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ECONOMIC AND INTERNATIONAL ISSUES IN GLOBAL WARMING POLICY

HEARING

BEFORE THE

SUBCOMMITTEE ON PRIVATE SECTOR AND CONSUMER SOLUTIONS TO GLOBAL WARMING AND WILDLIFE PROTECTION

OF THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

July 24, 2007

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ONE HUNDRED TENTH CONGRESS
FIRST SESSION

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[1]Note: During the 110th Congress, Senator Craig Thomas, of Wyoming, passed away on June 4, 2007. Senator John Barrasso, of Wyoming, joined the committee on July 10, 2007.

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ECONOMIC AND INTERNATIONAL ISSUES IN GLOBAL WARMING POLICY

TUESDAY, JULY 24, 2007

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON PRIVATE SECTOR AND CONSUMER
SOLUTIONS TO GLOBAL WARMING AND WILDLIFE PROTECTION
Washington, DC.

The subcommittee met, pursuant to notice, at 2:30 p.m. in room 406, Dirksen Senate Office Building, Hon. Joseph I. Lieberman (chairman of the subcommittee) presiding.

Present: Senators Lieberman, Boxer, Craig, Inhofe, Sanders and Warner.

OPENING STATEMENT OF HON. JOSEPH I. LIEBERMAN, U.S. SENATOR FROM THE STATE OF CONNECTICUT

Senator LIEBERMAN. Good afternoon and welcome to this hearing of our Subcommittee on Climate Change. I am delighted to welcome everyone. I am particularly happy that the Chairman of the overall Committee, Senator Boxer, is with Senator Warner and me.

As many of you know, a while ago, Senator Warner and I joined in a collaboration and really a commitment to bring forth from both of us to this Subcommittee, and then hopefully from the Subcommittee to the full Committee and on, an effective legislative proposal that will impede the forward movement of climate change and the role that the United States is playing in it, in a way that is fair.

I am very pleased to say that since we joined together in this, we and our staffs have been working closely. It has been a pleasure to work with my dear friend with whom I have served for so many years on the Armed Services Committee, and really under whose leadership I have served and learned a lot on this matter. Our staffs have been reaching out to stakeholders on all sides of this challenge and learning a lot.

We issued a set of principles. We are committed to bring forth an economy-wide cap and trade climate change legislation. But we want to listen. This hearing is part of that listening which will focus on two of the main questions and concerns that people ask us as we go ahead with this process. Those two are, what do we do if there is an economic emergency? How do we create what Senator Warner I think wisely calls emergency off-ramps, not just easy off-ramps, but emergency off-ramps if there is a real economic problem?

And the second is, this is a global problem. It is global climate change. Yes, let's say that we are going to get America to take a leadership role in dealing with the problem, but unless other rising economic superpowers like China and India also do so, our hard work to reduce our emissions of greenhouse gases will have little affect on the overall global problem. So how do we deal with that?

I am going to suggest briefly two things. On the first, the question of the emergency off-ramps, and we will hear more about them in testimony today, this morning Senator Warner, joined by Senators Landrieu, Graham, and Lincoln, introduced a new cost containment or emergency off-ramp provision that they have said they hoped to see included in any cap and trade legislation. I myself found it to be a very impressive, thoughtful, sophisticated piece of work. I think it has the flexibility to deal with a genuine economic crisis, while not being so rigid as to undercut the power of the market which we are trying to harness in our approach to reducing American greenhouse gas emissions.

Second, earlier this month Senators Bingaman and Specter introduced an economy-wide cap and trade bill. It had some very interesting and thoughtful provisions in it. Senator Warner and I have given close attention to it. I think one of its most interesting provisions addresses the second question, which is the need to ensure that once the U.S. joins of the developed world in controlling and attempting to reduce greenhouse gas emissions, that rising economic superpowers like China and India will in fact follow suit so that together we can forestall warming of our planet that could mean catastrophe for all of us.

We are very appreciative of the section of the Bingaman-Specter bill that deals with this problem and we are very fortunate to have with us today some witnesses who can describe the way it would work.

Finally, I do want to say on the question of cost, there is a very, very significant report issued by the Environmental Protection Agency today, published earlier today, appearing on its website earlier. Senator McCain and I asked the EPA to do an evaluation, an economic analysis of our climate change legislation. I am very pleased by what it says, both in terms of the effectiveness of the proposal and the affordability, if I can call it that. EPA finds that if the U.S. Government enacted the climate stewardship act of ours in 2007, and concentration—and this is with conservative estimates—concentration of greenhouse gases in the atmosphere will remain below 500 parts per million at the end of this century. According to the IPCC, the international body that has the most experts, keeping the concentration below that 500 parts per million will avoid a high risk of global warming that could cause extremely severe impact. So the first judgment of EPA on this proposal does what it needs to do.

Second, if enacted, they say that the U.S. gross domestic product would increase 111 percent over the 2005 level by 2030. That increase is 1 percent lower than the increase projected in the absence of our legislation. Of course, the analysis does not take into account the negative influence that a failure to curb global warming would have on U.S. GDP.

This EPA report also finds that the Climate Stewardship Act if enacted average annual per-household consumption in the U.S. would increase 103 percent by 2030. Here is the point: that increase is 2 percent lower, only 2 percent lower than the increase projected in the absence of the climate change legislation.

EPA also says that while the models do not represent benefits, it can be said that as the abatement of greenhouse gas emissions increases over time, so do the benefits of abatement. EPA also finds that if this climate change legislation is enacted, electricity rates will over 15 years rise from about 8 cents per kilowatt hour to about 8.5 or 9 cents per kilowatt hour. In other words, yes, there is a cost to doing something about this problem, but it is manageable and quite affordable when one thinks of the benefits and the catastrophe avoided.

Detailed power sector modeling finds that if the legislation were enacted, coal will remain economically viable in the United States as a fuel for electricity generation, with coal production remaining essentially constant until around 2030, when coal use will begin increasing because of the escalating deployment of carbon capture and storage technology.

The report also found that this climate change legislation would have no effect on natural gas prices through 2030, at which point it would start reducing natural gas prices below what they would otherwise be.

And finally, with regard to gas prices, the projection is that over the next 23 years, the increase in gas prices as a result of this legislation would only be 9 percent over 23 years. Obviously, that is well within the fluctuations that have already occurred because of market movements and manipulation.

So I congratulate EPA for a first rate piece of work analytically. Second, I am grateful that this is a matter of choice. Nothing is for free, but facing the potential for real disaster and enormous costs associated with a disaster, this now says to us that we can do this in an affordable way and avoid the worst impacts of climate change. I think that is very important as we go forward with this process.

I apologize for taking a little longer than I thought I would.

Senator Warner? Thank you very much.

[The prepared statement of Senator Lieberman follows:]

STATEMENT OF HON. JOSEPH LIEBERMAN, U.S. SENATOR FROM THE STATE OF CONNECTICUT

Good morning, and welcome to this hearing on economic and international issues in global warming policy.

When Senators Lincoln and Coleman cosponsored the climate bill that I wrote with Senator McCain, they urged refinement and strengthening of the cost-containment and international provisions. When Senator Warner announced his partnership with me on a new climate bill, he made clear his interest in doing just that.

When Senator Warner says he is going to do something, he does it. This morning he and Senators Landrieu, Graham, and Lincoln introduced a new cost containment provision that they hope to see included in cap-and-trade climate legislation. I think the provision is very impressive. I congratulate my four colleagues for designing it.

Their contribution comes in the nick of time. Senator Warner and I have made rapid progress on our new bill. We will make the particulars of it public before the Senate recesses late next week. Then we will spend several weeks incorporating the comments of many Senate climate leaders on and off this committee, prior to introducing the bill in early September and marking it up in this subcommittee shortly

thereafter. It is my hope that, under the expert leadership of Chairman Boxer, a bill containing strong, greenhouse-gas reduction mandates will be reported to the Senate floor this fall, for the first time in U.S. history.

Earlier this month, Senators Bingaman and Specter introduced an economy-wide, cap-and-trade climate bill. It is an impressive piece of work. Senators Warner and I have been giving it close attention. One of its most interesting provisions addresses the need to ensure that once the U.S. joins the rest of the developed world in reducing its greenhouse gas emissions, rapidly developing nations such as China and India will follow suit, so that together we can forestall warming of a degree that would spell catastrophe for all of us.

Senator Warner and I are intrigued by this international provision in the Bingaman-Specter bill. We are fortunate to have here today witnesses who can describe the way it would operate and say whether they think it would help protect America's strong position in the global economy.

Also, several of our witnesses are prepared to describe various cost containment provisions that have been proposed in bills to curb global warming. A couple of our witnesses are particularly well qualified to describe the ways in which the different options for containing costs might interact with what might be the greatest cost control measure of all: a large, liquid emissions trading market.

Finally, I seek unanimous consent to place into the record the economic analysis that EPA published earlier today on the climate bill that I wrote with Senator McCain. EPA's analysis finds that if the U.S. Government enacted that bill this year, then—making conservative assumptions about the pace of emissions reductions in the rest of the world—the concentration of greenhouse gases in the atmosphere would remain below 500 parts per million at the end of this century. EPA's detailed power-sector modeling also finds that if that bill were enacted, coal would remain economically viable in the U.S. as a fuel for electricity generation, with U.S. coal production remaining constant until around 2030, when it would begin increasing due to the escalating deployment of carbon capture and storage technology for coal-fired power plants.

I thank all the witnesses for coming today. With that, I will invite my friend and colleague, Senator Warner, to make an opening statement.

OPENING STATEMENT OF HON. JOHN WARNER, U.S. SENATOR FROM THE COMMONWEALTH OF VIRGINIA

Senator WARNER. Thank you, Mr. Chairman.

I want to associate myself with the remarks that you have just made. To achieve a little brevity, I will introduce into the record my statement. I would simply say that we have been partners in quite a few ventures since we have been in the Senate together. This is an extraordinary challenge. I look upon this as an old Marine, we are going to lay a beachhead, and we will revisit that beachhead in ensuing Congresses in the future.

I also think that this goal of ours can only be achieved if we forge—I say we, that is the Congress working with the executive branch—form the strongest partnership that I can recall between Government and the private sector and our citizens. We cannot hope to do it unilaterally, either the Government doing it, with the private sector sitting out there trying to manage their affairs, without the necessary regulatory framework.

So this is a start. It is an honest, well-intentioned start, a bipartisan start. From here on in, I think that success is directly related to the cooperation, the advice and consent, I might say, that we achieve from the private sector.

I thank our distinguished Chairman for her participation in this. I respect my old friend and colleague here, and his thoughts on it. I also appreciate you referring to the legislation that I joined with Senator Graham of South Carolina and two very fine Senators, Landrieu and Lincoln, on the other subject. I hope it will become a part of this bill.

[The prepared statement of Senator Warner follows:]

STATEMENT OF HON. JOHN WARNER, U.S. SENATOR FROM THE COMMONWEALTH OF VIRGINIA

Welcome, members of the panel and thank you to my friend and colleague, Senator Lieberman, for agreeing to hold this hearing today. He and I created quite a stir with our announcement that we are writing a climate change bill together and today's witnesses will help guide a critical part of that process.

Two issues of concern to me in crafting climate change legislation remain: how do we prevent severe impacts on the economy and how do we account for emissions from developing nations, both from an American competitiveness perspective and an effectiveness perspective.

Our reductions will only constitute a drop in the bucket if the rest of the world does not follow suit, but I reject that as an excuse for the U.S. to do nothing. Today, we are the largest greenhouse gas emitter. We are also a world leader, a nation that does not shy away from challenges. The time for us to show leadership is now.

Before I turn the stage over to the panelists, I would like to make an announcement. This morning, I joined three of my colleagues, Senators Graham, Landrieu, and Lincoln, in introducing the "Containing and Managing Climate Change Costs Effectively Act of 2007." This bill will minimize negative impacts to consumers and industry by providing the market with flexibility to help reduce potential costs. Our bill, which we designed in a way so it could serve as an amendment to any climate bill, would create a Carbon Market Efficiency Board, modeled after the Federal Reserve.

This Board will monitor the market, and if/when necessary, choose from a suite of "emergency off ramps" in times of economic distress. The key element is that these emergency off ramps provide clear paths back onto the main road.

We were not alone in devising this concept. Our four offices worked in consultation with the Nicholas Institute for Environmental Policy Solutions at Duke University. I am pleased to see them on the panel today, and I am hopeful that this bill will be incorporated in the Lieberman-Warner bill.

Mr. Chairman, I will conclude by saying thank you for your support and cooperation through this process. I cannot think of another member with whom I'd rather be taking this journey.

I look forward to the testimony.

Senator LIEBERMAN. Thanks very much, Senator Warner, for that very thoughtful statement. I agree. We have worked together a lot, almost always on national security matters, so I appreciate the national security reference because I know you and I both see climate change as a threat to our national security. I like the "laying the beachhead" metaphor, too, because you can't advance unless you lay a beachhead, and there is certainly no chance of victory unless you first lay a beachhead. I think that is exactly what we are hoping to do in a way that is united. Thank you.

Chairman Boxer, we are honored to have you here and we would welcome any comments you would like to make now.

OPENING STATEMENT OF HON. BARBARA BOXER, U.S. SENATOR FROM THE STATE OF CALIFORNIA

Senator BOXER. Thank you so much, Mr. Chairman and Ranking Member Warner. I am so pleased at the leadership you are both showing. Since we are using war metaphors, I would say you are on a great mission. It is a mission that is important for our grandchildren and their children. So thank you for your leadership.

I also want to thank the private sector for being so far out ahead of us in many ways. I think you are a driving force. This has nothing to do with partisanship at all. This is about the future.

I would ask unanimous consent that my full statement be placed in the record. I will just highlight a couple of my statements, in addition to the one I have already made.

Senator LIEBERMAN. Without objection, so ordered.

Senator BOXER. This is a ground-breaking hearing. These are two people who came together and we needed that to happen. We are so pleased, all of us who want to see global warming legislation move forward. I look forward to working not only with my two friends here, but every member of this Committee and every member of the Senate.

We are going to go to Greenland if we don't have to be here this weekend. The hope is we can go Saturday and Sunday, Friday night, Saturday and Sunday, to get a better look at what is really happening out there. I hope that type of a trip is going to just put some more wind behind us as we move ourselves forward.

I note that Senator Warner has been working hard on an innovative cost containment provision based on borrowing of emission allowances. I am very interested in this. We need this kind of new idea as we move forward. I want to commend him for that and his colleagues that he worked with on that notion.

We have to address the economic impacts of global warming from all sides. Sir Nicholas Stern, former Chief Economist at the World Bank indicated the cost of failing to take action on global warming will outweigh greatly the cost of action. According to Stern, a dollar spent a day will save at least $5 tomorrow. That doesn't mean we are not going to have to deal with some of the issues here at home. We must. But I firmly believe at the end of the day, we will see a great increase in our energy independence. We will grow our green collar job industry. We will increase our competitiveness by developing technologies that will not only be wanted by the rest of the world, they will be desperately wanted by the rest of the world.

As we develop a greenhouse gas control program, we should do it in a way to give the business sector certainty, and that is important. And let me just quickly go through, without elaborating because I am going to speak very fast if I can, some of the things that I think are key, that Bernie Sanders and I worked on together in our bill which we hope that you, Senators Lieberman and Warner, will look at.

Senator LIEBERMAN. Absolutely.

Senator BOXER. Certainly, a cap and trade. We know that can work with standards. Certainly, the borrowing of emission permits, which as I said, Senator Warner has talked about. We can allow facilities that reduce emissions in early years to bank their reductions and use them later. We can distribute the proceeds from allowances auctioned to help reduce the cost on consumers and other entities that are most affected, because we hear colleagues always talk about the impacts. We need to mitigate those impacts and we can.

We need to make sure that whatever cost containment mechanisms we have don't create a disincentive for investment in the technologies that we so need in this fight.

In terms of international emissions, obviously, obviously, we have to make sure that other countries do their part. We have Senators Lugar and Biden taking a great lead on the Foreign Relations Committee on this point, but I think Senator Bingaman deserves some recognition here because he is looking at a cost that would be borne by countries such as China when they import their goods

into our country, and they are not doing anything about global warming. There has to be a cost to that. So I hope you will look at that, because I think in fairness some people are saying we need to look at that.

Last, I met with you and Secretary General Ban Ki-moon and I joined the Secretary in asking the President, our President, if he would come to the U.N. on the 24th of September for a groundbreaking meeting with all the nations of the world. I was very glad that the President's people said that he is going to do something I suggested, which is invite the 12 largest emitting nations to the White House, to Washington at least, to discuss steps that can be mutually taken.

So all in all, I have to say I couldn't be more pleased with the progress we are making. When I took the gavel, I only could hope for this day, that we would have this bipartisan breakthrough and we will be making progress. I stand ready as the Chair to work with each and every member, address everyone's concern as we make history in fighting global warming.

Thank you, Mr. Chairman.

Senator LIEBERMAN. Thank you, Madam Chair.

Senator Inhofe, thanks for taking the time to be here. We would be happy to hear an opening statement if you would like.

OPENING STATEMENT OF HON. JAMES INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Senator INHOFE. Thank you, Mr. Chairman.

This is our 16th, I believe if my count is right on the number of hearings we have had on global warming, but this one is different. I am pleased that you are having it because this is the first hearing I believe that we have had where we really are addressing substantive issues. We have been unwilling to do that in the past, it seems, and I hope that we can follow this pattern at the overall Committee level.

It seems clear to me, though, that the carbon cap and trade approach itself doesn't work. The Kyoto Protocol is an international beacon warning to our Nation of what not to do. The failure of the United Nations's grand experiment is not a lesson in how better to tinker with its structure so that the next time it might possibly, hopefully work. I just don't think it has been working at this point.

The body has now passed two resolutions on climate change that are similar. One was the Byrd-Hagel amendment that passed 95 to zero. The other was the Bingaman amendment. Byrd-Hagel said that we would not want to ratify any kind of a treaty that would inflict very serious economic damage to the Country, and also one that would not affect—and I would think that you would be interested in this, Mr. Baugh—developing countries. I mean, if we do it, developing countries should do it. The Bingaman amendment was very similar to that. It resolved that the United States should address global warming as long as it will not significantly harm the United States economy and encourage comparable action by other nations that are major trading partners with and key contributors on global emissions.

Not a single bill before Congress meets these criteria, not one of them. Now, maybe this one will. I don't know, because I don't know

anything about it. I think there has been some discussion. I missed your entire opening statement. Maybe you covered some of that. I will be interested to look at it and see, because so far they have not met this criteria.

For instance, according to the MIT study, the Sanders-Boxer bill would cost the energy sector consumers an amount equal to $4,500 per family of four. Now, the same study found that the Lieberman-McCain bill, and of course we don't have the information for anyone to perform any type of an analysis on the current bill that you are talking about with Senator Warner, but the McCain bill would have been $3,500 per family of four.

A new EPA analysis released less than an hour ago shows Lieberman-McCain bill would cost up to a half trillion dollars by 2030 and $1.3 trillion by 2050. That was based on assumptions designed to lowball the number, making me wonder how high the real figure would be.

It does nothing to encourage reductions from the world's largest emitter of carbon dioxide, and that is China, as currently they are not the No. 1 emitter and we are not. In fact, like all these bills, it would worsen the problem. Even the Bingaman bill would export hundreds of thousands of jobs, Mr. Baugh, mostly to China. But the U.S. emissions as a measure of productivity are far lower than China's or Europe's, for that matter. So every job sent there will increase emissions.

This is an interesting concept. It is bad enough that we have job flight to places like China, but when those jobs are performing functions that they used to perform in the United States, they are doing so under conditions where they are emitting more CO_2 or more greenhouse gases.

As Lu Xuedu, the Deputy Director General of China's Office of Global Environmental Affairs said last October, "You cannot tell people who are struggling to earn enough to eat that they need to reduce emissions."

Cap and trade in theory offers certainty in emissions, but volatility in price. But in practice, it has offered certainty in neither. Taxes offer a more certain price. I have often said, if we are going to do this, let's be honest with the American people and let's have a carbon tax, so you can't hide it. It is there. I think that would be a better alternative.

That said, we can't ignore that Congressman Dingell is right that taxes are a more straightforward and efficient approach than cap and trade, and would at least probably work. I don't want a tax, but given the choice between the two, I think I would take it. I think it is a more honest approach.

There are two other issues, and I will make this real quick, Mr. Chairman, I would like to raise, which are that these bills also fail on. The first is the issue of layered climate regulatory mandates. We are in the process of crafting an international agreement on how to proceed on greenhouse gases that should be complete within 18 months or so. We are also debating national mandates on greenhouse gases and many States must comply with their own new mandates.

Now, it makes no sense to have national mandates with States having different requirements. I support States's rights, but it

makes no sense for a State program to supersede a national program any more than it makes sense for us to unilaterally sign up to national caps without ensuring developing countries have to join us at the same time.

The last issue in the question is of why we are even doing this. Hypothetically, for argument's sake, even if there really is a man-made problem, shouldn't any legislation, especially legislation which will enrich China at our expense, solve the supposed problem? None of the bills before Congress even do this. We remember when then-Vice President Al Gore had his scientist Tom Wigley answer the question: if all developed nations were to sign onto the Kyoto Treaty and comply with its emission requirements, which they don't do, I might add, in Europe, but if they did, what effect in 50 years would that have on the climate? The answer was 0.07 of 1 degree Centigrade. That tells you.

So I really think we need to look at these things logically and hopefully this hearing is going to examine some of these things that I am bringing up in my opening statement, Mr. Chairman. I thank you for allowing me to go a little bit over.

