

COUNTING THE CHANGE: ACCOUNTING  
FOR THE FISCAL IMPACTS OF  
CONTROLLING CARBON EMISSIONS

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HEARING

BEFORE THE

COMMITTEE ON THE BUDGET  
HOUSE OF REPRESENTATIVES

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

HEARING HELD IN WASHINGTON, DC, NOVEMBER 1, 2007

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**THURSDAY, NOVEMBER 1, 2007**

HOUSE OF REPRESENTATIVES,  
COMMITTEE ON THE BUDGET,  
*Washington, DC.*

The committee met, pursuant to call, at 12:04 p.m. in room 210, Cannon House Office Building, Hon. John Spratt [chairman of the committee] presiding.

Present: Representatives Spratt, Doggett, Tsongas, Hooley, Moore of Kansas, Moore of Wisconsin, Ryan, Garrett, Lungren, Campell, and Smith.

Chairman SPRATT. I will call the meeting to order and welcome our witnesses and other participants to the Budget Committee's hearing on the fiscal considerations of controlling carbon emissions. Before going any further, let me announce and introduce our most recent addition, Niki Tsongas, recently elected from the Fifth District of Massachusetts, the widow of Paul Tsongas. And we are delighted to have you.

The steering committee of our party has appointed her to this position. She hasn't been confirmed yet on the House floor. Oh, she was. I beg your pardon. You are a full-fledged Member. We are glad to have you this morning to participate.

The concentration of greenhouse gases, carbon dioxide in particular, has gradually increased in the atmosphere over the last century, and is widely believed to be contributing to the warming of our climate. In light of the damages of climate change, there is gathering momentum in the Congress for legislation that uses market-based mechanisms to limit and eventually to lower emissions of greenhouse gases resulting mainly from the burning of fossil fuels, coal, oil, and natural gas.

In fact, the Senate Committee on Environment and Public Works is holding a subcommittee markup of the Lieberman-Warner bill on the subject today.

As Congress considers systems for control of carbon emissions, this committee, the Budget Committee, needs to consider budgetary issues to be resolved in implementing any such system. Our consideration of these issues is not meant to impede implementation of controls, but it is an important part of working out what assistance should look like and include, if and when Congress adopts one.

The most prominent option is a cap-and-trade program for carbon dioxide emissions. Cap-and-trade programs would establish an overall limit on greenhouse gas emissions, declining over time, but allowing producers to buy and sell allowances or permits as needed. By capping emissions, but allowing trading, a new and highly valuable commodity would be created: the right to emit CO<sub>2</sub>. How this commodity is allocated and treated in the budget is a vitally important topic for the Budget Committee to consider.

Today's topic is not only important, it is complex, and we are fortunate to have some lucid witnesses on the subject. My chief of staff took that word out and put "outstanding," but I am putting "lucid" here because we put great stock in that. We have asked you here to come and explain it to us from your different viewpoints.

Dr. Peter Orszag, who is the Director of CBO, will lead; followed by David Doniger, Policy Director for the National Resources Defense Council; followed by Bob Greenstein, Executive Director of the Center on Budget and Policy Priorities; and, finally, Anne Smith, who is the Vice President of CRA International.

Before turning to our witnesses for their testimony, let me ask Mr. Ryan, our Ranking Member, for any opening statement that he may wish to make. Mr. Ryan.

Mr. RYAN. I thank you, Chairman. Before I make my opening statement, I simply want to recognize something that is pretty important here. Today is your birthday. I simply want to say happy birthday.

Chairman SPRATT. Thank you, sir. I hope we couldn't put that on the record.

Mr. RYAN. I wasn't going to say what birthday it is.

Thanks for holding this hearing. There seems to be broad agreement that carbon dioxide and other greenhouse gases are accumulating in the Earth's atmosphere. There also seems to be broad agreement that man is creating carbon dioxide emissions, primarily through the combustion of fossil fuels such as coal, oil, and natural gas. There is far less agreement, however, about what this may mean for the planet's climate over time.

While this is very clearly a worthy debate, the Budget Committee isn't the place for weighing the science of global warming. We will leave that to the other committees with expertise over that issue. What this committee can and should do, though, is examine the economic and budgetary implications associated with different approaches to reducing carbon emissions. We all want to be good stewards of the planet. So if keeping our planet healthy means we must reduce carbon emissions, Congress and the public have got to recognize that there are going to be tradeoffs involved.

First, any increases in regulations and costs imposed on energy producers will be passed on to consumers directly in the form of higher prices. And those with lower incomes will be hit the hardest.

Second, the rise in energy costs will have a suppressing effect on economic growth. And without a strong and growing economy, our options for addressing environmental challenges in the future will become extremely limited.

I note some have suggested Congress create yet another mandatory program to help consumers offset the higher energy prices that would result from regulating carbon emissions, but we already

have an unsustainable rate of entitlement growth. We should not keep making promises we simply can't keep.

Finally, we also must recognize the international dimensions of this issue. According to the Congressional Research Service, the United States currently accounts for about 20 percent of global carbon emissions, and our share of emissions is expected to fall in the decade ahead as countries such as China and India continue their rapid growth. So in short, we are not going to fix anything simply through our actions alone. It must be a global worldwide effort.

We should also start to look beyond the government mandates to reduce carbon emissions. We have got to look toward research and development from both the government and private sector. In short, I think we need to spend a little less time writing government mandates and a little more time advancing cleaner methods of producing energy America needs. And with that, Mr. Chairman, I thank you for holding this hearing.

Chairman SPRATT. Thank you, Mr. Ryan.

Chairman SPRATT. And just one housekeeping detail before we move on with the testimony. First of all, I ask unanimous consent that we include in the record for this hearing, testimony which has been submitted by Representative Norm Dicks of Washington. I also ask unanimous consent that all members be allowed to submit a statement at this time, at this point in the record. If there is no objection, it is so ordered.

[The prepared statement of Mr. Dicks follows:]

PREPARED STATEMENT OF HON. NORMAN D. DICKS, A REPRESENTATIVE IN CONGRESS  
FROM THE STATE OF WASHINGTON

Mister Chairman, Mister Ranking Member, and Members of the Budget Committee: thank you for holding this important hearing to examine impacts of proposals to address climate change, and for the opportunity to submit testimony for the record.

I believe that climate change is the emerging issue of our time. Climate change could alter the face of our planet in ways we cannot yet fully comprehend, and I believe it is our responsibility not only to do as much as possible to halt or slow it, but also to do everything in our power to protect the earth's living resources from its impacts so that future generations will be able to appreciate and benefit from them as we and past generations have done. While it is not the specific focus of this hearing today, as Chairman of the Interior, Environment and Related Agencies Appropriations Subcommittee, I wish to highlight for the Budget Committee the impending crisis faced by our federal natural resource management agencies as the impacts of climate change on our nation's wildlife and ecosystems continue to grow. My testimony also recommends that the Budget Committee support dedicated funding from revenues that may be generated from comprehensive climate change legislation for a balanced program to support our federal natural resource management agencies in navigating this crisis.

Our nation's wildlife is one critically important resource that is particularly vulnerable to climate change, and it is also a resource that is a fundamental part of America's history and character. Conservation of wildlife and wildlife habitat is a core value shared by all Americans.

America's wildlife is vital to our nation for many reasons. Wildlife conservation provides economic, social, educational, recreational, emotional and spiritual benefits. The economic value of hunting, fishing, and wildlife-associated recreation alone is estimated to contribute \$100 billion annually to the U.S. economy. Wildlife habitat, including forests, grasslands, riparian lands, wetlands, rivers and other water bodies, is an essential component of the American landscape, and is protected and valued by federal, state, and local governments, tribes, private landowners, and conservation organizations.

Unfortunately, it is becoming increasingly apparent that the effect of climate change on wildlife will be profound. Reports from the Intergovernmental Panel on Climate Change (IPCC) have made clear that global warming is occurring, that it

is exacerbated by human activity, and that it will have devastating impacts on wildlife and wildlife habitat. Wildlife is already suffering from massive changes in habitat, particularly in the arctic, and shifts in ranges and timing of migration and breeding cycles. Continued global warming could lead to large-scale species extinctions. These impacts add to and compound the adverse effects wildlife and its habitat already suffer from land development, energy development, road construction, and other human activities, and from other threats such as invasive species and disease.

A U.S. Geological Survey Study released in September points to one particularly tragic and unthinkable consequence—there will be no polar bears in Alaska within the next 50 years due to a drastic decline in Arctic sea ice by mid-century. And polar bears are not the only animal that relies on Arctic sea ice. We can expect that many other ice-reliant creatures will also be in jeopardy.

According to the IPCC, global warming and associated sea level rise will continue for centuries due to the time-scales associated with climate processes and feedbacks, even if greenhouse gas concentrations are stabilized now or in the very near future. I believe that, as a nation, we must craft responses and mechanisms now to help wildlife navigate the looming bottleneck of complex threats caused by global warming, so that wildlife populations can survive to reap the benefits from reductions in greenhouse gas emissions undertaken now.

As Chairman of the House Interior and Environment Appropriations Subcommittee, I have held hearings to assess the impacts of climate change on federally protected resources. Officials from federal agencies with responsibility for managing our national wildlife refuges, forests, parks, monuments, other public lands, and fish and wildlife already are seeing impacts from climate change out on the ground that make a compelling case for a national response.

All of the Interior Department and Forest Service officials who testified expressed concern over the current and future impacts of global warming on the natural resources they are entrusted to protect and maintain for the American people. Their task is overwhelming. As Deputy Secretary of Interior, Lynn Scarlett, stated: “Perhaps no subject relevant to managers of public lands and waters is as complex and multi-faceted as climate change.”

Spectacular American treasures are at risk. Everglades National Park lies entirely at or near sea level. Park Superintendent Dan Kimball told my subcommittee that if IPCC sea level rise projections of 7 to 23 inches hold true by century’s end, 10% to 50% of Everglades National Park’s freshwater marsh would be impacted and transformed by salt water intrusion.

Glacier National Park has lost 73% of its glaciers. Point Reyes National Seashore, one of 74 coastal national park units, has witnessed seal haul-outs and endangered bird nesting areas washed out by rising seas, changes to offshore krill populations that have devastated sea bird populations, and reductions in fog patterns affecting forest and scrub species dependent on fog moisture.

Sam Hamilton, Regional Director of the Southeast Region of the U.S. Fish and Wildlife Service testified that there are more than 160 coastal national wildlife refuges threatened by sea level rise. Places like Pea Island National Wildlife Refuge on North Carolina’s Outer Banks are losing chunks of marsh and beach to the ocean every year. Hamilton also warned that the incredible biological diversity of U.S. coral reefs, including reefs within national wildlife refuges, has already been impacted by warming-induced coral bleaching events. Hamilton added:

“As wildlife managers, we have managed around and through weather patterns like drought, which occur annually and can last years. However, now we are beginning to face growing certainty that these recent observations are not part of an annual or even decadal change in weather pattern, but are potentially linked to a long-term change in the climate system itself. If so, the implications for wildlife and fisheries management are consequential.”

The Bureau of Land Management (BLM) is very concerned that exotic, noxious weeds like cheatgrass and red brome, will benefit from higher concentrations of carbon dioxide and further out-compete native species in the Great Basin and other parts of the West. These weeds are largely responsible for the increase in damaging wildfires in sagebrush habitats. Combined with an increase in woody vegetation, also stimulated by global warming, the risk of wildfires will much magnified, impacting human population centers, wildlife, grazing, and other uses of the public lands.

The BLM has also seen direct evidence of desertification as a result of an increase in the frequency and duration of drought. Reductions in water availability have directly affected plant and animal communities. According to Ron Huntsinger, the National Science Coordinator of the BLM, “The overall results of these changes are more fragile ecosystems, a greater susceptibility to the outbreak of attacks by

parasites and diseases, increased vulnerability to wildlife fire and erosion, and an overall reduction in carrying capacity of the land.”

These are just some of the impacts of global warming presented by federal agency officials to my subcommittee. These impacts have been documented first hand by our federal resource managers.

Based on this overwhelming evidence, it is obvious that, to conserve our wildlife and ecosystems in the face of the far-reaching effects of global warming, there is a need for a coordinated, national response that includes a strategy based on sound scientific information to ensure that impacts on wildlife and ecosystems that span government jurisdictions are effectively addressed and to ensure that federal funds are provided and prudently committed.

That is why I introduced the “Global Warming Wildlife Survival Act,” H.R. 2338. The bill takes a first step in ensuring that our nation is using all possible means to help America’s wildlife navigate the global warming bottleneck.

I introduced this along with my friends and colleagues, Jay Inslee of Washington and Jim Saxton of New Jersey. I also am deeply grateful to my friend and colleague, the Chairman of the House Natural Resources Committee Nick Rahall of West Virginia and his staff for working with me to develop the “Survival Act” and for including it in his comprehensive legislation, the “Energy Policy Reform and Revitalization Act” that passed the House of Representatives as part of H.R. 3221, Speaker Pelosi’s “New Direction for Energy Independence Act” just before the August recess. Senator Sheldon Whitehouse of Rhode Island recently introduced a similar version of the bill, S. 2204.

The “Global Warming Wildlife Survival Act” has four elements:

- First, it includes a Congressional declaration of national policy recognizing that global warming is having profound impacts on wildlife and its habitat and committing the federal government, in cooperation with partners, to use all practicable means to assist wildlife in adapting to and surviving the effects of global warming.

- Second, the bill requires development of a national strategy for assisting wildlife impacted by global warming developed by the Secretary of the Interior, in consultation with other relevant federal agencies, state and local governments, tribes, and other partners. A committee of scientists is established to advise the Secretary in development of the National Strategy. The Secretaries of the Interior, Agriculture and Commerce are charged with implementing the National Strategy on federal lands and in conservation programs they administer.

- Third, the bill will support improved science capacity for federal agencies to respond to global warming, including establishment of a National Global Warming and Wildlife Science Center in the United State Geological Survey, and enhanced science capacity in federal land management and wildlife agencies.

- Finally, the bill directs strategic allocation of funding for implementation of the National Strategy and state and tribal actions to enhance wildlife resilience to global warming. The Act allocates federal funding to implement the National Strategy—45% to federal land management agencies, 25% to federally-funded and implemented fish and wildlife programs, and 30% to states through the State and Tribal Wildlife Grants Program created by our subcommittee in the FY 2001 Interior appropriations bill as a mechanism to facilitate comprehensive wildlife conservation in each state and as an upstream solution to help conserve species before they decline to the point where they need Endangered Species Act protection.

The “Survival Act” will help to ensure that the pressing needs faced by our natural resource management agencies and programs that help wildlife and wildlife habitat are addressed strategically, based on a foundation of sound scientific information, and that funding is allocated among the federal agencies and the states in the most efficient way possible.

As Members of the Budget Committee, you surely can understand that, as an appropriator, and considering the pressures on the federal budget, I would call for a new program only if it were critically needed. In the face of the overwhelming evidence already before us showing significant impacts on wildlife borne out by observations of the federal natural resource agencies on the ground, it is apparent that we are behind the curve in addressing this crisis and that we must move quickly to start to deal with this now before it is too late.

Also, as an appropriator, I believe that any new program must be carefully and solidly structured. And the “Survival Act” program meets that test by building on and better coordinating many existing federal, state and tribal conservation programs around the problem of climate change. The framework established in the “Survival Act” is a strong one in which the components complement one another.

Recently, two new reports have been released that underscore the need for the measures included in the “Survival Act.” A report released by the Government Accountability Office (GAO), “Climate Change: Agencies Should Develop Guidance for

Addressing the Effects on Federal Land and Water Resources” evaluated how federal resources management agencies are dealing with the impacts of climate change and federal lands. The GAO found that the federal land and wildlife management agencies lack the capacity and guidance to effectively respond to the impacts of global warming on our federal lands and wildlife. On the heels of the GAO report, the National Academy of Sciences (NAS) released a report, “Evaluating Progress of the U.S. Climate Change Science Program: Methods and Preliminary Results.” The NAS report found that the government is failing to monitor global warming’s impacts at a regional level, which is the scale of study necessary to inform sound policy choices. The “Survival Act” directly responds to both the GAO and NAS findings by giving our natural resource managers the national policy direction and mandate, as well as the scientific capacity, to plan for, and respond to, global warming impacts on wildlife and its habitat.

Of primary interest to the Budget Committee, it is my firm belief that there ultimately should be dedicated funding for the program established in the “Survival Act.” Today’s hearing examines proposals to address global warming that will likely generate new sources of funding for the federal government. Although the “Global Warming Wildlife Survival Act” as it currently stands merely authorizes funding to implement the provisions of the bill, I believe that a portion of any revenues that will be generated by upcoming climate change legislation should be specifically dedicated to implement the provisions of the “Global Warming Wildlife Survival Act” and I urge the Budget Committee to support me in ensuring this outcome.

As the Chairman of the Interior and Environment Appropriations Subcommittee that has jurisdiction over our natural resource management agencies, I can say that my subcommittee allocation is already woefully stressed even to deal with the current pressing needs of the agencies and programs under its jurisdiction. Our federal land management agencies already have tremendous backlogs for operations and maintenance of our national wildlife refuges, parks, forests and other public lands. This situation has been greatly exacerbated by the past 6 years of Bush administration budgets and prior Congresses. Hundreds of important biologist positions have been cut, and the agencies’ budgets are far below what they have needed just to keep up with inflation. These programs have been starved to the point where they are on life support. It became apparent in the hearings on global warming held by the subcommittee that the land management agencies are already seeing broad changes from climate change out on the ground, but that they have few, if any, resources to deal with these changes. With these increasing impacts, our Subcommittee allocation and agency budgets will be stressed beyond the breaking point. I greatly appreciate the work of Chairman Spratt and the Budget Committee to provide increases for FY 2008 in Function 300, natural resources and environment funding, as a significant first step in addressing the current shortfalls. However, it will be crucial, if we are to help our nation’s wildlife and ecosystems navigate the global warming bottleneck, to infuse dedicated new funding into our efforts to address this crisis, and I ask the Budget Committee’s support in working with me to make this happen.

Mr. Chairman and Members of the Committee, this is a great nation with a unique and irreplaceable natural heritage. Even though we face challenges today on many fronts both internationally and nationally, I believe we are a great enough nation not to allow our nation’s magnificent wildlife to fall to the ravages of climate change that we ourselves have created. I sincerely hope that by starting now we will be able to hold our wildlife losses to the absolute minimum, and that the lion’s share of our rich wildlife heritage will survive to benefit our grandchildren and future generations just as it has benefited us. Again, thank you for the opportunity to provide my views to the Committee.

Chairman SPRATT. Dr. Orszag, thank you for coming. You can proceed with your testimony. The floor is yours.

**STATEMENT OF PETER R. ORSZAG, DIRECTOR,  
CONGRESSIONAL BUDGET OFFICE**

Mr. ORSZAG. Thank you very much, Mr. Chairman, Mr. Ryan, members of the committee. Global climate change is one of the Nation’s most significant long-term problems. The accumulation of greenhouse gases, especially carbon dioxide, will impose economic and social costs, including through rising sea levels, altering agricultural zones, and increasing the severity of storms and droughts. There is furthermore some risk those costs could be catastrophic.

For example, if the thermohaline circulation stopped or if there were a breakdown of the west Antarctic ice sheet.

In effect, we are conducting an experiment with potentially quite dangerous consequences and no backup plan. Mitigating those risks requires some reduction in carbon dioxide and other greenhouse gas emissions, which can be thought of as an insurance policy against the severe risks or the severe costs that could be entailed in the further accumulation of greenhouse gases in the atmosphere.

Most analysis suggests that this insurance is worth purchasing; that is, a well-designed policy to reduce emissions would produce larger benefits than costs. There would, however, be costs as the economy adapted to lower emissions levels. Those costs would be much higher under a command-and-control type of approach in which there were, for example, technology standards that were imposed or other rigid approaches to reducing emissions. And they would be lower under an incentive-based approach in which the power of markets were used to seek out the lowest cost possible reductions.

There are two basic incentive-based approaches to reducing emissions, a carbon tax and a cap-and-trade system. A tax is generally the more efficient approach for two reasons:

First, it allows reductions to occur in the years in which they are cheapest to undertake. A reduction of a ton of emissions this year is not that much different for the climate ultimately than a reduction next year, but the cost of those reductions could vary significantly from year to year depending upon the weather, economic conditions, the development of technology, and other factors. A rigid cap each year does not allow you to undertake the emission reductions in the cheapest year. A tax does. In addition, a tax provides price certainty to households and to firms, and there can be benefits associated with that certainty. A cap-and-trade system, however, can be made relatively more efficient through various design features; for example including a safety valve that is a maximum price at which permits would be sold. The government would stand ready to sell permits at some price, and that would put a cap on the price risk or the potential cost of the permits. And also banking and borrowing, which would allow emissions to be basically shifted across years and help address that year-to-year variability that I mentioned before.

Under cap-and-trade, the mechanism for taking emissions down to the cap level is an increase in the price for carbon-intensive goods and services. And it is very important to recognize that a price increase is absolutely essential to having the cap system work. That is the mechanism through which reductions occur, because when you price carbon-intensive goods more, there is shifting towards less carbon-intensive activities and production processes.

The size of the price increase would depend on things including the technology available, but especially including the stringency of the cap. The more that you try to reduce emissions, the higher the price increase. It is also important to recognize that that price increase would occur regardless of whether the permits were sold to firms or households or were given away to them at no cost.

It is sometimes thought that if you gave the permits away to firms, the ultimate price increases would not occur. And that is not likely to be correct. It is not what has occurred in the European Union where permits were allocated at no cost and there were price increases that varied from country to country. And it is not what we would expect to occur in the United States either. Those price increases by themselves are regressive, because low-income households consume a larger share of their income in the form of energy than higher-income households, so the price increases for carbon-intensive goods and services impose a relatively larger burden on low-income households than higher-income households. But the overall distributional impact of the policy will depend not only on that effect, but also, very importantly, on how the value of the allowances themselves are allocated.

We estimate that the allowances would be worth somewhere between \$50 and \$300 billion a year by the year 2020. And what policymakers decide to do with those allowances could have a very big effect on the overall distributional consequences of a cap-and-trade system. In particular, if the permits were allocated at no cost to firms, the firms would obtain that \$50 to \$300 billion.

And just to put that in context, profits for U.S. producers of oil, gas and coal over the last 10 years have averaged less than \$70 billion a year. So relative to existing profits, those permits would be extraordinarily valuable.

Furthermore, allocating the permits in that way would exacerbate the regressivity of the underlying policy because the shareholders in those firms tend to be disproportionately higher-income households.

The alternative is to auction the permits, in which case the \$50 to \$300 billion a year could be used to reduce the deficit or used to reduce other taxes. This approach could attenuate the distributional effects if the money was used to cushion the blow, especially for the poor, and it could also potentially reduce the macroeconomic consequences if some of those funds were used to reduce other distortionary taxes, including the individual income tax marginal rates and corporate income tax marginal rates. In particular, because giving the permits away to producers would disproportionately benefit high-income households and would preclude the possibility of using the allowance value to reduce the macroeconomic costs, such a strategy would appear to rank low from both a distributional and efficiency perspective.

The final part of my testimony addresses the scoring of cap-and-trade systems under our role as the Congressional Budget Office and the budget scoring process. This is an important topic, but has received little attention to date. If the permits were auctioned, it is fairly clear that the revenue collected would be scored as revenue. And then depending on what was done with those funds, there may or may not be an outlay associated with the activity.

If the permits were given away, however, the scoring is less clear. There is a solid case to be made that given the depth and liquidity of the secondary market in these permits that giving a firm or a household permits worth a hundred dollars which they could immediately transform into cash is effectively equivalent to giving that firm or household \$100 in cash. And therefore giving

away a permit should be scored as an outlay and a corresponding revenue with no net effect on the budget deficit.

