for the U.S. except in the unlikely event that U.S. maintains an emissions policy substantially more stringent than that in other regions and can lower its cost through the purchase of cheap permits from abroad. Rather, such global emissions trading is probably best thought of as an instrument by which the U.S. (and perhaps other developed countries) might induce developing countries to take on an emissions commitment by implicitly agreeing to pay for their reductions by awarding them allowances that we will then purchase back to meet domestic targets.

It is not possible to connect U.S. policy targets with a particular global concentration or temperature goal, or the avoided damages, because any climate gains depend on efforts in the rest of the world. And, unfortunately, absent a global agreement a country's best strategy in terms of its own self-interest is to do little and free-ride on the actions of others. Of course, if all behave in this way very little mitigation will be achieved. If a cooperative solution is at all possible, a major strategic consideration in setting U.S. policy targets should be their value in leading other major countries to take on similar efforts. This assessment shows that a few-decade delay in the participation of developing countries in a global climate change regime need not prevent achievement of important century-scale climate goals. On the other hand, failure to take any action, or failure to substantially involve the developing countries would lead to very substantial warming over the century.

Planning over a half-century horizon is a challenging task. Setting targets for the next 40 to 50 years could provide some certainty for economic agents who would have to make substantial investments in new, climate-friendly technologies. At the same time, this certainty in goals has to be balanced with flexibility in case other countries do not follow the path of stringent emissions reduction, or advances in earth science lead to substantial changes in projections of the climate response to human emissions.

The full text of the report is available at: http://mit.edu/globalchange/www/abstracts.html#a146

Table S-1. A Summary of Approximate Costs of Current Congressional Proposals if Implemented as Pure Cap-and-Trade or Price Policies. (Note: Based on interpretation of legislation as of early 2007).

Congressional Proposals		Approximate Costs if Implemented as a Pure Cap-and-Trade or Price Policy				
Allowance Path	**Policy Objective**	**CO_2-e Price, $/ton**		**Welfare cost %**		**Comments**
		2015	**2050**	**2020**	**2050**	
Bingaman-Specter Draft 2007	Limit cost using a Safety Valve with cap-and-trade	7	39	–0.06 –0.07	–0.46 +0.45	Gains in U.S.+ROW stem from terms-of-trade effects
Udall-Petri 2006	Similar to Bingaman-Specter					
Lieberman-McCain 2007	Achieve emissions levels 60% below 1990 by 2050 for covered sectors using cap-and-trade	31	121	–0.23	–1.11	National emissions allowed estimated at 216 bmt, costs would thus be slightly lower.
Feinstein August 2006	Achieve emissions levels 70% below 1990 by 2050 though sector-based policies	41	161	–0.32	–1.45	National emissions allowed is 195 bmt, costs would be slightly higher. Policies and measures rather than a pure cap-and-trade.
Kerry-Snowe 2007	Achieve emissions levels 65% below 2000 levels by 2050 for covered emitters using cap-and-trade.	~47	~141	~ –0.28	~ –1.62	Calculated as halfway between these two cases. Includes additional efficiency standards and other features.
Sanders-Boxer 2007	Achieve emissions 80% below 1990 by 2050 using market-based and other measures.	53	210	–0.55	–1.79	Many other features of the bill—e.g., efficiency standards, renewable portfolio requirements—are not included.
Waxman 2007	Similar to Sanders-Boxer with somewhat faster rate of decline to 2050 goal, leading to somewhat higher costs.					