[The prepared statement of Senator Inhofe follows:]

STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Thank you for holding this hearing, Mr. Chairman. It is refreshing that we are beginning the process of examining substantive issues that need to be examined before any individual piece of legislation can be seriously considered. It is my hope that this approach will be adopted at the full Committee as well so that all the Members of the Committee can begin examining the nuts and bolts of how various approaches would operate. We need to begin looking at the economics—both at what works and what doesn't work.

It seems clear to me, though, that the carbon cap-and-trade approach itself is what doesn't work. The Kyoto Protocol is an international beacon warning our nation of what not to do. The failure of the United Nations' grand experiment is not a lesson in how better to tinker with its structure so that the next time it might possibly, hopefully work. No, the lesson is more fundamental. It is the lesson of a failed approach. Let me be clear: carbon cap-and-trade systems will never work.

This body has now passed two resolutions on climate change that are similar. The Byrd-Hagel Sense of the Senate, which passed 95—0, resolved that the U.S. should not be a signatory to any international agreement that would result in serious harm to the U.S. economy or did not mandate reductions from the developing world. Similarly, the Bingaman Sense of the Senate resolved that the U.S. should address global warming as long as it will not significantly harm the United States economy and encourages comparable action by other nations that are major trading partners and key contributors to global emissions.

Not a single bill before Congress meets these criteria—not one. They range from costly to ruinous. But they all fail to meet the requirements of Byrd-Hagel or Bingaman.

For instance, according to an MIT study, the Sanders—Boxer bill would cost energy sector consumers an amount equal to $4,500 per American family of four. The same study found the Lieberman—McCain bill would cost consumers $3,500 per family of four. And a new EPA analysis released less than an hour ago shows the Lieberman—McCain bill would cost up to half a trillion dollars by 2030 and $1.3 trillion by 2050—and that was based on assumptions designed to low-ball the number, making me wonder how high the real figure would be.

It does nothing to encourage reductions from the world's largest emitter of carbon dioxide—China. That's right, China just surpassed the United States as the world's largest emitter.

In fact, like all these bills, it would worsen the problem. Even the Bingaman bill would export hundreds of thousands of jobs—mostly to China. But the U.S. emissions as a measure of productivity are far lower than China's, or Europe's for that matter. So every job sent there will increase emissions, not lower them. China has made it abundantly clear that it will be decades before it signs onto mandatory lim-

its because it wants to grow—and unilateral global warming bills will help them do so at our expense.

As Lu Xuedu, Deputy Director General of China's Office of Global Environmental Affairs, said last October:

"You cannot tell people who are struggling to earn enough to eat that they need to reduce their emissions."

Cap-and-trade in theory offers certainty in emissions, but volatility in price. But in practice, it has offered certainty in neither. Taxes offer certainty in price, but not emissions. I oppose unnecessary taxes as a matter of principle, and putting a price on carbon is clearly in my mind unnecessary. But that said; we cannot ignore that Congressman Dingell is right that taxes are a more straightforward and efficient approach than cap and trade, and would at least probably work.

I don't want a tax. But given a choice between the two, a tax is the more honest approach because at least we know what we're singing up to.

There are two other issues I would like to raise, which are two that these bills also fail on. The first is the issue of layered climate regulatory mandates. We are in the process of crafting an international agreement on how to proceed on greenhouse gases that should be complete within 18 months or so. We are also debating national mandates on greenhouse gases and many States must comply with their own new mandates.

It makes no sense to have national mandates with States having different requirements. I support States' rights, but it makes no sense for a State program to supersede a national program, any more than it makes sense for us to unilaterally sign up to national caps without ensuring developing nations join us. If it is a global problem, and we have a national approach to the issue, State programs should be pre-empted.

The last issue is the question of why are we even doing this? Hypothetically, for arguments sake, if there really is a man-made problem, shouldn't any legislation—especially legislation which will enrich China at our expense—solve the supposed problem? None of the bills before Congress do so. Even the Kyoto Protocol, according to Gore's scientist Tom Wigley, if fully implemented and complied with, would only reduce temperatures by 0.07 degrees Celsius in 50 years. If the answer is that these bills are just the first installment and that more will follow, shouldn't we be debating what the total cost of going down this road will be?

Thank you.

Senator LIEBERMAN. Thanks, Senator Inhofe.

Senator Sanders, thank you for being here and for the bill that you have introduced, which will be an important part of our considerations.

OPENING STATEMENT OF HON. BERNARD SANDERS, U.S. SENATOR FROM THE STATE OF VERMONT

Senator SANDERS. Thank you very much, Mr. Chairman. We thank you and Senator Warner for holding this very important and timely hearing.

I think while we want to look at what the costs are associated with preventing and reducing greenhouse gas emissions, it is also important to understand what happens if we do not go forward aggressively. I would argue, and I think the scientific community would strongly support me, that not going forward aggressively, not substantially cutting greenhouse gas emissions, not dealing with global warming, can cause not only huge, huge global environmental problems that will impact billions of dollars, but also catastrophic economic problems.

So I don't think the choice is either/or. I think we have to act. I think Senator Warner's use of the term, the warlike metaphor, is exactly right. We are in a war that we cannot afford to lose. The good news is I think we now know how to win it.

What the World Health Organization tells us is that today some one million people have already died as a result of global warming, and that number will clearly escalate if we do not get a handle on

this problem. The CIA is now examining the political implications of what happens when drought and hunger take over, and there is massive migration from one country to the other, and the increased likelihood of war. That is what happens if we do not get the handle on this.

Now, I am optimistic about the situation because I believe we do know how to address this crisis, and I believe that from an economic perspective, we can in fact create millions of good paying jobs. Will there be economic dislocation? Of course there will be, but let me give you some examples.

What scientists tell us is that if we move forward in terms of energy efficiency, we can reduce energy use in the average home by some 40 percent. Think of the number of jobs that are created there. I recently talked to a major light bulb manufacturer who talks about the huge savings that will be available if we move to LED light bulbs in the future.

Right now in terms of job creation, where are we getting our photovoltaics from, those units from? More often than not, we are not producing them in this Country, but we are importing them despite the fact that we helped create that technology. California now proposes to have one million units of photovoltaics on their rooftops in the next 10 years. If as a Nation we did 10 million units, think about the jobs that are created in production, as well as installation.

In terms of wind turbines, we are on the verge of producing small wind turbines for $12,000 or $13,000 that could produce half the electricity that the average home needs. Think of what it means to our economy when we are beginning to produce wind turbines.

Public transportation, compared to Japan, compared to Europe, even to China, we have a rail system which is way, way behind. Think of the jobs that we create as we have an efficient rail system, as we have subway systems all over America in terms of jobs.

The evidence is overwhelming that if we substantially increase our CAFE standards to compare with Europe or China even, we can save huge amounts of carbon and energy in general.

I must say that in the midst of all that, I cannot support a safety valve as currently put forward by some of our colleagues. To my mind, the safety valve represents a white flag of surrender and I do not think, given the crisis that we are facing, that we should do that, with the implications of what it means to our children and grandchildren. I remain open to the ideas of banking and borrowing, but have withheld final judgment on that.

Mr. Chairman, I think this is a historical integral moment in American history. I think if we do the right thing, we cannot only save this planet. We can be a model for China and for India. We can create jobs as we help transform their economies. We can create jobs in our own Nation. We can do it if we have the political will, and I certainly look forward to working with you and Senator Warner to make that happen.

[The prepared statement of Senator Sanders follows:]

SUPPLEMENTAL STATEMENT OF HON. BERNARD SANDERS, U.S. SENATOR FROM THE STATE OF VERMONT

During the hearing on Tuesday, I failed to make a very important point.

In the area of international competitiveness, I am, quite literally, thrilled by the strong foundation that Senator Bingaman and Senator Specter have put forward in their Low Carbon Economy Act of 2007. They approached the issue in a very thoughtful manner and their leadership in bringing attention to the topic is well recognized. I know that the AFL–CIO was engaged in that process and I commend their work and the work of all those involved in crafting the language.

Senator LIEBERMAN. Thank you very much, Senator.

Senator Craig?

Senator CRAIG. Thank you, Mr. Chairman. If this is the beachhead, I am here to spot the land mines. Please proceed.

[Laughter.]

Senator LIEBERMAN. Semper Fi. OK. Let's go ahead.

Senator WARNER. Mr. Chairman?

Senator LIEBERMAN. Just in case anybody doesn't know——

Senator WARNER. Probably that is for the best, though. You can get the land mines.

[Laughter.]

Senator WARNER. The Chairman and I, and I want you to amplify my remarks, have decided that to forge this partnership we have to, again, get the advise and consent, and we are going to put out a study document, rather than a bill, before we leave in August, such that during that period of time, we hope to have our staff and indeed myself and the Chairman working to receive the benefit of your comments.

Now, would you like to add to that?

Senator LIEBERMAN. No, absolutely right. We are working very hard on that now. Our staffs are working very hard reaching out, talking, listening to a lot of people. That is right. Before we leave next week, we want to put out essentially a draft proposal and then give folks the time to work it over and tell us what they like and they don't like. Then we will come back after Labor Day having absorbed all that. We will put together the best proposal we can to deal with this problem.

Senator WARNER. A bill.

Senator LIEBERMAN. A bill, right, and then offer that to this Subcommittee as early as we are ready in September. And then report to the full Committee. I am encouraged to believe that under the leadership of Chairman Boxer, a bill containing strong greenhouse gas reduction requirements will be reported to the Senate floor this fall for the first time ever.

Senator BOXER. Senators, if I just might take a moment to thank you for your timetable. I think it is important. Everyone is always asking me, and I am sure you now, almost every day. A couple of you followed us around and tried to get the timeframe. Assuming you do make this timeframe and your study document is available, which is sort of the map to your bill, our plan, and I will discuss this with Senator Inhofe of course, to run by the schedule, would be to look at then all of the economy-wide proposals when we get back.

At that point, my goal is to look to you as a basic document, because frankly you are going to be the last ones up. You will be able to look at the Bingaman proposal, the Sander-Boxer proposal, the

Kerry-Snowe proposal. Who am I missing? And of course, your own Lieberman-McCain proposal.

I am therefore trusting to get the best of these ideas. So that would be a very good vehicle for us. So it all works, and I want to again thank you for that.

Senator LIEBERMAN. Thank you, Madam Chairman. That is exactly what we intend to do. We are trying to draw from the experience and the thoughts that others have had, both here in the Senate, where there is an enormous amount of activity and very productive work going on, in the university communities, in the business community, groups like the Climate Action Partnership, obviously in the environmental community.

So this is a global problem. We want to come up with a national response to it that is as much as possible by the time we present it really a consensus recommendation.

Now we will go to our witnesses. First, I am going to from my left to right. We begin with Tim Profeta, who comes to us as the Director of the Nicholas Institute for Environmental Policy Solutions at Duke University. He has risen above a rather checkered past during which time he was my legislative assistant for environmental matters. I am very proud that in an extremely competitive process, Tim was chosen to be the Director of this new institute.

Mr. Profeta, welcome.

STATEMENT OF TIMOTHY PROFETA, DIRECTOR, NICHOLAS INSTITUTE FOR ENVIRONMENTAL POLICY SOLUTIONS, DUKE UNIVERSITY

Mr. PROFETA. Thank you, Mr. Chairman.

Chairman Lieberman, Senator Warner and members of the Subcommittee, thank you for the opportunity to testify today. It is an honor to be here.

Two years ago, I left Washington to found the Nicholas Institute at Duke University. Our institute is intended to be a two-way bridge between knowledge and community power of Duke and decisionmakers such as yourselves. In undertaking our mission, we focused our resources on the key environmental challenges facing our planet, and no topics demand greater attention than global climate change.

In particular, we have concentrated on just what we have perceived to be the key sticking points that prevented the passage of mandatory climate legislation. No issues have been more difficult than the two raised by today's hearing.

First, which I will call cost containment, pertains to how we could provide economic relief if a program to reduce greenhouse gases resulted in unexpectedly high costs to the economy. The second, which I would term competitiveness protections, is a question of how we can create a U.S. greenhouse gas control program that does not lead to a competitive disadvantage for the United States.

The importance of these two concerns in the broader climate debate is underscored by last Congress's Sense of the Senate resolution, to which Senator Inhofe referred, in which 53 Senators voted that the Congress should create a mandatory system to address climate change so long as it did not significantly harm the United

States economy and encourages comparable action by our major trading partners.

Thus, the issues you seek to address today are the same ones that the Senate set as preconditions to action on climate change, true sticking points if ever there were ones.

So permit me to address these issues and our efforts to design policies to address them one at a time.

First, the issue of cost containment. When you consider the challenge of global climate change, it is not surprising that there is great concern about cost. Climate change is no ordinary environmental challenge. As opposed to other relatively localized environmental issues, the problem of global warming is entwined with every aspect of our life. Of course, as the science has mounted, it is clear that costs of inaction will dwarf the costs of a greenhouse gas reduction program.

So it is now inevitable that our Government, likely under the leadership of this Committee, will act. Fortunately, several members of this Committee already have embraced a number of policies that will ensure that we achieve our greenhouse gas reductions as efficiently as possible. Just the fact that most proposed legislation embraces a cap and trade system may be the most significant cost containment provision in any final legislation. An efficient cap and trade system will naturally seek out the lowest cost greenhouse gas reductions in the economy and provide a continual stimulus to innovate cleaner and cleaner technology.

Beyond the basic architecture, a cap and trade system can also decrease costs by including provisions that allow banking and borrowing and offsets. The utility of these provisions is outlined in my written testimony, so I will refrain from discussing them further here.

However, many believe we need to go farther than manage costs and promote investment in long-term solutions. That is where the institute's recent work comes in. Earlier this year, the institute was engaged by four Senate offices, the offices of Ranking Member Warner, Senator Landrieu, Senator Graham and Senator Lincoln, seeking assistance in the development of some new and innovative means of providing protection against unforeseen high costs of a cap and trade system.

All four offices were familiar with the proposal to cap the price of carbon in the market, using what is called a safety valve. While all the offices were sympathetic to the safety valve's goal of controlling the overall costs to the economy, they were all concerned about the safety valve's potential to frustrate the program's environmental goals, to quell investment in climate-friendly technologies, and to limit the ability to link the U.S. system to other markets. Thus, they sought an alternative means to address unanticipated costs.

With some assistance from the institute, the four offices began by developing five principles for any proposal. I would like to review them. First, any proposal should maintain the environmental integrity of the program. Second, any proposal should avoid unexpectedly high costs to the economy. Third, any proposal should focus on sustained price departures, rather than short-term volatility. Fourth, it should maximize the use of market-based mecha-

nisms. And fifth, it should provide effective incentives for long-term investment.

Using these criteria, institute staff met with these four offices regularly since January, providing necessary analyses and feedback as they developed their proposal, which was released today. Fundamentally, the proposal provides the market with cost relief measures and an oversight board to employ them. More specifically, the board will be given several authorities to reduce the cost of greenhouse gases in the market.

First, the board would be empowered to increase companies' flexibility in determining when and how to meet the reduction goals by broadening their ability to borrow permits against future years.

A second lever at the board's disposal would be the ability to adjust the pace of the national emissions reductions temporarily, while still achieving the overall reductions over time by increasing emission allowances available in the short term. Again, this remedy would be employed by borrowing against future years, but at a nationwide level, guided by the board, rather than at a firm level, and keeping in mind the overall reductions.

A third remedy was also considered, by which the ability of emitters to account for their emissions through real and verified offsets could be expanded, provided those offsets were somehow limited in the underlying legislation. But because not all offices wished to assume that such limits would exist, we have not included that concept. However, if offsets are limited, it could provide a third lever for controlling costs.

After determining the means by which the board could provide relief in the event of potential harm to the economy, the group carefully crafted a structure by which the board could be made a neutral, trustworthy, and knowledgeable overseer of the market, with a particular view to the precedent of the Federal Reserve.

That, in sum, is the offices' economic protection proposal, to create market-based measures for cost relief and to create an independent market overseer to implement those measures.

I must State that I believe there is an elegance to this proposal. At bottom, it is the first proposal for cost containment that does not claim to know the unknowable. We cannot know right now what the proper price of a carbon allowance will be that will successfully balance our environmental and technological economic goals. While our models were the best available, our models simply can't know what that price is, especially when dealing with long-term projections of technology.

So this plan cleanly addresses the need to make decisions under the unavoidable uncertainty, by providing the levers necessary to stop economic harm, without undercutting the market or the program's environmental integrity.

Now, if we successfully implement a market-based cost relief program, we still must address the second paragraph of the Senate's resolution, the need to ensure that the climate program encourages comparable action by major trading partners. About a year ago, we at the institute engaged in high level conversations with a number of major corporations to assess their sticking points on Federal cli-

mate policy and concerns about trade disparity came screaming out at us.

Working with Professor Joost Pauwelyn at Duke Law School, we evaluated a range of proposals that could re-level the international playing field should the U.S. create a domestic cap and trade program for greenhouse gases, with an eye to compliance with the WTO. Our efforts focused on provisions under Article XX of the GATT, which allows trade measures related to the conservation of natural resources.

In general, the legal analysis led to the conclusion that such a provision could be sustained if, first, the United States first engaged in good faith efforts to achieve an agreement with any nation whose products were targeted; second, it applied even-handedly to domestic products and imports; and third, it was adjusted based on the local conditions in other countries.

At the same time we were working on this proposal at Duke, AEP and a number of unions were undertaking similar projects, which were incorporated in the Bingaman-Specter Act that was introduced last week. Our assessment of that provision is that it is consistent with our work and provides a good start for language to equalize the playing field in international trade once the United States creates its own cap and trade program.

Under that proposal, the United States is required at the outset of the program to negotiate an agreement with all other nations to create programs comparable to our own to control greenhouse gas emissions. If it is not successful by 2020, however, their proposal would require importers to the United States to submit allowances to cover the greenhouse gas emissions released during the production of the imported goods. These allowances, called international reserve allowances, would be set at a price equivalent to the price of domestic allowances, thereby ensuring equal treatment of domestic and foreign manufacturers of energy-intensive goods under the WTO.

There are a few important points to make about this proposal. First, it does not affect the pool of allowances available to domestic companies. The first version of the proposal would have done so, which may have driven up the costs for our domestic companies. That promised to be politically unpopular, and Senators Bingaman and Specter appear to have modified it in the bill's current version.

Second, the proposal only covers the biggest emitting nations and only applies to a limited class of primary products, such as steel, cement and pulp. And finally, our legal reading is that this approach respects the WTO ground rules I described earlier by, first, exhausting efforts to find a less trade-restrictive alternative; second, ensuring equal treatment between foreign and domestic companies; and third, by creating differential treatment depending on an individual country's situation.

In the two provisions I describe here today, the Subcommittee has the ability to address the fundamental concerns about climate legislation expressed in the 2005 Sense of the Senate resolution. We hope these ideas are a help to the Subcommittee. I would be happy to answer any questions that you may have.

Thank you.

[The prepared statement of Mr. Profeta follows:]

STATEMENT OF TIMOTHY H. PROFETA, DIRECTOR, NICHOLAS INSTITUTE FOR ENVIRONMENTAL POLICY SOLUTIONS, DUKE UNIVERSITY

Chairman Lieberman, Senator Warner, and members of the subcommittee, thank you for the opportunity to testify before the Subcommittee today. It is an honor to be here.

Two years ago, I left Washington to found the Nicholas Institute for Environmental Policy Solutions at Duke University. The Institute is intended to be a two-way bridge between the knowledge and convening power of Duke and decision-makers such as yourselves. The Institute has focused its resources on the key environmental challenges facing our planet, and no topic has demanded greater attention than global climate change.

In particular, the Institute has concentrated on addressing what we have perceived to be the "sticking points" that have prevented the passage of mandatory climate legislation. No issues have been more difficult than the two raised by today's hearing:

(1) the first, which I will call cost containment, pertains to how we could provide economic relief if a program to reduce greenhouse gases resulted in unexpectedly high costs across the economy; and

(2) the second, which I will term "competitiveness protections," is the question of how we can create a U.S. greenhouse gas control program that does not lead to a competitive disadvantage for U.S. firms as compared to firms in nations that have not limited greenhouse gas emissions.

The importance of these two concerns to the broader climate change issue is underscored by last Congress' Sense of the Senate resolution on climate change, in which 53 Senators voted that the Congress should create a mandatory system to address climate change so long as it:

(1) will not significantly harm the United States economy; and

(2) will encourage comparable action by other nations that are major trading partners and key contributors to global emissions.

Thus, the issues that you seek to address today are the same ones that the Senate set as preconditions to action on climate change legislation—true "sticking points" if ever there were ones.

To tackle these two challenging issues, the Institute went beyond traditional academic circles. We engaged congressional offices, corporate CEO's and nonprofit leaders to appraise the issues, to guide our research in answering them, and to engage in the development of the answers. On the Institute's end we engaged Duke law, economics, and science faculty. I am happy with our progress, and believe that this group collectively has designed policy solutions that can work to address these "sticking points" in the legislation that the subcommittee is developing.

So permit me to address these issues one at time, discussing first the challenges inherent in each, then the approach the Institute has taken to address them, and finally some proposals and concepts for tackling these concerns in final legislation.

I. COST CONTAINMENT

When you consider the challenge of addressing global warming, it is not surprising that there is great concern about the cost. Climate change is no ordinary environmental challenge. As opposed to other relatively localized environmental challenges, the problem of global warming is in many ways a direct result of our way of life. Fundamentally, processes that produce greenhouse gases exist in every corner of our economy. Most of our energy sources produce substantial amounts of greenhouse gases. Other major sectors of our economy, such as the forestry and agricultural sectors, control the ebb and flow of greenhouse gases in the atmosphere.

