

S. HRG. 111-912

**AUCTIONING UNDER CAP AND TRADE:  
DESIGN, PARTICIPATION, AND  
DISTRIBUTION OF REVENUES**

---

---

**HEARING**

BEFORE THE

**COMMITTEE ON FINANCE  
UNITED STATES SENATE**

ONE HUNDRED ELEVENTH CONGRESS

FIRST SESSION

—————  
MAY 7, 2009  
—————



Printed for the use of the Committee on Finance

—————  
U.S. GOVERNMENT PRINTING OFFICE

64-630—PDF

WASHINGTON : 2009

---

For sale by the Superintendent of Documents, U.S. Government Printing Office  
Internet: [bookstore.gpo.gov](http://bookstore.gpo.gov) Phone: toll free (866) 512-1800; DC area (202) 512-1800  
Fax: (202) 512-2104 Mail: Stop IDCC, Washington, DC 20402-0001

COMMITTEE ON FINANCE

MAX BAUCUS, Montana, *Chairman*

JOHN D. ROCKEFELLER IV, West Virginia	CHUCK GRASSLEY, Iowa
KENT CONRAD, North Dakota	ORRIN G. HATCH, Utah
JEFF BINGAMAN, New Mexico	OLYMPIA J. SNOWE, Maine
JOHN F. KERRY, Massachusetts	JON KYL, Arizona
BLANCHE L. LINCOLN, Arkansas	JIM BUNNING, Kentucky
RON WYDEN, Oregon	MIKE CRAPO, Idaho
CHARLES E. SCHUMER, New York	PAT ROBERTS, Kansas
DEBBIE STABENOW, Michigan	JOHN ENSIGN, Nevada
MARIA CANTWELL, Washington	MICHAEL B. ENZI, Wyoming
BILL NELSON, Florida	JOHN CORNYN, Texas
ROBERT MENENDEZ, New Jersey	
THOMAS R. CARPER, Delaware	

RUSSELL SULLIVAN, *Staff Director*

KOLAN DAVIS, *Republican Staff Director and Chief Counsel*

# CONTENTS

## OPENING STATEMENTS

	Page
Baucus, Hon. Max, a U.S. Senator from Montana, chairman, Committee on Finance .....	1
Grassley, Hon. Chuck, a U.S. Senator from Iowa .....	2

## WITNESSES

Krueger, Dr. Alan B., Assistant Secretary for Economic Policy, Department of the Treasury, Washington, DC .....	4
Elmendorf, Douglas, Ph.D., Director, Congressional Budget Office, Washington, DC .....	5
Delbeke, Dr. Jos, deputy director-general and directorate general for environment, European Commission, Brussels, Belgium .....	7
Smith, Anne, Ph.D., vice president and practice leader of climate and sustainability, CRA International, Washington, DC .....	9

## ALPHABETICAL LISTING AND APPENDIX MATERIAL

Baucus, Hon. Max:	
Opening statement .....	1
Prepared statement .....	37
Bunning, Hon. Jim:	
Prepared statement .....	39
Delbeke, Dr. Jos:	
Testimony .....	7
Prepared statement .....	40
Responses to questions from committee members .....	55
Elmendorf, Douglas, Ph.D.:	
Testimony .....	5
Prepared statement .....	68
Grassley, Hon. Chuck:	
Opening statement .....	2
Prepared statement .....	95
Krueger, Dr. Alan B.:	
Testimony .....	4
Prepared statement .....	97
Smith, Anne, Ph.D.:	
Testimony .....	9
Prepared statement .....	103

## COMMUNICATIONS

American Society of Civil Engineers (ASCE) .....	117
Association of Public and Land-grant Universities .....	122
Boyce, James K. ....	125



**AUCTIONING UNDER CAP AND TRADE:  
DESIGN, PARTICIPATION, AND  
DISTRIBUTION OF REVENUES**

---

**THURSDAY, MAY 7, 2009**

U.S. SENATE,  
COMMITTEE ON FINANCE,  
*Washington, DC.*

The hearing was convened, pursuant to notice, at 10:07 a.m., in room SD-215, Dirksen Senate Office Building, Hon. Max Baucus (chairman of the committee) presiding.

Present: Senators Conrad, Bingaman, Kerry, Stabenow, Cantwell, Nelson, Carper, Grassley, Hatch, Snowe, Bunning, Roberts, and Enzi.

Also present: Democratic Staff: Bill Dauster, Deputy Staff Director and General Counsel; Cathy Koch, Chief Tax Counsel; Darci Vetter, International Trade Advisor; Jo-Ellen Darcy, Senior Environmental Advisor; and Kelly Whitener, Fellow. Republican Staff: Nick Wyatt, Tax Research Assistant; and Jim Lyons, Tax Counsel.

**OPENING STATEMENT OF HON. MAX BAUCUS, A U.S. SENATOR  
FROM MONTANA, CHAIRMAN, COMMITTEE ON FINANCE**

The CHAIRMAN. The hearing will come to order.

Voltaire wrote, "Men argue, nature acts."

While people argued over global warming, nature acted. Now, at long last, people appear nearly ready to act in response.

Last year, the Senate had a good discussion of legislation to respond to climate change. As part of that effort, the committee heard from witnesses about the tax and trade aspects of a cap-and-trade program. But ultimately, the Senate did not act on legislation last year.

This year we will once again take up climate change legislation. President Obama has given a high priority to addressing the problem. It is time for us as a Nation to show leadership and responsibility. It is our moral imperative to address climate change. It is time for us to act.

Action would not be without cost. But the cost of inaction would be far greater.

Many have analyzed the effects that a cap-and-trade program would have on our economy and our ability to compete in the world. Each study has generated its own set of questions and uncertainties. But we need to move ahead with the best information that we have.

Today we have asked our witnesses to share their analysis of the effects of a cap-and-trade program on the economy. And we have also asked for their thoughts on the best way to design the system to provide certainty, where we can. We need certainty in terms of establishing and containing costs. And we need certainty in terms of meeting our greenhouse gas reduction goals.

We will ask: How can we reduce the effect of potentially increased energy costs on our economy?

How can we reduce the effect on energy consumers?

How should an auction be structured?

How should allowances be allocated? Should they be auctioned, given away for free, or some combination of the two? What is the proper balance between free allowances and auction revenues?

Are free allowances an effective tool to assist industries facing particularly high costs? Are they effective to assist industries that are trade-sensitive?

If we provide free allowances, who should receive them? Based on what criteria?

These are all questions that I hope our witnesses can help us answer.

And so, while people argued, nature acted. Now Congress can act in response. Let us find out what we can, so that we may act wisely.

Senator Grassley?

**OPENING STATEMENT OF HON. CHUCK GRASSLEY,  
A U.S. SENATOR FROM IOWA**

Senator GRASSLEY. Well, I think everybody knows that the Senate Finance Committee, when it comes to the suggested cap-and-trade tax, that we have a very essential role to play in this. When it comes to the potential environmental benefits of such a system, of course most of that is going to be handled by the Environment and Public Works Committee. However, we are talking about a program that will raise hundreds of billions of dollars every year for the Federal treasury. With revenue of that magnitude, that is obviously why we are having this hearing.

What is more, the cost will be paid by every American in the form of higher prices for energy services or any product that takes energy to produce or transfer it to market. President Obama has acknowledged that, under a cap-and-trade system, electric rates would necessarily skyrocket. The exact quote is, "Electricity rates would necessarily skyrocket."

When OMB Director Orszag was before this committee last year in his previous capacity, he made it clear that: "Under a cap-and-trade program, firms would not ultimately bear most of the costs of the allowances but instead would pass them along to their customers in the form of higher prices." In other words, it is going to be a consumer tax, not a corporation tax. Those energy price increases will also have a significant and negative impact on economic growth and job creation.

If that sounds suspiciously like a Federal energy tax to those of you here, you are right, it is. The Senate Finance Committee has jurisdiction over all Federal taxes and has extensive experience in considering the tax incidence of certain policies. That experience

will be invaluable on this subject because a very important aspect in designing a cap-and-trade system is who will ultimately bear the cost of the program, and in what proportion. In short, who are the winners and the losers?

One troubling aspect of cap and trade is that speculators from Wall Street, Chicago, and San Francisco are foaming at the mouth to get their hands on trading profits from cap-and-trade allowances. Hedge funds, private equity funds, and other companies have been lobbying Congress to pass cap-and-trade legislation.

When I say the “troubling aspect” of that, that is not this Senator saying it just on my own suspicions, but this is what I am beginning to hear more from the grassroots of my State. It probably comes because right now Wall Street does not have a very good reputation at the grassroots of America.

Then people are looking at Enron, which is not much of a company today, but 10 years ago was quite a company. They were early supporters of this. AIG was as well, and we all know the reputations of those companies. When you are talking about their support for things like this, that raises more questions in the minds of people who are already fed up with bailouts and things of that nature.

We have Democratic Representative John Dingell quoted this way: “I attended a meeting of an organization interested in climate change legislation, and guess who it was? It was a bunch of good-hearted Wall Streeters getting ready to cut a fat hog.” Well, I want to make sure that the American taxpayers are not the fat hog that gets cut.

Today’s hearing will help us to better understand the economic consequences of cap and trade and the various trade-offs that Congress will need to carefully consider. Our distinguished panel will help us do that. Thank you all very much.

The CHAIRMAN. Thank you, Senator, very, very much.

Our first witness is Alan Krueger, the new Assistant Secretary of the Treasury for Economic Policy. Congratulations, Dr. Krueger, on your confirmation. Any day now you will get sworn in, and we look forward to that very, very much. I know that Secretary Geithner expects and looks forward to having you on board; we all do. Thank you very much for appearing before us on such short notice.

The second witness is Doug Elmendorf, who performs yeoman duty and does everything around here, crunches numbers on every subject under the sun, under a lot of pressure from lots of different sides to get their numbers first. We thank you very much, Dr. Elmendorf. But from our perspective, we sure like your work on health care reform, especially.

Dr. Delbeke, thank you very, very much for appearing before us today. We appreciate your coming before us, especially in your capacity as deputy director-general of the European Commission and directorate-general for the environment. As is the normal course of business when foreign government officials testify before this committee, I note for the record that the U.S. Congress has no authority over Dr. Delbeke. Now, that begs the question, over whom do we have any authority anyway? [Laughter.] He is appearing today as a diplomatic courtesy.

Also, Dr. Anne Smith, vice president and practice leader of climate and sustainability for CRA International. Thank you very much, Dr. Smith.

So, Dr. Krueger, why don't you begin?

**STATEMENT OF DR. ALAN B. KRUEGER, ASSISTANT SECRETARY FOR ECONOMIC POLICY, DEPARTMENT OF THE TREASURY, WASHINGTON, DC**

Dr. KRUEGER. Sure. Good morning, Chairman Baucus, Ranking Member Grassley, and other members of the committee. I am delighted to be before the committee again so soon. [Laughter.]

I took your advice very seriously, Senator Baucus, that it was time to get to work, and that is why I am here today to talk to you about cap-and-trade auctions.

In my remarks I will describe the important role that auctions can play in an efficient greenhouse gas cap-and-trade program. I will also talk about the Department of Treasury's experience running auctions and how auctions have been used in some existing greenhouse gas cap-and-trade programs in the U.S. and abroad.

As you know, one of the President's top priorities is to develop a comprehensive energy and climate change plan to invest in clean energy, address the global climate crisis, and create new jobs. In turn, we believe that a greenhouse gas cap-and-trade program should play a central role in our effort to achieve these goals at the lowest possible cost. We are very appreciative of the work being done in the Congress to this end and look forward to working together to craft successful legislation.

One important element of an efficient and fair cap-and-trade system is allowance auctions. When designed and managed effectively, auctions distribute greenhouse gas emissions allowances efficiently by assuring that they are allocated to those who value them the most, thereby helping to minimize the cost of achieving our economy-wide emission targets. At the same time, the use of auctions can avoid the creation of undeserved windfall profits and can provide revenue that can be used to help families in the transition to a clean energy economy.

Treasury has had significant experience in running high-value auctions. To finance the public debt, the Treasury Department uses auctions to sell a large volume of debt securities. The regular, predictable, and transparent nature of these auctions furthers Treasury's objectives of financing the Federal Government at the lowest possible borrowing costs.

Each year the Treasury Department's Bureau of Public Debt conducts more than 250 public auctions and issues over \$5 trillion in gross debt. In fiscal year 2008, for example, we conducted 279 auctions, in each case releasing the auction result data within our self-imposed time constraint of 2½ minutes after the auction is closed.

Given the large volume of financing provided through Treasury's auctions, ensuring a smooth and efficient auction process has been a critical component of our success. We place a premium on running the most reliable Treasury auctions possible in the most transparent manner, and the Department delivers on this responsibility each and every week. Treasury's long track record of successfully running high-value auctions demonstrates the key technical



expertise necessary to manage auction details in a manner that builds public trust and confidence.

Now I would like to briefly describe a few prominent examples of the use of auctions in the existing greenhouse gas cap-and-trade programs. In 2005, the European Union established its emissions trading scheme commonly known as EU ETS, which I am sure Dr. Delbeke will discuss. This is the world's largest emissions cap-and-trade program. The EU ETS caps carbon dioxide emissions from the electric power sector and several other major industrial sectors in Europe, which collectively account for about half of Europe's CO<sub>2</sub> emissions.

The use of auctions in the EU ETS has been limited to date, but is growing. To offer one example of the use of auctions, since November 2008 the United Kingdom has held two single-round sealed bid uniform price auctions which yielded a combined \$144 million in revenue. Britain's Treasury conducts these auctions, and auction revenue is deposited into the United Kingdom's consolidated fund for general spending purposes. There will be a substantial increase in the use of auctions in the EU ETS program in the future.

Another example of auctions in the greenhouse gas area is the Regional Greenhouse Gas Initiative known as "ReGGIe." This is the first mandatory greenhouse gas cap-and-trade program in the United States, and it covers electric power plants in 10 participating States in the Mid-Atlantic and Northeast regions. Auctions play a key role in allowance allocations in ReGGIe.

Auction shares are set by each State and currently average 85 percent across all of the participating States. The majority of States auction 100 percent of the allowances. I think it is useful to highlight some of the principles that were established to guide the development of the ReGGIe auctions: (1) fairness and transparency; (2) efficiency; (3) price discovery; (4) revenue; (5) to minimize collusion; (6) to minimize price volatility; (7) to make sure there is adequate liquidity; and (8) to conduct the auctions at the lowest administrative and transaction costs.

To conclude, I would emphasize that the Treasury Department recognizes that designing auctions for a cap-and-trade program will require careful consideration of many auction features and program goals, and substantial expertise. Treasury's long experience in developing and conducting auctions can offer important insights into the design and operation of high stakes greenhouse gas allowance auctions. I look forward to working with the Congress to enact and implement a successful cap-and-trade program to reduce greenhouse gas emissions.

The CHAIRMAN. Thank you very much. That was very informative.

[The prepared statement of Dr. Krueger appears in the appendix.]

The CHAIRMAN. Dr. Elmendorf?

**STATEMENT OF DOUGLAS ELMENDORF, Ph.D., DIRECTOR,  
CONGRESSIONAL BUDGET OFFICE, WASHINGTON, DC**

Dr. ELMENDORF. Thank you, Chairman Baucus, Senator Grassley, members of the committee. I appreciate the invitation to testify today.

Global climate change poses one of the Nation's most significant long-term challenges. Human activities are producing increasing quantities of greenhouse gases, and a strong consensus has developed in the expert community that, if allowed to continue unabated, the accumulation of these gases in the atmosphere will have extensive, highly uncertain, but potentially serious and costly impacts on the world. Moreover, the risk of abrupt and even catastrophic changes in climate cannot be ruled out.

These expected and possible harms can justify policy actions to reduce the extent of climate change; however, the cost of doing so may be significant because it would entail large reductions in global emissions and, thus, probably in U.S. emissions over the coming decades.

To accomplish this will mean transforming the U.S. economy from one that runs heavily on carbon dioxide-emitting fossil fuels to one that relies on nuclear and renewable fuels, as well as achieving improvements to energy efficiency or the large-scale capture and storage of carbon dioxide emissions.

One option for reducing emissions in a cost-effective manner is to establish a carefully designed cap-and-trade program. The government would set gradually tightening limits on emissions, issue allowances consistent with those limits, and let firms trade the allowances among themselves. Such a program would lead to higher prices for energy and energy-intensive goods, which would in turn provide incentives for households and businesses to use less energy and to develop energy sources that emit less carbon dioxide.

Higher relative prices for energy would also shift income among households at different points in the income distribution, across industries, and across regions of the country. Policymakers could counteract those income shifts by using the revenue from selling emission allowances to compensate certain households and businesses or by giving the allowances away.

Let me make three points about the distribution of revenue or allowances in a cap-and-trade program. First, consumers would ultimately bear most of the cost of emission reductions. Indeed, the price increases that would arise would be essential to the success of a cap-and-trade program because they would be a chief mechanism through which businesses and households would be encouraged to make investments and change behavior to reduce emissions.

Second, higher prices for energy-intensive goods and services would have a variety of consequences for different industries, regions of the country, and income groups. For industries, those producing energy or energy-intensive goods and services could experience a decrease in sales, with adverse consequences for shareholders and employees.

These effects would be larger for producers with foreign competitors that do not face similarly stringent programs for reducing emissions. For different regions of the country, the impact would depend on the extent to which a household's income is derived from carbon-intensive fuels and the extent to which their consumption is linked to carbon-intensive activities.

For income groups, energy-intensive goods and services such as electricity, home heating, and transportation consume a larger frac-

tion of the income of low-income households, so those households would bear a relatively larger direct burden from policies that would reduce emissions.

Point three. Policymakers have a wide range of options for distributing the value of the allowances, but choosing among these options entails trade-offs. For example, if allowances were auctioned, some of the revenue could be used to fund climate-related research and development. This approach might reduce the cost of transitioning the economy but would not provide immediate help to affected households and businesses.

Instead, auction revenue could be used to reduce existing taxes on capital and labor. This could lessen the overall economic cost of restricting emissions, but again would do little to offset the burden that higher prices would impose on certain households and businesses.

A different approach is to use the revenue to give rebates to low-income households, perhaps through the tax system. This would lessen the burden on these households. Alternatively, allowances could be given away for free to certain industries. Giving away allowances is generally equivalent to auctioning the allowances and giving the proceeds to the same firms.

Giving allowances to energy-intensive manufacturers would not, by itself, hold down the price of their output, which would rise to reflect the private market value of those allowances. The result could be windfall profits for those firms, which would tend to benefit higher-income households who own most stocks.

However, if the distribution of free allowances was tied to future production or employment, then prices in those industries would not rise as much as otherwise, and employment would not fall as much. At the same time, because these firms would not reduce emissions as much as they would have without these free allowances, other sectors of the economy would have to reduce emissions by a larger amount in order to meet the same overall cap.

In sum, emission allowances in a cap-and-trade system would be valuable commodities. Your decisions about how to distribute that value would matter tremendously for the overall effects of such a system.

Thank you very much.

The CHAIRMAN. Thank you, Dr. Elmendorf.

[The prepared statement of Dr. Elmendorf appears in the appendix.]

The CHAIRMAN. Next, Dr. Delbeke?

**STATEMENT OF DR. JOS DELBEKE, DEPUTY DIRECTOR-GENERAL AND DIRECTORATE GENERAL FOR ENVIRONMENT, EUROPEAN COMMISSION, BRUSSELS, BELGIUM**

Dr. DELBEKE. Thank you, Mr. Chairman. Thank you very much for your kind invitation. Today, a comprehensive set of regulations exist in the EU to bring down greenhouse gas emissions. They cover cars, fuels, buildings, appliances. But the central piece of that whole set of regulations is the EU ETS, the cap-and-trade system that exists already since 2005. It covers the power and manufacturing industry that produces almost half of the greenhouse gas

emissions of the EU. It does not cover transport, as we have a system of motor fuel taxation in place.

This comprehensive policy starts to pay off. Under the Kyoto Protocol, we have to do an 8-percent reduction by 2012. In 2007, we were at minus 4.3 for the EU 15, so abstraction can be made from the latest enlargement. In that year, emissions went down by 1.6 percent, and analysts attribute almost half of that decrease to the functioning of the EU ETS. The reason is that the carbon price is a driver for increased investments in low-carbon technology. That means energy-efficient technology, fuel switching, and not the least, renewable energy.

It is useful to recall that we started in 2005 with a 3-year learning-by-doing phase. That was necessary, it turned out, because the cap that the EU member states had allocated was too generous, and the system was over-allocated. But since then the cap-setting became more centralized by the European Commission, and the overall cap was lowered from \$2.3 billion a year in the first period to about \$2 billion in the current Kyoto period, and in December the EU decided to lower this gradually to \$1.7 billion by 2020 in view of a clear and predictable long-term signal to industry.

In December, as well, on allocation, important decisions were made. Two principal methods were adopted: allocations can be given for free to regulated entities or they can be sold or auctioned. The EU ETS now uses a mixture of both. In the period of 2012, in fact, only 4 percent of the allowances are being auctioned. But as from 2013, at least half of the allowances will be auctioned.

Why do we do so? We learned that power companies in the deregulated European market increased power prices even though allowances were handed out for free. This was giving rise to a lively political debate on windfall profits. So, the EU decided to stop giving free allowances to the power sector. Through full auctioning, moneys will instead go to the public authorities which can use them for climate action and other purposes. There is only one temporary derogation possibility for the newer member states, for plants built before 2008.

For the manufacturing industry, in principle the same applies, but to a lesser extent, as the manufacturing industry is much more than power exposed to international competition. We therefore, today, analyze industry to determine to what extent they have an ability to pass on the costs from ETS.

We use two variables in this assessment: cost impact and trade openness. As a transitional measure, all manufacturing industries will get some free allowances, contrary to what is going to be full auctioning in the power sector. But the sectors exposed to international trade will get a higher share.

The free allowances will be distributed based on technological benchmarks, thus there will be a certain amount of free allowances per unit of production, say per ton of flat glass. This benchmark per product will be determined in advance of the trading period, and it will be multiplied with historic production figures. As a result, the facilities will therefore know already by 2011 how many allowances they will get for free until the year 2020.

There are many reasons for deciding the amount of free allowances in advance, and they are outlined in the written submission. Revisions of the amount of free allowances will be made only if a facility closes down or significantly changes its capacity. The reason is that the EU wants to create a maximum of regulatory stability and wants to limit allocation decisions as much as possible over time.

The allocation rules will be reviewed after the international agreement in Copenhagen. If the competitive situation for European companies is being corrected due to climate action by other nations, then less free allowances will be given away.

As a conclusion, the ETS as a cap-and-trade system functions reasonably well today, but will be strengthened as of 2013 with a much tighter cap and much more auctioning. The key is the price signal. It acts as an incentive for low-carbon technology and energy-efficient equipment and fuel switching, not the least in renewable energy.

Thank you very much.

The CHAIRMAN. Thank you, Dr. Delbeke, very much.

[The prepared statement of Dr. Delbeke appears in the appendix.]

The CHAIRMAN. Dr. Smith?

**STATEMENT OF ANNE SMITH, Ph.D., VICE PRESIDENT AND PRACTICE LEADER OF CLIMATE AND SUSTAINABILITY, CRA INTERNATIONAL, WASHINGTON, DC**

Dr. SMITH. Mr. Chairman and members of the committee, thank you for inviting me. I am Anne Smith. I lead the climate and sustainability group at CRA International. My testimony today is my own and does not represent CRA or any of its clients.

Today we have heard a lot about alternatives for distributing revenues from a carbon cap. These decisions are very important in determining the winners and losers under a carbon policy, but many people think that this carbon revenue will be large enough to eliminate the cost of the carbon cap, and this cannot be so. Any policy that cuts carbon emissions will have a net cost on society.

Now, most people understand that a tax creates net costs to an economy, even while it raises large revenues—potentially large revenues—for the government. In tax circles, that net cost is called the “dead weight loss.” There is no way that the government can recycle the tax revenues to make that dead weight loss of the policy go away.

The same is true of the cap-and-trade policy, because the allowance price works just as if it were a carbon tax rate. For cap and trade to work, auction prices have to rise high enough to make using conventional fuels cost more than the more expensive, lower-carbon energy sources.

The allowance price works just like a tax by creating an unavoidable net cost. This is the cost of reducing emissions down to the cap and this cost happens no matter whether the government or the private sector is given the rights to the revenues that come from this tax.

There is a corollary to the fact that a carbon limit will have a net cost. Carbon limits cannot increase total employment across the

economy. Yes, a shift to more expensive forms of lower carbon energy will create new jobs. These are the so-called “green jobs.” But the use of the more expensive energy will also reduce demand for workers across the whole economy even more so.

It is important to recognize then that the net cost of a carbon cap could be large, so cost minimization should be just as important as cost burden sharing in designing the policy. While that option increases flexibility in how the cost burden can be shared, it does not address another concern with cap and trade, which is certainty in its costs.

Prices in all cap-and-trade programs are notoriously uncertain. The EU’s ETS has seen prices cycle up and down by a factor of 4 twice in the past few years. In the EU, carbon price uncertainty has inhibited companies from investing in low-carbon technologies, as was desired. There are other unnecessary costs of allowance price uncertainty, including credit rating risks, costs of risk management by businesses, and their costs of preparing auction billing strategies. There is the inevitable wasted investment when price expectations on which decisions were made turn out to have been wrong.

The government also should prefer predictable allowance prices because they make auction revenues predictable. For instance, what use is there for variability in the government’s revenues if those revenues will be funding programs that have long-term funding needs?

Even if auction revenues would just be rebated back to citizens, would the citizens appreciate their ability and the size of their rebate checks? This price certainty is a completely avoidable feature of a market-based approach to carbon policy. It can be done through price ceilings and floors, or even simpler, by using carbon fees or taxes.

So why is there resistance to these price certainty measures? Some are self-interested. Price certainty could kill the prospects for traders and hedge funds, et cetera, to sell a lucrative array of new financial products, but their lost demand for these services actually means a reduction in the cost of the policy to the economy at large. Others feel price ceilings could take away the certainty but will make adequate reductions in emissions.

However, there is no scientific imperative to insist on very precise cap levels in specific time periods, and it is that insistence on the very precise reductions that creates the volatility in the prices. The meaningful emissions goal is to reduce all emissions to nearly zero over the long run, over many decades. This will require sustained investment in other new directions in our economy. That sustained investment will more likely come if the carbon price is predictable, durable, and credible for decades to come.

In the end, a cap works just like a carbon tax except that, with a cap, you do not know what the tax rate will be. Having better knowledge of what the carbon price will be will help minimize the net cost to the policy, but it will still leave us with carbon revenues that can be used to distribute that policy’s cost fairly.

Thank you for this time. There are more details in my written comments, which I request be put in the record.

The CHAIRMAN. Thank you very much, Dr. Smith.

[The prepared statement of Dr. Smith appears in the appendix.]

The CHAIRMAN. Dr. Krueger, if you could just flesh out a little more Treasury's experience in dealing with various auction markets and the degree to which the variance in different markets does or does not make a difference, and how well Treasury would be qualified to deal with auctions under a cap-and-trade system. Just flesh out what Treasury does. You did in your statement, but give a little more detail.

Dr. KRUEGER. Sure.

The CHAIRMAN. Give us the confidence we would like to have—and I think we already have that confidence, but if you could underline it—of what a great job Treasury would do.

Dr. KRUEGER. Sure. I think the Treasury Department and the Bureau of Public Debt do a remarkable job with their auctions. The auctions are transparent. There is a schedule announced well in advance when each auction will be held, when it opens, when it closes. As I had mentioned, the results are announced within 2½ minutes after the end of each auction. There is a working group that provides surveillance to make sure that the auctions are not manipulated that meets every 2 weeks and monitors price movements, volumes, and so on. I think that Treasury auctions are well-regarded throughout the world.

The CHAIRMAN. Senator Grassley asked—and I do not mean to steal his thunder—and he implied something that I hear from some folks too, that, gee, we have an auction and allowances, those folks on Wall Street will figure out a way to make a buck. They will manipulate it. The specter of Enron sometimes comes up a little bit.

You said you have a surveillance team. Could you outline just what manipulation may or may not have occurred under some of the auction markets that Treasury conducts currently, as well as what manipulation may or may not occur if cap-and-trade allowances were auctioned and that auction were managed by the Treasury?

Dr. KRUEGER. The working group that Treasury participates in also includes representatives from the Federal Reserve Board, from the Federal Reserve Bank of New York, the SEC, and the Commodity Futures Trading Commission. As I mentioned, they meet weekly. They monitor activities. The Treasury, as you know, does not have enforcement power. If it is warranted in the case, the relevant enforcement agencies then follow up.

I think it is important to recognize that the design of an auction can have an influence on its susceptibility to manipulation, and there are a great many design features of auctions: who participates, are they sealed bids or open bids, what is released after the auction, before the auction, and so on, a great many design features that need to be carefully thought out. But there are ways of designing an auction to try to minimize manipulation and to minimize price volatility.

The CHAIRMAN. What is the difference between the cap-and-trade allowance auction market versus SO<sub>x</sub> and NO<sub>x</sub> auctions? The EPA conducts, as I understand it, the auctioning of SO<sub>x</sub> and NO<sub>x</sub>. Of course, this is much, much greater—auctions of allowances under cap and trade—than auctions of nitrous oxides and sulphur oxides, et cetera. Could you give us a flavor of just the huge magnitude

of difference between SO<sub>x</sub> and NO<sub>x</sub>, the Clean Air Act versus auction of the carbon allowances under a cap-and-trade system? I want to try to understand the competency of Treasury in conducting such a large auction.

Dr. KRUEGER. Yes. Well, they would be several orders of magnitude different in terms of the revenue they would collect. Of course, it would depend on how many of the allowances under a cap and trade were auctioned. The administration budget proposed that there would be around \$80 billion of revenue from cap and trade per year, which is—I do not have the exact figures on the SO<sub>x</sub> auctions in front of me—several orders of magnitude different.

I think one way of thinking about the design of the auction is, it should be related to, ultimately, the goals of the program. The ReGGIe auctions are actually done quite similarly to the way that treasuries are auctioned in that they are uniform-price, sealed-bid auctions. I think that a good deal of thought would need to go into how best to design auctions under a cap-and-trade system to meet the ultimate goals of the program.

The CHAIRMAN. Do you think Treasury is qualified to properly design the market, the auction?

Dr. KRUEGER. I think Treasury has a tremendous amount of expertise and experience in conducting auctions, and I think the Treasury Department would be very willing to work with whatever agency or institution ultimately is responsible for conducting the cap-and-trade auctions and add their expertise. I think there is considerable expertise.

I would also add that auction theory within economics is a branch of economics which is quite well-developed. In preparing for this hearing, I read a paper by John McMillan about some things that went wrong and some things that went right in the spectrum auctions, drawing on international evidence as well as the U.S. It is an area of economics in which there is considerable expertise outside of the government as well which can be drawn on.

The CHAIRMAN. Who wrote that paper?

Dr. KRUEGER. It was written by John McMillan. I should also—full disclosure: I was the editor of the journal in which it was published, the American Economic Association's journal. Unfortunately, John passed away a couple of years ago.

The CHAIRMAN. I am sorry. All right. Thank you very much. Senator Grassley?

Senator GRASSLEY. Yes. Dr. Elmendorf and Dr. Smith, between a carbon tax and a cap and trade, which provides more certainty for consumers and businesses—question number one. Question number two, which is more efficient from an economic standpoint? Three, and last, what role would speculators play in either a carbon tax system or a cap-and-trade system?

Dr. ELMENDORF. Senator, many analysts favor a carbon tax over a cap-and-trade system because it provides greater flexibility in the timing of the emissions reductions. But that comparison I have just stated is to a pure cap-and-trade system, if you will. Much of the work that has gone on in the expert community and in the discussions in Congress has been about essentially hybrid systems to which basic cap and trade has added a price ceiling, price floor, or other mechanisms for trying to reduce the volatility of prices. That



muddies that comparison. But I think the crucial issue, from an expert's point of view, is trying to give firms and households flexibility in the timing of emissions reductions.

Either a cap and trade or carbon tax has an advantage over command and control systems in giving flexibility, and who is reducing emissions, and in what context. But the additional flexibility and timing, either through a tax or through some of these more flexible versions of cap and trade is viewed by experts as being very important at minimizing the economic burden of reducing emissions, and also minimizing the uncertainty facing households and firms.

Senator GRASSLEY. Dr. Smith?

Dr. SMITH. Yes. A carbon tax is going to be more efficient and more certain than a carbon cap. Now, as Dr. Elmendorf said, there are some more hybrid schemes that are being suggested but have yet to make their way into the policy proposals that are in front of the Congress, to put price floors, price ceilings on top of the cap and trade. In doing that, you do get a lot closer to the efficiency of the tax; however, you also get a lot closer to a tax that is just more cumbersome because you have to do auctions and the like. It is just a much more complicated scheme in order to simply set a well-established carbon price.

So once you go that route, it really probably makes a lot more sense to just acknowledge it is a tax. Additionally, if you are auctioning all the permits, the benefits of cap and trade that are associated with the allocation of permits go away and the auction looks a lot like a tax, except, again, you do not know the tax rate. Thank you.

Senator GRASSLEY. Yes.

When it comes to speculators, I think we in Congress have to keep in mind, particularly as it deals with energy, the outrage that came last summer with \$4 gas and speculators driving it up to \$147 a barrel, and in turn the impact that that made on the price of grains, as an example, and the increased price of food, as an example. Then we all want alternative energy, and the negative impact it made on alternative energy, particularly biofuels. Some of us are going to be very careful about enhancing the role of speculators in this whole process of solving global warming.

Dr. Smith, just a yes or no on this. Did I read you right, that you firmly believe that, with this system we are talking about, we are going to increase unemployment in the United States?

Dr. SMITH. Yes.

Senator GRASSLEY. I want to ask you and Dr. Elmendorf another question. We had debate in the Senate on the budget. Fifty-four Senators voted for an amendment stating that any climate change legislation should be done "without increasing electricity or gasoline prices or increasing the overall burden on consumers, through the use of revenues and policies provided in such legislation."

I would like to ask you two, given what you have heard today about the dead weight loss inherent in any cap-and-trade system, is it possible to design a system using the revenue it generates to ensure no net increase in the overall burden to consumers? Dr. Smith?

Dr. SMITH. No.

Senator GRASSLEY. Dr. Elmendorf?

Dr. ELMENDORF. No, sir.

Senator GRASSLEY. So then 54 Senators had a wrong assumption based on that amendment.

One last point.

The CHAIRMAN. That will not be the first time.

Senator GRASSLEY. No, it sure will not be. [Laughter.] And I have made some mistakes too, and misunderstanding.

Let me make a point for Dr. Delbeke, I believe. This comes from the *Washington Post*, April 9, 2007. It is a long article on European cap and trade. I'm going to quote from three paragraphs.

"In other ways, the approach has been a bureaucratic morass with a host of unexpected and costly side effects and a much smaller effect on carbon emissions than planned. Many companies complain that it is unfair.

"Consider the plight of Kollo Holding's factory in the Netherlands, which makes silicon carbide, a material used as an industrial abrasive and lining for high-temperature furnaces and kilns. Its managers like to think of the plant as an ecological stand-out. They use waste gases to generate energy and have installed the latest pollution-control equipment.

"But Europe's program has driven electricity prices so high that the facility routinely shuts down for part of the day to save money on power. Although demand for its product is strong, the plant has laid off 40 of its 130 employees and trimmed production. Two customers have turned to cheaper imports from China, which is not covered by Europe's costly regulations."

Is that right or wrong?

Dr. DELBEKE. Thank you, Senator. I am not familiar with the specifics of the case, but as I indicated, we had a learning-by-doing regime between 2005 and 2008, so the system has moved on. The system has been improved in order to avoid any distortions between companies, and I think we have been successful on that. These types of articles are no longer read, or the arguments are no longer made by our companies.

I think it is very important to indicate that there are economic activities that are going to be favored through a cap and trade and economic activities that are going to be discouraged, because it is those activities with the low-carbon technology overall that are going to be at the winning side of the equation.

So, we see a lot of substitution of economic activities following the cap and trade, but as I indicated, we have independent advice and analysis indicating that the cap that we are setting for ourselves in Europe has been respected, that the emissions go down, and that, correspondingly, economic activity has not been hampered.

The CHAIRMAN. Thank you, Dr. Delbeke, very much.

Senator Kerry?

Senator KERRY. Thank you very much.

Senator Grassley, I hope you heard that final comment: "economic activity has not been hampered." I might add that the ReGGIe that we have in New England has been entered into voluntarily—voluntarily. Half of the American economy has entered into a voluntary mandatory reduction. In our mandatory voluntary re-

duction, we are doing better than many parts of the country economically. In fact, it has not resulted in a loss of jobs.

But let me just point out one other thing, if I can. I know many people in the country are determined to try to make cap and trade into a “tax.” I have seen the consultant reports and the suggestions. But it is, in fact, not a tax. It creates an asset, and the asset is tradeable.

Are there some costs attendant because the unit cost of electricity might go up or production of power? Yes. But what many of the studies do not take into account—including, I believe, Dr. Smith’s—is what energy efficiencies come along with that so that the net cost to the consumer goes down.

The Union of Concerned Scientists has just come out with a report showing that in every sector of the country, over a 25-, 30-year period, the consumer’s out-of-pocket expenses because of energy efficiencies, better gas mileage, less expenditure, et cetera, their cost net out-of-pocket would be less even though the unit of gas or electricity kilowatt hour may be up.

Now, let me point out something else. On a tax, carbon tax, the purpose of this exercise is to reduce emissions. We want to reduce emissions because science is telling us that, if we do not, there are catastrophic consequences. Almost every economic model I have seen thus far, certainly from the industries, never takes into account the cost of the tax to the consumer of the catastrophic damages, never takes into account the energy efficiencies and savings, or the new jobs. The modeling is about as deficient, or purposefully deficient, as any modeling I have ever seen.

The fact is, if you put a carbon tax in place, that is all well and good. You have put a price on carbon, but you have absolutely no guarantee you are going to reduce emissions. You have to wait for the marketplace to perhaps respond to the cost of the carbon tax. Many people do as they always do, just subsume it into the cost of doing business. So they will take the tax, they will write it into the cost of their product, and will do nothing to reduce emissions.

So, if you are going to really meet the challenge of this exercise, which is to reduce emissions, you have to find a way to create a mechanism in the marketplace that people are thinking emissions reductions rather than just writing off the cost of doing business. Oh, we have to pay this tax, we will pay this tax, we will write it into our product, but nobody reduces emissions, and you continue to go down a catastrophic path.

Now, I will just say very quickly, Dr. Elmendorf, is it not a fact that CBO has concluded that—you know, we hear people trying to say it is going to increase people’s taxes. I understand CBO’s analysis says that there are ways to design climate change policy so the typical household does not experience a loss of purchasing power in their budget. Is that correct?

Dr. ELMENDORF. I think it depends on what mean by “typical” here. The consensus of economic analysis is that the diversion of resources from making stuff under the baseline set of policies toward reducing carbon emissions under a cap-and-trade policy, that diversion of resources reduces by a modest amount the measured output of the economy relative to what would otherwise be the case. I say “modest amount.”

Senator KERRY. Let me cut in. If you have a complementary policy that increases the efficiency of our buildings, increases the efficiency of energy systems, increases the mileage people get for gasoline even though they are spending more, you can, in net cost, in fact, reduce or eliminate an impact, and you could have a net savings.

Dr. ELMENDORF. So my point was about the net cost that—think of a refrigerator. If one spends the time designing and uses the metal to build the parts that make it produce less emissions, then one has not used those pieces and that time to build a bigger refrigerator, or a better crispener, or what have you, but the effects on net for the country as a whole seem to be modest.

The bigger issue, I think, in economic terms is the distribution across people, businesses, and regions in the country. One of the key points of my remarks and many people's analysis is that you affect that distribution crucially in what you do with the value of this asset that you described, Senator.

Senator KERRY. Let me just point out that the global consulting firm, McKenzie Company, which has been hired by no single industry and no party with an interest in this argument, has shown in a study they spent millions on that you can get the first 30 percent of emissions reductions, which takes you for the next 10 or 15 years, and the first 30 percent of emissions reductions pays for itself. Is that a fact, Dr. Delbeke?

Dr. DELBEKE. Indeed, that is what we observed in Europe.

Senator KERRY. Thank you.

The CHAIRMAN. Thank you, Senator.

Senator Cantwell?

Senator CANTWELL. Thank you, Mr. Chairman. I thank the panelists for their testimony. I am very interested, concerned, obviously, about the distribution implications of the cap-and-trade system, and I think that I am much more interested in something that tries to make the public whole and keeps our costs down over the long term. I am certainly concerned about the trading implications as they relate to Wall Street.

But I am struck that your predecessor, Dr. Elmendorf, was here a year ago, Peter Orszag, and he testified before the committee, "If you don't auction carbon permits, it would represent the largest corporate welfare program that ever has been enacted in the history of the United States."

And so I guess I am asking you, Dr. Elmendorf, about your CBO studies and analysis of auctioning of carbon emission permits and returning the revenue to households in the form of payments as the best way to protect households, obviously, from higher prices resulting from capping carbon. If you could expand on that analysis and what that means, particularly for the low income.

Dr. ELMENDORF. CBO has stated consistently that giving away allowances is effectively the same thing as selling them and giving the proceeds from their auctions away. The amounts of money involved can be very large. It depends, of course, on the precise nature of the cap and other parts of the legislation.

In CBO's estimate of the Lieberman-Warner bill last year, we estimated the total revenue that would be gained from auctioning the permits over 10 years in the neighborhood of \$1.2 trillion. So that

is a collection of \$1.2 trillion that will show up in higher prices, but then the distribution of that \$1.2 trillion makes all the difference in the world for the impact that certain households, industries, and regions would face.

Senator CANTWELL. So instead of giving them to companies, as Mr. Delbeke was saying has happened in Europe, and the prices go up, give them to consumers instead to protect them.

Dr. ELMENDORF. I think a crucial point about giving them to companies that I tried to make in my remarks is that just giving them to affected companies amounts to a windfall receipt by them. If, on the other hand, one gives them to companies in a way that is linked to their decisions to continue production or continue employment, then one is providing an incentive to them to continue production and continue employment, and it is not simply a giveaway and then it has other economic effects. But how one gives them away, what restrictions are on that gift, again, makes all the difference in the world for the economic effects.

Senator CANTWELL. I know my colleague Senator Grassley brought this up, and having lived through the Enron thing, and now the credit default swap situation, I will tell you, the trading scheme thing worries me. I see that last November Credit Suisse announced that they were securitizing carbon deals in which they bundled together carbon credits for 25 offset projects, split these into three tranches representing different risk levels, and then sold them to different investors. To me, that sounds a lot like what we just did with the mortgage-backed securities that were at the heart of our meltdown.

So, Dr. Delbeke, I wonder if—I know the prices have fluctuated sharply from 2 euros to 30 euros over the course of the first phase of the program. What lessons can we learn about the trading experience? I know you said do more on the auctioning side, but I am also concerned about the offset markets and how to do a better job there, obviously, when you are incenting historic polluters as opposed to those who have already been historically helping in the situation.

Dr. DELBEKE. Well, perhaps a few comments to start with on the use of the intermediaries and the role that they have been playing in the European market. I think that a very important element that we observed is that the liquidity of the market is very important, and the intermediaries have given that in the European market, because after all the European market is a limited market, given the scale of the problem, so the wider the market, the more liquidity, and the intermediaries have played the role of bringing demand and supply to a very positive extent.