That kind of treatment would put on equal footing two transactions that economists believe are equivalent. Selling the permits for a hundred dollars and then giving a hundred dollars to particular firms and households, or simply giving a hundred dollars' worth of permits to those same firms or households, which they can then immediately and easily transform into cash.

On the other hand, existing scoring—for example for the sulfur dioxide program—does not treat permits that are given away at no cost in this manner, and the Federal budget remains a primarily cash-based thing. And the transactions involved in giving away permits are not cash, they are just quasi-cash transactions.

This scoring issue is something that CBO will be examining over the coming months as cap-and-trade proposals move through committee and we are forced to decide one way or the other how to score permits that are given away.

Thank you very much, Mr. Chairman.

Chairman SPRATT. Thank you, Dr. Orszag.

[The prepared statement of Peter R. Orszag follows:]

PREPARED STATEMENT OF PETER R. ORSZAG, DIRECTOR,  
CONGRESSIONAL BUDGET OFFICE

Mr. Chairman, Congressman Ryan, and Members of the Committee, thank you for the invitation to discuss issues related to reducing U.S. emissions of greenhouse gases, most prominently carbon dioxide (CO<sub>2</sub>).

Global climate change is one of the nation's most significant long-term policy challenges. Human activities are producing increasingly large quantities of greenhouse gases, particularly CO<sub>2</sub>. The accumulation of those gases in the atmosphere is expected to have potentially serious and costly effects on regional climates throughout the world. The magnitude of such damage remains highly uncertain. But there is growing recognition that some degree of risk exists for the damage to be large and perhaps even catastrophic.

Reducing greenhouse-gas emissions would be beneficial in limiting the degree of damage associated with climate change, especially the risk of significant damage. However, decreasing those emissions would also impose costs on the economy—in the case of CO<sub>2</sub>, because much economic activity is based on fossil fuels, which release carbon in the form of carbon dioxide when they are burned. Most analyses suggest that a carefully designed program to begin lowering CO<sub>2</sub> emissions would produce greater benefits than costs.

The specific policy approach adopted to reduce emissions can have significant effects on the costs involved and on their distribution. In particular, an incentive-based approach for curbing CO<sub>2</sub> emissions is substantially more economically efficient than alternative “command-and-control” policies, which might dictate specific technologies or set standards for particular products or producers. An incentive-based approach to lowering CO<sub>2</sub> emissions could be implemented in two main ways: by regulating the price of those emissions (for example, by taxing emissions) or by adopting a market-based system to regulate the quantity of emissions (for example, by establishing a “cap-and-trade” program for them). Either approach would raise the price for consuming goods and services that result in CO<sub>2</sub> emissions. Those price increases could provide an effective financial incentive for firms and households throughout the economy to take actions that would decrease emissions.

My testimony makes the following key points about those issues:

- The risk of potentially catastrophic damage from climate change can justify taking action to reduce that risk in much the same way that the hazards we all face as individuals motivate us to buy insurance. Some of society's resources may best be devoted to addressing climate change even if the most severe risks ultimately do not materialize.

- Although both a tax on emissions and a cap-and-trade system use the power of markets to achieve their desired results, a tax is generally the more efficient approach. The efficiency of a cap-and-trade program can be enhanced, how ever, through various design mechanisms, such as a “safety valve” that would allow addi-

tional emission allowances to be sold when the price of an allowance exceeded a specified level.

- Under a cap-and-trade program, a key decision for policymakers is whether to sell emission allowances or to give them away. The value of those allowances would probably be substantial: Under the range of cap-and-trade policies now being considered by the Congress, the annual value of emission allowances would be roughly \$50 billion to \$300 billion by 2020 (measured in 2006 dollars). More-stringent caps would result in higher total allowance values.

- Policymakers' decisions about how to allocate the allowances could have significant effects on the overall economic cost of capping CO<sub>2</sub> emissions, as well as on the distribution of gains and losses among U.S. households. Giving allowances away to companies that supply fossil fuels or that use large quantities of fossil fuels in their production processes could create "windfall" profits for those firms. The reason is that the cap-and-trade program would still result in higher prices for consumers and households but would not impose additional costs on those firms. Even if the companies received allowances for free, they would still raise prices to their customers because the cost of using an emission allowance for production—rather than selling it to another firm—would be embodied in the prices that they would charge for their goods and services. The resulting price increases would disproportionately affect people at the lower end of the income scale.

- If the government chose to sell emission allowances, it could use the revenue to offset the disproportionate economic burden that higher prices would impose on low-income households. Selling allowances could also significantly lessen the macroeconomic impact of a CO<sub>2</sub> cap. Evidence suggests that the macroeconomic cost of a 15 percent cut in U.S. emissions (not counting any benefits from mitigating climate change) might be more than twice as large if policy-makers gave allowances away than if they sold the allowances and used the revenue to lower current taxes on labor or capital that discourage economic activity, such as income or payroll taxes.

- The budgetary treatment of a federal cap-and-trade system for CO<sub>2</sub> emissions is an important topic that has received relatively little attention. If the federal government sold emission allowances, the proceeds would clearly be scored as federal receipts. The appropriate treatment of allowances issued at no charge is less clear. There is a solid case to be made that even allowances that were given away by the government should be reflected in the budgetary scoring process—specifically, that the value of any allowances initially distributed at no cost to the recipients should be scored as both revenues and outlays, with no net effect on the budget deficit. A different perspective would suggest that issuing allowances at no charge should be viewed as a straightforward regulatory action, with no direct budgetary consequences.

#### THE BENEFITS OF REDUCING GREENHOUSE-GAS EMISSIONS

Human activities—industry, transportation, power generation, and land use—produce large quantities of greenhouse gases. Those gases are accumulating in the atmosphere more rapidly than natural processes can remove them. Atmospheric concentrations of CO<sub>2</sub>, for example, have risen from 280 parts per million in the preindustrial era to about 380 parts per million today. The result of that and other greenhouse-gas accumulation has been a gradual warming of the global climate: Average temperatures have already increased by about 0.8 °C (1.4 °F).

Under a business-as-usual case, the total stock of greenhouse gases in the atmosphere would rise significantly, and estimates suggest that the global climate could warm by at least another 2 °C to 6 °C (4 °F to 11 °F) over the coming century. Such warming would impose economic and social costs—for example, by raising sea levels, altering agricultural zones, and increasing the severity of storms and droughts. At the higher end of the range of projections, the amount of warming to come would be at least as great as the amount that has occurred since the depths of the last ice age and could produce unexpected, rapid, and very costly changes in the Earth's climate. Some experts think that the effects of climate change could be modest, especially if society is ingenious in adapting to the change. However, other experts are concerned that rising concentrations of greenhouse gases could produce much more severe consequences for the global and U.S. economies than have generally been projected—as well as other costs, such as mass species extinction, that are difficult to quantify in economic terms.

Curbing greenhouse-gas emissions would help reduce not only the expected costs of future global climate change but also the chances of irreversible or potentially catastrophic damage. The Congressional Budget Office (CBO) has no basis to judge the scientific merits of the more extreme outcomes. But in general, the possibility

of such extreme costs provides an economic motivation for additional action to moderate the growth of emissions—and, potentially, to reduce emissions to very low levels in the longer run. Individuals take actions, such as mitigating risky behavior or buying insurance, to reduce their harm from extreme events. Similarly, societies or governments do and should take actions to avoid catastrophic collective harm. The difficulty for policymakers is determining the appropriate cost to be paid today to reduce what may be a small risk of a potentially catastrophic event in the future.<sup>1</sup>

#### INCENTIVE-BASED APPROACHES TO REDUCING EMISSIONS

Any effort to limit CO<sub>2</sub> emissions would have two principal effects: It would produce long-term economic benefits by avoiding some future climate-related damage, and it would impose immediate economic costs by reducing the use of fossil fuels. Most analyses suggest that a carefully designed program to begin lowering CO<sub>2</sub> emissions would produce greater benefits than costs.

Employing incentive-based policies to reduce CO<sub>2</sub> emissions would be much more cost-effective than using more-restrictive command-and-control approaches (such as imposing technology standards on electricity generators). Command-and-control approaches rely on policymakers to determine where or how emissions should be cut. Incentive-based policies, by contrast, use the power of markets to identify the least expensive sources of emission reductions. Thus, they can better reflect technological advances, differences between industries or companies in the ability to make low-cost emission reductions, and changes in market conditions.

The two main incentive-based approaches to reducing CO<sub>2</sub> emissions are to tax such emissions or to establish a cap-and-trade program for them. Under a tax, a levy would be imposed on CO<sub>2</sub> emissions or on the carbon content of goods (which is ultimately released in the form of CO<sub>2</sub>). Under a cap-and-trade program, policymakers would set a limit (the cap) on total emissions during some period and would require regulated entities to hold rights, or allowances, to the emissions permitted under that cap. After allowances were initially distributed, entities would be free to buy and sell them (the trade part of the program). Reducing emissions to the level required by the cap would be accomplished mainly by stemming demand for carbon-based energy through increasing its price.<sup>2</sup> The size of the required price increase would depend on the extent to which emissions had to be reduced—larger reductions would require larger price increases to reduce demand sufficiently.

#### EFFICIENCY ADVANTAGES OF A TAX ON CO<sub>2</sub> EMISSIONS

Although both types of incentive-based approaches are significantly more efficient than command-and-control policies, studies typically find that over the next several decades, a well-designed tax would yield higher net benefits than a cap-and-trade approach. A tax creates relative certainty about the cost of emission reductions each year, because firms will undertake such reductions until the cost of decreasing emissions by another ton just equals the tax on an additional ton of emissions. A cap-and-trade program, by contrast, creates relative certainty about the quantity of emission reductions each year, because the cap limits total annual emissions. In terms of the impact on the climate, however, it does not matter greatly whether a given cut in emissions occurs in one year or the next.<sup>3</sup> From that perspective, a tax has an important advantage: It allows emission reductions to take place in years when they are relatively cheap. Various factors can affect the cost of emission reductions from year to year, including the weather, the level of economic activity, and the availability of new low-carbon technologies (such as improvements in wind-power technology). By shifting emission-reduction efforts into years when they are relatively less expensive, a tax can allow the same cumulative reduction to occur over many years at lower cost than can a cap-and-trade program with specified annual emission levels. In addition, by avoiding the potential volatility of allowance prices that might result from a rigid annual cap, a tax could be less disruptive for affected companies.

The relative advantages of a tax and a cap-and-trade program could change over time, however. For example, because a cap creates relative certainty about the level of emissions, it could become more efficient than a tax if additional emissions were likely to trigger a sharp increase in damage, or if new technologies offered the opportunity to make extremely large cuts in emissions at a low and fairly constant cost. Analysts who have tried to define more precisely the conditions under which a cap would be more efficient than a tax have found those conditions to be quite narrow and not likely to be relevant in the near term. Specifically, scientists would need to have fairly precise knowledge about the level of an emissions threshold—beyond which additional emissions would trigger a sharp increase in total global damage—and such a threshold would have to be sufficiently close that policymakers

would want to make very large cuts in emissions each year to avoid crossing it.<sup>4</sup> In the absence of those conditions, a tax offers a more efficient approach for reaching a multiyear emission-reduction target.

#### ENHANCING THE EFFICIENCY OF A CAP-AND-TRADE SYSTEM

Although a tax is a more efficient policy in the near term, the efficiency of a cap-and-trade approach can be enhanced by various design features. In addition, some participants in the policy discussion believe that analytical comparisons of a tax and a cap-and-trade system ignore the idea that policymakers may be more inclined to set a tight cap than a correspondingly high tax.<sup>5</sup>

Policymakers could capture some of the efficiency advantages of a tax, while maintaining the structure of a cap-and-trade program, by adding features that would help keep the price of allowances in line with the anticipated benefits of emission cuts. For example, a price cap—typically referred to as a safety valve—and a price floor could keep the price of allowances from climbing too far above or falling too far below the anticipated benefits of emission reductions. The government could implement a safety valve by agreeing to sell as many allowances as firms wanted to buy at a specified price. (If the safety valve was triggered, emissions would exceed the level of the cap.) A price floor could be implemented if policymakers decided to sell a significant fraction of the allowances in an auction and set an auction reserve price. Alternatively, rather than setting a price floor, policymakers could allow firms to “bank” allowances when the cost of reducing emissions was low and to use those allowances in the future when costs were higher. Banking would keep the price of allowances from falling too low, provided that prices were expected to be higher in the future.

The effects of a cap-and-trade system would also depend substantially on whether the allowances were sold or issued at no cost, as discussed below.

#### THE DISTRIBUTIONAL CONSEQUENCES OF A CAP-AND-TRADE PROGRAM

By establishing a cap-and-trade program, policymakers would create a new commodity: the right to emit CO<sub>2</sub>. The emission allowances—each of which would represent the right to emit, say, one ton of CO<sub>2</sub>—would have substantial value. Based on a review of the existing literature and the range of CO<sub>2</sub> policies now being debated, CBO estimates that the value of those allowances could total between \$50 billion and \$300 billion annually (in 2006 dollars) by 2020. The actual value would depend on various factors, including the stringency of the cap (which would need to grow tighter over the years to keep CO<sub>2</sub> from continuing to accumulate), the possibility of offsetting CO<sub>2</sub> emissions through carbon sequestration or international allowance trading, and other features of the specific policy selected.<sup>6</sup>

Policymakers would need to decide how to allocate the allowances that would correspond to each year’s CO<sub>2</sub> cap. One option would be to have the government capture their value by selling the allowances, as it does with licenses to use the electromagnetic spectrum. Another possibility would be to give the allowances to energy producers or some energy users at no charge. The European Union has used that second approach in its 2-year-old cap-and-trade program for CO<sub>2</sub> emissions, and nearly all of the allowances issued under the 12-year-old U.S. cap-and-trade program for sulfur dioxide emissions (which contribute to acid rain) are distributed in that way. Policymakers’ decision about whether to sell the allowances or to give them away would have significant implications for the distribution of gains and losses among U.S. households and for the overall cost of the policy.

The ultimate distributional impact of a cap-and-trade program would be the net effect of two distinct components: the distribution of the cost of the program (including the cost of paying for the allowances) and the distribution of the allowances’ value (because someone will pay for them, someone will benefit from their value). Market forces would determine who bore the costs of a cap-and-trade program, but policymakers would determine who received the allowance value. The ultimate effect could be either progressive or regressive.

#### MARKET FORCES WOULD DETERMINE WHO BORE THE COSTS OF A CAP

Obtaining allowances—or taking steps to cut emissions to avoid the need for such allowances—would become a cost of doing business for firms that were subject to the CO<sub>2</sub> cap. However, those firms would not ultimately bear most of the costs of the allowances. Instead, they would pass along most such costs to their customers (and their customers’ customers) in the form of higher prices. By attaching a cost to CO<sub>2</sub> emissions, a cap-and-trade program would thus lead to price increases for energy and energy-intensive goods and services that contribute the most to those emissions. Such price increases stem from the restriction on emissions and would

occur regardless of whether the government sold emission allowances or gave them away. Indeed, the price increases would be essential to the success of a cap-and-trade program because they would be the most important mechanism through which businesses and households were encouraged to make investments and behavioral changes that reduced CO<sub>2</sub> emissions.

The rise in prices for energy and energy-intensive goods and services would impose a larger burden, relative to income, on low-income households than on high-income households. For example, not incorporating any benefits to households from lessening climate change, CBO estimated that the price increases resulting from a 15 percent cut in CO<sub>2</sub> emissions would cost the average household in the lowest one-fifth of the income distribution about 3.3 percent of its income but the average household in the top quintile about 1.7 percent of its income (see Table 1).<sup>7</sup>

**Table 1.**

### Effects on U.S. Households of the Higher Prices Resulting from a 15 Percent Cut in CO<sub>2</sub> Emissions

	Average for Income Quintile				
	Lowest	Second	Middle	Fourth	Highest
Annual Cost Increase in 2006 Dollars	680	880	1,160	1,500	2,180
Annual Cost Increase as a Percentage of Income <sup>a</sup>	3.3	2.9	2.8	2.7	1.7

Source: Congressional Budget Office, *Who Gains and Who Pays Under Carbon-Allowance Trading? The Distributional Effects of Alternative Policy Designs* (June 2000).

Notes: These numbers do not reflect any of the benefits from reducing climate change.

The policy examined here is a cap-and-trade program designed to lower U.S. carbon dioxide (CO<sub>2</sub>) emissions by 15 percent from 1998 levels. (CBO performed the analysis in 2000 and used 1998 emission levels so that the distributional effects could be based on actual, rather than projected, data on consumer spending and taxes.) CBO assumed that the full cost of cutting emissions would be passed along to consumers in the form of higher prices and that the price increase for a given product would be proportional to the amount of CO<sub>2</sub> emitted from the fossil fuels used in its production.

These numbers reflect data on each quintile's cash consumption and estimates of cash income. (A quintile contains one-fifth of U.S. households arrayed by income.) Because of data limitations, the numbers should be viewed as illustrative and broadly supportive of the conclusions in this analysis rather than as precise estimates.

a. The cost increases are equivalent to percentage declines in households' after-tax income.

The higher prices that would result from a cap on CO<sub>2</sub> emissions would reduce demand for energy and energy-intensive goods and services. Thus, those price increases would create losses for some current investors and workers in the sectors that produce such goods and services. Investors could see their stock values decline, and workers could face the risk of unemployment as jobs in those sectors were cut. Stock losses would tend to be widely dispersed among investors, because shareholders typically have diversified portfolios. In contrast, the costs borne by existing workers would probably be concentrated among relatively few households and, by extension, their communities.

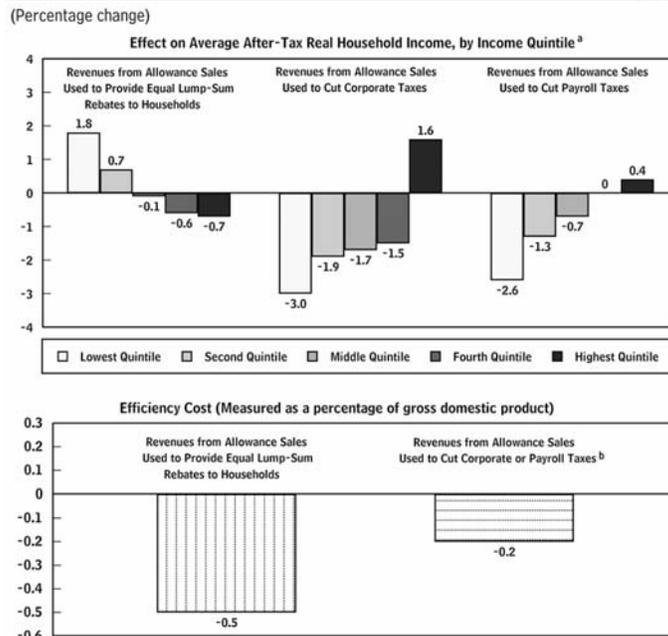
#### POLICYMAKERS WOULD DETERMINE WHO RECEIVED THE VALUE OF THE ALLOWANCES

Although the price increases triggered by a cap-and-trade program for CO<sub>2</sub> emissions would be regressive, the policy's ultimate distributional effect would depend on policymakers' decisions about how to allocate the emission allowances. As noted above, those allowances would be worth tens or hundreds of billions of dollars per year. Who received that value would depend on how the allowances were distributed.

Lawmakers could more than offset the price increases experienced by low-income households or the costs imposed on workers in particular sectors by providing for the sale of some or all of the allowances and using the revenue to pay compensation. For example, CBO examined the ultimate distributional effects of a cap-and-trade program that would reduce U.S. CO<sub>2</sub> emissions by 15 percent and concluded that

lower-income households could be better off (even without including any benefits from reducing climate change) as a result of the policy if the government chose to sell the allowances and used the revenue to pay an equal lump-sum rebate to every household in the United States. In that case, the size of the rebate would be larger than the average increase in low-income households' spending on energy and energy-intensive goods.<sup>8</sup> Such a strategy would increase average income for households in the lowest income quintile by 1.8 percent (see the top panel of Figure 1). At the same time, average income for households in the top quintile would fall by 0.7 percent, CBO estimates.

**Figure 1.**  
**Effects of a 15 Percent Cut in CO<sub>2</sub> Emissions, with Allowances Sold and the Revenues Used in Various Ways**



Sources: Congressional Budget Office (top panel); Terry M. Dinan and Diane Lim Rogers (bottom panel), "Distributional Effects of Carbon Allowance Trading: How Government Decisions Determine Winners and Losers," *National Tax Journal*, vol. 55, no. 2 (June 2002).

Notes: These figures do not reflect any of the benefits from reducing climate change.

The policy examined here is a cap-and-trade program designed to reduce carbon dioxide (CO<sub>2</sub>) emissions by 15 percent from 1998 levels. (CBO performed the analysis in 2000 and used 1998 emission levels so the distributional effects could be based on actual, rather than projected, data on consumer spending and taxes.) In the top panel, the costs of the cap-and-trade policy are shown as decreases in real household income, measured as a percentage of after-tax income before the policy change. Those numbers reflect data on each quintile's cash consumption and estimates of cash income. (A quintile contains one-fifth of U.S. households arrayed by income.) Because of data limitations, those numbers should be viewed as illustrative and broadly supportive of the conclusions in this analysis rather than as precise estimates.

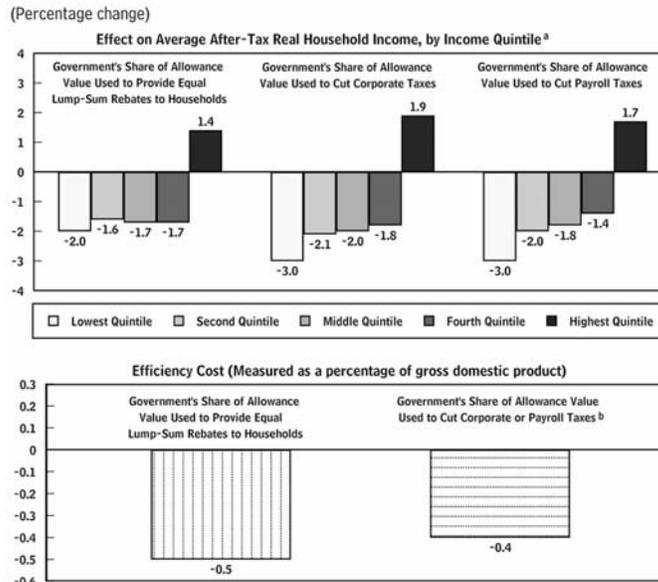
- a. Indicates the net effect of households' increased expenditures because of cap-induced price increases and the income that households would receive as a result of the allowance-allocation strategy.
- b. This estimate by Dinan and Rogers does not distinguish between the gains in economic efficiency associated with reducing corporate taxes and the gains associated with reducing payroll taxes. It implicitly assumes that capital and labor respond similarly to changes in the taxes on them and that increases in marginal tax rates on capital and labor have similar effects on economic efficiency. That assumption differs from the assumptions that CBO typically uses in analyzing the effects of policy changes on the economy.