But, of course, no other environmental problem promises to be as costly to us as climate change if we allow it to go unabated. As the science has mounted, it is clear that the costs of our inaction will dwarf the costs of a greenhouse gas reduction program. So it is now inevitable that our Government, likely under the leadership of this Committee, will act.

Thus, as the Nation tackles this daunting issue, it must take care to ensure that it is done in a way that embraces the economic opportunities that change undoubtedly will beget, and minimize any economic harm. This sentiment was clear in the 2005 Sense of the Senate Resolution, which stated that the Congress must act to reduce greenhouse gas emissions, but impose that limit in such a way that "will not significantly harm the U.S. economy."

The Institute's view is that these goals are not necessarily in conflict and can be achieved with careful attention to them both. We must set the course toward reduc-

ing our nation's greenhouse gas emissions, and we can use that leadership to encourage developing nations to do the same. We must also provide measures to avoid imposing excessive costs on our industries, companies, and consumers. And finally, we need to encourage investment in the solutions that will reduce costs and present opportunity over time. We need a plan that will do all three of those things.

Fortunately, several members of this Committee already have embraced a number of polices that will ensure that we achieve our greenhouse gas reductions as efficiently as possible. In the Lieberman/McCain bill, there are a number of cost containment provisions. Just the fact that the legislation embraces a cap-and-trade system may be the most significant cost containment provision in any final legislation.

If designed appropriately, a "cap and trade" system is the market-based policy design that helps control costs. Because companies must purchase emission permits, or "allowances" to account for the emissions they generate, the "per ton" cost of emitting carbon and other greenhouse gases above the limit is an expense that a company can work to eliminate. A company that develops ways to reduce emissions below the limit will generate emission credits it can sell for profit to companies with higher emissions.

Designing a cap-and-trade program that will limit costs and increase profits also will stimulate the development and deployment of technologies to either reduce emissions or capture and store them away from the atmosphere. As long as there appears to be a potential that greenhouse gas reductions will be valuable in the future, investors will seek to own the technologies that create those reductions. This will drive the innovation and deployment of advanced technologies necessary to meet our objectives of reducing or mitigating greenhouse gas emissions. Moreover, that driver could provide economic stimulus, and competitive advantage, for the most innovative sectors of the U.S. economy.

As a result, an efficient cap-and-trade system will naturally seek out the lowest-cost greenhouse gas reductions in the economy—and it will avoid the costs that would come from less efficient, source-by-source regulations. To achieve the greatest efficiencies, a cap and trade system should at least contain these key features:

First, the policy must provide the ability to bank and borrow emission allowances. Specifically, banking would allow any emitting firm that, at the end of a year, held more allowances than it needed to cover its own emissions the choice of "banking" the allowances for future years. Borrowing is just the reverse, allowing emitting firms to "borrow" emission allowances from future years if they are short the allowances they need in the present year. If emitters have the freedom to bank or borrow allowances, the ability of entities to find the cheapest compliance option is increased. This is so because it allows emitters not only to seek the cheapest opportunities for reductions in the present year, but also across time.

Second, the approach should allow some ability to offset emissions from sectors of the economy that are not included in the cap, like agriculture and forestry. Some are concerned that too many offsets in the market will allow the major sources of greenhouse gas emissions to buy their way out of their compliance obligation and refrain from investing in transformational technologies or processes necessary to create the needed long-term reductions. Yet a sufficiently aggressive long-term emissions goal should dissuade any company from such a strategy. In the interim, some ability to access these offsets should provide a bridge to the next generation of technological innovation.

What is more, a strong long-term emissions goal—if it is handled with flexibility and phased in on a reasonable schedule—also will stimulate the development and deployment of technologies to either reduce emissions or capture and store them away from the atmosphere. As long as there appears to be a potential that greenhouse gas reductions will be valuable in the future, investors will seek to own the technologies that create those reductions. That driver could provide economic stimulus, and competitive advantage, for the most innovative sectors of the U.S. economy.

In sum, designing a cap-and-trade system with these features will go a long way toward helping the market naturally avoid excessive costs in the short term, and develop the solutions that will keep costs down in the long-term. In many policymakers' view, however, more robust measures are still needed to manage costs and promote investment in the long-term solutions. That is where the Institute's work comes in.

Earlier this year, the Institute was engaged by four Senate offices—two Republican, two Democrat. All of these Senators had voted in favor of the 2005 Sense of the Senate Resolution to act on climate change, but none had ever voted in favor of a mandatory climate proposal. All four offices were focused on their desire to develop some new and innovative means of providing protection against any unforeseen high costs of a cap-and-trade system to the economy.

All four offices were familiar with the proposal to cap the price in the carbon market, using what is called a "safety valve." A safety valve creates a parallel carbon tax regime, whereby an entity always has the ability to pay a set fee to the Government rather than have to go to the market to buy allowances. While all the offices were sympathetic to the safety valve's goal of controlling the overall costs to the economy, all were concerned about the safety valve's potential to frustrate the program's environmental goals, to quell investment in climate-friendly technologies, and to limit the ability to link the U.S. system to international markets. Thus, they sought an alternative means to address unanticipated costs.

With some assistance from the Institute, the four Senate offices developed principles to guide their deliberations. The offices determined that whatever proposal was created should meet five criteria:

1. It should maintain environmental integrity.
2. It should avoid unexpectedly high costs to the economy.
3. It should focus on sustained price departures rather than short-term volatility.
4. It should maximize the use of market-based mechanisms.
5. It should provide effective incentives for long-term investment.

Using these criteria, Institute staff met with these four offices regularly since January, providing necessary analyses and feedback as they developed their proposal. We are now ready to discuss that proposal.

Fundamentally, the proposal provides the market with cost-relief measures and an oversight board to employ them. The measures are focused on adjusting the market to relieve sustained—not short term—high prices that threaten economic harm. The oversight board, which would be called the Carbon Market Efficiency Board, would have the discretion to use these measures to influence the market price for greenhouse gases. It would operate in a manner similar to the Federal Reserve, charged with protecting the market from runaway prices while preserving the market's stability and continuity for investors.

Specifically, the proposal would empower the Board with three authorities to administer relief when it finds that economic conditions require it to act:

• First, the Board would be given the authority to increase companies' flexibility in determining when and how to meet their emissions reduction goals—by broadening their ability to borrow permits against future years. This lets individual firms make decisions based on the availability of technology that is expected to come on line and give the flexibility to make a transition to new technology with timing more in line with their own capital planning. For example, if a company is having trouble meeting a current year's goal, but is investing in a low-carbon solution that will be ready in years hence, it might decide to borrow a little more against those years. This remedy would increase the company's ability to do that, by increasing the amount of allowances it is permitted to borrow, lengthening the time into the future from which an allowance can be borrowed or altering the interest rate that applies to the payback of the allowances.

• The second lever at the Board's disposal would be the ability to adjust the pace of national emissions reductions temporarily—while still achieving overall reductions over time—by increasing emission allowances available in the short term. Again, this remedy would be employed by borrowing against a future year or years, but at a nationwide level, guided by the Board, rather than at a firm level, and always keeping in mind overall reductions in the long term. Increases in allowances in the short term would result in reduced allowances available in later years, thus preserving the long-term environmental goal while providing short-term economic relief.

• A third remedy was also considered, by which the ability of emitters to account for their emissions through real and verified offsets could be expanded, provided these offsets were somehow limited in the underlying legislation. But because not all offices wished to assume that such limits would exist in final legislation, we have not included the concept. However, if offsets are limited, it could provide a third lever for controlling costs.

Each of these measures would be taken incrementally, minimally, and temporarily by the Board to preserve market certainty and continuity.

Finally, we also considered the ability of Board oversight to reduce costs. The Board would be required to report quarterly on the status of the market—on investment trends, technology availability, and economic effects in different regions of the country. This type of information should greatly aid the market in seeking out the best efficiencies, calm the market from overreaction to short-term changes, and aid Congress in understanding the effect of the program.

After determining the means by which the Board would provide relief in the event of potential harm to the economy, the group discussed at length the means by which

the Board could be made a neutral, trustworthy and knowledgeable overseer of the market, with a particular view to the precedent of the Federal Reserve. As a result, under the proposal, the Board's primary mission would be to uphold the ultimate environmental and investment goals of the legislation while having the ability to make market corrections as needed to protect the economy. It would not be empowered to change the goals of the underlying legislation, or engage in administering relief to individual firms or sectors.

To carry out these goals, the Board would be appointed by the President and serve full-time terms in which it would behave similarly to the Federal Reserve. It would observe and report regularly to Congress on the status of the market, and it would be empowered with these limited tools to help regulate the market when necessary.

Moreover, the proposal provides an initial period in which the Board could study the market to learn its trends, but still provide some means of relief. Thus, to avoid overreaction to normal short-term price spikes, and to preserve investment certainty, the proposal recommends using an estimated price range as a benchmark during the first 2 years, with the intention of applying the market remedies only when spot market prices are sustained on average above the range.

To establish the range, the proposal requires that Congress request an estimate of expected price ranges during the first 2 years of the market, estimated through trusted economic models and based on the terms of the underlying legislation. It was our view collectively that the range of numbers that the Congressional Budget Office (CBO) could provide would be the most appropriate on which to base the program, as those numbers would be based on the economic studies that were before Congress when it chose to pass a mandatory climate policy.

That, in sum, is the offices' economic protection proposal: (1) to create market-based measures for cost relief, and (2) to create an independent market overseer that will provide market information critical to keeping costs low and which is be empowered to mitigate unacceptably high costs in the economy without undercutting the program's environmental performance or motivation for investment in solutions.

I must State that I believe that there is elegance in the four offices' proposal. At bottom, it is the first proposal for cost containment that does not claim to know the unknowable. We cannot know right now what the proper price of a carbon allowance will be that will successfully balance the desire to make environmental and technological progress and not harm our economy.

In fact, the Institute convened a conference of some of the nation's best economic minds just last week (available at www.nicholas.duke.edu/econmodeling), and the inability to forecast the market over the long term was the number-one take-home message. While our models are the best available, our models simply cannot know what that price is, especially when dealing with long-term projections of technology.

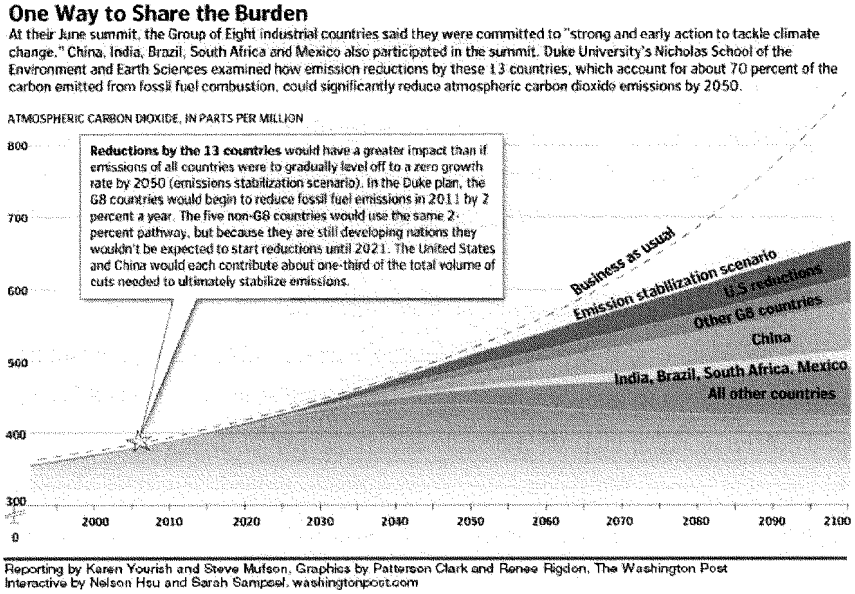
So this plan cleanly addresses the need to make decisions under this unavoidable uncertainty. It provides the levers necessary to stop economic harm without requiring new congressional action, and does so in a way that preserves and enhances the market, heightens its transparency, and maintains both its environmental integrity and the stimulus for long-term investments.

II. COMPETITIVENESS PROTECTIONS

If we successfully implement a market-based cost relief program, we still must address the second paragraph of the Senate's resolution—the need to ensure that the climate program "encourage[s] comparable action by other nations that are major trading partners and key contributors to global emissions." This is a challenge on which the Institute has focused independently from our work with the four Senate offices.

First, let me underline the importance of getting other nations and our trading partners to act, beyond the political. As the top emitter of greenhouse gases in the world, the United States is clearly a key part of the solution. And we very much need to lead the world in this area, both because we have done much to create the problem and because we have always led the world's technological advancement to address global problems.

But action by a number of other countries is almost as equally important, with action by China being particularly essential. At Duke, we have struggled with how much of the task of addressing greenhouse gases needs to fall on the shoulders of the United States, and how much on others. As the figure below indicates, all nations must play a major part for the world to get on a path toward stabilizing greenhouse gases at safe levels. This figure represents one possible emission scenario for global emissions on a nation-by-nation basis.



Reporting by Karen Yourish and Steve Mufson. Graphics by Patterson Clark and Renee Rigdon, The Washington Post
Interactive by Nelson Hsu and Sarah Sampsel, washingtonpost.com

As the Committee knows, developing countries, including China and India, have argued that they should not be obligated to take on a cap until the United States and other industrialized countries—which have emitted most of the greenhouse gases that are currently in the atmosphere—take initial action. This situation creates a paralyzing chicken-or-egg dynamic for some policymakers, where fear over loss of competitiveness to China prevents them from supporting a domestic cap-and-trade. On the other hand, international negotiations prevent a truly global solution until the United States takes domestic action.

At the Institute, we realized that resolving this chicken-or-egg situation required special attention. About a year ago, we at the Institute engaged in high-level conversations with a number of major corporations to assess their "sticking points" on Federal climate policy, and concerns about trade disparity came screaming out at us.

As we dove deeper into the companies concerns, and expanded our outreach to Senate and House offices, we realized there are in fact three factors involved in addressing concerns about international disparities:

1. Equal Treatment. At a minimum, we must develop policy that assures that any costs imposed on domestic emissions will be equally imposed on imports from countries that refuse to enact a similar cap.

2. Engagement. It is in the U.S.'s interest, and is legally required under World Trade Organization (WTO) rules, that we seek to engage our uncapped counterparts to encourage them to develop a similar domestic program before we impose any obligation on imports.

3. Opportunity. Opportunity has been the least considered and yet likely the most important in thinking about competitiveness. We know China and other developing nations will need lower-carbon technologies, particularly technologies used by the U.S.'s electric utility sector, and that they are behind us in development of those technologies and lack the capital to invest. When considering international competitiveness we should evaluate our policies to encourage the development of those technologies here, sooner, in order to facilitate their sale to developing nations. There is substantial opportunity for U.S. patents and U.S. profits generated by U.S. leadership.

The Institute began by paying particular attention to the first concern: what provisions could be made to re-level the international playing field should the U.S. create a domestic cap-and-trade program for greenhouse gases. Working with Professor Joost Pauwelyn of Duke Law School, we evaluated a range of such proposals with an eye to their compliance with the WTO. Our efforts focused on provisions under Article XX of the General Agreements on Tariffs and Trade (GATT), which allows

trade measures "relating to the conservation of natural resources."[1] In general, the legal analysis led to the conclusion that such a provision could be sustained if

(1) the United States first engaged in a good faith effort to achieve an agreement with any nation whose products were targeted; (2) it was applied even-handedly to domestic products and imports; and (3) it was adjusted based on local conditions in the other countries.

At the same time that Duke was undertaking this analysis, American Electric Power (AEP) and a number of unions, led by International Brotherhood of Electrical Workers (IBEW), were undertaking a similar analysis. Working with Andy Shoyer, who for years served as the United States' principal negotiator of the rules governing disputes under the WTO, and whose analysis of the AEP and IBEW proposal was submitted to the record by the Chairman, AEP and IBEW developed their own proposal under Article XX to address the same issues.

The Institute's assessment of the AEP/IBEW provision, which was incorporated into the Bingaman/Specter Low Carbon Economy Act that was introduced last week, is that it provides a good start for language to re-equalize the playing field of international trade once the United States creates its own cap-and-trade program. Under the proposal, the United States is required at the outset of the program to negotiate an agreement with all other nations to create programs comparable to our own to control greenhouse gas emissions. If it is not successful by 2020, however, the AEP/IBEW proposal would require importers to the United States to submit certificates to cover emissions released during production of the imported goods, adjusted to the emissions burden required of similar U.S. products under the domestic cap-and-trade system at the U.S. border. These certificates, called "international reserve allowances," would be set at a price equivalent to the price of domestic allowances, thereby ensuring equal treatment of domestic and foreign manufacturers of energy intensive goods under the WTO.

There are a few important points to make about this proposal, as it has been outlined in the Bingaman bill. First, the proposal does not affect the pool of allowances available to domestic companies. The first version of the proposal would have let importers meet their allowance obligations at the border by buying allowances out of our domestic market, which may have driven up the price of the allowances for our domestic companies. That promised to be politically unpopular, and Senators Bingaman and Specter appear to have modified it in the bill's current version.

Second, the proposal only covers the biggest emitting nations, and it only applies to a limited class of primary products. It does not apply to final manufactured goods, but it addresses the needs of particularly energy intensive—and thus, particularly sensitive—industries such as steel, cement and pulp.

Clear rules also would be set for calculating the annual required amount of certificates for each good from each country, based in part on emissions generated during production. The amount of certificates required would be adjusted in proportion to the amount of allowances distributed for free in the U.S. system and the level of economic development of the country of production. The Subcommittee might also want to consider other means of calculating the emissions burden, such as creating a default obligation to submit an amount of allowances equal to the U.S. average emissions rates but allowing individual firms to prove their own lesser rates, if possible.

Finally, our legal reading is that this approach respects WTO ground-rules in completing its mission to ensure fair trade. Such ground rules require:

- That the U.S. first exhausts any alternative that is less trade restrictive, such as direct negotiations. The U.S. would therefore vigorously pursue a good-faith effort to negotiate bilateral or multilateral climate agreements to include these nations, and the U.S. would only implement these procedures in 2020 only if those negotiations failed;
- That imported goods be treated similarly to domestic goods because both must hold emission allowances; and
- That America's remedy be directly related to the objective of curbing greenhouse gas emissions, for example, requiring that imports that are accompanied by emission allowances actually addresses the environmental objective.

Through this proposal it is possible to successfully tackle the first concern of international competitiveness: re-levelizing the playing field. In addition, this sets the table for addressing the second concern: requiring engagement. It will be important for the Committee to consider how to further encourage engagement with developing nations, and how to pursue competitive advantage by encouraging the development of technology for sale to those nations.

[1]GATT Article XX(g).

III. CONCLUSION

In these two provisions—the market-based cost relief and oversight proposal and the international allowance reserve—the Subcommittee has the ability to address the fundamental concerns about climate legislation expressed in the 2005 Sense of the Senate resolution. The Board will provide the oversight and ability for self-regulation and market correction measures that has been lacking to date in climate proposals, and thereby would ensure that worst cost estimates would not come to pass. The international reserve requirement proposed by AEP and IBEW will provide a backstop against fears that the program will simply result in the leakage of our greenhouse gas emissions, and jobs, to facilities overseas.

There are other costs that the system must contain, of course. The Institute has worked closely with the exceptionally broad range of religious groups concerned about the poor's ability to address global warming and will be designing policy solutions that will ensure that the "least of us" are not left behind in a climate regime. This Committee heard from the religious community about their fears on July 7, and I commend their testimony to you. Concerns about the cost to particular industries and sectors are also well founded, and Chairman Lieberman has designed programs to recycle revenue from the cap-and-trade system into the technology programs and transition assistance needed to minimize those costs.

In conclusion, in calling this hearing, you have taken head on the greatest sticking points that have prevented climate legislation to date. At the Nicholas Institute, we have tried to provide at least the beginnings of a solution to each of these "sticking points," and to do so in a way that brings not only a strong analytical basis but the political support of members of the Senate and the corporate and labor worlds.

We offer our ideas in that spirit, working first to mitigate any chance for causing harm to the economy, and second to realize the competitive opportunity before us and approach the development of climate legislation with an eye toward this country's strengths. Thank you again for the opportunity to testify before you today. We hope that these ideas are helpful to the Subcommittee. I would be happy to answer any questions you may have.

Senator LIEBERMAN. Thank you very much for an excellent opening statement.

This is an excellent panel, very diverse and experienced.

Blythe Masters is the Managing Director in charge of the Global Commodities Group at JP Morgan Chase. Welcome.

STATEMENT OF BLYTHE MASTERS, MANAGING DIRECTOR, JP MORGAN SECURITIES

Ms. MASTERS. Thank you. It is an honor to be here today.

As you said, my name is Blythe Masters. I am responsible for the global commodity business at JP Morgan Chase. Of particular relevance to today's hearing, I manage the trading and marketing of JP Morgan's energy and emission credit trading businesses.

I am also a member of CAPS, which is a joint effort including JP Morgan, Environmental Defense, and the Duke Nicholas Institute, whose mission is to provide intellectual capital and resources in the crafting of a U.S. greenhouse gas framework.

In nearly 2007, our Global Commodities Group established an environmental product subgroup dedicated to helping clients reduce emissions and manage associated risks. Today, we have a team focused on the origination, marketing and trading of carbon emissions covering the EU ETS, European Emissions Trading Scheme, essential elements of the Clean Development Mechanism, emerging regional compliance and pre-compliance markets in the United States, as well as voluntary emissions markets.

We have a dedicated team of sales and trading experts in London covering EU allowances, or EUAs, and certified emissions reductions, or CERs; in New York, covering verified emissions reduc-

tions, VERs; and in Tokyo covering CERs. We are also actively expanding to meet growing client demands for environmentally related projects and advisory services.