On the use of the revenues from auctioning, indeed, we have seen in our economic analysis that you can really boost economic activity if you spend revenues in one or the other way; you can have a positive or a negative effect. So, the use of the revenue is a critical element.

On the price development, I would like to say that of course prices fluctuate, but since we have started our system in 2008 under the Kyoto provisions, prices have been fluctuating roughly between 8 euros and 25, 27 euros. That is the maximum we got. They have been mostly fluctuating in the range of 15 to 25.

Now, I would consider that as an acceptable fluctuation given the exceptional economic recession that we are having because, in fact, through the economic recession it is cheaper to reach the target. So in that sense it is anti-cyclical. It helps companies to respect carbon limits in a time of recession as somewhat cheaper, and that has been an important element that we observed to date.

Another element is that incentives for innovation have been the key driver, and we see in our analysis that the type of renewable energy that we have set ourselves in Europe for more than half is going to be realized through the cap-and-trade scheme as we have set it up.

The CHAIRMAN. Thank you very much.

Senator CANTWELL. Thank you, Mr. Chairman.

The CHAIRMAN. Senator Enzi? Thank you. Thank you very much, Senator.

Senator ENZI. Thank you, Mr. Chairman. When I came in here I thought I understood what we were doing, and now I am very confused. I thought our purpose was to reduce carbon, but it appears it is to raise money. I know that there is already a market in trees, orchards. Chicago has an exchange that does some carbon credits.

Now, one of the things that always worries me about that, I was at the Hague when we were doing some of the global warming Kyoto Protocol, and the United States was not allowed any credit for trees, I guess because trees have always been absorbing it, so we are not making any change in the atmosphere by continuing to do trees.

But out our way, the Rural Electric Association has had a voluntary green program, and a lot of people have been paying in addition to their bill so that the REA could buy new trees and plant them. I think that makes some sense. That would be some additional carbon absorption.

But from listening this morning, we know the government prints some allowances. They are not going to provide anything other than a cost of doing business, which to me means a tax. Then we are going to auction them. The businesses, I guess, will buy them in proportion to their emissions, and then the companies will pass that cost on to their customers, who hopefully then would use less.

But that sounds like a carbon tax. The money from the allowances would then be distributed back to the people so that they do not revolt over their increased prices. Now it is starting to sound like a Ponzi scheme to me: tax the companies, raise the price, give the money to the people, then the people give the money back.

At any rate, I am also confused on these allowances that are given to industries. That sounds to me like the Federal Government then picking and choosing the winners and the losers, or a brand-new form of earmarks. I have been visited by a lot of small companies, and I am curious as to how the small companies are affected by this. I heard some comments that the system adjusts around after a while. I am not sure small companies exist after a while. They are the ones that are particularly concerned about the way this is going to hit them, and how they are going to be able to participate in an auction.

So, you can see that I am very confused on this, and I need a lot of answers. I cannot get them in 5 minutes, but I will try a little bit here.

Dr. Delbeke, you mentioned that only 4 percent of your credits are auctioned, the rest are given away. How much revenue does that produce, and what is the revenue used for?

Dr. DELBEKE. This 4 percent is being auctioned today by the member states, and I have no precise figures with me what that represents. But the auctions that are going to happen as of 2013, which is more than half of the allowances in the ETS, will correspond to, depending on the price, some 20 to 30 billion euros a year.

Senator ENZI. And half of that is going to go to cleaning up things and the other half goes to what?

Dr. DELBEKE. A political decision was taken that half would be used to finance climate-related expenditure, such as deforestation, incentives for clean technology, etc., both at international and domestic levels. It is for the member states to decide this. The other half would go to the general revenues of the state. But this is not an issue over which the European Commission has direct power. The revenues accrue to the treasuries of the member states.

Senator ENZI. Thank you.

Dr. Smith, could you go into the dead weight loss a little bit more? Is that small administrative charges?

Dr. SMITH. The dead weight loss is the cost that occurs when you put a tax or carbon price on the economy. It is just the cost of reducing the emissions. The revenues from the auction, if there is an auction, are never going to be enough to offset that cost. It is a separate piece of the puzzle.

So, yes, there is a large revenue stream, there is a lot of recycling of revenues that can be done and spent in different ways. But you talked about this Ponzi scheme. I would not call it a Ponzi scheme, but, if you tax the companies, you have them raise the prices, and then you pass the revenues back to the citizens, you would never have enough revenues to offset the cost from the tax or the carbon cap.

Senator ENZI. Thank you. My time has expired.

The CHAIRMAN. Thank you, Senator, very, very much.

Senator Nelson?

Senator NELSON. It was mentioned by Senator Grassley, Mr. Assistant Secretary of the Treasury, that we saw speculators get into the unregulated marketplace and run up the price of oil, and then, when people had to start selling their positions, they started selling their positions, and the price of oil came down.

Now, as we look to an auction system here, how do we keep speculators out of the marketplace?

Dr. KRUEGER. Thank you. The design of the auction can be done in such a way to try to minimize manipulation, so there are features that can be used that increase flexibility, for example, in the availability of allowances over time. That is one way of reducing the opportunity for speculators—if there were speculators who can infiltrate the market—from influencing the price.

So there are some design features. I think a good deal of thought needs to go into how cap-and-trade auctions can best be designed,

but there are some design features that can help minimize the role of speculators. Then there are other issues like surveillance to try to prevent collusion and market manipulation.

Senator NELSON. Give me an example of a design feature.

Dr. KRUEGER. One issue has to do with whether the allowances can last for more than 1 year. So you can have a temporary short-fall where you have more opportunity to exploit limited supply, but, if there is banking and borrowing over some period of time, that is one way of potentially limiting the role of speculators who could cause a spike in prices.

Senator NELSON. Dr. Elmendorf, we had such a success with acid rain, and understandably this is of much greater magnitude, as you said. But how can we sell this, for the objections of people like Senator Enzi, that this is a scheme that is designed to increase revenue more than it is to try to reduce carbon? How can we sell it on the basis of what we learned with the success of the acid rain?

Dr. ELMENDORF. So, selling is not my line of work, really.

Senator NELSON. Well, it is ours. [Laughter.]

Dr. ELMENDORF. I think the basic economic point here is that the private markets work very effectively at allocating resources because people bear the costs of the things that they do. People want a steel plant that uses too much raw materials, they pay more for that and they do not do that well in the marketplace. A standard lesson of Economics 101 is that markets do not do well if people and firms do not bear the costs of their economic activities.

Climate change is a classic example of that. The carbon emissions attributable to my personal activities I do not bear the cost of, but collectively we in this country and we in this world are bearing the cost, and the increasing cost, of higher carbon emissions. What putting a price on carbon does is to get the households and businesses to take those indirect effects into account in their own decisions and to economize on their release of carbon emissions in the same way they economize in their use of steel, their use of fuels, and everything else.

The round trip of the money that Senator Enzi noted does indeed sound circular, but I think the crucial aspect of that is that, even if the money goes directly back to the household, the household still faces a higher relative price of activities that involve a lot of carbon emissions.

So, we change the relative price of certain activities, of certain goods in the society, and thus lower the relative price of others. It is that change in relative price that then tends to reduce the demand for the things that are relatively higher price and redirects it toward activities and products that are relatively lower price. That is exactly the shift that is needed to end up with less carbon emissions.

So it is changing the relative price that creates the incentive, but the money that is collected can go back in its entirety, if you choose, to give households back the income that they have lost through the payment of that tax to the government.

Senator NELSON. Was that the experience that we had with sulphur dioxide and its cap and trade?

Dr. ELMENDORF. The scale is sufficiently different that I do not want to draw too clear an example of that. But I think what that



experience does demonstrate is that having a system in which the right to emit things can be traded, within a certain limit, is a way of reducing those emissions in a very efficient manner. I think my experience shows that.

The CHAIRMAN. Thank you very much.

Senator NELSON. And it worked?

Dr. ELMENDORF. Yes, it did.

The CHAIRMAN. Thank you, Senator.

Senator Conrad?

Senator CONRAD. First of all, I want to thank you, Mr. Chairman, for holding this hearing and bringing this panel before us, because I, for one, feel that I have learned a lot this morning just in an hour and a quarter. I want to thank each of the witnesses.

The purpose of this exercise, as I understand it, is to reduce carbon emissions, so I would ask each of the witnesses, what is the most efficient way to reduce carbon emissions, between cap and trade and a carbon tax? I will start with you, Dr. Krueger.

Dr. KRUEGER. Well, as was mentioned before, a cap-and-trade system has certainty on the reduction in greenhouse gas emissions. So, if the main focus is to reduce greenhouse gases, I think the certainty of the cap is the reason why I would say that cap and trade is a more certain way of reducing emissions.

Senator CONRAD. All right.

Dr. Elmendorf?

Dr. ELMENDORF. For a given amount of emissions reduction in a year, most analysts would say that a carbon tax is more efficient because it reduces the volatility of the price of emissions. But it has the feature that Alan Krueger noted, that at a given moment in time one is less certain of the amount of reduction that one would achieve, and that is a trade-off that has to be made.

As I suggested earlier, development of more complicated cap-and-trade approaches is building in some of the flexibility in the timing of emissions reductions that comes naturally with a carbon tax, and that is bringing those two closer together in their effects.

Senator CONRAD. But I want to be very clear in what I am hearing. I am hearing you say that the most efficient way to reduce carbon emissions is with a carbon tax, not with respect to an annual target, but going forward, an economic analysis would tell you that the most efficient way is a carbon tax?

Dr. ELMENDORF. That would be the conclusion of most analysts. Yes, Senator.

Senator CONRAD. And Dr. Delbeke?

Dr. DELBEKE. I would emphasize two elements. The cap is being reached, so a cap and trade gives certainty on that. The second is that the flexibility within the system allows that the one for whom it is cheaper to reduce emissions can do more and gain money from that. He gets paid by those for whom it is more difficult to reach the emission reduction.

So the inherent flexibility in the system is something that is incredibly important, contrary to imposing a tax on any economic operator in the same manner irrespective of what his capabilities are for reducing the emissions. That comes close to the heart of technology; for one operator it may be much cheaper to reduce emissions than for another. We observed in Europe, for example, that

power companies have much more capability for reducing emissions compared to, for example, steel mills or aluminum smelters. One can pay for the other to do the job.

Senator CONRAD. Dr. Smith?

Dr. SMITH. A tax actually gives you just as much flexibility as the cap and trade. The idea that one can pay for the other only works if there is a 100-percent allocation of permits to the businesses in the first place, which does not happen with an auction. There is no question that tax is the most efficient way to get the emissions down. It gives you some uncertainty about the emissions at any point in time, but since the goal is a very long-run target of zero emissions across the globe, we need a durable policy and price certainty, and the tax gives you that.

Senator CONRAD. All right. Let me go to my final question, and that is, in economic terms—because we have to be concerned about bringing down emissions, but we also have to be concerned about economic effects—which of these approaches is best from an economic standpoint: economic growth, jobs, and the rest? Dr. Krueger?

Dr. KRUEGER. Well, one thing I would point out, which is not directly answering your question but it is certainly related, is I think the way we measure dead weight loss needs to change. We need to take into account the effect of emissions on well-being on society. The traditional measures of dead weight loss, which Dr. Elmendorf and Dr. Smith discussed, ignore the purpose of the program, which is to reduce greenhouse gas emissions.

Now, I am sure that they are aware of this, so I think a broader measure of well-being and of output, kind of adjusted for pollution, would take that into account. So it is not clear to me that the dead weight loss goes quite in the direction that was stated.

I guess I would just emphasize on your question that you have a tremendous amount of flexibility with a cap-and-trade system, and certainly compared to the regulation, the command and regulatory control system, you have tremendous amount—more flexibility, and that would lead towards a much more efficient system.

Senator CONRAD. My time has expired, but perhaps we will have another round.

The CHAIRMAN. Thank you, Senator.

Senator Bunning?

Senator BUNNING. Thank you, Mr. Chairman.

Dr. Krueger, whether we look at allowance auctions or free allocation under a cap-and-trade system, this will mean nothing unless we reach an international agreement on cap and trade. I have concerns about mandating a system that would not only punish American consumers and producers, but would restrict domestic economic growth.

Advocates of cap and trade argue that by implementing such a system America can take a global leadership position on climate change. They argue that developing nations like China, India, and Russia will follow, not lead, on climate change and that mandatory agreements with these nations would not be necessary because they will voluntarily adopt the emissions standard in the future.

Do you agree with that?

Dr. KRUEGER. Well, I agree that it is critical to bring the rest of the world's emissions down. I think this is one area where there is a practical difference between a tax and a cap and trade, which has not been mentioned. I think it is easier to integrate a cap and trade system in the U.S. with the rest of the world than it would be on a tax.

Senator BUNNING. No. Answer my question: do you agree, unless we have an international agreement with India, China, and other emitters of more pollutants than the United States, even 20 years from now if we cap and trade or we put a carbon tax on and we do not get any cooperation out of China, opening 94 coal-fired generating plants with no restrictions, India, the fastest-growing country in the world, and Russia, who just thumbs their nose at us when we talk about this, are we going to lower emissions in the world if we do not get that agreement?

Dr. KRUEGER. I agree with you that it is very important to have such an agreement. If we lower our own emissions, I do believe that will lower world emissions. However, that does not mean it is not essential that we have agreements with the rest of the world. I think it is very important that the Special Envoy for Climate Negotiations, Mr. Stern, is pursuing those types of agreements.

Senator BUNNING. Do you believe that there will be any transfer of economic job loss to other countries that do not cap and trade?

Dr. KRUEGER. In some industries, I believe there is a risk of—

Senator BUNNING. Steel makers and those types of people who use a lot of electricity and a lot of power, aluminum makers and those kind of—

Dr. KRUEGER. I think it would be very important to look across industries, look at trade-sensitive, high energy-using industries and to address them if it is deemed necessary.

Senator BUNNING. I heard the number \$1.2 trillion mentioned. I do not know whether it was Senator Kerry or somebody at the table. I saw a study done by MIT that mentioned \$1.8 trillion as the cost or the tax, or whatever you want to call it, of doing a cap-and-trade system. The \$600 billion that was mentioned in the budget was not in the same vocal report that MIT made. Is that false, or is that anywhere close to being true?

Dr. ELMENDORF. Senator, the amount of money involved depends tremendously on the details of the system. It depends on how much the cap reduces emissions relative to the baseline and how quickly it does that. It depends on the extent to which activities outside of the traditional cap sectors overseas, or in this country, can be used as offsets to the emissions reductions that are required. So the number that I gave was CBO's estimate of the revenue—

Senator BUNNING. CBO.

Dr. ELMENDORF. Of the particular Lieberman—

Senator BUNNING. One bill?

Dr. ELMENDORF [continuing]. Legislation from last year.

Senator BUNNING. All right.

Dr. ELMENDORF. We have not scored the Waxman-Markey bill for this year because it is not a fully formed bill, and we cannot do our estimates until we know.

Senator BUNNING. I understand that.

Dr. ELMENDORF. So it depends on what the legislation is.

Senator BUNNING. All right.

The CHAIRMAN. Actually, your time has expired.

Senator BUNNING. Thank you.

The CHAIRMAN. Thank you very much.

Senator Stabenow? Thank you, Senator.

Senator STABENOW. Thank you, Mr. Chairman. And thank you to all of you. I think it is clear that we are talking about rewriting the rules of the economy to a low-carbon economy. I think there are very important reasons to do that, and costs that do not show up in the modeling so far.

I am interested in any studies that have been done regarding increased storms, hurricanes, the kinds of damage that have been done to families' homes and businesses, and changes that will come in agricultural production that relate to these issues. I think there are multiple costs that we need to address as we look at this. But clearly there are costs as well. I certainly come from a manufacturing State where we are very concerned about those costs.

Dr. Elmendorf, you were talking about, sort of, the trade-offs on making stuff. I believe that we can make new stuff, and clean energy, and working very hard around issues of building wind turbines, making the 8,000 parts in my State, as well as across the country, solar energy, and all of the other new things that create jobs in the industries that I share the concern about with Senator Bunning.

I would like to ask questions relating to distributing cost, which is really, I think, very much at the heart of how we do this in the right way so, instead of losing jobs, we gain jobs, which is, in my mind, the critical question.

When we look at the allocations versus auction and the concern—which I think is legitimate—about windfall profits going to individual companies, if we look at an auction in my State and assume a \$22 price for carbon, rates, I am told, would increase about 20 percent. Would it not be better to address the rate increase directly by providing the allocations to consumers through the utility commissions or the local distribution companies? I know that is one of the options I have seen for rate increase mitigation and rebates so that it is seen directly on their utility bill.

You can bypass, instead of having that go to the utility—I know that our utilities would support that as well—and go directly to the State or local—in Michigan it is a public service commission—to address whether it be individual home price increases, manufacturers, other businesses. Could you speak to that approach, Dr. Elmendorf and Dr. Krueger?

Dr. ELMENDORF. I think the key point to keep in mind is that the prices of some things that are fossil fuel-intensive have to rise to induce the shift in behavior so we can prevent—you can prevent through your policies—increases in particular prices, and a particular design of the use of the allowances might do that for electricity.

But that then shifts the burden of the overall emissions reduction, the difference between where it would be without policy and where you are trying to be. It shifts the burden on overall reduction out of the electricity sector and into other sectors. So it does not make the concern go away, it puts its somewhere else. The

prices of other things will have to rise by more in order to get the emissions reductions outside of the electricity sector if we decide—if you decide—not to take the reductions in the electricity sector.

Senator STABENOW. Well, I am not suggesting, first of all, that there not be a cap. Obviously the cap is the ultimate pressure, the cap, and the cap coming down, and the number of the allocations. But it is a question of whether it goes directly, that allocation, to the utility to determine how to spend that in terms of lowering rates, or to the State regulatory agency that can determine, is it the manufacturer's rates that are going up, is it the individual homeowner, what is happening? They, at least in our State, determine what shall happen in terms of the rate structure and the rate increases.

Dr. ELMENDORF. Again, I would just caution that, if the effect of that is to keep household rates lower, then business rates will rise by more, and that cost will be passed on to households in the prices of the products they buy from those businesses.

Senator STABENOW. I understand that. I understand. For us, they regulate both, so there is no assumption that it has to be a higher rate increase for manufacturers under that. You are saying that is one outcome.

Dr. ELMENDORF. I am just saying that the price increase will have to occur somewhere in order to induce the change in behavior, and you can move around where it happens, but you cannot get away from it altogether.

Senator STABENOW. Sure. Sure.

The CHAIRMAN. Thank you very much.

Senator Snowe, you are next.

Senator SNOWE. Yes. Thank you, Mr. Chairman. Thank all of you for being here today. This has been very valuable testimony as we move forward on this significant initiative.

Dr. Delbeke, welcome. It is important to learn from the European experience as we proceed in crafting legislation regarding cap and trade.

Could you tell me how you would regard a greenhouse gas registry, now that the European Union has established one? That is something that another Senator, Senator Klobuchar, and I are working on, and in fact got the money to implement it, and EPA is moving forward on that. But the registry, as we have determined, would be instrumental.

Obviously having an overall assessment of the level of emissions, not only by, collectively, the industries, but by each sector in terms of determining how the allocations are made with respect to allowances or the value, obviously, of the price of carbon. I know in the European experience, the price of carbon collapsed initially. Would a greenhouse gas registry have been useful in this process from the outset?

Dr. DELBEKE. Thank you very much for this question. Absolutely. I would say this is an essential piece of the infrastructure for having the cap and trade running, and the risk we took in 2005 is that we had to rely on estimates without having historical emissions measured, verified by third parties, et cetera. We did not have that. But we were basing our system on estimates, and we had to overcome that.

So, after the second year we got our database right, so it is an essential piece. That is why we are very confident that the price collapse we had in the first period will never happen again, because we have, now, the database in place that we needed to base our reviewed cap and our declined cap on between now and 2020.

Senator SNOWE. So you think that it stabilized the price of carbon in that sense, and at least now you have a handle on the overall pricing because of the historical basis?

Dr. DELBEKE. Absolutely. Even the companies were overestimating their emissions of carbon. So by the moment they had to measure and there was a third party verifying, we saw that they had pleasant surprises, that their carbon emissions went down quicker simply because they were looking at it. Before that moment, they were just not having that tool available and that element for comparison with others in the sector and across sectors.

Senator SNOWE. Thank you.

Dr. Krueger, what is your view on that?

Dr. KRUEGER. I think it is extremely important to have information, accurate information. One of the issues is, how is that information released, how transparent is the information? That is one way of trying to reduce volatility.

Senator SNOWE. Now, Dr. Delbeke, one of the issues that we are going to be making a decision on as well is to what extent how much of the revenue should be allocated for energy efficiency investments. Some parts of the country already have had that experience. Certainly in my part of the country, in the northeast, we have what is known as the ReGGIe system. About 70 percent of the revenues are reinvested into energy-efficient alternatives in technology, so it has worked very well, and innovation has developed as a result.

Now, am I to understand the European Union has had a net investment of its revenues into energy alternatives up to 70 percent now? Is that going forward? What was the history in the past between member States and the overall European Union?

Dr. DELBEKE. Well, just to clarify, an important element of the European institutional setting is that revenues and the way they are going to be used belong to the member states and not to the central European decision-making system, so it depends very much on what the member states want to do with it. But we see that those who have been going forward with a willingness to become technology leaders have done so. If you look at, for example, Germany and what they have done in the field of renewables, cars, and carbon capture and storage, it was with the revenues from auctioning, partly, that all of these efforts were financed.

Senator SNOWE. So none of the revenues went to the overall European Union? All went back to the member states in that respect?

Dr. DELBEKE. Indeed. Indeed.

Senator SNOWE. So there is not, probably, an average. Each state, each country, makes its own determination.

Dr. DELBEKE. Indeed, Madam.

Senator SNOWE. Dr. Krueger, this is going to be obviously a central issue, because I know the President has suggested 80 percent go to the Making Work Pay tax credit to obviously alleviate hardship on Americans who are experiencing increased costs, and that

is certainly understandable, and 20 percent for energy innovation. In the northeast, obviously it has been about 70 percent investments.

Is there going to be any allowance for flexibility for those areas of the country that are already on a cap-and-trade system and have shown innovation, to have some flexibility in continuing that innovation?

Dr. KRUEGER. I think you raise a very important issue for a national cap-and-trade system. The administration, I think, would welcome an opportunity to work with you and Congress on how we integrate a program like ReGGie into a national system.

The President has said that also, where the proposal says that it is very important that businesses, communities, and citizens see some of the benefit from the money coming back that is collected in this program.

Senator SNOWE. I appreciate it. Thank you.

Senator BINGAMAN. Senator Carper?

Senator CARPER. Thanks very much.

To our witnesses, welcome. Dr. Krueger, I think you are new on the job. I think you were confirmed yesterday, and I just want to congratulate you and welcome you and say that we look forward to working with you.

I would ask Senator Roberts to join us in this conversation for just a moment if I could. Senator Roberts? If I could.

Senator ROBERTS. Yes, I am here. Were you going to ask my questions like you normally do?

Senator CARPER. I would like to, if you would let me. I just want to come back to some points that—

Senator ROBERTS. We have a luncheon date.

Senator CARPER. Yes, we do. We are going to talk about this at lunch, too.

Senator ROBERTS. Right. All right.

Senator CARPER. But I just want to come back to a couple points raised by you and Senator Enzi, whom I think are among the more thoughtful, and usually entertaining, colleagues.

Senator ROBERTS. Well, I have not said anything yet. Senator Enzi has been thoughtful and entertaining.

Senator CARPER. You will have your turn. I am sure you will be.

Senator ROBERTS. All right.

Senator CARPER. My colleagues have heard me say before, one of the things that intrigues me, as a person who works in public policy and has for a long time, is how do we harness market forces to try to drive good public policy outcomes? One of the reasons I have been interested in cap and trade is because I think it enables us to harness market forces to drive public policy outcomes, and that is to reduce emissions and to use a market-based system to do that.

Senator Enzi raised the issue of trees and forests and trying to preserve those and promote the planting of more. I could not agree more, and that is why I have supported for a number of years, as I am sure he does, the notion of using offsets. Whether they be trees or forests, including farming, providing methane containment units, whether it is cattle feed lots, or pig feed lots, or whatever,

those are the kinds of things that I think make sense; I suspect he does as well.

I would just say, I think we have the opportunity—Delaware was the first State to ratify the Constitution. In certain matters it is good to be first. I would go along to say there are some things you do not want to be first in, and maybe one of those is to have a cap-and-trade system on climate, on CO<sub>2</sub>. As it turns out, somebody else has gone first. We will learn from their mistakes, and we have a lot to learn from their mistakes.

Finally, I would say—this point has been made by some—we have the opportunity to experiment with cap-and-trade in this country. We have had a chance to do that with sulphur dioxide, and it actually turned out pretty well. If we used a tax on sulphur dioxide, we would probably have come in with a tax between \$800 and \$100 per ton. With the market approach that we used with the acid rain legislation, we ended up with a price set by the marketplace in the cap-and-trade system for sulphur dioxide of about \$200. So I would just say, I would urge my colleagues, especially to whom I address my comments, whom I respect a lot, to not lose sight of those arguments.

The other thing I would ask my colleagues not to lose sight of is, we focused a whole lot on emissions from utility plants. I focused a lot on that in the last 7 years. We have not talked much at all about transportation. About a third of the CO<sub>2</sub> emissions that are seen in this country come from the transportation sector. In 1975, if you will recall, we created CAFE legislation that raised fuel efficiency standards from about 15 miles per gallon to about 25.

So you would think, well, we are going to see a big reduction in CO<sub>2</sub> emissions from transportation. Wrong. We saw a huge increase instead of a big reduction. The reason why is because people simply drove more. We planned our neighborhoods and put work and schools far from where we lived and we just drove a lot more in the years that followed.

If we are going to make real progress in reducing CO<sub>2</sub> emissions, we cannot forget transportation. Today we fund the transportation systems through a gas tax, and by that we pay for our roads in transit by burning more gasoline. The more you burn, the more you fund your roads. It is like our incentives are actually kind of perverse there. We drive less, our transportation budgets dry up.

I think we can do better. Senator Arlen Specter and I have introduced legislation called Clean-TEA. Clean-TEA uses 10 percent of any auction proceeds that would come from a climate change bill to fund more energy-efficient transportation systems, whether they be passenger rail, freight rail, transit, to help people get out of their cars, trucks, and vans and to use something that is more energy-efficient. Under Clean-TEA, 10 percent of the auction proceeds would be provided to States and localities based on how much they reduce emissions, not increase emissions.

A question for Dr. Elmendorf. I noticed in your testimony that you did not include funding alternative transportation as a way to reduce cost to the consumer. I just want to know, is there a reason why? Since we are getting more alternatives to driving, will this not save consumers money under what we have proposed?



Dr. ELMENDORF. So, Senator, we did not list every option conceivable in the testimony. The omission of something should not be viewed as a negative judgment about it.

I think in general, the virtues of a carbon tax or a cap-and-trade system are that the market, as you say, then gets to decide what the most efficient place is to reduce emissions. The more that the government tries to decide separately that the best place to reduce emissions is in transportation or the worst place is in electricity or something else, those sorts of judgments tend to raise the cost of the reductions as a whole.

Now, the important exception to that is that we know there are certain sorts of research and development activities and certain sorts of transportation projects and so on that the private sector is going to do by itself, and there is, of course, an appropriate public role for the government in funding basic research and development and providing public transportation and other services.

The CHAIRMAN. Thank you, Senator, very much.  
Senator Bingaman?

Senator BINGAMAN. Thank you all very much.

Dr. Delbeke, thank you for your leadership on this important issue and the courtesies you extended to me and my staff when we visited with you at the EU a month or so ago.

Let me just ask Dr. Elmendorf, first, and maybe Dr. Krueger, if I am understanding this correctly. It seems as though a lot of the discussion is assuming that our choices are three: either leave things the way they are, impose a cap and trade system, or impose a carbon tax.

I do not think those are the three choices we have because of what the EPA is on track to do. As I understand what the EPA is now committed to, the Supreme Court told them they had to take action to determine whether or not greenhouse gases, in fact, endangered public health. They entered into, or issued, an endangerment finding, and therefore they are on track to regulate greenhouse gases under the Clean Air Act, unless Congress says do not do that, we want to do it some other way.

So one way or another, the cost of reducing greenhouse gas emissions is going to be experienced and imposed upon our economy, the way I am thinking about it. Is that an accurate way to think about it, Dr. Elmendorf?

Dr. ELMENDORF. I think there is very widespread agreement that it is much more efficient—much more efficient—to reduce carbon emissions through putting a price on carbon through a tax or cap and trade than it would be to regulate carbon emissions on a plant-by-plant, building-by-building basis. I think you would have difficulty finding anybody who would disagree with that proposition.

Exactly where the EPA is headed at this point, I think, is less clear; of course, they are at a very early point in their response. There was a particular concern that, under the provisions of the Clean Air Act, they would be forced to regulate many very small emitters. They assert that they do not have to under the Act, and I am not a lawyer with expertise in that area. But even if they do not have to cover all of these very small emitters, I think there is still no doubt that it would be more expensive for the country as

a whole to reduce emissions through that sort of direct command and control than through one of these market-based mechanisms.

Senator BINGAMAN. And absent a change in law, an amendment to the Clean Air Act or something to that effect, they are on track to limit greenhouse gas emissions unless we tell them otherwise. Am I accurate in that, Dr. Krueger?

Dr. KRUEGER. This is my first morning on the job, so I probably should not comment on that. I can say that—

The CHAIRMAN. And you are doing a good job, too.

Dr. KRUEGER. Thank you. I should say I have not even had a chance to sign up for health insurance yet. [Laughter.]

The CHAIRMAN. Yes. We are trying to help there, too. [Laughter.]

Dr. KRUEGER. The President very much believes in trying to use market-based solutions to address this.

Senator BINGAMAN. Let me just ask, as a matter of economics, Senator Enzi was complaining about the so-called Ponzi scheme where we have this round trip of the money, where basically we have a cap-and-trade system, we auction allowances, we then try to return the money to the people who are having to pay for higher electricity bills.

In direct regulation of greenhouse gas emissions, which I believe the EPA would accomplish assuming they go ahead, there is no round trip, there is no return of any money to the folks who are bearing the cost of that increased regulation, as I see it. Is that an accurate way to think about it, Dr. Elmendorf?

Dr. ELMENDORF. Yes, that is right.

Senator BINGAMAN. So basically what we have a choice of here is, do we allow this to be done by direct regulation, which it is now on track to be done by, or do we substitute for that a cap-and-trade system, or a direct tax of some kind where we would at least have the opportunity to return some of that money to mitigate the economic impact on people who may suffer from increased costs in the process. Is that the right way to think about it?

Dr. ELMENDORF. I think you are right, Senator. The opportunity to use the proceeds from allowances—or from a tax if you went that direction—to mitigate the effects that will be concentrated in particular households, industries, and regions, is a very important opportunity and a very important decision that you face in constructing this legislation.

Senator BINGAMAN. My time is up. Thank you.

The CHAIRMAN. Thank you very much, Senator.

Senator Roberts, you are next.

Senator ROBERTS. Well, thank you very much, Mr. Chairman, and thank you for holding this hearing.

I appreciate the admonition and the counsel by my friend from Delaware, who is not present, I see. I was not aware of the Clean-TEA bill, and we are exploring that. I am not going to say what I thought Clean-TEA was, but we can get into that at some other time.

We have more cattle than people out in Kansas by 2:1, and usually they are in a better mood.

The CHAIRMAN. Than who?

Senator ROBERTS. Than most of us. Fifty percent of the energy consumed by Kansas is generated by coal-fired plants. Actually, I

think that is 73 percent, but I will not quibble over that. We have over 150,000 head of cattle there in Dodge City. I did stop to think, when you all were talking about measuring CO<sub>2</sub>, how you would do that with a herd of 150,000. We would like to invite you out, if you have some ideas. Taking it one cow at a time might take you a little long, but it would be an interesting way if you could measure that.

Wichita is a major manufacturing city. It is the air capital of the world. I have an awful lot of rural communities, very similar to others on this committee, more especially Montana, and others in the high plains, Wyoming. They dot the landscape and the prairie. They also have energy-intensive industries that keep the local economy above water and their community banks investing, and the American dream a reality, and they feed America and a troubled and hungry world, so it is a pretty good investment.

But cap and trade or cap and tax, whatever we want to say, a simple energy consumption tax, our folks take a pretty dim view of that, despite the excellent testimony of the panel.

I met with the chairman, president, and vice president of a small, independent oil and gas refining company; I do not need to get into who it is. There are 30 of them, by the way, that make up the small refineries across the country, 13 percent of our U.S. refining capacity. They just told me that a cap-and-trade—or a cap and tax system is what I call it—the one being considered in the House by Congressman Waxman and others, if passed, would simply cause them to shut their doors on day one. That was their judgment. I trust them on the issue, and they were very clear.

I just do not think this is the way we want to treat our domestic small businesses, with the hope that somehow some of that money would come back in the way that Senator Enzi tried to explain it in regards to his testimony.

We feed 145 people. One farmer feeds 145 people throughout the high plains in agriculture. They are going to begin their spring planting here real quick, if they have not already started. But during last year's global warming debate I was not at the Hague, but I was at Manhattan, KS. I asked the Kansas State research and extension folks to run an economic analysis of what cap and trade—or the bill at that time, and I know it is changing—or cap and tax means. That is not MIT, but those are the folks that I really pay attention to in regards to agriculture program policy. The response I got from them was very much like the small refiner: it was a little frightening.

The cost of production from one acre of irrigated corn increased over \$100, an acre of wheat, roughly \$25, and an acre of sorghum, \$30. Parlay this into the increased energy cost for transportation, and refrigeration, and storage, and you can start to imagine how much more disposable income will be used just to purchase our food and fiber.

This, I think, is the reason why Collin Peterson, who is the esteemed chairman of the sometimes powerful House Agriculture Committee, indicated in the press just the other day, cap and trade is dead as far as he is concerned.

Now, you have the additional tax increase for your electric bill, your vehicle fuel, and you are not left with much in your pocket-

book. In fact, about the only winner out of this scenario is the Federal Government and the good intentions of all the folks who work in the Federal Government. That ties back to the questions that Senator Enzi asked, and I will not repeat that.

But the point that needs to be made is that every cap and trade proposal I have seen is a core way to tax energy consumption to get CO<sub>2</sub> down, as was pointed out in previous testimony, but it is also a way to bring more revenue to the Federal Government.

Once again, my time is running out, and you have been pretty tough on that, Mr. Chairman. But I went to the Antarctic very early and looked at the ice corridors when we were even debating it and we had a problem with global warming, and I saw the ice corridors and I became convinced, and I was trying to tell everybody in Agriculture—I was somebody then, I was a chairman—that we really ought to pay attention to this, and do not say there is not a problem, say there is a challenge and we can be part of it with carbon sequestration. So I know there is a problem.

But we asked the person who was in charge of that whole operation, if we had passed the Kyoto treaty, how much CO<sub>2</sub> would we take out of the air in 100 years? He said 0.015, which stunned me. I said, why? He said, because without the support of some kind of international cooperation you will feel good about yourself and you may take some CO<sub>2</sub> out of the air, but you are really not going to make much of a difference.

The CHAIRMAN. Right. Senator. There is a little light on over there on the clock, which means a vote just started.

Senator ROBERTS. I understand that. I understand that.

The CHAIRMAN. So, Senator Hatch, you are next.

Senator HATCH. Well, thank you, Mr. Chairman. I thank all of you for being here.

Dr. Smith, thank you so much for joining us today. I appreciate learning more about the distinction between auction allowances and free allocations with regard to price volatility. However, I would like to focus on testimony debunking a myth that a carbon cap or tax would create jobs. Now, you state that even though a shift towards lower-emitting forms of energy would create new jobs, these jobs would be created by forcing out current energy jobs with more expensive forms of energy. Because it will cost more for companies to produce the same amount of output with these new technologies, overall worker productivity would fall and aggregate payments to workers would also fall.

Now, do you believe that implementing a cap-and-trade program or a carbon tax would result in net job losses?

Dr. SMITH. Yes. That statement argues that there is a net decrease in wages paid to workers in total. There are only two ways to interpret that: there are either fewer jobs or the jobs that we have are a lot less well paid.

Senator HATCH. All right. Now, some climatologists believe that implementing a cap and trade or a program that would reduce carbon emissions by 83 percent, in the year 2050, would reduce temperatures by only 9 hundredths of one degree Fahrenheit. Are we sacrificing millions of jobs in order to reduce climate change by 9 hundredths of one degree?

Dr. SMITH. If we look at the U.S. action in isolation, yes. There is nothing else that we are considering when we estimate the cost of the U.S. policy. The costs of inaction are not the benefits of action in the U.S. policy.

Senator HATCH. Dr. Delbeke, thank you for coming. We appreciate you participating here today. Now, some European economists examined Spain's Green Jobs initiative. As you know, President Obama is using Spain and other European countries as a model for creating more U.S. green jobs. These economists have revealed some alarming statistics about the transition to greener jobs. Here are some of them: the U.S. can expect 2.2 jobs to be destroyed for every renewable job financed by the government; 9 out of 10 green jobs created by Spain over the past 10 years are no longer in existence today; since 2000, Spain has spent \$753,778 to create each "green job;" consumer energy costs in Spain would have to be increased 31 percent to repay the debt generated by the green job subsidies.

Now, can you comment on any of these particular claims, and do you believe the same would apply to the United States under a cap-and-trade program?

Dr. DELBEKE. Thank you very much, Senator. I am not familiar with the precise figures as you called them, but two comments. I think that renewable energy technology is developing very fast, and I would not be surprised that, indeed, those who were in business 20 years ago have changed their business or have gone out of business.

The other thing I think that needs to be underlined that we see in Europe is that the jobs created in the renewable sector have been, and are today, the most growing. We saw also on the stock exchange that the valuations for these companies are incredibly high, including in Spain and elsewhere. So, in that sense we think there is a transition that is being undergone in Europe, but it is towards those low-carbon, clean technologies that pay off in terms of jobs and output.

Senator HATCH. All right. Thank you.

Dr. Elmendorf, my constituents in Utah are deeply concerned about an increase in energy prices as a consequence of cap-and-trade legislation. The Congressional Budget Office estimates the Lieberman-Warner bill from last year would raise \$902 billion over 10 years. Now, this year's version would be far higher. According to the President's budget proposal, part of these revenues would be redistributed to "compensate the public."

Now, according to the National Rural Electric Cooperative Association, if a \$50 cost per metric ton of carbon dioxide is imposed under a cap-and-trade system, residential electric bills would increase by 70 percent in Utah. Now, that is a very high rate compared to most other States.

Now, am I correct that the people of Utah and these other carbon-intensive States such as West Virginia, North Dakota, and Arkansas would have to bear a far greater burden of higher electric bills as a result of the President's climate change agenda?

Dr. ELMENDORF. Senator, CBO has not done analysis on a State-by-State or regional basis. I recognize it would be very useful for you if we had.

Senator HATCH. Yes.

Dr. ELMENDORF. So I cannot speak to Utah specifically. But it is true, and I said in my remarks, that the effects of raising the price of energy and energy-intensive goods would be distributed very unevenly across the country, and that puts squarely in front of you and your colleagues the question of whether you want to use the revenue that would be collected through such a cap-and-trade system or a carbon tax to offset those effects, and to what extent you want to do that for people who live in certain areas of the country, or work in certain industries, or have certain levels of income.

Senator HATCH. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator. Thank you all.

Senator Cantwell had a question.

Senator CANTWELL. If I could just ask a quick question.

The CHAIRMAN. Sure.

Senator CANTWELL. Do we have time?

The CHAIRMAN. Sure. We have a couple, 3 minutes.

Senator CANTWELL. About upstream caps. Would an upstream cap on fossil fuel cover more than 80 percent of the greenhouse gas emissions, Dr. Smith?

Dr. SMITH. It would be close to that.

Senator CANTWELL. So, I mean, that is an agreement. Everybody is agreed on that, is that correct? Is that correct, Dr. Elmendorf?

Dr. ELMENDORF. I think that is roughly correct, yes. I do not have precise numbers.

Senator CANTWELL. All right.

And then the upstream cap obviously would avoid the problems of partial fuel, fossil fuel, emission coverage and verification, and all of that that is usually with a cap-and-trade system. Is that right, Dr. Smith?

Dr. SMITH. Definitely.

Senator CANTWELL. All right.

And then Dr. Elmendorf, there is a Research for the Future map that basically shows that carbon intensity, if you did an upstream cap, does not really vary that much by region. Is that right? So, I mean, if you implemented something, you do not see this variation in cost by region across the country?

Dr. ELMENDORF. It is a topic of ongoing research about how the regional effects interact with the effects at different levels of the income distribution. So there is a recent study that suggests that low-income people in particular parts of the country might have particular effects. It really depends, as I suggested earlier, on both the fossil fuel intensity of the production in certain areas, what industries people mostly work in, but also on the fossil fuel intensity of their consumption.

For people who drive further because they live in rural areas, people whose local utilities generate electricity mostly using coal, they would find it more or less difficult to get power from other sources—those consumption issues matter as well. So it is complicated to keep track of on a regional basis, and the Research for the Future people are doing terrific analysis that we often draw on. I think it is a little bit of an unsettled question as to how to look at this, not just by region, but also by region and income group together.

Senator CANTWELL. Thank you.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator.

Thank you all. This has been very important, very helpful, informational testimony. I think we have all learned a lot here on an extremely important subject. Thank you, Dr. Delbeke, for joining us as well. This is certainly going to require collaborative and cooperative effort, and your presence here helps in that regard. So, thank you all very, very much.

The hearing is adjourned.

[Whereupon, at 12:02 p.m., the hearing was concluded.]





# APPENDIX

## ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD

---

### **Hearing Statement of Senator Max Baucus (D-Mont.) Regarding Auctioning Under a Cap-and-Trade Program**

Voltaire wrote: "Men argue, nature acts."

While people argued over global warming, nature acted. Now, at long last, people appear nearly ready to act in response.

Last year, the Senate had a good discussion of legislation to respond to climate change. As part of that effort, the Committee heard from witnesses about the tax and trade aspects of a cap-and-trade program. But ultimately, the Senate did not act on legislation last year.

This year, we will once again take up climate change legislation. President Obama has given a high priority to addressing the problem. It is time for us as a nation to show leadership and responsibility. It is our moral imperative to address climate change. It is time for us to act.

Action would not be without cost. But the costs of inaction would be far greater.

Many have analyzed the effects that a cap-and-trade program would have on our economy and our ability to compete in the world. Each study has generated its own set of questions and uncertainties. But we need to move ahead with the best information that we have.

Today, we have asked our witnesses to share their analyses of the effects of a cap-and-trade program on the economy. And we have also asked for their thoughts on the best way to design the system to provide certainty, where we can. We need certainty in terms of establishing and containing costs. And we need certainty in terms of meeting our greenhouse gas reduction goals.

We will ask: How can we reduce the effect of potentially increased energy costs on our economy?

How can we reduce the effect on energy consumers?

How should an auction be structured?

How should allowances be allocated? Should they be auctioned, given away for free, or some combination of the two? What is the proper balance between free allowances and auction revenues?

Are free allowances an effective tool to assist industries facing particularly high costs? Are they effective to assist industries who are trade sensitive?

If we provide free allowances, who should receive them? Based on what criteria?

These are all questions that I hope our witnesses can help us to answer.

And so, while people argued, nature acted. Now, Congress can act in response. Let us find out what we can, so that we may act wisely.

###



**STATEMENT FOR SENATOR BUNNING**  
**SENATE COMMITTEE ON FINANCE**  
**“Auctioning under Cap and Trade: Design, Participation and**  
**Distribution of Revenues”**  
May 7, 2009

Thank you, Mr. Chairman.