Conversely, giving all or most of the allowances to energy producers to offset the potential losses of investors in those industries—as was done in the cap-and-trade program for sulfur dioxide emissions—would exacerbate the regressivity of the price

increases. On average, the value of the CO<sub>2</sub> allowances that producers would receive would more than compensate them for any decline in profits caused by a drop in the demand for energy and energy-intensive goods and services that cause emissions. As a result, the companies that received allowances could experience “windfall” profits, with the government regaining only part of that windfall through corporate income taxes. For example, one study suggested that if emissions were reduced by 23 percent and all of the allowances were distributed for free to producers in the oil, natural gas, and coal sectors, stock values would double for oil and gas producers and increase more than sevenfold for coal producers, compared with projected values in the absence of a cap.<sup>9</sup> If emissions were instead reduced by 15 percent, as in the scenario discussed above, profits in those sectors would rise several fold. For example, in 2000, CBO examined the effects of reducing emissions from 1998 levels and estimated that under a 15 percent cut, the value of allowances would be 10 times as large as coal, oil, and natural gas producers’ combined profits in 1998 and more than double their profits in 2006.<sup>10</sup> Because the additional profits would not depend on how much a company produced, they would be unlikely to prevent the declines in production and resulting job losses that would stem from the price increases.

In addition, those profits would accrue to shareholders, who are primarily from higher-income households, and would more than offset those households’ increased spending on energy and energy-intensive goods and services. Low-income households, by contrast, would benefit little if allowances were given to energy producers for free, and they would still bear a disproportionate burden from price increases. Thus, giving away allowances would be significantly regressive, making higher-income households better off as a result of the cap-and-trade policy while making lower-income households worse off (see the top panel of Figure 2, which, like Table 1 and Figure 1, does not incorporate the benefits of reducing climate change). That regressive outcome could occur even if the government used its share of the allowance value—received through corporate income taxes on the windfall profits—to provide lump-sum rebates to households.

**Figure 2.**  
**Effects of a 15 Percent Cut in CO<sub>2</sub> Emissions, with Allowances Given Away and the Government's Share of Their Value Used in Various Ways**



Sources: Congressional Budget Office (top panel); Terry M. Dinan and Diane Lim Rogers (bottom panel), "Distributional Effects of Carbon Allowance Trading: How Government Decisions Determine Winners and Losers," *National Tax Journal*, vol. 55, no. 2 (June 2002).

Notes: These figures do not reflect any of the benefits from reducing climate change.

The policy examined here is a cap-and-trade program designed to reduce carbon dioxide (CO<sub>2</sub>) emissions by 15 percent from 1998 levels. (CBO performed the analysis in 2000 and used 1998 emission levels so the distributional effects could be based on actual, rather than projected, data on consumer spending and taxes.) The government is assumed to distribute emission allowances for free but to regain some of their value by taxing the additional corporate profits resulting from free distribution. In the top panel, the costs of the cap-and-trade policy are shown as decreases in real household income, measured as a percentage of after-tax income before the policy change. Those numbers reflect data on each quintile's cash consumption and estimates of cash income. (A quintile contains one-fifth of U.S. households arrayed by income.) Because of data limitations, those numbers should be viewed as illustrative and broadly supportive of the conclusions in this analysis rather than as precise estimates.

- a. Indicates the net effect of households' increased expenditures because of cap-induced price increases and the income that households would receive as a result of the allowance-allocation strategy.
- b. This estimate by Dinan and Rogers does not distinguish between the gains in economic efficiency associated with reducing corporate taxes and the gains associated with reducing payroll taxes. It implicitly assumes that capital and labor respond similarly to changes in the taxes on them and that increases in marginal tax rates on capital and labor have similar effects on economic efficiency. That assumption differs from the assumptions that CBO typically uses in analyzing the effects of policy changes on the economy.

Giving away all of the allowances and using the government's regained share of their value to reduce corporate tax rates would be particularly regressive. In that scenario (once again not including any benefits from reducing climate change), average household income would fall by 3.0 percent in the lowest quintile and rise by 1.9 percent in the highest quintile. However, that approach would help lessen the macroeconomic cost of the cap on CO<sub>2</sub> emissions.

REDUCING THE OVERALL ECONOMIC IMPACT OF A CO<sub>2</sub> CAP

The ways in which lawmakers could allocate the revenue from selling emission allowances would affect not only the distributional consequences but also the total economic cost of a cap-and-trade policy. For instance, the government could use the revenue from auctioning allowances to reduce existing taxes that tend to dampen

economic activity—primarily, taxes on labor, capital, or personal income. Research indicates that a CO<sub>2</sub> cap would exacerbate the economic effects of such taxes: The higher prices caused by the cap would lower real (inflation-adjusted) wages and real returns on capital, which would be equivalent to raising marginal tax rates on those sources of income. Using the allowance value to reduce such taxes could help mitigate that adverse effect of the cap. Alternatively, policy-makers could choose to use the revenue from auctioning allowances to reduce the federal deficit. If that reduction lessened the need for future tax increases, the end result could be similar to dedicating the revenue to cutting existing taxes.

The decision about whether or not to sell the allowances and use the proceeds in ways that would benefit the economy could have a significant impact. For example, researchers estimate that the efficiency cost of a 15 percent cut in emissions could be reduced by more than half if the government sold allowances and used the revenue to lower corporate income taxes, rather than devoting it to providing lump-sum rebates to households (see the bottom panel of Figure 1). The efficiency cost of a policy reflects the economic losses that occur because prices in the economy are distorted in ways that do not reflect the (nonenvironmental) resources used in their production. That cost includes decreases in the productive use of labor and capital as well as costs (both monetary and nonmonetary) associated with reducing emissions. To provide perspective on the magnitude of such efficiency costs, they are depicted as a share of gross domestic product.

Giving the allowances away to producers, by contrast, would largely prevent the government from using the allowance value in ways that would lower the cap's total cost to the economy. For example, as indicated in the bottom panels of Figures 1 and 2, selling the allowances and using the revenue to reduce existing taxes that discourage economic activity would entail only about half the efficiency cost of giving the allowances away and devoting any revenue that the government regained (through the corporate income tax) to reducing those types of taxes.

#### THE FEDERAL BUDGETARY TREATMENT OF A CAP-AND-TRADE PROGRAM

The budgetary treatment of a federal cap-and-trade program for carbon dioxide is an important topic, although it has received little attention. Auctioning off allowances would clearly generate receipts for the federal government, and those amounts would be recorded as revenues or as offsetting receipts (reductions in outlays) in the federal budget. For example, if the government conducted an auction of cap-and-trade allowances and received \$100 for them, the \$100 would be recorded in the federal budget as a receipt.

The appropriate treatment of allowances issued at no charge is less clear, however. A solid case can be made that even allowances that are given away by the government should be reflected in the federal budgetary scoring process—specifically, the scoring should show, as both revenues and outlays, the value of any allowances distributed at no cost to the recipients. If the allowances given away by the government were worth \$100, the budgetary scoring process would record the \$100 as both a revenue and an outlay.<sup>11</sup> The net effect on the budget deficit or surplus would be zero, since the value of such allowances would increase revenues and outlays by the same amount.

Several considerations motivate that type of approach to scoring CO<sub>2</sub> allowances. The government is essential to the existence of the allowances and is responsible for their readily realizable monetary value through its enforcement of the cap on emissions. (The allowances would trade in a liquid secondary market, since firms or households could buy and sell them, and thus they would be similar to cash.) In addition, that type of scoring approach best illuminates the trade-offs between different policy choices. Distributing allowances at no charge to specific firms or individuals is, in effect, equivalent to collecting revenue from an auction of the allowances and then distributing the auction proceeds to those firms or individuals. In other words, the government could either raise \$100 by selling allowances and then give that amount in cash to particular businesses and individuals, or it could simply give \$100 worth of allowances to those businesses and individuals, who could immediately and easily transform the allowances into cash through the secondary market. Treating allowances that were issued at no charge as both a revenue and an outlay would mean that those two equivalent transactions were reflected in parallel ways in the scoring process.

A different perspective would suggest that issuing allowances at no charge should be viewed as a straightforward regulatory act, with no direct budgetary consequences. That perspective stresses that the federal budget is primarily a cash-based concept, and granting allowances at no cost involves no cash transaction between the government and the private sector. That approach would be the same as

the one now applied to the Environmental Protection Agency's issuance of emission allowances for sulfur dioxide.

As legislative proposals to create a cap-and-trade system for CO<sub>2</sub> emissions are introduced in coming months, CBO will evaluate those approaches to scoring such proposals.

#### ENDNOTES

<sup>1</sup>For more discussion of policy choices in the face of catastrophic costs, see Cass R. Sunstein, *Worst-Case Scenarios* (Cambridge, Mass.: Harvard University Press, 2007).

<sup>2</sup>Emissions could also be reduced to some extent through "carbon sequestration"—the capture and long-term storage of CO<sub>2</sub> emissions underground (geological sequestration) or in vegetation or soil (biological sequestration). For more information, see Congressional Budget Office, *The Potential for Carbon Sequestration in the United States* (September 2007).

<sup>3</sup>Although it is difficult to measure, the long-term cumulative nature of climate change implies that the benefit of emitting one less ton of CO<sub>2</sub> in a given year—referred to as the marginal benefit—is roughly constant. In other words, the benefit in terms of averted climate damage from each additional ton of emissions reduced is roughly the same as the benefit from the previous ton of emissions reduced, and shifting the reductions from one year to another does not materially affect the ultimate impact on the climate. In contrast, the cost of emitting one less ton of CO<sub>2</sub> in a given year—the marginal cost—tends to increase with successive emission reductions. The reason is that the least expensive reductions are made first and progressively more-expensive cuts would then have to be made to meet increasingly ambitious targets for emission reductions.

<sup>4</sup>See William A. Pizer, *Climate Change Catastrophes*, Discussion Paper 03-31 (Washington, D.C.: Resources for the Future, May 2003).

<sup>5</sup>Some analysts also suggest that a cap-and-trade program could be more politically acceptable than a tax because distributing the allowances for free could provide a method of directly compensating producers in the most affected industries. See Robert N. Stavins, *U.S. Cap-and-Trade System to Address Global Climate Change* (Washington, D.C.: Brookings Institution, October 2007). The revenues from a tax could be used in a similar fashion, however.

<sup>6</sup>For information about carbon sequestration, see footnote 2.

<sup>7</sup>Those calculations are based on cash income, which excludes in-kind transfers and accrued but still unrealized income. CBO could have presented results based on alternative measures of income, such as adjusted family income, which adjusts for family size. Using that measure would alter the quantitative results slightly but would not affect the conclusions of the analysis in any qualitative way. The numbers are based on an analysis that CBO conducted using 1998 data; see Congressional Budget Office, *Who Gains and Who Pays Under Carbon Allowance Trading? The Distributional Effects of Alternative Policy Designs* (June 2000). In an updated analysis, the qualitative findings would be unlikely to change, but the quantitative results could be significantly different because of various factors, including changes in the distribution of income and in marginal tax rates.

<sup>8</sup>One researcher has suggested that an environmental tax credit based on earnings could offer another means of reducing the regressive effects of the price increases that would result from a tax or cap on CO<sub>2</sub> emissions. See Gilbert E. Metcalf, *A Proposal for a U.S. Carbon Tax Swap* (Washington, D.C.: Brookings Institution, October 2007).

<sup>9</sup>Lawrence H. Goulder, *Mitigating the Adverse Impacts of CO<sub>2</sub> Abatement Policies on Energy-Intensive Industries*, Discussion Paper 02-22 (Washington, D.C.: Resources for the Future, March 2002), Table 3.

<sup>10</sup>Specifically, CBO estimated that the value of those allowances would total \$155 billion (in 2006 dollars). By comparison, profits for U.S. producers of oil, natural gas, and coal totaled \$13.5 billion in 1998 (in 2006 dollars). Those companies' total profits were substantially higher in 2006: \$174 billion.

<sup>11</sup>The value of allowances that were given away could be estimated either from the prices of any allowances that were auctioned or from the prices at which allowances were subsequently bought and sold by firms.

Chairman SPRATT. Let me add to the housekeeping details, previously the typical stipulation that all of your statements will be made part of the record so that you can summarize them as you see fit.

Now we will go next to Mr. Doniger.

#### **STATEMENT OF DAVID DONIGER, CLIMATE CENTER POLICY DIRECTOR, NATURAL RESOURCES DEFENSE COUNCIL**

Mr. DONIGER. I thank you very much, Mr. Chairman and Mr. Ryan, for the opportunity to testify. I am David Doniger. I am the Policy Director of the Climate Center at the Natural Resources Defense Council. I am here on behalf of our 1.2 million members and supporters across the country.

A discussion about global warming, in my view, needs to start very briefly with some words on the urgency. And I wonder if I could have the slide shown.

[Slide.]

Mr. DONIGER. We are already suffering dangerous impacts from global warming. We used to think it was off in the future. It is upon us now. There is a strong consensus in the Intergovernmental Panel on Climate Change, that won a Nobel prize recently, that global warming is occurring, it is human-caused, it is within our power to control. The picture here shows the loss of Arctic ice at the summertime minimum since 1979. Forty percent of the Arctic ice has melted away this past year in comparison with 1979.

As Peter mentioned, we have the danger that the Greenland ice sheet and the Antarctic ice sheet would melt, triggering over a longer period very, very large sea level rises, 21 feet from either one of those melting.

We have the expectation of more wildfires like the ones that have been suffered in California. I am not here to say whether that was or was not definitively caused by global warming, but it is of the kind that we will see more of, because there will be stronger droughts occurring as a result of global warming. There will also be stronger hurricanes like of the kind we saw hit New Orleans in Hurricane Katrina. The Centers for Disease Control, when it isn't being censored, acknowledges that there are public health impacts.

I would point out as well that apart from the warming impact, the oceans are soaking up a great deal of carbon dioxide. This is increasing the acidity of the oceans. And scientists are now predicting that coral and shellfish may lose the ability to lay down shells as a result of the changing acidity of the oceans.

In our view, we need to hold the future temperature increase—we have already had about a degree Fahrenheit already occur this past century—we need to hold the future increase under two degrees more Fahrenheit in order to avoid the worst effects of global warming. And this will take a declining cap on the emissions imposed here in the U.S. by our industrial partners, and eventually as well by developing countries.

In the U.S. we need a cap that would be reducing emissions by 2020 on the order of 15 percent, and on the order of 80 percent by 2050. That is the sort of specifications that Mr. Dingell—at least at the strong end of the range that he is talking about. There is a bill approaching that that was just marked up by Senators Lieberman and Warner in the subcommittee in the Senate this morning.

My next point is that we can afford this, but it gets much harder if we delay. If I could have the second slide.

[Slide.]

Mr. DONIGER. The first point I would make before really referring to that slide is that estimates of the cost of these kinds of programs show that the actual effect on a growing gross domestic product is quite minimal.

I will submit a study for the record that was just done by the Duke University Nicholas Institute that shows that by 2030 if we don't have a program, we will have GDP growth on the order of 112 percent. If we do have a declining cap like the Lieberman and

Warner proposal, the growth would be 111.5 percent. And by 2050, 238 percent growth expected. If you have a climate change program that might be 236.5 percent. Very small differences in our growth. But the longer we wait—and this is what this slide illustrates—the harder it is to meet these kinds of targets. Because you ramp-up the emissions to a higher point, and that means the ramp-down has to be much steeper in a shorter period of time. So a slow start means a crash finish.

And that is why we think it is so important for Congress to act to pass this kind of legislation without further delay. A cap-and-trade program with complementary policies such as performance standards for efficiency and incentives to help achieve these standards and move new technologies is, we believe, the most efficient and effective way to meet carbon limits needed to curb this kind of serious impact. And I believe there are tools to smooth out the costs, to control the costs, such as banking and borrowing which Dr. Orszag mentioned.

We are, however, opposed to including a safety valve. The fundamental problem with a safety valve, as that term has come to be used, is that it breaks the cap. You just keep bringing more allowances, and we don't achieve the environmental protection objectives that are needed.

One or two other points. The key thing is to look at these allowances, as Dr. Orszag has said, as a public asset, something that should be used for public purposes. Those can include promoting new technologies such as renewable energy and a faster deployment of efficiency, technologies to promote the faster takeup of carbon capture and storage by coal-burning facilities, to retool Detroit to help make vehicles that fit the profile we need for a carbon-constrained world, to have greener buildings and lower energy-consuming appliances, and to rebuild electricity companies' demand-side management programs to reduce energy. These are some of the technology-oriented uses that can be made of the value of the allowances.

There is another dimension which I know Bob Greenstein will talk about in greater detail, but with our full support, that one needs to use a very large, probably the largest part of the value of these allowances to protect low- and moderate-income people who will be seeing the cost increases associated with the cap.

There are vulnerable workers and communities in certain other industries which deserve to have some assistance. There is a need for spending to protect and restore ecosystems on land and in other coastal and ocean resources.

My last point is, though, I would urge a distinction between ends and means, between the public purpose of the allowances and the tool of auctions. Auctions is a very good tool, but not the only tool available to achieve the public purposes that I have been describing. Some of these purposes can be achieved by having allowances go by formula towards certain objectives.

For example, the Tax Code already includes production tax credits for wind energy, for example. That can also be funded, or similar things can be funded with a production allowance credit. Perhaps a certain number of allowances go to a coal-burning utility that stores the carbon safely geologically underground. A certain

number of allowances would go to the makers of super-efficient vehicles or super-efficient appliances. These can be done by formula. They can also be done by raising the money through an auction and spending the money out by spending formulas.

The key thing in using all these tools is the need for stability, for dedicated resources that are stably allocated for multiple years; because the investors, the marketplace, needs to have clarity not only coming from the cap, but clarity about how the allowances are going to be allocated so that smart investment decisions can be made.

And to go back to the production tax credit example for a moment, the wind energy industry has suffered because the tax credit in that instance has come on again and off again several times. So you have booms and busts which are triggered by the presence or absence of that tax credit. Stability is important. And in that sense, direct allocation, directed spending, tax incentives on a multiyear basis are, in our view, preferred over using the annual appropriations process to achieve these purposes.

I would be happy to answer questions. Thank you.

Chairman SPRATT. Thank you, Mr. Doniger.

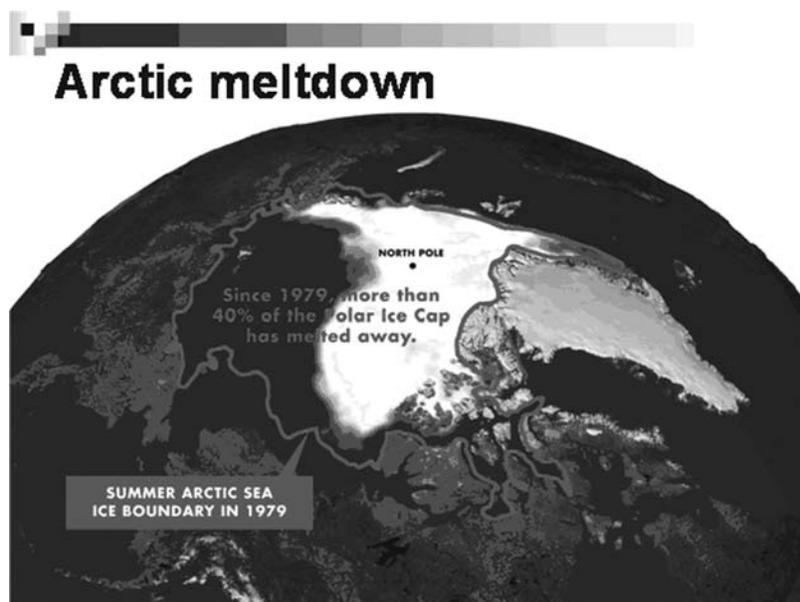
[The prepared statement of David Doniger follows:]

PREPARED STATEMENT OF DAVID DONIGER, CLIMATE CENTER POLICY DIRECTOR,  
NATURAL RESOURCES DEFENSE COUNCIL

Thank you for the opportunity to testify today regarding the impacts of global warming legislation on the federal budget and the U.S. economy. My name is David Doniger. I am policy director of the Climate Center at the Natural Resources Defense Council (NRDC). NRDC is a national, nonprofit organization of scientists, lawyers and environmental specialists dedicated to protecting public health and the environment. Founded in 1970, NRDC has more than 1.2 million members and online activists nationwide, served from offices in New York, Washington, Los Angeles and San Francisco, Chicago and Beijing.

Our discussion of the impacts of global warming legislation must begin with a reminder of why this legislation is so badly needed. Action to curb the pollution that is driving global warming has already been delayed too long. Every day we learn more about the ways in which global warming is already damaging our planet and its ability to sustain us. As described in a full page story in the October 22nd Washington Post, dramatic new satellite pictures show that summertime arctic ice has declined by 40 percent since 1979 (Figure 1). The UN Intergovernmental Panel on Climate Change found that 11 of the past 12 years are among the 12 hottest years on record. The Greenland and West Antarctic ice sheets are losing mass at accelerating rates. Rising sea surface temperatures correlate strongly with increases in the number of Category 4 and 5 hurricanes like Hurricane Katrina that devastated New Orleans. More wildfires like the disaster that just hit California, more heat waves, and more droughts and floods are predicted to occur as global warming continues unabated. Our own Centers for Disease Control—when not censored by the White House—calls global warming a threat to public health. Our oceans are warming and becoming more acidic, threatening the survival of corals and shellfish. Everywhere one looks, the impacts of a disrupted climate are confronting us.

FIGURE 1



The reality of global warming is now a recognized fact throughout the world. Earlier this year, the United Nations Intergovernmental Panel on Climate Change (IPCC) concluded that warming of the earth is “unequivocal” and that with 90 percent certainty, humans are causing most of the observed warming. At about the same time, major businesses, including many of the world’s largest companies in diverse industry sectors, banded together with environmental organizations, including NRDC, under the umbrella of the U.S. Climate Action Partnership (USCAP) to call for mandatory legislation that would reduce emissions by 60-80 percent by 2050. In April, the United States Supreme Court ruled that greenhouse gases are air pollutants subject to control under the Clean Air Act.

In the past year, stories about global warming have appeared on the covers of Time, Newsweek and Sports Illustrated. And recent polls show very high levels of concern about global warming. For instance, a recent opinion poll conducted by the Yale University Climate Center indicates that 62 percent of Americans believe that life on earth will continue without major disruptions, only if society takes immediate and drastic action to reduce global warming. Finally, just this month, the Nobel Peace Prize was awarded jointly to Al Gore and to the IPCC for their work on global warming. Global warming has come of age as an issue of supreme importance.

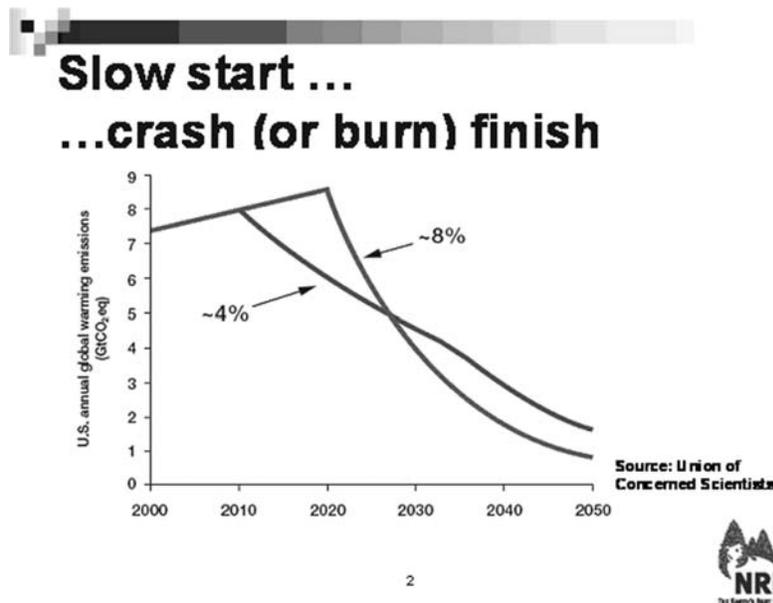
Climate scientists now warn that we must act now to begin making serious emission reductions if we are to avoid truly dangerous global warming pollution concentrations. Because carbon dioxide and some other global warming pollutants remain in the atmosphere for many decades, centuries, or even longer, the climate change impacts from pollution released today will continue throughout the 21st century and beyond. Failure to pursue significant reductions in global warming pollution now will make the job much harder in the future—both the job of stabilizing atmospheric pollution concentrations and the job of avoiding the worst impacts of a climate gone haywire.