We are also leaders in the U.S. acid rain or sulphur dioxide and nitrogen oxide emissions markets and in 2006 we were recognized by Environmental Finance as the best trading company in sulphur dioxide emissions.

On a professional level, I have direct experience in markets with significant similarities to the growing emissions markets. I have been a trader in commodities markets, a trader and manager of our global credit derivatives business, the head of global credit portfolio, the head of credit policy and strategy, and just prior to my current position, I was the Chief Financial Officer of JP Morgan's Investment Bank.

I would like to thank Senators Lieberman and Warner for their leadership on an issue of such worldwide importance. JP Morgan operates in over 55 countries and has clients in every sector of the international economy. We recognize that the climate change poses grave risks to the global environment and to the international economy that need to be urgently addressed.

We are working with our clients to ask the right questions about climate change and the environment generally when making investment decisions. We can't dictate to our clients. We are not the Government, but we can engage in a dialog that surfaces the right issues and considers alternatives that help the environment.

Congress is studying whether to create a so-called cap and trade emissions framework. JP Morgan supports a framework that caps greenhouse gas emissions and establishes a price for those emissions.

For the private markets to most effectively address the problem of climate change, greenhouse gas emissions, which practitioners refer to as carbon, must have a price. By establishing a price for carbon through a cap and trade system, Congress will essentially unleash the forces of supply and demand. There are precedents for this.

As you know, Congress created the first cap and trade program in 1990 to combat acid rain. It is my understanding, Senator Warner, that you played a key role in creating this legislation. Well done. It has worked transparently and more cheaply than expected, and it has delivered the needed environmental benefits.

By setting a price on SO_x and NO_x emissions, market forces drove down the cost of compliance significantly below original projections. The market rewarded emitters that reduced their emissions, penalized those that could not or did not, and spurred the development of technologies that made further reductions possible in the most cost-effective way.

Like any new program of Government regulation, the cost of compliance was a very important and worrisome issue. So it is the case with today's proposed cap and trade system for greenhouse gases. Given the uncertain cost of the emissions allowances that would be required under any cap and trade program and its potentially wide reach, Congress is justifiably searching for ways to moderate expected compliance costs. To be sure, there are legitimate economic concerns that make cost containment a priority. Indeed,

some of my fellow panelists will be speaking to one of the implications of compliance costs, that of international competitiveness.

Having said that, there are multiple approaches to cost containment. In any free market, costs or prices are a reflection of supply and demand. Prices will tend to be lower the more supply there is. The most effective way to expand supply, and hence to reduce costs, is to allow a larger percentage and wider variety of emissions offsets to meet emission reduction targets.

As a result, there are two issues. One, what percentage of an emitter's reduction requirement can be met by purchasing carbon offsets, instead of actually reducing his or her own emissions? And two, what kind of projects are eligible to be considered as offsets?

As for the first question, I don't have a precise recommendation today, but there is an optimal number that effectively balances achieving real and verifiable reductions and minimizing compliance costs. JP Morgan would be pleased to provide intellectual resources to the Committee as it contemplates that balance.

As for eligible offset projects, I believe we can learn from one of the mistakes of the Kyoto Protocol. The Kyoto Protocol currently prohibits using the preservation of tropical rain forest as a carbon offset. This is a mistake. Deforestation accounts for 1.5 billion tons of carbon dioxide equivalent annually, and makes up approximately 20 percent of annual greenhouse gas emissions. In fact, deforestation is the largest source of emissions in the developing world.

Allowing tropical forest preservation to count as an offset would expand the supply for carbon reductions significantly, act to contain compliance costs, and provide a huge bonus in preserving biodiversity. Congress should give serious consideration to the depth and breadth of how offsets can be used in any cap and trade system.

Let me digress for a moment. There has been recently some controversy over whether a small proportion of offset projects actually achieve the emission reductions for which the offsets were granted credit. Some of the controversy is well founded. Like any new and fast moving market, standards can take some time to develop.

JP Morgan is at the forefront of industry efforts to harmonize meaningful industry standards to ensure that actual reductions do take place, to eliminate double counting, and to require effective monitoring. We have recognized the legitimate challenges and are rising to them.

In addition to offsets, a greenhouse gas cap and trade program can be designed to minimize costs using a variety of approaches, including the banking of allowances and offsets, where banking means saving of offsets for future use; the borrowing of allowances, where borrowing means using future allowances today in return for over-achieving them in the future; linkage with other trading systems, a subject to which I will return; staggering of compliance deadlines; extending of compliance deadlines; and other complementary policies that drive energy efficiency and technological innovation.

This is a long list, but cost containment essentially boils down to three things. The cap and trade program must be flexible. It must be broad. And it must be long term.

Perhaps the most discussed approach is that of the so-called safety valve. Under a safety valve provision, exemplified by the recommendation of the National Commission on Energy Policy, covered entities would be allowed to pay the implementing agency a specified amount per ton of greenhouse gas, instead of submitting emissions allowances, thus capping the cost per ton at the specified safety valve level.

From the perspective of greenhouse gas emitters, a safety valve provides certainty of the upper limit of the cost of compliance. However one characterizes this approach, in economic terms it is a price control. It has been argued that a price control on emissions credits may be justified in the initial phases of a cap and trade program given the relatively higher degree of uncertainty over compliance costs. However, in both the near and the long term, the case for such price controls is not compelling.

Commodity markets exist to buy and sell commodities. High prices tend to incent an increase in supply in that commodity and/or to reduce demand. Carbon markets are no different. Obviously, carbon markets do not exist to incent an increase in the supply of carbon, but rather to increase the supply of capital allocated to expanding low carbon technology. By controlling the maximum price an emitter must pay for emissions, Congress would quite directly be decreasing the available capital to invest in new and innovative low carbon technology.

The effect of such price controls on investors and emitters should not be underestimated. For example, a frequently proposed price cap for carbon is $10/ton of carbon dioxide equivalent. At the same time, the International Energy Agency estimates that the cost of carbon capture and storage, known as CCS, technology at between $30 and $90 per ton of carbon dioxide equivalent.

With that differential, it is hard to see the economic logic of investing in CCS. And given that over 50 percent of U.S. electricity generation comes from coal, that demand is still increasing, and that over 150 coal-fired plants are in the pipeline, a price cap that retarded the commercialization of a technology that would allow the U.S. and the rest of the world to safely use its most abundant fossil fuel would seem inappropriate.

It is not too dissimilar to wonder how much exploration and production activity would be occurring in the global oil markets if the price of crude was capped at $30 per barrel. It is safe to say that the oil majors would be returning most of their exploration budgets to their shareholders and that recoverable reserves would, at best, slowly continue to decline. No new supply would be coming to the market.

Sadly, a price control has another drawback. It may prevent the U.S. market from linking to the EU ETS and other international carbon markets. Other systems, principally the EU ETS, will be unlikely to allow carbon credits and offsets from outside the EU if the cost of those credits is artificially low due to price controls and if the price control simply acts as a carbon tax that allows emitters to bust the cap.

Quite apart from the diplomatic fallout of such a policy, failure to link to other carbon markets will reduce liquidity and therefore raise compliance costs to U.S. emitters.

It is worth noting that neither the acid rain program or the EU's ETS have used price controls. In the case of the acid rain program, there have been price spikes, but they have been temporary and self-correcting. Moreover, the cost of compliance in the SO_x and NO_x markets was initially estimated from $3 billion to $25 billion per annum. After the first 2 years of phase one, costs were around $800 million per year.

In the case of the EU ETS, despite not having a price control in place, neither emissions allowance volatility nor high prices have caused major dislocation to either emitters or consumers. Importantly, the experience of the EU framework has also identified a number of lessons in exactly the manner that its first phase was intended and designed to do.

I realize that I am out of time, so I will stop here and look forward to your questions.

[The prepared statement of Ms. Masters follows:]

STATEMENT OF BLYTHE MASTERS, MANAGING DIRECTOR, JP MORGAN SECURITIES

Thank you. It's a pleasure to be here today on behalf of JP Morgan Chase.

My name is Blythe Masters and I am the Managing Director in charge of the Global Commodities Group. Of particular relevance to today's hearing, I manage the trading and marketing of JP Morgan's energy and emission credit trading businesses.

In early 2007, JPMorgan's Global Currencies and Commodities Group (GCCG) established an Environmental Products group dedicated to helping clients reduce emissions and manage associated risks.

We have a team focused on the origination, marketing and trading of carbon emissions, covering the EU ETS (European Emissions Trading Scheme), essential elements of the Clean Development Mechanism (CDM), emerging regional compliance / pre-compliance markets in the U.S., and voluntary emissions markets. We have dedicated teams of Sales and Trading experts in London (covering EU Allowances (EUAs) and Certified Emissions Reductions (CERs)), New York (covering Verified Emissions Reductions (VERs)), and Tokyo (covering CERs), and are actively expanding to meet growing client demands for environmental-related products and advisory services.

We are also leaders in the U.S. acid rain or SO_2 and NO_x emissions markets and in 2006 were recognized by Environmental Finance for Best Trading Company in SO_2 Emissions.

On a professional level, I have direct experience in markets with significant similarities to the growing emission credit markets. I have been a trader in the commodities markets. A trader and a manager of our global credit derivatives and structured products business. The head of Global Credit Portfolio and Credit Policy and Strategy. And just prior to my current position, the Chief Financial Officer of JP Morgan's Investment Bank.

I would like to thank Senators Lieberman and Warner for their leadership on an issue of such worldwide importance. JP Morgan operates in over 55 countries and has clients in every sector of the international economy. We recognize that climate change poses grave risks to the global environment and the international economy that need to be urgently addressed.

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Congress is studying whether to create a so-called cap and trade emission framework. JP Morgan supports a framework that caps greenhouse gas emissions and establishes a price for those emissions.

For the private markets to most effectively address the problem of climate change, greenhouse gas emissions, which practitioners refer to as carbon, must have a price. By establishing a price for carbon—through a cap and trade system—Congress will unleash the forces of supply and demand. There are precedents.

As you know, Congress created the first cap and trade program in 1990 to combat acid rain. It's my understanding, Senator Warner, that you played a key role in cre-

ating the acid rain program. Well done. It's worked—transparently, more cheaply than expected and it's delivered the needed environmental benefits.

By setting a price on SO_x and NO_x emissions, market forces drove down the cost of compliance significantly below projections. The market rewarded emitters that reduced their emissions, penalized those that could not or did not, and spurred the development of technologies that made further reductions possible in the most cost effective way.

Like any new program of Government regulation, the cost of compliance was a very important and worrisome issue. So it is with the proposed cap and trade system for greenhouse gases.

Given the uncertain cost of the emission allowances that would be required under any cap and trade program and its potentially wide reach, Congress is justifiably searching for ways to moderate expected compliance costs. And to be sure, there are legitimate economic concerns that make cost containment a priority. Indeed, some of my fellow panelists will be speaking to one of the implications of compliance costs—international competitiveness.

Having said that, there are multiple approaches to cost containment. In any free market costs—or prices—are a reflection of supply and demand. Prices will tend to be lower the more supply there is. One way to expand supply is to allow a larger percentage and wider variety of emission offsets to meet emission reduction requirements.

As a result, there are two issues: One, what percentage of an emitter's reduction requirement can be met by purchasing carbon offsets—instead of actually reducing his or her own emissions? And two, what kind of projects are eligible to be considered offsets?

As for the first question, I don't have a precise recommendation but there is an optimal number that effectively balances achieving real and verifiable reductions and minimizing compliance costs. JP Morgan would be pleased to provide intellectual resources to the Committee as it contemplates that balance.

As for eligible offset projects, I believe we can learn from one of the mistakes of the Kyoto Protocol. The Kyoto Protocol currently prohibits using the preservation of tropical forest as a carbon offset. This is a mistake. Deforestation accounts for 1.5 billion tons of CO_2 -equivalent annually and makes up approximately 20 percent of annual greenhouse gas emissions. In fact, deforestation is the largest source of emissions in the developing world.

Allowing tropical forest preservation to count as an offset would expand the supply for carbon reductions significantly, act to contain compliance costs and provide a huge bonus in preserving biodiversity. Congress should give serious consideration to the depth and breadth of how offsets can be used in any cap and trade system.

Let me digress for a moment. There has recently been some controversy over whether a small proportion of offset projects actually achieve the emission reductions for which the offsets were granted credit. Some of the controversy is well founded. Like any new and fast moving markets, standards can take some time to develop.

JP Morgan is at the forefront of industry efforts to harmonize meaningful industry standards that ensure reductions take place, eliminate double counting and require effective monitoring. We have recognized the challenges and are rising to them.

In addition to offsets, a greenhouse gas cap-and-trade program can be designed to minimize costs using a variety of approaches including:

- banking of allowances and offsets;
- borrowing of allowances;
- linkage with other trading systems—a subject to which I'll return
- staggering compliance deadlines;
- extending compliance deadlines; and
- complementary policies that drive energy efficiency and technological innovation

But perhaps the most discussed approach is that of the so-called safety valve. Under a safety valve provision, exemplified by the recommendation of the National Commission on Energy Policy (NCEP), covered entities would be allowed to pay the implementing agency a specified amount per ton of GHG instead of submitting emissions allowances, thus capping the cost per ton at the specified "safety valve" level.

From the perspective of greenhouse gas emitters, a safety valve provides certainty of the upper limit of the cost of compliance. However one characterizes this approach, in economic terms this is a price control. It has been argued that a price control on emission credits may be justified in the initial phases of a cap and trade program given the relatively higher degree of uncertainty over the compliance costs.

In both the near and long term, however, the case for price controls is not compelling.

Commodity markets exist to buy and sell commodities. High prices tend to incent an increase in supply in that commodity and/or reduce demand. Carbon markets are no different. Obviously, carbon markets do not exist to incent an increase in the supply of carbon but rather to increase the capital allocated to expanding the supply of low carbon technology. By controlling the maximum price an emitter must pay for emissions, Congress would be quite directly decreasing the capital available to invest in new and innovative low carbon technology.

The effect of such price controls on investors and emitters should not be underestimated. For example, a frequently proposed price cap for carbon is $10/ton/ CO2 equivalent. At the same time, the International Energy Agency estimates the cost of carbon capture and storage technology at $30 to 90/t CO_2.

With that differential, it's hard to see the economic logic of investing in CCS. And given that over 50 percent of U.S. electricity generation comes from coal, that demand is still increasing, and that over 150 coal fired power plants are on the drawing board, a price cap that retarded the commercialization of a technology that would allow the U.S.—and the world—to safely use its most abundant fossil fuel would seem inappropriate.

It is not too dissimilar to wonder how much exploration and production activity would be occurring in the global oil markets if the price of crude was capped at $30 a barrel. It's safe to say that the oil majors would be returning most of their exploration budgets to their shareholders and that recoverable reserves would, at best, slowly continue to decline. No new supply would be coming to market.

Sadly, a price control has another drawback—it may prevent the U.S. market from linking to the EU ETS and other international carbon markets. Other systems, principally the EU ETS, will be unlikely to allow carbon credits and offsets from outside the EU if the cost of those credits is artificially low due to price controls and if the price control simply acts as a carbon tax that allows emitters to bust the cap.

Quite a part from the diplomatic fallout of such a policy, failure to link to other carbon markets will reduce liquidity and, therefore, raise compliance costs to U.S. emitters.

It is worth noting that neither the acid rain program or the EU's ETS have used price controls. In the case of the acid rain program, there have been price spikes but they have been temporary and self correcting. Moreover, the cost of compliance in the SO_x and NO_x markets was initially estimated from $3-$25 billion annually. After the first 2 years of Phase I, the costs were around $800 million per year.

In the case of the EU ETS, despite not having a price control in place emission allowance volatility and/or high prices have not caused major dislocation to emitters or consumers.

I realize that I'm almost out of time, so I'll stop here. I look forward to your questions.

Thank you.

RESPONSE BY BLYTHE MASTERS TO AN ADDITIONAL QUESTION FROM SENATOR SANDERS

Question. It is clear that we are moving toward a cap and trade approach to dealing with greenhouse gas emissions. I strongly believe that there are supplemental policies that we must address at the same time that we promote cap and trade. For example, we must push energy efficiency to the utmost maximum. Additionally, we must require greater use of renewable sources of energy. I am wondering if you can provide information about the importance of including supplemental policies for energy efficiency and renewable energy in global warming cap and trade legislation. Also, can you provide examples of particular policies you think we should consider?

Response. Thank you for your question on energy efficiency and alternative energy. We share your view that policies in addition to a cap and trade system are required for the transaction to a low-Greenhouse Gas (GHG) economy.

JPMorgan Chase believes that the Congress should increase investments and create incentives for low-GHG Technology: Policy should reward energy efficiency and emissions avoidance and promote rapid low-GHG product and service research, investment, development, and deployment to help drive emission reductions. We believe that policy should provide U.S. companies greater opportunity in the energy and technology options. JPMC also believes Congress should increase investments in basic research into alternative energy as well as carbon sequestration.

A specific example of energy efficiency is ensuring that power generators and distributors have incentives to engage in energy efficiency activities. In certain parts of the U.S., some jurisdictions do not permit utilities to recover costs incurred in furtherance of energy efficiency. In some cases, utilities' profits suffer when conservation is implemented. This should be changed.

JPMC also shares your view that alternative energy has a key role to play in combating climate change. As a leading financer of alternative energy projects, we recognize the crucial role Federal support plays in the economics of energy deployment. As a result, JPMC supports the extension or permanence of the Production Tax Credit.

We appreciate the opportunity to share our views.

Senator LIEBERMAN. Thank very much, Ms. Masters.

Senator WARNER. We always say the balance of your remarks may be included in the record.

Senator LIEBERMAN. Yes, and they will be. That was a very impressive and helpful statement.

Our next witness is Robert Baugh, Executive Director of the AFL–CIO Industrial Union Council. Thank you for being here.

STATEMENT OF ROBERT BAUGH, EXECUTIVE DIRECTOR, INDUSTRIAL UNION COUNCIL, AFL–CIO

Mr. BAUGH. Senator Lieberman, on behalf of the——

Senator WARNER. That is a proud name. Best football player we ever had was Sammy Baugh.

[Laughter.]

Mr. BAUGH. He is supposedly a very distant relative.

Senator WARNER. Hang onto it.

Senator LIEBERMAN. This will allow us to transition from military metaphors to football metaphors.

[Laughter.]

Mr. BAUGH. Senator Lieberman, on behalf of the 10 million members of the AFL–CIO, I want to thank you and the members of this Committee for having us testify this afternoon on such an important subject.

America needs an energy policy for the 21st century that will result in a cleaner planet, greater energy efficiency, and the revitalization of our manufacturing base. Climate change is a serious environmental threat in need of prompt legislative response by the U.S. Congress. It is an opportunity for our Nation to prove that economic development and environmental progress can and should go hand in hand.

Our Energy Task Force has been informed by science and economic reality to come to this conclusion. Global warming is a problem and we need balanced measures to address it. Our energy system must maintain diversity in the utility industry to include all fossil fuels, nuclear, hydro and renewables as part of a solution to this problem.

The third piece is that our Nation needs a strong manufacturing base, but it is one that is in deep, deep trouble. We are awash in record-setting trade deficits. We have lost more than 3.5 million manufacturing jobs since 1998, and 40,000 manufacturing facilities in this Country have closed in the last 6 years. The manufacturing drops and the off-shoring of skilled work, R&D, design and engineering and more erodes our innovative and technical capabilities and capacities. This is about the foundation of our national security and our national economic security.

Over the past year, our interaction with Congress, the National Commission on Energy Policy, the Apollo Alliance, and many other business, environmental and labor organizations has helped focus the thinking of the AFL–CIO Energy Task Force. It has also helped us establish the principles to address carbon emissions. We need a balanced approach with a diverse, affordable energy supply that creates good jobs and improves the environment.

We need an economy-wide approach with standards that allow for the development and deployment and financing of new technology. We need a cap and trade system designed to clean the environment, create new jobs, and discourage the off-shoring and sale of assets.

We need investments that capture cutting edge technologies and are manufactured here. We need an international component to assure that the major developing nations participate.

It is on this basis that we last week endorsed the Low Carbon Economy Act of 2007 introduced by Senators Bingaman and Specter. They have five important interrelated actions that speak to those principles. One, it made a significant statement about the environment. Two, it has a timetable for reductions that balances concerns about the economy with our ability to develop and deploy new technology and makes those subject to a system of regular reviews.

It provides pricing certainty for long-term investment decisions, the conservation we have been having, and assures a modest effect on fuel and electricity prices, and avoid short-term price fights that can lead to fuel switching. They do this through the technology accelerator payment, the safety valve.

It provides resources for early and major investments in clean coal, renewable energy, advance technology vehicles and components, and the modernization of manufacturing facilities. It has an international perspective with incentives and penalties to encourage the participation of major developing nations in a global solution.

I will focus the remainder of my comments on those last two items.

One of the most important aspects of the Low Carbon Economy Act of 2007 is its commitment to major long-term domestic technology investments, and the fact that this is self-financing. There will be no further demand on the Federal budget to do this. The cap and trade program in the bill sets aside 47 percent of the allowances for auction for public benefit and investment. This will gradually rise over time to 100 percent. Eight percent from the getgo is set aside for carbon capture and storage; 20 percent of the total credits, up to $25 billion a year, are set aside for research and development and deployment of low and no-carbon technologies.

Four percent is set aside for assistance to low-income households. Five percent of the allowances are for agricultural sequestration, with another 1 percent for bonuses for firms that do some carbon reductions in advance of the implementation of this bill. And 9 percent is set aside for States to look at their own regional differences and issues and needs, and for technology or energy efficiency and for security purposes.