This hearing is trying to answer the question of how a cap and trade system should be designed. But there is a much bigger question that needs to be answered: Why on earth would we embark on a cap and trade system when our economy is in shambles?

We know that cap and trade will raise prices for consumers. In Kentucky, utility prices are expected to rise by 65 percent. One of my home state newspapers predicts a 100 percent increase in costs. Families will be paying more every time they turn on a light, drive a car, or buy groceries or any other goods.

The “Making Work Pay” tax credit proposed by the President won’t even come close to making these families whole. Perhaps the name “Making Work Pay” should be changed to “Making Work Disappear,” because that’s exactly what would happen under a cap and trade system. If we want slower job growth, then cap and trade is the answer. If we want more manufacturing jobs shipped overseas, then cap and trade will do it. If we want more imported energy and less domestic supply, then cap and trade is the solution.

If we were really serious about reducing emissions, then we would not move forward without assurances that India, China and other developing countries were moving along with us. Why would we put ourselves at a further competitive disadvantage when we are already facing a massive trade deficit?

Let’s be honest. Cap and trade is better named “cap and tax.” It is a massive tax on families, transportation, energy and manufacturing. It will kill jobs and shrink the economy. It will further erode our international competitiveness.

This hearing should not be about how cap and trade should be designed. It should be about how cap and trade should be defeated.

Thank you, Mr. Chairman.

**Hearing by the Senate Committee on Finance on  
“Auctioning under Cap and Trade: Design, Participation and Distribution of  
Revenues”**

Written statement by

Jos Delbeke

Deputy Director-General

Directorate General for Environment

European Commission, Brussels

May 7, 2009

**Summary**

The EU Emissions Trading System (EU ETS) exists since 2005. It covers almost half of the EU's greenhouse gas emissions. While there is no sunset clause, the EU ETS operates in multi-year trading periods.

Phase 1 (2005-2007) was a test phase and started with a moderate cap. This phase delivered significant learning benefits, and created an EU-wide carbon price with a liquid market. Due to lack of data, industrial facilities in some cases received too many free allowances.

In the current Phase 2 (2008-2012) the cap is much firmer, and allocations to industry were made at a much more realistic level, ensuring a requirement on the part of industry to reduce emissions (even though the current recession has temporarily rendered the cap less strict).

For Phase 3 (2013-2020) the power sector, and all other power generation, will get no free allowances. Industry will also have to buy a substantial share of needed allowances through auctioning. Sectors that are considered to be significantly exposed to carbon leakage on the basis of objective and transparent criteria and data will get a higher share of free allowances than other industries.

This implies that at least half of the allowances will be auctioned from 2013. The reason for abolishing free allocation to the power sector is that power companies, in the deregulated EU market, increased power prices even though allowances were distributed for free. Revenues from the auctions will go to the public authorities in the Member States, which can use them for climate action or other purposes.

Industry will also receive less free allowances. As a transitional measure, all industry will get some free allowances, but the sectors more exposed to international competitive pressure will get a higher share. Exposure is based on cost impact of the EU ETS and the trade openness of the sector.

The free allowances will, from 2013, be distributed based on technology-based benchmarks to the extent feasible. Thus, there will be a certain amount of free allowances per ton of product, e.g. per ton of flat glass. This benchmark per product

will be determined in advance of the trading period. It will be multiplied by a historic production figure. There will also be pre-determined annual reductions. The facilities will therefore know already by 2011 how many free allowances they will get each year until 2020. This method will provide high degree of certainty for industry, and ensure that only the most efficient facilities will get a large share of the required allowances for free.

There are many good reasons for deciding the amount of free allowances in advance, which are outlined in the statement. Revisions of the amount of free allowances will be made only if a facility closes down, or significantly changes its capacity.

The allocation provisions will be reviewed after the international agreement expected in Copenhagen. If the competitive situation for EU companies improves due to climate action by other nations, less free allowances may be provided.

It is crucial that the auctions are properly organized to ensure that they do not distort the secondary market for the EU allowances, and that they are conducted in an open, transparent, harmonized and non-discriminatory manner. The EU will adopt a Regulation by mid-2010 to set the rules.

## Introduction

The method to allocate allowances is one of the most important decisions to be taken in the design of a robust carbon cap and trade system. Two principal methods are at hand – allowances can be given away for free to regulated entities, or they can be sold or auctioned. The methods are not mutually exclusive and there can be a mixture of both. While both methods have been researched in detail, the practical experience that exists so far is largely on different ways of giving away allowances for free. For example, the operational cap and trade systems to control air pollutants at federal and state level in the United States are largely based on free allocation. These free allowances were the result of significant reductions from existing emissions (about 50 to 80%) and were meant, in part, to compensate firms for the reduced value of existing capital assets. Currently, free allocations in these US systems only cover about 20 to 30% of the baseline in these programs.

In general, carbon allowances represent a much larger asset value than e.g. sulfur dioxide allowances. Allocating them for free, rather than by means of a market mechanism, is a major distributional exercise for the responsible legislator or regulatory agency. Free allocations not only involve a complex exercise but also require substantial and robust emissions and other data to avoid distributional outcomes that are perceived as unfair. Finally, regulated companies subject to the carbon cap and trade system will pass on as much of the allowance value to their customers (in the form of increased prices) as the market situation allows, even if the allowances are allocated for free.

This leads to the distributional effect (dubbed windfall profits), where carbon-intensive companies actually see increased profitability due to the implementation of a robust carbon market. The more robust the system (i.e. the higher the value of the allowances), the more significant these distributional effects are likely to be. The increased profitability from windfall profits in principle comes at the expense of the public budget, which could have received income from selling allowances instead of allocating them for free.

For all these reasons, the interest in auctioning as an allocation method for carbon allowances is growing world-wide. In revised legislation decided in December 2008, the European Union made auctioning the default future allocation method for carbon

allowances in Europe's emissions trading system (EU ETS). For some sectors – notably power generation – free allocation will cease immediately at the start of the third trading period in 2013, subject to limited justifiable exceptions; other sectors will in principle see a gradual phase-out of free allocation by 2027. In the regional carbon market in the US Northeast (Regional Greenhouse Gas Initiative), each participating state auctions off at least 25% of the allowances and some participating RGGI states have decided to auction 100% right from the start in 2009. In the discussions of other emerging carbon markets (e.g. Australia) a significant amount of auctioning is being considered from the beginning.

#### **Allocation provisions in EU ETS Directive**

The EU ETS covers over 11,500 energy-intensive installations (facilities) across the EU, representing close to half of Europe's CO<sub>2</sub> emissions. These installations include combustion plants, oil refineries, coke ovens, iron and steel plants, and factories making cement, glass, lime, brick, ceramics, pulp and paper. From 2012, aviation will be included in the EU ETS (the EU ETS does not otherwise cover transportation) and from 2013 further sectors such as non-ferrous metals and basic chemicals will be included.

The aim of the EU ETS is to help the EU achieve compliance with its commitments under the Kyoto Protocol and further reductions beyond 2012. Implementing an emissions trading system does not imply new environmental targets, but allows for cheaper compliance with existing and future targets. Letting participating companies buy or sell carbon allowances means that the targets can be achieved at least cost.

#### Existing rules for the first (2005-2007) and second (2008-2012) trading periods

Inspired and informed by the practice in the existing and well-functioning US air pollutant cap and trade systems at the time its initial rules were established earlier in this decade, Europe has so far based its allocation policy in the carbon market largely on free allocation. This was in particular due to concerns expressed by industry sectors about a loss of competitiveness and to the fact that the ETS was introduced



with a learning phase. Furthermore, it was not certain that the Kyoto Protocol would indeed come into force when the ETS allocation policy was decided.

The Directive<sup>1</sup> of 13 October 2003, setting up the EU ETS, contains provisions that fix the minimum amount of free allocation at 95% of the total amount of allowances that each Member State created in the first trading period (running from 2005 to 2007). The minimum amount of free allocation is reduced to 90% in the second trading period (running from 2008 to 2012). Consequently, in the first trading period, Member States were allowed to auction up to 5% of total allowances, while for the second trading period the Directive provides for auctioning of allowances up to 10% of the total amount. The Directive does not provide for any such limit from 2013 onwards.

The current rules (applicable until 2012) governing allocation in the EU ETS establish a relatively loose framework at European level beyond the above-mentioned provisions on limiting auctioning. Detailed rules for free allocation in the first and second trading period were set rather at Member State level, leading to a wide diversity of approaches that generated concerns in terms of transparency and fair competition.

The basic principle has nevertheless been to allocate free allowances based on historical emissions, with the negative effect of favoring less efficient facilities. The variety of methods and detailed rules in the Member States has given rise to preferences both from Member States and a wide range of stakeholders for much more EU-wide harmonization. This has resulted in substantially revised rules, decided in December 2008, to be applicable in the third trading period (2013-2020) and beyond.

#### Revised rules for the third trading period (2013-2020)

---

<sup>1</sup> Directive 2003/87/EC of the European Parliament and of the Council establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 98/61/EC

In December 2008 the European Union adopted the so-called climate and energy package, which contains an amended EU ETS Directive<sup>2</sup>. The changes to the legal framework of the EU ETS will apply as of the start of the third trading period.

A core element of the revised legal framework is to make auctioning the basic principle of allocation because of its simplicity, transparency and economic efficiency and since it also generates income for climate action.

Since the power market in the EU is largely liberalized / deregulated, with only a few temporary exceptions, and since it is not exposed to competition from outside the EU, the power companies have to a high degree passed on the costs of carbon allowances right from the start of the EU ETS. Combined with free allocation of allowances, this led to windfall profits. Full auctioning is therefore the rule from 2013 onwards for the power sector, and also for power production taking place within an industrial facility, e.g. in the form of combined heat and power production.

Some of the newer Member States<sup>3</sup> have the right (so-called derogation) to continue to allocate some allowances to the power sector for free. They requested the right to do so in order to temporarily mitigate potential increases in electricity prices. Since providing the allowances for free would imply foregone public revenue, and have an uncertain impact on power prices, it is not certain that the derogation will be much used. Eligible Member States have to make decisions to what extent to use the derogations in 2011.

For the industrial sectors, a transitional system to phase out free allocation over time has been agreed. This was decided in view of the commitment of the EU to reduce greenhouse gas emissions by 20%, independently of what efforts other countries undertake. The EU has also committed to reduce emissions by 30% provided that other developed countries commit themselves to comparable emission reductions and economically more advanced developing countries contribute adequately according to their responsibilities and respective capabilities.

In order to ensure a smooth transition to full auctioning for industrial sectors, it was decided that the amount of free allowances would be gradually reduced over time to

---

<sup>2</sup> [http://register.consilium.europa.eu/pdf/en/08/st03/st03737\\_en08.pdf](http://register.consilium.europa.eu/pdf/en/08/st03/st03737_en08.pdf)

<sup>3</sup> Criteria are if more than 30% of electricity was produced from a single fossil fuel, and where GDP per capita did not exceed 50% of the average GDP per capita in the EU

allow the industries to adapt. The reduction of free allowances works in two ways. On the one hand through an annual reduction of the overall amount of free allowances available for industrial facilities. This applies equally to facilities across all covered industrial sectors. On the other, there will be a gradual reduction in the degree of free allowances for sectors not deemed to be exposed to the risk of carbon leakage. These two mechanisms are further explained below.

*How to allocate allowances for free*

In the first and second phase, allowances were to a large extent distributed for free based on historical emission values. For the third phase, the base for the allocation of free allowances will be, to the extent feasible, emission benchmarks and historical production values. This means that all facilities within a given sector will get the same number of free allowances per amount of product (e.g. per ton of steel).

The production values that will be used for determining free allowances will be from a past period (most likely the average for 2005-2007). The amount of free allowances per unit of production will be determined based on the performance of the 10% most efficient facilities across the EU.

A facility will in principle receive free allowances by multiplying historic production with a benchmark. Taking into account certain pre-determined reduction factors, the facilities will know already by 2011 how many free allowances they will get each year until 2020. The only exception is if they close down or significantly reduce capacity, or if they increase capacity. For those cases, modification of the number of free allowances is envisaged, also in line with pre-determined but yet to be fixed rules.

There are several reasons why the EU opted for allocating the allowances for free based on historical data (so called ex-ante allocation), instead of basing it on actual production figures (ex-post allocations). The main reason is to minimize distortions in the decision making of companies, beyond the evident aim of providing incentives to reduce CO2 emissions. If a company were to receive more free allowances the more it produced, we would *de facto* subsidize some carbon intensive production over other competing products which are less carbon intensive.

It could be argued that subsidizing production and encouraging maximum production is the aim of the free allowances. To some extent it is, but it is important not to provide more support than necessary, which would be the case if more allowances were allocated as more was produced. It can also be noted that since the start of the EU ETS, free allowances are set ex-ante, in the form of fixed amounts per year for the entire trading period, based on historical emissions but without a link to actual production figures. This method is considered to have performed well in avoiding carbon leakage and competitiveness problems even at times when EU allowances were at the level of 30 Euro (40 US\$) per ton.

Providing free allowances based on actual production would also lead to major administrative complexities. In the EU ETS, facilities have to surrender allowances by the end of April to achieve compliance for the preceding year. However, to collect production figures, verify them, calculate the amount of free allowances per facility and then to distribute them would by necessity take much more time than the four months available. The compliance schedule would be much delayed with the risk that compliance in one year would not be finalized the year after. Linked to this, there would also likely be legal challenges on a recurring basis, instead of only at the start of the trading period, since all allocations will be revised every year.

A further disadvantage for industry is that an individual facility would not know how many free allowances it would receive for a given year until several months after the compliance year, since the amount of free allowances per unit of production would depend on how much other facilities covered by the ETS have produced. This uncertainty may in fact substantially detract from the intended effect of supporting facilities to maintain production within the EU.

Using historical production figures for providing free allowances will also significantly reduce the confidentiality problems with an approach based on actual production. Since the benchmarks (free allowances per production unit) will be known, and the number of free allowances per facility will also be public, it would be easy to calculate the production figures of the previous year. Using historical production figures for the allocation will be much less sensitive since e.g. production data from 2005/2007 will not be very sensitive if disclosed in 2013 or later.

*Sectors exposed to carbon leakage*

The EU ETS Directive defines carbon leakage as the extent to which it is possible for a sector to pass on the costs resulting from the EU ETS into product prices without loss of market share to less carbon efficient facilities outside the EU. There is thus an economic and an environmental dimension to carbon leakage.

If a sector is deemed to be exposed to risk of carbon leakage, the sector will have its benchmark multiplied by 100% when calculating the amount of free allowances to a facility in the sector. For other sectors the benchmark will be multiplied with a discount factor that will start at 80% and decline annually to reach 30% in 2020.

The sectors are in principle assessed at the European four-digit industry code level (NACE4 – equivalent to the US six-digit NAICS codes), but an analysis at a higher disaggregation might be accepted for some sub-sectors.

The list of sectors that will be eligible for 100% of the benchmark depends mainly on CO<sub>2</sub> intensity, electricity intensity and trade intensity of the sectors concerned. A sector is in principle exposed:

- if the cost impact of the EU ETS (buying needed allowances plus higher electricity prices) exceeds 5% of gross value added, and trade exposure<sup>4</sup> exceeds 10%,
- or if either of these two parameters exceeds 30%.

The regulatory decisions on the thresholds were informed by input from various independent studies, reports made for and by governments, and other relevant sources. A general explanation for the final thresholds is the following:

- The "cost increase" threshold (5%) was decided to be reasonable in relation to the average profitability of EU industry
- the "trade intensity" threshold (10%) was inspired by a method used in competition law to determine the geographical size of the markets

---

<sup>4</sup> Defined as  $(\text{imports} + \text{exports} / \text{production} + \text{imports})$ .

- the "cost only increase" threshold (30%) and the "trade only intensity" threshold (30%) reflect cases where either a particularly high additional cost could lead to a rapid change in trade patterns if not taken into account, or where a very high trade openness rendered the EU industry very vulnerable to foreign competition.

The environmental dimension ("carbon efficiency in the EU vs. the rest of the world") is currently under examination, but it is clear that it is more difficult to quantify and therefore more difficult to take into account when determining the list of sectors.

The list of exposed sectors will be formally determined in December 2009, but the first results of the economic analysis, made on data from 2005 and 2006, were recently made public on the Commission's carbon leakage website<sup>5</sup>. After the list has been finalized, it will be updated every five years based on most recent data. Sectors may also be added to the list before the five-year review in the case of data changes.

The total amount of allowances available for industry to receive for free is limited in advance. This amount, as well as the total EU ETS cap, will be reduced annually by 1.74 % to ensure compliance with the EU's -20% target. If there is a successful international agreement, and the EU then takes on a more stringent target, the total EU ETS cap, and the amount available for free to industry, will also be reduced year by year. In addition, the entire system of free allowances, including criteria to determine sectors exposed to carbon leakage, may also be reviewed following Copenhagen.

In summary, the EU has for the period 2013 to 2020 and beyond opted for a system with no free allowances for the power sector (with some small potential exceptions), a quickly reducing amount of free allowances for non-exposed sectors, and a slower reduction of free allowances for the trade-exposed sectors. What will happen beyond 2020 is not decided, but the Directive outlines that the aim is to abolish free allowances for non-exposed sectors in 2027.

#### *Border measures*

---

<sup>5</sup> [http://ec.europa.eu/environment/climat/emission/carbon\\_en.htm](http://ec.europa.eu/environment/climat/emission/carbon_en.htm)

Border measures, in the form of a CO<sub>2</sub> tax or obligation for importers to purchase carbon allowances to compensate for CO<sub>2</sub> emissions in imported products, have sometimes been put forward as a means to address competitiveness problems.

However, the EU has decided not to introduce border measures, for several reasons. Firstly, it is extremely difficult to set the correct border measure, since the emissions factor for each imported product would need to be known. Secondly most industry sectors covered by the EU ETS oppose border measures for fear of retaliation and since they often import intermediate products which would in turn become more expensive. Most manufacturing industry also opposes border measures, suggesting for example that the price of steel would increase within the EU, harming the competitiveness of, for example, car producers. For all these reasons the EU has not introduced border measures.

Nevertheless, the EU ETS Directive states that the Commission should analyze the outcome of the international climate change negotiations and if appropriate propose modifications to the Directive. This may include the inclusion of importers, but it is unlikely that the EU's position would change, unless the international agreement would considerably modify the current competitive situation for European companies covered by the EU ETS.

#### *Summary on allocation*

In summary, the allocation of allowances in the EU ETS differs clearly in the three trading periods.

- Phase 1 (2005-2007) started with a moderate cap and allocation was to a large extent for free and made based on stated needs to manufacturing industry. Due to lack of data, industrial facilities in many cases received too many free allowances. The power sector was in general subject to a tighter allocation, but due to its ability to pass on full costs, including the opportunity costs of allowances that were received for free, there were significant "*windfall profits*" to the power sector.
- In the current Phase 2 (2008-2012) the cap is much firmer, and allocations to industry were made at a much more realistic level, ensuring a need to reduce emissions (even though the current recession has temporarily rendered the

cap less strict). For legal reasons, the power sector still gets part of its allowances for free, while some Member States have introduced taxation to recuperate at least part of the windfall profits.

- For Phase 3 (2013-2020) – on which most of the text of this statement is focused - the EU has reversed the societal burden of proof. The power sector, and all other power generation, will get no free allowances. Industry will have to buy a substantial share of its allowances through auctioning. Sectors that are considered to be significantly exposed to carbon leakage and can provide this proof to society on the basis of objective and transparent criteria and data will get a higher share of free allowances than other industries. However, all industries will face strict benchmarks, ensuring that only the most efficient facilities will get most of the required allowances for free.

### **Preparing for phase 3 auctions**

The new legislation stipulates that all allowances not allocated for free will be auctioned, so from 2013 more than 50% of the total cap will be auctioned. This constitutes a major change since the current level of auctioning is only less than 4%.

The share of each Member State in the total quantity to be auctioned is largely based on historical emissions in the trading system. However, 10% of the quantity is distributed on the basis of GDP per capita and another 2% is distributed among nine Member States that in 2005 had emissions reductions well below their requirements pursuant to the Kyoto Protocol. This basically implies that there will be a redistribution of 12% of the auctioning revenues from the richer to the poorer (new) Member States.

The Member States will dispose of the auctioning revenues and it is for Member States to decide on the use. The legislation stipulates, however, that 50% of the revenues should be used to fight and adapt to climate change mainly within the EU, but also in developing countries.

The legislation provides for a procedural responsibility for Member States to auction their allowances, but also requires adequate harmonization and does not exclude the



possibility for Member States to use a common auctioning process and/or involve a central auctioneer to carry out the auctions on their behalf.

Designing and implementing auctions presents a technical challenge due to the limited practical experience with auctioning in operational emissions markets. However, governments conduct auctions of other economic assets with considerable value on a regular basis (e.g. government or treasury bonds, spectrum licenses) and these offer rich experience and institutional arrangements to draw from. Moreover, there is already a well-developed secondary market for allowances which gives a clear carbon price signal, thereby greatly facilitating the organization of competitive auctions. In this context it will be important to ensure that the auctions are conducted in a way that will support and strengthen the functioning of the secondary market.

The European Commission is given the task to adopt by June 2010 further legislation to ensure that auctions are conducted in an open, transparent, harmonized and non-discriminatory manner. The auctioning process should be predictable, particularly regarding the timing and sequencing of auctions and the estimated volumes of carbon allowances to be made available. An open consultation of stakeholders on all relevant aspects is planned for later this year.

### **Conclusions**

The EU ETS is now in its fifth year of operation, and has proven that a cap and trade system for greenhouse gases functions. It has created a European carbon market and it provides a fixed cap of emissions, together with an economic incentive to reduce emissions. The cap has been set for many years ahead, ensuring both regulatory stability for the carbon market and that emissions are being reduced annually until 2020 and beyond.

The EU ETS directive has already put in place all the measures needed in case the EU will decide to tighten the cap following an international climate change agreement.

The considerable share of carbon allowances auctioned in phase 3 will generate tens of billions of Euro in income for Member States. These funds can and should be used

in part for climate change mitigation and adaptation. The auctions will be conducted in an open and transparent manner to ensure no distortion of the carbon market.

The costs for involved companies are contained by allowing for the use of Clean Development Mechanism (CDM) credits (a form of UN-based international offsets). Over time, the CDM should increasingly be superseded with a sectoral crediting mechanism, as major developing countries transition to cap and trade. The incentive for abatement action in developing countries could be strengthened considerably if other developed nations pursued a similar approach as regards the recognition of international offsets / credits in their respective cap-and trade legislation.

===

**Senate Finance Committee**  
**“Auctioning Under Cap and Trade: Design, Participation and Distribution of Revenues”**  
**May 7, 2009**  
**Questions for Jos Delbeke**

**Questions from Senator Baucus D-MT**

1. Mr. Delbeke, your testimony states that for Phase 3 of the EU’s cap-and-trade program, sectors that are considered to be significantly exposed to carbon leakage on the basis of objective and transparent criteria and data will get a higher share of free allowances than other industries.

Can you please walk us through the process of how the EU has garnered such objective and transparent criteria with regard to these vulnerable industries? What has the EU learned with regard to competitiveness concerns through the free allocation process?

*In the first two phases we had quite generous provisions for free allowances. Following the experience gained, we have decided to be much more restrictive in providing free allowances.*

*For Phase 3 (2013-2020) the power sector, and all other power generation, will get no free allowances except for a conditional derogation possibility that new Member States can invoke for plants built before 2008. Industry will also have to buy a substantial share of needed allowances through auctioning. Sectors that are considered to be significantly exposed to carbon leakage on the basis of objective and transparent criteria and data will get a higher share of free allowances than other industries.*

*As I mentioned in my written submission the criteria were selected by input from various independent studies, reports made for and by governments, and other relevant sources. More in detail, the explanation for the final thresholds is the following:*

*The “cost increase” threshold (5%) was decided to be reasonable in relation to the average profitability of EU industry; the “trade intensity” threshold (10%) was inspired by a method used in competition law to determine the geographical size of the markets; the “cost only increase” threshold (30%) and the “trade only intensity” threshold (30%) reflect cases where either a particularly high additional cost could lead to a rapid change in trade patterns if not taken into account, or where a very high trade openness rendered the EU industry very vulnerable to foreign competition.*

*The work on assessment of the energy intensive industries has increased the Commission’s knowledge of how these industries operate in the international context and the impacts of the emissions trading system etc.*

2. Mr. Delbeke, some cap-and-trade bills allocate free emission allowances to industry. Advocates argue that free allowances will ease the transition for industry as we move to an economy with a price on carbon. Critics argue that free allocations would provide windfalls to these companies, without restraining energy prices.

If free allowances are provided, how can we guard against providing windfalls to companies?

*In our view the only guard against that is to only provide free allowances to companies that really need them since they are exposed to competitive pressure from companies in other countries not covered by equal systems. For example, in the EU we decided that as from 2013, as a general rule, no free allowances should be provided for electricity production, since we observed that power companies could indeed pass on costs despite the fact that they received allowances for free, thus generating windfall profits. The power installations face little competitive pressure from countries outside the EU without similar systems.*

*For industrial installations we have analyzed to which extent they can be deemed to be exposed to carbon leakage. Those sectors exposed to such a risk will get a higher share of free allowances than other industries.*

3. The climate change debate in the United States is complicated by the fact that different regions of our country rely on different energy sources and are engaged in international trade to differing degrees. Just as our U.S. states have different economic circumstances, so do the Member States of the European Union.

Mr. Delbeke, in what ways does the European Trading System reflect the differing economic realities among the EU Member States? What was the political process for achieving a system that was acceptable to all Member States?

*Indeed there are large differences in the level of economic development and in the structure of the economies of the EU Member States.*

*To account for them the climate and energy package contains an element of transfer of resources from the richer to the poorer Member States. Around 12% of the auctioning revenues are thus transferred this way by means of assigning proportionally more allowances for auctioning to poorer Member States.*

*Finally, as a transitional measure, the law provides that some new Member States can provide a certain amount of its free allowances to their national power sectors for a limited period of time. It is not yet clear how many Member States will use this option, however.*

4. Mr. Delbeke, the EU has chosen to use allocation of free carbon allowances to address cost and trade sensitivity concerns among EU industries.

Did the EU consider imposing a price cap or "safety valve" to control costs? Did it consider using border taxes or fees on products from countries that do not have cap and trade programs? Why were these approaches ultimately not adopted by the EU?

*As a general principle the Commission is opposed to active price control and discretionary intervention by public authorities to correct market outcomes.*

*It should be noted that the EU also allows the use of a limited quantity of international offsets or credits for compliance, which has an important role in containing costs.*

*The outcome of a thorough political discussion was a decision to introduce a mechanism which will kick in only in the case of extreme price fluctuations, and then allow for certain planned auctions to be brought forward or auctioning of some of the allowances set aside for new entrants to increase the short-term supply of allowances on the market. Border measures were discussed at a certain time, but this idea was discarded for the*

*time being for the reasons I outlined in my written submission (lack of interest from most Member States, fear of retaliation, lack of interest and fear of cost increases from manufacturing industries, and potential WTO problems).*

5. Mr. Delbeke, what features of a U.S. cap and trade regime would make it more likely that our carbon market could link to the EU market for carbon allowances?

*Public opinion in the EU on the robustness of a US cap and trade system is likely to be driven by three main considerations: the cap, which needs to be sufficiently strict; the domestic and international offset recognition rules, whether these are sufficiently robust; and the absence of price control mechanisms. To allow linking, our systems need to be compatible but not identical. While an overall convergence is desirable, certain technical features can be different in the two systems, at least in the interim without preventing linking.*

6. Some cap-and-trade proposals allocate free emission allowances to industry. Advocates argue that free allowances will ease the transition for industry as we move to an economy with a price on carbon. Critics argue that free allocations would provide windfalls to these companies, without restraining energy prices. If free allowances are provided, how can we guard against providing windfalls to companies?

*Reply: Same question as question 2.*

#### **Questions from Senator Grassley R-IA**

1. In light of the dead-weight loss from cap and trade, is it possible to implement a cap and trade system that distributes revenues in a way to “make the public whole”? Please explain your answer.

*In essence this is an issue of debate among economists. However, it is evident that revenues accrued from auctioning can be redistributed in the form of lower income taxes, support to environmental investments etc.*

2. What is your view and the consensus economist view on whether a carbon tax would reduce carbon emissions?

*A carbon tax may also contribute to reducing emissions, but after a policy debate that lasted almost a decade the EU decided to opt for cap and trade system. A major advantage of a cap and trade system is that the environmental outcome is known in advance. Given the importance of having a clear track of reducing greenhouse gases, and the link to international commitments to reduce emissions, this is a very important aspect.*

3. Senator Kerry mentioned that a difference between cap and trade and a carbon tax is that cap and trade creates an asset and that helps drive the economy. Can you comment on his statement that cap and trade produces an asset and that helps drive the economy? Does a cap and trade system add wealth to the economy? Does Senator Kerry’s assertion that cap and trade creates an “asset” really a difference from a carbon tax in terms of its ultimate effect on the economy?

*A cap and trade system indeed creates an asset that can be traded. It thereby puts a price on a scarce resource which otherwise would have no price, and thus would be over-exploited, as we have seen. A tax may accomplish similar environmental effects, but the environmental outcome is not known in advance, and a tax will not be able to create a dynamic market with e.g. offsetting. As the asset can be traded, companies can sell allowances and generate extra income to reward emissions reductions. This provides a greater incentive for innovation and a strong impetus towards a low carbon economy. For all these reasons one can assume that a cap and trade system delivers the environmental objective in a cost-effective manner.*

4. Dr. Krueger said during the hearing that cap and trade is easier to integrate with rest of world. Do you agree with Dr. Krueger's assertion? Please comment on the merits of a carbon tax in a multi-country context?

*I definitely agree with Dr Krueger as regards the ease of integration with the rest of the world. I think that a carbon tax is challenging to agree upon in a national context but undoubtedly even more challenging in an international context.*

5. In your testimony, you explained the reasons why the EU chose not to include a border measure as part of your cap and trade system.

But as you know, there are many proponents for including such a measure in a U.S. system.

How would the EU react if the United States enacted a cap and trade system that included a border measure?

*At this stage we cannot speculate on the EU reaction, given that we still do not know many details of the US cap and trade system, of any possible border measures and their context. However, the EU will follow closely developments regarding the US cap and trade system and its trade aspects. But it is the EU's firm view that international climate negotiations are the first best option to avoid distortive trade effects.*

6. I'm concerned about the impact on U.S. manufacturers if we enact a cap and trade system without an international agreement that includes the advanced developing countries, such as China and India.

You explained in your testimony that the EU is addressing this concern by issuing free emission allowances to trade-exposed sectors.

You also said the EU might revisit its approach if an international agreement considerably modified the current competitive situation for EU companies covered by the EU cap and trade system.

Are you suggesting that an international agreement could adversely affect the competitive situation for EU industry? If so, how?

Or are you suggesting that such an agreement could improve the competitive situation for EU industry, and thereby permit the EU to allot fewer free allowances to trade-exposed sectors?

*An international agreement at the UN Copenhagen climate conference in December this year could change the status quo with the establishment of a more level playing field*

*signed up to by all parties, reducing the risk of carbon leakage for EU sectors covered by our cap and trade systems. As set out in the EU cap and trade legislation, we will take account of the outcome of the international climate agreement, and this could lead to revision of our legislation.*

7. Has the European Commission done any analysis of the WTO compatibility of various types of border measures?

*Some preliminary analysis was undertaken on the relation between potential border measures and WTO rules in the context of the impact assessment made for the revision of the EU ETS legislation in 2008. As the EU did not pursue the option of border measures, we did not develop a specific border measure design. Therefore, our analysis of potential WTO aspects was done only in abstract with many unknown variables. This did not provide conclusive results, as WTO compatibility is determined by the actual, detailed design of the measures.*

For example, does the Commission believe a CO<sub>2</sub> tax would be WTO consistent?

*In theory, it could be possible to design a CO<sub>2</sub> tax that is WTO consistent provided that the measure provides no less favorable treatment for imported and domestic products. However, since such a tax was rejected on policy grounds in the EU in the 1990s the Commission has not seriously reflected on it in its recent consideration. In any event, WTO consistency depends on the specific design of the tax and cannot be verified in abstract. Significant questions of feasibility also arise.*

How about an obligation for importers to purchase carbon allowances to compensate for CO<sub>2</sub> emissions in imported products?

*Similarly, in theory, measures based on this approach can also be made WTO compliant as long as the measure provides no less favorable treatment for imported and domestic products. The WTO consistency depends on the specific design of the measure and cannot be verified in abstract. Significant questions of feasibility also arise.*

Does the Commission believe one approach is more WTO-compatible than the other? And if so, why?

*As said above, the Commission did not undertake a detailed examination of different possibilities in terms of WTO compatibility, given that neither was taken forward in the EU. In any event WTO compliance is determined by many practicalities and specificities of the specific measure, and, therefore, we cannot decide in abstract whether one broad approach is more WTO compatible than the other.*

8. In your testimony, you explained the reasons why the EU avoided basing the allocation of allowances on actual production figures (ex-post allocations).

You did not mention any concerns about adherence to trade obligations.

*There is a long list of reasons why ex ante allocations are preferable to ex-post allocations. I mentioned these in my testimony e.g. ex-ante allocation minimizes distortions in the decision making of companies; avoids subsidizing carbon intensive production over other competing products which are less carbon intensive; avoids major administrative complexities – i.e. every year collecting production figures, verify them,*

*calculate the amount of free allowances per facility and then to distribute them; reduces the confidentiality problems related to disclosure of actual production data).*

*Adherence to trade obligations were not one of the issues considered here.*

Was the EU concerned about the possibility that basing allocations on actual production figures might in some cases (depending on the nature of a particular product and the market for that product) result in the granting of *de facto* export subsidies?

*We do not think that basing free allocations on actual production figures could result in granting de facto export subsidies in WTO terms.*

9. Do you believe the provision of free emissions allowances to manufacturers would constitute the provision of subsidies within the meaning of the WTO Agreement on Subsidies and Countervailing Measures?

If so, the EU presumably must believe they are WTO-compatible subsidies.

Is the EU's belief premised on a lack of specificity, on a lack of adverse effects, or on some other rationale?

*We refrain from taking a view on whether free allocations would constitute the provision of subsidies or not under WTO law. Were they to qualify as subsidies we consider them as WTO compliant.*

10. In the conclusion of your testimony, you referenced superseding the Clean Development Mechanism (CDM) with a sectoral crediting mechanism.

Would you elaborate further on this issue?

*To stabilize and reduce global greenhouse gas emissions, developing countries, especially emerging economies and advanced sectors, will need to make increasing contributions to global mitigation efforts. (see response to question from Senator Stabenow for more details)*

*Over time, domestic cap and trade is the way for advanced developing countries to spur efficient action, especially for advanced sectors in their countries. We would like to see this happen by 2020. However, most developing countries do not have the capacity to implement cap and trade systems now. The EU is looking to help interested developing countries (governments and stakeholders) gain experience in emissions trading, in particular to set up sound governance structures and strong domestic institutions and to boost their capacity to monitor and report emissions. We need mechanisms that provide incentives now for increased action in developing countries, which at the same time provide a stepping stone to cap and trade in these countries.*

*The Clean Development Mechanism (CDM) is currently designed as a project-based offset mechanism in which developing countries can sell credits that represent emission reductions achieved by a specific project for compliance by or in developed countries. It has helped developing countries to participate in the carbon market, provided financing for clean technology, whilst helping building capacity for climate policies in developing countries. However, as a project based system, its' scope is not sufficiently broad covering a limited number projects, not sectors, unevenly distributed across countries. As an offsetting approach, it helps developed countries comply with their emissions*



*reductions targets. It does not lead to extra emissions reductions above commitments from developed countries; these extra reductions are increasingly necessary to help shift developing country emissions below their business as usual path.*

*A broader sectoral approach is needed, which leads to emissions reductions significantly below business as usual. For advanced developing countries and highly competitive economic sectors, the project based CDM should be phased out in favor of moving to a sectoral carbon market crediting mechanism. The CDM should continue to be available for less developed countries and be reformed in the UNFCCC context, crediting only those projects that deliver real additional reductions and go beyond low cost options.*

*Different designs are on the table such as no-lose crediting where countries are rewarded with credits for emissions reductions beyond an ambitious baseline (set below business as usual) and sectoral trading with a cap. The structure of a sectoral approach is being fleshed out in the ongoing UN negotiations. This is an area where EU-US cooperation can yield important mutual gains. In addition, to ensure a coherent transition, the EU, USA and other countries implementing cap-and-trade systems and generating demand for offset credits should seek common ground to ensure that demand is created in a coordinated manner.*

#### **Questions from Senator Conrad D-ND**

There is ongoing debate among economists, policy analysts, and members of Congress over the most appropriate approach to addressing the challenge of climate change. The choice of a policy to reduce greenhouse gas emissions will have significant effects on the economy and employment, effects that will be especially pronounced in certain states and sectors of the economy. As the testimony given at this hearing has indicated, the details of design of a given policy will shape the outcome of that policy considerably, but my questions focus on a more fundamental level.

1. Between a carbon tax and a cap-and-trade system, what is the most efficient way to reduce greenhouse gas emissions?

*Economists may debate this, but what is clear is that a cap and trade system can provide a specific environmental outcome at least macroeconomic cost. A tax could also encourage cost efficient abatement, but the environmental outcome is not possible to know in advance, since perfect information on all abatement possibilities cannot be known in advance.*

2. Between a carbon tax and a cap-and-trade system, what is the best method to reduce greenhouse gas emissions from the perspective of producing higher job levels and economic growth?

*Again, this is something that economists may debate. We are convinced that the cap and trade system chosen in the EU will lead to a least cost solution, and also drive the economy to a low carbon state. This will minimize negative effects on the traditional economy, and will provide a major stimulus to the new low carbon sectors of the economy. Innovation is good for competitiveness, economic growth and jobs.*

### Questions from Senator Bingaman D-NM

1. One critical consideration in the design of a cap-and-trade system is how best to protect consumers from undue hardship related to increased costs. Do any of the members of the EU have plans in place to return some, or all, of the auction revenue to consumers? If not, was it considered, and what are the anticipated costs to consumers from the next phases of the ETS?

*In principle, no money is intended to be returned to consumers in a direct way. But major income will accrue to the Member States, and thus to taxpayers. The Member States can use the revenues to reduce taxes, provide subsidies for environmental investments etc. Most of this will ultimately benefit consumers.*

2. After meeting with you in Europe recently, we heard an idea that seemed far simpler than establishing benchmarks for every energy-intensive industry in order to grant them allowances – to provide an investment subsidy to sectors that are subject to carbon leakage so that they could upgrade existing or new facilities. The EU opted for free allowances over this option. Was this something that you considered?

*The EU did not really consider this option. Investment subsidies may not be that simple either, if each investment has to be assessed before any allowances are provided. Furthermore, it is not sure that this will be sufficient for industries that are significantly exposed to international competition.*

3. Europe began with free allocations to the power sector and is transitioning to a 100% auction there to avoid windfall profits. To the extent that the United States implements a similar transition from free allocations to auctions, what advice do you have?

*Given what we have observed, we would not provide free allowances to the power sector, in particular not if they are operating in a deregulated power market.*

### Questions from Senator Stabenow D-MI

1. Dr. Delbeke, there has been lots of skepticism about the value of international offsets – allowing domestic emitters to meet their reduction targets by purchasing emission reduction allowances from other nations, which helps control the cost of allowances. The only real system in place for offsets like this is the Clean Development Mechanism (CDM). The CDM has received lots of criticism. It has been difficult to verify the integrity of the emissions they reduce. But isn't it true that many of the initial challenges to the CDM are being overcome? Could you talk a bit about how the CDM has improved and how the European emissions trading system has benefited from international offsets – not just to make real and significant emissions cuts in developing countries and to control the price of carbon allowances, but also to spur innovation and investment at home, by nature of a robust carbon market and clear price signals?

*The CDM and Joint Implementation (JI) both allow developed countries to meet part of their commitments more cost effectively by investing in projects that reduce emissions in other countries. The CDM engages developing countries, and has played an important role in encouraging these countries to participate in carbon markets through projects that*

*lead to emissions reductions. This has allowed projects to go ahead that demonstrate the viability of clean technologies in host countries, promoting technology transfer. It has helped build awareness of the potential of carbon markets in developing countries as well as some capacity for engaging in these markets and was successful in leveraging finance for low cost abatement in developing countries.*

*Allowing CDM credits into the EU ETS (up to a ceiling) has also allowed the EU to contain compliance costs- the CDM and EU ETS allowance price are clearly closely related. I would not say however that CDM use itself has led to innovation and investment in the EU.*

*The EU ETS is one of the main markets for CDM credits. That is why we have a particular interest in reforming the CDM to achieve higher climate benefits and improve its governance structure. Indeed, the CDM and its governance structure have already been improved considerably. For example, rules have now been adopted by the CDM Executive Board that give further guidance when it comes to validation and verification of CDM project proposals. In addition, accreditation standards for those companies that verify and validate CDM proposals have been adopted. Furthermore, at its last meeting the CDM Executive Board enhanced transparency in the regulatory process, by adopting a classification framework to add clarity and improve access to Board decisions, as requested by stakeholders and Parties. Also, building on the oath taken by Board members and alternate members when they join the Board, the Board adopted a code of conduct to further describe its approach in implementing the mechanism. Thus, first but considerable steps have been taken to enhance the governance of the CDM and thus eventually also its environmental quality.*

*The CDM, however, needs to be further improved in particular with relation to achieving real and additional climate benefits. That is why the Commission is advocating a more objective approach when assessing the additionality of emission reductions, for example, through the mandatory use of benchmarks for baseline setting (e.g. based on top performing installations or processes taking into account national circumstances) for specific project types in the CDM.*

*However, whilst procedures for approving projects under the CDM are improving, as a project-based system, the CDM will continue to present structural limitations. Whilst we have to give credit to the CDM for extending the price signal from developed country ETS (in particular the EU ETS) to developing countries, the price signal is still far too patchy, with the CDM focused on individual projects. A project based approach involves more administration - we need a system with lower transaction costs. It is also clear that a greater level of environmental ambition is needed, moving from offsetting against a business as usual baseline to crediting against a much more ambition benchmark. These are some of the reasons why the EU is calling for a shift to a new sectoral crediting for advanced developing countries and highly competitive economic sectors; the CDM should continue to be available for less developed countries.*

2. Also, does the European Community feel that international offsets or CDM credits should only come from nations who are committing to reducing emissions in industrial sectors or nationally?