Since the start of the industrial revolution, carbon dioxide concentrations have risen from about 280 parts per million (ppm) to more than 380 ppm today, and global average temperatures have risen by more than one degree Fahrenheit over the last century. A growing body of scientific opinion has formed that we face extreme dangers if global average temperatures are allowed to increase by more than another 2 degrees Fahrenheit from today’s levels. We may be able to stay within this envelope if atmospheric concentrations of CO<sub>2</sub> and other global warming gases are kept from exceeding 450 ppm CO<sub>2</sub>-equivalent and then rapidly reduced. However,

this will require us to halt U.S. emissions growth within the next few years and then cut emissions by approximately 80% over the next 50 years.

This goal is ambitious, but achievable. It can be done through an annual rate of emissions reductions that ramps up to about a 4% reduction per year. (See Figure 2.) But if we delay and emissions continue to grow at or near the business-as-usual trajectory for another 10 years, the job will become much harder. In such a case, the annual emission reduction rate needed to stay on the 450 ppm path would double to 8% per year. In short, a slow start means a crash finish, with steeper and more disruptive cuts in emissions required for each year of delay.

FIGURE 2



It is critical to recognize that continued investments in old technology will “lock in” high carbon emissions for many decades to come. This is particularly so for the next generation of coal-fired power plants. Power plant investments are large and long-lasting. A single plant costs around \$2 billion and will operate for 60 years or more. If we decide to do it, the United States and other nations could build and operate new coal plants that return their CO<sub>2</sub> to the ground instead of polluting the atmosphere. With every month of delay we lose a piece of that opportunity and commit ourselves to 60 years of emissions. The International Energy Agency (IEA) forecasts that more than 20 trillion dollars will be spent globally on new energy technologies between now and 2030. How this money is invested over the next decade, and whether we will have the proper policies in place to drive investment into cleaner technologies, which can produce energy from zero and low carbon sources, or that can capture and dispose of carbon emissions, will determine whether we can realistically avoid the worst effects of global warming.

We have the solutions—cleaner energy sources, new vehicle technologies and industrial processes and enhanced energy efficiency. We just lack the policy framework to push business investments in the right direction and to get these solutions in the hands of consumers.

Congress is beginning to respond. Many bills to cap and reduce global warming pollution have been introduced in the House and Senate this year. The strongest of these bills—H.R. 1590, sponsored by Rep. Henry Waxman and a bipartisan group of 142 other members, and S. 309, co-sponsored by Senators Bernie Sanders and Barbara Boxer and 19 other members—would reduce U.S. emissions 80 percent by 2050. The committees of jurisdiction are also working hard on serious legislation. In the Senate, the Environment and Public Works Committee is taking up the bipartisan America’s Climate Security Act, S. 2191, co-sponsored by Senators Joseph Lieberman and John Warner, a cap-and-trade bill that would cut the global warm-

ing pollution from three key sectors—electric power, transportation, and industry—15 percent by 2020 and 70 percent by 2050, with additional policies to reduce emissions from other sources. Here in the House, Energy and Commerce Chairman John Dingell and Subcommittee Chairman Rick Boucher have started the legislative process by circulating a white paper on the scope of a cap-and-trade program to reduce U.S. global warming pollution 60-80 percent by 2050.<sup>1</sup>

NRDC believes a declining emissions cap and an emissions allowance trading system—combined with complementary policies such as performance and efficiency standards and incentives for new power plants, vehicles, appliances, buildings, and renewable sources of electricity and motor fuel—is the most environmentally effective and economically efficient approach to curbing global warming pollution. (I would note that a final energy bill containing the best of the House and Senate provisions would enact some of the most important of these performance and efficiency standards, including the House’s renewable electricity standard and the Senate’s CAFE standard, and would be a down-payment on global warming.)

Under a cap-and-trade system, Congress creates a limited number of emissions “allowances” in an amount equal to the intended emissions cap. The cap, and the number of allowances, declines each year. Each entity that Congress designates—for example, power plants, oil refiners, major industries—must acquire and then turn in one allowance for each ton of CO<sub>2</sub> (or the equivalent amount of another greenhouse gas) that it emits, or that will be emitted when its products (like gasoline or refrigerants) are burned or released to the atmosphere. Tradable allowances can also be bought or sold. A cap-and-trade system thereby harnesses the marketplace to achieve the necessary pollution reductions and meet the cap at the lowest cost. Firms with low pollution control costs will make the most reductions, and firms with highest costs will make the least.

Analyzing a predecessor to the Lieberman-Warner bill, the Environmental Protection Agency found that reducing global warming pollution will have an imperceptible affect on economic output overall. If that bill were enacted, EPA found consumption of goods and services by U.S. households would increase 103% between 2005 and 2030, which is virtually indistinguishable from the 105% increase projected without the legislation.<sup>2</sup> Household consumption, of course, is not the same as welfare. It does not include the value we place on reducing the risk of catastrophic storms, preserving our favorite beaches and alpine meadows, and preventing polar bears and countless other species from being driven to extinction.

Some have expressed the view that even these modest costs are too high, and that legislation should include a feature—often called a “safety-valve”—to artificially limit the operation of the marketplace. The fundamental problem with the safety valve is that it breaks the cap without ever making up for the excess emissions. Simply put, the cap doesn’t decline as needed or, worse, keeps growing. In addition to breaking the U.S. cap, a safety valve also would prevent U.S. participation in international trading systems. If trading were allowed between the U.S. and other capped nations, a major distortion would occur. Firms in other countries (acting directly or through brokers) would seek to purchase the artificially lower-priced U.S. allowances. Their demand would almost immediately drive the U.S. allowance price to the safety valve level, triggering the “printing” of more American allowances. The net result would be to flood the world market with far more allowances—and far less emission reduction—than anticipated.

Although NRDC believes that the primary and most effective cost containment device in any mandatory legislation will be the cap-and-trade system itself, NRDC also supports other means of providing flexibility. Banking has long been a feature of cap and trade systems. We also support provisions allowing firms to borrow allowances with appropriate interest and payback guarantees. Banking and borrowing can smooth out unpredictable year-to-year volatility.

As members of this committee are aware, one must pay close attention to the equity of major national policies, as well as their efficiency. In this regard, a cap-and-trade system requires careful attention to how the emissions allowances are allocated, and for what purposes. Even though the overall economic cost of curbing global warming will be modest, the value of the pollution allowances created by a cap-and-trade law will be much higher: The best estimates of their value lie between \$50 billion and \$100 billion per year.

NRDC believes these pollution allowances are a public trust and a public asset. They represent permission to use the atmosphere, which belongs to all of us, to dispose of global warming pollution. As such, they are not a private resource owned

<sup>1</sup> <http://energycommerce.house.gov/Climate—Change/White—Paper.100307.pdf>

<sup>2</sup> EPA, Analysis of The Climate Stewardship and Innovation Act of 2007, S. 280 in 110th Congress, July 16, 2007, <http://www.epa.gov/climatechange/downloads/s280fullbrief.pdf>

by historical emitters and such emitters do not have a permanent right to free allowances. The value of the allowances should be used for public purposes, including promoting clean energy solutions, protecting the poor and other consumers, ensuring a just transition for workers in affected industries, and preventing human and ecosystem impacts both here and abroad, especially where they can lead to conflicts and threats to security.

If one looks back over the past few years of debate over global warming legislation, one can see a marked shift in thinking about allowance allocation. Five years ago, the common assumption was that all of the emissions allowances should simply be given away—grandfathered—to historical polluters. This is what was done with the much smaller pool of allowances for sulfur dioxide in the 1990 Clean Air Act amendments which established the cap-and-trade program to curb acid rain. The acid rain program has been extremely successful at meeting its environmental target at much lower cost than predicted. But the grandfathering approach to allowance allocation chosen in 1990 is not appropriate for a global warming program adopted now.

Economic studies have established that in the case of global warming, 100 percent grandfathering would result in vastly enriching the regulated entities. The Congressional Budget Office has summarized this literature as follows:

Researchers generally conclude that less than 15 percent of the allowance value would be necessary to offset net losses in stock values in both “upstream” industries (such as suppliers of coal, natural gas, and petroleum) and energy-intensive “downstream” industries (such as electricity generators, petroleum refiners, and metal and machinery manufacturers). The reason is that the cost of holding the allowances would generally be reflected in the prices that producers charged, regardless of whether those producers had to buy the allowances or were given them for free.<sup>3</sup>

It follows that if more than about 15 percent of the allowances are given away to polluters for free, there will be a large transfer of wealth to them at the expense of consumers. And as CBO further found the impact would be disproportionate for poor consumers, who have the least income and who must devote a larger percentage of their income than others for energy-related costs.

These insights have been borne out in real experience. The European Union deserves great credit for moving forward with a cap-and-trade program for a large fraction of their emissions in 2005, even before their obligations under the Kyoto Protocol take effect in 2008. But they have made some start-up mistakes—an experience they are learning from and we should too. Specifically, they grandfathered 100 percent of their allowances to electric power companies. Predictably, the electric companies raised electricity prices to reflect the value of those allowances, even though they received the allowances for free. From these price increases the firms reaped several billion dollars in windfall profits.

In the other direction, a group of U.S. states in the northeast have established the “Regional Greenhouse Gas Initiative,” a cap-and-trade program for electric power in that region. All of these states so far have chosen to auction their allowances and use them for promoting energy efficiency and other public purposes. For example, Governor Spitzer announced last week that New York will auction 100 percent of its CO<sub>2</sub> allowances and use the proceeds from the auction to fund energy efficiency programs and renewable energy projects.

As a result of these insights and experiences, there is more and more acceptance that the bulk of the allowances must go to public purposes, not private enrichment. Still, the battle is not yet entirely won. In this body, there are some who still speak of grandfathering nearly all of the allowances. And in the Senate, while the Lieberman-Warner bill eventually devotes most allowances to a variety of public purposes—promoting clean energy solutions, protecting the poor and other consumers, ensuring a just transition for workers in affected industries, and preventing human and ecosystem impacts both here and abroad, especially where they can lead to conflicts and threats to security—it still grandfathers too many allowances to power companies and industries at the outset and takes too long to phase out that grandfathering. We are working cooperatively with the sponsors and others to improve their bill.

Note that in this discussion I generally have said “public purposes” rather than “auction.” I put it this way in order to focus on the ends before the means. It is possible to directly and efficiently allocate allowances to achieve many of the public purposes to which they should be put. Here are some examples found in bills introduced either in this or prior Congresses:

<sup>3</sup> CBO, Trade-Offs in Allocating Allowances for CO<sub>2</sub> Emission, April 25, 2007, p.5, <http://www.cbo.gov/ftpdocs/80xx/doc8027/04-25-Cap—Trade.pdf>

- Promoting renewable energy: Congress could write legislation that includes an appropriate formula for allocating bonus allowances to firms that produce electricity from wind or other renewables. The recipient would sell the allowances into the marketplace to realize their value. The incentive would function just like the current production tax credit for wind: the developer of a new wind farm would receive incentive revenue in proportion to its electricity output.
- Encouraging Carbon Capture and Storage: Congress could include a bonus allowance formula to encourage power companies to adopt carbon capture and storage technology. As above, the power company would receive incentive revenue from selling the allowances in the marketplace.
- Retooling the Auto Industry: To help domestic automakers retool and reposition for a changing market, Congress could establish an allowance allocation formula that functioned like a consumer rebate to encourage the purchase of low-emitting vehicles.
- Greening Buildings, Equipment, and Appliances: Likewise, allowance formulae could be written to promote faster deployment of highly energy-efficient appliances and construction of highly energy-efficient buildings.
- Demand-Side Management and Climate Rebates: Allowances also could be allocated to local electric and gas distribution utilities on condition that the proceeds from selling them into the marketplace are used to fund energy efficiency and rebate programs for their consumers.

These same objectives could be achieved, of course, by auctioning the allowances and using the revenue to support tax credits, directed spending, or appropriations aimed at the same results. Direct allocation of allowances for these public purposes, however, has the advantage that it can be accomplished in a single piece of legislation. It can also create incentives that planners and investors will see as stable and predictable over multi-year periods. To achieve the same degree of stability and effectiveness through an auction approach, it would be critical to put the allowance revenue into a dedicated trust fund mechanism that is sheltered from the uncertainties introduced by annual appropriations.

There are some public purposes, however, that can be more effectively and efficiently pursued through such measures as tax credits or programs administered by federal or state agencies. For example, as Robert Greenstein of the Center on Budget and Policy Priorities will elaborate, in order to protect low-income consumers from a disproportionate distributional impact, the most effective and efficient approach may be a combination of (1) raising the Earned Income Tax Credit, and (2) delivering climate rebates through the electronic benefits card already used to deliver benefits to poor Americans. Likewise, an efficient way to deliver a climate rebate to moderate-income consumers would be through an increase in the standard deduction for income taxes.

Another example of an important public purpose is transition assistance for workers and communities that otherwise would be disproportionately affected by a climate program. Assistance programs provided through government agencies could be funded by statutorily directing a certain percentage of auction revenues.

Likewise, programs to protect our nation's health and our land and ocean resources, which are already suffering serious global warming impacts, could be funded with auction revenues. Indeed, a dedicated trust fund for the protection of ocean resources was a recommendation of the non partisan Pew Oceans Commission in 2003.<sup>4</sup>

Whether the means to achieve these public purposes is direct allowance allocation or the use of auction revenues, it is important to put things on a stable footing. Allocation formulae, tax credits, and dedicated funding can provide such stability. These are preferable to year-to-year appropriations, which introduce more uncertainty. Whether one is thinking of technology investors or low-income beneficiaries, there is significant value in establishing stable and predictable incentives and benefits.

Finally, while the resources that can be made available in a cap-and-trade program to fight global warming may seem significant, so are the public needs associated with the program—promoting new technology, protecting low- and moderate-income citizens, providing transition assistance for workers and communities, and addressing both domestic and international adaptation needs. Therefore, regardless of other chronic budget needs that could make a claim to these resources, it is critically important given the magnitude of the threat from global warming that the top priority for their use be the success of this program.

Let me briefly mention a couple of additional issues in designing a national cap-and-trade system. Some contend we should do nothing until China and India agree to act. To the contrary, the best way to bring China and India on board is to take

<sup>4</sup><http://www.pewtrusts.org/our-work.aspx?category=130>.

leadership. We are the world's most powerful economy. We are responsible for more of the global warming pollution now in the atmosphere than any other country. We have the most technological know-how. The best way to get global action is to start acting at home, and to negotiate reciprocal action from other countries.

We've done this before. Twenty years ago, in 1987, industrial nations took the lead in a binding treaty to phase-out ozone-depleting CFCs. In just three years, in 1990, developing countries came on board. Led by China and India, they accepted binding limits on their own CFC production. Since then we've marched together—developed and developing—ever since, and have already eliminated 95 percent of the ozone-depleting chemicals. Just this past September, China and India agree to a new round of mandatory cuts in ozone-depleting chemicals. What's missing on global warming is our leadership. We are the only major industrial country that has refused to limit its own emissions. It's time to act.

At the same time, Congress can design legislation to encourage other nations to join in action to reduce greenhouse gas emissions, and to protect American businesses and workers from unfair competition if specific nations decline to cooperate. Under a proposal advanced by American Electric Power and the International Brotherhood of Electrical Workers, the United States legislation would instruct the President to negotiate for "comparable" emissions reductions from other emitting countries within 8 years of enactment. Countries failing to make such commitments would be required to submit greenhouse gas allowances for certain carbon intensive products. NRDC supports this provision, while bearing in mind that the U.S., as the world's greatest contributor to the burden of global warming pollution already in the atmosphere, needs to show leadership in meeting the global warming challenge.

Thank you for the opportunity to testify and I would be pleased to answer any questions that you may have.

Chairman SPRATT. And now Bob Greenstein.

**STATEMENT OF ROBERT GREENSTEIN, EXECUTIVE  
DIRECTOR, CENTER ON BUDGET AND POLICY PRIORITIES**

Mr. GREENSTEIN. Thank you, Mr. Chairman. My focus will be on the potential effects of climate change legislation on the Federal budget and the budgets of American families, especially those of modest means.

Our analysis indicates that Congress can develop climate change policy that is environmentally sound, fiscally responsible, and that treats low-income families equitably. But to do so, the policy has to be well designed. Our analysis of these issues is summed up, to a significant degree, in four sets of numbers that I would now like to discuss. The first number is \$750 to \$950 a year. That is the average increase in energy-related costs for households in the poorest fifth of the population from a relatively modest reduction, 15 percent, in emissions.

As Dr. Orszag noted, effective policies to reduce emissions work in part by raising prices for fossil fuel energy products. And that will raise prices to consumers for a wide array of items from heating fuel, to gasoline, electricity, food, mass transit, and various other products and services with energy inputs.

As Dr. Orszag also noted, households—and I think Mr. Ryan also noted—households with limited incomes will be affected the most since they spend a larger share of their incomes on energy-related products than more affluent households do. And it should be noted that lower-income households also have less ability to afford investments that can reduce their energy consumption, like buying a new, more fuel-efficient car or replacing your heating and cooling system with a new one.

This means that if climate change legislation is passed but nothing is done to protect people of modest means, many of them will slip into poverty. Those who are poor will become poorer, and the

trend towards widening income inequality will be aggravated: \$750 to \$950 a year is a particularly large number when you reflect on the fact that the average income of households in the bottom fifth of the population is a little more than \$13,000 a year.

Figure number two you have already heard from Peter Orszag, \$50 billion to \$300 billion a year, which is the Congressional Budget Office's estimate of the resources potentially generated by climate change policies that could be used to assist low-income consumers and address a range of other climate change-related needs. In other words, this would be the amount that would be raised if the government auctioned off permits under a cap-and-trade system, because it is the expected value of the permits that would be created.

Figure number three is approximately 14 percent. This is the share of the auction proceeds that we estimated would be needed to fully offset the increased energy costs faced by low-income consumers and provide some relief to moderate-income consumers as well.

In my written testimony I set forth a series of principles—we elaborate on them more in our paper that is on our Web site—for how to effectively and efficiently, without new bureaucracies or big administrative costs, provide this kind of relief so that we would fully offset the impact on the poorest 20 percent of people and provide some relief to many hard-pressed families in the next 20 percent as well. We estimate that that could be done with 14 percent, that is one-seventh of the resources that would be generated by auctioning off all the permits in a cap-and-trade system. And because the resources would come from the revenues, the new system created, it would not increase the deficit or put any pressure on the budget. It would be part of the self-contained system that climate change legislation created.

Of course, there are other legitimate claims that arise on the budget from climate change legislation as well. Beside the need to protect vulnerable population, these include basic research into alternative energy resources, as Mr. Doniger noted, assistance for workers and communities that depend upon the coal industry and other industries that will be most affected by the shift to a less carbon-intensive economy.

In addition, I want to note, of particular interest to this committee I would think, higher energy prices will raise costs to Federal, State, and local governments. They consume energy-related products. For example, the single largest consumer of energy in the United States is the U.S. Department of Defense, not surprisingly. What that means is that if those costs are not offset, either the Federal deficit will rise or government services will have to be reduced or taxes raised.

But this too can readily be addressed. If one auctions off the lion's share of the permits, one can take the appropriate fraction of the permits, or the proceeds from an appropriate fraction of the permits, use them to offset these costs so that the net effect on the Federal Government is a deficit-neutral effect.

My fourth and final number, and could you put up the blue slide at this point, the one called Well-Designed Climate—thank you very much.

[Slide.]

Mr. GREENSTEIN. My final number is also from the Congressional Budget Office. And this is 15 percent, actually, technically, a little less than 15 percent. This is the share of the potential resources from auctioning off permits that the Congressional Budget Office, based on a thorough review of the literature in the field, estimates is needed to compensate energy companies and other emitters for financial losses due to climate change.

This indicates that about 85 percent of the permits could safely be auctioned, a quite sufficient amount to meet the legitimate budgetary needs and to avoid increases in poverty, increases in deficits to fund the necessary basic research into alternative energy sources and so forth.

So the real bottom line here, as we see it, is the need to ensure that needed legislation to address global warming that uses a cap-and-trade system if it does, auctions off the bulk of the allowances, gives away those needed to make emitters whole, but auctions off the rest rather than giving away more than is needed to make emitters whole by giving too many of them away free to energy companies.

Again, CBO's estimate of the evidence is about 15 percent would be needed to make—offset the effects on energy companies. And I believe the term CBO has used is “windfall” gains for what would result if significantly more than that amount were given away free to the companies.

I looked yesterday at a recent piece written by Greg Mankiw, the former Chairman of President Bush's Council of Economic Advisors, one of the Nation's most distinguished economists. Dr. Mankiw, in this piece, notes that if you had a cap-and-trade system that gave away to the energy companies more than was needed to offset their costs, what you basically would be doing would be to establish a very large program of—Dr. Mankiw's term—“corporate welfare.”

I would also note, and I will be very brief here because Dr. Orszag already really covered this, that the main argument one sometimes hears for giving away more of the permits is the claim, well, if you give them away, prices to consumers won't go up; but if you auction them off, they will. As Dr. Orszag has noted, that belief is simply not correct. It defies the basic laws of supply and demand. And I doubt that many, if any, economists, regardless of where they are on the political spectrum, would subscribe to that view. So in conclusion, well-designed climate change policy can generate sufficient resources to meet legitimate budgetary claims that arise from the policy. If we do a cap-and-trade policy, that means it is necessary to auction off most of the permits. If that is done, the proceeds can be used to avoid increasing poverty, increasing deficits or debt, and also allowing resources to fund alternative energy, shield coal mining communities, and the like. The key, again, making sure that we auction off the appropriate share of the permits rather than failing to meet budgetary needs, failing to meet the needs of low-income families, and erecting a new program of corporate welfare instead.

Chairman SPRATT. Thank you, Mr. Greenstein.

[The prepared statement of Robert Greenstein follows:]

PREPARED STATEMENT OF ROBERT GREENSTEIN, EXECUTIVE DIRECTOR,  
CENTER ON BUDGET AND POLICY PRIORITIES

Effective action to reduce greenhouse gas emissions is necessary to prevent costly and potentially catastrophic environmental and economic damages from climate change. The Center on Budget and Policy Priorities is not making recommendations about how much we need to reduce emissions; that is not our area of expertise and we leave those recommendations to experts in environmental policy. Instead, our focus is on how climate change legislation might affect 1) the budgets of American families, especially those of modest means; and 2) the federal budget.

Our analysis indicates that Congress can develop climate change policy that is environmentally and economically sound and fiscally responsible, and that treats low-income families equitably, avoiding increases in poverty and hardship. To achieve these objectives, however, the policy has to be well designed. This means the policy must generate sufficient budget resources to address the requirements and challenges of sound climate-change policy—including the resources needed to offset the direct impact of those policies on the federal budget—and must cushion the impact on vulnerable populations, especially people with low incomes.

FOUR KEY NUMBERS ON CLIMATE POLICY, THE BUDGET, AND LOW-INCOME FAMILIES

Our analysis of the effects of climate-change policy on the federal budget and the budgets of low-income households can be summed up in four key sets of numbers.