Another critical element to this bill that we demanded as part of the labor movement in looking at the economy are prohibitions to prevent firms from gaming a system. Firms cannot collect credits for reductions achieved through closures, cutbacks or the outsourcing of work. Only actively operating manufacturing facilities will receive allowances based on the number of production employees at those U.S. facilities.

The point of the system, the point of the allowances, the point of the prohibitions, is to encourage a positive change in the domestic behavior of energy producers and manufacturers. That is the point of the major investments we cite in this legislation.

The Bingaman-Specter bill primarily targets conversion to clean coal, carbon capture and sequestration, renewable energy, manufacturing upgrades, and the auto products market. Simply, look at my own testimony and the charts that are in there, we cannot achieve energy independence nor meet carbon reduction goals without utilizing the existing coal resources in the United States. Today, they provide over half of our electrical energy, and frankly it is what the world uses. If we can solve this problem, we will help everybody.

We must use our coal cleanly and more efficiently by accelerating the development and deployment of carbon sequestration and other energy efficient coal technologies. The targets and timetables of the Bingaman-Specter bill work hand in hand with its technology incentives, provisions to assure that essential capture and storage technologies are available in time to meet the bill's substantial 2030 emissions reductions targets.

On the renewables side, we are a Nation with a huge fertile land base, a moderate climate, rivers, coasts and mountains. The U.S. has an untapped abundance of potential renewable energy resources. In the early 1980's, we led the world in renewable technology like solar, batteries, biomass, and wind, but we failed to follow through. I think this is a critical point here. Germany, Japan and Brazil as a matter of industrial and energy policy, which is what we should be talking about, targeted these technologies and invested in them. Today, they lead the world and export these products around the globe. This is the way we need to act. It is time to go back to the future for this Country.

But we must have no illusions about the timing and real technical challenges ahead. We need early investment and development and then deployment, and deployment takes time. As the auto industry and the UAW have sat before these committees and said, it takes 15 to 18 years to turn over the entire U.S. fleet. The same is true for power production, and that is what we are talking about here. For wide scale deployment of these new technologies, whether it is in coal or renewables, it will take time and it will take decades and it will take major investments. We have to keep that in sight.

Targeting investments toward our domestic manufacturing and processes and automotive products is critical because transportation and the industry account for approximately 50 percent of today's energy usage. Investing in manufacturing is in the Nation's interest because it is the foundation of our Nation's economic and national security. It has been a vital engine for productivity growth, technology development, innovation, good jobs, good bene-

fits, tax revenues and additional job creation in local communities, up to four jobs.

The automotive sector is at the heart of manufacturing. It accounts for 25 percent of all manufacturing, roughly 4 percent of our GDP. Currently, many advanced technology vehicles are assembled overseas and virtually all the key components are built in foreign countries. We have joined with the UAW in calling on Congress to establish a Marshall Plan to help re-tool the U.S. auto industry.

The Bingaman-Specter bill has responded with critical investments targeted to upgrading manufacturing to be more energy efficient, as well as on specific investments in the domestic production of advanced hybrid, diesel and fuel cell vehicles, as well as vehicles that can run on ethanol and other alternative fuels, as well as their component parts. It answers both the energy efficiency question in terms of how we manufacture. It also answers the question of having advanced automotive vehicles that achieve high energy efficiency and clean technologies. This will help create tens of thousands of automotive jobs, while reducing global warming and our reliance on foreign oil.

From the economic development perspective, the Low Carbon Economy Act of 2007 has a number of positive payouts: the retention of good manufacturing jobs; the creation of new jobs in these new technologies and industries; and the capturing of cutting edge technology for domestic production and export.

The inclusion of an international section in the Bingaman-Specter bill was critical to our support for the legislation. The AFL–CIO believes that having a dynamic and healthy industrial base is in the best interest of the Nation, and we must do our best to cut our carbon emissions. However, this cannot be a go it alone proposition. Mexico and Brazil account for more than half the emissions from Central and South America. Deforestation, as we already heard, is estimated to account for at least 20 percent of that. Much of this is coming from the burning of the Amazon and clearing for deforestation. It is a major contributor.

China passed the United States, as we heard someone else today earlier, in 2006 in terms of carbon emissions. They have 500 coal plants coming online over the next 10 years, one a week. They are based on 1950's technology that is dirty, but cheap to build. Unabated by 2030, China's emissions will grow 139 percent and make up 26 percent of the world's total.

China, India and the other major developing nations must be part of the solution or everything that we do, or that the European Union does, or that other nations do to cut emissions, will be for naught if they do not participate.

There is a second economic implication. China, India and the other rapidly developing countries are already a magnet for manufacturers seeking to avoid labor, environmental, currency and other standards. Most of China's new energy resources will be dedicated to the manufacturing export strategy which accounts for 40 percent of their GDP, and 70 percent of the foreign direct investment in China is actually in the export markets and the export platforms.

Since 1997, our trade deficit with China has ballooned from $50 billion a year to $235 billion last year, and they hold $1.5 trillion in U.S. securities and dollars. They account today for 47 percent of

our total trade deficit in manufactured goods. So to put it bluntly, Senators, it is not in our national interest to see our efforts to reduce carbon emissions become yet another advantage that a developing nation uses to attract business. However, it is in our interest and the world's interest to have developing nations become part of the solution because the problem cannot be solved without them.

The Bingaman-Specter bill takes this into account in several ways. It will take me 2 seconds, and then I will do this.

The executive branch is directed to negotiate with the developing nations over implementing a system of carbon control. The bill provides incentives—this is an important piece—to fund joint research and development, technology transfer, ways in which to incent the partners to move to cleaner technology. The bill provides for 5 year reviews to reassess our domestic actions base upon international and based upon the science and technology that we put in place for our own goals and standards.

If the President would deem that the actions of the trading partners to be inadequate, the U.S. Government can require these countries to purchase carbon allowances for their exports to the U.S. If there is sufficient international effort on the greenhouse gases, the President could recommend further reductions of emissions and move our standards upward.

We believe, the AFL–CIO believes that climate change is a crisis and an opportunity for our Nation. By taking the right steps—time lines, goals, a safety valve sensitive to the economic impacts on business, workers and communities, assuring that our investments capture the intellectual property of cutting edge technology, by producing these new technologies and goods domestically, and by engaging the developing world in solving this problem we can have a cleaner planet, greater energy efficiency, and a revitalized manufacturing base for this Nation.

Thank you.

[The prepared statement of Mr. Baugh follows:]

STATEMENT OF ROBERT BAUGH, EXECUTIVE DIRECTOR, INDUSTRIAL UNION COUNCIL, AFL—CIO

Chairman Boxer, on behalf of the 10 million members of the AFL—CIO, I want to thank you and the members of the Environment and Public Works Committee for the opportunity to testify this afternoon on this important subject.

America needs an energy policy for the 20 first century that will result in a cleaner planet, greater energy efficiency and the revitalization of our manufacturing base. Climate change is a serious environmental threat in need of a prompt legislative response by the U.S. Congress. It is also an opportunity for our nation to prove that economic development and environmental progress can and should go hand-in-hand.

CRISIS AND OPPORTUNITY

Embodied in our position is a set of ideals that reflects a major change of direction for the AFL—CIO on energy policy. They grew out of the recognition by the AFL—CIO Energy Task Force that "A growing body of scientific evidence has confirmed the environmental challenges posed by global warming. Human use of fossil fuels is undisputedly contributing to global warming, causing rising sea levels, changes in climate patterns and threats to coastal areas. Because of these dangers, the AFL—CIO supports balanced measures to combat global warming."

The task force also recognized that "reliable and affordable electrical energy is the lifeblood of the manufacturing, transportation, construction and service industries;" and that we must "maintain diversity in the electric utility industry, by retaining all current generating options, including fossil fuels, nuclear, hydro and renewables, to ensure a stable, reliable and low-cost supply of electricity for the United States."

We also believe that a strong and diverse manufacturing base are in the national interest but the reality is this sector is in a deep and ongoing crisis. The nation is awash in record setting trade deficits. Since 1998 more than 3.5 million manufacturing jobs were lost and over 40,000 manufacturing facilities have closed. The offshoring of skilled work, R&D, design, engineering and more continues to erode our innovative and technical capacities. Solving the climate change crisis is an opportunity to address the manufacturing crisis

POLICY AND PRINCIPLES

Over the past year, our interaction with Congress and many other businesses, industry, environmental and international labor organizations have helped evolve and sharpen the thinking of the AFL—CIO Energy Task Force. The work of the National Commission on Energy Policy, the Apollo Alliance, House and Senate energy legislation, the broad and open stakeholder process initiated by Senators Bingaman and Specter as well as Chairman Dingell's detailed questionnaires regarding cap and trade programs forced our thinking about how these systems can and should work.

The task force recognized that any discussion about climate change was a discussion about the nation's industrial policy because energy and the environment are at the nexus of manufacturing and trade policy. As a result, the AFL—CIO established a set of principles to guide our participation in the carbon emission discussion.

1) Our Nation should embrace a balanced approach that assures diverse, abundant, affordable energy supplies, creates good paying jobs for American workers, improves the environment, and reduces our dangerous dependence on foreign oil.

2) We support an approach to carbon emissions that does not advantage one sector over another, is economy wide, has timetables and standards that allow for the development and deployment of new technology, and helps finance the new technologies that can provide clean energy at prices close to conventional sources.

3) Energy incentives and investments by the Federal Government must be based upon a set of economic development principles that cleans the environment and creates jobs but will not encourage offshoring of manufacturing or the sale of assets.

4) Investments must be used to identify, develop and capture cutting edge technologies and to manufacture and build these technologies here for domestic use and export

5) The international component of any carbon emission/cap and trade program must provide a system of incentives and penalties to assure that major developing nations, like China and India, participate.

We have applied these principles in every discussion held with staff and Members of Congress. Two weeks ago, after months of dialog with Senate staff about new carbon emission legislation we endorsed the Low Carbon Economy Act of 2007 introduced by Senator Bingaman and Senator Specter.

We believe this legislation represents and important step forward with five interrelated actions:

- It makes a significant environmental statement with a 2050 goal of final emission reductions of 60 percent or more below current levels.
- It has a timetable for reductions that balances concerns about the economy with our ability to develop and deploy new technology and makes those subject to a system of regular reviews of the targets and technological capability.
- It provides pricing certainty for long-term investment decisions, assures a modest effect on fuel and electricity prices and avoids short-term price spikes that can lead to fuel-switching through a Technology Accelerator Payment.
- It provides resources for early and major investments in new technology from clean coal and renewable energy technologies to advanced technology vehicles and components and the modernization of manufacturing facilities for energy efficient production.
- It provides an international perspective that includes both incentives and penalties designed to encourage the participation of major developing nations in a global solution to the problem of carbon emissions.

I will focus the remainder of my time on the last two points investment policy and international aspects.

INVESTING FOR THE FUTURE: RESOURCES, ENERGY, MANUFACTURING AND AUTO

Meeting the future energy needs of the Nation while reducing our carbon footprint offers difficult choices and huge opportunities. It requires a commitment to major long term investments, that these be invested domestically and that the technology and products resulting from the investments be produced domestically. In this way the Nation can maximize the outcomes from its investments by assuring that those dollars recirculate through the domestic economy. This is environmental and industrial policy working in harmony.

New Resources for New Investments

One of the most important aspects of S. 1766, the Low Carbon Economy Act of 2007, is that it does not place additional demand on the Federal budget for financing new technology investments. The cap and trade program in S. 1766 is self-funding. It creates a large pool of capital by initially setting aside a 47 percent of the allowances available for auction for public benefit/investment. This will gradually rise over time to 100 percent.

- 8 percent of allowances will be set aside annually to create incentives for carbon capture and storage to jump-start an intensive strategy to sequester GHG emissions. Approximately $35 billion by 2020.
- 20 percent of the total credits, up to $25 billion per year will be auctioned by the Government to generate much-needed revenue for research, development, and deployment of low-and no-carbon technologies; to provide for climate change adaptation measures;
- 4 percent of the allowances are set aside to provide assistance to low income households
- 5 percent of allowances are reserved to promote agricultural sequestration, and 1 percent of the allowances will reward companies that have reduced emissions before program implementation.
- 9 percent of the allowances are left to be distributed by States to address regional impacts, promote technology or energy efficiency, and enhance energy security.

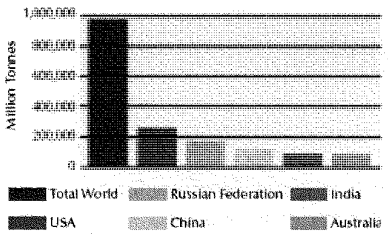
Another important element of this cap and trade proposal are the steps taken to impede the ability of manufacturing firms to game the system simply for financial gain or to drive them offshore. Firms cannot collect credits for reductions achieved through closures, cutbacks or outsourcing works. Only actively operating manufacturing facilities (including new facilities) will receive allowances, and their allocation is based on the number of production employees at those U.S. facilities. The point of the system is to encourage a positive change in the domestic behavior of energy producers and manufacturers while retaining jobs and our technical capability to produce goods.

Targeting Energy Production

The revenues generated under the Bingaman—Specter bill are primarily targeted to finance improvements in technology that will allow clean energy to be produced at prices close to what consumers pay for energy from conventional sources, and to encourage deployment of this technology in manner that promotes domestic production and jobs for American workers. The investments and incentives are targeted for conversion to clean coal technology, carbon capture and sequestration, domestic production of advanced technology vehicles and their components, energy efficiency and renewable energy resources

Proved Coal Reserves

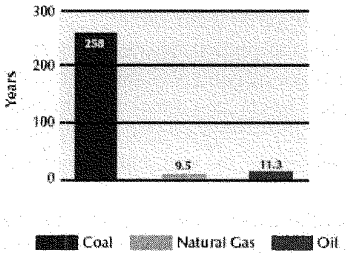
The United States has the largest proved coal reserves of any nation in the world (the top five nations are shown here).



Data Source: BP, 2004

U.S Fossil Fuel Reserve/Production Ratios

At current production levels U.S. proved coal reserves would last over 250 years



Data Source: BP, 2004

We cannot achieve energy independence nor meet carbon reduction goals without utilizing existing coal resources. This nation is blessed with the largest known coal deposits in the world, a resource that provides over half of the electrical energy in the U.S. But, we must use our coal cleanly and more efficiently. To do so we must accelerate development of carbon sequestration technologies and the deployment of more efficient coal burning technology. The targets and timetables of the Bingaman-Specter bill work hand in hand with its technology incentive provisions to ensure that essential capture and storage technologies will be available in time to meet the bill's substantial 2030 emission reduction target.

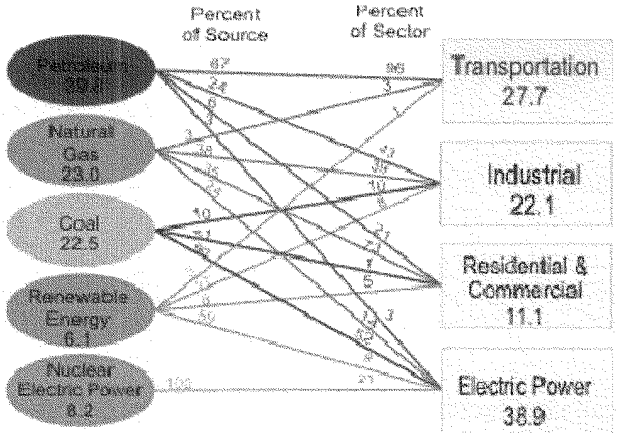
The conversion to clean coal technologies is an opportunity both domestically and internationally. It is in our interest to develop these new technologies and export them to China and the rest of the world. But, we must be as equally committed to rapidly developing carbon capture and sequestration as we are to developing renewable sources of energy.

With a huge fertile land base, moderate climate, coastal and mountain lands the U.S. has an untapped abundance of renewable energy resources available such as wind, solar, hydro and biomass-derived fuels. There was time in the early 1980's we led the world in solar, battery and wind turbine technology but we failed to follow through on those commitments. On the other hand, Germany and Japan, as a matter of industrial and energy policy, targeted those technologies and invested in them. Today they lead the world and export these products around the globe. It is time for our nation to go back to the future.

We believe the investments targeted for energy production in the Bingaman-Specter bill can provide a path to reducing our reliance on foreign oil and cut CO_2 emissions while promoting broad-based economic development. Each of these resources faces technical hurdles and it would be wrong to assume that it is simply a matter of technology deployment. There is the need for matching up early investment in technology development and then deployment. For example, the auto industry often cites that it will take 15—18 years to replace the entire U.S. fleet. The same is true in energy production. It will take decades and major investments to convert to clean coal technologies as well as to achieve large-scale deployment of renewable technology.

Targeting Auto and Manufacturing

Linking the energy production investments to domestic manufacturing is only one part of national energy/environment/industrial strategy. The other half is targeting investments in our domestic manufacturing processes and the automotive products we produce because transportation and industry account for approximately 50 percent of our energy usage.



Investing in manufacturing is in the nation's interest because of the broader role this sector plays throughout the economy. It is the productivity leader that helps expand the economic pie. It accounts for two thirds of all R&D investment and is the primary source of innovation. It is the leading purchaser of new technology and financial and technical services. It is the leader in new work organization and work process. At the community level manufacturing jobs have been a critical economic ladder with rungs at all levels. And, because of the web of supplier industries and the relatively high wages and benefits, each manufacturing job, it is estimated, is associated with up to four additional jobs.

The automotive industry is the single most important industry to American manufacturing. Manufacturing accounts for 16 percent of the nation's GDP, and the automotive sector makes up 25 percent of all manufacturing, some 4 percent of GDP. Auto is the cornerstone of an advanced manufacturing economy, not only because of its enormous economic impact but also because it involves the most complex integration and assembly of leading edge technologies and products. From the glass, rubber, steel, and electronics to engines, transmissions, design, engineering, R&D and more, an automobile encompasses the critical elements of this nation's industrial infrastructure.

Currently, many advanced technology vehicles are assembled overseas, and virtually all of the key components are built in foreign countries. However, a study by the University of Michigan's Transportation Research Institute demonstrates that Federal incentives to encourage domestic production can reverse this trend, create jobs and result in higher tax revenues for the Federal and State Governments.

The AFL—CIO Energy Task Force has called for the U.S. Government to pursue measures to improve energy efficiency. We have called upon Congress to establish a Marshall Plan to help re-tool the U.S. auto industry to accelerate domestic production of advanced technology and alternative fuel vehicles and their key components.

The Bingaman—Specter bill has responded with critical investments targeted to upgrading manufacturing as well as auto specific investments in domestic production of advanced hybrid, diesel and fuel cell vehicles, as well as vehicles that run on ethanol and other alternative fuels. This initiative will help create tens of thousands of automotive jobs for American workers, while at the same time helping to reduce global warming emissions and our reliance on foreign oil.

From the economic development perspective, the Low Carbon Economy Act of 2007 has a number of positive payoffs. The upgrading of manufacturing facilities will help retain good manufacturing jobs. The investments in clean coal, renewables and advanced automotive technology and component parts will create new jobs. All the investments will help capture cutting edge technology for use in domestic production and export.

INTERNATIONAL ASPECTS: THE NEED FOR A GLOBAL SOLUTION

The inclusion of an international section in the Bingaman-Specter bill was the result of many hours of discussion. It was a critical issue in our support of the legislation. The AFL—CIO believes that having a dynamic and healthy industrial base is in the best interest of the Nation and we must do our best to cut our carbon emissions. However, this cannot be a go it alone proposition.

The participation of developing nations is critical to solving this problem while assuring the competitiveness of U.S-based manufacturing. Mexico and Brazil account for more than half the emissions from Central and South America. Deforestation is estimated to account for 20—30 percent of carbon emissions with the burning of forests in the Amazon basin acting as a major contributor.

By some estimates, China passed the United States in carbon emissions in 2006. They have a new "1950's technology" coal plant coming online every week with 500 plants being planned. They are dirty but cheap to build. Unabated, by 2030 China's emission will grow 139 percent and make up 26 percent of the world's total. They and other major developing nations must be part of the solution or everything we the EU and other nations do to cut carbon emissions will be for naught.

There is a second economic implication of the non-participation of these nations. China, and other rapidly developing countries are already a magnet for manufacturers seeking to avoid labor, environmental, currency and other standards. Seventy percent of China's foreign direct investment is in manufacturing, with heavy concentration in export-oriented companies and advanced technology sectors. Much of this energy resource will be dedicated to China's manufacturing export platforms, which already account for nearly 40 percent of Chinese GDP.

In 1997 when the AFL—CIO rejected the Kyoto protocol because it did not include the developing world the federation took a lot of criticism but our concerns were well founded. Since Kyoto the Chinese Government has said they will be a developing county for at least the next 50 years and will not agree to be restricted by this framework. In that time our trade deficit with China soared from $50 billion in 1997 to $235 billion in 2006. They now hold $1.5 trillion in U.S. dollars and securities. This year China overtook the United States as the No. 1 exporting nation in the world, and it now accounts for 47 percent of the U.S. trade deficit in manufactured goods.

In a May 2, 2007 study the Economic Policy Institute estimates that "the rise in the U.S. trade deficit with China between 1997 and 2006 has displaced production that could have supported 2,166,000 U.S. jobs. Most of these jobs (1.8 million) have been lost since China entered the WTO in 2001. Since China entered the WTO in 2001, job losses increased to an average of 441,000 per year—more than the total employment in greater Dayton."