*The EU is looking for a comprehensive global agreement in Copenhagen, with broad participation. Both our proposals for international action and our domestic climate policies are designed so as to encourage ambitious action by other countries.*

*Developing countries, and especially emerging economies and advanced sectors, need to be stepping up their contributions to reducing global greenhouse gas emissions. To avoid average global temperatures rising by more than 2 degrees Celsius above pre-industrial levels, science tells us that in addition to the 25-40% reduction effort by developed countries, developing countries as a group need to reduce the growth in their emissions so that emissions are 15-30% below business as usual levels by 2020.*

*The European Commission aims to develop a new sectoral crediting mechanism which is better adapted to the challenges we face going forward, particularly:*

- *To encourage and support emerging economies and advanced sectors in making a greater contribution to global mitigation efforts, through reductions significantly below business as usual*
- *To scale up the flow of finance by moving from a limited and unevenly distributed project based approach to a broader sectoral approach with lower transaction costs*
- *To help developing countries transition over time to more efficient policies for achieving domestic emissions goals- specifically cap and trade. We believe that advanced developing countries or competitive sectors in these countries should start introducing cap and trade by 2020*

*The EU is looking to help interested developing countries (governments and stakeholders) gain experience in emissions trading, in particular to set up sound governance structures and strong domestic institutions and to boost their capacity to monitor and report emissions. A sectoral market crediting mechanism would be a stepping stone.*

*Our proposals for a post-2012 agreement and sectoral crediting mechanism would involve emerging economies deciding to limit emissions from sectors within their country in order to benefit from approaches such as no-lose targets and to sell credits into the EU ETS for example.*

*As mentioned in answer to the previous question, for advanced developing countries and highly competitive economic sectors, the project based CDM should be phased out in favour of a sectoral crediting mechanism. Under such a mechanism, countries would receive credits which can be sold on carbon markets for emissions reductions below a baseline, set significantly below business as usual.*

*The CDM should continue to be available for less developed countries.*

*It should also be noted that under our proposals for a Copenhagen agreement, we ask developing countries to commit the development of low carbon development strategies*

*that set out a credible pathway to limit the country's emissions through nationally appropriate mitigation actions that cover all key emitting sectors, especially the power sector, transport, major energy-intensive industries and, where significant, forests and agriculture, as well as support needed.*

*In addition, the revised EU ETS legislation includes provisions that encourage countries outside the EU to sign up to the international agreement; for example from 2013 onwards, only credits from other countries that have ratified the agreement will be accepted into the EUETS, or, if there is no agreement, from countries that have reached bilateral agreements on GHG emission reductions with the EU. The EU legislation also allows for restrictions on credits allowed into the EU ETS based on qualitative criteria.*

3. Dr. Delbeke, one of the big obstacles of implementing Cap and Trade legislation is ensuring that industries and jobs in the United States do not move to countries with lower emissions standards. If the EU does determine that carbon-intensive industries are moving from the EU what mechanisms are in place to adjust allocations? Have you considered a border tariff on imports that come from nations without a similar carbon policy? Can you explain the type of debate you have witnessed on this issue?

*Border measures were discussed at a certain time, but were discarded as part of the policy package on the 20% greenhouse gas reduction by 2020, for the reasons I outlined in my written submission (lack of interest from most Member States, fear of retaliation, lack of interest and fear of cost increases from manufacturing industries, and potential WTO problems). Still, some in the EU may still consider border measures as an option. Once an international agreement is in place, the Commission will re-assess the situation for energy intensive industries and may propose any appropriate measure related to this.*

4. Dr. Delbeke, all eyes are looking to Copenhagen in December as a critical step towards a low-carbon world. During Copenhagen a considerable amount of attention will be placed on the developing countries including China. It is extremely important to ensure they remain committed to climate change cooperation. The EU and China have committed to a strong road map that would reduce carbon emissions. How is each country ensuring the other country is sticking to that roadmap?
5. Also, can you tell us a little more about the European position towards major developing countries and the sorts of commitments they should be making. Can we enforce these sorts of agreements in the future?

*Reply to 4 and 5: Both the EU and China are implementing domestic legislation or plans to address climate change. The EU has legislation in place since December 2008, which will allow us to meet our target of reducing greenhouse gas emissions by 20% relative to 1990 by 2020. China has a commitment to reduce energy intensity by 20% under the 11th Five-Year plan (2006-10) and to increase renewable energy use. The EU and China also work together on a political and technical level to ensure progress in addressing climate change; the EU-China Partnership on Climate Change launched in 2005, provides a high-level political framework to strengthen the cooperation between EU and China, with detailed actions set out in a rolling work Plan.*

*The European Community as a signatory to Kyoto has a binding economy-wide target for absolute emissions reductions and reports on progress towards meeting its commitments*

*annually, submitting a greenhouse gas inventory which follows established guidance and is reviewed by experts. Such commitments should continue under a post-2012 agreement. China, like other emerging economies, does not have absolute emissions reduction commitments, although China and a number of other developing countries have formulated national mitigation plans.*

*It is clear that to keep global warming within 2 degrees Celsius of pre-industrial levels, which is the EU's goal, developing countries, as a group, will need to limit the rise in their GHG emissions to 15-30% below baseline by 2020.*

*The EU is looking for all developing countries, except the least developed, to adopt low carbon development strategies, and to commit under a post-2012 agreement to doing so by the end of 2011. These low carbon development strategies would set out a credible pathway to limit the country's emissions through nationally appropriate mitigation actions that cover all key emitting sectors, especially the power sector, transport, major energy-intensive industries and, where significant, forests and agriculture. The strategies would also identify the support required to implement the proposed actions resulting in incremental costs that cannot be sustained by the country itself. Robust and verifiable low-carbon development strategies should then be a prerequisite for access to international support for mitigation action.*

*Independent technical analyses would assess whether there is a sufficient level of ambition, looking both at proposals for action and support. In addition, a Facilitative Mechanism for Mitigation Support would provide a platform to match proposed action with appropriate bilateral and multilateral support mechanisms, based on a technical assessment. It should also assess whether the overall level of ambition pursued in the plan is in line with the capacity of the country to take action and appropriate for achieving the overall emission reduction compared to baseline of the group of developing countries.*

*In addition, developing country action should be recorded in an international registry, using transparent and robust measurement, reporting and verification methods.*

*The UN conference will then review the mitigation efforts of the group of developing countries as a whole and could decide to request developing countries to strengthen their mitigation efforts and/or developed countries to increase their support.*

#### **Question from Senator Nelson D- FL**

1. You testimony discusses the EU's phased in approach to auctioning. How do you see covered industries preparing for the transition from a 4% auction level to 50%?

*The main reason for this sharp increase is due to the fact that, as a general rule, the electricity production no longer will receive any free allowances. The power sector will not have any problems to adapt to this, as they have enjoyed additional profits during the years when they received free allowances and increased the power prices. For industrial*

*sectors there is a considerable phase in period foreseen, which we think will allow them to adapt.*

#### **Questions from Senator Enzi R-WY**

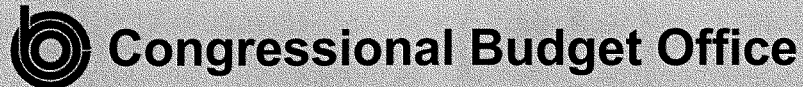
1. Dr. Elmendorf's testimony makes the statement that price increases would be essential to the success of a cap-and-trade program. Do you think it makes sense to increase prices on goods and services for Americans at a time when the economy is struggling?

*The first issue is whether the cost of action will be higher than the cost of non-action. Many convincing studies have highlighted that the cost of non action are very likely to be far higher than the cost of action. Studies also show that the more we delay the higher the cost.*

*The second issue is thus, given that it makes sense to take action, how do we do it at least cost to society. In our view, the EU ETS, like any well designed cap and trade system, is an instrument that will provide the necessary emission reductions at least cost.*

2. There is no question that implementing a climate change program will raise a tremendous amount of revenue, and many are setting their sights on the auction proceeds as a source of funding for their own proposals. Some have suggested that this go toward healthcare reform while others say that it should be returned to consumers. If the true goal of the program is to reduce greenhouse gas emissions to combat climate change as opposed to paying for unrelated federal priorities, wouldn't it make sense for all of the revenue to go towards the development of technology and efforts to clean up pollution?

*In the EU we have suggested that half of the income should be used for climate change and environmental purposes, both for domestic and international actions, but this is ultimately the choice for each Member State.*



## Testimony

Statement of  
Douglas W. Elmendorf  
Director

### The Distribution of Revenues from a Cap-and-Trade Program for CO<sub>2</sub> Emissions

before the  
Committee on Finance  
United States Senate

May 7, 2009

*This document is embargoed until it is delivered at 10:00 a.m. (EDT) on Thursday, May 7, 2009. The contents may not be published, transmitted, or otherwise communicated by any print, broadcast, or electronic media before that time.*

CONGRESSIONAL BUDGET OFFICE  
SECOND AND D STREETS, S.W.  
WASHINGTON, D.C. 20515



Chairman Baucus, Senator Grassley, and Members of the Committee, thank you for the invitation to testify on the distribution of revenues that could be generated by a cap-and-trade program for reducing U.S. emissions of carbon dioxide (CO<sub>2</sub>).

Global climate change poses one of the nation's most significant long-term policy challenges. Human activities are producing increasingly large quantities of greenhouse gases, especially CO<sub>2</sub>. A strong consensus has developed in the expert community that, if allowed to continue unabated, the accumulation of greenhouse gases in the atmosphere will have extensive, highly uncertain, but potentially serious and costly impacts on regional climates throughout the world. Those impacts are expected to include changes in the physical environment, changes in biological systems including agriculture, and changes in the viability of some economic sectors. Moreover, the risk of abrupt and even catastrophic changes in climate cannot be ruled out.

Those expected and possible harms can justify policy actions to reduce the extent of climate change. However, the potential cost of doing so may be significant because it would entail substantial reductions in global emissions over the coming decades. U.S. emissions currently account for roughly 20 percent of global emissions. As a result, substantially reducing global emissions would probably entail large reductions in U.S. emissions. Achieving such reductions would be likely to involve transforming the U.S. economy from one that runs on CO<sub>2</sub>-emitting fossil fuels to one that relies on nuclear and renewable fuels, improvements in energy efficiency, or the large-scale capture and storage of CO<sub>2</sub> emissions.

One option for reducing emissions in a cost-effective manner is to establish a carefully designed cap-and-trade program. Under such a program, the government would set gradually tightening limits on emissions, issue rights (or allowances) consistent with those limits, and then let firms trade the allowances among themselves. Such a cap-and-trade program would lead to higher prices for energy and energy-intensive goods, which would in turn provide incentives for households and businesses to use less energy and to develop energy sources that emit smaller amounts of CO<sub>2</sub>.

Higher relative prices for energy and energy-intensive goods would also shift income among households at different points in the income distribution and across industries and regions of the country. Policymakers could counteract those income shifts by authorizing the government to sell CO<sub>2</sub> emission allowances and using the revenues to compensate certain households or businesses, or by giving allowances away to certain households or businesses.

My testimony makes the following key points:

- Under a cap-and-trade program, consumers would ultimately bear most of the costs of emission reductions. Firms that used emission allowances for CO<sub>2</sub> would generally pass along to consumers the cost of using those allowances in the form of higher prices for their products—regardless of whether the government sold emission allowances or gave them away. Such 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.

- Higher prices for energy-intensive goods and services would lead to a variety of consequences for different industries, regions of the country, and income groups. Industries that produce energy or energy-intensive goods and services could experience a decrease in sales, with adverse consequences for shareholders and employees in those industries. The impact on different regions of the country would reflect the location of industries and the ability of local economies to adapt to changes in the mix of production that a cap-and-trade program might bring about. Furthermore, energy-intensive goods and services such as electricity, home heating, and transportation consume a larger fraction of the income of low-income households, so those households would bear a relatively larger direct burden from policies that reduced CO<sub>2</sub> emissions.
- Policymakers have a wide range of options for distributing the value of the allowances. If allowances are auctioned, the revenues could be used to fund climate-related research and development, reduce existing taxes on capital or labor, give rebates to low-income households, or provide assistance to workers or industries or regions that would be most affected. Alternatively, some or all of the allowances could be given away for free. Giving away allowances to particular firms is generally equivalent to auctioning the allowances and giving the auction proceeds to those same firms.
- Designing programs that protect certain industries, regions, or income groups would entail trade-offs. Reducing existing taxes, for example, could lessen the overall cost of a cap-and-trade program but would do little to offset the burden that higher prices would impose on certain industries or on low-income households. Instead, policymakers might use the revenues from allowance sales to provide support for low-income households—an approach that would lessen their burden but have somewhat higher economywide costs. Or, allowances could be given away to certain industries. Depending on the conditions imposed as part of such free distributions, that strategy might or might not blunt increases in certain prices or protect certain workers.
- If policymakers gave priority to protecting low-income households, a variety of policy instruments would probably be needed. Although a significant fraction of those households have earnings—and thus are likely to file tax returns—many do not. Some mechanisms already in place, such as cost-of-living adjustments for Social Security and other entitlement programs, would automatically compensate some households for part or all of the increased energy costs. Still, no program could address all the region- and household-specific circumstances that could affect families' costs.

The testimony I am presenting today is the product of various efforts by the Congressional Budget Office (CBO) to support the Congress in its consideration of policies related to climate change. Earlier this week, we released the report *Potential Impacts of Climate Change in the United States*, which presents an overview of the current understanding of the impacts of climate change on the United States, emphasizing the wide range of uncertainty about the magnitude and timing of those impacts and the implications of that uncertainty for the formulation of effective policy responses.

In earlier work that was more directly related to the specific topic of today's hearing, CBO evaluated the distributional issues that would arise if a cap-and-trade policy was put in place in *Who Gains and Who Pays Under Carbon-Allowance Trading?* (2000). Today's testimony updates that analysis and others along the way, and a more detailed report is forthcoming. In recent years, CBO has also considered a number of approaches to reducing the cost of controlling emissions, in, for example, a testimony, *Flexibility in the Timing of Emissions Reductions Under a Cap-and-Trade Program*, delivered to the House Ways and Means Committee in March of this year. Other CBO analyses of design issues include *Policy Options for Reducing CO<sub>2</sub> Emissions* (2008) and *Trade-Offs in Allocating Allowances for CO<sub>2</sub> Emissions* (2007). A complete listing of CBO's efforts in the climate change area and access to them can be found under the Climate Change tab under the Frequently Requested heading at [www.cbo.gov](http://www.cbo.gov).

My testimony focuses on a policy that would reduce CO<sub>2</sub> emissions by enacting a cap-and-trade program. A cap-and-trade program would set a limit on total emissions during some period and require regulated firms to hold rights, or allowances, to the emissions permitted under that cap. (Each allowance would entitle companies to emit one ton of CO<sub>2</sub> or to sell fuel that would release one ton of CO<sub>2</sub> when it was burned.) After the allowances for a given period were distributed, firms would be free to buy and sell the allowances among themselves. Firms that were able to reduce emissions most cheaply would profit from selling allowances to firms that had relatively high abatement costs (that is, relatively high costs of reducing emissions). The trading aspect of the program would lead to substantial cost savings relative to command-and-control approaches—which would mandate how much entities could emit or what technologies they should use—because it would provide more flexibility in where and how emission reductions necessary to meet any given target were achieved.

A cap-and-trade program has been implemented at the federal level in the United States to limit emissions of sulfur dioxide (which contribute to acid rain). That program has been in effect since 1995 and is widely judged to have reduced emissions at a significantly lower cost than would have been the case if lawmakers had chosen to rely on a command-and-control approach. A cap-and-trade program for CO<sub>2</sub> emissions is currently in effect in the Northeast region of the United States, and several states outside that region are considering following suit. The European Union has a cap-and-trade program for CO<sub>2</sub> emissions as part of its effort to comply with emission

limits under the initial phase of the Kyoto Protocol, which spans the period from 2008 to 2012.

### **The Risk of Damage from Climate Change**

Over the past century, researchers have developed an increasingly sophisticated understanding of the climate system through direct observations of the system, statistical analyses of those observations, and, more recently, simulations of the system using computer models. In spite of extensive uncertainties, both in the data and in the projections based on that data, researchers are increasingly confident about their ability to decipher the relationship between past activities and recent warming, to distinguish the effect of rising concentrations of greenhouse gases and changing land-use patterns from natural variability and other influences on climate, and to develop projections of the pace and ultimate magnitude and distribution of future warming and related changes.

The great majority of experts conclude that they cannot explain observed patterns of warming and related changes without considering emissions from human activities and that it is very likely that most of the warming is due to human activities. Those experts also conclude that ongoing emissions at current or rising levels will continue to raise atmospheric concentrations and temperatures indefinitely.

These changes are expected to result in many different kinds of impacts on widely differing scales that will develop over widely varying periods of time. The projected types of impacts include changes in seasonal weather patterns; the amount and type of precipitation; storms and sea level; regular climate fluctuations; ocean acidity; ecosystems and biodiversity; agriculture, forestry, and fishing; water supply and other infrastructure; and human health. For example, a changing climate will involve changes in typical patterns of regional and seasonal temperature, rainfall, and snowfall, as well as changes in the frequency and severity of extreme events, such as heat waves, cold snaps, droughts, storms, and floods. Regional climates in the United States are expected to become more variable, with more intense and more frequent extremes of high temperature and rainfall. In general, extreme events tend to have disproportionately greater effects: A small percentage increase in hurricane wind speeds, for example, can greatly increase the potential damage. Unfortunately, changes in the frequency and intensity of extreme events—especially precipitation—are also more difficult to simulate and project.

Some effects, including the melting of ice caps, a rise in sea level, and increasing acidity of the oceans, will unfold relatively gradually. Other effects could appear comparatively abruptly. Some extreme, abrupt changes—such as major shifts in ocean currents and regional patterns of rainfall—could occur unexpectedly, even centuries after emissions have been curtailed and concentrations have been stabilized.

Uncertainty about the magnitude and effect of climate change arises from two main sources: how population growth, technological developments, and economic change

will influence land cover and the growth of emissions; and how rapidly the climate system will respond to accumulating greenhouse gases and other changes and how much warming will ultimately occur. Those uncertainties do not imply that nothing is known about future developments; rather, they suggest that projections of future changes in climate and of the resulting impacts should be considered in terms of ranges of outcomes or probability distributions. For example, some recent research suggests that the median increase in average global temperature during the 21st century will be in the vicinity of 9° Fahrenheit (F)—near the middle of the estimated range of the increase in temperature between the last ice age and today—if no actions are taken to reduce the growth of greenhouse-gas emissions. However, warming could be much less or much greater than that median level, depending on the growth of emissions and the response of the climate system to those emissions.

Just as the amount of warming that would occur in the absence of a policy to reduce emissions is uncertain, so too is the extent to which any given policy would reduce that warming. For example, a policy that limited emissions with the goal of stabilizing atmospheric concentrations of greenhouse gases at roughly 2.3 times the preindustrial CO<sub>2</sub> concentration would significantly moderate warming, but the policy could still result in warming of anywhere between 3° and 6°F over the course of the 21st century (see Figure 1).<sup>1</sup>

Given current uncertainties, crafting a policy response to climate change involves balancing two types of risks: the risks of limiting emissions to reach a temperature target and experiencing much more warming and much greater impacts than expected versus the risks of incurring costs to limit emissions when warming and its impacts would, in any event, have been less severe than anticipated. Climate policies thus have a strong element of risk management: Depending on the costs of doing so, society may find it economically sensible to invest in reducing the risk of the most severe possible impacts from climate change even if those impacts are not very likely to occur. In particular, the potential for unexpectedly severe and even catastrophic outcomes, even if unlikely, would justify more stringent policies than would result from simply balancing the costs of reducing emissions against the benefits associated with the expected reduction in the degree of warming.

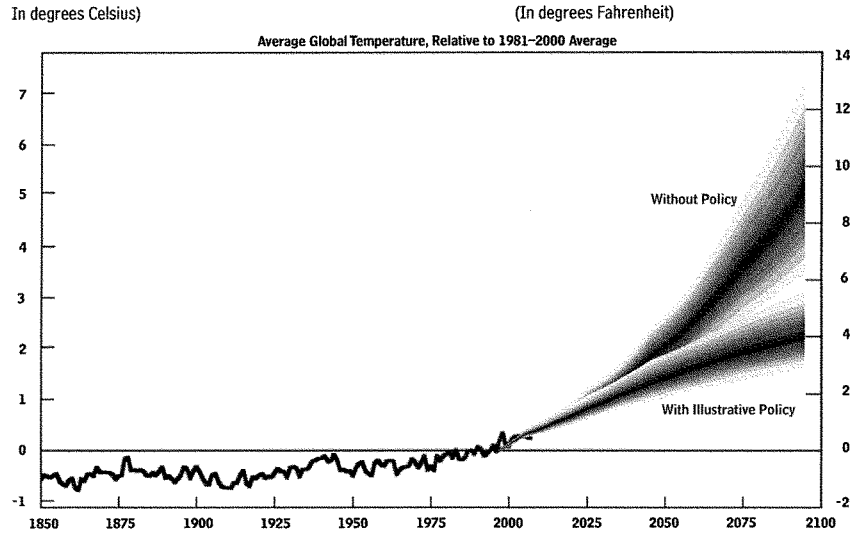
### **Economic Consequences of a Cap-and-Trade Program**

A cap-and-trade program for reducing CO<sub>2</sub> emissions in the United States could reduce the risks of climate change and the damages that would come from such change. It would do so by curtailing the use of fossil fuels, which in turn would change the patterns of output and employment in the United States.

---

1. Congressional Budget Office, *Potential Impacts of Climate Change in the United States* (May 2009), p. 14.

**Figure 1.**  
**Historical and Projected Climate Change**



Source: Congressional Budget Office. Historical data are from the Hadley Centre for Climate Prediction and Research, <http://hadobs.metoffice.com/hadcrut3/diagnostics/global/nh+sh/annual>, and described primarily in P. Brohan and others, "Uncertainty Estimates in Regional and Global Observed Temperature Changes: A New Dataset from 1850," *Journal of Geophysical Research*, vol. 111 (June 24, 2006). The projection is based on data provided by Henry Jacoby, Massachusetts Institute of Technology, in a personal communication to CBO, December 22, 2008; the results are discussed in A.P. Sokolov and others, *Probabilistic Forecast for 21st Century Climate Based on Uncertainties in Emissions (Without Policy) and Climate Parameters*, Report No. 169 (Cambridge, Mass.: MIT Joint Program on the Science and Policy of Global Change, 2009), [http://globalchange.mit.edu/files/document/MITJPSPGC\\_Rpt169.pdf](http://globalchange.mit.edu/files/document/MITJPSPGC_Rpt169.pdf).

Note: The projection, which is interpolated from decadal averages beginning in 1995, shows the possible distribution of changes in average global temperature as a result of human influence, relative to the 1981-2000 average and given current understanding of the climate. Under the Sokolov study's assumptions, the probability is 10 percent that the actual global temperature will fall in the darkest area and 90 percent that it will fall within the whole shaded area. However, actual temperatures could be affected by factors that were not addressed in the study (such as volcanic activity and the variability of solar radiation) and whose effects are not included in the figure.

### Changes in Overall Economic Output

Policies that limit emissions of greenhouse gases would reduce the risk of damage from climate change. However, by channeling productive resources toward reducing that risk rather than toward producing goods and services that are measured in gross domestic product (GDP), such policies would be likely to reduce GDP relative to what would otherwise occur.

Restrictions on emissions would lower overall output through several channels. Those restrictions would raise prices for energy produced using fossil fuels, discouraging the use of such energy and energy-intensive products (such as cars and aluminum) and encouraging the use of nonfossil energy and more energy-efficient products. Lower energy consumption would render existing capital and labor less productive, which would lower output directly and would also tend to discourage investment and work. The cost of the energy-intensive process of producing new capital would rise, and some investment would be diverted toward the production of nonfossil replacements for the current fuel mix, reducing investment in other types of productive capital.

The aggregate economic costs of reducing emissions are quite uncertain, and estimates of them vary widely among studies, depending on the models used and the assumptions that analysts make about key factors, such as the development of new technologies. For example, in a review of modeling results for the Lieberman-Warner bill, which the Congress considered last spring (S. 2191), the Congressional Research Service found that estimated reductions in per capita GDP in 2030—relative to the level of GDP that would have occurred in the absence of the cap on emissions but not accounting for the effect that any additional warming might have on GDP—ranged from a low of less than 0.5 percent to a high of 3.8 percent. Six of the 10 available estimates found per capita GDP losses of less than 1 percent.<sup>2</sup>

The policy's design could also affect the macroeconomic costs of reducing emissions. The modeling results mentioned above assumed the allocation of allowances and revenues from the sale of allowances specified in S. 2191. Other allocations and uses of revenues could result in significantly different overall costs.

Despite changes in economic output as measured by GDP, CBO expects total employment to be only modestly affected by a cap-and-trade program to reduce greenhouse-gas emissions. Except during cyclical downturns such as the current recession, most individuals who seek employment are able to find jobs, and a cap-and-trade program would not greatly alter that ability. However, some regions and industries would experience substantially higher rates of unemployment and job turnover as the program became increasingly stringent. That transition could be particularly difficult for individuals employed in those industries (such as the coal industry) or living in those regions (such as Appalachia). However, any aggregate change in unemployment would be small compared with the normal rate of job turnover in the economy.

---

2. Larry Parker and Brent Yacobucci, *Climate Change: Costs and Benefits of S. 2191*. CRS Issue Brief RL34489 (Congressional Research Service, May 15, 2008), pp. 33–36.

Of course, policymakers need to weigh the aggregate costs of reducing emissions against the costs of climate change itself, including the effects on both measured output and other aspects of national life. Most of the economy involves activities that are not likely to be directly affected by changes in climate, so published estimates of the economic costs of direct impacts of climate change in the United States tend to be modest. A relatively pessimistic estimate for the loss in projected real (inflation-adjusted) U.S. GDP is about 3 percent for warming of about 7°F by 2100.

However, most of the published studies do not include all of the potential costs of climate change to the country over the coming century and beyond. Most important, there are few detailed estimates of the costs of warming in the upper half of the projected range of 6°F to 13°F of warming during the 21st century. Even for the levels of warming that have been examined, most of the estimates cover only a portion of the potential costs. Most studies leave aside nonmarket impacts—such as the effects on human health and quality of life and the loss of species' habitat, biodiversity, and ecosystem services—because determining the value of those changes is especially difficult. Most studies also do not incorporate the potential for abrupt changes in climate, such as shifts in ocean currents that could change weather patterns and affect agriculture over large areas, and rapid disintegration of ice sheets, which could dramatically raise sea level. Moreover, most studies do not incorporate impacts outside the United States. Most experts agree that populations in other countries, especially poor countries near the equator and bordering on desert zones, are likely to suffer the bulk of the damage from climate change during the 21st century. That would harm living standards that are already marginal in regions of Asia, Africa, and the Middle East; it might also contribute to widespread political instability.

### **The Distribution of Economic Costs**

The effects of a cap-and-trade system on overall economic output are only part of the story. Some sectors of the economy, income groups, and regions of the country could shoulder a substantial burden under a cap-and-trade program, while others could benefit. Policymakers could partially compensate those who are harmed by distributing some part of the value of the emissions allowances to them.

The prices that consumers pay for energy and energy-intensive goods and services would rise to reflect the cost of CO<sub>2</sub> emissions under a cap-and-trade program. Such price increases would stem from the restriction on emissions and, in most circumstances, 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 would be encouraged to make economically motivated changes in investment and consumption that reduced CO<sub>2</sub> emissions.

Those higher prices would create losses for some current investors and workers in the sectors of the economy that produce energy and energy-intensive goods and services. Investors would see the value of their stocks decline, and workers would face higher



risk of unemployment as jobs in those sectors were cut. Stock losses would tend to be widely dispersed among investors because shareholders typically diversify their portfolios. In contrast, the costs of unemployment would probably be concentrated among relatively few households and, by extension, their communities. The magnitude of those transitional costs would depend on the pace of emission reductions, with more rapid reductions leading to larger transitional costs. At the same time, the prices of stocks in industries that would be expanding under a cap-and-trade program could rise, as would job openings in those industries.

The distribution of costs would also be affected by international trade, especially for goods or services that embody large amounts of greenhouse-gas emissions. The cost of producing such goods in the United States would rise under a cap-and-trade system, thereby disadvantaging producers of those goods relative to foreign competitors that do not face a similarly stringent program for reducing emissions. Although large segments of our economy either do not face significant foreign competition or involve trade with countries that have a cap-and-trade system (the European Union, for example), some important manufacturing industries, such as steel, face competition from countries that do not face the costs of such a system.

Policymakers can significantly affect the distribution of costs associated with a cap-and-trade program, depending on how they decide to distribute the value of the allowances. In establishing a cap-and-trade program, policymakers would create a new commodity: the right to emit CO<sub>2</sub>. Those rights would have substantial value. On the basis of a review of the literature and the range of CO<sub>2</sub> policies recently debated, CBO estimates that, by 2020, the value of those allowances could total between \$50 billion and \$300 billion annually (in 2006 dollars). The actual value would depend on various factors, including the stringency of the cap, the possibility of offsetting CO<sub>2</sub> emissions through carbon sequestration or international allowance trading, and other features of the specific policy that was selected.<sup>3</sup>

Unlike the potential reduction in GDP described above, the value of the allowances is not a cost to the economy as a whole: Some households will pay for the allowances, and other households will receive the income associated with them (either directly, by the government giving them allowances, which they can then sell, or indirectly, by the government selling the allowances and giving them the revenues in the form of tax reductions, for example).

Market forces would determine what households would pay for the allowances. In contrast, policymakers would determine how the value of the allowances was distributed. The options facing policymakers include cutting existing taxes to reduce the overall cost that the policy would impose on the economy, offsetting costs incurred by

---

3. Carbon sequestration is 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).

workers or shareholders in adversely affected industries, providing compensation to adversely affected regions, or cushioning the effects of policy-induced price increases on low-income households.

### **Effects on Industries, Income Groups, and Regions**

A cap-and-trade program would have different consequences for different industries, income groups, and regions of the country.

**Energy-Intensive Industries.** Imposing a price on emissions through a cap-and-trade program would increase production costs in the economy in two ways. For sectors that produce relatively large amounts of emissions, such as the electricity sector, costs would increase as firms acquired emission allowances or invested in equipment to reduce emissions. For sectors that purchase relatively large amounts of energy, such as the cement industry, costs would increase as energy prices rose in response to the cap. In differing degrees, those increases in costs could be passed along to consumers of energy and energy-intensive products. For energy producers—with the exception of electricity producers subject to rate-of-return regulation—most of the costs eventually would be passed forward to consumers, which would tend to reduce demand for their product. For energy-intensive manufacturers that produce traded goods, the ability to pass increased costs on to consumers depends on the availability of competitors' goods that are not subject to the cap-and-trade price on emissions.

Energy-producing sectors, such as coal-fired electric utilities, and energy-intensive manufacturing, such as the steel industry, would be expected to experience the greatest increases in production costs. However, producers of energy that yield a relatively low amount of greenhouse-gas emissions (for example, nuclear energy, wind generators, and biomass-fired electric utilities) could benefit from a cap-and-trade program. The reason is that those sources, even if they have compliance obligations under the cap-and-trade program, would become more attractive to consumers because their prices would not rise by as much as other energy sources, such as gasoline or electricity generated from burning coal. For example, the Energy Information Administration projected in its analysis of S. 2191 that the amount of electricity produced from nuclear power plants and from renewable energy sources (such as wind turbines and biomass utilities) would be more than 30 percent higher than under the baseline in 2030 and that production from coal-fired utilities would be more than 20 percent lower.

Of the manufacturing sectors, petroleum refiners, coal miners, primary metal manufacturers, and chemical producers have the highest greenhouse-gas emissions relative to their output. In 2006, those sectors alone accounted for about 10 percent of U.S. emissions of greenhouse gases (including emissions from the electricity consumed in those sectors) and employed more than 1.4 million workers at above-average wages, relative to the rest of the economy. The nonmetallic minerals sector (for example, the glass and cement industries), the paper and pulp industry, the apparel and textile sectors, and the mining industries also have relatively high emissions and energy costs.

Together, mining and manufacturing employed more than 10 percent of the U.S. labor force in 2006, accounting for about 15 million jobs. Losses in competitiveness in those sectors would be largest during the initial period of transition and would diminish over time as firms switched to lower-carbon fuels and invested in energy efficiency.

Other sectors of the economy also use significant amounts of energy and produce large amounts of emissions relative to their output but may not be directly covered under the cap-and-trade program. For example, U.S. agriculture purchases and burns significant quantities of fuel and also purchases large amounts of energy-intensive goods (such as fertilizer), but farms are not required (under most cap-and-trade designs) to hold allowances for the farms' greenhouse-gas emissions. That sector would face higher input costs but might be able to pass some of those along to consumers because the competition it faces from imported goods is not as strong as that faced by energy-intensive manufacturers. Similarly, the air, truck, and passenger transportation industries have very high energy costs and emissions relative to output, implying that a cap-and-trade program would result in higher input costs, which would probably be passed along to consumers in higher prices. Those transportation sectors accounted for nearly 5 percent of U.S. emissions in 2006 and employed roughly 2 percent of the U.S. labor force.

**Households in Different Income Brackets.** 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 those costs along to their customers (and their customers' customers) in the form of higher prices. Such price increases would stem from the restriction on emissions and in most circumstances would occur regardless of whether the government sold the allowances or gave them away.

Although the price of energy-intensive items such as electricity, natural gas, home heating fuels, and gasoline would increase the most, the price of nearly all items would rise in response to the imposition of a cap-and-trade program because energy is an input for almost all goods and services. The price increases for items that were not energy-intensive would account for approximately 40 percent of the total price increases for households.

Without incorporating any benefits to households from lessening climate change, CBO estimates that the price increases resulting from a 15 percent cut in CO<sub>2</sub> emissions could cost the average household roughly \$1,600 (in 2006 dollars). As noted above, most of those costs reflect the value of the allowances and would appear as income somewhere else in the economy, with the specific location depending on policymakers' decisions. The increased expense would vary for individual households, depending on the amount they consume and the types of goods they purchase. Accounting for those differences, CBO estimates that the additional cost would range from nearly \$700 for the average household in the lowest one-fifth (quintile) of all

**Table 1.**


---

**Average Annual Household Expenditures on  
Energy-Intensive Items, by Income Quintile, 2007**


---

(Dollars)

	Quintile					All Households
	Lowest	Second	Middle	Fourth	Highest	
Utility Expenditures	1,203	1,596	1,840	2,181	2,847	1,934
Gasoline Expenditures	1,046	1,768	2,418	2,988	3,696	2,384
Total Spending on Energy-Intensive Items	2,249	3,364	4,258	5,169	6,543	4,318
Total as a Percentage of Income	21.4	12.2	9.2	7.1	4.1	6.8

Source: Congressional Budget Office based on data from Bureau of Labor Statistics, Consumer Expenditure Survey, 2007 ([www.bls.gov/cex/2007/Standard/quintile.pdf](http://www.bls.gov/cex/2007/Standard/quintile.pdf)).

Note: Energy-intensive items include natural gas, electricity, fuel oil, other heating fuels, gasoline, and motor oil.

---

households arrayed by income to about \$2,200 for the average household in the highest quintile.

The rise in prices would impose a larger burden, relative to income, on low-income households than on high-income households for two reasons. First, low-income households spend a much larger fraction of their income than do high-income households. Second, energy-intensive items account for a greater share of low-income households' total expenditures. Data collected by the Bureau of Labor Statistics indicates that, measured as a share of income, spending on energy-intensive items by households in the lowest income quintile averages more than five times that by households in the highest income quintile (see Table 1).

**Regions of the Country.** The regional effects of a cap-and-trade policy would vary according to the extent to which the sources of income in the region depend on carbon-intensive fuels, such as coal, and the extent to which households' consumption is linked to carbon-intensive fuels. Regions in which the employment base is linked to the production of carbon-intensive fuels, or to industries that rely heavily on those fuels, would probably be more substantially affected. Those regions would be particularly hard hit if workers had limited opportunities to gain employment in industries that are less carbon-intensive.

Regions would also tend to experience greater costs if the households in that region consumed goods that result in greater CO<sub>2</sub> emissions (for example, their electricity comes from coal-fired generators or they need to drive long distances). Some studies that compare the costs of average households across regions have found little variation. However, a recent study that compared household costs on the basis of both income levels and regions found that the costs borne by low-income households varied significantly across regions. For example, the study found that the extra costs

low-income households faced were significantly lower in California and New York State than in the Ohio Valley and the Mid-Atlantic States.<sup>4</sup>

### **Distributing the Value of the Allowances**

A key decision that policymakers would face in designing a cap-and-trade program is how they would distribute the value of the allowances. One option would be to have the government capture the value of the allowances by selling them, as it does with licenses to use the electromagnetic spectrum. Another possibility would be to give the allowances to energy producers, some energy users, or other entities at no charge. The European Union has used that second approach in its cap-and-trade program for CO<sub>2</sub> emissions, and nearly all of the allowances issued under the 14-year-old U.S. cap-and-trade program for sulfur dioxide emissions are distributed in that way. Giving the allowances away to specific entities is equivalent to selling the allowances and giving them cash because those allowances could be sold in a liquid secondary market and, thus, could be easily converted into cash.

How policymakers decided to use the value of the allowances would have significant implications for the distribution of gains and losses among U.S. households and for the overall cost of the policy. Although the direct economic effects of a cap-and-trade program described in the previous section would fall disproportionately on some industries, on some regions of the country, and on low-income households, the program's *ultimate* economic effect would depend on policymakers' decisions about how to allocate the revenues from the emission allowances.

Those decisions would affect not only the distributional consequences of a cap-and-trade policy but also its total economic cost. For instance, the government could use the revenues from auctioning allowances to reduce existing taxes that tend to dampen economic activity. Some of the effects of a CO<sub>2</sub> cap would be similar to those of raising such taxes: The higher prices caused by the cap would reduce real wages and real returns on capital, which would be like raising marginal tax rates on those sources of income. Using the value of the allowances to reduce taxes could help mitigate that effect of the cap. Such an approach would lower the "efficiency cost" of the policy, which reflects the economic losses that occur because prices of goods and services do not reflect the resources, including nonenvironmental resources, used in their production. The efficiency cost includes decreases in the productive use of labor and capital as well as costs (both monetary and nonmonetary) associated with reducing emissions.

In general, policymakers face a trade-off between using the value of the allowances to reduce the overall cost of the policy and using that value to offset costs that are

---

4. See Dallas Burtraw, Richard Sweeney, and Margaret Walls, *The Incidence of U.S. Climate Policy: Alternative Uses of Revenues from a Cap-and-Trade Auction*, Discussion Paper (Washington, D.C.: Resources for the Future, April 2008).

imposed on particular households (for example, those that have low income, that work in particular industries, or that live in certain regions of the country).

CBO previously examined the distributional and efficiency effects of a cap-and-trade program that would reduce CO<sub>2</sub> emissions in the United States by 15 percent. In that analysis, CBO considered the implications of three ways to use the value of the allowances that illuminate some of the trade-offs that policymakers face. Those options were:

- Selling the allowances and issuing lump-sum rebates to households,
- Selling the allowances and using the revenues to finance cuts in existing taxes, and
- Giving the allowances to producers in adversely affected industries.

My testimony summarizes CBO's quantitative estimates of the distributional effects associated with those alternative uses of the allowance value and points out the potential efficiency consequences of those options.

The three cases that CBO considered represent only a small number of the many options available. For example, policymakers have also considered:

- Using some of the revenues obtained by selling allowances to fund research and development of low-carbon energy technologies or
- Giving some of the allowances to local companies that deliver electricity to households.

Although CBO has not estimated the magnitude of the distributional and efficiency consequences of those two approaches, this section presents a qualitative discussion of those consequences. In addition, CBO has written more extensively about the ability to target compensation toward low-income households. The final section of my testimony concludes with a discussion of CBO's findings.

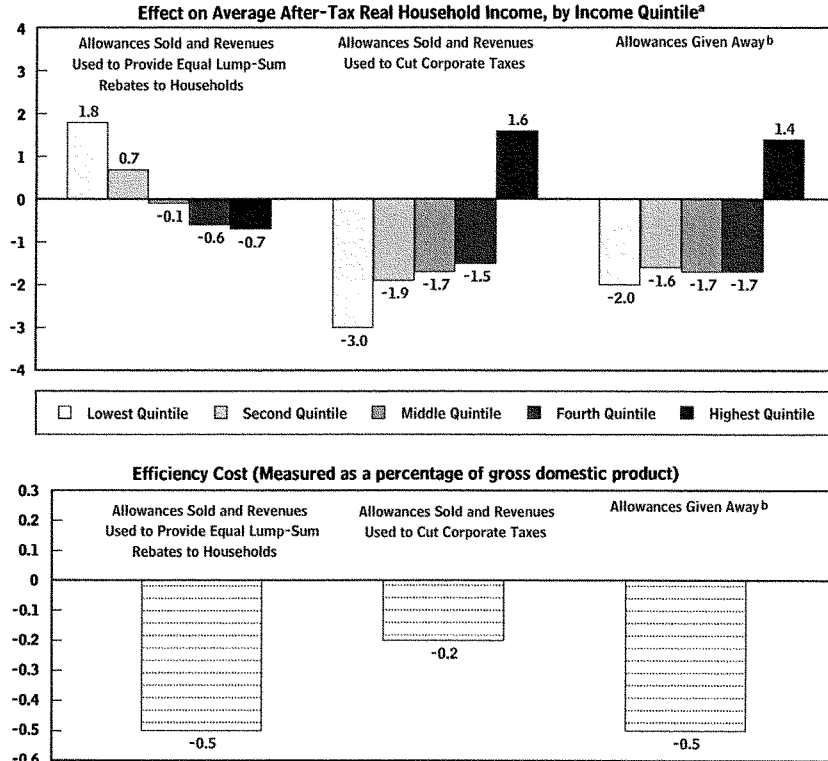
**Cut Taxes.** Using the revenues from selling allowances to reduce corporate income taxes could lower the overall cost to the economy. For example, the efficiency cost of a 15 percent cut in emissions could be reduced by more than half if the government sold allowances and used the revenues to lower corporate income taxes rather than to provide lump-sum rebates to households or to give the allowances away (see Figure 2).

However, that approach would be likely to provide smaller offsets to the price increases experienced by low-income households than would an equal lump-sum rebate to every household. Although corporations write the checks to pay the corporate income tax, that money ultimately comes from households through some combination of lower returns to capital, lower wages, and higher prices. Who pays the tax is

**Figure 2.**

**Effects of a 15 Percent Cut in CO<sub>2</sub> Emissions, with the Allowances' Value Used in Various Ways**

(Percentage change)



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), 199–221.

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. These estimates assume that the government would use any positive net revenue remaining after accounting for ways in which the policy affected the federal budget to provide equal lump-sum rebates to households. The results would be more regressive if the government used any positive net revenue to decrease corporate taxes or payroll taxes.

uncertain, but most assumptions about the incidence of the tax suggest that higher-income households pay a greater portion of the corporate income tax than low-income households. Thus, the benefits to low-income households from reducing corporate income taxes probably would not offset the increased costs they would face from higher energy prices. Using the revenues from selling allowances to decrease payroll taxes would also provide smaller offsets to low-income households than would an equal per-household rebate.

**Rebate the Allowance Value to Households.** Lawmakers could choose to help offset the price increases experienced by households by providing for the sale of some or all of the allowances and using the revenues to provide rebates. CBO examined the potential effects of a decision to sell the allowances and use the revenues to pay an equal lump-sum rebate to every household in the United States.<sup>5</sup> Low-income households would be better off in that case because the size of the rebate would be larger than the average increase in their spending resulting from the higher price of energy (see Figure 2).<sup>6</sup> High-income households would be worse off under that scenario (again, excluding any benefit from reducing the risks associated with climate change) because the average increase in their spending would be larger than the rebate.

**Give Allowances to Key Industries.** Rather than sell the allowances, the government could give all or most of them to energy producers—as was done in the cap-and-trade program for sulfur dioxide emissions. However, this approach would not offset the regressivity of the price increases. The reason is that the prices of energy-intensive goods and services would rise regardless of whether producers were required to purchase the allowances or received them for free. The price increases would stem from the restriction on emissions and the resulting fact that allowances would have value in the private market even if they were given away by the government. Thus, giving away allowances to energy-intensive manufacturers without requiring certain actions would generally not affect the prices charged for energy-intensive goods.