1. *\$750—\$950 per year: the average increase in energy-related costs for the poorest fifth of the population from a modest (15 percent) emissions reduction*

Effective policies to reduce greenhouse-gas emissions work in part by raising the prices of fossil-fuel energy products to encourage energy efficiency and the substitution of clean energy sources for fossil fuel. This is essential to prevent extensive environmental and economic damage from climate change. However, it will raise costs to consumers for a wide array of products and services, from gasoline and electricity to food, mass transit, and other products or services with significant energy inputs.

Households with limited incomes will be affected the most by those higher prices, since they spend a larger share of their incomes on energy-related products and services than more affluent households do. They also are less able to afford investments that can reduce their energy consumption, such as buying a more efficient car or a new heating and cooling system. If nothing is done to protect people of limited means, many more of them will slip into poverty, those who are poor will become poorer, and the trend toward widening income inequality will be aggravated.

\$750 to \$950 per year is our estimate of how much, if left to fend for themselves, average families in the poorest 20 percent of the population would have to come up with to cover the increased costs arising from a 15 percent reduction in emissions.<sup>1</sup> This is a group whose average income is only modestly over \$13,000 a year, and our \$750-\$950 estimate already takes into account increases in cost of living adjustments that they may receive, such as through the annual Social Security COLA, as a result of higher energy costs. Moreover, the 15 percent reduction in emissions, which is what CBO uses in its analysis, is relatively modest by the standards of current proposals. It is 15 percent below business-as-usual levels (what emissions would be if there were no restrictions), not 15 percent below the 1990 or 2005 levels that are often used as benchmarks in legislative proposals. Those benchmarks themselves are well below business-as-usual levels.

<sup>1</sup>The Congressional Budget Office has provided a figure of \$680 for the average increase in cost for the bottom 20 percent of households. It should be noted that the \$680 figure is for the fifth of households with the lowest incomes, not the poorest fifth of the U.S. population. There is an important difference. If one simply ranks households by income, regardless of household size, then the bottom fifth of households disproportionately consists of one- and two-person households, and as a result, includes significantly less than one-fifth of the people in the United States. Moreover, the bottom fifth of households, if measured in this manner, includes many small households that are not poor (i.e., that are above the poverty line), while missing many larger households that are poor. (The poverty line is adjusted by household size.) The \$680 figure for the bottom fifth of households is measured in this manner. CBO has also developed a standard methodology to address this household-size problem when dividing households into income quintiles (or income “fifths”) and uses that methodology in most of the work it conducts on income distribution issues. We use the CBO size-adjustment methodology here to allow us to examine the poorest fifth of the population, rather than the bottom fifth of households irrespective of household size. This produces a figure of \$750 to \$950 for the poorest fifth of the U.S. population.

2. *\$50 billion to \$300 billion per year: resources potentially generated by climate-change policies to help low-income consumers and to address other climate-change-related needs*

Fortunately, the same climate-change measures that generate higher energy-related costs can also generate substantial resources to cover those costs. CBO estimates that various recent proposals to limit greenhouse-gas emissions by establishing a cap-and-trade system would create a valuable resource—emission permits—that would be worth \$50 billion to \$300 billion per year by 2020, depending on the specifics of each proposal. That is how much revenue the government could expect to raise if it auctioned off all of the permits. It is also how much revenue the government could expect to raise if a carbon tax with a similar effect on limiting emissions were used instead of a cap-and-trade approach.

3. *Approximately 14 percent: share of auction proceeds or carbon tax revenues needed to fully offset the increased energy-related costs faced by low-income consumers*

The amount of revenue the government could raise by auctioning off all of the permits in a cap-and-trade system is far more than what would be needed to protect low-income consumers from higher energy-related prices arising from climate-change legislation. We estimate that a program designed according to the principles laid out later in this testimony, which would fully offset the impact on the poorest 20 percent of people and also provide some relief to many hard-pressed working families in the next 20 percent, could be fully funded with approximately 14 percent of the resources that would be generated by auctioning off all the allowances in a cap-and-trade system, or by a carbon tax.

The specific dollar amounts in our first two sets of numbers—\$750 to \$950 per year of added costs for low-income consumers and \$50 to \$300 billion per year of potential revenue are tied to specific emissions targets, but the 14 percent figure is not. When the emissions target is looser (and hence the emissions reduction is smaller)—as it would be in the early years of most proposals—the dollar amount of revenue that could be raised would be lower, but so too would be the increase in energy prices and the amount of added costs that households would face. As the cap tightens and larger emissions reductions are called for, the added costs to households increase, but so too does the potential revenue that would be available to offset those costs. In each case, the revenue needed to protect low-income consumers would be about 14 percent of the revenue that could be generated.

4. *Less than 15 percent: share of potential budget resources needed to fully compensate energy companies and other emitters for financial losses due to climate-change policies*

Although the resources that can be generated by sound climate-change policies are substantial, so too are the budget claims arising from those policies. Besides the need to protect vulnerable populations, those claims include basic research into alternative energy sources, assistance for workers and communities that depend on the coal industry and other industries most affected by the shift to a less carbon-intensive economy, and other needs. In addition, higher energy prices will drive up the cost to federal, state, and local governments of providing many important services and benefits. Unless these costs are offset, government services will have to be reduced or taxes raised, or the federal deficit will rise.

In a cap-and-trade system, making sure there are adequate budget resources requires that most of the emission allowances are auctioned off, not given away for free to energy companies and other emitters due to misconceptions about the financial losses they would incur. One misconception is that those losses would be very large. CBO's review of the evidence, however, concludes that less than 15 percent of the total value of the allowances would be sufficient to offset the net financial losses of companies affected by policies to restrict emissions. More than that would simply create what CBO has called "windfall profits" for companies receiving the free allowances.

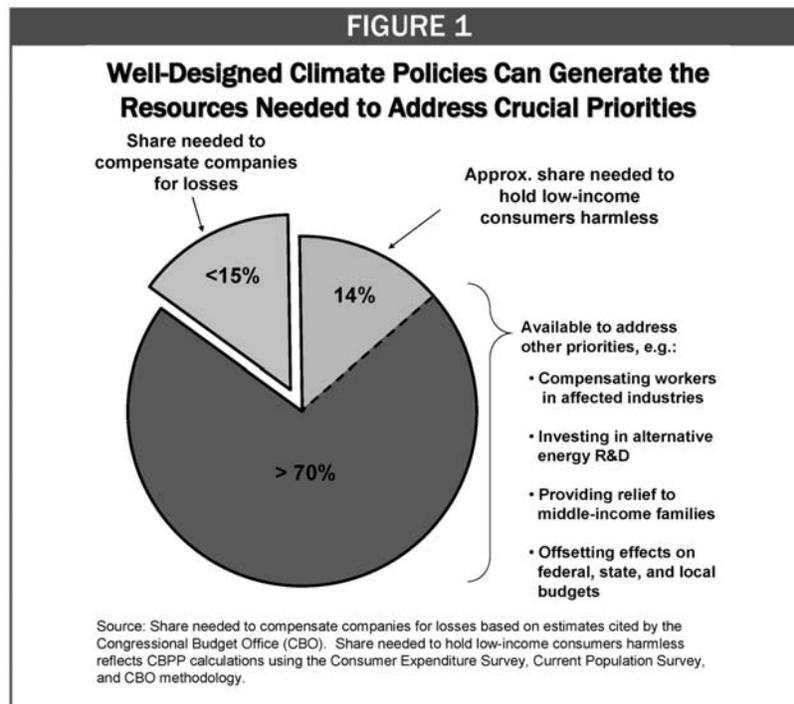
A related misconception about cap-and-trade may also contribute to the belief that large numbers of emission allowances should be given away to energy companies and other industrial emitters. This is the mistaken belief that energy prices will not rise if the allowances are given away. That belief is not correct; it flies in the face of the basic law of supply and demand. A cap on emissions will limit the amount of energy produced from fossil fuels. Regardless of whether the government gives away or sells the allowances, market forces will raise the price of fossil-fuel energy to the point where the amount demanded will fall to equal the amount supplied. Either way, energy companies will be able to sell their products at the higher price. The increase in prices is the source of windfall profits for the companies that receive allowances for free but are able to charge the higher price.

There are legitimate policy issues around the choice between a carbon tax and a cap-and-trade mechanism. But we should not let misconceptions cloud the debate or create false choices. Here is how Harvard economist Greg Mankiw, who served as Chairman of President Bush's Council of Economic Advisers, has characterized a cap-and-trade mechanism under which the allowances are given away:

Economists recognize that a cap-and-trade system [in which the allowances are given away to emitters] is equivalent to a tax on carbon emissions with the tax revenue rebated to existing carbon emitters, such as energy companies. That is, Cap-and-trade [under which the allowances are given away to emitters] = Carbon tax + Corporate welfare.<sup>2</sup>

#### AVOIDING REGRESSIVE OUTCOMES WHILE MEETING OTHER CLIMATE-RELATED BUDGET PRIORITIES

The policies needed to reduce greenhouse-gas emissions would, by themselves, result in regressive changes in energy prices. But they also can generate substantial revenue that could be used to offset those regressive impacts. Our analysis, like that of CBO, shows that the potential revenue from auctioning off emission allowances under a cap-and-trade system could yield more than enough revenue to offset the losses likely to be experienced by low- and moderate-income families and by workers in the industries hit hardest by the adjustment to a less carbon-intensive economy. The revenue could be sufficient both to address these issues and to meet various other legitimate purposes arising from the legislation as well (see figure 1).



In contrast, giving away a substantial fraction of emission allowances to existing energy producers would do almost nothing to compensate low- and moderate-income families for their losses. A very large percentage of the benefits of such a giveaway would go to shareholders of the energy companies, most of whom have high incomes, while little revenue would be available to mitigate the effects on those least well-off.

Addressing regressivity and adjustment costs would not be the only claims on the resources that could be generated by a cap-and-trade system or carbon tax. Govern-

<sup>2</sup>Greg Mankiw, "Greg Mankiw's Blog: Random Observations for Students of Economics," August 2, 2007.

ments at all levels would pay more for the energy and energy-related products that they consume directly. For example, the Defense Department is the single largest consumer of energy in the United States. In addition, there would be impacts on living costs and economic activity, which, while modest in the overall economy, could nevertheless trigger increases in automatic cost-of-living adjustments in Social Security and other benefit programs and some modest reductions in tax revenues. These issues can be addressed—and any increases in deficits and debt avoided—by using a share of the allowances to offset such tax and expenditure changes. (Note: action to reduce the damages from climate change should have positive effects on the budget over the longer run, by reducing government expenditures for such things as natural disasters, crop failures, and disease epidemics. In other words, in the absence of effective climate-change policies, natural events are likely to occur sooner or later that entail large federal costs and throw the budget farther out of whack.)

In addition, although higher energy prices would create strong incentives for energy conservation and for investment in clean-energy technologies, there will be claims for additional subsidies to encourage a wide variety of activities in the name of combating climate change. In many cases (including various types of basic alternative energy research), such investments can be a valuable complement to the market incentives provided by a cap-and-trade system or carbon tax. Such spending will be wasteful, however, if it merely subsidizes activity that would take place anyway or that is not well focused on reducing greenhouse-gas emissions.

Finally, economic analysis suggests that if there are instances where existing taxes have some disincentive effects that may dampen economic activity, receipts from cap-and-trade auctions or a carbon tax could be used to reduce those taxes. This, in turn, would lower any economic cost of restricting greenhouse-gas emissions. For example, CBO reports that the changes in economic activity required to achieve a 15 percent reduction in greenhouse-gas emissions would result in economic losses equivalent to roughly one-half of one percent of GDP in 2010 if the all the allowances were given away. If, however, all of the emission allowances were auctioned off and the proceeds were used to cut payroll taxes or corporate income taxes, that loss could be cut substantially. At the same time, CBO points out that using all of the auction proceeds exclusively to reduce net economic costs would itself come at a price, because those proceeds would not be available to address the regressive effects of increases in consumer costs or to make investments in basic research on clean technologies.

It should be noted, that these calculations of net economic loss do not take into account the substantial benefits that may arise from avoiding environmental and economic damages from climate change. Economic costs of the magnitude that have been reasonably estimated appear to be a modest price to pay to achieve the important goal of reducing greenhouse-gas emissions. In a well-designed climate-change policy, these are necessary costs for achieving the benefits of reduced greenhouse-gas emissions. They do not “harm” the public any more than expenditures on antibiotics to fight a serious infection “harm” a patient. Moreover, these “side effects” in terms of economic performance are modest (analogous to losing a day or two of work a year due to the antibiotic treatment in order to avoid greater harm from failing to treat the infection).

To return to the trade-off between reducing net economic costs and equitable treatment of families facing higher costs, CBO has found that using the proceeds from auctions exclusively for tax cuts would offset only a very modest fraction of the impact of higher energy costs on low-and moderate-income households, and that cutting corporate taxes would be highly regressive. With all of the auction receipts used for either a payroll tax cut or a reduction in corporate income taxes, the poorest 20 percent of households would have the largest net losses (as a share of income) while the richest 20 percent of households would end up with tax cuts that exceeded their increase in energy costs. (It also should be noted that analyses by CBO and others find that reducing long-term budget deficits would do substantially more to boost the economy over time than cutting taxes and have a far less regressive impact.)

While there are tradeoffs between economic efficiency and fairness in the design of climate-change policy, one policy that fails to measure up on either ground is giving away a substantial fraction of the permits to existing emitters. As CBO has explained,

Because giving allowances to energy producers would disproportionately benefit higher-income households and would preclude the possibility of using the allowance

value to reduce taxes on capital and labor, such a strategy would appear to rate low from both a distributional and an efficiency perspective.<sup>3</sup>

If lawmakers capture the necessary revenue and make wise choices among competing claims in designing climate-change policy, they can achieve the economic and environmental benefits from reducing greenhouse-gas emissions while addressing the impact of higher prices on low-income consumers and other legitimate new claims on available resources. (It might even be possible to achieve some modest deficit reduction, which would be valuable at a time when, as this Committee well knows, the pressures on the federal budget will be increasing.)

If, however, lawmakers give away too many emissions rights to existing emitters, as a number of the bills currently pending in Congress would do, they will fail to capture sufficient resources to meet these needs, while conferring windfall profits on energy companies and other emitters. This latter course would risk large increases in deficits and debt (already on course to reach unsustainable levels in future decades), significant increases in poverty and hardship, and a further widening of the gap between rich and poor.

#### DESIGNING CLIMATE-CHANGE LEGISLATION THAT SHIELDS LOW-INCOME HOUSEHOLDS FROM INCREASED POVERTY AND HARDSHIP

Making sure that sufficient resources are available to shield low-income households from increased poverty and hardship is crucial in the design of climate-change policies. But it is only the first step needed to avoid increases in poverty. It also is vital to use the resources made available for this purpose in a way that is effective in reaching low-income households, efficient (with low administrative costs), and consistent with energy conservation goals. At this early stage of the debate, no climate-change legislation introduced on Capitol Hill meets this goal, although there is a growing interest among a number of lawmakers in finding effective ways to protect low-income people from increased costs.

To shield vulnerable households from higher energy costs in a manner that is both effective and efficient, we recommend that policymakers follow these six basic principles.

1. Fully protect the most vulnerable households. Climate-change legislation should not make poor families poorer or push more people into poverty. To avoid that outcome, climate rebates should be designed to fully offset higher energy-related costs for low-income families. A good place to start is by fully protecting households in the bottom fifth of the income spectrum—those with average incomes of \$13,000—or less than \$27,000 for a family of three. Families at modestly higher income levels that struggle to make ends meet will need some help, as well, in coping with higher bills.

2. Use mechanisms that reach all or nearly all low-income households. Some low-income households work for low wages and could receive their climate rebate through the tax code, such as through an increase in the Earned Income Tax Credit. But others are elderly, unemployed (especially during recessions), or have serious disabilities. Climate rebates need to reach all of them.

Fortunately, policymakers can tap existing mechanisms to reach the large number of low-income households that cannot be reached through a tax rebate mechanism because their incomes are so low they are not required to file a federal income tax return. For example, “climate-change rebates” could be provided through the electronic benefit transfer (EBT) systems that state human service agencies use to provide assistance to many poor people. Policymakers could fill any remaining gaps, and provide weatherization assistance, through some increases in the Low Income Home Energy Assistance Program.

3. Minimize red tape. Funds set aside for low-income consumers should go to intended beneficiaries, not to administrative costs or profits. Accordingly, policymakers should provide assistance as much as possible through existing, proven delivery mechanisms rather than new public or private bureaucracies.

4. Don’t focus solely on utility bills. For households in the bottom fifth of the population, higher home energy costs will account for less than half of the hit on their budgets from increased energy prices. And about 20 percent of the households in the bottom fifth have their utility bills reflected in their rent, so they pay for utilities only indirectly, through the rents their landlords charge. Policymakers should structure “climate-change rebates” so they can also help low-income families with these rent increases, as well as higher prices for gasoline and other products and services that are sensitive to energy costs.

<sup>3</sup> Congressional Budget Office, letter to Senator Jeff Bingaman, Chairman, Committee on Energy and Natural Resources, United States Senate, July 9, 2007, pp. 3-4.

5. Adjust for family size. Larger households should receive more help than smaller households because they have higher expenses. Families with several children will generally consume more energy, and consequently face larger burdens from increased energy costs, than individuals living alone. Many other forms of assistance vary by household size; this one should as well.

6. Adjust relief to reflect changing needs. Assistance for low-income consumers should be smaller in the beginning, when a cap-and-trade system or carbon tax is just phasing in and the impact on energy-related prices is less substantial, and larger when the system is fully in place.

#### CONCLUSION

The economic and distributional effects of climate-change policy will generate major new claims on the federal budget, especially the need to offset the regressive impact of higher energy prices. But a well designed climate-change policy can also generate significant resources that can be used to avoid regressive outcomes and address other legitimate budgetary claims that arise from the new policy. Policy-makers need to recognize the importance of generating adequate revenue and addressing fairness concerns to avoid ending up with a policy that increases poverty and further widens gaps between rich and poor, increases deficits and debt, or both.

Chairman SPRATT. Now, Dr. Smith.

#### **STATEMENT OF ANNE E. SMITH, Ph.D., VICE PRESIDENT, CRA INTERNATIONAL**

Ms. SMITH. Mr. Chairman, members of the committee, thank you for inviting me to participate in today's hearing. I am Anne Smith. I am a vice president at CRA International. My testimony today reflects my own research and opinions, and not any positions of my company, CRA.

Today you have heard a lot about alternative methods for allocating allowances under cap-and-trade schemes. And allocations are extremely important, but they are also greatly misunderstood. For instance, many people seem to be saying that the very large value associated with the allowances can outweigh the costs of a carbon cap, and it cannot. Any policy that cuts carbon emissions will always impose a net cost on society. And there are only two ways that different types of allocation rules could even help reduce that net cost on society. And neither one is being seriously considered by the Congress at this moment.

The first of these ways would be to use the auction revenues, rather than allocating some of the allowances, to reduce the drag on the economy that comes from income taxes. CBO has talked about this possibility. And I just want to emphasize that they made the statement, and it is true, that the benefit in the reduction on the drag on the economy that would come from this approach requires reducing marginal income tax rates, which is highly unpopular politically because it is regressive. If you don't reduce the marginal income tax rates you don't get the benefit in reducing the cost of the policy on the economy. So in contrast, giving tax rebates to households or increasing their tax deductions, that will not reduce the policy's net societal costs, although it will change the distribution of the impacts of that policy.

The second way in which allocation values could be used to reduce the net costs of a carbon policy would be to promote the invention of new, advanced low-carbon technologies. Most of the allocations proposed so far for supporting technology are just subsidies, deployment subsidies, for instance, and demonstration project funding. These do not improve the incentives for breakthrough tech-

nology research and development. And that is what is needed in order for those uses of allocations to cut the policy's net costs.

So the other types of allocation schemes that are being discussed will only change the distribution of the policy costs, and they will not reduce those costs. And it is important to recognize that the net cost of any of these hard-cap bills that are currently being discussed in the Congress are quite large. For example, I have estimated that the current set of bills for hard caps would generate the following impacts by 2020 compared to a case with no carbon limits: Net losses of between \$1,000 and \$1,500 per year in the average household's real spending power. Net reductions of 2 to 4 million jobs. And reductions in the U.S. GDP of between \$300 billion and \$500 billion in 2020, which represents a drop of 1.5 percent to 2.5 percent. Of course, that drop in GDP would cause a corresponding 1.5 percent to 2.5 percent drop in government revenues approximately. Keep in mind these costs keep rising after 2020.

These economic impacts are substantial enough to warrant a serious discussion about how to meet the proposed emissions targets as cost-effectively as possible.

Before discussing a couple of ways that we can do this, I would like to note a couple of other misunderstandings about allocations that I frequently hear and have heard today. First, assertions that businesses require no more than 15 percent of the allowances to compensate them for their profitability losses due to carbon cap are misleading. We have just seen that in Mr. Greenstein's testimony. It also appears in some form similar to that in the CBO's written statement.

I am one of the three researchers whose analyses are cited in support of that 15 percent rule, and I disagree with this oversimplification. In my written statement I describe four specific reasons why the actual percentage that businesses would require under a real-world carbon cap would be larger than 15 percent, in some cases much larger.

Another misunderstanding is the view that allocations can protect U.S. companies whose products compete in international markets. As carbon price levels rise, more and more of these types of businesses will cease production in the U.S. no matter what their allocation is. However, as they close their operations here in the U.S., their emissions will simply reappear in another country, one that doesn't have a carbon cap of a similar magnitude. This is called "leakage." And even fully compensating allocations to these companies cannot stop it. Short of global cooperation on emissions limits, the only way to stop leakage with a cap-and-trade would be through border tax adjustments, but these may not be legal under international trade agreements in a cap-and-trade application. If border tax adjustments are not put in place at the same time that a cap is imposed, in the same time period, the only alternative for minimizing this perverse leakage phenomenon would be to place a reasonable ceiling on the price of allowances. This is the idea of the safety valve that has been mentioned in other testimony today.

An allowance price ceiling would have some important additional economic merits besides helping protect against unreasonable amounts of leakage. Prices in all cap-and-trade programs are noto-

riously volatile, and volatility in carbon prices will translate into volatility in economic performance generally.

Even the government should prefer to see stable allowance prices. For example, would large variability in any auction revenues that are going to be used to fund technology deployment programs be of any value when they need long-term stable funding?

Mr. Doniger spoke of the need for projects like these to have stable funding. But if it is funded through auction revenues, this funding may not be stable at all if the prices that can be returned in those auctions are quite volatile. Even if the auction revenues were to be simply rebated to citizens, would either the government or the citizens prefer to have variability in the size of their rebate checks?

So in closing, be aware that cap-and-trade schemes are not the only market-based policy option, as Dr. Orszag said at the beginning of his testimony. Other options, such as a carbon tax, may be more suitable to the challenge of reducing carbon to the proposed levels that we are looking at without excessive damages to our economy.

Thank you for this time. I have a longer written statement that I request be submitted into the record.

Chairman SPRATT. Thank you very much. As.

[The prepared statement of Anne E. Smith follows:]

PREPARED STATEMENT OF ANNE E. SMITH, PH.D., VICE PRESIDENT,  
CRA INTERNATIONAL

Mr. Chairman and Members of the Committee: Thank you for your invitation to participate in today's hearing. I am Anne Smith, and I am a Vice President of CRA International. Starting with my Ph.D. thesis in economics at Stanford University, I have spent the past twenty-five years assessing the most cost-effective ways to design policies for managing environmental risks, including cap-and-trade systems. For the past fifteen years I have focused my attention on the design of policies to address climate change risks, and have prepared many analyses of the economic impact of climate policies. I thank you for the opportunity to share my findings and climate policy design insights with you. My written and oral testimonies reflect my own research and opinions, and do not represent any positions of my company, CRA International.