To put it bluntly, it is not in our national interest to see our efforts to reduce carbon emissions become yet another advantage that a developing nation uses to attract business. However, it is in our interest and the worlds interest to have developing nations become part of the solution because the problem cannot be solved without them.

The Bingaman—Specter bill takes an evenhanded approach to this issue:

- The Executive branch is directed to negotiate with the major developing nations over implementing a system to control carbon emissions.
- To effectively engage developing countries the bill provides incentives to developing nations. For example, it would fund joint research and development partnerships and technology transfer programs similar to the Asia Pacific Partnership.
- The bill also provides for a Five-Year Review Process to reassess domestic action based on an assessment of efforts by our major trade partners (as well as climate science and available technology).
- If the President deems the actions of these trading partners nations to be inadequate then the U.S. Government can require that imported products from these countries purchase carbon allowances from a separate pool.
- If there is sufficient international effort on greenhouse gases, the President could recommend further reductions of emissions at least equal to 60 percent below current levels.

The AFL—CIO believes climate change is both a crisis and an opportunity for our Nation. By taking the right steps—timelines, goals and a safety valve sensitive to the economic impacts on business, workers and communities; assuring that our investments capture the intellectual property of cutting edge technology, by producing these new technologies and goods domestically, and engaging the developing world in the solution—we can have a cleaner planet, greater energy efficiency and a revitalized manufacturing base.

Senator LIEBERMAN. Thank you, Mr. Baugh. Excellent statement that raised some thoughts which I am sure we will want to question you about.

Next, we have Mr. Garth Edward, Trading Manager for Environmental Products at Shell Energy Trading. I must say, listening to the witnesses, particularly Ms. Masters, and having you here, it is

really both noteworthy and encouraging the effort that the private sector is putting into both dealing with the problem and, frankly, getting involved in the solution in a way that might actually be profitable.

Mr. Edward?

STATEMENT OF GARTH EDWARD, TRADING MANAGER, SHELL INTERNATIONAL TRADING AND SHIPPING COMPANY

Mr. EDWARD. Thank you, sir.

Good afternoon, Chairman Lieberman, Ranking Senator Warner and members of the Subcommittee. My name is Garth Edward. I am the Trading Manager, as you said, over at Shell for environmental products. I thank you for this opportunity to speak to you all today. My remarks will focus on the components of a cap and trade system that will facilitate economic growth and ensure that the United States remains competitive in a global market.

For a more thorough discussion, as well as a discussion of related policy tools, I will refer you to my written testimony.

Since the 1990's, Shell's refining and power generation installations in the U.S. have been covered by SO_2 and NO_x market legislation under the Clean Air Act. In Europe, Shell has over 30 regulated installations under the EU emissions trading system, including oil rigs, refineries, and chemical plants.

So I am speaking here today as a representative of a company that has some hands-on experience of operating its business under cap and trade.

On the purely trading side of the business, Shell was the first company to transact CO_2 allowances under the EU system and today we run a global environmental trading business that transacts in nine different emission markets with teams in Houston, London, Beijing and Tokyo.

So first, let me say that Shell believes that a cap and trade system is ideally suited to managing direct emissions in large industrial facilities and power stations. Second, Shell does not believe that a cap and trade system is suitable for the transportation market. In particular, we believe that a cap and trade system is most effective at achieving environmental goals when the point of regulation is also the point where those emissions occur.

So in Shell's view, a successful cap and trade program is one that achieves its environmental goals in a manner that ensures economic growth, international competitiveness, and energy security.

Today, I will first set out our view on what a cap and trade system enables us to do. Second, from the perspective of maintaining competitiveness, I will emphasize the importance of accessing a supply of domestic offsets and international credits. Third, I will also mention how allocation approaches can impact cost. And finally, I will explain why we believe that straight price caps may not offer a helpful way forward.

On the first point, an emissions market by its very existence drives capital toward the most efficient way of reducing emissions. For example, if Shell can reduce emissions internally by investing in a new technology or changing our operations for, say, $10 a ton while the market price is $15 a ton, then we would certainly deploy our capital internally on Shell projects. But if the projects inside

our business cost $15 a ton and the market was trading at $10 a ton, then it is certainly more cost efficient for us to buy the allowances from the open market and effectively finance other companies to reduce their emissions on better terms. Either way, we are going to use our capital to find the most efficient way to reduce emissions.

It is worth noting that an emissions market does itself function as a basic cost containment mechanism, since it drives capital to find the lowest cost abatement opportunity.

In terms of regulated entities, the wider the pool of possible emission reduction activities, then the more opportunities there are to find low cost emission reductions. If the pool of regulated entities is spread across different industry sectors and locations, then there will be many possibilities to find emission reductions and the overall market will be less exposed to short-term impacts on local emission levels due to weather or economic turbulence.

Another way in which overall compliance costs can be constrained is through access to offsets from domestic projects, such as gas caps for coal mine methane capture, agriculture waste management, and reforestation. In the future, Shell expects that a major source of emission reductions will come from the geological sequestration of CO_2 or carbon capture and storage. It seems necessary that these kinds of offsets must be recognized in future programs.

Clearly, the use of offsets has to be built on a robust system of rules and procedures for generating these offsets. The integrity of the underlying allowance market itself will depend on the vigor of these offset rules. Regulators, investors and the public all have a vested interest in making sure that these rules are rock solid and that real reductions take place.

In effect, the rules for the creation of offsets should be every bit as robust as the rules for monitoring and reporting emissions from regulated entities.

The United States can further stabilize compliance costs and ensure the competitiveness of its companies by making certain that a U.S. cap and trade system interfaces with existing international systems. This would allow U.S. companies to buy credits from international projects in the same way that overseas competitors are already doing. International credits already exist, and notably the EU has made good use of this international credit market as a way to reduce their cost exposure to high compliance costs in the EU. The EU has done this by initially authorizing EU companies to buy credits from projects in developing countries and in the future from 2008 onwards from Russia and Ukraine.

The EU, however, has not allowed unlimited access to these international credits, but the current level of supply has certainly reduced EU allowance prices and dampened volatility. So EU companies have therefore reduced their compliance costs, but also found significant opportunities to transfer technology and implement emissions reduction projects with developing country partners.

Before closing the discussion on cost containment, I should emphasize that Shell believes allowances should be granted free at the start of any cap and trade program, and should initially be based on existing emissions. If the Government auctions most of the al-

lowances up front, then this will require large initial payments from companies who must buy enough allowances to maintain their license to operate, but this would result in taking capital out of the very same companies that must implement the new technologies and practices to reduce emissions.

Let's turn to the issue of price caps. Shell does not support the issue of price caps as a form of cost containment for two reasons. First, price caps sacrifice the basic environmental goal that is the very foundation of a cap and trade system. A fundamental advantage of cap and trade versus tax, for example, is that it enables the public to get a guaranteed environmental result. Cap and trade does this by limiting the emissions of all regulated entities to the size of the total emissions cap. A price cap compromises this emissions cap because it offers a buy out. Companies may pay a fine, rather than simply reduce their emissions, and in effect you can have a guaranteed emissions level or a guaranteed price level, but you can't have both.

Introducing a price cap converts the cap and trade system into something like a tax system where the environmental results can no longer be guaranteed.

A second problem with the price cap approach is that it effectively caps the return on investment. In a free market, higher allowance prices will drive the flow of capital into more advanced technologies, larger projects, and more innovation. But with a price cap, the incentive to invest in new technologies and practices is also capped.

So I appreciate this opportunity very much to share with you our views on cost containment. I thank you for your time, and will be happy, of course, to answer questions.

[The prepared statement of Mr. Edward follows:]

STATEMENT OF GARTH EDWARD, TRADING MANAGER, SHELL INTERNATIONAL TRADING AND SHIPPING COMPANY

Chairman Lieberman, Ranking Senator Warner and members of the subcommittee, my name is Garth Edward. I am the trading manager for the Shell Group's environmental trading business. In that capacity, I oversee Shell's trading in the European Union's Emission Trading System.

The Royal Dutch Shell Group is an international group of companies engaged worldwide in all of the principal aspects of the oil and natural gas industry. Shell also has interests in chemicals, power generation and renewable energy. Shell's environmental products trading business is active in over 15 environmental markets around the world. The markets in which Shell trades include: EU Greenhouse Gas Emission Allowance Scheme, the Danish CO_2 quotas trading system, the Clean Development Mechanism Greenhouse Certified Emission Reductions, the UK Greenhouse Gas Emissions Trading System, the Houston/Galveston Area (HGA) NO_x Emission Allowance Program, the California South Coast Air Quality Management District (SCAQMD) Regional Clean Air Incentives Market (RECLAIM) for NO_x; the U.S. EPA expansion of the Eastern States Ozone Transport Commission NO_x trading program under State Implementation Plans (SIPs) to a total of 19 States; the Netherlands NO_x emissiehandel and the U.S. EPA Acid Rain Program (Title IV of the 1990 Clean Air) SO_2 Emission Allowance.

I am pleased to appear before you today to testify on economic and international issues in global warming policy. In particular, I would like to share what Shell has learned from its experience with the EU's emission trading system, a trading system that regulates emissions from more than 10,000 installations across 27 countries with more than USD $50 million worth of allowances traded each day through several exchanges and brokerage houses.

I will identify the key elements of a successful cap and trade program. In Shell's view, a successful program is one that achieves its environmental goals in a manner that ensures economic growth and energy security. Based on Shell's experience with

the EU's system, I will also identify some pitfalls to avoid in creating a program to regulate greenhouse gas emissions here in the U.S.

Finally, I will address other policies that Shell considers important in reducing Greenhouse Gas emissions and should accompany a clear, workable cap and trade system. A single instrument like an economy-wide trading system is unlikely to deliver the necessary breadth of change that needs to start now. Rather, it may result in pockets of change. In particular, the carbon price set in a cap-and-trade system, say $50 per ton, may not be high enough to prompt change in the transportation sector. Therefore, a number of approaches will be required—but not many—to achieve environmental goals.

In addition to cap-and-trade for large, stationary sources, these approaches would include a three-prong policy approach to reducing GHG emissions in the transportation sector that prompts change by fuel suppliers, vehicle manufacturers and consumers and a strong investment by the Government in the research, development and deployment of large-scale carbon capture and storage projects.

In addition, Shell supports robust energy efficiency standards for buildings, appliances etc. with incentives that encourage consumers, businesses and industry to retrofit existing infrastructure. Shell also supports continued public/private partnerships for the research, development and deployment of new technologies that conserve energy and reduce emissions.

First, let me congratulate you on your determination to act now to address the issue of climate change. Shell believes that now is the time to act on climate change. A clear, workable climate change policy implemented now that includes long-range, achievable environmental goals will have less impact on consumers, businesses and the economy than a more stringent policy with costlier mandates implemented years from now.

The later action is taken, the more mandate-driven the outcome is likely to be. Shell supports the flexible, market-based approach that is on the table today.

Shell supports a national U.S. climate change policy. We believe a national policymakes much better sense than dozens of regional policies or fifty State policies.

ELEMENTS OF CLEAR, WORKABLE CAP AND TRADE PROGRAM:

A cap-and-trade system is ideally suited to managing direct emissions in large industrial facilities and power stations. A cap-and-trade system is most effective at achieving environmental goals when the point of regulation is also the point at which emissions occur rather than separating these and relying on indirect price signals to encourage emission reductions.

Shell believes that a clear, workable cap-and-trade program would include the following essential components:

• The aim of a cap-and-trade system should be to provide an incentive for greater efficiency and to direct capital toward more CO_2 efficient projects, via a market price for CO_2 emissions.

• The trading system should not withdraw that capital from the industries or firms covered by the system. Removing capital from the market would slow down the necessary investment in more CO_2 2 efficient technologies and projects to the detriment of the environment in the long term. For this reason, Shell discourages the auctioning of allowances in the early years of a program.

• Shell believes a workable cap-and-trade program sets clear, reachable goals then stays the course. Tinkering with carbon goals mid-course creates uncertainty in the marketplace and discourages investment due to concern that the Government will change the rules and diminish the value of the investment. Today, companies invest billions of dollars in projects that last twenty-five years or more. The Government must set a goal 20 years out or more, then include interim targets that bring the market to the final goal.

• Cap-and-trade requires the application of a fixed cap across the covered sector for each compliance period, with the number of allowances in circulation equating to the cap and less than a "business as usual" expectation. This then creates the necessary scarcity for trade to develop. The extent of scarcity should be set with a view to the efficiency gains and low carbon investments that are technologically feasible within the compliance period. Once allocated the number of allowances in circulation should not be changed.

• A compliance period could be up to 5 years in length. Allowance allocation for a given compliance period should be known 3—5 years before the start of the period.

• Allowances should be granted free (a concept known as "grandfathering") at the start of an emissions trading system and this should be based on historical emissions from a fixed year or average over a number of years. The allocation process

must account for the entry of new facilities, significant expansions to existing facilities, or facility modifications required by regulation.

• Shell does not favor auctioning particularly in an initial phase of a system. However, Governments may eventually use auctions because of the ease with which allowances can be allocated and to capture some of the value of the allowances. However, the system should not withdraw capital from the industries and firms covered by the scheme. Implementation of a profit-neutral system would require detailed information on each industry's market structure and demand conditions, which could potentially be developed during an initial phase of the system when allowances are distributed for free. It should be recognized moreover that there is not a one-size-fits-all approach to achieving a profit neutral scheme and that conditions to achieve profit neutrality may well differ across industries and firms. Auctioning also raises a number of specific and significant concerns, namely:

—Payment for allowances withdraws capital from the covered sector to the extent that this cost cannot be recovered from higher product prices. The impact of a system on profits depends on an industry's market structure and demand conditions and consequently the arrangements to guarantee profit neutrality are likely to differ across industries.

—Some methods of achieving profit neutrality are likely to be more efficient than others. For example, a system of mixed grandfathering and auctioning would be more efficient than a system that recycles auction proceeds through corporate profit tax credits.

—The conduct of multiple auctions in the course of a continuous and free market has the potential to lead to price spikes and collapses.

—The administration of auctions is a serious undertaking because participation must be open to the public but must also involve financial checks so that auction participants can guarantee to be able to pay for the allowances they bid for.

• Should auctioning be used, two key design criteria must be incorporated:

—The system be designed with the aim of profit neutrality at the industry and firm levels. Environmental objectives are not advanced by arbitrarily destroying shareholder value in existing firms; indeed this can act as a deterrent to necessary investment. The incentive for abatements comes from the carbon price signal.

—There must be safeguards to ensure that this objective is delivered in practice and not just in principle.

• The point of regulation (allocation) should be set by the "make or buy" principle. This means that the holder of allowances should be both the emitter and (even more importantly) the party that can launch projects that reduce emissions. Under a system where the allowance holder is the project developer, the allowance holder can use the emissions market to help finance the project by selling the future reduction in the forward market and bringing capital back. Alternatively, if no reduction opportunities present themselves, the allowance holder can purchase allowances for compliance and thus channel capital into the market for others to use for their projects. This is called "make (reductions) or buy (allowances)". "Make or buy" is fundamental to the operation of an emissions trading system.

• The system should operate as other commodity markets do. While an emissions market can only be created by regulation and the creation of a scarcity, such regulation should not affect the trading behavior of the market. For example, regulation should not be used to manage price (e.g. through caps or floors) or limit the trading of any of the instruments created for the market (e.g. flow to/from linked schemes). Doing so may lead to market distortions (e.g. price spikes), which in turn may lead to the call for additional regulation (e.g. price caps).

• There should be a design review process within 5 years of startup to correct any design oversights or anomalies. The review should not be used to change the environmental goal.

• Key abatement technologies should be recognized from the outset. The program should embrace technologies as they mature (e.g. Carbon Capture and Storage—CCS). CCS is one of the few technologies that is entirely climate change driven. Other zero carbon power generation alternatives exist, such as wind. But they are also driven by factors such as energy costs, security of supply concerns and local air quality standards. This is not the case for CCS. Without carbon emission targets, CCS technology will not develop or be deployed. To develop and deploy CCS, the Government must:

—Provide suitable financial encouragement to a number of large-scale pilot projects in the United States in the period 2007—2015. Similar projects should be encouraged China and India. This will facilitate the development of a global CCS industry, accelerate technology cost reduction and promote economies of scale.

—Introduce additional tools to better manage the long-term carbon market risk associated with CCS.

—Include CCS in the cap-and-trade system and coordinate the development of standard rules and measurement protocols.

—Include CCS in any project-based offset mechanism linked to the cap-and-trade system.

—Address the issue of long-term liability for stored carbon dioxide.

• Policies should be designed so that activities such as cogeneration are incentivized.

• Project offset mechanisms, such as the international Clean Device Mechanism (CDM) offset program should be linked to a cap and trade program. The program should not limit their use. It would be better to recognize the existing international project mechanism rather than developing a parallel system. The effort involved in establishing a good mechanism should not be underestimated. CDM works today as a result of such effort.

• A cutoff for small facilities should be established in order to avoid an inefficient system that would require an immense effort in respect of administration and verification.

• It should be built on a sound infrastructure base, which includes clear definitions, measures and reporting protocols and adequate information technology to support the registries.

PITFALLS TO AVOID:

In my experience, there are five pitfalls to avoid when creating a cap-and-trade system.

• First, don't try to legislate "safety valves" into your cap-and-trade program. Set the basic rules of your cap and trade system, make them as clear and simple as possible, then leave the system alone. Let it self-regulate. Don't implement barriers to trade. For example, don't create offsets, then limit how much they can be used. Offsets are your natural safety valve when prices start climbing. A market-based cap-and-trade system will use offsets as needed to achieve both environmental goals and economic growth.

• Don't rush into measures like the full-auctioning of allowances. Take a step-by-step approach. Prime the pump first. Start out by giving allowances away then consider how you might introduce auctioning or create benchmarks.

• Recognize that some changes take time to implement. For example, implementing a major efficiency project within a refinery may require the refinery to shut down. Full-scale shutdowns are expensive, can impact gasoline prices and only occur every 5 years or so. Bringing forward a refinery shut down, with its related impacts on price and supply, to implement efficiencies may be problematic.

• Don't expect a single policy instrument to do everything. For example, the most effective cap-and-trade system is one where the regulation occurs at the point of emission. But it is difficult to regulate at point-of-emission in the transportation sector. No one expects personal drivers to hold carbon allowances and manage their emissions. Another policy instruments, such as vehicle efficiency and a low carbon fuel standard, may achieve better results.

• Don't reinvent the wheel where you don't have to. A vibrant international offset system exists and should be embraced. This international offset system has generated 549 projects underway in 120 countries, including India and China. Another 1,600 projects are in the pipeline, according to the May 2006 report by the U.N. Commission on Sustainable Development. These projects will send approximately $6.62 billion dollars every year to developing countries, lifting these nations out of poverty by providing to electricity while also reducing global greenhouse gas emissions.

SUCCESS OF THE EU-ETS:

I would like to talk briefly about the success of the EU-ETS since its launch on January 1, 2005. The price volatility in the first 2 years of operation and the low prices earlier this year have been seen by some as evidence that the EU trading system is not working well.

Shell disagrees. The EU-ETS is structurally sound, with a framework that broadly matches the ideal arrangement for a cap-and-trade system. It was largely modeled on the U.S. Sulphur cap-and-trade system, which is seen as one of the most successful pieces of environmental legislation ever enacted in the United States.

If the EU-ETS could be improved in one key area (apart from some more minor harmonization fixes) it would be to give a longer-term perspective on the reductions required. This is slowly developing but has not been implemented with the very clear and pragmatic approach used in the U.S. sulphur scheme, where allowances were issued many years into the future.

The EU-ETS started with very little data on the emissions of facilities across the EU. This lack of data led to the price volatility and low first-period price, not the underlying structure of the system. When EU Member States formulated the first allocation plans, they erred on the side of caution rather than over-constrain the system. The result is that the first period has likely suffered from over allocation. This became clear to the market on the day of release of the first year compliance data, and the market reacted as expected, with prices moving sharply down.

The market can only be absolutely certain of over-allocation on the very last day of trading in the period when more sellers than buyers remain. Then the price will be effectively zero. Until that time the market will trend slowly downwards as increasing certainty of a surplus is gained with the passing of time. This is currently being seen.

However, this trend is no different than, say, the period in an oil market where the market becomes aware that one or more traders are holding a surplus cargo. The discovery can result in very low prices that are hardly reflective of the overall price in the market. The difference is that the oil market trades in days and months, not years, so these periods of very low prompt price are short lived.

Meanwhile, the further out prices remain robust in the emissions trading market. While 2005—2007 is trading at less than 1 Euro—less than $1.38 cents, the 2008—2012 price is at 20 Euros, or $27.63. This is the real price in the market today and the one that is driving investment and operational change.

The EU-ETS has managed this early volatility well. It has reacted promptly and clearly to market information, it has provided sufficient depth and liquidity for traders to execute their business and it has developed a forward price that reflects the longer-term supply and demand. These are all characteristics of a market that is working, not one that is failing.

TRANSPORTATION THREE-PRONG APPROACH:

As already indicated, cap and trade works best when the point of regulation and the point of emission are the same. But apart from aviation or large vehicle fleets, that's not feasible in the transportation sector. You would have to require every driver to hold allowances and manage their emissions. The best approach is to break the transportation carbon dioxide challenge down into its three basic components—fuel, vehicle and driver—then use a three-prong approach to address each.

The first prong: One way to address fuel is to reduce the carbon footprint of the fuel's lifecycle. Shell sees some merit in a national low carbon fuel standard that encourages a broad range of technologies that can reduce the well-to-wheels CO_2 emissions per unit of energy supplied.

Shell supports a low carbon fuel program that assigns a carbon value to existing fuel mixes and volumes then reduces that value over time, prompting fuel makers to reduce the amount of CO_2 released in the production and consumption of fuel.