Moreover, giving allowances to producers would tend to benefit higher-income households. If companies benefited from the price increases but did not have to purchase allowances, they would receive windfall profits, which could be very large. For example, in 2000, CBO estimated that if emissions were reduced by 15 percent and all of the allowances were distributed free of charge to producers in the oil, natural gas, and coal sectors, the value of the allowances would be 10 times the combined profits of those producers in 1998. Thus, the windfall gains that they would receive as a result of the free distribution would far outweigh the loss in sales that they might experience as consumers cut back on their use of fossil fuels.

---

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

6. One researcher has suggested that an environmental tax credit based on earnings also could reduce 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*, Discussion Paper 2007-12 (Washington, D.C.: Brookings Institution, Hamilton Project, October 2007).



Profits resulting from a free distribution of allowances would accrue to shareholders, who are primarily from higher-income households. That additional income would more than offset those households' increased spending due to higher prices (see Figure 2). Low-income households, by contrast, would benefit little if allowances were given unconditionally to firms, and they would still bear a disproportionate burden from the price increases that would nonetheless occur. Thus, giving away allowances unconditionally would be significantly regressive, making higher-income households better off as a result of the cap-and-trade policy and making lower-income households worse off.

Giving away allowances for free but with certain conditions would have a different effect on households. For example, if energy-intensive manufacturers received allowances as transition assistance based on historic levels of output or emissions, producers would be likely to experience windfall profits. However, if the receipt of that assistance was tied to future decisions about production, such as the level of output, firms would generally maintain production and thereby employment at higher levels than they would without such assistance. As a result, prices for those goods would not rise by as much as they might have. At the same time, because sectors receiving such transition assistance would not be likely to reduce emissions as much as they might have without free allowances, other sectors would have to reduce emissions by a larger amount in order to meet an overall cap on emissions, leading to higher price changes in the sectors that did not receive such assistance.

Finally, giving the allowances to selected industries, regardless of whether or not those allowances were tied to their decisions about production, would not encourage the productive use of labor and capital in the same way that cutting tax rates would. As a result, the efficiency cost of a cap-and-trade program would be higher if policymakers chose to give allowances to firms rather than to use the value of the allowances to reduce the corporate income tax (see Figure 2).

**Give Allowances to Local Distribution Companies.** One option that policymakers have considered is to give allowances to local distribution companies, which purchase electricity from generators and sell it to households. The distributional and efficiency outcomes associated with this option depend on how those companies would use the revenues obtained from selling the allowances (because they would not need the allowances for compliance purposes, they would sell them to producers that did). For example, they could use the revenues to offset the higher electricity prices that households would otherwise face. Alternatively, they could use the revenues to directly fund improvements in energy efficiency for the households that they serve.

Determining the distributional effects of these different options would require further research because electricity is only one of the goods that households consume, and actions that the local distribution companies took could result in the need for greater emission reductions outside the electricity sector. For example, using the allowance revenues to offset the increase in electricity prices that households would otherwise face would seem to decrease the burden that the cap-and-trade program would

impose on low-income households, but that may or may not be the case. Muting the increase in electricity prices would increase the overall cost of the policy because it would reduce households' incentives to undertake measures to reduce their electricity consumption, such as choosing more efficient appliances or turning down their thermostats. As a result, the burden of meeting the cap would fall more heavily on other sectors, and that additional burden would be reflected in higher prices for other goods and services that households purchase. (For example, the price of gasoline would probably increase more than would otherwise be the case.) As a result, determining the distributional consequences of having the local distribution companies use the value of the allowances to offset increases in electricity prices would require accounting both for the protection that households would receive from electricity price increases and the corresponding increases in the prices of other goods and services that they purchase.

**Fund Research and Development.** Some observers have proposed that the federal government allocate a part of the revenues that could be generated by a cap-and-trade program to research and development (R&D) that would reduce the cost of transitioning from a high-emissions economy to one that uses less energy overall and produces that energy with lower-emission technologies. In 2008, the federal government spent over \$6 billion recorded on the "climate change budget," a cross-agency tabulation of spending for programs directed toward better understanding and monitoring the global climate, providing incentives to firms and households to develop and adopt technologies that reduce energy use and greenhouse-gas emissions, and supporting developing countries in reducing their greenhouse-gas emissions. The American Recovery and Reinvestment Act of 2009 (Public Law 111-5) provided one-time spending authority of almost \$40 billion for purposes that arguably could be included in a future tabulation of the climate change budget.

The breadth of programs clustered under the climate change umbrella makes it difficult to characterize the benefits provided by past spending: Some programs have been judged to be cost beneficial while others have failed to achieve their stated objectives. But going forward, at least one justification for additional and large public expenditures would be weakened if a cap-and-trade program was in effect. The damages caused by greenhouse-gas emissions are not currently recognized in the prices that firms and households pay for energy and other goods that cause those emissions when produced. Because a cap-and-trade program would increase the prices paid by firms and households, both groups would have incentives to seek alternatives. In the case of firms, that would probably include increased investment in developing and putting in place new lower-emission technologies, which would be more eagerly sought by consumers in the marketplace. In that sense, a cap-and-trade program is an R&D program because it encourages firms to spend more on innovation; it also supports the wide adoption of lower-emission technologies because it reduces the relative price that consumers pay for those innovations.

## **Options for Offsetting the Economic Impact of a Cap-and-Trade Program on Low-Income Households**

Lawmakers could choose a variety of policies for offsetting the costs to households of higher energy prices. An important consideration in using revenues to provide assistance to households would be to do so in a way that did not incur significant new administrative or compliance costs. Using existing transfer programs or providing rebates through the income tax system would avoid creating new institutional structures for administering payments. Existing systems that already collect information on household income also are well suited to targeting assistance on the basis of need.

No single existing system would reach all households, however. For example, only 54 percent of households in the lowest fifth of the income distribution receive earnings and thus would be likely to file an income tax return (see Figure 3). Households that normally would not file a return would need to file to participate in a rebate program based on the income tax system. The response to the recent stimulus rebates suggest that such an approach can work but that 100 percent participation is unlikely.

Delivering rebates through a combination of the income tax system and existing transfer programs would, in theory, do a better job of reaching affected households than would relying on either approach by itself, and it would not require a new program. In practice, however, it is not easy to coordinate among existing programs to avoid overlap and ensure that economically equivalent households receive roughly the same benefit. For example, although 54 percent and 45 percent of households in the lowest quintile receive earnings and Social Security benefits, respectively, 10 percent of households receive both. As a result, 11 percent of households in the lowest quintile receive neither.

### **Reductions in Income Tax Rates**

Reductions in individual or corporate income tax rates would be straightforward to administer and would provide the largest benefits in terms of economic efficiency, but they would score low in terms of offsetting energy price increases for low- and moderate-income households. Reductions in individual income tax rates would enable taxpayers to lower the amount of taxes withheld from their paychecks to cover the cost of additional expenditures on energy-intensive items as they occurred throughout the year.

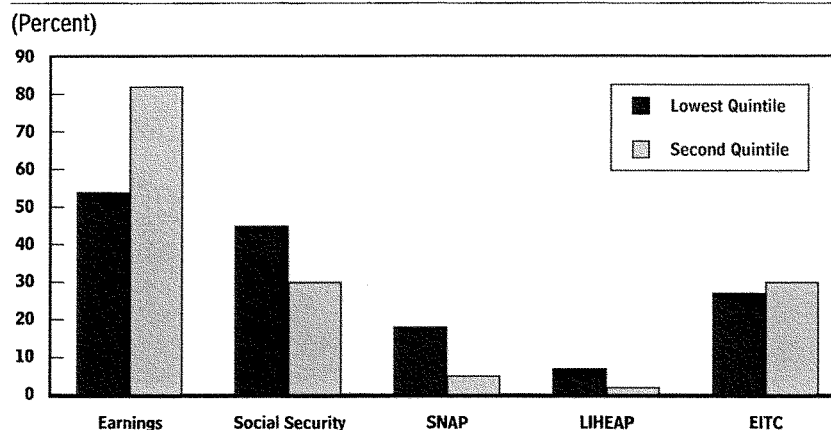
A proportional reduction in all individual income tax rates would provide the largest percentage increase in after-tax income and the largest dollar amount of tax reductions for taxpayers in the highest income tax brackets; taxpayers in the 10 percent or 15 percent tax brackets, who constitute roughly two-thirds of taxpayers with taxable income, would receive minimal benefits. Limiting the rate reductions to only the two lowest income tax brackets would provide a larger share of the tax benefits to taxpayers in those brackets, but taxpayers whose income put them near the top of the 15 percent bracket (\$41,450 for a single taxpayer and \$83,000 for a couple in 2008)

**Figure 3.**


---

**Low-Income Households with Income and Benefits from Selected Sources**


---



Sources: Congressional Budget Office tabulations and tax calculations based on data from the March 2005 Current Population Survey.

Notes: Quintiles are based on household income, unadjusted for household size. Quintiles have equal numbers of people.

SNAP = Supplemental Nutrition Assistance Program; LIHEAP = Low Income Home Energy Assistance Program; EITC = earned income tax credit.

---

would benefit the most. Reductions in income tax rates would not help low-income households that did not have sufficient income to owe income taxes.

A reduction in corporate income tax rates would benefit owners of corporate stock in the short run, with most of the benefits going to higher-income households. As capital markets adjusted over the longer term, however, the economic gain from reducing the tax would spread across all types of capital. And over time, at least some of the economic gains could also be shifted to wage earners, although the degree of such shifting is uncertain. Nevertheless, any gains by low- and moderate-income households from a reduction in corporate taxes would be modest—even over the longer term—and insufficient to offset their increased energy costs.

**Payroll Tax Rebates.** A payroll tax rebate would reach the approximately 165 million workers covered under the Social Security and Medicare programs. Economist Gilbert Metcalf of Tufts University has proposed a payroll tax rebate for Social Security and

Medicare taxes as an offset to a carbon dioxide tax.<sup>7</sup> Under that proposal, the rebate would apply to the tax on the first \$3,660 of earnings. With a combined employee and employer tax rate of 15.3 percent, the maximum energy credit per worker would be \$560.<sup>8</sup>

Households without covered earnings would not benefit from a payroll tax rebate. Many of those households have low income or include retirees. Data from the 2008 Current Population Survey, produced by the U.S. Census Bureau, indicate that although about 80 percent of all households would be eligible for a payroll tax rebate, only slightly more than half (54 percent) of the households in the lowest fifth of the income distribution would qualify. Among those who qualified, some would receive less than a full \$560 rebate if their earnings were less than \$3,660. About three-quarters of the households in that quintile who would not qualify for a payroll tax rebate receive Social Security benefits and thus would be partially protected from higher energy costs by cost-of-living adjustments.

Administering a payroll tax rebate would be complicated by a number of issues. Adjusting payroll tax withholding would impose some administrative burden on employers, who also would lack the necessary information to adjust withholding for workers with more than one job. An alternative to adjusting payroll tax withholding would be to pay the rebate through the income tax system when workers filed their returns. Although that approach would be easier to administer, the timing of the rebate would not coincide with the timing of individuals' increased expenditures. Furthermore, because some workers who pay payroll taxes do not currently file income tax returns, some additional administrative costs would be incurred to process more returns.

A payroll tax rebate (like any fixed-dollar rebate) would be progressive over most of the income distribution, providing benefits that were a larger percentage of income for lower-income households except for those with the very lowest income and little or no earnings. (The rebate would not necessarily be equal for households with the same income, because the rebate amount would depend upon the number of workers within each household.)

A payroll tax rebate would provide modest incentives for greater participation in the labor force by increasing workers' take-home pay. It would not offer new work incentives for people already in the labor force with earnings high enough to qualify for the maximum rebate.

---

7. Gilbert E. Metcalf, *A Green Employment Tax Swap: Using a Carbon Tax to Finance Payroll Tax Relief, Tax Reform, Energy, and the Environment Policy Brief* (Washington, D.C.: Brookings Institution and World Resources Institute, June 2007).

8. A payroll tax rebate would not have to affect the financial status of Social Security and Medicare or the future retirement benefits of workers. Workers would receive credit for their full covered earnings, and the Social Security and Medicare trust funds could be credited for the full amount of the payroll tax.

**Income Tax Rebates**

The Internal Revenue Service (IRS) has experience delivering rebates based on information in income tax returns, most recently with the 2008 stimulus payments. When filing, households could claim a rebate as a credit against their income tax liability. That transaction would present the same timing issues described in the preceding section. Unless the rebates were refundable (that is, payable in excess of the amount of income tax owed), they would be of little or no value to taxpayers who filed income tax returns but owed no income tax—which was the case for approximately 45 million of the 138 million returns filed in 2006. Moreover, as seen in the experience with stimulus payments, the IRS would need to undertake substantial educational efforts, and many wage earners and others who otherwise would not file income tax returns (because their income falls below the statutory requirements for filing) would need to file one to obtain the rebate. In 2006, for example, an estimated 20 million households did not file a return. Households with very low income and those headed by elderly people account for most of the households that do not file a return.

The economic stimulus rebates that were available in 2008 provide an indication of the number of eligible households that are likely to file an income tax return in order to claim a rebate. The IRS received approximately 156 million individual income tax returns during the 2008 filing season, the first year in which filers could claim the recovery rebate included in the Economic Stimulus Act of 2008. That total represents an increase of 16 million returns (11.5 percent) over the number received in the previous year. Much of that increase probably represents those filing solely to claim the rebate—the annual increases in returns received during the 2006 and 2007 filing seasons were just 1.6 percent and 3.0 percent, respectively. Although many households appear to have filed a return just to claim the rebate, the number that did so was a bit below expectations. When the Economic Stimulus Act of 2008 was enacted, the Joint Committee on Taxation estimated that \$106.7 billion in stimulus payments would be paid in fiscal year 2008. A total of \$94.1 billion was actually distributed in that year, although it is difficult to know how much of the shortfall was attributable to eligible people failing to claim the rebate. The economic stimulus rebates were temporary, however. The percentage of eligible households that would file under a permanent program would probably be higher.

A refundable tax rebate of a fixed dollar amount would be progressive, providing greater relief as a percentage of income to low-income households. Rebates can be adjusted for differences in family size. They can also be targeted toward lower-income taxpayers by reducing (phasing out) the amount of the credit at higher incomes. For example, the individual income tax rebates that were part of the 2008 economic stimulus package were reduced by 5 percent of income in excess of \$75,000 for individuals and \$150,000 for couples. Phasing out a rebate reduces its budgetary cost but adds complexity to the calculation of tax liability and makes the true tax on additional income (the marginal tax rate) less transparent.

One issue is whether the rebates would be paid to all households or only those that met certain income requirements. The recent economic stimulus rebates were payable to households without income tax liability if their combined income from earnings, Social Security, and veterans' disability payments was at least \$3,000. Allowing all households to claim a refundable income tax rebate would increase administrative costs.

A fixed rebate that did not depend on earnings would not provide households with any additional incentives to work or save and thus would not offset any of the overall economic costs associated with a cap-and-trade program.

### **Expand the Earned Income Tax Credit**

An option based on the current tax system, and targeted specifically toward low-income households, would be to expand the earned income tax credit. The EITC is a refundable credit (that is, households receive a payment if the credit exceeds their income tax liability) payable to low-income families with earnings. In 2008, single parents with one child and income up to \$33,995 (\$36,995 for a married couple) were eligible for the credit. Single parents with two or more children could qualify with income up to \$38,646 (\$41,646 for a married couple). Childless workers between the ages of 25 and 65 were eligible for a much smaller credit but must have had income less than \$16,000 to qualify.

In 2006, taxpayers filed for the earned income tax credit on 23 million tax returns. The total amount of the credit was \$44.4 billion, of which \$39.1 billion (88 percent) was refundable. About half of the total EITC payments went to families whose income was less than \$15,000.<sup>9</sup>

Increasing the EITC payments would be straightforward for the IRS to administer. If the increase was proportional to the existing credit, most of the benefits would go to low-income families with children and very few to childless workers. Increasing the EITC would not provide any benefits to households that had no earnings, however.

An expansion of the EITC could also yield economic benefits. For example, studies have found that increases in the EITC have had a positive effect on the participation of low-income single women in the labor force.<sup>10</sup> Although increasing the EITC would raise marginal tax rates for some workers, there appears to be little adverse effect on the number of hours worked by people who are already working.

9. Internal Revenue Service, *Statistics of Income—2006: Individual Income Tax Returns*, Publication 1304 (Rev. 07-2008), 2008.

10. See Bruce D. Meyer, "The U.S. Earned Income Tax Credit, Its Effects, and Possible Reforms," Harris School of Public Policy Studies (University of Chicago) and National Bureau of Economic Research (August 2007); and Nada Eissa and Hilary W. Hoynes, "Behavioral Responses to Taxes: Lessons from the EITC and Labor Supply," in James M. Poterba, ed., *Tax Policy and the Economy*, vol. 20 (Cambridge, Mass.: MIT Press, 2006), pp. 74–110.

### **Automatic Increases in Social Security and Supplemental Security Income Benefits**

Households receiving benefits from the Social Security or Supplemental Security Income (SSI) programs would be partially protected from higher energy costs because those benefits are automatically increased each year to reflect increases in consumer prices. Therefore, considered in combination with automatic increases in Social Security benefits and SSI, options such as a payroll tax rebate that are limited to households with earnings can reach a large portion of the low- and moderate-income population. Data from the Current Population Survey indicate that about 95 percent of households would qualify for a payroll tax rebate or an automatic cost-of-living increase in Social Security benefits, including 85 percent to 90 percent of households in the lowest income quintile. Cost-of-living increases for Social Security and SSI would only partially protect households receiving those benefits because income from those sources covers only part of their total expenditures. That effect would be exacerbated because expenditures on energy-intensive items are a higher share of total expenditures for the elderly (see Table 2).

### **Supplement to SNAP Benefits**

An energy credit based on the same eligibility rules as those for the Supplemental Nutrition Assistance Program (SNAP, formerly known as the Food Stamp program) would be a way to target benefits toward low-income households. To be eligible for SNAP, an applicant's monthly income must be at or below 130 percent of the poverty guideline (\$2,238 for a family four) and countable assets must be less than \$2,000 (\$3,000 for households with elderly or disabled members). Approximately 27 million people receive SNAP benefits each month. About 65 percent of eligible people participate in the program, and nearly 90 percent of eligible children do.<sup>11</sup>

An energy credit could be distributed to households through the same system as SNAP benefits, which are paid through an electronic benefit transfer system. Those SNAP benefits are deposited electronically in individual accounts each month, and recipients use a card to debit their account when paying for groceries.

An energy supplement to SNAP benefits would not affect work or savings incentives at the margin and thus would not offset any of the economic efficiency costs of higher energy prices.

### **Increased Funding for the Low-Income Home Energy Assistance Program**

Increases in funding for the Low Income Home Energy Assistance Program (LIHEAP) could supplement other options for offsetting higher energy costs but by themselves would not be an effective way to help the majority of low- and moderate-income households. Federal rules restrict LIHEAP assistance to households with

---

11. Kari Wolkwitz, *Trends in Food Stamp Program Participation Rates: 1999–2005* (prepared by Mathematica Policy Research for the U.S. Department of Agriculture, Food and Nutrition Service, June 2007).



**Table 2.**


---

**Average Annual Household Expenditures on Energy-Intensive Items, by Age, 2007**


---

(Dollars)

	Under Age 65	Age 65 and Over	All Households
Utility Expenditures	1,947	1,880	1,934
Gasoline Expenditures	2,607	1,461	2,384
Total Spending on Energy-Intensive Items	4,554	3,341	4,318
Total as a Percentage of Income	6.6	8.3	6.8

Source: Congressional Budget Office based on data from Bureau of Labor Statistics, Consumer Expenditure Survey, 2007 ([www.bls.gov/cex/2007/Standard/sage.pdf](http://www.bls.gov/cex/2007/Standard/sage.pdf)).

Note: Energy-intensive items include natural gas, electricity, fuel oil, other heating fuels, gasoline, and motor oil.

---

income up to 150 percent of the federal poverty guideline (or 60 percent of state median income if greater). States, however, can choose to set lower income limits, and as a result, eligibility requirements vary from state to state. In 2006, an estimated 5.5 million households received assistance through LIHEAP—about 16 percent of federally eligible households.

Providing assistance to all low- and moderate-income households would require a major expansion of the program, a substantial increase in administrative costs, and possibly a major overhaul of the program. The current program is funded as a block grant from the federal government to the states and other entities, leaving wide latitude in the types of assistance provided. Increasing LIHEAP subsidies could raise the overall cost of achieving a given cap because it would offset the price signals that are necessary to motivate households to undertake low-cost reductions.

**Increased Incentives for Energy-Saving Investments by Households**

The increase in energy prices that would result from a cap-and-trade program would encourage businesses and households to adjust their energy usage. Using revenues from auctioning allowances to subsidize household investments that reduced carbon dioxide emissions would lower the cost to households of adapting to higher energy prices. For example, subsidizing weatherization improvements would enable households to use less energy for heating and cooling.

However, incentives for energy-saving investments in combination with a cap-and-trade program would not reduce CO<sub>2</sub> emissions below the level set by the program. Although investment incentives could alter the timing of emission reductions by lowering the cost of meeting the targets, the cap set by the program would ultimately determine the total amount of the reductions.

Furthermore, such incentives could increase the total costs (both public and private) of meeting the cap because they would encourage households to choose certain alternatives over others in adjusting to higher energy prices. For example, a tax credit for solar heating would encourage the use of that technology even if it was not the most cost-efficient alternative in the absence of the credit. Creating a tax-incentive system without distorting technology choices is difficult.

A wide variety of deductions or credits related to energy savings already exist at both the federal and state levels. A federal credit (termed the Section 45 production tax credit) is available for electricity produced using certain renewable energy sources, including wind, biomass, geothermal energy, solar energy, and others. Other credits are available for the manufacture of energy-saving appliances, the construction of new energy-efficient homes, energy-efficient improvements to existing homes, and purchases of alternative types of motor vehicles.

*United States Senate*  
*Committee on Finance*



*Sen. Chuck Grassley · Iowa*  
*Ranking Member*

OPENING STATEMENT OF SENATOR CHUCK GRASSLEY  
Hearing, "Auctioning under Cap and Trade: Design, Participation and Distribution of Revenues"  
May 7, 2009

Some people may be wondering why the Senate Finance Committee is having a hearing on a cap and trade system for greenhouse gas emissions. When it comes to the potential environmental benefit of such a system, this committee probably does not have much to add to the work of the Environment and Public Works Committee. However, we are talking about a program that will raise hundreds of billions of dollars every year for the federal Treasury. With revenue of that magnitude, it would be surprising if the Finance Committee were not involved. What's more, the cost will be paid by every American in the form of higher prices for energy, services, and any product that takes energy to produce or transport to market.

President Obama has acknowledged that under a cap and trade system "electricity rates would necessarily skyrocket." When OMB Director Orszag was before this committee last year in his previous capacity, he made it clear that "Under a cap-and-trade program, firms would not ultimately bear most of the costs of the allowances but instead would pass them along to their customers in the form of higher prices." Those energy price increases will also have a significant negative impact on economic growth and job creation. If that sounds suspiciously like a federal energy tax to those of you listening, you're right.

The Senate Finance Committee has jurisdiction over all federal taxes and has extensive experience in considering the tax incidence of various policies. That experience will be invaluable on this subject because a very important aspect in designing a cap and trade system is who will ultimately bear the cost of the program and in what proportion. In short, who are the winners and losers?

One troubling aspect of cap and trade is that the speculators from Wall Street, Chicago, and San Francisco are foaming at the mouth to get their hands on trading profits from cap and trade allowances. Hedge funds, private equity funds, and other companies have been lobbying Congress to pass cap and trade legislation. In fact, Enron and AIG were early supporters of cap and trade legislation. Democratic Representative John Dingell has been quoted as saying, "I

attended a meeting of an organization interested in climate change legislation and guess who it was? It was a bunch of good-hearted Wall Streeters getting ready to cut a fat hog.” End quote. Well, I want to make sure the American taxpayer is not the fat hog that gets cut.

Today’s hearing will help us to better understand the economic consequences of a cap and trade system and the various trade-offs that Congress will need to carefully consider. Our distinguished panel of witnesses will no doubt give us some food for thought on these important issues.

STATEMENT OF ALAN KRUEGER, ASSISTANT SECRETARY FOR ECONOMIC  
POLICY-DESIGNATE AND CHIEF ECONOMIST, U.S. DEPARTMENT OF THE  
TREASURY BEFORE THE SENATE FINANCE COMMITTEE

May 7, 2009

Good morning Chairman Baucus, Ranking Member Grassley and other members of the Committee. Thank you for inviting me to testify before the Committee today. I would like to start by describing the important role that auctioning can play in an efficient greenhouse gas (GHG) cap-and-trade program, then discuss the Department of the Treasury's experience running auctions, and finish by briefly describing how auctions have been used in some existing greenhouse gas cap-and-trade programs in the United States and abroad.

**The Role of Auctioning in a Greenhouse Gas Cap-and-Trade Program**

As you know, one of the President's top priorities is to develop a comprehensive energy and climate change plan to invest in clean energy, address the global climate crisis, and create new jobs. In turn, we believe that a greenhouse gas cap-and-trade program should play a central role in our effort to achieve these goals at the lowest possible cost. We are very appreciative of the work being done in both Houses of Congress to this end, and look forward to working together to craft successful legislation.

An economy-wide GHG cap-and-trade program would be one of the most important and substantial pieces of environmental legislation in our nation's history. Therefore, it is critical that we get the design and implementation of this program right.

Today, I'm here to discuss one important element of an efficient and fair cap-and-trade system -- allowance auctions. When managed effectively, auctions can distribute GHG emissions allowances efficiently by ensuring that they are allocated to those who value them most, thereby helping to minimize the cost of achieving our economy-wide emission targets. At the same time, the use of auctions can avoid the creation of windfall profits and can provide revenue that can be used to help working families in the transition to a clean energy economy.

The Administration's proposed budget auctions 100 percent of the allowances under a cap-and-trade program. Beginning in 2012, proceeds would be used to fund \$15 billion annually in vital investments in clean energy research, development, and deployment and to provide tax relief for families through the Making Work Pay Tax Credit. The Administration's budget has proposed additional revenue generated from an allowance auction above that needed to fund these two initiatives will be used to assist vulnerable households, communities, and businesses in the transition to a clean energy economy.

While various estimates have been offered regarding the revenue that would be collected in an allowance auction, it is important to recognize that the actual amount of auction revenue that will be realized is highly sensitive to the design details of a cap-and-trade system and to fundamentals such as the price of energy and the cost and availability of key technologies, which will collectively influence allowance prices. Of course, reducing the share of allowances auctioned would also lower revenue generation and transfer the value of those allowances to their recipients—without reducing the price impacts felt by consumers.

Next, I'll describe Treasury's experience with public auctions.

#### **Treasury Experience with Auctions**

To finance the public debt, the Treasury Department uses auctions to sell a large volume of debt securities annually that can be classified into bills, notes, bonds, and Treasury Inflation Protected Securities. These constitute a diverse array of instruments, ranging from bills that mature in as few as 4 weeks to bonds maturing in 30 years. Each instrument has its own yield rates and terms. Collectively, these instruments offer characteristics that appeal to a wide range of institutional and individual investors. Moreover, the regular, predictable, and transparent nature of these auctions furthers Treasury's objective of financing the federal government at the lowest possible borrowing cost.

Each year, the Treasury Department's Bureau of Public Debt conducts more than 250 public auctions and issues over \$5 trillion in gross debt through these operations. In FY 2008, for example, we conducted 279 auctions, in each case releasing the auction results data within our self imposed time constraint of two-and-a-half minutes after the auction's close. Such a rapid and consistent pattern of operations and information transmittal serves to minimize market dislocations and greatly enhance overall transparency.

Auctions are open to individuals, brokers, and institutions. Treasury encourages broad access to its auctions through simple online bidding tools available on its website at [www.TreasuryDirect.gov](http://www.TreasuryDirect.gov). Minimum denominations for auctions are \$100, offering individual small investors and individuals the opportunity to participate.

In these auctions investors are allowed to offer either competitive or non-competitive (i.e., price taking) bids. Competitive bids specify a set of particular yield levels acceptable to the investor. Treasury accepts these bids in ascending yield order until it reaches the auction clearing yield, whereby the total quantity of bids reaches the amount offered for sale (some bids may not be accepted). All accepted bids receive the same auction-clearing yield and a pro-rata amount of securities. Non-competitive bidders agree to accept the yield determined at auction, and are guaranteed to receive the desired pro-rata share of securities.

Treasury recognizes the critical importance of maintaining the integrity of, and ensuring investor confidence in, the market for its debt securities, including the proper dissemination of price and

yield information. Toward that end, Treasury's Office of Debt Management leads bi-weekly market surveillance discussions through the Inter-Agency Working Group, which consists of staff from the Federal Reserve Board, the New York Federal Reserve Bank, the Securities and Exchange Commission, and the Commodity Futures Trading Commission. Treasury also encourages related private sector initiatives to broaden Treasury market liquidity. Such public and private surveillance efforts will also be important elements of a future carbon market in order to instill complete confidence among prospective participants.

Given the importance of funding the federal government, and given the large volume of financing provided through Treasury's auctions, ensuring a smooth and efficient auction process has been a critical component of our success to date. We place a premium on providing the most reliable Treasury auctions possible, in the most transparent manner – and the Department delivers on this responsibility each and every week. Treasury's long track record of successfully running high-value auctions demonstrates the key technical expertise necessary to manage auction details in a manner that builds public trust and confidence.

#### **Auctions Under Other Greenhouse Gas Cap-and-Trade Programs**

I'll focus next on briefly describing a few prominent examples of the use of auctions in existing GHG cap-and-trade programs.

##### European Union Emission Trading Scheme

In 2005, the European Union established its Emission Trading Scheme (commonly known as the EU ETS), which is the world's largest emissions cap-and-trade program. The EU ETS caps carbon dioxide (CO<sub>2</sub>) emissions from the electric power sector and several other major industrial sectors in Europe, which collectively account for about half of Europe's CO<sub>2</sub> emissions. The EU ETS was set up to run in a series of phases. Phase I of the program ran from 2005 to 2007 and Phase II covers 2008 to 2012. Phase III will run from 2013 to 2020. As the EU ETS has progressed through these phases, there has been an evolution in the use of allowance auctions.

The use of auctions in the EU ETS has been limited to date. This is, in part, due to decisions made by the European Parliament, which required Member States to freely allocate at least 95 percent of their allowances in Phase I and 90 percent in Phase II, thereby limiting the potential role of auctions. In Phase I, only three Member States (Hungary, Ireland, Lithuania) chose to auction allowances, and each employed a sealed-bid, uniform price auction format. A fourth Member State, Denmark, sold allowances into secondary markets through a financial intermediary. In total, the number of allowances auctioned or sold by Member States during Phase I amounted to less than 0.2 percent of all allowances issued under the EU ETS.

Auctions are being employed somewhat more in Phase II (up to 10% of allowances), with roughly half of Member States planning to auction or sell allowances. These will collectively amount to at least 3 percent of all allowances issued across the European Union.

Since November 2008, the United Kingdom has already held two single-round, sealed-bid, uniform price auctions, which yielded a combined \$144 million (€109 million) in revenue. Eight more auctions are planned between now and April 2010. In total, the United Kingdom expects to auction at least 7% of its Phase II allowances. Entities wishing to make competitive bids in these auctions must make them through financial institutions that act as intermediaries and directly participate in the auctions. Going forward, businesses will also be able to submit non-competitive bids for up to 10,000 allowances in an auction. Those submitting non-competitive bids agree to pay the auction's clearing price that is established through competitive bidding.

Britain's 2007 Finance Act authorized Her Majesty's Treasury to conduct these auctions. In turn, the auctions are being run by the U.K. Debt Management Office, an Executive Agency of Her Majesty's Treasury that is also responsible for auctioning U.K. Government securities (Gilts) and U.K. Treasury bills. Her Majesty's Treasury has also appointed an Independent Observer to oversee the auctions, whose role is similar to that of an auditor. Auction revenue is deposited into the United Kingdom's consolidated fund for general spending purposes.

There will be a substantial increase in the use of auctions in Phase III of the EU ETS. This significant shift followed from the recognition that free allocation of nearly all allowances has led many firms that received those allowances to realize windfall profits. In particular, with limited exceptions, the European Parliament has prohibited Member States from freely allocating allowances to the electricity sector, and has limited free allocations to other covered sectors. As a result, more than half of all allowances are expected to be auctioned in 2013, and this share is expected to increase thereafter. While the EU will not publish final guidelines for allowance auctions until next year, some principles have already been established. In particular, auctions must be open to all participants — not just to regulated entities — and must be conducted in an “open, transparent, harmonised and non-discriminatory manner.” While Member States can ultimately use auctions revenues as they wish, the European Parliament is encouraging States to use at least half of all revenues to fund climate-related mitigation and adaptation efforts in Europe and in developing countries.

#### Regional Greenhouse Gas Initiative

The Regional Greenhouse Gas Initiative (RGGI), which is the first mandatory GHG cap-and-trade program in the United States, covers 10 participating states in the mid-Atlantic and northeast (CT, DE, MA, MD, ME, NH, NJ, NY RI, VT). RGGI covers GHG emissions from electric power plants, and mandates a 10 percent reduction in emissions from 2009 levels by 2018. Auctions play a key role in allowance allocation in RGGI. Auctioned shares are set by each state, and currently average 85 percent across all the states; the majority of states auction 100 percent. Auction revenues are spent at the discretion of each state, and a substantial share is devoted to promoting energy efficiency. The participating RGGI states are implementing a regional auction platform to sell CO<sub>2</sub> allowances that each state issues, resulting in a single price in each auction.



Here are some basic features of RGGI auctions. Auctions occur on a quarterly basis via an online auction platform, using a uniform price, sealed bid, single round format with a pre-announced reserve price. This reserve price establishes a lower bound on the auction's clearing price. Auctions are open to all parties who complete a Qualification Application and provide financial security in the form of cash, bond, or letter of credit. A party's maximum bid cannot exceed the amount of its financial security. No entity may buy more than 25 percent of the allowances for sale at any given auction. The auction clearing price is posted on the website after the auction, and financial settlement commences immediately following posting of the auction's clearing price. The clearing price for 2009 allowances at the most recent auction in March was \$3.51 per short ton of CO<sub>2</sub>, and the auction generated over \$100 million in revenue. An independent market monitor oversees auctions and market activity. The monitor reports any bidder behavior that may have a material effect on the efficiency and performance of the auction. This independent monitoring is intended to help maintain a transparent auction mechanism that is free of irregularities.

The following principles established to guide development of RGGI auctions highlight some desirable characteristics of allowance auctions.<sup>1</sup>

- Fairness and transparency – auction participants and the public should understand the auctions and consider them to be credible.
- Efficiency – allowances should go to bidders who place the highest value on them. Efficient allocation of allowances means emissions reductions are made at least cost.
- Price discovery – accurate price discovery in an auction can help identify a market price close to the marginal cost of reducing emissions.
- Revenue – subject to efficiency and other goals, auctions should also effectively raise revenues.
- Minimize collusion – the system should limit opportunities for participants to engage in non-competitive behavior that could undermine auction prices.
- Minimize price volatility – price variability should reflect new information on fundamentals, not features of the auction design.
- Liquidity – auctions should not reduce the liquidity of the broad allowance market by limiting trading options or generating systematically different prices from the secondary market.
- Low cost – auctions should limit administrative costs, and avoid imposing high transaction costs on auction participants. For example, automated online systems can help control administrative and transaction costs.

---

<sup>1</sup>Based on Holt, C., W. Shobe, D. Burtraw, K. Palmer, and J. Goeree. 2007. "Auction Design for Selling CO<sub>2</sub> Emission Allowances Under the Regional Greenhouse Gas Initiative." Final Report.

**Concluding Comments**

The Treasury Department recognizes that designing a working auction scheme for a cap-and-trade program will require careful consideration and substantial expertise. As we move forward in enacting and implementing cap-and-trade legislation, we expect that — together with domestic and international experiences in other cap-and-trade allowance auctions — Treasury's long experience in developing and conducting auctions will offer important insights in the design and operation of high-stakes GHG allowance auctions.

**Prepared Statement of  
Anne E. Smith, Ph.D.  
on  
“Auctioning under Cap and Trade: Design, Participation and Distribution of Revenues”  
before the  
U.S. Senate Committee on Finance  
Washington, DC  
May 7, 2009**

Mr. Chairman and Members of the Committee:

Thank you for your invitation to participate in today’s hearing. I am Anne E. Smith, a Vice President of CRA International and leader of its Climate and Sustainability Group. Starting with my Ph.D. thesis in economics at Stanford University, I have spent the past thirty years assessing the most cost-effective ways to design policies for managing environmental risks, including cap-and-trade systems. For the past twenty years I have focused my attention on the design of policies to address climate change risks, with a particular interest in the implications of different ways of implementing greenhouse gas (GHG) emissions trading programs. I have analyzed and commented on the merits and issues with all the major climate legislation proposals that the U.S. Congress has proposed and deliberated over that period. 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 this hearing is auctioning under a cap-and-trade program. Policy makers are increasingly considering relying on allowance auctions more than on free allocations to distribute the allowances under a carbon cap-and-trade policy. Once the goal of the auction is well-defined, designing an auction to achieve that goal is a technical matter more than a policy matter. In contrast, the question of what to do with the revenues from a carbon auction (the “carbon value”) is a very substantial policy matter. As the portion of the carbon value that is collected and redistributed by the government grows under a cap-and-trade program, the differences between cap-and-trade and a carbon fee or tax diminish. In my testimony, I highlight the remaining differences – which are predominantly related to uncertainties – and explain why effective management of that uncertainty is a critical aspect of a long-term, enduring carbon policy.

**Distributing Carbon Value under Auctions versus Free Allocations**

A cap-and-trade program with 100% auction of allowances would actually function much like any other cap-and-trade program that relies on free allocations. In the absence of any auction, if all the allowances are allocated to parties with compliance requirements, an allowance market forms naturally. Participants in that market include companies buying and selling solely to serve their compliance needs, but also include non-compliance traders (who I refer to as “speculators” but could include traders who are using allowance trading

to hedge against energy or other price changes driven by carbon prices). The latter parties are considered helpful, especially during the period of market formation. If allowances are only available through a government auction, there will be no literal allowance transactions until after the first auction, but a secondary market for allowances would form immediately after the first auction. This secondary market will have all the same players as in the primary market that forms in the absence of any auction. Thus, even if participation in the auction were to be limited to compliance buyers only, speculators would still play an active role from the outset of the cap-and-trade policy.

In general, prices in the secondary market and in the auctions will converge, because they are selling identical products. However, this does not mean that there will be any difference in price uncertainty or volatility under an auction-dominated or an allocations-dominated cap. Both approaches to cap-and-trade will be marked by *a priori* uncertainty about fundamental carbon price levels, and *ex post* continual volatility in prices. The main difference between an auctioning approach and an allocations approach would be the technique by which the carbon value is distributed. Under an auction, that value would be distributed in the form of cash (e.g., via subsidies under other government programs, via increased spending by the government, or as direct rebate checks) after the auction is over. In contrast, under an allocations approach, the same amount of value as the auction revenue is distributed in the form of pieces of paper (i.e., "allowances") in advance of market start-up that the recipients can then convert into cash by selling them.

Theoretically, any distribution of carbon value that can be accomplished under an auction can also be accomplished under free allocations. In practice, there are two key differences that may arise:

1. Free allocations to those with compliance obligations have been treated in the past (e.g., under the Title IV SO<sub>2</sub> cap) as having a zero basis for tax purposes. If used for the recipient's compliance, there are no tax consequences. However, if the recipient sells any such free allocations, it must pay tax on the full profit from a zero basis. If the recipient needs to buy more allowances in the future, it incurs the full market cost. Thus, there is an incremental incentive for recipients of free allocations who have compliance obligations to hold unused allowances that were originally allocated for free, in order to use them for meeting future compliance obligations for which they would otherwise expect to need to buy more allowances. This tax-related concern can be mitigated in several ways other than simply avoiding free allocations.<sup>1</sup>
2. In practice, it is easier for the government to distribute the value of the allowances broadly to many small entities such as individual households and small businesses, if the government first converts that value into a pool of cash through an auction. Achieving broad allocations of relatively small amounts of value without an auction would entail the government sending out just a few allowance certificates to many different entities. These entities would then have to bear the burden of converting

---

<sup>1</sup> One way to eliminate the effect could be to change the rule that the tax basis of a free allocation is zero, and assign it a value equal to allowance prices at the time of the allocation.

them to cash, which would impose higher transactions costs, and could lead to scams and swindles of consumers or small businesses with little sophistication about the policy and few options for monetization. Such an allocation scheme could also produce an exceptionally thin market and very high prices in the initial years. Thus, any desire to distribute a portion of the carbon value broadly and in relatively small amounts per recipient will require an auction of that portion of the allowances. (Whether the Federal government should conduct the auction or designate a trustee to do it requires a more extended discussion.)

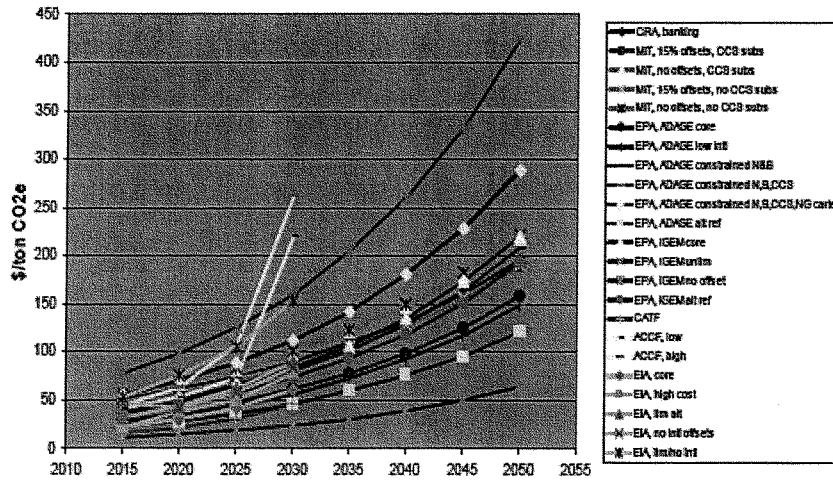
### **Benefits of Carbon Price Stability for the Government**

If one perceives the above two points are arguments in favor of auctions over free allocations, it is worth considering what can be accomplished under a policy that directly establishes a price on carbon (or even a fairly narrow price collar), instead of relying on the uncertain price outcomes of an auction. The same benefits mentioned above would be maintained: no tax-related disincentives to trading, and greatly enhanced flexibility to distribute the carbon value more widely across many players in the economy. At the same time, an approach that directly establishes a carbon price, or directly narrows its range of variability, offers some additional benefits over an auction under a hard cap. These relate to the inevitable fact that carbon prices under a hard cap are highly uncertain in advance of policy implementation and are volatile long after implementation.