The topic of today's hearing is the fiscal impacts of controlling carbon emissions. Much of the discussion these impacts revolves around options for how the government can shift the economic burden of a cap-and-trade system on greenhouse gases through alternative formulas for allocating the capped allowances. When a market-based approach to greenhouse gas emissions control is implemented, a very large amount of wealth in the form of the allowances will be created, even while the policy also forces net resource costs on society. No one should be surprised by the intensity of interest focused on how that wealth might be distributed because any single interest group could be made far wealthier under a carbon cap-and-trade program than not—if it can get the “right” kind of allocation assigned to it. Without denying the great importance of the allocations decisions, I would like to make a number of observations about the resource costs and economic impacts of such policies that policymaker's should not lose sight of when contemplating greenhouse gas emissions legislation.

MINIMIZING THE POLICY'S COST VERSUS SHARING ITS COST

The total value of allowance allocations will always be less than the total cost of a carbon cap: the policy will always have a net cost.

The total resource cost of an emissions limit is the sum of the expenditures that emitters will make in order to physically reduce their emissions from what they would otherwise have been. Under a market-based system, a limit is placed on emissions, and regulated emitters are required to pay for every ton that they emit. If the policy is a cap-and-trade system without any free allocations, emitters do this by buying as many allowances as they emit in a year, and rendering those allow-

ances to the government. Because there are not as many allowances as there would be emissions (at least in the aggregate), emitters also are forced to reduce their emissions. Thus, there are two expenditures that emitters incur: (1) they spend money to reduce emissions down to the level of the cap and (2) they pay for allowances to cover all of their emissions that remain after the controls have been applied.

In aggregate over all emitters, the second component of total expenditures by emitters is simply the value of the allowance pool that is created by the government when it sets up a cap-and-trade system. Therefore, the entire wealth that government will have to allocate is only equal to the second component of the emitters' costs. The government can give that entire value back to the companies by making a free allocation of 100% of the allowances to emitters, but that leaves companies still incurring the first cost component—the real resource cost associated with actually reducing emissions, which is the real net cost to society.

The wealth associated with the allowances can be very large compared to the real resource costs of the cap. For example, if emissions without a cap are 100 tons and a 10% reduction is required by establishing a cap at 90 tons, the cost of controls (and hence the market value of the 90 tons of allowances) might be \$20/ton of CO<sub>2</sub>. In that case, the real resource cost of reducing 10 tons of emissions would be less than \$200 whereas the market value of the pool of 90 allowances would be \$1800. However, even if the government gave all the allowances to the emitters, it would only reduce emitters' expenditures from \$2000 (i.e. the sum of \$200 for emissions controls and \$1800 to buy allowances for their remaining emissions) down to the net societal resource cost \$200.<sup>1</sup>

The net resource cost is therefore an inescapable fact of an emissions limit via a cap-and-trade program that cannot be eliminated through any allocation formula that may be devised. All that an allocation scheme can do is alter the companies and individual consumers that end up bearing the burden of that resource cost. An excessive amount of focus on who will gain the value in the allocations can cause policymakers to lose sight of the fact that they are creating a new cost to society that should be evaluated in the context of overall societal budget priorities.

The net cost of a carbon cap of the stringencies now being discussed in the Congress would be very substantial.

A large number of proposals have circulated in recent months that entail hard caps on US greenhouse gas emissions reaching reductions of about 75% to 90% from projected "business as usual" emissions by 2050. These current hard cap proposals vary in their specific timing and stringency, but all of them would impose significant costs on the US economy even in the near term, if implemented. I have performed economic impact analyses of many different levels and types of emissions limits using CRA International's general equilibrium model of the US economy called "MRN-NEEM." My analyses indicate that the current set of proposals in the Congress for hard caps on greenhouse gas emissions would impose real resource costs to the US economy of the following general magnitude:

- Net losses in the average household's real spending of \$1000 to over \$1500 per year by 2020.
- Net reductions in jobs by 2020 of 2 million to 4 million.
- Reductions in US gross domestic product (GDP) of \$300 billion to \$500 billion (i.e., a reduction of 1.5% to 2.5%) from a case with no carbon limits, by 2020.

Needless to say, a drop in GDP implies a reduction in government revenues too—also roughly on the order of 1.5% to 2.5% by 2020. The costs of these proposals are projected to increase continuously up to 2020, and are only somewhat lower in their very first year of implementation. Further, these costs are projected to continuously increase in the decades beyond 2020, because the reductions they require by 2020 are small compared to those that would be mandated by 2050 in these Bills.

These economic impacts are substantial enough that they warrant a very serious discussion about priorities for the spending of our society's resources. There is no question that achieving significant reductions in greenhouse gas emissions will be very costly, and it is therefore important to strive to minimize those costs. That cannot be done by focusing solely on how to allocate allowances. The design of the program itself is what matters, which requires taking care to ensure the following attributes in a cap-and-trade system:

- A cap that comprehensively covers all types of emissions sources.
- A policy that protects against leakage of emissions to economically competing nations.
- A supportive set of policies that provide effective incentives for research and development on breakthroughs in technologies that produce low-carbon energy.
- A cap stringency that is timed to match the availability of new, low-carbon technologies.

- A policy that offers businesses price certainty for planning major new investments in new technologies.
- Provisions in the policy to limit the costs that it will impose on the economy overall if emissions reductions turn out to be more expensive to achieve than currently anticipated.
- A policy that will deliver even larger emissions reductions if they turn out to be less expensive to achieve than currently anticipated.

None of these attributes are easy to design into a greenhouse gas policy, and none of the hard cap proposals that are currently being discussed in the Congress have sufficiently addressed these needs. Their projected costs (described above) are thus probably unnecessarily high for achieving their stated emissions goals. I will discuss several of these points in more detail below, after a few more comments about allocations.

There are very many claimants to the value associated with the allowance allocations.

The costs of greenhouse gas reductions will directly increase the costs of companies that are emitters targeted by a regulation. These companies are thus the traditional and natural claimants on the allocations. However, in the case of greenhouse emissions limits, many of those emitters' costs will be passed on to consumers. This will occur through multiple routes. Energy prices will increase. The costs of most goods and services will increase because they can only be produced by using energy. Some companies will be forced out of business, with attending consumer costs of making job transitions. Energy cost impacts will be regressive, and affect the poor disproportionately. All of these impacts create additional groups in society that also can make a valid claim for a share of the wealth associated with the allowance pool. Finally, in addition to the claims from industry, businesses, workers, and representatives of the socio-economically disadvantaged, government must also contend with its own needs. Government needs to support a massive increase in energy research and development. Government also needs to grapple with likely declines in its traditional tax revenues due to the costs, reduced profits and reduced household incomes that the policy imposes on its tax base.

Clearly, policymakers face an unusually complex situation where almost every group in the economy has a reasonable claim for some share of the allowance value. This becomes an outright dilemma when one realizes that there will never be enough allowance value to cover all of the claims. When the net resource costs of the policy are so large, policymakers should focus should be on creating the most cost-effective policy possible; an emphasis on allocations rules does not further this goal.

Alternative allocation formulas being proposed would not reduce the overall societal cost of a cap-and-trade policy.

As I have described above, the value associated with the allowance pool that would be created under a cap-and-trade scheme is a "transferable" amount of wealth. By allocating that wealth in different ways, the cost burden of the policy can be adjusted across the many players in the economy. That is, the allocation formula just splits the same pie in different ways. If one group is handed a pie slice that is larger than its slice of resource costs, that group will be better off. But because the total pie of transferable wealth is smaller than the total pie of expenditures that emitters must incur, a larger allocation for one group inevitably means that another group will be less well off. Almost all of the alternative allocation formulas being discussed would merely alter how the pie is sliced, and not how large the pie is.

There are only two alternative uses of the allowance value that would actually reduce the net economic burden of a greenhouse gas policy, and neither one receives very much attention in current bills in the Congress:

1. It is often stated that giving away free allowances reduces the opportunity for the government to enhance economic activity by lowering the economic distortions of existing taxes. If the allowances could instead be auctioned and the new revenues to the US government used to reduce these existing "tax distortions," then there would be a generalized benefit to the economy that could partially offset the newly imposed economic cost of the emissions reductions. However, not a single one of the many policy proposals that have been introduced in Congress has proposed to use the auction revenues in the manner necessary to gain this offsetting economic benefit. It requires specifically that the auction revenues be used to reduce the marginal tax rate on either the personal income tax or on corporate tax rates. Several analyses have found that this could reduce the net impact to the economy of a cap by as much as 50%.<sup>2</sup> However, it is highly unpopular politically because of its expected regressive nature.<sup>3</sup> (In fact, reduction of marginal payroll tax rates would have much less beneficial impact than reduction of marginal personal income tax

rates, and even less than if the marginal corporate income tax rates are reduced, each of which would be increasingly regressive.) While economists agree that reduction of marginal income tax rates would be an excellent way to reduce the net economic impact of a policy, policymakers seem incapable of implementing the right form of tax rate reductions to claim policy cost reduction as a justification for auctioning a larger share of permits. Rebate checks to households, reductions in average tax rates, and other forms of tax reductions called “lump sum” do not accomplish any such policy cost reduction.

2. It is widely accepted that another way to reduce the cost of a greenhouse gas cap would be to reduce the costs of, and to speed the time of commercial availability, of new and advanced low-carbon technologies. This might be accomplished through government policies that offer greater and more cost-effective incentives for targeted and successful research and development in energy technologies. Most of the recent carbon policy proposals attempt to direct some of the allowance value towards technology development, and this is a positive development. However, most of these proposals’ provisions are limited to subsidies and demonstration project funding. They still give insufficient attention to how to actually improve the incentives for both public and private researchers to effectively target their efforts towards new, breakthrough technologies. Far more effort needs to go into designing these research and development initiatives before one can argue that allocating a larger share of allowances or auction revenues to fund technology programs will have much effect in reducing the cost of the associated cap.

#### CLARIFICATION OF SOME ISSUES REGARDING ALLOCATIONS TO EMITTERS

Assertions that emitting businesses require “less than 15%” of the allowances to compensate them for their losses due to a carbon cap costs are misleading, and incorrect in most cases.

A common assertion within greenhouse policy circles is that only a small fraction of the total allowances need be given to emitters to offset their profit losses. The Congressional Budget Office (CBO) has characterized this “small fraction” as less than 15%.<sup>4</sup> I am one of the researchers whose analyses are cited in support of CBO’s statement. I would like to identify several problems with that are associated with this type of oversimplifying summary statement.<sup>5</sup>

- Phase out of allocations over time. The small percentages of allowances that modeling studies find would offset sectoral average profitability losses are calculated assuming that the free allocation percentage will remain constant permanently (i.e., infinitely) into the future. In real application (and in all present policy proposals), the allocations are not permanent, but are phased out; yet the policy’s impacts only continue to increase over time. If an allocation is to be phased out over time, the percentage share that achieves the same degree of compensation is higher. For example, an 8% perpetual allocation would need to become a 54% allocation per year if it were to end after ten years.<sup>6</sup> It would need to be in the range of 50% or more in the first year, if it were to be phased out gradually over 20 or more years.

- Compensation estimated only for average sectoral impacts. The estimates of a percentage of allocation that would compensate “businesses” is actually based on a model that does not consider individual businesses, but only entire aggregate sectors, such as the “energy-intensive industries” sector or “the electricity generating” sector. There will, in fact, be both winners and losers in any large aggregated sector, and these models cannot distinguish between them. Instead, the share of allocation estimated to compensate the entire sector on average assumes the winning companies’ gains within a sector can be netted against the losses of the losing companies. This is like saying that profitability increases to wind farmers and nuclear generators due to a cap will be taken from them and given to coal generators. Then, any remaining net losses to coal generators would be compensated by free allocations to that sector. If one of the modeled sectors had an equal balance of winners and losers, the model would estimate a zero need for any allocations to that sector—clearly that would be insufficient to compensate companies facing profitability losses within that sector. In one case where the analysts were able estimate the allocations needed to compensate each individual business rather than the sectoral average, the analysis found that that actual compensation of every individual business would require a 33% allocation to that sector, even though the analysis indicated a 0% allocation need when estimated on the typical sectoral average basis.<sup>7</sup>

- Compensation estimates largely ignore how trade exposure reduces abilities to pass costs through to customers. One of the reasons that some businesses may be able to be compensated for their profit reductions under a carbon policy is that they can actually pass a large share of their cost on to the consumer. That is, impacts to their profits are not as large as their increased compliance expenditures. The

economy-wide models that have been used to assess how many allocations are needed to compensate sectors are not detailed enough to address the degree to which different sectors are able to pass costs through in their product prices, and they tend to overstate the pass-through. In particular, if parts of some sectors are highly exposed to competition from international competitors, they have exceptionally little ability to raise prices, because they will lose market share to foreign producers. However, when aggregated with a variety of other types of businesses in a “sectoral model,” their actual vulnerability to cost increases is averaged away. The model will assume they can achieve an average degree of price pass-through, and thus understate the profitability impacts of the very highly trade-exposed within each sector. Those types of companies would require larger allocations than the modeling exercises have estimated.

- **Comprehensiveness of cap’s coverage.** The modeling exercises have modeled idealized caps that would be applied uniformly to all emissions in the US. However, if a real-world cap were to only apply to about 50% of the emissions, while non-market policies and measures would be applied to the remaining sources, then the economic impacts of the policy would be the same or higher, but there would only be half as many allowances (and half as much allowance value) available to allocate. The amount of value needed to offset profitability impacts would be the same, but in this case, achieving that amount of compensation would require allocation of twice as large of a percentage of the allowance pool (because it is half as large). The bottom line is that as the comprehensiveness of the cap is lowered, the percentage of the allowances needed to achieve the same level of compensation rises.

The above set of bullet points identify many limitations in the ability of models to address the question of fair compensation. The ideal solution would be to develop more disaggregated models to refine the estimates. Unfortunately, there are limits to what any models can do, due to lack of the necessary disaggregated data. In the end, there are no available analytical methods for determining allocations of allowances to individual companies throughout all sectors of the economy that would equitably mitigate the financial impacts of the policy.

The available analyses do suggest that not all companies would require a 100% allocation in order to be compensated. However, any rule of thumb based on the quantitative results of these analyses (such as “less than 15%”) probably understates the true aggregate need when several of the real-world features of climate policies are taken into account. Such simplistic rules also clearly are not correct at the level of individual businesses, some of which will benefit without any allocation, and others of which may not be compensated even with a 100% allocation.

Domestic companies whose products compete in international markets are likely to be driven out of business no matter what allocation they receive.

A generous allocation could increase the shareholder value of a company that is unable to increase its prices due to competition in international markets (i.e., a “trade exposed” industry). However, it will do this in a perverse way that policy-makers need to be aware of. As the price of allowances rises, a company that cannot raise its product prices will experience falling margins. If that company is also granted free allocations, it can use them to offset some of the costs, and thus maintain profitability. However, this will only be true for a range of lower allowance prices. For every type of company that cannot pass costs through, there will be an allowance price level at which the company would be able to make more money by selling its allowance allocation than by using those allocations to continue to produce its usual product. When allowance prices reach that level, the company will cease production, and become a seller of allowances instead. The shareholders may be satisfied with their financial situation, and use the proceeds of their allowance sales to invest in some different business venture that can be profitable in the carbon-constrained world. However, from the vantage point of the US economy, there will be premature retirement of the existing productive assets in our trade-exposed sector, and reductions in the economic activities associated with those sectors.

This hardly fits the image that some may have of the notion of achieving compensating allocations for the businesses. Yes, the losses in profitability are offset for the affected shareholders, but this goes hand in hand with plant closures and loss of key economic sectors. Given that the cause of the closures is international competition, these lost US manufacturing activities would be replaced by foreign manufacturing: global emissions will not fall but the US economy will still pay the price.

This perverse outcome of climate policy is called “leakage” because the policy is rendered ineffective environmentally when it causes emissions to “leak” across national borders. Emissions from any part of the globe have comparable impacts on climate risks, as they all first accumulate together in the global atmosphere to have their combined and joint effect on the global greenhouse effect. On the one hand, this offers important flexibility to reduce emissions anywhere in the globe that has

cost-effective opportunities to do so, and not to confine domestic efforts to actions within US borders. On the other hand, it also means that any GHG cap we impose domestically, and its attending domestic reductions, may be undermined by offsetting emissions increases in nations that do not have comparable caps on their own economies. Large sums of money could be spent with no actual global environmental benefit. US economic output and jobs leak to other countries as well.

Leakage has often been talked about in very general terms. Estimates of leakage due to a US domestic policy are suggested in the range of about 10-15%, meaning that for every 10 tons that is reduced in the US, 1 ton is just emitted elsewhere in the world. This may sound like a relatively small price to pay in order to get a net 9 tons of reduction from US action. The difficulty with this view, however, is that leakage is not a phenomenon that applies to every ton of emissions reduction. Instead, there may be almost no leakage associated with controls on emissions that are not trade-exposed (e.g., personal and commercial transportation, electricity generation, and services), but nearly 100% leakage associated with controls on emissions in sectors that are trade-exposed (e.g., many of the energy-intensive manufacturing processes such as cement, iron and steel, chemicals, transportation equipment manufacturing, textiles, etc.) Concentrated economic impacts on specific sectors that offer no benefit in terms of global emissions reduction make no sense as a matter of policy design. The possibility that the shareholders could be made whole is not a relevant argument to allow this to happen.

The potential severity of the impacts to trade-exposed industries appears not yet fully appreciated by policy analysts or policymakers. Most of the attention on estimating climate policy impacts has been focused on transportation and electricity generation, which are among the least concerned with potential leakage. The potential plight of the trade-exposed industries has been mostly thought to be something that could be dealt with through compensating allocations. While that might solve the concerns of some of the shareholders of those businesses, policymakers should closely examine whether they are prepared to face the economic impacts of reduced exports, increased imports, and losses of domestic output of many important elements of the US manufacturing base.

#### SOME OPTIONS FOR REDUCING NET ECONOMIC IMPACTS

I noted in the first section that there are a few attributes of a greenhouse gas policy that would be important to keeping the policy's economic impacts in an acceptable and politically sustainable range. I believe that these require at least as much attention in designing a policy as the question of how to allocate allowances. This section provides some discussion of several of those attributes.

Policymakers should focus on how to limit US emissions without creating leakage.

As I noted in the last section of these comments, leakage is a serious concern for some portions of the economy, and not one that can be addressed satisfactorily with some free allocations to the trade-exposed sectors. There are two ways to mitigate leakage without exempting trade-exposed sectors from an emissions cap:

1. The first is to impose domestic emissions limits only as part of a global agreement among all nations that compete with our products, or which might start to compete once a policy offers them a greater cost advantage than they have now. Clearly, the present policy proposals in the Congress would not accomplish this.

2. The second is to find ways to remove the competitive advantages of competitors at our borders, through "border tax adjustments." Border tax adjustments are allowed only under very special circumstances under the rules of the World Trade Organization.

The legality of obtaining effective border tax adjustments in the case of a cap-and-trade system is quite questionable at present.<sup>8</sup> While a proposal to do so has been circulated by American Electric Power and the International Brotherhood of Electrical Workers (the "AEP-IBEW" proposal), it appears to have dubious chances of success in limiting leakage due to a cap-and-trade proposal. The AEP-IBEW proposal contains quite a complex set of provisions, each aimed at addressing one of several hurdles that would be faced in order to achieve the ultimate goal of equalizing costs of imports at the US border in a WTO-compliant manner. Each element of the proposal would be open to legal challenge, leaving multiple potential ways that the approach could fail to provide the intended protection from leakage. Most critical in my mind, however, is that these many steps require time to accomplish. As embodied in the bill of Senators Bingaman and Specter, the imposition of leakage protection from the AEP-IBEW scheme might not be possible until 2020. Given that the cap in that policy would start in 2012, this would imply up to eight years during which US trade-exposed manufacturers would be facing competitive pressures, eroded ability to profitably continue in business, and experiencing leakage.

Delays of this sort in obtaining that coverage are not acceptable for the businesses that face rapidly responding markets.

The AEP-IBEW proposal for obtaining WTO-compliant leakage protection was crafted to work with a cap-and-trade form of proposal. Interestingly, the prospects of successfully and immediately implementing border tax adjustments are considered to be much greater in the case of a greenhouse gas tax than in the case of cap-and-trade.<sup>9</sup> Those having a hand in creating a climate policy for the US should become much more familiar with the intricacies of WTO rules, and the likelihood of successfully creating immediate and durable protection from leakage under different types of greenhouse gas policy designs. This needs to be sorted out before and not after a greenhouse gas policy is enacted.

In the absence of a clear mechanism for preventing leakage with a cap-and-trade system, the only alternative for keeping economic impacts within acceptable bounds is to place a ceiling on the cost of allowances.

The higher the price of permits under the domestic cap, the more serious “leakage” is likely to be if there are no border tax adjustments in place. Thus, potential for leakage provides an important reason for directly ensuring that the price of permits that may occur under a domestic GHG cap-and-trade program will remain relatively low. The only way to design a domestic cap-and-trade program to address this international competitiveness risk is simply to keep the carbon price low enough that such losses remain within acceptable bounds. This, naturally, limits the amount of domestic emissions reductions that will be achieved as well. Until international competitiveness issues are resolved (either through coordinated action or a system of border tax adjustments) ambitions to make significant reductions through any domestic cap-and-trade program will be thwarted, or else highly disruptive to key parts of our economy. This also implies that any domestic cap-and-trade program that is implemented in advance of internationally coordinated efforts should be designed with clearly defined permit price caps.

An allowance price ceiling has important additional merits for businesses and government.

Prices in all previous and existing cap-and-trade programs have exhibited substantial volatility, and this can be expected of GHGs as well.<sup>10</sup> Price volatility, however, is likely to have much greater generalized economic impacts with a CO<sub>2</sub> cap than for caps on SO<sub>2</sub> and NO<sub>x</sub>. CO<sub>2</sub> is a chemical that is an essential product during the extraction of energy from any fossil fuel. As long as fossil fuels are a key element of our energy system (which they are now, and will remain for many years even under very stringent caps), any change in the price placed on GHG emissions will alter the cost of doing business throughout the economy. This is because all parts of the economy require use of energy to one degree or another.

In contrast, under the Title IV SO<sub>2</sub> cap, a fluctuating SO<sub>2</sub> permit price would only affect emissions from coal-fired electricity generation. In deregulated electricity markets, coal-fired electricity does not always affect the wholesale price of electricity, and even significant fluctuations in SO<sub>2</sub> permit prices might have almost no effect on electricity prices. Even in regulated electricity markets, the impact of the SO<sub>2</sub> price on the cost of all electricity generation would be diluted by the unaffected costs of all other sources of generation before it reached customers. Also in contrast to an economy-wide GHG cap, no other sources of energy in the economy are affected at all by SO<sub>2</sub> price changes. Finally, under the Title IV SO<sub>2</sub> cap, price variations during the past year that range from \$400/ton to \$1500/ton (the range observed in the past year under Title IV) have a modest effect on the majority of coal-fired units that are already either scrubbed or burning low-sulfur coal. Such units might see the cost added due to its SO<sub>2</sub> emissions vary between 7% and 26% of its base operating cost,<sup>11</sup> and (as noted) the impact on consumer’s cost of electricity would be much smaller, if anything.