Fuel makers should be given the maximum amount of flexibility to reach their CO_2 goals, helping to ensure that energy prices remain stable while environmental goals are achieved.

Fuel makers should be able to get carbon credits for: Implementing efficiencies that reduce carbon; switching to lower-carbon fuels such biofuels or alternative fuels like hydrogen; or using lower-carbon processes when making fuel, such as processing ethanol using methane from a cattle feedlot.

A workable program sets feasible goals on an achievable timeline and has long-term predictability that encourages fuel makers to make long-range investments in lower-carbon technologies, is easy to comply with and easy to enforce. Given that technologies expected to be used to comply with a low carbon fuels standard are not yet all-commercial, there must be a clear process for reviewing progress and making necessary adjustments to the program.

Shell prefers a standard that assigns a carbon value to various classes of fossil fuels because the global fossil fuel market is too complex to accurately measure actual carbon content. However, the ethanol market, which is largely domestic, should be measured by actual carbon content. This will drive the market for second-generation biofuels with low carbon footprints, helping to achieve environmental goals.

Calculation of the well-to-wheels CO_2 footprint of different fuels must be determined using scientific, peer-reviewed methodology and assumptions in consultation with relevant stakeholders.

Compliance with a low carbon fuel standard is likely to require a substantial increase in renewable fuel use. Policy makers should consider the full economic, environmental and societal impact of such an increase, including the effect on the food chain, fuels supply and distribution systems.

Shell believes that minimizing potential supply chain complexity by having one national fuel program versus many different State and local Government programs is preferable. State "boutique" fuel requirements undermine the flexibility that Congress established in the Federal renewable fuels program, which calls for a nationwide program that encourages the most economic use of renewable fuels for the benefit of consumers by not dictating where renewable fuels must be used and by allowing credit trading.

The second prong: An effective carbon dioxide reduction program also requires Federal regulations to make vehicles more energy efficient. The program should include a higher CAF standard or regulations/incentives to encourage the increased production of hybrids, plug-in hybrids, diesels and vehicles powered by batteries, fuel-cells or other low-carbon technologies.

Third prong: Finally, an effective program includes a national educational campaign and empowers consumers to make wise transportation choices that result in less fuel consumption such as purchasing fuel efficient vehicles, carpooling or using public transportation.

CARBON CAPTURE AND STORAGE:

Finally, I would like to address carbon capture and storage at greater length. A workable climate change program encourages the development of innovative technologies like the capture and storage of carbon, which can dramatically reduce the amount of carbon emitted in the production of electricity and fuels from fossil sources.

The InterGovernmental Panel on Climate Changes estimates that carbon capture and storage could play a role in as much as 55 percent of the total carbon mitigation effort until year 2100. The panel also estimates that carbon capture and storage technology applied to a modern conventional power plant could reduce CO_2 emissions to the atmosphere by approximately 80—90 percent compared to a plant without this technology.

Hence, a sound U.S. climate change program must include policies to encourage the development and deployment of CCS technologies.

As I mentioned, Shell supports the creation of credits for the capture and storage of carbon dioxide that can be traded in a cap-and-trade program. This requires developing standard rules and measurements for carbon storage.

Shell urges the U.S. Government to help fund the development and deployment of CCS technologies, including CO_2 storage demonstration projects. Such funding can be critical to success of first-of-a-kind technologies. We believe the United States must have at least 10 large-scale CO_2 storage demonstration projects up and running by 2015. Several projects are needed to test and refine different technologies and storage methods.

We believe the carbon storage component of the U.S. climate change program must interface with international efforts. Shell believes the reduction of carbon emissions anywhere in the world is a victory for the global environment. A U.S. program that encourages carbon storage projects in other parts of the world encourages the development of a global CCS industry and reduces the cost of the CCS technology, a savings ultimately passed on to consumers.

Because CCS technology is still evolving, Shell supports Federal regulations that address the liability of leakage or migration of carbon once it has been stored. Shell believes these regulations must encourage the deployment of CCS technologies. Companies faced with unending liability for CO_2 stored in the ground will be discouraged from investing in carbon storage facilities. In the long run, this may diminish the important role CCS can play in reducing global carbon emissions.

Carbon storage operators expect to be responsible for monitoring and maintaining the integrity of a site and would encourage the active involvement of regulatory authorities in the monitoring process.

Senator LIEBERMAN. Thank you, too, Mr. Edward. Very detailed. That is exactly the point we are at. I thought your analysis of the tax was interesting, particularly the way you phrased it. I wrote it down because people compare. Our friend, Senator Inhofe, mentioned that he didn't favor it, or said he wouldn't support it, but the cap and trade actually guarantees an environmental result.

That is the cap. As opposed to the tax increase, which does not guarantee a result. There is speculation as to what would the effect be of a tax increase, but it doesn't have the same guarantee of a result. I appreciate your pointing that out.

Our last witness on this panel, and we thank you very much for being here. Dr. Margo Thorning is Senior Vice President and Chief Economist at the American Council for Capital Formation with which I have had the pleasure of working on matters over the years. Thank you for being here.

STATEMENT OF MARGO THORNING, SENIOR VICE PRESIDENT AND CHIEF ECONOMIST, AMERICAN COUNCIL FOR CAPITAL FORMATION

Ms. THORNING. Thank you, Mr. Chairman, and thank you for your kind words. It has been a pleasure to work with you over the years. I appreciate very much the chance to appear in front of this Committee. Senator Warner and other members of the Committee, I am very grateful for the opportunity. I would like to present this testimony and ask that it be submitted for the record.

The American Council for Capital Formation is a group that has over the years focused on cost-effective approaches to tax issues, environmental issues, regulatory issues. So listening to the testimony of the earlier witnesses, I am reminded of the fact that if we do want to address climate change, we really must focus on the most cost-effective ways to achieve our goals. I appreciate very much the work and the testimony that the other witnesses have submitted.

I would like to raise three issues before I get into commenting on some of the specific points that the bills that have been introduced have raised. I think we need to keep in mind that we have three challenges here in the U.S., and in fact globally. One is energy security of supply. Second is environmental protection. And third is the reduction of global energy poverty.

Developed countries have devoted a lot of attention to the first two goals, but not so much attention to the third goal, reducing global energy poverty. Since energy use goes hand in hand with economic development, many experts think that we ought to be focusing more time and more resources on that. According to the International Energy Agency, by 2030 one-third of the world's population will still be relying on biomass—wood, charcoal and animal dung—for cooking and there will still be 1.4 billion people in the world without any electricity. Shockingly, about 1.3 million women and children die every year because of exposure to indoor air pollution.

Another thing we need to keep in mind is that the IEA and the recent report by the National Petroleum Council point out that fossil fuels are going to remain the dominant source of energy for the next several decades, and the carbon emissions in spite of our best efforts are probably going to increase substantially. In fact, China's CO_2 emissions exceeded those of the U.S. by about 8 percent, so China is now the No. 1 emitter of CO_2.

Another key point we need to be mindful of is that energy security will require massive investment. Meeting the world's growing

demand for energy will require over $20 trillion in 2005 dollars over the next 25 years.

So as we approach climate change, we need to be mindful of the impact that the drag that some of these policies might exert on our economy by raising energy prices, and we need to balance these goals.

Points to consider before we adopt a cap and trade approach, I think some of the previous witnesses have raised the issue about the impact of a cap and trade on price volatility. Price volatility, according to many studies, is responsible for much of the economic downturns that we have experienced, particularly after the oil price shock of the 1970's. So when we design a system, we want to avoid price volatility if at all possible because producers are already subject to price volatility in the energy sector because of the global nature of energy supplies now and the fact that prices, even without a carbon tax, do tend to vary quite a bit.

The impact of a cap and trade system if allowances are not sold, if they are just given out, will tend to confer windfall benefits on the recipients of these allowances and worsen the distribution of income in the sense that upper income people who are shareholders in these companies will benefit. A tax, on the other hand, could provide the funds to mitigate some of the price changes caused by trying to reduce carbon emissions.

Thinking more broadly about the international front, the question of how to involve developing countries in a cap and trade system present some obstacles also. For example, Bill Nordhaus of Yale recently released a new study that talks about the pros and cons of a tax versus a cap and trade system. One of the telling points that he makes in this new study is that a cap and trade system is a positive sum game for both Government and business. Let's take for example a developing country like China, both producers and the Government benefit if they cheat in terms of reporting actual emissions, whereas a tax on carbon, if such a system were in place, is a zero sum game because the Government has quite a bit of interest in getting the tax revenue from the company. So a tax tends to build in some incentives for keeping the system honest, a tax system does.

Another point that some of the previous witnesses have talked quite a bit about, the European emissions trading system. In my testimony, I have several charts showing that right now the European Environmental Agency shows that the EU–15 who have a target of 8 percent below 1990 levels are not on track to meet that. So by 2012, they will not have met their 8 percent reduction. They are projected to be 7 percent above 1990 levels. So without strong new measures, the EEA says they are not going to meet their target.

The EU–12, the 12 new member States, have because of their economic collapse after the 1990's, have reduced emissions by about 27 percent, but that is due to economic collapse and it is to be hoped that situation will not continue. So I think looking at the EU emission trading system as an effective mechanism for reducing greenhouse gases is not necessarily accurate.

Looking in general at mandatory systems as opposed to voluntary approaches to reducing greenhouse gas emissions, in the

U.S. with our growing population, a fixed cap on emissions will inevitably collide with our population growth. Europe is not really growing in terms of population and they are still having trouble meeting their emission cap.

In addition, if we adopt caps here without involving China and India, they will have every incentive to accelerate their development of energy-intensive industries because, of course, of the price advantage that they would enjoy.

With respect to some of the plans that were discussed earlier in terms of trying to monitor what type of a carbon content is coming in with, say, Chinese or Indian goods so that we could try to be sure that under the regime that was discussed earlier that China and India were complying, it strikes me as a very difficult challenge because right now we can't even control the pet food or the toothpaste that comes in from places like China. To think that Government regulators would be able to ascertain with any accuracy that the products coming in from India and China and other developing countries have a certain carbon content just strikes me as highly unrealistic.

Last, to look at strategies that I think I would urge our policymakers to look at as they try to reduce not only greenhouse gas emissions in the U.S., but also abroad, we really have to put more effort into carbon capture and storage. Some of the previous witnesses made that case. It is not technologically cost effective right know, but with hope and research in time that will be a powerful force that will enable us to burn coal without damaging the atmosphere. We probably should spend more than we do on renewables. We probably will have to rely more on nuclear power for electricity generation.

U.S. policymakers should also take a look at the tax code. The ACCF just released a study by Ernst and Young comparing capital cost recovery allowances for 11 different energy assets across 12 countries: China, India, Brazil, Germany, the U.S., et cetera. That table is in my testimony. It shows that for investment in combined heat and power, we have the worst cost recovery practically in the world—29 cents after 5 years, versus much higher returns in other countries. Smart meters, which we need to increase efficiency, again, we are about the worst in the world. In fact, if you look at that table, we are the worst in the world in terms of capital cost recovery for energy investment, almost without exception. We also have the highest effective tax rates on these new investments. So I would urge our policymakers to take a look at how the tax code could be used to incentivize the kind of investments that we need.

Last, and I realize I am out of time, but last if we could build on what we already have here in the U.S. which is international partnerships. The Asia Pacific partnership has made a start at encouraging the reforms in developing countries that would enable technology to flow to them at a higher rate. The Administration, I understand, is working to expand that group. The G–8 meeting is looking at involving the top 15 emitters in the world in technology transfer and reforms.

If we could continue to focus on encouraging the technology transfer that would enable China and India to modernize their capital stock. There is a table in my testimony that shows that they

are four times less energy efficient than we are. So modernizing their capital stock could go a long way toward reducing the global growth in greenhouse gas emissions.

So I think we need a variety of approaches. I would encourage policymakers to take a look at the positive impact that economic growth itself can have on environmental protection, and also will give us the resources we need to reduce global energy poverty and promote energy security.

Thank you.

[The prepared statement of Ms. Thorning follows:]

STATEMENT OF MARGO THORNING, SENIOR VICE PRESIDENT AND CHIEF ECONOMIST. AMERICAN COUNCIL FOR CAPITAL FORMATION

INTRODUCTION:

Mr. Chairman and members of the Senate Committee on Environment and Public Works Subcommittee on Sector and Consumer Solutions to Global Warming and Wildlife Protection, my name is Margo Thorning, senior vice president and chief economist, American Council for Capital Formation (ACCF)[1], Washington, DC. I am pleased to present this testimony to the Subcommittee.

The American Council for Capital Formation represents a broad cross-section of the American business community, including the manufacturing and financial sectors, Fortune 500 companies and smaller firms, investors, and associations from all sectors of the economy. Our distinguished board of directors includes cabinet members of prior Republican and Democratic administrations, former Members of Congress, prominent business leaders, and public finance and environmental policy experts. The ACCF is celebrating over 30 years of leadership in advocating tax, regulatory, environmental, and trade policies to increase U.S. economic growth and environmental quality.

SECURITY OF ENERGY SUPPLIES, ECONOMIC GROWTH AND ENVIRONMENTAL PROTECTION

High energy prices in recent years have drawn policymakers' attention to the key role that energy plays in maintaining strong economic growth. In the United States, each 1 percent increase in Gross Domestic Product (GDP) is accompanied by approximately a 0.3 percent increase in energy use. Security of energy supplies and protection for the environment are two important policy goals on which developed countries have focused significant amounts of time and money in recent years. Since energy use goes hand-in-hand with economic development, many experts think increasing the supply of clean energy for the poor, many of whom live on less than a dollar per day, should be a top priority as well. As Fatih Birol, Chief Economist of the International Energy Agency, noted in a recent article in The Energy Journal, (Volume 28, Number 3, 2007), policymakers have devoted considerable time and resources to the goals of energy security and environmental protection while the need of the world's poor for clean energy has received much less attention.

My testimony attempts to put these three policy objectives in perspective and suggests ways to move forward on all three fronts. The testimony also reviews the effectiveness of current policies in the European Union and in the United States in reducing greenhouse gas emissions (GHGs) and reviews mandatory and voluntary policy options to reduce the threat of human-induced climate change.

A REALITY CHECK ON TRENDS IN ENERGY USE AND CARBON EMISSIONS

• Energy Use

Globally, fossil fuels will remain the dominant source of energy to 2030, absent sharp changes in consumption and technological breakthroughs, according to the

[1]The mission of the American Council for Capital Formation is to promote economic growth through sound tax, environmental, and trade policies. For more information about the Council or for copies of this testimony, please contact the ACCF, 1750 K Street, N.W., Suite 400, Washington, DC. 20006—2302; telephone: 202.293.5811; fax: 202.785.8165; e-mail: info@accf.org; website: www.accf.org

2006 International Energy Agency (IEA) report. The IEA report projects that global primary energy demand will increase by an average annual rate of 1.6 percent between now and 2030.

Almost half of the increase in global primary energy use stems from generating electricity and one-fifth from meeting transport needs, almost entirely in the form of oil-based fuels. Coal will see the biggest increase in demand in absolute terms over the next two decades, driven mainly by power generation. China and India account for almost four-fifths of the incremental demand for coal. Coal will remain the second-largest primary fuel, its share in global demand increasing slightly. The share of natural gas also rises. Hydropower's share of primary energy use rises slightly, while that of nuclear power falls. The share of biomass falls marginally, as developing countries increasingly switch to using modern commercial energy, offsetting the growing use of biomass as feedstock for biofuels production and for power and heat generation. Non-hydro renewables—including wind, solar and geothermal—grow quickest, but from a small base, the IEA report states.

The IEA's energy demand projections are similar to those in the new draft report by the National Petroleum Council (NPC). The NPC report notes that world energy demand has increased by about 60 percent over the past 20 5 years and most forecasts project a similar increase (from a much larger base) over the next twenty-five years. (Facing the Hard Truths about Energy, National Petroleum Council, July 18, 2007.)

• The Threat to the World's Energy Security is Real and Growing

Rising oil and gas demand, if unchecked, will accentuate the consuming countries' vulnerability to a severe supply disruption and resulting price shock. OECD and developing Asian countries are projected to become increasingly dependent on imports as their indigenous production fails to keep pace with demand. Non-OPEC production of conventional crude oil and natural gas liquids is set to peak within a decade. By 2030, the OECD as a whole will import two-thirds of its oil needs in the IEA's base case scenario compared with 56 percent today. Much of the additional imports come from the Middle East, along vulnerable maritime routes. The concentration of oil production in a small group of countries with large reserves—notably Middle East OPEC members and Russia—will increase their market dominance and their ability to impose higher prices. An increasing share of gas demand is also expected to be met by imports, via pipeline or in the form of liquefied natural gas from increasingly distant suppliers. The share of transport demand, which is relatively price-inelastic compared to other energy services, in global oil consumption is projected to rise.

Oil prices still matter to the economic health of the global economy. Although most oil-importing economies around the world have continued to grow strongly since 2002, they would have grown even more rapidly had the price of oil and other forms of energy not increased. Most

OECD countries have experienced a worsening of their current account balances, most obviously the United States. The recycling of petro-dollars may have helped to mitigate the increase in long-term interest rates, delaying the adverse impact on real incomes and output of higher energy prices. An oil-price shock caused by a sudden and severe supply disruption would be particularly damaging—for heavily indebted poor countries most of all.

• Investment Needed to Promote Energy Security

Meeting the worlds growing hunger for energy requires massive investment in energy-supply infrastructure, according to the IEA report. The IEA base case calls for cumulative global investment of just over $20 trillion (in 2005 dollars) over 2005—2030. The power sector accounts for 56 percent of total investment—or around two-thirds if investment in the supply chain to meet the fuel needs of power stations—is included. Oil investment, three-quarters of which goes to the upstream, amounts to over $4 trillion in total over 2005 030. But the impact on new capacity of higher spending is being blunted by rising costs. Expressed in cost inflation-adjusted terms, investment in 2005 was only 5 percent above that in 2000. Planned upstream investment to 2010 is expected to slightly boost global spare capacity. Beyond the current decade, higher investment in real terms will be needed to maintain growth in upstream and downstream capacity.

Energy investment needs in the U.S. are also quite large. For example, the electric utility sector will need to invest approximately $412 billion dollars over the next twenty-five years to meet rising demand. (U.S. Department of Energy, Energy Information Administration, Annual Energy Outlook, February, 2007).

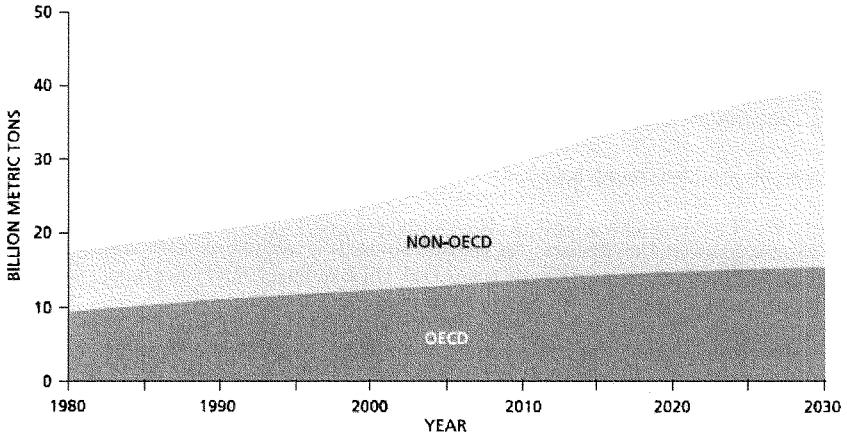
• Impact of Global Energy Demand on Carbon Dioxide Emissions

Global energy-related carbon-dioxide (CO_2) emissions will increase by 55 percent between 2004 and 2030, or 1.7 percent per year, in the IEA's base case scenario. Power generation contributes half of the increase in global emissions over the pro-

jection period. Coal overtook oil in 2003 as the leading contributor to global energy-related CO_2 emissions and consolidates this position through to 2030. Developing countries account for over three-quarters of the increase in global CO_2 emissions between 2004 and 2030 in the base case scenario (See Figure 1) . They overtake the OECD as the biggest emitter around 2010. The share of developing countries in world emissions rises from 39 percent in 2004 to over one-half by 2030. This increase is faster than that of their share in energy demand, because their incremental energy use is more carbon-intensive than that of the OECD and transition economies. In general, the developing countries use proportionately more coal and less gas.

China alone is responsible for about 39 percent of the rise in global emissions. China's emissions more than double between 2004 and 2030, driven by strong economic growth and heavy reliance on coal in power generation and industry, according to the IEA. In fact, China's CO_2 emissions in 2006 were 8 percent larger than those of the United States, according to a new report by the Netherlands Environmental Assessment Agency report. (Netherlands Environmental Assessment Agency (June 22, 2007). Other Asian countries, notably India, also contribute heavily to the increase in global emissions. The economies and population of developing countries will grow much faster than those of the OECD countries, shifting the center of gravity of global energy demand and carbon emissions.

Figure 1. World Carbon Dioxide Emissions



Source: National Petroleum Council, "Facing the Hard Truths about Energy", July 18, 2007

• Bringing Modern Energy to the World's Poor Is an Urgent Necessity

Although the IEA projects steady progress in expanding the use of modern household energy services in developing countries, many people will still depend on traditional biomass in 2030. Today, 2.5 billion people use wood, charcoal, agricultural waste and animal dung to meet most of their daily energy needs for cooking and heating. In many countries, these resources account for over 90 percent of total household energy consumption.