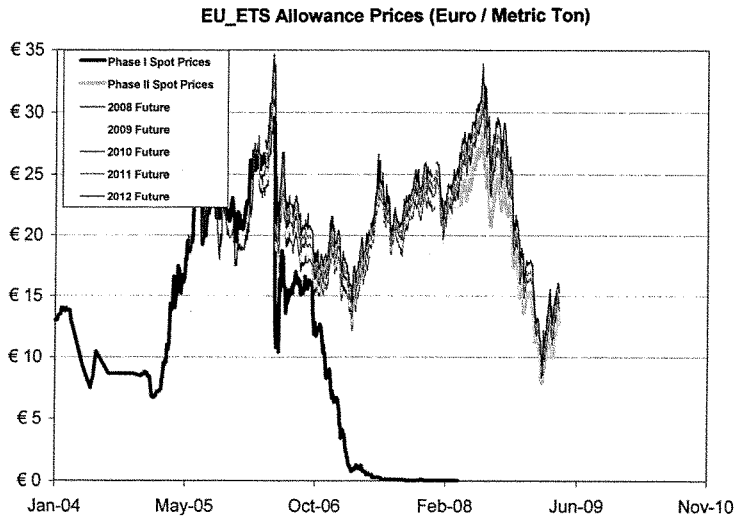
The pronounced degree of *a priori* price level uncertainty is apparent in the wide range of carbon price estimates produced by policy analysts using models of the economy. Figure 1 shows how estimates of carbon prices for the Lieberman-Warner Bill varied by about a factor of eight, even for the first year of the policy. This range does not just reflect alternative modelers' views: the minimum and maximum of the range both came from the EPA's analyses.

A pattern of *ex post* continuation of price instability or price volatility is also the norm in emissions markets. Figure 2 below prices in the EU's Emissions Trading Scheme (ETS) for carbon. Even ignoring the volatility in its learning phase ("Phase I" which ended in 2007), volatility continues to be endemic to this carbon market now that it is in its mature phase (see the "Phase II" prices in Figure 2). For example, many people mistakenly believe that the EU ETS's high price peak near €35/ton (roughly \$42/ton) that was followed by a rapid descent to prices below €15/ton (roughly \$18/ton) was a phenomenon confined to the learning during Phase I. However, as Figure 1 shows, Phase II prices have been even more volatile since that time. Less than a year ago, Phase II prices again peaked near €35/ton, and only eight months later they hit a low of about €8/ton. This volatility was not a result of "learning," nor of the first release of official emissions data. It was tied to

**Figure 1. Range of Carbon Prices Projected for Lieberman-Warner Bill**  
 (Source: T. Wilson, "Understanding Model Estimates of the Economic Costs of Climate Policy," EPRI Modeling Workshop, Washington, DC, May 8, 2008)



**Figure 2. Prices Experienced in the EU ETS's Phase I and II.**



macroeconomic outcomes unrelated to the carbon market *per se*. It is an example of what can be expected of any carbon market in the U.S. if firm price ceilings are not enacted with it.<sup>2</sup>

Government auction revenues will fluctuate continually, perhaps dramatically, in the face of such price uncertainty. The future path of revenues will also be very difficult to predict. The government ought to prefer to know what the carbon price level will be in advance of establishing its policies, enabling fairly robust estimates of the revenues that it will be receiving, and how they will change over time. This would enhance the prospects for providing stable funding for whatever rebate, subsidy, research and other programs the government may wish to fund with the carbon revenues. It will help avoid potentially disruptive year to year fluctuations in program funding, and fluctuations in the size of the rebate checks that consumers will come to expect, and perhaps even start to incorporate into their household budgets.

Thus, carbon price stability and *a priori* certainty can only be beneficial from the Federal government's perspective. Further, it is entirely in the government's hands to create such price certainty at the time that it enacts the policy that creates any carbon value at all. This could be done under a carbon cap through provisions to directly and transparently establish allowance price ceilings and price floors (e.g., a price "collar"). An even simpler and more certain approach within the toolkit of market-based measures would be to establish a carbon fee or price rather than through a carbon cap.<sup>3</sup>

#### **Benefits of Carbon Price Stability for the Economy as a Whole**

The private sector also will benefit from a carbon policy that offers carbon price certainty. For example, if the carbon price is known in advance – including how it can be expected to

---

<sup>2</sup> The EU ETS is not an outlier among emissions markets. Almost all of the U.S. emissions caps have experienced comparable volatility. For example, the SO<sub>2</sub> market under Title IV of the Clean Air Act is widely considered to have been a highly successful cap-and-trade program, but has nevertheless suffered exceptional volatility in the past few years. 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. They dropped below \$100/ton in mid-2008 when the court remanded CAIR. Some have argued that banking reduces price volatility. While it may reduce it, it certainly does not eliminate it: this high SO<sub>2</sub> price high volatility occurred even though there was a large bank of allowances in place. Although prices in all previous and existing allowance trading programs have exhibited substantial volatility without causing much macroeconomic consternation, such price volatility is likely to have much greater generalized economic impacts under 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.

<sup>3</sup> In fact, a cap-and-trade system with a well-defined, narrow price collar and a full auction will function just like a carbon fee, except that there remains some residual uncertainty about the ability of the market manager to defend the price collar, and there is substantially more complexity to the compliance requirements for covered businesses. While both of these market-based approaches would offer much greater planning certainty and hence potential investment in costly low-carbon technologies, neither would be popular with the financial community, which would face diminished prospects for selling their carbon market management services to the affected businesses.

change many years forward, covered emitters can plan compliance more easily. They will be far more willing to undertake major capital investments in advanced, low-carbon technologies if they have some confidence that the carbon price level will either rise to, or continue to remain at levels that make such investments cost-effective. They may also find it easier to obtain funding for such investments if they are subject to less market risk. These are the predominant benefits of a policy that much more directly establishes a carbon price. An additional benefit is that emitters also can avoid the complex process of developing bidding strategies for auctions and hedging strategies for fine-tuning their needs in the secondary market.

The EU ETS experience has also demonstrated that even very high carbon prices do not necessarily translate into a willingness of the private sector to make investments in new, lower-carbon technologies. Despite the fairly high average prices in the EU ETS, there has been no serious degree of private sector investments in cleaner technologies.<sup>4</sup> The usual explanation for the failure of the EU ETS to motivate investments in clean energy technologies is the uncertainty its carbon price levels, and potential impermanence of the scheme. Even if investments in some clean technologies might be justifiable for the average carbon prices of about €20/ton that have been experienced over the past four years, they have not been forthcoming. Uncertainty on what the carbon price level will be – not just for the next few years but for 10 to 20 years into the future – appears to be inhibiting private sector investments in low-carbon technologies.

The EU's response to this outcome of low investment has been to focus on further government involvement and project subsidization. A simpler approach would be to devise a carbon emissions pricing scheme that would provide much greater certainty for businesses about carbon prices now and in the future.

Another potentially serious concern with volatility in carbon prices should also be mentioned here. When companies need to buy allowances to cover their emissions, as with a full auction, their new cash flow may be large compared to their current net revenue. For example, the cash needed by an electricity generating company that has a diversified mix of coal, gas and zero-carbon generation similar to the US average would face new outlays for allowance purchases of \$35/ton allowances that are approximately 20% of its gross revenues, and perhaps 200% of its net revenues. Any delays in the pass-through of such costs to customers could seriously disrupt their financial position. Volatility exacerbates this situation by causing continual variations in the cash flow needs. For example, fluctuation in the allowance price between \$15/ton and \$50/ton would mean that the cash flow requirements might vary from 85% and 350% of pre-policy cash flows, thus even after price pass-through has occurred, delays in adjustments of the retail rates could translate into see-sawing profitability. Similarly, if a company has any substantial bank of allowances, it could face large swings in its balance sheet situation. Conditions such as these could translate into reduced credit ratings and companies facing more difficulties in raising capital for their investment needs. This possibility has not been studied at all yet, but certainly requires some careful study, including gaining an understanding of whether

---

<sup>4</sup> The fairly high rate of investment in renewables such as wind and solar in Germany is traceable to the very high guaranteed returns known as "feed in tariffs" for such generation, and is not attributed to carbon prices.



any potential financial impacts could be exacerbated by the greater use of allocations rather than free allocations of allowances. But the better solution is simply to eliminate the carbon price volatility, which is not in any way essential to the functionality of a market-based carbon reduction policy.

#### **Dissection of Arguments against Providing Carbon Price Certainty**

Given both the government and private sector advantages of having well-defined carbon price expectations, one might ask why there is such strong preference among many cap-and-trade advocates to retain price volatility. I believe this comes from two sources: the existence of an influential sector that has a strong vested interest in preserving uncertainty and volatility, and a misconception about what makes a “market-based approach” work.

##### **A) The financial products community would not benefit under a tax like it would under an auction.**

Even under a 100% auction there would be a thriving secondary carbon market, and substantial price uncertainty and volatility to manage. These are the phenomena that create demand for new and different services from the financial community (e.g., hedge funds, traders, etc.). It is correct that *if there is to be a cap-and-trade approach*, then such speculators and risk managers have an important role to play which cannot be eliminated by resorting to an auction. A policy approach that offers carbon price stability would effectively eliminate the secondary market and the need for risk management services – and thus eliminate the prospects of a lucrative new area of financial products and services.

The financial sector’s loss of potentially large new revenue sources does not mean that this is a loss of wealth in the economy at large. It simply eliminates the ability of the financial community to divert some of that wealth to itself, at the cost of its clients who must also contend with the cost of reducing their emissions.

##### **B) The “market” is not what makes cap-and-trade work, it is the “carbon price”.**

If the auction is designed well, its clearing price will reveal the marginal cost of control to meet the emissions cap. Compliance bidders will be induced to make additional controls if they can do so more cheaply than the clearing price, and thus the carbon price from an auction will induce the most cost-effective degree of control action. That is, the use of a mechanism that sets a clear, uniform price on emissions helps reduce emissions to a cap in a way that minimizes the deadweight loss, or net cost of the policy. The same occurs if the government simply taxes emissions. The tax rate is the price on emissions, just like the auction clearing price, and it provides the same inducement to control emissions if doing so is cheaper than paying the emissions price. The only difference is that if the tax rate is fixed in advance of the policy, it is not clear what amount of emissions reduction will actually occur – particularly in the first few years of the new policy. The emissions reductions under the tax would still occur in least-cost order, given that a common price signal is being used. However, to get to a specific emissions reduction level – if that were the overriding goal – the government would have to adjust the tax rate multiple times.

Thus, an emissions cap (whether 100% auction or not) works just like an emissions tax, except that the tax rate is unknown in advance.

This also should make it clear that it is not “the market” that enables emissions to be reduced in a least-cost manner: *it is the existence of a price on emissions*. It is a widely held misconception is that “market-based measures” for controlling emissions exist only if there is a mandatory cap, tradable allowances, and active trading. In fact, a reading of the economics literature that gave rise to the concept of market-based measures makes it clear that the critical element for least cost policy designs is that individual emissions control decisions be guided by a common, uniform price on emissions. Both a carbon tax and a cap-and-trade (with or without auctions) are “market-based” measures: both achieve an efficient mix of controls through that price signal. The difference is that under a cap, the carbon price varies because achieving emissions exactly at the cap (no higher and no lower) is presumed to be more critical than the costs that such rigidity about precise amounts of emissions reductions imposes on the economy at large. The consequence of this presumption is not just the dramatic variability in allowance prices that we have observed under all policies with hard caps. In the case of carbon caps, it will also translate into high macroeconomic costs.

In the carbon policy debate, those who are adamantly in favor of a cap over a steady, well-defined price on emissions offer a false choice to policy makers. They say that we must have an active carbon market with constantly varying allowance prices or else we cannot have the cost-minimizing benefits of a “market-based approach.” They insist that carbon price uncertainty and volatility are healthy signs that the market is working. Their language is conceals their true assumptions: carbon price volatility is only an inherent part of an efficient carbon policy if one insists that a very specific level of emissions be achieved within the U.S., and during a specific period of years. These advocates are not assigning sanctity to the market, they are assigning sanctity to their specific cap.

There is no scientific basis for such rigid views on the necessity of meeting any specific cap. The precise level of U.S. emissions will not affect climate risks in any quantifiable way if they are on a general track towards near-zero emissions. This is particularly true because global climate outcomes over the next century will be determined by controls on developing country emissions much more so than by a few percentage points of difference in U.S. emissions during the next couple of decades. Expressions of fears that price certainty would take away the certainty of adequate reductions in emissions are misplaced. The certainty needed for emissions is their long-term reduction to nearly zero, not any specific reduction in a specific year. Achieving that goal will require sustained investment in utterly new directions, which is more likely to happen under a policy that establishes a carbon price signal that is predictable and credible for decades to come.

At the same time, the decision to embrace such rigid views in a carbon policy imposes some economic costs of its own that could seriously undercut the theoretical promise of cost-effectiveness associated the cap-and-trade form of market-based regulation. Price uncertainty and price volatility are not costless phenomena for businesses. 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>5</sup> Further, if policy costs turn out to be truly excessive, this unnecessary rigidity over caps that are set at inherently arbitrary levels in the first place could undermine the goal of steady progress towards the long-term goal of near-zero emissions.

#### **Misconceptions about the Cost of a Cap-and-Trade Program**

Achieving the degree of global greenhouse gas (GHG) emissions control that is necessary to significantly reduce the risks of climate change will be costly, no matter how it is done. Indeed, for cap-and-trade to work, the policy has to drive prices for conventional energy up enough to make people prefer the more costly, low-carbon energy options. To make such changes viable as a political and social matter demands a focus on minimizing the costs of making a transition to a low-carbon economy. Policy practice and theory have demonstrated that market-based approaches offer the best prospects for minimizing cost of achieving regulatory goals. Assurance of a transparent and efficient carbon market therefore should be a central concern in a climate policy. Having minimal price uncertainty is clear a part of the solution. One might ask why so few people appear to be concerned about overall policy costs as well.

#### **There will never be enough value to offset all the costs of a carbon limit of any form.**

Some of this lack of concern may be traceable to a belief that the carbon value inherent in the allocations created under a cap-and-trade program is so large that it can actually offset the costs of the carbon reductions that the policy also imposes. It may be helpful to explore the similarities between the cap-and-trade and carbon tax approaches to understand why this cannot happen.

Few people seem to have difficulty understanding that a carbon tax would create net costs on the economy, even as it would generate very large revenues for the government to redistribute. This may be because there is a general understanding among those involved in public finance that when a tax raises revenues, it also always leaves behind a "deadweight loss," which is the cost of the tax policy. The tax payments are one part of costs to taxpayers, and the changes in markets due to the higher price of the taxed goods are a less direct and separate cost. At best, the government can redistribute all of the tax revenues back into the economy, but this revenue recycling will never alter the deadweight loss of the policy.

Under a 100% carbon auction, the phenomenon will be identical: the auction of allowances will create revenues to the government just as if the clearing price of carbon were a carbon tax. The cost of controlling emissions down to the cap will be the equivalent of a tax's deadweight loss. This is the net cost of the policy, and it cannot be reduced by any scheme for recycling the auction revenues. At best, recycling auction revenues can compensate some of the parties for their costs of reducing emissions; but in compensating them,

---

<sup>5</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.

different losers will be created. Further, if the revenues are recycled to make some parties even better off than they are today, that will only deepen the costs borne by those who would be harmed by the policy. The net cost cannot be “recycled away.”

The situation for a cap-and-trade with free allocations is a more complex situation to compare to the tax, but the effect on the economy is the same. Free allocations are just a different way of distributing carbon values in which the distribution occurs without the government first monetizing the carbon value. But there is still a deadweight loss from the act of imposing a price on carbon emissions in order to ration them. No matter what formula the government uses to allocate allowances, there will still be a net cost incurred by the economy as a whole as a result of the policy. That net cost will be the cost of controlling emissions down to the cap, and it is completely separate from the value of the remaining pool of emissions (i.e., the erstwhile auction revenues). The latter is simply a set of transfer payments while the former is a true cost, or loss of economic welfare.

Thus, any carbon-limiting policy will have a net cost. This is true for carbon taxes, caps with price ceilings, and hard caps with 100% auctions or with 100% allocations. In each case, the net cost will be determined primarily by the stringency of the carbon limit, while the distribution of carbon revenues and/or free allocations will determine the pattern of winners and losers across the economy. All of these market-based approaches function much the same as a carbon tax, except that under the hard cap approaches, the effective tax rate is unknown. That carbon price uncertainty, however, allows actual policy costs of the hard cap approaches to rise above the least-cost solution that all market-based approaches are *theoretically* supposed to offer.<sup>6</sup> These extra costs come from mistaken expectations, greater risk aversion, and more risk management activities necessary to manage the price uncertainty. These added costs will be incurred for only one reason: an excessive concern about precisely achieving pre-specific but essentially arbitrary emissions caps.

**A carbon cap or tax will cause net job reductions for the whole economy, even though “green jobs” will be created.**

Another, even more widely held misconception about cap-and-trade policy is the view that it will create new jobs. A corollary to the fact that any carbon-limiting policy will have a net economic cost, is that a carbon-limiting policy cannot produce a net boost to overall employment.

There is no question that a shift to lower-emitting forms of energy will create new jobs in new areas of economic activity involving low-carbon energy supplies and energy efficiency. However, these jobs would be created only because the carbon policy would be forcing out economic activities producing goods and services for consumers and replacing them with activities that support producing more expensive forms of energy. When our economy’s productive processes are required to use more costly inputs to produce the same outputs, overall worker productivity will fall, and aggregate payments to workers will also have to fall. This leads to a number of possibilities that reconcile the presence of new types

---

<sup>6</sup> The theoretical solution being one that occurs under assumptions of perfect certainty.

of jobs with reduced payments to labor across the economy. Some or all of the following would have to occur:

- The new “green jobs” may be lower paying.
- Some of the new “green jobs” may employ people outside of the U.S.
- The new “green jobs” will be fewer in number than losses in jobs elsewhere in the economy.

In general equilibrium analyses I have conducted of the cost of carbon policies, it becomes apparent that the vast majority (about 80%) of the job losses that would accompany such a policy will be reductions in employment opportunities in the services and commercial sectors.<sup>7</sup> These will tend to be “silent” losses of opportunity in the relatively low-wage portions of the economy that are least often associated with either the emitting sectors who will face the direct cost of the policy, or the activities where the most overt examples of new “green jobs” will be found. These net job losses are engendered by the indirect effects on our economy of using higher cost forms of energy.

#### **Carbon Prices Alone Do Not Provide Sufficient Incentives for the Transformational Innovation Needed to Stabilize Atmospheric GHGs**

My testimony has been focused on carbon market design options. However, even a highly effective and efficient market-based approach for GHGs will still have a serious limitation that most carbon bills have not attempted to fill. Stabilization of climate change risks will require that global 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. 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 transformational energy technology research and development (R&D).

Economic analysis shows that market forces produce a less than socially optimal quantity of R&D, because private entities funding research may not be able to benefit financially from their innovations to the same degree that society as a whole would benefit. Patent protections and other intellectual property rights are intended to minimize this wedge between private and societal benefits from R&D. However, 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. It will require breakthroughs in basic science, placing much of the most essential R&D results beyond the boundaries of patent protection. Market-based policies that place a price on carbon can very effectively stimulate incremental innovation and deployment into the market place of emerging new technologies. However, their ability to motivate major high-risk investments in

---

<sup>7</sup> Anne E. Smith, “Net Job Impacts of Climate Policy,” CRA International presentation at the Policy Forum on Green Jobs, American Enterprise Institute, February 12, 2009 (available at [http://www.aei.org/docLib/20090213\\_Smithpresentation.pdf](http://www.aei.org/docLib/20090213_Smithpresentation.pdf)).

transformational technologies is hampered by concerns with the credibility of the government sustaining very high carbon prices as a matter of policy, once such technologies may become available. This concern undercuts the power of carbon pricing policies to promote riskier forms of private sector R&D directed toward the longer-term, more advanced technological solutions to abatement.<sup>8</sup>

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 needs to be built into any carbon-limiting policy. The difficult decisions, which have barely been addressed to date, are how much to spend now, and how to design programs to stimulate R&D that avoid mistakes of the past.<sup>9</sup> The current focus of carbon policy discussions (including today's hearing) has been almost entirely about how to impose near-term controls through cap-and-trade programs. This is encouraging policy makers to neglect much more important, more urgently needed actions for greatly expanded government-funded R&D program, along with concerted efforts to reduce barriers to technology transfer to key developing countries.<sup>10</sup> Neither of these will be easy to accomplish effectively, yet they are receiving too little attention by policy makers.

### Summary

To sum up, price uncertainty and price volatility will impose impacts in the case of hard carbon caps that are completely different in scale and scope from those under previous emissions trading programs. The US experience with other emissions caps and the EU ETS experience with carbon caps provide good reason to expect high volatility under a US carbon cap. Their potential to increase variability in overall economic activity thus should be viewed as a core concern in designing a carbon 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 carbon 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. Thus, 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. The emissions certainty that is needed is the long-term reduction to a near carbon-

<sup>8</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, 2008.

<sup>9</sup> Arrow, Kenneth J., Linda R. Cohen, Paul A. David, Robert W. Hahn, Charles D. Kolstad, Lee Lane, W. David Montgomery, Richard R. Nelson, Roger G. Noll, Anne E. Smith (2008). "A Statement on the Appropriate Role for Research and Development in Climate Policy." AEI Center for Regulatory and Market Studies, Working Paper 08-12.

<sup>10</sup> Some have argued that the U.S. is losing a long-term business opportunity to become a leader in selling advanced, low-carbon technologies, which will eventually open up markets for those technologies in the developing countries. The current expectation of those countries is more that the U.S. will *pay for* implementing those technologies in their countries. (This view is made quite clear in the Bali Accords.) The expectation that any new, transformational technologies will need to be used in developing countries (whether paid for by them or by the developing countries) lends further concerns with future governments' credibility in maintaining a sufficiently high carbon price level to reward innovators for their research investments (see Smith and Montgomery, *op. cit.*)

free economy. That objective will have greater certainty under a cost-effective, affordable and non-disruptive policy that establishes a carbon price signal that is predictable and credible for decades to come. Once a decision is made to rely primarily on auctions rather than free allocations to define the winners and losers under a carbon policy, carbon price uncertainty becomes the primary differentiator remaining between the hard cap approach and market-based approaches that directly set or manage the carbon price.





## COMMUNICATIONS

---

Statement of  
The American Society of Civil Engineers  
Before the  
Committee on Finance  
of the  
U.S. Senate  
on  
Auctioning Under Cap and Trade: Design, Participation and  
Distribution of Revenues  
May 7, 2009

Mr. Chairman and Members of the Committee:

The American Society of Civil Engineers\* (ASCE) appreciates the opportunity to provide these comments to the Committee on Finance as it considers auctioning under cap and trade: design, participation and distribution of revenues.

### ASCE Policy

ASCE supports public and private sector strategies and efforts to achieve significant reductions in greenhouse gas emissions. The United States must establish a comprehensive, long-term infrastructure development and maintenance plan at federal, state and local levels. This plan must support sustainable development through a substantial reduction of greenhouse gas emissions and timely adaptation to the effects of climate change, while maintaining and enhancing environmental quality.

We need to stimulate private investment in greenhouse-gas-reducing technologies by establishing a market value for greenhouse gas emissions over the long term through the auctioning of emissions credits. Congress should therefore create a market for emissions in order to encourage alternative energy sources and to raise revenues to address the problem of America's aging infrastructure. Emissions credits should be auctioned, and a significant portion of the revenues from these credits should be allocated to the Highway Trust Fund and other infrastructure financing methods to support technology investment as well as the necessary investments in "green" upgrades to the nation's deteriorating public works infrastructure in order to reduce greenhouse gas emissions.

---

\* ASCE was founded in 1852 and is the country's oldest national civil engineering organization. It represents 146,000 civil engineers in private practice, government, industry and academia who are dedicated to the advancement of the science and profession of civil engineering. ASCE is a non-profit educational and professional society organized under Part 1.501(c) (3) of the Internal Revenue Code.

By authorizing the allocation (under existing federal infrastructure programs) of revenue from greenhouse gas emissions credits for those infrastructure projects that will reduce greenhouse gas emissions, the program can protect the environment and renew the nation's aging infrastructure. Examples of such infrastructure projects include new public transportation systems; projects to reduce major chokepoints that cause transportation congestion; and improvements in intercity rail transportation.

At the same time, we must establish clear and reasonable targets and schedules for the reduction of greenhouse gas emissions.

We need to improve the energy efficiency of, and the reduction of greenhouse gas emissions from, infrastructure systems over their entire life cycles by making cost-effective use of existing technologies. These improvements should cover all sectors, and include both stationary and mobile sources.

We must encourage the use of non-greenhouse gas emitting energy-generating sources such as nuclear, hydropower, wind and solar, and we must support research into new technologies and materials to further improve energy efficiency and reduce greenhouse gas emissions.

As a nation, we must adopt additional incentives for the short-term development and implementation of high-efficiency and low- or zero-greenhouse-gas-emitting technologies and cost-effective carbon capture and storage.

Finally, ASCE believes that we must provide credits to those industries that take early action to reduce greenhouse gas emissions; encourage actions by other countries to reduce their greenhouse gas emissions; and explore the utilization of forests and the ocean as carbon sinks or other mitigation technologies.

By the end of this century, if current trends continue, atmospheric greenhouse gas concentrations could be twice what they were at the beginning of the industrial revolution. These increased concentrations are predicted to contribute to climate change, causing significant increases in global average temperatures and changes in precipitation patterns. The expected results will be increases in the severity of storms, floods and droughts, all of which will have substantial effects on our infrastructure, economy and quality of life.

Improvements in the durability and resiliency of our infrastructure systems will make them less vulnerable to effects of climate disruption. Improvements in the design and construction of our infrastructure systems can also increase their functionality and safety, and reduce greenhouse gas emissions during their construction and use.

## Climate Change: The Scientific Background

Although the subject of climate change remains controversial in some U.S. political circles, the science is largely undisputed. Scientists at the United States

Geological Survey (USGS) stated as early as 1989 that the Earth's climate had warmed about 1°C (1.8°F) during the previous 100 years. As the climate has warmed following the end of a recent cold period known as the "Little Ice Age" in the 19th century, sea level has been rising about 1 to 2 millimeters per year due to the reduction in volume of ice caps, ice fields, and mountain glaciers in addition to the thermal expansion of ocean water.<sup>1</sup>

The USGS concluded that, if present trends continued (including an increase in global temperatures caused by increased greenhouse-gas emissions), many of the world's mountain glaciers would disappear. For example, at the rate of melting 20 years ago, all glaciers likely would be gone from Glacier National Park, Montana, by the middle of the 21st century. In Iceland, about 11 percent of the island is covered by glaciers (mostly ice caps). If warming continues, Iceland's glaciers will decrease by 40 percent by 2100 and virtually disappear by 2200.

Most of the current global land ice mass is located in the Antarctic and Greenland ice sheets. Complete melting of these ice sheets could lead to a sea-level rise of about 80 meters, whereas melting of all other glaciers could lead to a sea-level rise of only one-half meter.

More recently, the Environmental Protection Agency reported the following: "Since the Industrial Revolution (around 1750), human activities have substantially added to the amount of heat-trapping greenhouse gases in the atmosphere. The burning of fossil fuels and biomass (living matter such as vegetation) has also resulted in emissions of aerosols that absorb and emit heat, and reflect light."<sup>2</sup>

Meanwhile, economists have been concerned for more than three decades about the issue of climate change and the release of carbon dioxide based on their likely influence on the world economy.<sup>3</sup>

## The European Experience

The legal basis of the European Climate Change Program is the 2003 ETS Directive, which established a cap-and-trade program for greenhouse gases in the European Union. The ETS is the EU's main tool for reaching its Kyoto Protocol target. The ETS Directive is binding legislation that was enacted in 2003 by the European Parliament and the European Council. The Directive created the cap-and-trade scheme, which began with a two-year start-up phase (2005-2007). The second phase (2008-2012) coincides with the Kyoto Protocol's commitment period.<sup>4</sup> Carbon dioxide emissions from selected heavy industries were the focus of the start-up phase, with the idea that the sectors and pollutants covered would expand in the second phase.<sup>5</sup>

The program covers 45 percent of the continent's emissions from 10,000 companies in 27 EU countries. It has built registries that list carbon dioxide emissions for every major plant.

The first-phase program has experienced serious problems. For one thing, many emissions credits were given away at no cost to power plants. The credits were less than the plants needed to abate their emissions, requiring them to buy some credits on the open market. These plants bought credits and then charged their energy customers the equivalent price of *all* credits—including the credits they received at no cost. This increased corporate profits and drove up the cost of energy.<sup>6</sup>

Another problem arose from the fact that the EU assigned too many carbon emissions credits to polluting firms, causing the price of the credits to collapse. This over allocation was based on faulty economic models based on overly optimistic estimates of economic growth. EU countries overestimated the amount of carbon that would be released under the normal business cycle. This led to the allocation of more credits than necessary.

“Although there certainly were some [EU members] in which over allocations were partly due to real emission reductions, in most cases it was overly generous allocations to companies that caused this decline in prices.”<sup>7</sup>

Finally, the refusal of the United States to commit to the Kyoto process significantly hampered the EU cap-and-trade program from the outset. With the U.S. on the sidelines, economic modeling indicated that the price of permits in Europe would fall dramatically as required emissions reductions declined.<sup>8</sup>

The European experience argues for a robust American cap-and-trade program within an international framework. Under the U.S. program, most of the emissions credits should be auctioned based upon realistic calculations of total carbon dioxide releases from power plants, motor vehicles, and other sources. A significant portion of the revenues from these credit sales should be allocated to carbon-reducing infrastructure investments across the spectrum—highways, bridges, levees, dams, wastewater and drinking-water treatment plants, ports and inland waterways, airports, and other systems essential to the growth and sustainability of the U.S. economy.

# # #

---

**ENDNOTES**

<sup>1</sup> See <http://pubs.usgs.gov/fs/fs2-00/> .

<sup>2</sup> U.S. ENVIRONMENTAL PROTECTION AGENCY, RECENT CLIMATE CHANGE, *available at* <http://www.epa.gov/climatechange/science/recentcc.html>.

<sup>3</sup> See, e.g., William D. Nordhaus, *Economic Growth and Climate: The Carbon Dioxide Problem*, 67 AM. ECON. REV. 341 (1977) (“The most careful study to date predicts that a doubling of atmospheric concentrations of carbon dioxide would eventually lead to a global mean temperature increase of 3°C.”).

<sup>4</sup> Vivian E. Thomson, *Early Observations on the European Union’s Greenhouse Gas Emission Trading Scheme: Insights for United States Policymakers* 5 (Apr. 19, 2006).

<sup>5</sup> *Id.*

<sup>6</sup> Most emissions credits under various American legislative proposals would be sold at auction, with the revenue going to the Treasury.

<sup>7</sup> SPEECH OF STAVROS DIMAS, MEMBER, EUROPEAN COMMISSION, IMPROVING ENVIRONMENTAL QUALITY THROUGH CARBON TRADING (May 2, 2007), *available at* <http://europa.eu/rapid/pressReleasesAction.do?reference=SPEECH/07/265&format=HTML&aged=1&language=EN&guiLanguage=en>.

<sup>8</sup> William D. Nordhaus, *Life after Kyoto: Alternative Approaches to Global Warming Policies* 8, NBER Working Paper 11889 (December 2005), *available at* <http://www.nber.org/papers/w11889>



May 19, 2009

Senate Committee on Finance  
Attn: Editorial and Document Section  
219 Dirksen Senate Office Building  
Washington, D.C. 20510-6200

RE: Senate Finance Committee Hearing: "Auctioning under Cap and Trade: Design, Participation and Distribution of Revenues" May 7, 2009, at 10:00 a.m.

Dear Chairman Baucus and Ranking Member Grassley:

The Association of Public and Land-grant Universities (A·P·L·U), with 218 members including flagship and leading research universities in every state, would like to comment for the record on the Committee's May 7<sup>th</sup> hearing "Auctioning under Cap and Trade: Design, Participation and Distribution of Revenues." Under the leadership of Presidents Gordon Gee of The Ohio State University and Elsa Murano of Texas A&M University, A·P·L·U has undertaken a major effort to help direct the talents of its member institutions towards the goal of helping solve our nation's energy problems in a manner consistent with environmental protection and climate stabilization.

The commitment to undertake this initiative was made by A·P·L·U's membership at its annual meeting last Fall where the university presidents in attendance expressed strong support for an organized effort to maximize university contributions in energy research and development, in endeavors to move university inventions related to energy into the commercial marketplace, in application of the social sciences to understanding behavior related to energy use, and in energy education at all levels.

While we do not have a position on the regulatory mechanism for achieving climate change mitigation, we recognize that there is strong scientific evidence that climate change must be addressed and that our knowledge base for addressing this problem is insufficient. Significant expert studies in recent years have concluded that there is both a direct correlation between increased energy research and development (R&D) spending and increased innovation and invention in the energy sector and that substantially increased energy R&D funding is a necessary ingredient in addressing our energy needs and solving our climate problems. Therefore, we strongly urge the Committee to direct that a specific portion of any new revenues, generated under whatever system the Congress decides is appropriate, be applied directly to finding the answers we need to solve our energy problems through strong funding for energy research and development and technology demonstration. We note that any success in creating new clean energy innovations will decrease carbon emissions, reduce our dependence on foreign

oil, and reduce, but not eliminate, the disruptive impacts of such a regulatory system. We recommend the Committee front-load this R&D investment because the sooner research breakthroughs occur, the less man-made environmental change will occur.

Along with the country and much of the world, we are looking to the U.S. government for leadership and coordination in this area. It is crucial that the Federal government's commitment to the development and deployment of new technologies be long-term and be sustained -- even during periods when energy prices decline. Significant increases in federally-funded energy research and development in the 1970s were quickly followed by significant reductions in the Federal energy research and development (R&D) efforts in the early 1980s, when energy prices dropped. Researchers preparing for energy R&D careers did not have resources to continue and left the field. Efforts to develop new energy technologies stagnated and the annual number of energy inventions declined significantly, depriving us today of the new energy options that increased research would have provided. In 2005, U.S. spending on energy research and development was still only two percent of all U.S. R&D spending as compared to being 10 percent in 1980.

Another adverse effect of our nation's decline in energy research has been our nation's decline in capabilities in world energy technology markets. In the late 1970s, the U.S. was viewed as the world leader in much of energy technology, but that has changed dramatically. The next generation of nuclear technology may well come from France. Denmark has emerged as a world leader in wind technology. The most energy efficient buildings are now probably built in Germany and Switzerland. Asian countries are moving up fast in next generation lighting and those energy technologies that involve sophisticated controls and electronics. If we are to fulfill President Obama's dream of green jobs in the energy sector, we will need to move quickly to re-establish the U.S. at the forefront of these technologies.

In the last couple years, energy budgets have started to grow once again but at current rates of increase would not return to the 1980 percentage of U.S. research for decades. There is a level of enthusiasm on our campuses for energy research careers that we have not seen in 30 years. Students are yearning to make a difference in this area. It is clear that if R&D investment increases, large numbers of talented young people will step forward to help meet the challenge.

We, of course, support the continued incremental increases in appropriated funding for basic research as embodied in the America COMPETES Act signed into law by President Bush, embraced in President Obama's budget and expanded in his Recovery Act program. However, these increases will only bring us a fraction of the way back to the energy research funding levels proposed for 1980-81. If we as a nation are serious about addressing our energy concerns, we must supplement the America COMPETES Act levels with a further steady, sustained and significant ongoing investment, such as that which revenues expected from capping carbon emissions can provide.

A recent survey conducted by A·P·L·U showed that our member institutions have the technical expertise and strong commitment to work on research, development, and demonstration projects for innovations in production, storage, and efficiency technologies across the entire energy spectrum. We have become actively engaged in this national priority and are prepared to commit our best talent to this task, but without the kind of sustained support summarized above; this effort will not achieve its promise. The research institution community is ready now to help lead

the country in developing the technological solutions to our energy problems our nation requires, but this cannot be done without a significant federal commitment to energy basic research and development.


Success in achieving a sustainable energy economy will require more than the development of energy saving technologies; it will require connections to industry to ensure follow-on implementation. Our universities across the country are working hard to become connected engines of innovation to transition these technologies. Success will also require changes to behavioral patterns for energy conservation and an understanding of the energy marketplace. The university-based program of the Cooperative Extension Service, which exists in nearly every county in the nation, could make an important contribution in educating consumers about how they individually can benefit from conservation and utilize renewable energy technologies. Our research universities are also prepared to lead this effort in energy-related behavioral research, community educational outreach, and economic policy analysis.

As the Committee examines the allocation of the potential revenue stream from a climate change mitigation system, we strongly urge you to provide the necessary investments in energy basic research, development, and education. The sooner we can increase the alternatives to fuels emitting large quantities of uncaptured carbon dioxide and other green house gasses, the faster we will progress toward the energy future we all desire. We would be happy to provide more details and answer questions the Committee might have as it moves forward in its important work on distribution of auction revenues.

Sincerely,



Peter McPherson  
President  
Association of Public and  
Land-grant Universities



E. Gordon Gee  
President  
The Ohio State University



Elsa A. Murano  
President  
Texas A&M University



Claude R. Canizares  
Vice President for Research and  
Associate Provost  
Massachusetts Institute of Technology



Michael Witherell  
Vice Chancellor for Research  
University of California, Santa Barbara



Statement of  
James K. Boyce

Professor of Economics  
University of Massachusetts  
Amherst, MA

Political Economy Research Institute  
Gordon Hall  
418 North Pleasant Street  
Amherst, MA 01002

Tel: 413.545.0915  
Email: [boyce@econs.umass.edu](mailto:boyce@econs.umass.edu)

Auctioning under Cap and Trade:  
Design, Participation and Distribution of Revenues

May 7, 2009

Submitted to the  
Committee of Finance  
U.S. Senate

**Cap-and-Dividend: Issues and Options**

Chairman Baucus, Senator Grassley, and Members of the Committee, thank you for the invitation to submit testimony to these hearings on auctioning under cap and trade. My remarks are accompanied by “Cap-and-Dividend: How to Curb Global Warming While Protecting the Incomes of American Families,” a working paper of the University of Massachusetts Political Economy Research Institute that I co-authored with Matthew Riddle.

### **1. Why Cap Carbon?**

A cap on carbon dioxide emissions is a crucial element of any serious policy to curb global warming and promote energy efficiency and the transition to renewable energy. A carbon cap will be most efficiently administered “upstream,” requiring permits to be purchased by the first sellers of fossil fuels into the economy. Because the cap will reduce supply, it will raise fuel prices. The resulting market signals will spur investments by firms and households in energy efficiency and clean energy.

### **2. Costs versus Transfers**

While higher prices for gasoline, heating oil, natural gas, electricity are a cost to consumers, these are not a “cost” from the standpoint of the U.S. economy as a whole. Instead, they are a transfer. Every dollar paid in higher fuel prices will be redistributed to the holders of the carbon permits. Unlike the case when oil prices rise due to market forces or supply is restricted by OPEC, the carbon cap will recycle dollars within the United States. From the standpoints of both economic fairness and political durability, the key policy question is: Who will get the money?

### **3. How Would a Cap-and-Dividend Policy Work?**

In a “cap-and-dividend” policy, 100% of the permits will be auctioned by the government, and all or most the auction revenue will be returned to the public as equal payments per person. This is what economists call a “feebate” arrangement: individuals pay fees based on their use of a scarce resource that they own in common, and the total fees collected are rebated in equal measure to all co-owners. In this case, the scarce resource is the U.S. share of the carbon storage capacity of the atmosphere; the fee is set by the carbon footprint of the individual household; and the co-owners are the American people.

The accompanying paper, “Cap-and-Dividend: How to Curb Global Warming While Protecting the Incomes of American Families,” analyzes the distributional impacts of a cap-and-dividend policy. As we document in the paper, the real incomes of low-income and middle-income families will be not only be protected by the policy but will rise. Overall, about six in ten American families come out ahead in purely monetary terms – not counting the environmental benefits that are the main rationale for any carbon policy.

A transparent and efficient way to disburse dividend payments to the public is via an ATM card, similar to the cards now used by many Americans to access Social Security

payments. At the ATM, people can view the auction revenue deposits into their accounts and withdraw available funds at their own convenience.

#### **4. Free Permits to Firms Would Not Protect Consumers**

It is sometimes claimed that free permit allocations to firms would eliminate or mitigate the impact of a carbon cap on consumer prices. This is not true. Elementary economics dictates that when goods become more scarce, their price goes up. A carbon cap makes fossil fuels more scarce.

In housing markets, the price of a dwelling and the rent charged by its owner do not vary depending on whether the owner purchased it or inherited it for free. In the same way, the price of gasoline will not differ if permits are auctioned to companies or handed out free-of-charge. A cap-and-giveaway policy that provides free permits to firms would simply transfer the money paid by consumers in higher fossil fuel prices to the shareholders of the firms as windfall profits.

During last year's election campaign and in his budget proposal submitted to Congress in February, President Obama endorsed the principle that 100% of carbon permits should be auctioned.

#### **5. Free Permits to Electric Utilities or LDCs Would Not Protect Consumers**

It is sometimes claimed that free permit allocations to regulated electric utilities or local distribution companies (LDCs) would eliminate or mitigate the impact of a carbon cap on consumer prices. This claim is a misleading for two reasons.

First, there is no guarantee that public utility commissions across the country will be able to ensure that the full value of the permits is passed to consumers rather than captured by electricity providers via higher prices.

Second, insofar as electricity prices do not rise and electricity consumption does not decrease, other fuel prices will have to rise even more to meet the emission reductions set by the carbon cap. If consumers don't pay higher prices via their electricity bills, they will pay via other purchases.

If the aim is to protect consumers from the impacts of higher fuel prices, there is a far easier and more reliable way to do this: return the money directly to consumers.

#### **6. With 100% Auction There is No Need for Permit Trading**

Most permits in our society are not tradable. Driving permits, gun permits, parking permits, landfill disposal permits, and building permits are cannot be traded in markets. Why should carbon permits be different?

The need for tradable permits is premised on the assumption that some or all of the permits will be given away for free rather than sold by auction. With giveaways based on some formula (like historic emissions), some firms will get more permits than they need, while others will get fewer; trading is required to redistribute them. If instead 100% of the permits are auctioned, say monthly or quarterly, firms can make their own real-time decisions as to how many permits they acquire. The need for permit trading disappears.

With non-tradable permits, none of the carbon revenue will be siphoned off by trading firms who need to earn a profit. In addition, non-tradable permits will safeguard the policy from the perception or reality of market manipulation by speculators or other players seeking to game the system.

### **7. Regional Differences in Consumer Price Impacts are Small**

The main systematic differences in the impacts of higher fossil fuel prices on households arise from differences in income. Higher-income households typically consume more energy (and more of most other goods and services) than lower-income households. They will therefore pay more under a cap-and-dividend policy (or any other policy that caps carbon emissions). For example, as shown in Table 7 of our paper, at a permit price of \$200/ton carbon (or \$54/ton carbon dioxide), the “carbon charge” paid by individuals in the top 10% of the consumer expenditure distribution is \$1475/year, almost seven times greater than the \$215 paid by individuals in the bottom 10%.

By comparison, inter-state differences in the impacts of higher fossil fuel prices on consumers are modest. Taking into account inter-state differences in income and the carbon intensity of electricity consumption, the impact of this permit price on the median household across the states ranges from \$502/year to \$771/year. These are roughly 20% below and above the national median of \$649/year, with most states considerably closer to the national median.

A number of states with coal-intensive electricity supply have below-average incomes. In West Virginia, for example, the average income is 24% below the national average. In such cases, the effect of the carbon intensity of the electricity mix is partially or wholly offset by the effect of inter-state income differences. In West Virginia, the income effect dominates: the median West Virginian would pay \$625/year in higher prices, somewhat less than the national median; under a cap-and-dividend policy, the majority of West Virginians would receive more in dividends than they would pay in higher prices.

### **8. Mitigating Regional Differences in Employment Impacts**

Any policy to cut U.S. carbon emissions will have impacts on employment, apart from the impacts on consumers described above. In some sectors (for example, coal mining), jobs will be lost; in others (for example, retrofitting of buildings and the manufacture of renewable energy technologies) jobs will be created.