Variation of CO<sub>2</sub> prices such as that observed in the EU ETS market over the past two years (approximately \$2/ton to \$35/ton) would cause all coal-fired units to see additional costs varying between about 10% and 175% of their base operating costs. Further, even gas-fired units would experience absolute cost increases equal to about half those of the coal-fired units.<sup>12</sup> Since gas-fired units do frequently set the wholesale market price of electricity, consumer electricity prices would also vary markedly with the price of GHG permits. Retrofits would not be available to attenuate these costs (at least, not until even higher permit price levels would be achieved and sustained at those levels.) At the same time, all other key energy demands in the economy (e.g., for transportation, industrial process heat, building heating and air conditioning, etc.) would also experience similar fluctuations with varying GHG permit prices. Clearly, the effect on the economy could be disruptive.

These are not just theoretical calculations. The EU’s statistics bureau, Eurostat, reports that electricity prices rose significantly throughout the EU in 2005. House-

hold rates rose by 5% on average over all 25 EU countries, and industrial rates rose by 16% on average.<sup>13</sup> The high prices of GHG permits under the EU ETS during that period is widely viewed as having contributed to this price increase, and indeed, wholesale electricity prices have fluctuated in step with the wide swings in ETS permit prices. It is not clear yet how or whether the wide variations in permit prices may begin to contribute to the variation in economic activity. However, it should also be noted that the EU ETS does not cover all sources of GHGs, or even a majority of sources of CO<sub>2</sub> emissions in the EU. (This may dampen the impacts of CO<sub>2</sub> permit price volatility on the EU economy, but is also a widely observed flaw in that cap-and-trade system's potential to produce sufficient cuts in GHG emissions necessary for the EU to meet its GHG targets.)

To sum up, price uncertainty and price volatility will impose impacts in the case of GHG emissions limits that are completely different in scale and scope from those under previous emissions trading programs. Their potential to increase variability in overall economic activity thus should be viewed as a core concern in designing a GHG cap-and-trade program. At the same time, the nature of climate change risks associated with GHG emissions is such that it is possible to design price-stability into a GHG cap-and-trade program without undermining its environmental effectiveness. In the case of a stock pollutant such as greenhouse gases, there is no need to absorb high costs in return for great specificity in achieving each year's emissions cap.<sup>14</sup> Economists widely agree that the cost to businesses of managing the price uncertainty of a hard cap is not worth the greater certainty on what greenhouse gas emissions will be from year to year.

Businesses clearly prefer having reliable allowance price expectations, but even governments would probably prefer some stability in the year to year revenue streams from an auction. For example, would large variability and uncertainty in allowance auction revenues be of any use if those revenues are intended to fund important technology-related projects that have long-term funding needs? Even if the revenues would simply be rebated to citizens, would either the government or the citizens find any value in such uncertainty in the size of the rebate checks?

There are various ways to provide much greater price certainty under a cap-and-trade program, although none have been used in any trading programs to date. One of the simplest concepts that has gained substantial attention for GHGs has been called a "safety valve." Unfortunately, this term has begun to be used loosely (e.g., under the rules of the Regional Greenhouse Gas Initiative, and in California's AB32 program) for a variety of mechanisms that do not actually provide the price certainty originally intended. To be quite specific, the cap-and-trade program mechanism that provides the requisite price cap is one where the government offers to issue any number of additional permits to regulated companies at a pre-specified and fixed price per permit. This price is set low enough that it is not considered punitive, but rather as an assurance by the government that it would not consider control costs above that level to be desirable as a normal course of events.<sup>15</sup> This is the mechanism that has been incorporated into the bill of Senators Bingaman and Specter.

Because regulated entities know that they need not ever pay more for a permit than the established safety valve price, it functions as a price ceiling. No company would ever pay more to purchase a regular permit in the emissions market if it knows that it can always obtain sufficient permits at that price from the government, if necessary. Permit prices may fluctuate at levels below the safety valve price, but by judicious selection of an appropriate safety valve price, policy makers can ensure that these variations would not rise to a level that might be viewed as potentially harmful to the economy at large. If the safety valve price is hit on an occasional basis under a cap, then the goal of achieving long-term reductions in emissions is not harmed, given that the primary environmental risk of GHG emissions is a long-term, cumulative one. If the safety valve price is hit on a perpetual basis, this suggests an important need for policy makers to consider how we should address the evidence that meeting targets that are more difficult than hoped; however, this policy deliberation will be possible without the urgent need to throw "band-aid" solutions onto the cap-and-trade program, and with concrete evidence of the degree of economic pain that is associated with the initially-established maximum permit price. A higher price might then be deemed acceptable, but if not, the safety valve will have helped us avoid the greater pain of learning that fact through a hard cap approach.

Aversion to the idea of a price ceiling has been widespread among parties that prefer hard caps at any cost over a long-run policy that offers price certainty in exchange for some flexibility in year to year emissions outcomes. Recently, a proposal for a "Carbon Market Efficiency Board" (CMEB) was released that was supposed to offer an alternative to the price ceiling approach.<sup>16</sup> This concept has since been in-

corporated into the bill of Senators Lieberman and Warner. This CMEB proposal provides no cost certainty at all, and it explicitly states that it does not wish to diminish allowance price volatility: “The cost relieve measures are not intended to relieve brief price spikes that are part of normal, healthy market volatility.”<sup>17</sup> The proposal goes on to assert that “‘volatility’ in price is expected and even desirable.”<sup>18</sup> As I have noted above, volatility creates unnecessary planning and management costs to businesses, and should be eliminated if possible without harming one’s objectives for reducing emissions within acceptable cost bounds. This is entirely possible in the case of a market that is entirely the result of regulation, such as an allowance market. The CMEB proposal does not meet the objectives of providing price certainty or policy cost containment.

#### THINKING OUTSIDE OF THE CAP

Almost everybody considers it as a foregone conclusion that cap-and-trade is the only option for achieving cost-effective reductions in greenhouse gas emissions. However, in efforts to secure a greater share of the allowance values for non-industry interests, and in efforts to raise government funds for supporting research, and even in efforts to raise government revenues to reduce other taxes, there is growing pressure for a large share of the allowances to be auctioned. In the limit, however, an auction works just like a tax—except that the level of the tax is unknown in advance of passing the legislation, and will probably remain highly variable over time even after implementation of the legislation. This price uncertainty is not a helpful element to achieving reductions at lowest possible cost to the economy.

If we find ourselves shifting into a world where auctions predominate, one must ask: why not simply apply a tax? All parties—public and private—would benefit from the much greater price certainty, reduced administrative and strategic planning effort. Often expressed concerns with manipulation of allowance markets (for both the auction and the secondary markets) would also be eliminated. Further, as CBO has demonstrated in one of its issue briefs, the tax approach can outperform either a hard cap or a cap with a price ceiling in terms of cost-benefit outcomes.<sup>19</sup>

Thus, it may be wise for policymakers to take time to consider more closely alternatives to the cap-and-trade approach for greenhouse gases. Cap-and-trade is not the only form of market-based policy option, and others may be more suitable for the challenge of reducing greenhouse gases to levels that are being proposed without excessive damages to our economy.

With those central points in mind, I want to close by noting that even a highly effective and efficient market-based approach for GHGs will have a serious limitation that should not be forgotten. An adequate national climate policy must consist of more than a system of efficient GHG controls. Actual stabilization of climate change risks will require that GHGs be reduced to nearly zero levels. Although this goal may be possible to achieve at some point in the later part of this century, it can only be done through truly revolutionary technological progress and the resulting changes in the structure of how our energy systems.

Hoffert et al. report that “the most effective way to reduce CO<sub>2</sub> emissions with economic growth and equity is to develop revolutionary changes in the technology of energy production, distribution, storage and conversion.”<sup>20</sup> They identify an entire portfolio of technologies requiring intensive R&D, suggesting that the solution will lie in achieving advances in many categories of research. They conclude that developing a sufficient supply of technologies to enable near-zero carbon intensity on a global scale will require basic science and fundamental breakthroughs in multiple disciplines. Therefore, Herculean technological improvements beyond those that are already projected and accounted for in cost models appear to be the only hope for achieving meaningful reduction of climate change risks. By inference, no cap-and-trade system should be placed into law that does not simultaneously incorporate specific provisions that directly support a substantially enhanced focus on energy technology R&D.

Placing a price on carbon emissions, as a cap-and-trade program would do, would affect the pattern of private sector R&D. However, this so-called “induced-innovation effect” would be small. Economic analysis shows that market forces produce a less than socially optimal quantity of R&D. Once a private sector innovator demonstrates the feasibility and profitability of a new technology, competitors are likely to imitate it. Copycats can escape the high fixed costs required to make the original discovery. Therefore, they may gain market share by undercutting the innovator’s prices. In that case, the initial developer may fail to realize much financial gain. Foreseeing this competitive outcome, firms avoid investment in many R&D projects that, at the level of society as a whole, would yield net benefits.<sup>21</sup>

The task of developing new carbon-free energy sources is likely to be especially incompatible with the private sector's incentives. With no large emissions-free energy sources lying just over the technological horizon, successful innovation in this area will require unusually high risks and long lead times. As Hoffert et al. pointed out, developing the needed technologies will entail breakthroughs in basic science, placing much of the most essential R&D results beyond the boundaries of patent protection. These are precisely the conditions under which for-profit firms are least likely to rely on R&D as an approach to problem-solving. Thus, greenhouse gas caps on their own would insufficiently increase private sector R&D directed toward technological solutions to abatement.

Market-based policies can very effectively stimulate incremental innovation and deployment into the market place of emerging new technologies. They cannot, however, stimulate the kinds of technological progress necessary to enable meaningful emissions reductions later on. Realistically, then, government must play an important role in creating the correct private sector incentives for climate-related R&D, as well as in providing direct funding to support such activity. This role must be built into any cap-and-trade policy, in order to avoid establishing an emissions policy that cannot fulfill expectations, and to avoid wasteful diversion of key resources for the requisite forms of R&D.

Merely establishing cap and trade cannot meet the crucially important need for enhanced emphasis on basic research rather than additional subsidies for specific technologies that are already far along in the development process. It also does not clearly define government's role or an appropriate division of labor or risk between the public and private sectors in the development of new technologies, whether as commercialization and incremental improvement of existing low-carbon technologies, or R&D for new, breakthrough technologies. Creating an effective R&D program will not be easy, but it ultimately has to happen if climate risks are to be reduced. The difficult decisions are how much to spend now, and how to design programs to stimulate R&D that avoid mistakes of the past.

In conclusion, the current policy debate about how to impose near-term controls through cap-and-trade programs is encouraging policy makers to neglect much more important, more urgently needed actions for reducing climate change risks. The top priority for climate change policy should be a greatly expanded government-funded research and development (R&D) program, along with concerted efforts to reduce barriers to technology transfer to key developing countries. Neither of these will be easy to accomplish effectively, yet they are receiving minimal attention by policy makers.

#### ENDNOTES

<sup>1</sup> Emitting companies may be able to pass some of these two cost components on to their customers, and so directly-regulated companies could be given more compensation than the cost that their shareholders bear if all of the allowances were allocated to them alone. However, this only means that a part of the net cost has been spread to other, non-regulated parties, including consumers. They, in turn, would require their share of the allowance allocation to be compensated for the part of the cost that was passed to them. There is not enough value in the allowances to cover all costs to regulated companies if they cannot pass those costs on, and neither can that value cover all the incurred costs even if they are passed through to customers and spread throughout the entire economy.

<sup>2</sup> For a review of the literature and specific analytical examples, see A. E. Smith, M. T. Ross and W. D. Montgomery, Implications of Trading Implementation Design for Equity-Efficiency Trade-offs in Carbon Permit Allocations, Charles River Associates Working Paper, December 2002.

<sup>3</sup> Congressional Budget Office, Trade-offs in Allocating Allowances for CO<sub>2</sub> Emissions, Economic and Budget Issue Brief, April 25, 2007, Figure 1.

<sup>4</sup> Congressional Budget Office, op. cit., p. 5.

<sup>5</sup> The points are further explained in my paper (Smith, Ross and Montgomery, op cit.). The CBO does acknowledge some of the following, but the caveats noted by CBO are not usually noticed, although they are extremely important to how this research is applied to actual policy design.

<sup>6</sup> Smith, Ross and Montgomery, op cit., p. 54.

<sup>7</sup> Congressional Budget Office, op. cit., p. 5, footnote 15.

<sup>8</sup> J. Pauwelyn, U.S. Federal Climate Policy and Competitiveness Concerns: The Limits and Options of International Trade Law, Nicholas Institute for Environmental Policy Solutions Working Paper NI WP 07-02, April 2007.

<sup>9</sup> Ibid.

<sup>10</sup> Some have argued that banking reduces price volatility. While it may reduce it, it certainly does not eliminate it. For example, the Title IV SO<sub>2</sub> market has experienced high volatility over the past two years, even though it has a large bank already in place. During 2005, SO<sub>2</sub> permit prices rose from about \$600/ton to above \$1600/ton, then plummeted to below \$400/ton by the beginning of 2007. Additionally, banking offers little price stability at all during the start up of a new cap, simply because no bank yet exists, and this initial-period volatility can be very

large if the first-period cap requires a substantial amount of reduction and/or has a relatively brief regulatory lead time. The experience of the first year in the NOx cap of the Ozone Transport Region of the northeastern U.S. is a classic example.

<sup>11</sup>By “base” operating cost, I mean the cost of generating a unit of electricity before accounting for the emissions price. The majority of this cost is the cost of the fuel.

<sup>12</sup>However, the percentage increase in the base operating cost would be much smaller (i.e., about 30% compared to 175%) because natural gas is so much more expensive than coal.

<sup>13</sup>Eurostat, “News Release—July 14, 2006” (Revised version 93/2006), available at <http://ec.europa.eu/eurostat>

<sup>14</sup>Richard G. Newell and William A. Pizer 2003, “Regulating Stock Externalities Under Uncertainty,” *Journal of Environmental Economics and Management*, Vol. 45, pp. 416-432.

<sup>15</sup>Outside of the U.S., further confusion about the notion of a “safety valve” has been created by application of this term to the traditional notion of a penalty for noncompliance. The EU ETS has a penalty for noncompliance that is (Euro) 40/ton CO<sub>2</sub> in Phase I and will be (Euro) 100/ton in Phase II, starting in 2008. This is often described as a price cap, but its very high level relative to the price at which the cap is expected to be met makes it extremely ineffective. Further, its role as a penalty rather than as an additional compliance mechanism clearly would undermine the willingness of companies to resort to its use for planning purposes. The same confusion of penalty and safety valve appeared in the proposal for an Australian emissions trading scheme released in 2007 by Australia’s National Emissions Trading Taskforce. The notion of a “safety valve” should be clearly separated from the role of a noncompliance penalty, with the former being set at a price that is considered an acceptable level of policy implementation cost, and the latter being set at a much higher level that is considered “punitive” and not acceptable as an indicator of the cost of meeting the policy goals.

<sup>16</sup>“Cost Containment for the Carbon Market: A Proposal,” developed in consultation with the Nicholas Institute of Environmental Policy Solutions, Duke University, July 24, 2007. Available: <http://www.nicholas.duke.edu/institute/carboncosts/carboncosts.pdf>.

<sup>17</sup>*Ibid.*, p. 3.

<sup>18</sup>*Ibid.*, p. 7.

<sup>19</sup>Congressional Budget Office, *Limiting Carbon Dioxide Emissions: Prices Versus Caps*, Economic and Budget Issue Brief, March 15, 2005.

<sup>20</sup>M. I. Hoffert et al., “Advanced Technology Paths to Global Climate Stability: Energy for a Greenhouse Planet” *Science*, Vol. 298, Nov.1, 2002, p. 981.

<sup>21</sup>These points are developed in a more rigorous fashion in W. D. Montgomery and Anne E. Smith “Price, Quantity and Technology Strategies for Climate Change Policy,” in M. Schlesinger et al (eds.) *Human-Induced Climate Change: An Interdisciplinary Assessment*, Cambridge University Press, 2007.

Chairman SPRATT. I listened to the testimony of all of you. You seem to be attributing great dexterity to the invisible hand that moves through a very substantial market, the entirety of the United States. What mechanism would you employ to administer and facilitate the operation of this system we are talking about, a cap-and-trade system? It obviously can’t be turned over just to the marketplace, it has to have some kind of overseer and administrator, it seems to me, to be operative. We will start with Dr. Orszag.

Mr. ORSZAG. Let me make two points about administration. The first is that you could impose a cap-and-trade system at different parts of the production process, if you will, either upstream—that is, you know, at the point of an oil or natural gas or a coal firm—or downstream, in the form of the goods and services that are actually then bought by households. It is almost universally viewed by analysts that an upstream approach would be much more administratively efficient because you have to then monitor many fewer potential sources. So that is the first point.

The second point is it is difficult to see how a system of—a cap-and-trade system could be effectively undertaken in the United States without at its heart the Federal Government playing an important role in monitoring and enforcement. And that actually then speaks to the scoring issue that I was mentioning. In addition to the allowances being very cash like, it is also the case that the Federal Government will have to be at the heart of enforcing and monitoring how the allowances are used and whether firms are exceeding their allowances and what have you.

Chairman SPRATT. Mr. Doniger.

Mr. DONIGER. Thank you, Mr. Chairman.

If I could add, of all the kinds of pollution regulatory programs, the cap-and-trade system is the most economical to administer. Everything that Mr. Orszag said is true, but it is a much simpler system than traditional command-and-control systems.

For example, the Environmental Protection Agency administers the acid rain cap-and-trade program, and I don't remember the exact number, but it is with a couple of dozen employees as opposed to the more command-and-control portions of the clean air program, which involves hundreds of people. And the fundamental thing, as Dr. Orszag said, is that you have to have systems of monitoring emissions and reporting those emissions and then making sure that the submission of allowances is made by a company in the number which it owes.

In the acid rain program there is almost perfect compliance. There is a system of monitors in the stacks of the major power plants in this country that gives hour-by-hour readings of four pollutants—excuse me, three pollutants, one of which is carbon dioxide. So we already have under the Clean Air Act all the data necessary to implement this program for the electric power industry. And there is equally good data on the amount of fuel that moves through refineries.

Various other statistics are already out there and collected by government agencies from which you can either directly measure or infer the amount of CO<sub>2</sub> that is released there, or will be released, when the fuel is burned by households or by cars or whatever.

So the system is actually quite economical. It does depend on there being a penalty which is larger than the market price. So most of these bills have, as a rule of thumb, that the penalty for not submitting allowances is on the order of three times the price of an allowance. And that is why you get such ready compliance, because it always makes sense for a company to turn in the number of allowances it owes rather than—

Chairman SPRATT. Is this a self-certifying system, then?

Mr. DONIGER. No, at least with the acid rain program and a couple of other programs of the same nature, companies file reports, there is a violation of law to mislead, there are extensive records which are kept which are quite good at preventing that kind of misleading. But you do need a government authority and the EPA or another agency which has the power and the resources to check and audit, and when it finds problems, go after violators. But it is a very economical system compared to many other kinds of pollution control systems.

Chairman SPRATT. Mr. Greenstein, you have been around the government a long time. What NRDC is proposing is a slight increase over time, less in previous—I think it is up to 450 million ppm or whatever it is, and then it drops down by 80 percent over the next 50 years. Can that be accomplished, in your view, without some sort of strong oversight by the Federal Government?

Mr. GREENSTEIN. I am not an expert on these aspects of environmental policy. My testimony really focuses on the areas we know: fiscal policy and distributional effects on low-income households. The only thing I would note on this front is that if the Congress

enacts legislation that phases various things in over time, you probably want to design it in a way that minimizes the potential for future Congresses to undo the phasing in of the controls over time.

Having said that, certainly both the economic price and the political difficulty of going in one fell swoop to the full degree of reduction in emissions one would like to achieve would make that impossible. I don't think there is any alternative but to phase in the reductions in emissions over time. Given that there is no alternative to do that, I think it means one designs the legislation in a way to try to maximize the potential for the reductions to stay in place and to minimize the potential for future policymakers to undo them before the goal is reached.

Chairman SPRATT. Dr. Smith, what do you propose for the oversight, administration, and implementation?

Ms. SMITH. If you are going to have a cap-and-trade system, you definitely need to have sound monitoring and sound enforcement. I don't think you need any sort of oversight board to interfere in the marketplace per se, and you definitely would not need that if you had a safety valve price. But I do want to comment that Mr. Doniger said that of all the types of emissions regulations that are possible, cap-and-trade is the easiest to administer. And this is simply not true.

A carbon tax would be far simpler to administer. There would be no auctions. There would be no volatility to worry about. There would be far fewer worries about possible market manipulation that could occur. You would still need to have the enforcement and the monitoring, of course, but the issues would be much simpler. And the analogy to the SO<sub>2</sub> market for a CO<sub>2</sub> market is actually a very poor one. The SO<sub>2</sub> market applied to a few thousand individual electricity-generating units, all of which were already highly overseen by regulators in the first place in a very uniform market. With CO<sub>2</sub> we are looking at thousands of more sources, all sorts of sectors of the economy, encompassing other types of gases than CO<sub>2</sub>. And even CO<sub>2</sub> sequestration activities, which are taking CO<sub>2</sub> out of the atmosphere, rather than emitting, all of these make for a far more complicated sort of marketplace to monitor and enforce.

Chairman SPRATT. In your testimony, and this is my last question, but you do raise a difference between your viewpoint and Mr. Doniger's and Dr. Orszag's. That is, you question the assertion that emitting businesses would require less than 15 percent of the allowances to compensate for losses due to the carbon caps. You call these misleading, and maybe even suggest you have been miscited. Would you like to explain to us why you think the 15 percent is misleading?

Ms. SMITH. Certainly. I will say that that literature does demonstrate that you don't necessarily need to give 100 percent of the allocations to businesses in order to compensate their profitability losses. The 15 percent is the oversimplification, and the suggestion that it is a very small percent. For instance, the models that have produced that number have always assumed that the allocation would be a permanent, infinite horizon allocation, year over year, all the way into the future. As you probably are aware, most real-world applications of cap-and-trade for CO<sub>2</sub> involve a phaseout of

those allocations, perhaps as short as 10 years as one amendment over on the Senate side says today. With a phaseout like that, you are going to get less value from your allocations because you will get them over a shorter period of time. But you have to nevertheless achieve the same amount of compensation because the costs go on forever and they continue to rise.

So if the allocation has to perform the compensation in a short period of time the percent will rise. It is just a very simple piece of algebra. And we saw, for instance, in our analysis that an 8 percent allocation, if it were to be a constant allocation just for 10 years and then phase out, would require rising up to about 50 percent allocation in order to achieve the exact same amount of compensation to the exact same businesses with the exact same policy. So that is one important area.

Another one is that the percent, whatever it is, 15 percent or 50 percent, in the case of that other estimate, is based on the average of a sectoral impact. And there are many businesses in a sector. And these models work with very, very aggregated sectors. One sector is the entire electricity-generating sector, rather than all types of generators, some of which emit carbon and some don't. Another is all of the energy-intensive sectors, which include many, many diverse types of manufacturing all into one because they all happen to use a lot of energy in their production processes. They have very different marketplaces. Some of them may benefit under a carbon market and some may lose. If you try to estimate what the impact would be to the sector on average, you may find that you need no compensation, zero percent. But in fact if you say, well, if you look behind those numbers you find that that has assumed that you have taken the profits from the winning companies, compensated the losing companies in the sector with those profits that they will never get their hands on, and then only say what do we need in addition to further offset the overall sectoral losses?

So in one analysis we found a zero percent needed allocation to compensate a group of businesses. Actually, if you looked at the need to compensate each of the individual losers, without taking profits away from the winners, it translated into 30 percent allocations. So those are two very critical ones.

Also the models are very poor at estimating whether certain companies can actually pass their costs through to customers. The models assume a good deal of price pass-through. And that is simply not the case for some kinds of businesses, particularly those that are exposed to trade competition from foreign imports or exports. If they can't pass it through, they need a larger allocation to be made whole. Because part of the reason you don't need to give a hundred percent of the allocation to businesses is because a lot of the business costs do get passed through to the consumer. And that will happen.

As we said, prices of energy will go up, and it will get passed through in many cases to consumers as higher costs of goods and services.

Chairman SPRATT. Dr. Orszag, would you like to respond briefly?

Mr. ORSZAG. Sure. I would first note that the paper that talks about this from CBO was issued under my predecessor, Douglas

Holtz-Eakin. I have reviewed that. I think that the depiction therein is entirely accurate. It does distinguish between net effects on the sector and compensating individual firms. And I don't think there was anything misleading at all in CBO's presentation.

I would also note a deeper question, though, which is in many discussions of compensation for losses there is a level of aggregation that is undertaken. Mr. Greenstein, for example, talked about compensating low-income households. That was an average across all sorts of low-income households, some of whom will lose more and some of whom will lose less. If you compensate low-income households, on average, you are not going to hit each individual household exactly, nor do I think it is even possible for you to do so. So it is often the case in this kind of setting, that there is a level of aggregation done and an impossibility of reaching in and compensating each individual household or each individual firm for the effects imposed on them. If you tried to do that, I think you would wind up with a bigger administrative mess than administering the cap-and-trade program itself.

Chairman SPRATT. Thank you very much. Now, Mr. Doniger, did you want to say something?

Mr. DONIGER. Just one quick point. The whole premise that the company's shareholders need to be compensated is based on an assumption that this program is coming and hitting them as a surprise. But we have known for a long time that global warming is a problem. And smart investors have known that there were risks associated in holding positions in companies with a lot of carbon exposure. I am not sure that it is—I am not saying that we oppose using a share of the allowance proceeds for some sort of transitional assistance to companies in the fossil fuel industry. I am not saying that NRDC completely opposes that.

But I do think that it shouldn't be taken as a given that they are owed this, because like everybody else, they have been on notice that global warming is a problem and legislation is coming.

Chairman SPRATT. Thank you, sir. Mr. Ryan.

Mr. GREENSTEIN. One quick point also, since I was also accused, my testimony along with Dr. Orszag's, of being a little misleading here. As Dr. Orszag said, our estimate of a 14 percent of the allowances to offset the effects on low-income households, there would be winners and losers in that. If I tried to give you an estimate of how to do something you could administer that identified every single low-income household in the United States and made them whole, it would cost more, but that is not feasible. And it doesn't occur to me that it has been the policy over time of the U.S. Government every time it institutes a new policy in any area to try to identify every individual firm in the United States that may be affected by a change in policy or regulation and fully compensate it. It is not feasible.

The other point is it certainly is true that if you phase out the allocation of permits to energy companies after something like 10 years, then your initial percentage would need to be higher than 15 percent. The 15 percent figure that CBO talked about, and we are just citing their figure, is a steady-state figure. You can do 15 percent in perpetuity or you can do a somewhat higher percentage

initially and phase it down to zero over time. There is nothing misleading there. You just take your choice on how you do it.

Chairman SPRATT. Mr. Ryan.

Mr. RYAN. Thank you, Chairman. This is a good hearing and a good debate, and something we need to do a lot more of. Unfortunately, some of us are on Ways and Means, we are in the middle of a markup, we have amendments coming up, so we are going to be coming and going. I guess this debate shows you that, you know, modeling is a crude science still. And these sectors-wide, aggregate-wide, economy-wide models are tough and crude and difficult to measure.

And so when we put in place policies that are so prescriptive, it is really difficult to measure the outcomes. And so that is why I want to get into the debate about if we do cap-and-trade, and we don't have a safety valve on leakage, then what are the consequences? If we do have a safety valve, then we still lose emissions, either way you go, because of foreign competition.

It seems to me going down the cap-and-trade route, and if we take Mr. Doniger's recommendation and don't have any price protection, don't have a safety valve, then you will have a lot of leakage, at which planetarily-wise you are going to have a reduction in your goals. But if you do have leakage protection, or you do allow leakage—I mean if you do allow a price ceiling, then you are going to have—you are going to reduce your goals either way. So the point is why don't we have more discussion about a carbon tax instead of a cap-and-trade? If we are going to spend all of our time building a big mouse trap to try and reach the goal of cap-and-trade, isn't a better, more efficient, less economically damaging route a tax?

I think the Mankiw article that I think, Bob, you mentioned, which I agree, if you just take benefits out of the economy and give to a few, you are clearly giving something that is more valuable. Corporate welfare is probably a good way of describing it. But at the same time, think Greg also mentioned we maybe ought to look at a tax that is international. And therefore you can have global adjustments, border adjustments.

So here is my quick question to everybody. And then, Peter, I have a scoring question I want to ask you, and then I will turn it over. Those of you who are advocating cap-and-trade, why is it that you think this is so much better than a tax if, given we have to do all of these things to try and police a cap-and-trade, would seem to me are going to escape us and we will not meet our goals?

Mr. DONIGER. Could I take the first whack at that?

Mr. RYAN. Sure.

Mr. DONIGER. First of all, let me go back to the beginning. There is a distinction to be made between the volatility problem, prices going up and down year to year, and the long-term cost. The volatility problem, in my experience in talking with people from the industries, is the thing that really kills people. If their costs are predictable, they can adjust to them.

So how do you avoid volatility? Well, the primary way to avoid volatility in a cap and trade program is with banking, which means that if prices are low in a year, you control more and you save up the allowances and borrowing. If costs are high, you can borrow

from the future under an interest-based repayment. And that can have the capacity to smooth out this year-to-year volatility.

If you had the ability during the spike in natural gas prices to have borrowed and used natural gas that wouldn't be pumped from the ground until 2020, it would have dampened the price of 2006 natural gas.

You can do that with allowances because you can shift them in time. So I don't think the volatility problem is as serious a problem or it has a cure without going to the safety valve.

The second point I would make is that your question and Dr. Smith's observation assumes a very long period in which the United States is doing its thing on global warming all by itself and other countries are not coming along. Well, first of all, except for Australia, the rest of the industrial world is already ahead of us and we would be joining them rather than leading them.

Secondly, there are provisions in several of the bills to create more leverage for bargaining with key developing countries by proposing that there should be border pollution purchase requirements like a board of tax adjustment if after a number of years key countries don't have comparable control requirements.

As someone who has worked in the international negotiations as well as the domestic arena, I think the time actually has come where the developing countries are ready to respond if and when we lead. So it will come together in the next 5 to 10 years, and you won't have that sort of thing.

The last point on the tax, what the atmosphere sees is the number of tons that go into it. That is what causes global warming. So we need, in my opinion, a direct limit on the amount of pollution that goes into the atmosphere. When you use a tax approach, you are guessing at how much response there will be in terms of what pollution levels will go in. And it is not easy to write a tax. Everyone has their own different provisions and subprovisions and loopholes and this's and that's. It is not any less complicated than writing a cap and trade program, and you have to keep adjusting the amounts to get the results you want.

Mr. RYAN. I would simply say, constructing a border adjustment regime on a cap and trade program that is WTO compliant I think would be a lot more difficult than if you did it on a tax. We did DSC and FSC and all of these iterations, and now ETI, and now where are we. We have had a hard time just with existing trade law and tax policy complying with WTO. I think there is a case to be made that this would be very difficult. Because we are worldwide and the rest of the countries are territorial our tax regimes are different. We would have a very hard time, I would think, constructing a WTO compliant border adjustability regime under a cap and trade program than if we did in our tax system.

And I know you are not a tax guy, I think the other folks here are. But go ahead, Bob.

And then one just quick question, Peter, I want to ask you about scoring.

Mr. GREENSTEIN. It seems to me one way to think of this is think of three alternatives, carbon tax, cap and trade; the third alternative is doing nothing, sticking with what we have now.

Now, clearly, by far the worst alternative is doing nothing. The difference between that and either cap and trade or a carbon tax is vastly greater than the difference between a carbon tax and a cap and trade.

So I would agree with you that if we could either do a cap and trade or a carbon tax, I would prefer a carbon tax. My concern is that the political system I think would have a real—all of you and your colleagues—a much harder time enacting a carbon tax than a cap and trade system. I wish that weren't true. That certainly is true today; maybe it won't be true in a couple years.

Mr. RYAN. Right. But politics aside, in theory in the policy vacuum you are saying the carbon tax is the better way to go than a cap and trade?

Mr. GREENSTEIN. In a policy vacuum, I would prefer a carbon tax. But I have a very strong fear that if one tried to move it, those who advocated it would be immediately attacked as tax increasers and the whole thing would fall apart and we would end up with nothing. So in the ideal world with no politics, I would prefer a carbon tax. But I don't want to let the perfect be the enemy of the good.

Ms. SMITH. I first want to point out, banking is not a way to reduce volatility. There is an enormous amount of banking allowed and used in the SO<sub>2</sub> cap, and yet we have seen huge volatility in that market. Just in the past couple years, prices rose in the space of 12 months from \$400 per ton of SO<sub>2</sub> up to \$1,500 a ton, and then plummeted back down to the range of about \$500 a ton.

And you have hit it on the mark about the tax. For the WTO compliance, a tax allows a much easier and immediate, without delay, implementation of border tax adjustment that would be WTO compliant or very likely to much, more likely than anything that has been proposed around the cap and trade schemes. Taxes may be complicated to implement into law, to enact into law and write, but I think we are seeing that cap and trade is complicated to enact and write into law. Just have a look at the length of the Lieberman-Warner bill. But once you get it implemented, and it is pretty easy to know if it is a simple one or not. Once you get it implemented, then you have all the benefits of simplicity associated with the tax in addition to the international trade side of it.

Mr. RYAN. Okay, Peter. Answer that question, then I will tack this out at the end. Your written testimony, you go into sort of scoring rules that you are going to put down. If we send you a bill, one that auctions how we score that, if we send a bill that does not auction, that gives the allowances away, how is that going to be scored?

Mr. ORSZAG. Let me answer that question first. As my written testimony notes, if you auction the permits, that would be scored as a revenue. If you gave the permits away, there is a solid case to be made that that should be scored as a revenue and a corresponding outlay with no net effect on the deficit. That would be a departure from the way that the sulfur dioxide program, for example, was scored, and it would be a departure from the fact that the budget is primarily cash based.

On the other hand, again, there is a very solid argument to be made that that would be the most insightful scoring to put equivalent transactions on an equal footing in the scoring process.

Mr. RYAN. You can't be a two-handed economist when you are CBO Director though. You will have to make a decision.

Mr. ORSZAG. Within a very short period of time, we will have to make a decision.

Mr. RYAN. And you have yet to do that?

Mr. ORSZAG. We have not yet formally done that. Again, I would just say there is a solid case to be made for treating the permits that are given away as both a revenue and an outlay.

Mr. RYAN. So no net effect?

Mr. ORSZAG. No net effect on the budget. However, the benefit of that kind of approach is it would make it transparent what was happening. And in particular, again, repeating the equivalents, giving someone permits worth \$100 that they can immediately turn around and sell for cash is effectively equivalent to selling the permits for \$100 and then giving that person or firm \$100 in cash. Scoring the permits that are given away as a revenue and an outlay would make those equivalent transactions equivalent in the scoring process. And for transparency and so that policymakers can evaluate the tradeoffs clearly, there is a solid case to be made for that kind of scoring.

Mr. RYAN. Then, because I know you do tax as you dabble there, isn't it easier for us to concoct a border adjustability regime that is WTO compliant based on a tax versus a cap and trade system? And give me your take on the efficiencies of achieving the end goal between the two.

Mr. ORSZAG. First, as my testimony makes clear, a tax is generally more efficient than a cap and trade system. You can make a cap and trade system sort of approach the efficiency of a tax by changing its design features. So, banking and borrowing and then a safety valve, as you noted. And so, relatively speaking, a tax is more efficient, but a cap and trade can approach the efficiency of a tax with design features that I mentioned.

On the border tax adjustments and WTO compatibility, I would say the area of adjustments in a cap and trade system at the border has ambiguities associated with it. Before I joined CBO, I had done some work in the area. And I would just say that is a particularly complicated area in which I wouldn't want to make predictions about what exactly is or is not WTO compliant.

Mr. RYAN. Thank you.

Mr. SPRATT. Ms. Tsongas, welcome. Do you have any questions?

Ms. TSONGAS. I don't, but I have enjoyed your testimony. This is clearly an issue we have to face, and there is no time to waste.

Mr. SPRATT. Mr. Smith.

Mr. SMITH OF NEBRASKA. Thank you very much for your time here. I know that it gets to be a challenge balancing science and politics and economics, and I appreciate your efforts.

In trying to read up on so much of this, it has been interesting to see, and especially for my district, a large producer of livestock. And I have read about the impacts of high corn prices, not only high corn prices on the prices in livestock, but across the food spectrum, if you will, around the world.

Here are pluses and minuses along the way. But especially the criticisms of the livestock industry and relating to carbon, would situations be considered, Mr. Orszag, if you don't mind; with a cap and trade system would the increased costs of food production be considered in this equation?

Mr. ORSZAG. There would be a variety of effects that would be spread out across different sectors, and the agricultural sector in particular would experience effects. I would also note, the agricultural sector would be one of the sectors most affected by a change in climate, so you also need to weigh the costs and benefits.

And beyond that, I would just point out that your example might be a particularly salient one to return to the scoring issue. Handing a farmer a permit worth \$100 that the farmer then turns around and sells for cash of \$100 is really similar to handing that farmer \$100 in cash.

So you are right to identify your district and the agricultural sector in particular as a key sector in climate change. It is often noted that methane emissions are tied to the agricultural sector, and that is one of the greenhouse gases. And there would be important effects that are part of all of these models that strive as best they can to identify potential impacts on particular sectors.

Mr. SMITH OF NEBRASKA. Go ahead.

Mr. DONIGER. May I add a couple points? First, that most cap and trade bills don't suggest they would actually control the emissions from most agricultural activities. But the change in the markets for energy means that there will be even larger opportunities for farm-based energy production. And this is apart from allocation subsidies or other subsidies. It just becomes more valuable to make wind energy, to recover methane natural gas from the wastes of livestock production, to grow, we would hope, cellulosic products, not the corn but the stocks, switchgrasses and so on, and turn those into ethanol. So you get an increase in farm-related energy markets just from the imposition of a cap. And there can also be, inside the distribution of the allowances there can be incentives to make some of those technologies come forward faster.

Mr. SMITH OF NEBRASKA. Dr. Smith.

Ms. SMITH. I would like to also point out agriculture is one of the most energy intensive forms of manufacturing we have in the U.S. It is up there with other energy intense sectors. Cost of energy, when it rises, will raise the cost of farming. There is no question, though, that there may be some opportunities if the world is shifting towards biomass-based ethanol and use of land for forestry. There will be higher rises and changes in markets for land as well as change in markets for the crops off of the land, and I think it creates much uncertainty. There could be some upside for farmers, but it could also be a pretty disruptive time. At the same time, all the input prices are changing.

Mr. SMITH OF NEBRASKA. I think you might have been reading a transcript of some conversations I had with constituents. I appreciate your bringing that up, because agricultural producers, their greatest concern right now is the cost of energy. And with the direct impact that a cap and trade system would probably have on the energy costs, it would even exacerbate the problem that I see.

When we look at the larger issue, again, are we confident that those who would be most impacted across the border, whether it is individuals, whether it is companies, whether it is those on fixed income paying their utility bills, that we can truly address all those? I know that is an ambiguous question; but I am fearful that there might be some unintended consequences along the way.

If Mr. Greenstein would respond.

Mr. GREENSTEIN. Sort of following up on an earlier comment I made. If the question is, could we identify every individual firm or elderly person on a fixed income, or a farmer, and fully offset the impact, no, we can't do it for each individual one. We have never done that for any big policy the government has ever implemented.

What we can do, though, is we can identify the priority needs. And if we auction off the lion's share of the permits, the resources are there. One can design in an efficient manner how to provide the assistance in those areas.

Now, clearly you are not going to be able to fully offset the impact on everyone. If you took every consumer at all income levels and fully offset the cost on all of them, you wouldn't have money for basic research, or you might not have enough to go deeper in the coal mining communities. You make some choices. But the amount of revenue that can be raised, whether it be through auctioning permits or a carbon tax, as Mr. Ryan suggested, is sufficient that Congress could identify all the priority needs it needed to address, and it could on average fully address the needs in each of those areas, whether it be energy companies, people on fixed incomes, low income consumers, or the like.

Mr. ORSZAG. Mr. Smith, let me just add that it is not possible to compensate each individual household or each individual firm precisely because there is an overall economic cost to acting. That overall economic cost means it is not—I don't want to call it a fool's quest, but it is not possible to compensate everyone for the effects because there is some net cost. However, that cost has to be weighed against the benefit of purchasing insurance against climate change, basically.

And so attempts to fully compensate everyone for the economic costs involved are not going to succeed almost by definition, but the net cost that sort of will be there needs to be weighed against the benefit of reducing the risk of potentially catastrophic climate change.

Ms. SMITH. I would like to add, I completely agree. There was a net cost that was my starting point. The different forms of allocations can maybe help find a way to smooth out where the impacts are, but there is no way to make everybody better off even if you get a fully smooth and equitable sort of distribution.

But I also want to point out, yes, we need to try to weigh the costs against the benefits, and we need to look at the costs that I just reported in my statement. Those are the net costs after accounting for all the recycling of all the benefits associated with the revenues from the allocations. And so the net average cost to the household for the kinds of hard cap bills that we are looking at, without accounting for the uncertainty of volatilities, is in the range of \$1,000 to \$1,500 a year. That is what needs to be compared against the benefit from the climate.

Mr. ORSZAG. So it is not net-net.

Mr. SMITH OF NEBRASKA. Thank you, Mr. Chairman. I really want to thank the witnesses here today. This has been very interesting and I think a very productive debate. Thank you.

Mr. SPRATT. Thank you, Mr. Smith.

One final question of Ms. Smith. Would you take just a minute and explain to what extent that CRA's analyses, your analyses take into account the economic benefits of imposing climate control, particularly with respect to avoiding environmental harm and even catastrophic consequences?

Ms. SMITH. As I just said, those are the costs that need to be evaluated against the benefits. So they do not include the environmental benefits; instead, they provide you a sense of what you would be spending for different emissions targets. And then one can ask, what do we gain from those emission targets?

I would just take a moment to mention that some of these catastrophic changes, if they are happening now, will not—the risk of them will not be changed by any of these carbon policies. We can change the amount of future warming that might occur with deep cuts on a global basis, but the kinds of changes we are talking about in those cap and trade programs that the U.S. is undertaking would not be able to avert any catastrophic losses that are already in the works. They don't make enough change in the climate forecast.

Mr. SPRATT. Mr. Doniger.

Mr. DONIGER. Thank you, Congressman. First, what we are sketching out is the U.S. part of a balanced world program to cut back the global warming pollution not yet in the atmosphere. And the IPCC and many other analysts see increasingly dire future consequences as the temperature goes up.

If we had it in our power, we would keep the temperature from going up at all, but there is some increase coming from the pollution already in the bank, already in the air, and from the activities that we need to turn around that won't be turned around overnight.

So the goal, at least from the environmental community, is to draw as much as we can a bright line against letting the temperature increase over where we are now go on a global average up another 2 degrees Fahrenheit or more than that.

It is true, as Dr. Smith said, that there are impacts occurring now, and it is unfortunately true, that have resulted from the global warming pollution already in the atmosphere, changing the frequency of droughts and storms and some of the other bad events. Not every fire, not every hurricane obviously is caused by global warming, but you are changing the number of dots on the dice and changing the outcome as we roll the future climate dice.

We have no alternative but to cut back emissions now in order to stave off the impacts we have not yet committed to. If we just keep letting it go, it just gets worse and worse.

Mr. SPRATT. Mr. Greenstein?

Mr. GREENSTEIN. I was just going to say we need numbers to help guide us in work, especially those of us who deal with the budgets. One problem we sometimes run into is for things that we do not have enough data to quantify, we run the risk of ignoring

or acting like there is zero. In this case, the thing we can't quantify is the economic damage, and you could—how you would average it per household of doing nothing.

Now, think of the—let me be clear. I am not an expert on Hurricane Katrina. I don't know to what degree that was climate change related. But for sake of illustration, suppose over the next 50 years there were a series of events like that that could have been averted if we took strong action to address climate change. The potential economic impacts of those would be very large. And if we knew the number we could quantify it per household. We can't do it because we can't possibly predict what that is. We can't come up with a number. But it doesn't mean the number is zero. And there is a very substantial chance that that number is substantially larger than all the numbers we are talking about here today of the potential effect per household because of what would be relatively modest impacts on the economy.

Mr. SPRATT. Mr. Smith.

Mr. SMITH OF NEBRASKA. I know you are not scientists, but we are trying to balance all of this right here. If those who would wish to state on a scale of 1 to 100 the certainty of reversing global warming with a cap and trade program.

Mr. DONIGER. Let me take the first cut at this. The analysis by the IPCC scientists, the Intergovernment Panel on Climate Change, and by others is that the kind of emission reduction pathway that I am talking about, 15 percent reduction by 2020, 80 percent reduction in the U.S. by 2050. If matched by other developed countries, and there is a lot of those countries that are ahead of us, and if not exactly the same action but proportionate action is taken in moderating emissions growth in developing countries and ultimately to reduce it, that sketches out a budget, an atmospheric carbon budget that is consistent with avoiding the 2-degree increase or worse that I described. And that is the physics, that is the budget of the atmosphere that we are bringing to this economic budget hearing.

Mr. SMITH OF NEBRASKA. Anyone else wishing to respond?

Ms. SMITH. There is no question, if we were to stop the growth of the CO2 emissions and the other greenhouse gases going through the future and through this century, that we would reduce the amount of warming that will occur otherwise. But we are not going to reverse the warming that is occurring now without waiting another century or so.

So there is a certain amount that is committed. It is not going to get reversed. Then the question is, with these expenditures, what will we do in the way of reducing further growth? There is a serious issue here where we don't have developing countries involved and their emissions aren't being reined in, and there is nothing on a hard cap in the U.S. that actually brings them into the fold. In fact, they have more and more incentive not to come into the fold as we put tighter and tighter caps on ourselves unilaterally because they gain competitive advantages over it.

So the real issue is, can we get a globally coordinated reduction in those greenhouse gas emissions? And just putting a cap on the U.S. emissions and in bearing these costs in the near term isn't going to accomplish that.

That doesn't mean that we shouldn't try to take some action in the U.S. to start to put in effect a cost effective climate policy that will start to move us in the direction of getting towards zero emissions over the next century. And by "us," I mean the whole globe. And that is the other point I have been making, is that these policies are more costly than they need to be in order to get us on that long-term, centuries long action to prevent more greenhouse gas increase than is desirable.

Mr. ORSZAG. Could I just add one thought, which is I think too much of the discussion about future climate change has focused on the expected outcome, the range of say 2 to 6 degrees Celsius, for example, and too little on what economists call the tail, the small probability of really bad things happening. And I would think that more attention, even though they are extraordinarily difficult to quantify or even know what the risk is, more attention to that risk would be beneficial in evaluating the pros and cons of moving forward rather than just the sort of expected outcomes, because there is an important element of insurance here against that kind of catastrophic risk.

Mr. SMITH OF NEBRASKA. Thank you.

Mr. SPRATT. Thank you, Mr. Smith.

Now, I believe that concludes the hearing. I have one final detail. Any members who did not have the opportunity to ask questions, I ask unanimous consent they be given 7 days to submit questions for the record. Without objection, so ordered.

Thank you very much for your testimony and your lively presentation. We appreciate it, and we have learned a lot. Thank you.

[Whereupon, at 1:30 p.m., the committee was adjourned.]