Insofar as investment in renewables and energy efficiency is more labor-intensive than investment in the fossil fuel sector, job gains will exceed job losses. But no automatic mechanism ensures that job creation will occur in the same communities and for the same workers who are adversely impacted by job losses.

To protect these communities and workers, a fraction of the carbon revenues initially could be allocated to the states as block grants dedicated for this purpose. In the first year of the cap-and-dividend policy, for example, 10% of permit auction revenues could be directed to block grants and the remaining 90% distributed to households as dividends, with the block-grant share phasing out over a 10-year horizon. As shown in the accompanying paper, as long as the proportion of revenues dedicated to this purpose is modest, the majority of families will continue to be “made whole” by the cap-and-dividend policy.

Block grants would allow the states to tailor transitional adjustment assistance policies to their own needs. In coal-mining states, for example, funds could be invested in the ecological restoration of landscapes degraded by mountaintop removal, strip mining, and disposal of mine tailings and coal ash. In manufacturing-intensive states, funds could be invested in job training and support to “green” industries such as the production of wind-energy and solar-energy equipment.

## **9. Conclusion**

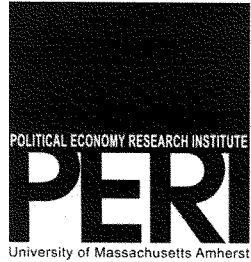
The principal political challenge confronting any policy to curb carbon emissions in the United States is how to protect American families from the impacts of higher fossil fuel prices – and how to protect the policy itself from the political fallout that otherwise will result.

What is needed is a policy in which the majority of Americans will not only be willing to pay higher prices at the gasoline pump and in their home heating and electricity bills, but will be positively enthusiastic about doing so, secure in the knowledge that they themselves are on the receiving end of the resulting transfers of money.

Neither a cap-and-giveaway policy in which permits are given free to firms, nor a cap-and-spend policy in which permits are auctioned and the revenues flow into the government budget, will yield this desirable result.

In short, a cap-and-dividend policy will not only address squarely the pressing problems of global warming and energy independence, but also strengthen the economic well-being of American families. By achieving these goals in a way that is fair and transparent, it will maximize the prospects for securing durable public support for a policy that weans the U.S. economy from dependence on fossil fuels.

The energy transition that is needed to avert the worst of climate change is certainly feasible. But it cannot happen overnight. This historic change will take decades, and for this reason it will require durable support. The time to launch the transition is now. The policies that undergird it must be built to last.



**Cap and Dividend:  
How to Curb Global Warming  
While Protecting the Incomes  
Of American Families**

**James K. Boyce & Matthew Riddle**

November 2007

**WORKINGPAPER SERIES**

Number 150

**POLITICAL ECONOMY  
RESEARCH INSTITUTE**

Gordon Hall  
418 North Pleasant Street  
Amherst, MA 01002

Phone: 413.545.6355  
Fax: 413.577.0261  
peri@econs.umass.edu  
www.peri.umass.edu



**CAP AND DIVIDEND:  
HOW TO CURB GLOBAL WARMING WHILE  
PROTECTING THE INCOMES OF AMERICAN FAMILIES**

James K. Boyce & Matthew Riddle

Political Economy Research Institute  
University of Massachusetts, Amherst



November 2007

**ABSTRACT**

*This essay examines the distributional effects of a "cap-and-dividend" policy for reducing carbon emission in the United States: a policy that auctions carbon permits and rebates the revenue to the public on an equal per capita basis. The aim of the policy is to reduce U.S. emissions of carbon dioxide, the main pollutant causing global warming, while at the same time protecting the real incomes of middle-income and lower-income American families. The number of permits is set by a statutory cap on carbon emissions that gradually diminishes over time. The sale of carbon permits will generate very large revenues, posing the critical question of who will get the money. The introduction of carbon permits – or, for that matter, any policy to curb emissions – will raise prices of fossil fuels,*

Key words: Global warming; fossil fuels; climate change; carbon permits; cap-and-dividend; cap-and-auction; cap-and-trade.

*and have a regressive impact on income distribution, since fuel expenditures represent a larger fraction of income for lower-income households than for upper-income households. The net effect of carbon emission-reduction policies depends on who gets the money that households pay in higher prices. We find that a cap-and-dividend policy would have a strongly progressive net effect. Moreover, the majority of U.S. households would be net winners in purely monetary terms: that is, their real incomes, after paying higher fuel prices and receiving their dividends, would rise. From the standpoints of both distributional equity and political feasibility, a cap-and-dividend policy is therefore an attractive way to curb carbon emissions.*

JEL codes: H22, H23, Q48, Q52, Q54, Q58

**EXECUTIVE SUMMARY**

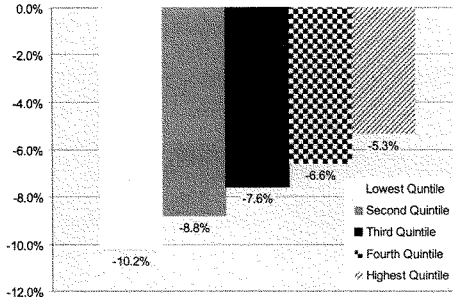
Policies to curb emissions of carbon dioxide – the main cause of global warming – will inevitably raise the prices of fossil fuels: coal, oil, and natural gas. The resulting price increases will reduce the real incomes of American families, striking hardest at those who can afford it least: lower-income households for whom fuel costs represent a higher fraction of their expenditures. The political feasibility of U.S. efforts to curb carbon emissions may hinge on whether policies are designed to protect middle-class and poor families from these adverse income effects.

A “cap-and-dividend” policy offers a simple and practical way to do this. The policy would auction carbon permits – rather than giving them free-of-charge to historic polluters – and then return all or most of the revenue to American families on an equal per person basis. Families who consume lower-than-average amounts of fossil fuels come out ahead, receiving more in dividends than they pay in higher prices. Those who consume more-than-average amounts pay more.

The policy has three basic steps:

- *First*, U.S. carbon emissions are capped at a level that gradually declines over time. One widely discussed target is to reduce emissions 80% below their current level by the year 2050.
- *Second*, based on the cap in a given year, permits are auctioned to firms that bring fossil carbon into the economy (whether through domestic extraction or imports). The supply of permits in a given year is fixed by the cap; their price depends on the demand for them.
- *Third*, revenue from the sale of permits is deposited into a trust fund and paid out equally to every woman, man, and child in the country. In addition, some fraction of the revenue initially may be earmarked for other uses, such as transitional adjustment assistance.

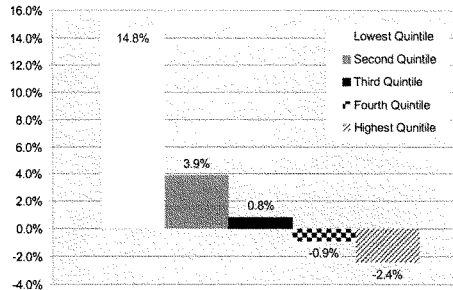
**FIGURE A: IMPACT ON FAMILY INCOMES OF A \$200/TON CARBON CHARGE**



Source: Calculated from Table 7.

This paper calculates the net effects of a cap-and-dividend policy on income distribution in the United States. We estimate that a permit price of \$200 per ton of carbon would reduce U.S. emissions by approximately seven percent. The resulting increases in the prices of fossil fuels, and in the prices of goods and services produced with them, would raise the cost of living of the median American family by \$1,570 per year. The price increases would represent a larger percentage of family income in poor households than in more affluent households (see Figure A).

**FIGURE B: NET IMPACT ON FAMILY INCOMES OF A CAP-AND-DIVIDEND POLICY**



Source: Calculated from Table 9.



The revenue from the sale of carbon permits would amount to roughly \$200 billion per year. If this revenue is recycled to the public equally, the majority of households receive more in dividends than they pay as a result of higher fossil fuel prices. The net impact ranges from a 14.8% income gain for the poorest 20% of families (and a 24% gain for the poorest 10%) to a 2.4% loss for richest 20% (see Figure B).

Initially earmarking a modest fraction of the carbon revenues for other uses, such as transitional adjustment assistance, could further enhance the appeal of the cap-and-dividend policy. Up to 10% of the carbon revenues can be dedicated to other uses while maintaining positive net benefits for roughly 50% of households.

Withholding carbon revenues beyond this threshold would push the net beneficiary share of the population below half.

A cap-and-dividend policy will assert the principle of common ownership of nature's wealth: the right to benefit from our share of the Earth's capacity to absorb carbon emissions is allocated equally to all Americans. It will protect the real incomes of the majority of Americans while curbing global warming and hastening the U.S. economy's transition towards the energy sources of the future. From the standpoints of both distributional equity and political feasibility, a cap-and-dividend policy is therefore an attractive way to curb carbon emissions.

**I. INTRODUCTION**

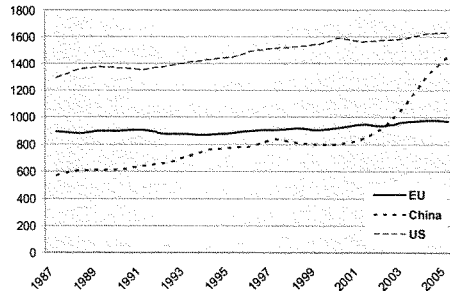
The time is coming when the United States government will enact policies to curb emissions of carbon dioxide and other greenhouse gases, joining the efforts of other nations to confront the historic challenge of global warming. When this happens, a key question – from the standpoints of both fairness and political feasibility – will be how to protect the incomes of American families.

The Clinton administration signed the 1997 Kyoto Protocol, which envisioned a 7% cut in U.S. carbon emissions from their 1990 level by the year 2012. But the Senate refused to ratify the agreement, and when the government of George W. Bush came to power it announced it had “no interest” in the accord.

Political winds in the country are now shifting. At the Group of Eight summit meeting in Germany in June 2007, the Bush administration agreed to re-enter international climate negotiations and to “seriously consider” a European plan to cut greenhouse gas emissions in half by 2050. A legislative proposal unveiled in August 2007 by U.S. Senators Joseph Lieberman and John Warner goes further, calling for a 70% reduction by 2050. It now seems possible, even likely, that the U.S. will adopt a serious emissions-reduction policy early in the post-Bush administration.

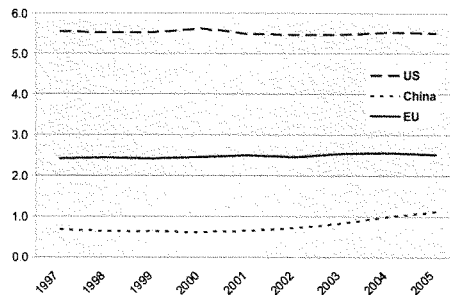
Any policy to curb carbon emissions will raise prices of fossil fuels – coal, oil, and natural gas – and the prices of other goods and services in proportion to the use of fossil fuels in supplying them. These price increases will reduce the real incomes of Americans in general, and low-income and middle-class American households in particular. But for every dollar paid by consumers in higher prices, someone else receives a dollar in additional income. Recycling this money to the public would protect real incomes of the majority of Americans. This paper examines how this can be done by a cap-and-dividend policy that distributes carbon revenues equally to all.

**FIGURE 1A: CARBON EMISSIONS OF THE U.S., CHINA, AND EU-15, 1987-2005<sup>1</sup>**  
(MILLION METRIC TONS)



Source: U.S. Energy Information Administration (2007, Table H.1).

**FIGURE 1B: CARBON EMISSIONS PER CAPITA OF THE U.S., CHINA, AND EU-15, 1987-2005**  
(MILLION METRIC TONS)



Source: U.S. Energy Information Administration (2007, Table H.1).

**II. THE CARBON ECONOMY**

The United States is the world’s top emitter of carbon dioxide (CO<sub>2</sub>), the most important greenhouse gas. The burning of fossil fuels in the U.S. released 1.6 billion metric tons (mt) of carbon (5.9 billion mt of CO<sub>2</sub>) in 2005. This is 12% more than China, the second-largest emitter, and 65% more than the EU-15 (see Figure 1a).

**TABLE 1: CARBON DIOXIDE EMISSIONS BY FUEL SOURCE AND SECTOR, 2004**(MILLIONS OF METRIC TONS OF CO<sub>2</sub>)

Fuel Source	Petroleum	Coal	Natural Gas	Other <sup>a</sup>	total	% via electricit
Residential	141.6	695.4	372.8	4.1	1213.9	69.4
Transportation	1902.7	3.8	32.7	0.0	1939.2	0.2
Industrial <sup>b</sup>	465.4	747.4	519.9	3.3	1736.0	38.1
Commercial	88.2	669.0	272.9	3.9	1034.1	77.4
Total	2597.9	2115.6	1198.3	11.3	5923.2	39
(%)	43.9	35.7	20.2	0.2	100	

a. "Other" includes emissions from electricity generation from municipal solid waste and geothermal energy.

b. Industrial emissions from coal include net coke imports.

Source: Calculated from U.S. Energy Information Administration's Historical Data Series. For details, see endnote 2.

In per capita terms, U.S. emissions are five times higher than China's and more than double those of the EU-15 (see Figure 1b).

The composition of U.S. carbon dioxide emissions across fuels and sectors is shown in Table 1. Petroleum accounts for roughly 44% of emissions, coal for 36%, and natural gas for 20%. Electricity generation using these fuels accounts for 39% of the total, with coal-fired plants accounting for more than four-fifths of this amount. Transportation accounts for roughly one-third of total emissions, industry for a further 29%, residential energy use for 20%, and commercial energy use for 18%.

The "carbon footprint" of individual American households – the amount of carbon emissions generated in supplying the goods and services

they consume – varies depending on their total expenditure and its composition. Table 2 shows how expenditure patterns varied across households in 2003, ranging from the poorest tenth of the population, whose annual per capita expenditure was under \$2,000, to the richest tenth, whose per capita expenditure was close to \$30,000.<sup>3</sup>

The carbon content of various categories of consumption items can be calculated from input-output accounts. These provide detailed data on the inputs used by each industry, making it possible to trace the price effects of a change in fossil fuel prices from industry to prices. For this purpose we rely on calculations by Metcalf (1999), updating his measure to reflect 2003 prices.<sup>4</sup> The results are presented in

**TABLE 2: CONSUMPTION PATTERNS BY EXPENDITURE DECILE, 2003**

Per capita expenditure decile	Per capita expenditure (\$)	Average per capita expenditures by consumption category (\$)							
		Food	Industrial goods	Services	Electricity	Household fuels	Car fuels	Air transport	Other transport
1	1927	659	225	729	128	52	124	3	8
2	3521	1118	426	1418	227	83	226	11	13
3	4736	1361	638	2001	278	113	304	23	18
4	5991	1621	904	2559	341	144	375	28	19
5	7380	1813	1188	3351	349	164	444	45	27
6	8847	2051	1795	3849	380	186	489	67	30
7	10711	2297	2219	4901	415	211	537	83	46
8	13228	2559	3343	5880	459	214	614	105	54
9	17178	3081	4821	7489	519	273	735	177	83
10	29943	4292	10908	12363	642	334	888	367	149
Total	10346	2085	2647	4454	374	177	474	91	45

Source: Authors' calculations from Consumer Expenditure Survey.

Table 3. As one would expect, the most carbon-intensive categories of consumption are electricity, household fuels (primarily heating oil and natural gas) and car fuels, each of which generates more than two metric tons of carbon per \$1000 expenditure. The least carbon-intensive category is services, for which the corresponding figure is 80 kilograms.

**TABLE 3: CARBON EMISSIONS PER DOLLAR EXPENDITURE BY CONSUMPTION CATEGORY**

Consumption category	tC per \$1000 (2003 dollars)
Food	0.15
Industrial goods	0.14
Services	0.08
Electricity	2.82
Household fuels	2.64
Car fuels	2.08
Air transport	0.56
Other transport	0.30

Source: Calculated from Metcalf (1999); see text for details.

Combining the information in Tables 2 and 3, we can examine the average carbon emissions from U.S. household consumption across the range of per capita expenditure. The results are presented in Table 4. The consumption of the average American, with per capita expenditure of about \$10,000, generates approximately 3.7

metric tons of carbon emissions.<sup>5</sup> Direct energy use in the form of car fuels, residential electricity, and household fuels (mainly heating oil and natural gas) accounts for roughly three-fifths of these emissions. Indirect use, via carbon emissions generated in producing other goods and services consumed by the household, account for the remaining two-fifths.

As one might expect, households with higher expenditure generally have bigger carbon footprints. As shown in the final column of Table 4, carbon emissions per person in the richest decile (tenth) of the population are more than double the national average, and more than eight times higher than the lowest decile.

Carbon emissions *per dollar* decline, however, as household expenditure rises. In the top decile, one dollar of expenditure on average generates 0.27 kilograms (kg) of carbon emissions; in the lowest decile the corresponding figure is 0.50 kg. The reason lies in their consumption patterns, as can be seen in Table 3: the poor spend a larger fraction of their household budget on electricity and fuels, while more affluent households spend a larger fraction on services and industrial goods. It so happens that necessities, which account for a larger share of the expenditure of the poor, are more carbon-intensive than luxuries, which account for a larger share of the expenditure of the well-

**TABLE 4: CARBON EMISSIONS BY EXPENDITURE DECILE (METRIC TONS OF CARBON PER YEAR)**

Per capita expenditure decile	Per capita expenditure (\$)	Average per capita carbon emissions by expenditure category								Total carbon emissions per capita
		Food	Industrial goods	Services	Electricity	Household fuels	Car fuels	Air transport	Other transport	
1	1927	0.10	0.03	0.05	0.36	0.15	0.26	0.002	0.002	0.96
2	3521	0.18	0.06	0.10	0.64	0.23	0.47	0.006	0.004	1.69
3	4736	0.21	0.09	0.15	0.79	0.32	0.63	0.013	0.005	2.21
4	5991	0.25	0.13	0.21	0.96	0.39	0.78	0.016	0.006	2.74
5	7380	0.27	0.17	0.27	0.99	0.46	0.92	0.025	0.008	3.11
6	8847	0.30	0.27	0.32	1.07	0.51	1.02	0.037	0.009	3.53
7	10711	0.34	0.33	0.41	1.17	0.58	1.12	0.047	0.014	4.01
8	13228	0.37	0.50	0.50	1.30	0.59	1.28	0.059	0.016	4.60
9	17178	0.44	0.72	0.64	1.47	0.75	1.53	0.099	0.025	5.66
10	29943	0.59	1.63	1.08	1.81	0.91	1.85	0.206	0.044	8.13
Total	10346	0.31	0.39	0.37	1.06	0.49	0.98	0.051	0.013	3.67

Source: Authors' calculations using data in Tables 2 and 3.

to-do. As a result, carbon emissions rise with household expenditure at a diminishing rate (see Figure 2). As discussed in the next section, this concave relationship has important implications for the distributional effects of public policies to reduce carbon emissions.

**III. THE CASE FOR A CAP-AND-DIVIDEND POLICY**

The most reliable way to reduce carbon emissions is to establish a "cap," a limit on the total amount of fossil-fuel carbon that enters the U.S. economy in a given year. The cap can gradually be lowered over time to meet targets for emissions reductions in future years. Based on the cap, a fixed number of annual permits are issued to suppliers of fossil fuels, including both domestic producers and importers. Whether these permits are sold or given away, they represent a claim on a scarce resource - the U.S. share of the biosphere's capacity to absorb and recycle carbon - and as such they have economic value.

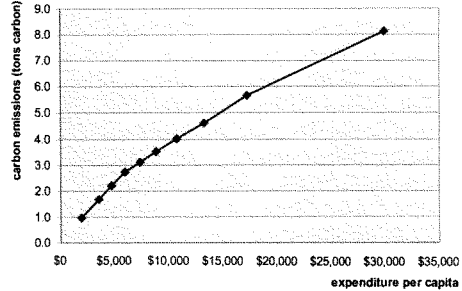
The net effect of emission-reduction policies on household incomes depends on:

- (i) how the household is impacted by higher prices for fossil fuels, and
- (ii) how the economic value represented by carbon permits is distributed.

If the permits are given away, a key issue is who gets them. If they are sold, a key issue is who gets the money.

If the permits are given free-of-charge to energy companies - based, for example, on their historic levels of sales of fossil fuels - the result is a windfall gain to these firms, or more precisely, to their shareholders.<sup>6</sup> If the permits are auctioned to the highest bidder and the proceeds are retained by the government, the revenue is similar to that from a tax, and the money can be used to increase government spending and/or cut other taxes. In this paper we analyze a third option, in which the permits are auctioned and the revenue is rebated to the public on an equal

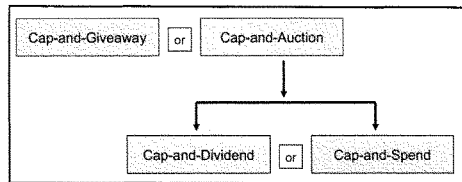
**FIGURE 2: CARBON EMISSIONS AND HOUSEHOLD EXPENDITURE, 2003**



Source: See Table 4.

per capita basis, a policy sometimes termed a "sky trust" (Barnes 2001).<sup>7</sup> We refer to these three policy options as "cap-and-giveaway," "cap-and-spend," and "cap-and-dividend," respectively (see Figure 3).

**FIGURE 3: THREE POLICY OPTIONS FOR CARBON PERMIT ALLOCATION**



*From open access to common wealth*

The enactment of policies to curb carbon emissions is tantamount to the creation of property rights to the sky, or more precisely, to the carbon-absorptive capacity of the biosphere. In the absence of such policies, this is an "open access" resource, in principle freely available to all but in practice disproportionately available to those with the wealth and power to claim it: those who burn the most fossil fuel.<sup>8</sup> Government regulations, carbon taxes, and carbon permits all assert the right to regulate access to

this resource, effectively converting it into a form of property.

The question then becomes, who are the rightful owners of this property? If we believe that the gifts of creation are held by all of us in common, rather than being the property of private owners or the government, then the answer is clear: it belongs equally to every woman, man, and child in the country.

A cap-and-dividend policy would transform the U.S. share of the Earth's carbon-absorptive capacity from an open-access resource into the common wealth of all Americans. As a way to curb U.S. carbon emissions, this policy has four attractive features:

- *First*, the cap-and-dividend policy puts into practice the principle of common ownership of nature's wealth: rights to benefit from the carbon-absorptive capacities of the biosphere are allocated equally to all.
- *Second*, the cap-and-dividend policy protects the real incomes of the majority of the population in the face of higher prices for fossil fuels, surmounting a major political impediment to the adoption of policies to curb global warming.
- *Third*, the cap-and-dividend policy results in a progressive redistribution of income, the scale of which depends on the level of the carbon charges and how the carbon intensity of household expenditure varies with income.
- *Fourth*, unlike carbon taxes or a cap-and-spend policy, the cap-and-dividend policy's favorable distributional outcome does not hinge on the willingness and ability of the government to do "the right thing" – however this may be defined – with present and future carbon revenues.<sup>9</sup>

*How would a cap-and-dividend policy work?*

The cap-and-dividend policy would deposit the revenues from auction sales of carbon permits into a trust fund, an autonomous institution apart from the government budget, akin to the

Social Security Trust Fund. These revenues would then be rebated to individuals on an equal per person basis.

Carbon revenues would be most easily collected "upstream," at the mine heads, oil refineries, natural gas pipelines, and ports where fossil fuels enter the U.S. economy. Nationwide there would be roughly 2000 such collection points (Kopp et al. 1999; CBO 2001). The costs of collecting the revenue would represent a very small fraction of the amount collected; the administrative costs of petroleum taxes and excise duties currently range from 0.12 to 0.25% of revenue (Smulders and Vollebergh, 2001, p. 116).<sup>10</sup>

A fixed number of carbon permits would be auctioned (monthly, quarterly, or annually), with the number determined by the national carbon cap at any given point in time. Permit holders would be entitled to bring fossil carbon into the economy within a specified time (say, one year from the date of purchase of the permit). A secondary market in permits could emerge – permit holders who decide not to use their carbon allotment could sell it to others – but with frequent auctions and limited permit life spans, this market would likely be small relative to the total number of permits.

The number of permits issued would diminish over time, as the cap on carbon emissions is gradually tightened. Issuing a fixed number of permits rather than setting a fixed carbon charge (a "carbon tax") would guarantee that the nation's emission-reduction objectives are achieved. The price of the permits would depend on demand and supply. When the economy is booming, for example, higher demand for permits will lead to a higher price than when the economy is sluggish. Similarly, if higher fossil fuel prices and other policies spark rapid improvements in energy efficiency and development of renewable energy sources, the carbon permit price will be lower than if these occur more slowly. In contrast, setting a fixed price instead of a fixed number of permits would allow the quantity of carbon emissions to vary depending on these and other factors. Given the

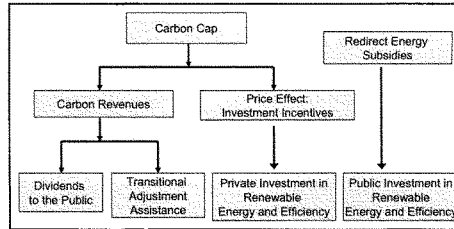
uncertainties as to the extent of emission reductions, the price-setting approach also could be more vulnerable to erroneous forecasts or political manipulations that undermine emission-reduction goals.

Revenues from the sale of carbon permits would be paid out equally to every man, woman, and child in the country. One way to distribute these dividends would be to issue "Sky Trust cards" that could be used at automatic teller machines (ATMs) to withdraw cash. If permit auctions are held quarterly, the balances in every individual's account would be topped up quarterly, too. As with bank accounts, individuals could check their balances online, as well as at the ATM. The administrative costs of issuing Sky Trust cards would be no greater than the current cost of issuing Social Security cards; in fact, after the initial distribution to existing holders of Social Security cards, the two operations could be combined.

In the case of children, an alternative way to distribute carbon revenues would be to accumulate their dividends in individual development accounts (IDAs) until they reach the age of eighteen. They could withdraw funds as they enter adulthood, perhaps with rules or incentives to encourage investment in further education or purchases of homes or businesses.

The introduction of carbon permits would alter relative prices throughout the economy. Fossil fuels, and goods and services whose supply relies heavily on them, would become more expensive, strengthening incentives to invest in energy efficiency and non-fossil energy sources. The energy investment playing field, which is currently tilted in favor of fossil fuels by the implicit subsidy resulting from free use of the Earth's finite capacity to recycle emissions, would become more level. The playing field could be further leveled by ending the explicit government subsidies currently given to fossil-fuel industries in the form of tax breaks and royalty-free access to public lands. Redirection of subsidies to public investment in energy

FIGURE 4: CAP-AND-DIVIDEND POLICY



efficiency and renewable energy would complement the stimulus to private investment arising from the realignment of relative prices.

The redirection of private investment is crucial for any strategy to curb global warming. The Intergovernmental Panel on Climate Change (2007, p. 13), which foresees future energy investments totaling more than \$20 trillion worldwide between now and 2030, observes that limiting global carbon emissions to 2005 levels by 2030 "would require a large shift in the pattern of investment, although the net additional investment required ranges from negligible to 5-10%."

As documented below, a cap-and-dividend policy would protect the real incomes of the majority of American families in the face of rising fossil fuel prices. But households and communities that currently depend on employment in fossil fuel-intensive industries, such as coal mining, would nevertheless see income losses. To protect these vulnerable sectors, a fraction of the revenue from the sale of carbon permits could be earmarked initially for transitional adjustment assistance. For example, Barnes (2001) proposes a transition fund that initially would recycle 25% of the revenue and gradually be phased out over a ten-year period.

Figure 4 summarizes the basic features of a cap-and-dividend policy: cap carbon emissions; auction permits to bring fossil carbon into the economy; distribute revenues from permit sales to the public, with a fraction initially earmarked

for transitional adjustment assistance; realign incentives for private investment; and redirect government subsidies to public investments in energy efficiency and renewable energy.

In the next section, we analyze how a cap-and-dividend policy would affect the distribution of income in the United States. Before doing so, we briefly review prior studies on the distributional impacts of higher fossil fuel prices and carbon revenue recycling.

*Distributional impact of higher fossil fuel prices*

Carbon emission-reduction policies – whether in the form of regulations, carbon taxes, or caps and permits – will raise the price of fossil fuels, at least in the foreseeable future. The increased price is the flip side of reduced use. The higher cost of coal, oil, and natural gas in turn alters relative prices of goods and services throughout the economy in proportion to the carbon embodied in their production and distribution. In the end, the price increases are passed along to consumers (although producers may absorb part of the cost via lower profit margins, a possibility to which we return below).

The result of higher prices, in terms of absolute dollars, is that those who consume more fossil fuels directly in the form of energy, and indirectly in the form of other goods and services whose supply uses fossil fuels, pay more. Since the rich generally consume more of most things than the poor, they pay more (although how much any specific household pays depends on its consumption decisions). Relative to total expenditure, however, the poor pay more as noted above. This means that carbon emission-reduction policies have a regressive impact on income distribution – unless coupled with revenue-recycling policies that protect the real incomes of the poor and middle classes.

Based on the data in Table 4, for example, we can calculate that a \$200/ton price for carbon would translate into a \$215 rise in the cost of living for the average person in poorest decile, equivalent to more than 10 per cent of annual

expenditure. The cost of living in richest decile would rise by \$1,475 per person, but this would be equivalent to less than 5 per cent of annual expenditure.

Previous studies have reached similar conclusions. The U.S. Congressional Budget Office (CBO), in an analysis of the distributional impacts of carbon permits, estimated that the price effects would reduce real incomes in the lowest quintile of the income distribution by 3.3%, almost twice the 1.7% reduction in the highest quintile (CBO 2000, p. 21). In a follow-on study, Dinan and Rogers (2002, p. 212) report an even sharper disparity: reductions of 6.6% and 1.7% for the poorest and richest quintiles, respectively. In estimates based on a higher carbon price, Barnes and Breslow (2003, p. 144) report the cost for the lowest decile to be equivalent to 16.8% of income, whereas the cost for the top decile is equivalent to 2.5% of income.

Studies in other industrialized countries generally support the conclusion that carbon charges are regressive – taking a bigger slice in percentage terms from low-income households than from high-income households – or, at best, distributionally neutral or mixed. An analysis by Symons et al. (1994) found that a carbon tax in the United Kingdom would be “severely regressive.” In Canada, Hamilton and Cameron (1994) concluded that a carbon tax would be “moderately regressive.” Cornwell and Creedy (1996) likewise found that a carbon tax in Australia would be regressive. Symons et al. (2000) reported regressive effects in Germany, France, and Spain, a mixed effect in the UK, and a neutral effect in Italy. Klinge Jacobsen et al. (2003) and Wier et al. (2005) found that Denmark’s existing carbon taxes are regressive, and Brännlund and Nordström (2004) reported that increases in carbon taxes in Sweden would be regressive.<sup>11</sup> Summarizing studies from a number of OECD countries, Cramton and Kerr (1999, p. 261) conclude: “The weak regressivity of carbon regulation appears to hold across countries and modeling techniques.”<sup>12</sup>



### *Carbon revenue recycling*

When consumers pay higher prices for goods and services, in proportion to the fossil carbon embodied in them, a great deal of money changes hands. The net effect of carbon charges depends crucially on where this money goes.

Recognizing that carbon charges could generate annual revenues of “tens or hundreds of billions of dollars,” the U.S. Congressional Budget Office (2000) compared two methods of allocating carbon emission allowances: selling them through an auction, or giving them away free-of-charge to the energy companies that produce and import fossil fuels. The CBO also compared two methods of revenue recycling: reducing corporate taxes or rebating an identical lump-sum amount to each household. The only policy mix found to have a progressive distributional effect was the “sky trust” combination of permit sales and lump-sum redistribution of the revenues.<sup>13</sup> In this case, the regressive effect of fossil-fuel price increases was outweighed by the progressive effect of equal payments to each household. With a carbon charge of \$100/ton, the CBO estimated that after-tax incomes in the lowest quintile of the income distribution would rise by 1.8%, while those of the top quintile would decrease by 0.9%. In an extension of the CBO analysis, Dinan and Rogers (2002) reported somewhat stronger redistributive impacts: a 3.5% rise in incomes for the lowest quintile, coupled with a 1.6% decline for the top quintile.<sup>14</sup>

Both of these studies assumed that carbon charges create “deadweight losses” by reducing fossil fuel consumption (and also, in the Dinan and Rogers study, by lowering real returns to labor and capital and thereby reducing factor supplies). For example, when consumers curtail fuel consumption in response to higher prices, they experience welfare losses in the form of “the discomfort associated with keeping their house cooler in the winter or the loss in satisfaction that would result from canceling a vacation because of high gasoline prices” (CBO 2003, p. 3). The studies add these losses to the

monetary costs borne by consumers in the form of higher prices for the fossil fuels that they continue to consume.

Neither study accounted, however, for the welfare *gains* that would result from reduced use of fossil fuels. These include benefits from the mitigation of climate change and “co-benefits” from reduced emissions of other pollutants, including airborne particulates and sulfur dioxide, that are released by burning fossil fuels.<sup>15</sup> Yet the rationale for policies to reduce carbon emissions is precisely that the welfare gains to society exceed the welfare losses. A comprehensive analysis of the welfare impacts of carbon emission-reduction policies would allocate these gains across households, too. In the absence of such an accounting, the incorporation of “deadweight losses” from carbon caps gives a misleading picture of net effects: it counts the cost of reducing carbon emissions without counting the benefits.

The effect of this one-sided treatment of welfare effects is that the total costs of carbon charges (from higher prices plus “deadweight losses”) exceed the total amount of revenue to be recycled (from higher prices alone). This understates the cap-and-dividend policy’s positive impact on incomes of low-income households, and overstates its negative impact on those of high-income households.

In this paper, we adopt the simpler – and, in our view, more appropriate – procedure of estimating the monetary impacts of carbon charges and revenue recycling alone, without attempting to incorporate other welfare effects. Barnes and Breslow (2003) followed this procedure in a third analysis of the distributional impact of a cap-and-dividend policy.<sup>16</sup> They find that the bottom decile would receive a net benefit equal to 5.1% of income, while the top decile would bear a net loss of 0.9%. Roughly 70% of the population sees net gains, getting more back in dividends than they pay in higher fuel prices. Insofar as public policy is guided by majority rule, this augurs well for the political feasibility of a cap-and-dividend policy for curbing carbon emissions.

#### IV. DISTRIBUTIONAL IMPACTS OF A CAP-AND-DIVIDEND POLICY

In this section we provide new estimates of the impacts of a cap-and-dividend policy on the distribution of income in the United States, taking into account both the impact of higher prices on consumers and the recycling of carbon revenue via equal per capita dividends.

Apart from using more recent data for these calculations, our analysis differs from prior studies in several respects. We stratify households on the basis of expenditure rather than income, on the grounds that expenditure is a better proxy for lifetime income. Since households differ in size, we use expenditure per person rather than expenditure per household, on the grounds that this is a better measure of relative income. In addition to our baseline estimate of the net impact of a cap-and-dividend policy, the next section examines how the results change when some fraction of the carbon revenue is allocated initially to other uses, such as transitional adjustment assistance. In the appendix, we also show how the results are affected if we assume that some fraction of the cost of carbon permits is absorbed by producers via lower profit margins, instead of being entirely "passed through" to consumers.

##### *What price for carbon?*

The amount of money that will be generated by the sale of carbon permits depends on both the quantity of permits sold and their price. The quantity is set by the carbon emission cap. The price depends on the price elasticities of demand for fossil fuels, which translate changes in quantity into changes in prices.

No one can be certain as to the precise magnitude of these elasticities, particularly in the long-run when induced technological changes are taken into account. The Intergovernmental Panel on Climate Change (2007, p. 19), for example, reports that carbon prices of \$20-295 per ton (\$5-80 per ton of CO<sub>2</sub>) in the year 2030 would be consistent with a trajectory for eventual stabiliza-

tion of atmospheric concentrations in the year 2100. This wide price range illustrates why setting a cap on the quantity of permits and letting market forces determine their price is preferable to setting a price on permits (or levying a carbon tax) and letting market forces determine the quantity of emissions. If our central aim is to meet a timetable for emissions reductions, fixing the quantity guarantees that we will hit the target. Fixing the price does not.

While we do not know the precise magnitude of the price elasticity of demand for fossil fuels, we do know that it is inelastic, particularly in the short run; that is, the percentage change in price exceeds the associated percentage change in quantity demanded. With a price elasticity of -0.2, for example, a 2% reduction in quantity requires a 10% increase in price. This means that the lower the quantity of emissions permitted under the cap (and the higher the price of the permits), the greater the total amount of revenue.

We base the calculations that follow on a permit price of \$200 per ton of carbon (tC). This is near the middle of the range of carbon price scenarios used in the literature reviewed by Barnes and Breslow (2003, pp. 142-3). It is also close to the initial price of \$180/tC (\$50/tCO<sub>2</sub>) that a recent study by the MIT Joint Program on the Science and Policy of Global Change reckons is needed to achieve an 80% reduction in emissions by the year 2050, with the price gradually rising to \$730/tC by that year (Paltsev et al., 2007). While the price we use for our calculations affects the magnitudes of costs and benefits, it does not affect their distributional pattern across households: if the permit price were higher, then the costs, dividends, and net benefits would rise; if the price were lower, they would be smaller.<sup>17</sup>

Table 5 shows how a \$200/tC charge would change energy prices, assuming the cost to be entirely passed through into the price to end-users. Price increases for gasoline, heating oil, and natural gas are in the 20-30% range. The price of coal rises much more steeply due to its

**TABLE 5: IMPACTS OF \$200/TON CARBON CHARGE ON FOSSIL FUEL PRICES**

Fuel	Price (2006) a	Carbon charge	Price increase
Gasoline	\$2.53/gallon	\$0.53/gallon	21%
Heating oil	\$2.42/gallon	\$0.71/gallon	29%
Natural gas (residential)	\$13.76/1000 cu. ft.	\$3.26/1000 cu. ft.	24%
Coal (delivered to electric utilities)	\$31.22/short ton	\$116/short ton	371%
Electricity	9.45 cents/kwh	3.68 cents/kwh	39%

Note: a. Coal and electricity prices refer to the year 2005.

Sources: Price data from U.S. Energy Information Administration (EIA). For each individual fuel reference, see endnote 17.

relatively low price and high carbon content, and electricity prices rise by nearly 40%.

To calculate how these price increases impact households, we use the data on consumption patterns and the carbon content of goods and services reported in Tables 2 to 4. To incorporate the response of consumers to changes in relative prices, we use estimates drawn from other studies of the price elasticities of demand for the various consumption categories.<sup>18</sup> These are reported in Table 6.

**TABLE 6: PRICE ELASTICITIES OF DEMAND**

Consumption category	Price elasticity of demand
Food	0.6
Industrial goods	1.3
Services	1
Electricity	0.2
Natural gas	0.2
Heating oil	0.27
Car fuels	0.26
Air transport	0.25
Other transport	0.25

Note: Short-run own price elasticities of demand.

We estimate that a \$200 per ton carbon charge would reduce U.S. emissions by approximately 7%. Put differently, if a cap on annual carbon emissions is set at 7% below current levels, and the corresponding number of carbon permits is auctioned to fossil fuel suppliers, we estimate that the market price for these permits will be approximately \$200/tC. At this price, the total amount of revenue generated by permit sales is \$198 billion per year.<sup>19</sup>

#### Baseline scenario

In Table 7, we present the distributional impacts of a cap-and-dividend policy, with the entire cost of carbon permits passed through to consumers and the entire revenue from the sale of permits recycled to the public in the form of equal per capita dividends. The amount per person that households pay in higher prices is reported in the "charge" column. This amount rises with per capita household expenditure, from \$215/person/year in the poorest decile to \$1,475/person/year in the richest decile. The dividend is the same across all households: \$678 per person. For the bottom six deciles, this exceeds the amount paid in higher prices; for the top four deciles the charge exceeds the dividend. In other words, roughly 60% of Americans come out ahead in sheer monetary terms from the cap-and-dividend policy, while 40% pay more in higher prices than they get back in their share of the dividends. The poorer the household, the larger the net benefit; the richer the household, the larger the net cost. The policy increases net incomes in the poorest decile by 24.0%, while net incomes in the richest decile decline by 2.7%.

These estimates are decile averages. But for any individual household, the net impact of the cap-and-dividend policy depends on its consumption pattern and how much it responds to changing relative prices by shifting from more carbon-intensive to less carbon-intensive consumption. Any household that curtails its direct and indirect consumption of fossil fuels to a level below the national average comes out ahead, receiving more money in dividends than it pays in higher prices, regardless of its expen-

**TABLE 7: DISTRIBUTIONAL IMPACT OF A CAP-AND-DIVIDEND POLICY**  
(BASED ON A CARBON CHARGE OF \$200/TC, WITH 100% RECYCLING TO INDIVIDUALS)

Per capita expenditure decile	Per capita expenditure (\$)	Average household size	Per capita incidence (\$)			As percentage of expenditures		
			Charge	Dividend	Net benefit	Charge	Dividend	Net benefit
1	1927	3.4	215	678	463	11.2%	35.2%	24.0%
2	3521	3.3	338	678	341	9.6%	19.3%	9.7%
3	4736	3.2	424	678	254	9.0%	14.3%	5.4%
4	5991	2.7	514	678	164	8.6%	11.3%	2.7%
5	7380	2.6	576	678	102	7.8%	9.2%	1.4%
6	8847	2.5	649	678	30	7.3%	7.7%	0.3%
7	10711	2.3	732	678	-53	6.8%	6.3%	-0.5%
8	13228	2.1	837	678	-158	6.3%	5.1%	-1.2%
9	17178	2.0	1024	678	-346	6.0%	3.9%	-2.0%
10	29943	1.8	1475	678	-797	4.9%	2.3%	-2.7%

Source: Authors' calculations (see text for details).

iture decile. The policy rewards "good behavior" – reductions in carbon emissions – across the income spectrum.

#### *Cap-and-dividend versus cap-and-giveaway*

The cap-and-dividend distributional outcome differs radically from what would happen under a cap-and-giveaway policy in which carbon permits are distributed free-of-charge to fossil-fuel firms. Both policies would increase the prices of fossil fuels, and of other goods and services in proportion to the use of fossil fuels in their supply, but instead of capturing the "rent" from permit sales and rebating it to the public on an equal per person basis, the cap-and-giveaway policy would generate windfall profits for fossil-fuel firms. These profits would flow to shareholders in the form of higher dividends and capital gains, benefiting households in proportion to their ownership of corporate stock. In the words of a U.S. Congressional Budget Office report (2007, p. 2), a giveaway strategy "would transfer income from energy consumers – among whom lower-income households would bear disproportionately large burdens – to shareholders of energy companies, who are disproportionately higher-income households."<sup>20</sup>

Data on the distribution of stock ownership by income decile are presented in Table 8.<sup>21</sup> Stock ownership is concentrated in upper-

income households, with the top tenth owning nearly 65% of the total, and the top two-tenths owning 77%. Using these figures, we can approximate the distributional effects of a cap-and-giveaway policy.<sup>22</sup>

Table 9 summarizes distributional outcomes under these two policy scenarios. In contrast to cap-and-dividend, the cap-and-giveaway policy results in a regressive redistribution of income and imposes net costs on the majority of American households: the bottom nine deciles pay more as a result of higher fuel prices than they receive in stock dividends and capital gains. The contrast between the distributional outcomes of the two policies is depicted graphically in Figure 5, with the deciles combined into quintiles for simplicity.

**TABLE 8: DISTRIBUTION OF STOCK OWNERSHIP**

Per capita income decile	Stock ownership	Share of total stock
1	7437	0.8%
2	4564	0.5%
3	8697	0.9%
4	16069	1.7%
5	23066	2.4%
6	40296	4.2%
7	54571	5.7%
8	67427	7.0%
9	116542	12.1%
10	626335	64.9%

Source: Calculated from 2004 Survey of Consumer Finances.

TABLE 9: CAP-AND-GIVEAWAY VERSUS CAP-AND-DIVIDEND

Per capita expenditure decile	Per capita expenditure (\$)	Household size	Cap-and-Giveaway		Cap-and-Dividend	
			Net benefits per capita (\$)	As % of total expenditures	Net benefits per capita (\$)	As % of total expenditures
1	1927	3.4	-91	-4.7%	463	24.0%
2	3521	3.3	-244	-6.9%	341	9.7%
3	4736	3.2	-309	-6.5%	254	5.4%
4	5991	2.7	-355	-5.9%	164	2.7%
5	7380	2.6	-377	-5.1%	102	1.4%
6	8847	2.5	-342	-3.9%	30	0.3%
7	10711	2.3	-336	-3.1%	-53	-0.5%
8	13228	2.1	-360	-2.7%	-158	-1.2%
9	17178	2.0	-231	-1.3%	-346	-2.0%
10	29943	1.8	2645	8.8%	-797	-2.7%

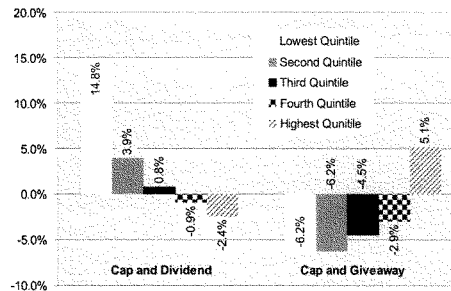
Based on a carbon charge of \$200 per tC.  
Source: Authors' calculations (see text for details).

In the absence of revenue recycling, the price increases arising from a carbon cap that yields a \$200/tC permit price would raise the cost of living of the median American family by about \$1,570 per year.<sup>23</sup> It is unlikely that the public would welcome such belt-tightening, particularly if they see the money going from their pockets into windfall profits for energy companies. Whether the public would be much happier if the money instead went to the government, as would occur with a cap-and-spend policy (or a carbon tax) is an open question. In contrast to these other policies, cap-and-dividend protects the real incomes of middle-class and low-income households. The political implications of these differences among policy outcomes should be evident.

Five caveats

Like all models of the distributional impacts of public policies, the estimates presented in Table 7 rest on a number of simplifying assumptions. We want to note five caveats in particular: (i) the assumption that the cost of carbon permits is passed through fully to consumers, rather than part of the cost being absorbed by producers via lower profit margins; (ii) the assumption of constant price elasticities of demand across expenditure deciles; (iii) the omission of welfare effects from our calculations; (iv) the omission of fossil fuel uses not tied to household consumption;

FIGURE 5: CAP-AND-DIVIDEND VERSUS CAP-AND-GIVEAWAY



Source: Calculated from Table 9.

and (v) the omission of sectoral employment impacts.

**\*Pass-through\* to consumers.** Studies of environmental policies – whether in the form of regulations, pollution taxes, or marketable pollution permits – typically assume that the costs these policies impose on firms are fully passed through to consumers in the form of higher prices. We have followed this conventional practice. It is plausible, however, that some fraction of the costs of carbon permits will be absorbed by producers via reduced profits – a possibility that may help to explain why producers often oppose environmental protection policies.

One reason why some firms might not shift the entire cost of carbon charges forward to consumers is that they are competing with other firms that are not equally impacted by the charges. Production costs of firms using less carbon-intensive technologies will rise less than those of firms in the same industry that use more carbon-intensive technologies.<sup>24</sup> To defend their market shares, the latter may trim profit margins rather than increasing prices to consumers enough to cover the full cost of their carbon permits. The ability of firms to absorb permit costs would be enhanced if they have been earning above-normal profits (for example, due to oligopolistic market power).

Households would bear the cost of any profit squeeze in proportion to their ownership of corporate stock. As noted above, this is highly unequal. Less-than-100% pass-through therefore would reduce the regressivity of carbon charges and enhance the progressivity of a cap-and-dividend policy. In the Appendix, we report calculations on distributional outcomes based on varying assumptions as to the actual extent of pass-through.

**Constant price elasticities.** In our calculations we assume that all households respond identically to price changes; that is, the price elasticity of demand does not vary across the expenditure spectrum. But there are plausible reasons to think that price elasticities may vary with income. For example, lower-income households may tend to respond more strongly to higher prices than upper-income households: with less money, they have a stronger incentive to economize.<sup>25</sup> In one of the few empirical studies of this question, West and Williams (2004) find that the lower-income households are more responsive to changes in the price of gasoline: in the poorest quintile they estimate the price elasticity of demand to be -0.73 (in other words, a 10% price rise leads to a 7.3% decline in demand), whereas in the richest quintile the price elasticity is only -0.18. If this pattern could be generalized, it would imply that our estimates overstate the impact of carbon charges on lower-

expenditure households and hence understate the progressivity of a cap-and-dividend policy.<sup>26</sup>

**Welfare effects.** Our calculations refer only to the real-income effects of carbon charges and revenue recycling. As noted above, we do not attempt to take into account the positive and negative welfare effects arising from reduced use of fossil fuels. But it bears repeating that the underlying rationale for policies to curb carbon emissions is that the benefits of doing so outweigh the costs. In an analysis of welfare effects that excludes benefits from reduced global warming, De Canio (2007) concludes that the distribution of carbon revenues has much stronger effects on household incomes than the macroeconomic effects of the carbon cap, and that an egalitarian distribution of carbon revenues “will improve the material well-being of a majority of the agents, even without taking into account the environmental benefits of the emissions reductions.”

Our analysis also does not take into account the diminishing marginal utility of income, the eminently plausible proposition that a dollar is worth more to a poor person than to a rich one. A cap-and-dividend policy would transfer dollars from richer households, where the marginal utility of a dollar is relatively low, to poorer ones, where the marginal utility of a dollar is relatively high. The incorporation of such “interpersonal comparisons” into a welfare-based accounting of distributional impacts would further reinforce the progressivity of the cap-and-dividend policy’s outcome.

**Non-household users of fossil fuels.** The Consumer Expenditure Survey (CEX) data on which we rely for our calculations omit non-household end-users of fossil fuels and other goods and services. According to the national income accounts (NIA), consumption represented 71% of U.S. GDP in 2003 (the remaining items are investment, net exports, and government spending).<sup>27</sup> This is fairly close to the ratio of our CEX-based measure of carbon emissions reported in Table 4 (3.67 mt/person/year) to total

U.S. emissions reported in Figure 1b (5.46 mt/person/year).<sup>28</sup>

Carbon permits will raise prices to non-household end-users, too. For simplicity, we have omitted these from our calculations of both revenue and dividends, but the distributional outcome is not greatly affected by the omission. Assuming that carbon charges associated with investment are passed to consumers in the same way as variable input costs, the inclusion of investment would simply increase the magnitudes of revenue and dividends without altering substantially the distributional pattern of net benefits.<sup>29</sup> Since carbon permit charges are levied on exports but not imports, omission of trade effects leads to a modest understatement of net benefits to U.S. households: part of the revenue rebated to them comes from foreign consumers, while the permit charges do not raise import prices.<sup>30</sup>

In the case of government, there are two ways to offset the impacts of higher fossil-fuel prices on real expenditure while providing the governments with an incentive to improve energy efficiency and shift to alternative energy sources. The first is to earmark a share of total carbon revenues to be directly recycled to federal, state and local governments, according to a formula based on their expenditures. Assuming this share equals what they pay in increased costs as a result of higher fossil-fuel prices, our calculations of net benefits would be unaffected. The second option is to dividend all of the carbon revenue to households, and let governments recoup their higher costs through taxation. Assuming this is accomplished through progressive taxes, this would enhance the progressivity of net benefits from the cap-and-dividend policy.

**Employment effects.** Finally, our calculations do not include the short-run impacts of carbon emission-reduction policies on employment. These include both negative impacts on fossil fuel-based sectors of the economy and positive impacts on other sectors, notably those involving alternative energy sources. Since the shift in

relative prices raises labor demand in some sectors while lowering it in others, there is no obvious reason to expect a substantial impact on aggregate employment. But insofar as alternative energy sectors are more labor-intensive than fossil-fuel industries – and there is some evidence that this is the case – the change may generate net increases in employment, particularly if investments are channeled into communities with high unemployment rates.

Labor does not move costlessly across industries and sectors, however. As we have noted, workers in fossil fuel-intensive industries could experience income losses as a result of policies that curtail carbon emissions. These adverse impacts could be offset by the provision of transitional adjustment assistance to the affected households and communities, an issue to which we turn in the next section. It is worth noting, however, that this issue arises with any public policy to reduce carbon emissions, not only a cap-and-dividend policy. Indeed, from the standpoint of displaced workers, cap-and-dividend at least has the advantage of offsetting the impact of higher fossil fuel prices on their real incomes, in the absence of which they would face a double blow from price effects as well as employment impacts.

## V. EARMARKS FOR NON-DIVIDEND USES

In this section we examine how the distributional outcome of a cap-and-dividend policy would differ if part of the revenue from carbon permits is earmarked initially for other uses, such as transitional adjustment assistance, rather than being entirely recycled as individual dividends.

The baseline results reported above assumed that all of the carbon revenues are recycled to individuals in the form of equal per capita dividends. It is possible, however, that policy makers will decide to earmark part of the revenue from the sale of carbon permits for other uses, particularly during the first few years of the policy's im-

TABLE 10: EFFECT OF WITHHOLDING CARBON REVENUES FOR OTHER USES

Per capita expenditure decile	Per capita expenditure (\$)	Net benefit/expenditure with different withholding percentages					
		0%	5%	10%	15%	20%	25%
1	1927	24.0%	22.3%	20.6%	18.9%	17.2%	15.5%
2	3521	9.7%	8.7%	7.8%	6.8%	5.9%	5.0%
3	4736	5.4%	4.7%	4.0%	3.3%	2.6%	1.9%
4	5991	2.7%	2.2%	1.6%	1.1%	0.5%	0.0%
5	7380	1.4%	0.9%	0.5%	0.0%	-0.4%	-0.9%
6	8847	0.3%	0.0%	-0.4%	-0.8%	-1.2%	-1.5%
7	10711	-0.5%	-0.8%	-1.1%	-1.4%	-1.8%	-2.1%
8	13228	-1.2%	-1.5%	-1.7%	-2.0%	-2.2%	-2.5%
9	17178	-2.0%	-2.2%	-2.4%	-2.6%	-2.8%	-3.0%
10	29943	-2.7%	-2.8%	-2.9%	-3.0%	-3.1%	-3.2%

Source: Authors' calculations.

plementation. For example, part of the revenue might be devoted to transitional adjustment assistance for workers and communities that suffer employment losses as a result of the reduced production and consumption of fossil fuels.

Other possible uses of carbon revenues include spending on public goods (such as investments in renewable energy), cuts in other taxes, and what might be termed transitional adjustment assistance to corporations (for example, via give-aways of a fraction of the carbon permits free-of-charge). Each of these may have its own attractions on political grounds, but there are economic and political costs to devoting more than a modest share of carbon revenues to them for reasons explained below.

The effects of withholding carbon revenues for other uses are shown in Table 10. We vary the percentage withheld from zero to 25% in five percentage-point increments, to show the sensitivity of our results to alternative assumptions. As the percentage earmarked for other uses goes up, net benefits to households go down and the percentage of households who come out ahead (in purely monetary terms) decreases. Whereas the bottom six deciles receive positive net benefits when 100% of the revenue is distributed in individual dividends (our baseline scenario, reproduced in the first column), only the bottom half receive positive net benefits with 10% of the revenue earmarked for

other uses. With 20% earmarked for other uses, only the bottom four deciles come out ahead.

Note that these results refer only to the net impact of higher fossil fuel prices and individual dividends, without taking into account the distributional effects of other uses of carbon revenues. The latter would depend, of course, on precisely what these other uses are. If the other uses benefit lower-income and middle-income households, their losses from lower dividends could be offset and the distributional progressivity of the overall result possibly enhanced. On the other hand, if the other uses primarily benefit upper-income households, this would reduce their losses and diminish the progressivity of the policy mix.

In our view, there are good economic and political reasons to minimize the extent of non-dividend uses of carbon revenues:

- *First*, the scale of other uses must be limited if we are to meet the central policy goal of reducing carbon emissions while protecting the real incomes of lower-income and middle-income households. We regard income protection as a crucial ingredient of climate policy: any policy that instead puts the economic burden on the poor and middle class risks a political backlash that could fatally undermine public support for curbing carbon emissions.



- *Second*, greater investment in energy efficiency and renewable energy sources will be induced by raising the price of fossil fuels and eliminating the implicit subsidy these now receive by virtue of the zero-pricing of carbon emissions. Such investment could – and, we believe, should – be boosted further by redirecting explicit subsidies from fossil fuels to renewables. Currently, federal subsidies for the fossil-fuel industry in the form of tax breaks and royalty-free access to public lands are worth \$24 billion per year (Andrews, 2007).<sup>31</sup> Reorienting these would dramatically increase federal support for energy efficiency and renewables without tapping the revenue from sales of carbon permits.
- *Third*, every dollar of revenues that is devoted to other uses is deducted equally from the dividends of all Americans, rich and poor alike. In other words, it is equivalent to a head tax: by taking a fixed amount from each person, it takes a higher percentage of income from the poor than from the rich. In effect, this would be one of the most regressive taxes in the country, a retreat from the principle of using progressive taxation to fund social expenditures.
- *Fourth*, using carbon revenues to make an equivalent cut in payroll taxes – as former vice-president Al Gore has advocated – would fail to protect the real incomes of lower-income and middle-income population who do not pay these taxes, including the elderly, the disabled and the unemployed.<sup>32</sup> It would also tie the future of Social Security and Medicare to a funding source that ultimately will shrink as the transition to a post-fossil fuel economy moves forward.
- *Finally*, if carbon revenues are used to finance government expenditures or tax cuts, there is no guarantee as to what these uses will turn out to be. Instead of a cut in payroll taxes, for example, we could see a cut in corporate income taxes; indeed, this is the alternative to the cap-and-dividend policy

that was analyzed in the CBO studies. Instead of financing expenditures on renewable energy or mass transit, we could see increased government spending on subsidies for fossil fuel corporations. We live with the administrations we have, not necessarily those we want. A policy in which the revenues are dedicated to individual dividends comes as close as possible to building a “locked box” that is not vulnerable to political vicissitudes in future years.

## VI. CONCLUSIONS

A cap-and-dividend policy would combine an effective means to curb U.S. carbon emissions from burning fossil fuels with protection of real incomes of lower-income and middle-income Americans from the consequences of higher fossil fuel prices.

Any policy that reduces carbon emissions will raise the prices of fossil fuels: higher prices are the handmaiden of lower demand. Higher prices for oil, coal, and natural gas will mean higher prices for goods and services produced with them. As documented in this study, these higher prices will hit the real incomes of lower-income and middle-income households harder than those of upper-income households.

But higher prices for fossil fuels are only one side of the story. The other side is summed up by the question, “Who gets the money?” If the money is recycled to the public on an equal per capita basis, via cap-and-dividend, the impact of the emissions-reduction policy on the distribution of incomes is transformed: lower-income and middle-income households come out ahead in monetary terms, both absolutely and relative to upper-income groups.

A cap-and-dividend policy has three basic steps:

- *First*, U.S. carbon emissions are capped at a level that gradually declines over time. For example, if we reduce emissions at a rate of 4% per year starting in 2010, we will cut

emissions to 20% of their 2010 level by the year 2050.

- *Second*, based on the cap in a given year, permits are auctioned to firms that bring fossil carbon into the economy (whether through domestic extraction or imports). The supply of permits in a given year is fixed by the cap; their price depends on the demand for them.
- *Third*, the revenue from the sale of permits is deposited into a trust fund and paid out to all individuals on an equal per person basis. In addition, some fraction of the revenue initially may be earmarked for other uses, such as transitional adjustment assistance.

A cap-and-dividend policy has several attractive features. It asserts the principle of common ownership of nature's wealth: rights to benefit from the U.S. share of the Earth's capacity to absorb carbon are allocated equally to all Americans. It protects the real incomes of the majority of the population, overcoming a crucial political hurdle to the adoption of effective policies to curb global warming. It results in a progressive redistribution of income, a result that does not hinge on the propensity of present and future governments to use the revenues for egalitarian purposes.

At a permit price of \$200 per ton of carbon, the annual revenue from the sale of permits would amount to roughly \$200 billion. If this revenue is recycled to individuals equally, the majority of households will receive positive net benefits: their dividends exceed the amount they pay as a result of higher fossil fuel prices. The net impact ranges from a 2.7% loss for the richest 10% of households to a 24.0% gain for the poorest 10%.

This "baseline scenario" assumes that 100% of the cost of carbon permits is shifted to consumers. If the extent of pass-through to consumers is less than 100%, and some of the cost is absorbed via lower profit margins, then the distributional progressivity of the outcome is enhanced and the percentage of American families who come out ahead increases.

Allowing a modest fraction of the carbon revenues to be earmarked initially for other uses, such as transitional adjustment assistance, could further enhance the political appeal of the cap-and-dividend policy. Our results indicate that up to ten per cent of the carbon revenues can be dedicated to other uses while maintaining positive net benefits for roughly 50% of households; withholding carbon revenues beyond the 10% threshold pushes the net beneficiary share of the population below half.

In sum, a cap-and-dividend policy is a "win-win" option for the majority of Americans, maintaining or increasing real incomes while curbing global warming and hastening the U.S. economy's transition towards the energy sources of the future. Not only is it an attractive policy on environmental, economic, and political grounds; it is, as far as we know, the *only* policy that combines these virtues in a realistic proposal. If the American public engages actively in shaping the nation's climate policies, the cap-and-dividend policy could become not just an attractive idea but a historic breakthrough.

**APPENDIX:****Distributional Impact with Less-than-100% Pass-through to Consumers**

In this appendix, we examine how the distributional impact of a cap-and-dividend policy would differ if part of the cost of carbon permits is absorbed by producers in the form of lower profit margins, rather than being passed fully to consumers in the form of higher prices.

Little empirical research has been done to ascertain the extent to which the cost of carbon permits will be passed through to consumers. In a recent literature review, Parry et al. (2005, p. 32) remark that "empirical studies on the extent to which the costs of environmental policies are passed forward into higher prices of consumer products would be extremely valuable." Studies on the extent of pass-through of sales and excise taxes have generated mixed results: some studies have found close to 100% pass-through, some have found significantly less, and still others have found "overshifting" in which prices rise by more than the amount of the tax (Fullerton and Metcalf 2004, pp. 1817-1823).<sup>33</sup>

If firms absorb part of the cost of carbon permits via lower profit margins, this has two effects on our calculations. First, it reduces the incomes of households in proportion to their ownership of corporate stock. Second, it translates into a higher permit price and higher total revenues for a given emission cap. (Permit

prices rise because the reduction in demand for fossil fuels is a function of the price increases passed through to consumers; total revenues rise because demand is price-inelastic).

To examine the effects of less-than-100% pass-through of carbon charges to consumers, we assume that reductions in corporate profits are distributed amongst households on the basis of stock ownership as reported in Table 8. We vary the share of permit costs absorbed via lower profits from 0% (our baseline scenario) to 25% in five percentage-point increments, to show the sensitivity of the results to alternative assumptions. That is, we allow the percentage of the carbon charge that is passed through to consumers to vary from 75% to 100%.

The results are presented in Table A.1. The first column - with zero charge from profits, or 100% pass-through - shows the net distributional impact of the cap-and-dividend policy as reported in Table 7. Subsequent columns show the distributional impact with rising shares of the permit price coming from corporate profits. As the pass-through to consumers diminishes, net benefits to lower-income and middle-income households increase. Insofar as the carbon charges cut into corporate profits rather than being shifted fully to consumers, our baseline results understate the favorable distributional impacts of the cap-and-dividend policy.

**TABLE A.1: IMPACT OF VARYING PERCENTAGE OF CHARGE FROM PROFITS**

Per capita expenditure decile	Per capita expenditure (\$)	Net benefit /expenditure with different percentage of charge from profits					
		0%	5%	10%	15%	20%	25%
1	1927	24.00%	25.70%	27.60%	29.70%	32.20%	35.00%
2	3521	9.70%	10.60%	11.70%	12.90%	14.30%	15.90%
3	4736	5.40%	6.00%	6.80%	7.70%	8.60%	9.80%
4	5991	2.70%	3.20%	3.80%	4.40%	5.10%	5.90%
5	7380	1.40%	1.80%	2.20%	2.60%	3.20%	3.80%
6	8847	0.30%	0.60%	0.80%	1.10%	1.50%	1.90%
7	10711	-0.50%	-0.30%	-0.20%	0.00%	0.20%	0.50%
8	13228	-1.20%	-1.10%	-1.00%	-0.90%	-0.80%	-0.70%
9	17178	-2.00%	-2.10%	-2.10%	-2.20%	-2.20%	-2.30%
10	29943	-2.70%	-3.30%	-4.10%	-4.90%	-5.80%	-6.90%
Carbon charge (per tC)		\$200.00	\$210.53	\$222.22	\$235.29	\$250.00	\$266.67

Note: Assumes 100% revenue recycling via dividends.

Source: Authors' calculations.

## Notes

<sup>1</sup> EU-15 refers to the fifteen member states of the European Union as of 1995. Emissions for Germany prior to German reunification in 1990 are the total for West Germany and East Germany.

<sup>2</sup> Emissions resulting from electricity use are allocated across fuel sources on the basis of total emissions from the electric power sector. Emissions by sector:

[http://www.eia.doe.gov/emeu/aer/pdf/pages/sec12\\_5.pdf](http://www.eia.doe.gov/emeu/aer/pdf/pages/sec12_5.pdf).

Emissions from electricity generation by fuel source:

[http://www.eia.doe.gov/emeu/aer/pdf/pages/sec12\\_16.pdf](http://www.eia.doe.gov/emeu/aer/pdf/pages/sec12_16.pdf).

<sup>3</sup> The data in Table 2 are drawn from the Consumer Expenditure Survey, conducted quarterly for the U.S. Bureau of Labor Statistics by the Census Bureau. We pooled annual consumption data for households that began participating in the survey from the 3rd quarter of 2002 through the 2nd quarter of 2003.

<sup>4</sup> We calculated separate price impacts for air transport and "other transport" (including trains and mass transit), categories combined in Metcalf's study, using data from the 1992 input-output accounts (Lawson 1997).

<sup>5</sup> The higher per capita emissions shown in Figure 1b (5.5 tC) include carbon emissions from other sources, such as government expenditure, in addition to those associated with household consumption.

<sup>6</sup> This is what happened when the European Union introduced carbon permits for electric power generation and gave them free-of-charge to utility companies. For accounts, see Ball (2006) and Dutzik et al. (2007, p. 22). As Paltsev et al. (2007, p. 5) note, if regulated utility markets were to prevent price rises (and windfall profits), this would dissipate the incentive for consumers to curb consumption.

<sup>7</sup> This is an extension of the 'feebate' concept, whereby fees are paid according to the extent of individual resource use, and the proceeds rebated equally to all use-rights holders. This idea has been applied to a variety of environmental problems; see, for example, Puig-Ventosa (2004). For an early application to gasoline taxes, see Shepard (1976).

<sup>8</sup> The so-called "tragedy of the commons" – in which unrestricted access to a scarce resource leads to its overuse – is more accurately termed the tragedy of open access, since communities often devise rules to protect common-property resources. Open access often leads to a second tragedy, too: those who reap most of the short-run benefits from open access are the wealthy and powerful, while those most severely impacted by the long-run costs are the poor and relatively powerless. For discussion, see Boyce (2002, pp. 7-8).

<sup>9</sup> It is possible to design alternative uses of carbon-charge revenues that are superior, at least in theory, to lump-sum redistribution on efficiency or distributional grounds (see Zhang and Baranzini 2004, pp. 511-2). In practice, however, these alternatives would be subject to the vagaries of fiscal politics. Moreover, Unlike the cap-and-dividend policy, they

would not affirm the fundamental principle of equal rights to nature's common wealth.

<sup>10</sup> For discussion of administrative costs, see also Fisher et al. (1998). As the CBO (2001, p. 19) notes, administrative costs would increase if charges were levied not only on fossil fuels, but also on imports of carbon-intensive products (such as aluminum) so as to avoid placing domestic producers at a disadvantage in the absence of similar carbon policies in the exporting countries. Presumably these cost increases would be offset by the additional revenue collected.

<sup>11</sup> A recent study of Italy's carbon tax (Tiezzi 2005) finds that it has a progressive incidence, however, by virtue of the facts that it is designed to hit transport fuels harder than domestic fuel use and that higher-income Italian households were less responsive to higher prices.

<sup>12</sup> In assessing distributional impacts, researchers often stratify households on the basis of expenditure rather than income, on the grounds that expenditure is a better proxy for lifetime income and less subject to transitory shocks. We do the same in this paper. If incidence instead is calculated on the basis of income data, carbon charges generally appear to be even more regressive because expenditure-to-income ratios typically decline as incomes rise. For discussion, see Metcalf (1999).

<sup>13</sup> The give-away option, sometimes referred to as "grandfathering," was the main method adopted when sulfur dioxide emission permits were introduced in the U.S. in the 1990s. Insofar as the resulting windfall profits are taxed, this method generates some government revenue (albeit less than if the permits were sold by auction). In an analysis of the effects of grandfathered carbon emissions permits with profits taxed at the rate of 35%, Parry (2004) likewise finds that the distributional impact is regressive even when coupled with lump-sum redistribution of the revenues recouped by taxation, due to the skewed distribution of profit income.

<sup>14</sup> The stronger distributional effects in the Dinan and Rogers study arise mainly from (i) use of a lower value for average income in the lowest quintile, and (ii) incorporation of an estimated "deadweight loss" in factor markets due to the impact of higher carbon prices on real returns to capital and labor.

<sup>15</sup> For a tool for calculating co-benefits, see Mulholland (2007). For estimates of damages from releases of particulates, sulfur dioxide, and nitrogen oxides in the U.S., see Mulier and Mendelsohn (2007).

<sup>16</sup> The authors assume that dividends are distributed equally per person, rather than equally per household as in the CBO (2000) and Dinan and Rogers (2002) studies.

<sup>17</sup> A doubling of the permit price would not quite double total revenue and net benefits, because it would entail reduced demand and fewer permits.

<sup>18</sup> For energy sectors, the elasticities are based on the literature review by Dahl (1993). For food, services, and in-

dustrial goods, we use Williamson's (2006) "stylized facts of demand."

<sup>19</sup> This falls near the middle of the \$50-300 billion/year range (in 2007 dollars) that the U.S. Congressional Budget Office (2007, p. 2) reports as the likely value of carbon emission permits in 2020, based on a review of the existing literature and the range of emission-reduction goals currently being debated.

<sup>20</sup> One rationale sometimes offered for a cap-and-giveaway strategy is that it would compensate shareholders of fossil-fuel companies for declines in stock values arising from lower sales. At the same time, however, shareholders of renewable-energy companies would be expected to experience increases in stock values due to higher sales. Some shareholders win, others lose. We see no compelling reason for the public to insure the shareholders of polluting firms against the risk that society will adopt policies to curb pollution. In any event, as the U.S. Congressional Budget Office (2007, p. 5) notes, compensation to adversely affected shareholders would require only a "small fraction" of the total value of carbon permits. Goulder (2002) estimates that a cap-and-giveaway policy with permits rising from a modest initial price of \$25/tC to a final price of \$50/tC would lead to a sevenfold increase in stock values for coal companies and to a doubling of stock values for oil and gas firms.

<sup>21</sup> The deciles in Table 8 are grouped by per capita income rather than per capita expenditure. (The difference between the two probably explains the anomalous finding that the bottom decile owns somewhat more stock than the second lowest decile.) We have not found comparable data for expenditure deciles. These stock ownership data include both direct ownership of stocks and indirect ownership through mutual funds and other sources. For discussion, see Bucks et al. (2006).

<sup>22</sup> For simplicity, we assume that all windfall profits are recycled to U.S. households in proportion to their stock ownership. In practice, some profits would "leak" out of the country in returns to foreign owners of stock in fossil-fuel companies, diminishing net benefits of the cap-and-giveaway policy to U.S. households. Some profits might also be withheld from shareholders and instead used to increase executive compensation. For both reasons, the cap-and-giveaway results presented in Table 9 can be regarded as a "best-case" approximation that, if anything, understates net costs for the majority of households.

<sup>23</sup> This is the average per capita charge for the 5th and 6th deciles, multiplied by the average household size in these deciles, as reported in Table 7.

<sup>24</sup> A similar situation could arise for tradable goods producers who face competition from foreign firms not covered by the carbon permit mandate. All else equal, the introduction of carbon permits in the U.S. economy would make imports more competitive and exports less competitive. In industries where these trade effects are significant, there is a case for corrective policies: tariffs on imports (based on fossil carbon

emissions in their production) and dividends on exports. Careful research is needed to assess needs for such compensating policies. We note, however, that many foreign competitors (notably in Europe) now pay higher prices for fossil fuels than U.S. producers, due to government environmental and taxation policies. In these cases, it would be difficult to argue that introducing carbon permits would place U.S. firms at an unfair disadvantage. More generally, trade competitiveness depends on many factors – including exchange rates, labor costs, taxation, and the pace of technological innovation – and these are likely to overshadow the effects of environmental policies, which empirical studies generally find to be quite small (for discussions, see Goodstein 1999 and Ackerman 2006).

<sup>25</sup> To be sure, lower-income households devote a higher proportion of their expenditure to necessities than to luxuries, and from this it is sometimes inferred that they tend to be less responsive, for example, to changes in the price of gasoline (Kayser 2000). But the same reasoning applies to non-fuel expenditures by lower-income households: not cutting gasoline consumption in response to higher prices would imply bigger cutbacks in other necessities such as food and health care. A more plausible reason to expect greater price responsiveness among upper-income households is that in some cases (such as buying more energy-efficient vehicles), cutbacks in fuel consumption require investments in expensive durable goods.

<sup>26</sup> Other studies of price elasticity differences across the income spectrum have produced mixed results. West (2004) and Archibald and Gillingham (1980) also find that lower-income US households are more responsive to gasoline prices than are upper-income households, while Kayser (2000) reports a contrary finding. In a study in the United Kingdom, Dargay and Vythoulkas (1999) also find greater price-responsiveness among lower-income households: the long-run elasticity of car ownership with respect to running costs is -0.92 for low-income groups, -0.51 for middle-income groups, and -0.38 for high-income groups (see also U.K. Department for Transport, 2006). In a study of Denmark, Brännlund and Nordstrom (2004) find little variation across income groups in the price elasticities of demand for gasoline and other goods.

<sup>27</sup> Unlike the CEX, the NIA consumption measure includes expenditures by non-profit institutions serving households, which account for roughly 11% of consumption, or 8% of GDP (based on 1993 data cited by Garner et al. 2006, p. 22). Subtracting this from the NIA measure, household consumption represented roughly 63% of national income.

<sup>28</sup> Another possible source of discrepancy between the two figures is under-reporting of consumption in the CEX. The CEX-based estimate of total consumption in the United States, derived from household surveys, is roughly 60% of the National Income Accounts-based estimate of aggregate consumption, derived primarily from economic censuses of firms (for discussion, see Garner et al. 2006). In part, this disparity arises from definitional differences (for example,

the latter includes consumption by many non-profit institutions whereas the CEX does not), and in part from measurement errors in one or both instruments. Insofar as under-reporting in the CEX accounts is to blame, this would affect the pattern of distributional impacts reported here only if the under-reporting were uneven across expenditure deciles. Since we lack adequate data on which to assess this possibility, we make do with the data at hand. If the degree of any under-reporting in the CEX is roughly constant across deciles, then its only effect on the distributional impacts of a cap-and-dividend policy reported in Table 7 would be on absolute magnitudes, not on the pattern of relative impacts across deciles.

<sup>29</sup> If investment per unit output and carbon emissions per dollar investment are roughly the same across sectors, inclusion of investment-related emissions would somewhat reduce the disparities in carbon content across consumption categories reported in Table 3. Since low-carbon categories account for a larger share of expenditure by upper-income households, this would reduce the regressivity of carbon charges and enhance the progressivity of the cap-and-dividend outcome.

<sup>30</sup> In some cases, however, trade policies may compensate for these effects; see note 24.

<sup>31</sup> To put this number in perspective, in 2005 public expenditure on research & development for wind energy, fuel cells and photovoltaics combined was about \$250 million (Kammen and Nemet 2005, p. 86).

<sup>32</sup> See "Solving the Climate Crisis," speech by Al Gore at New York University, 18 September 2006. Available at <http://www.nyu.edu/community/gore.html>.

#### NOTE TO APPENDIX

<sup>33</sup> A related but distinct issue is the impact of higher prices on the "welfare triangles" of consumers' surplus and producers' surplus. Basic microeconomic theory tells us that the ratio of these welfare losses depends on price elasticities of demand and supply: the more inelastic the demand curve, the higher the share of consumers; the more inelastic the supply curve, the higher the share of producers. These calculations assume that the full cost of carbon permits (or carbon taxes) is passed through to consumers. If the supply curve is not perfectly elastic, the reduction in output leads to a decline in marginal cost and this dampens the rise in the market price, but consumers still are assumed to pay the full carbon charge (the difference between the marginal cost of production without permits and the market price with permits). Here we do not attempt to incorporate the welfare losses from reduced consumers' surplus and producers' surplus, nor the welfare gains from reduced carbon emissions, for reasons explained in section 3.

## REFERENCES

- Ackerman, Frank (2006) "The Unbearable Lightness of Regulatory Costs," *Fordham Urban Law Journal*, May.
- Andrews, Edmund L. (2007) "Democrats Press Plan to Channel Billions in Oil Subsidies to Renewable Fuels," *The New York Times*, June 18.
- Archibald, Robert and Robert Gillingham (1980) "An Analysis of the Short-Run Consumer Demand for Gasoline Using Household Survey Data," *Review of Economics and Statistics* 62(4): 622-628.
- Ball, Jeffrey (2006) "For German Firms, New Emission Caps Roil Landscape," *The Wall Street Journal*, September 11.
- Barnes, Peter (2001) *Who Owns the Sky? Our Common Assets and the Future of Capitalism*. Washington, D.C.: Island Press.
- Barnes, Peter and Marc Breslow (2003) "The Sky Trust: The Battle for Atmospheric Scarcity Rent," in James K. Boyce and Barry G. Shelley, eds., *Natural Assets: Democratizing Environmental Ownership*. Washington, DC: Island Press, pp. 135-149.
- Boyce, James K. (2002) *The Political Economy of the Environment*. Cheltenham and Northampton: Edward Elgar.
- Brännlund, Runar and Jonas Nordstrom (2004) "Carbon Tax Simulations Using a Household Demand Model," *European Economic Review* 48: 211-233.
- Bucks, Brian K., Arthur B. Kennickell, and Kevin B. Moore (2006) "Recent Changes in U.S. Family Finances: Evidence from the 2001 and 2004 Survey of Consumer Finances," *Federal Reserve Bulletin* 92: A1-A38.
- Cornwell, Antonia and John Creedy (1996) "Carbon Taxation, Prices and Inequality in Australia," *Fiscal Studies* 17(3): 21-38.
- Cramton, Peter and Suzi Kerr (1999) "The Distributional Effects of Carbon Regulation: Why Auctioned Carbon Permits are Attractive and Feasible," in Thomas Sterner, ed., *The Market and the Environment*. Northampton, MA: Edward Elgar, pp. 255-271.
- Dahl, Carol (1993) "A Survey of Energy Demand Elasticities in Support of the Development of the NEMS," U.S. Department of Energy, National Energy Modeling System (NEMS), Contract No. DE-AP01-93EI23499.
- Dargay, Joyce M. and Petros C. Vythoulkas (1999) "Estimation of a Dynamic Car Ownership Model: A Pseudo-Panel Approach," *Journal of Transport Economics & Policy* 33(3): 287-302.
- De Canio, Stephen J. (2007) "Distribution of Emissions Allowances as an Opportunity," *Climate Policy* [forthcoming].
- Dinan, Terry M. and Diane Lim Rogers (2002) "Distributional Effects of Carbon Allowance Trading: How Government Decisions Determine Winners and Losers," *National Tax Journal* 55: 199-222.
- Dutzik, Tony, Rob Sargent and Emily Figdor (2007) *Cleaner, Cheaper, Smarter: The Case for Auctioning Pollution Allowances in a Global Warming Cap-and-Trade Program*. Boston: U.S. PIRG Education Fund. Available at <http://www.uspirg.org/uploads/Ma/3Q/Ma3Qikh90Wao1QdkyV9bHw/Cleaner-Cheaper-Smarter-USPIRG.pdf>.
- Fisher, Carolyn, Suzi Kerr and Michael Tom:an (1998) "Using Emissions Trading to Regulate U.S. Greenhouse Gas Emissions: Design and Implementation Issues," *National Tax Journal* 51(3): 453-464.

- Fullerton, Don and Gilbert E. Metcalf (2004) "Tax Incidence." In A.J. Auerbach and M. Feldstein, eds. *Handbook of Public Economics, Volume 4*. New York: Elsevier.
- Garner, Thesia I., George Janini, William Passero, Laura Paszkiewicz and Mark Vendemia (2006) "The CE and the PCE: A Comparison," *Monthly Labor Review* 129(9): 20-46.
- Goodstein, Eban (1999) *The Trade-Off Myth: Fact and Fiction about Jobs and the Environment*. Washington, DC: Island Press.
- Goulder, Lawrence H. (2002) "Mitigating the Adverse Impacts of CO2 Abatement Policies on Energy-Intensive Industries," Washington, DC: Resources for the Future, Discussion Paper 02-22.
- Hamilton, Kirk and Grant Cameron (1994) "Simulating the Distributional Effects of a Canadian Carbon Tax," *Canadian Public Policy* 20(4): 385-399.
- Intergovernmental Panel on Climate Change (IPCC) (2007) "Summary for Policymakers," in *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Available at [www.ipcc.ch/SPM040507.pdf](http://www.ipcc.ch/SPM040507.pdf).
- Kammen, Daniel M. and Gregory F. Nemet (2005) "Reversing the Incredible Shrinking Energy R&D Budget," *Issues in Science and Technology* 22(1): 84-88.
- Kayser, Hilke A. (2000) "Gasoline Demand and Car Choice: Estimating Gasoline Demand Using Household Information," *Energy Economics* 22: 331-348.
- Klinge Jacobsen, H., K. Birr-Pedersen K., and M. Wier (2003) "Distributional Implications of Environmental Taxation in Denmark," *Fiscal Studies* 24(4): 477-499.
- Kopp, Raymond, Richard Morgenstern, William Pizer, and Michael Toman (1999) "A Proposal for Credible Early Action in U.S. Climate Policy," Washington, DC: Resources for the Future. Available at <http://www.weathervane.rff.org/features/feature060.html>.
- Lawson, Ann M. (1997), "Benchmark Input-Output Accounts for the U.S. Economy, 1992," *Survey of Current Business* 77(11): 36-82.
- Metcalf, Gilbert E. (1999) "A Distributional Analysis of Green Tax Reforms," *National Tax Journal* 52(4): 655-681.
- Mulholland, Denise (2007) "Estimating and Valuing Human Health Effects of State and Local Emissions Reductions: The Co-Benefits Risk Assessment (COBRA) Screening Model," Washington, DC: U.S. Environmental Protection Agency.
- Muller, Nicholas Z. and Robert Mendelsohn (2007) "Measuring the Damages of Air Pollution in the United States," *Journal of Environmental Economics and Management* 54(1): 1-14.
- Paltsev, Sergey et al. (2007) "Assessment of U.S. Cap-and-Trade Proposals," Cambridge, MA: Massachusetts Institute of Technology Joint Program on the Science and Policy of Global Change, Report No. 146, April. Available at [http://web.mit.edu/globalchange/www/MITJSPSGC\\_Rpt146.pdf](http://web.mit.edu/globalchange/www/MITJSPSGC_Rpt146.pdf).
- Parry, Ian W.H. (2004) "Are Emissions Permits Regressive?" *Journal of Environmental Economics and Management* 47: 364-387.
- Parry, Ian W.H., Hilary Sigman, Margaret Walls, and Robertson C. Williams III (2005) "The Incidence of Pollution Control Policies," Washington, DC: Resources for the Future, Discussion Paper 05-24, June.



- Puig-Ventosa, Ignasi (2004) "Potential Use of Feebate Systems to Foster Environmentally Sound Urban Waste Management," *Waste Management* 24: 3-7.
- Shepard, Lawrence (1976) "The Short-Run Incidence of a Gasoline Tax Rebate Plan," *Journal of Economic Issues* 10(1): 169-172.
- Smulders, Sjak and Herman R.J. Vollebergh (2001) "Green Taxes and Administrative Costs," in Carlo Carraro and Gilbert E. Metcalf, eds., *Behavioral and Distributional Effects of Environmental Policy*. Chicago: University of Chicago Press, pp. 92-129.
- Symons, Elizabeth, John Proops, and Philip Gay (1994) "Carbon Taxes, Consumer Demand and Carbon Dioxide Emissions: A Simulation Analysis for the UK," *Fiscal Studies* 15(2): 19-43.
- Symons, Elizabeth, Stefan Speck, and John Proops (2000) "The Effects of Pollution and Energy Taxes across the European Income Distribution," Keele University Economics Research Paper No. 2000/05.
- Tiezzi, Silvia (2005) "The Welfare Effects and the Distributive Impact of Carbon Taxation on Italian Households," *Energy Policy* 33: 1597-1612.
- U.K. Department for Transport (2006) "Generalized Cost Elasticities & Income Level: Literature Review." Available at <http://www.dft.gov.uk/foi/responses/2006/jul/aandrsternreview/informationregardinganalyses2737>.
- U.S. Congressional Budget Office (2000) *Who Gains and Who Pays Under Carbon-Allowance Trading? The Distributional Effects of Alternative Policy Designs*. Washington, DC: CBO, June.
- U.S. Congressional Budget Office (2001) *An Evaluation of Cap-and-Trade Programs for Reducing U.S. Carbon Emissions*. Washington, DC: CBO, June.
- U.S. Congressional Budget Office (2003) *Shifting the Cost Burden of a Carbon Cap-and-Trade Program*. Washington, DC: CBO, July.
- U.S. Congressional Budget Office (2007) "Trade-Offs in Allocating Allowances for CO<sub>2</sub> Emissions," *CBO Economic and Budget Issue Brief*, 25 April.
- U.S. Energy Information Administration (2007) *Energy Information Annual 2005*. Washington, D.C.: U.S. Department of Energy. Available at <http://www.eia.doe.gov/emeu/iea/carbon.html>.
- West, Sarah E. (2004) "Distributional Effects of Alternative Pollution Control Policies," *Journal of Public Economics* 88: 735-757.
- West, Sarah E. and Robertson C. Williams III (2004) "Estimates from a Consumer Demand System: Implications for the Incidence of Environmental Taxes," *Journal of Environmental Economics and Management* 47: 535-558.
- Wier, Mette, Katja Birr-Pedersen, Henrik Klinge Jacobsen, and Jacob Klok (2005) "Are CO<sub>2</sub> Taxes Regressive? Evidence from the Danish Experience," *Ecological Economics* 52: 239-251.
- Williamson, Jeffrey G. (2006) *Did British Capitalism Breed Inequality?* London: Routledge.
- Zhang, Zhongxiang and Andrea Baranzini (2004) "What Do We Know about Carbon Taxes? An Inquiry into their Impacts on Competitiveness and Distribution of Income," *Energy Policy* 32: 507-518.