The inefficient and unsustainable use of biomass has severe consequences for health, the environment and economic development. Shockingly, about 1.3 million people—mostly women and children—die prematurely every year because of exposure to indoor air pollution from biomass. The data show that in countries where local prices have adjusted to recent high international energy prices, the shift to cleaner, more efficient ways of cooking has actually slowed and even reversed. In the IEA's base case scenario, the number of people using biomass increases to 2.6 billion by 2015 and to 2.7 billion by 2030 as population rises. That is, one-third of the world's population will still be relying on these fuels in 2030, a share barely smaller than today, and there will still be 1.4 billion people in the world without electricity. Action to encourage more efficient and sustainable use of traditional biomass and help people switch to modern cooking fuels and technologies is needed urgently. According to Dr. Birol, providing LPG cylinders and stoves to all the people who currently still use biomass for cooking would boost world oil demand by a mere 1 percent and cost at most $18 billion a year. The value of the improvements to so-

cial welfare, including saving 1.3 million lives each year, is surely worth the cost, he notes. Vigorous and concerted Government action, with support from the industrialized countries, is needed to achieve this target, together with increased funding from both public and private sources, he concludes.

PROS AND CONS OF MANDATORY GREENHOUSE GAS EMISSION REDUCTION PROGRAMS

• Cap and Trade Systems versus a Carbon Tax

As a recent paper by Ian Perry of Resources for the Future observes, there is considerable interest in the U.S. Congress in mandating reductions in U.S. greenhouse gas emissions. (Weathervane, March 23, 2007). He notes that as a result of the success of the U.S. sulfur dioxide trading program and the startup of the European Union's Emission Trading System, many in Congress have expressed support for a cap and trade system in the U.S. Perry cautions however, that other options, such as tax on carbon emissions may be a superior instrument if a mandatory Federal carbon emission program were to be established.

A cap and trade system puts an absolute restriction on the quantity of emissions allowed (i.e., the cap) and allows the price of emissions to adjust to the marginal abatement cost (i.e., the cost of controlling a unit of emissions). A carbon tax, in contrast, sets a price for a ton of emissions and allows the quantity of emissions to adjust to the level at which marginal abatement cost is equal to the level of the tax.

• Pros and Cons of a Cap and Trade System compared to a Carbon Tax

Price volatility for a permit to emit CO_2 can arise under a cap and trade program because the supply of permits is fixed by the Government, but the demand for permits may vary considerably year to year with changes in fuel prices and the demand for energy. As mentioned above, price volatility for energy has negative impacts on economic growth. In contrast, a CO_2 tax fixes the price of CO_2, allowing the amount of emissions to vary with prevailing economic conditions.

For example, in the EU the price of a permit to emit a ton of carbon has varied by 17.5 percent per month over the first 22 months' operation of the ETS. As a new study by Dr. Michael Canes, senior research fellow at LMI, points out, volatility in fossil energy prices have strong adverse impacts on U.S. economic growth. Even a reduction in the rate of growth from such a shock of as little as 0.1 percent per year implies costs of over $13 billion per year. (Why a Cap &Trade is the Wrong Policy to Curb Greenhouse Gases for the United States, The Marshall Institute, July, 2007).

In addition, studies have shown that under a cap and trade program which gives away (rather than auctioning the permits) can be highly inequitable; the reason is that firms receiving allowances reap windfall profits, which ultimately accrue to individual stockholders, who are concentrated in relatively high-income group.

Furthermore, it makes economic sense to allow nationwide emissions to vary on a year-to-year basis because prevailing economic conditions affect the costs of emissions abatement. This flexibility occurs under a CO_2 tax because firms can choose to abate less and pay more tax in periods when abatement costs are unusually high, and vice versa in periods when abatement costs are low. Traditional permit systems do not provide similar flexibility because the cap on economy wide emissions has to be met, whatever the prevailing abatement cost.

Regardless of how the allowances were distributed (unless they were all auctioned and the proceeds rebated to low income households), most of the cost of meeting a cap on CO_2 emissions would be borne by consumers, who would face persistently higher prices for products such as electricity and gasoline. Those price increases would be regressive in that poorer households would bear a larger burden relative to their income than wealthier households would. In addition, workers and investors in parts of the energy sector—such as the coal industry—and in various energy-intensive industries would be likely to experience losses as the economy adjusted to the emission cap and production of those industries' goods declined. (congressional Budge Office, Economic and Budget Issue Brief, April 25, 2007.) In contrast, carbon tax revenues could be rebated to low income individuals to offset the impact of higher energy prices caused by the tax on fossil fuels.

Finally, caps on U.S. emission growth are unlikely to succeed unless all the relevant markets exist (in both developed and developing countries) and operate effectively. All the important actions by the private sector have to be motivated by price expectations far in the future. Creating that motivation requires that emission trading establish not only current but future prices, and create a confident expectation that those prices will be high enough to justify the current R&D and investment expenditures required to make a difference. Motivating new investment requires that clear, enforceable property rights in emissions be defined far into the future

so that emission rates for 2030, for example, can be traded today in confidence that they will be valid and enforceable on that future date. The EU's experience over the last 2 years, with the price of CO_2 emission credits fluctuating between 1 and 30 euros per ton of CO_2 does not inspire confidence in companies having to make investment decisions. The international framework for climate policy that has been created under the UNFCCC and the Kyoto Protocol cannot create that confidence for investors because sovereign nations have different needs and values.

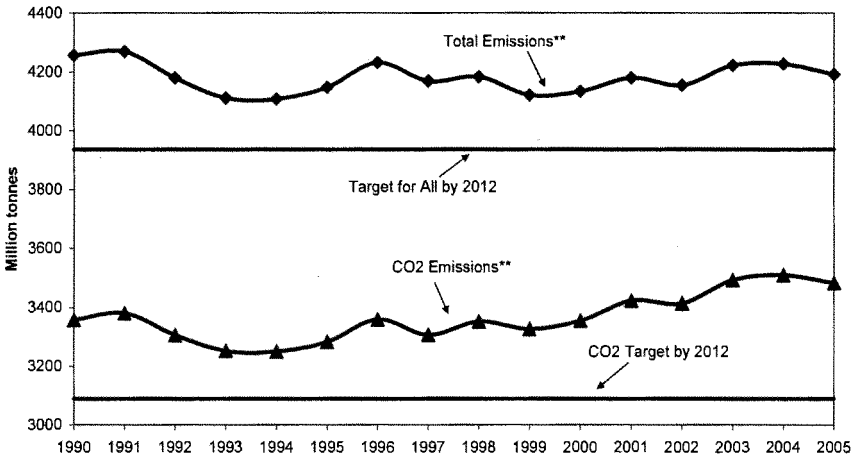
A carbon tax, as a system of inducing emissions reductions, is not without drawbacks. First, revenues from a CO_2 tax (or auctioned permits) might end up being wasted; for example, if the revenue went toward special interests, rather than substituting for other taxes. Second, progress on emissions reductions is uncertain under a CO_2 tax because emissions vary from year to year with economic conditions.

• European Union Greenhouse Gas Emissions: Myths and Reality

As we attempt to balance the sometimes conflicting goals of energy security, environmental protection and energy poverty reduction it is useful to examine the cost-effectiveness of current policies to reduce GHG emissions in developed countries. In the European Union, reduction of GHGs has become a major policy goal and billions of Euros, from both the private and the public sector, have been spent on this policy objective. Many policymakers, the media and the public believe that the European Union's Emission Trading System (ETS) has produced reductions in GHG emissions and that their system could serve as a model for the U.S. The ETS, created in 2005, is a market-based, EU-wide system that allows countries to "trade" (i.e., buy and sell) permits to emit CO_2. The ETS covers about 12,000 installations and approximately 40 percent of EU CO_2 GHG emissions.

The EU 15 (the major industrial countries) have a target of an 8 percent reduction in GHGs by 2010. As shown in Figure 2, CO_2 emissions in the EU 15 have risen sharply since 1990. Overall emissions (including all 6 of the greenhouse gases) have held constant only because of one-time events like the collapse of industry in East Germany after the fall of the Berlin wall and the switch away from coal to gas. In 2005, overall emissions were about 6 percent above the target. The main reason the ETS has not had much impact in reducing EU emissions is due to the fact that permits were "over allocated" to the approximately 12,000 industrial facilities covered by the system.

Figure 2. Greenhouse Gas Emissions in the EU-15*



* In CO2 Equivalents

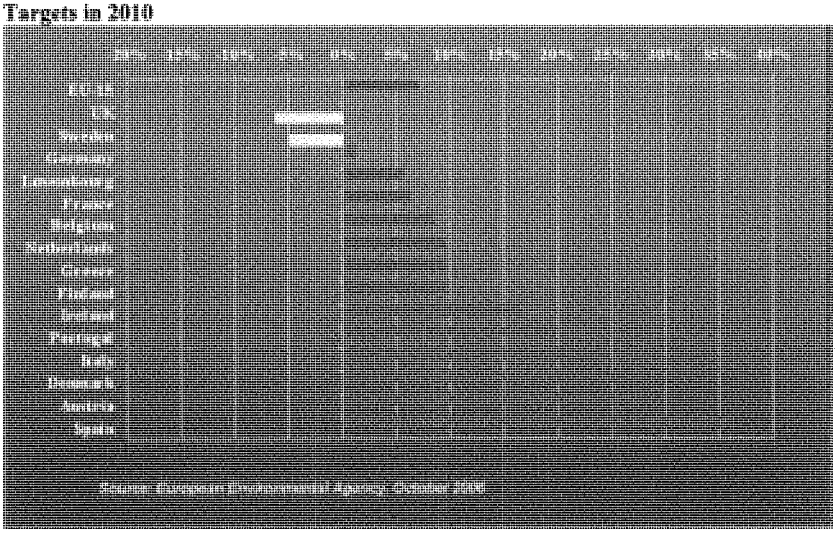
** Excludes land use, land use change and forestry.

Source: "Annual European community Greenhouse Gas Inventory 1990-2005 and Inventory Report 2007", European Environment Agency, version 27 May 2007.

The European Environmental Agency's latest projections (October 2006) for the EU 15 show that without strong new measures, EU 15 emissions will be 7.4 percent above 1990 levels in 2010, rather than 8 percent below as required by the Kyoto Protocol. (See Figure 3). Further evidence of the challenge the EU faces in meeting its Kyoto Targets is found in a just released report by the European Commission showing that electricity consumption continues to rise. Over the 1999—2004 period, residential and commercial electricity consumption increased by 10.8 percent and in-

dustrial electricity use rose by 6.6 percent in spite of numerous incentives to increase EU energy efficiency(Electricity Consumption and Efficiency Trends in the Enlarged European Union, Joint Research Centre, European Commission, July, 2007).

Figure 3. Greenhouse Gas Emissions in the European Union Projected to Exceed Kyoto Targets in 2010



Now that the ETS has been operational for 2 years, industry and households are feeling some of the effects of the system, even though its overall impact on emission growth has been small. As the Washington Post reported in "Europe's Problems Color U.S. Plans to Curb Carbon Gases" (April 9, 2007), the ETS 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 the ETS system is unfair. For example, Kollo Holding's factory in the Netherlands, which makes silicon carbide, a material used as an industrial abrasive, is regarded by its managers as an ecological standout: the plant uses waste gases to generate energy and has 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 reduce energy costs. Although demand for its products 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, the Post reports.

"It's crazy," said Kusters, the plant director, as he stood among steaming black mounds of petroleum coke and sand in northern Holland. "We not only have the most energy-efficient plant in the world but also the most environmentally friendly."

Of all the effects of the new rules, the rise in the price of power has aroused the most outrage. Much of the anger of consumers and industries has been aimed at the continent's utility companies. Like other firms, utilities were given slightly fewer allowances than they needed. Utilities in much of Europe charged customers for 100 percent of the tradable allowances they were given—even though the Government handed them out free. Electricity rates soared and environmentalists claimed that the utilities were garnering windfall profits.

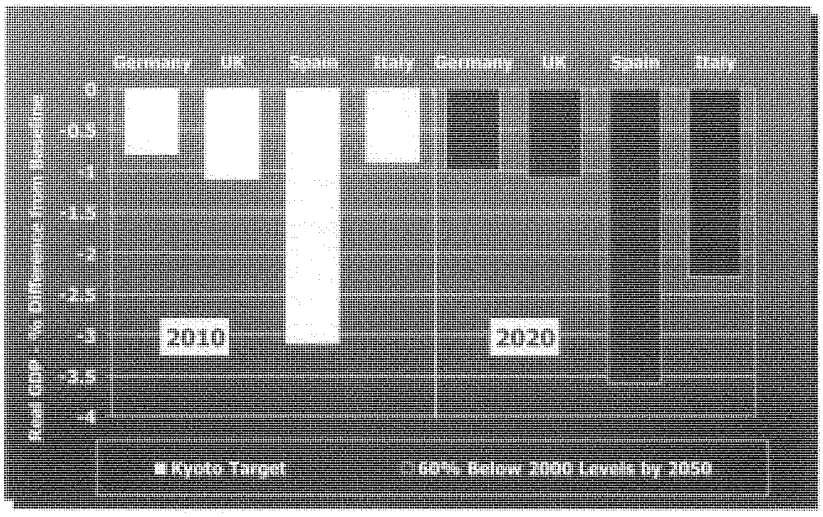
The chief executive of one utility, Vattenfall, which owns a coal plant that is one of the continent's biggest carbon emitters, defended the decision. Lars G. Josefsson, who is also an adviser to German Chancellor Angela Merkel, said higher electricity prices are "the intent of the whole exercise. . . . If there were no effects, why should you have a cap-and-trade system?"

An examination of the actual European emissions data, combined with anecdotal reports on its actual operation in the EU like those above, reinforce the idea that a cap and trade system is probably not an effective way to reduce GHG growth in the U.S.

Further, several different economic analyses show that if the EU were to actually meet its emission reduction targets under the protocol, the economic costs would be

high. For example, macroeconomic analyses by Global Insight, Inc. show the cost of complying with Kyoto for major EU countries could range between 0.8 percent of GDP to over 3 percent in 2010. (See Figure 4)

Figure 4: Impact of Purchasing Carbon Emission Permits on Gross Domestic Product Levels under the Kyoto Protocol and under More Stringent Targets on Major Industrial Economies



Source: International Council for Capital Formation "The Cost of the Kyoto Protocol: Moving Forward on Climate Change Policy While Preserving Economic Growth," November, 2005, (www.iccfglobal.org) and unpublished estimates for the U.S. prepared by Global Insight, Inc.

Levels under the Kyoto Protocol and under More Stringent Targets on Major Industrial Economies

Source: International Council for Capital Formation "The Cost of the Kyoto Protocol: Moving Forward on Climate Change Policy While Preserving Economic Growth," November, 2005, (www.iccfglobal.org) and unpublished estimates for the U.S. prepared by Global Insight, Inc.

According to Global Insight, the reason for the significant economic cost is that energy prices, driven by the cost of cap/trade emission permits, have to rise sharply in order to curb demand and reduce GHG emissions. Tighter targets for the post-2012 period will also be costly. For example, a target of reducing emissions to 60 percent below 2000 levels of emissions in the year 2050 would cause losses ranging from 1.0 percent to 4.5 percent of GDP in 2020. (This target is less stringent than the post-2012 targets adopted by the European Commission in January, 2007.) Even the EU's Commission for the Environment admits that emission reductions could cost as much as 1.3 percent of GDP by 2030. The fact that the European Environmental Agency projects that the EU 15 will be 7 percent above 1990 levels of emissions in 2010 (instead of 8 percent below) demonstrates that the mandatory ETS system as currently structured is not providing the desired results and that much stronger measures will be required to meet the Kyoto Protocol target as well as the new post-2012 target.

CHALLENGES IN IMPLEMENTING A MANDATORY PROGRAM TO REDUCE U.S. GREENHOUSE GAS EMISSIONS

Trying to reduce U.S. emissions through a cap and trade system or a carbon tax could have significant consequences for the U.S. economy, including reduced GDP and increased unemployment rates. For example, various economic models show that the imposition of the Kyoto Protocol (a target of reducing emissions to 7 percent below 1990 levels) would reduce U.S. GDP levels by 1 to 4.2 percent annually by 2010. In addition, a fixed cap on emissions inevitably collides with U.S. population

growth. The EU—15 countries are having difficulty meeting their Kyoto targets and they have negligible population growth. In sharp contrast, U.S. population is projected to grow more than 20 percent over 2002—2025, according to the EIA. More people means more mouths to feed, more houses to warm, more factories to run, all of which require more energy and at least some additional GHG emissions.

• Impact of a Cap and Trade System on Innovation

Caps on emissions are not likely to promote new technology development because caps will force industry to divert resources to near-term, "end of pipe" solutions rather than promote spending for long-term technology innovations that will enable us to reduce GHGs and increase energy efficiency. An emission trading system will send exactly the wrong signals to investors because it will create uncertainty about the return on new investment. A "safety-valve" price of carbon (designed to create a sense of confidence about future energy costs) can easily be changed. Such uncertainty means that the hurdle rate, which new investments must meet, will be higher (thus less investment will occur) and they will be less willing to invest in the U.S. Now is the time to provide incentives for companies to voluntarily undertake additional carbon dioxide intensity reducing investments, rather than promoting a system that raises the risk premium for any investment in the United States.

• Developing Countries Not Likely to Accept Emission Reduction Targets or Energy Taxes

Many U.S. policymakers are aware that even if the U.S. were to adopt a cap and trade system or a carbon tax, it is unlikely that developing countries, where most of the future growth in emissions will occur, would decide to follow suit. In fact, if we adopt emission caps or carbon taxes, higher energy prices will make U.S. industry less competitive vis-a-vis China, India and other developing countries. As a result, China and India, whose primary focus is economic growth, will see it in their interest to accelerate the development of industries that depend on a competitive advantage in energy prices. As this process proceeds, it will be harder and harder for China and India to reverse course and undertake policies (emission caps or taxes) which threaten these industries. Adopting GHG caps or taxes in the U.S. will, therefore, have the perverse effect of creating disincentives for developing countries to curb emissions. In addition, because developing countries use much more energy per dollar of output than does the U.S., global carbon emissions could increase due to "leakage" of U.S. industry and jobs.

STRATEGIES TO INCREASE ENERGY SECURITY AND REDUCE EMISSION GROWTH AND ENERGY POVERTY

Increased energy security in the developed countries including the U. S. and the EU will depend on factors such as increased economic growth, energy efficiency, technology developments in both fossil fuels (carbon capture and storage, for example) and renewable fuels (wind and solar, in particular) and possibly increased reliance on nuclear power for electricity generation. However, in order to reduce the potential threat of global climate change, it will be necessary to increase energy efficiency and reduce the growth of greenhouse gas emissions in the developing world since that is where the strong growth in emissions is coming from. Reducing the extreme energy poverty in the world's poorest nations will take a combination of technology transfer and public-private partnerships between wealthy nations and less developed countries. Making progress on all three objectives will require a significant commitment of resources, much of which will need to come from the private sector.

• The Role of Economic Growth and Technology in GHG Reduction

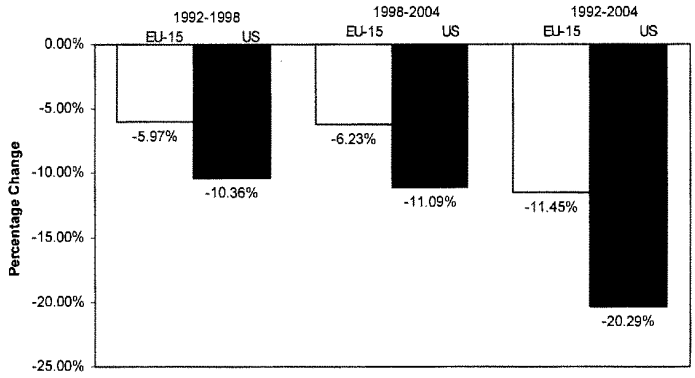
Many policymakers overlook the positive impact that economic growth can have on GHG emission reductions. For example, in 2006, while the U.S. economy grew at 3.3 percent, CO_2 emissions fell to 5,877 MMT CO_2 , down from 5,955 MMT CO_2 in 2005, a 1.3 percent decrease. Overall energy use only declined by 0.9 percent, indicating the U.S. economy is becoming less carbon intensive even without mandatory emission caps.

Internationally, the U.S. compares well in terms of reducing its energy intensity (the amount of energy used to produce a dollar of output). The U.S., with its voluntary approach to emission reductions, has cut its energy intensity by 20 percent over the 1992—2004 period compared to only 11.5 percent in the EU with its mandatory approach (see Figure 5). Strong U.S. economic growth, which averaged over 3 percent per year from 1992 to 2005 compared to about 1 percent in the EU, is responsible for the U.S.'s more rapid reduction in energy intensity in recent years.

Technology development and deployment offers the most efficient and effective way to reduce GHG emissions and a strong economy tends to pull through capital investment faster. There are only two ways to reduce CO_2 emissions from fossil fuel

use—use less fossil fuel or develop technologies to use energy more efficiently to capture emissions or to substitute for fossil energy. There is an abundance of economic literature demonstrating the relationship between energy use and economic growth, as well as the negative impacts of curtailing energy use. Over the long-term, new technologies offer the most promise for affecting GHG emission rates and atmospheric concentration levels.

Figure 5: Comparison of EU and US Energy Intensity Reduction, 1992-2004



Source: EIA, International Energy Annual 2007. (Percentage changes are calculated using Total Primary Energy Consumption per Dollar of Gross Domestic Product.)

• Accelerating the Uptake of New Technology by Private as Well as Nonprofit Entities.

The development of various high technology programs can be accelerated through Government programs as well as by encouraging private sector investment. For example, some policies may be of particular help to taxable entities while others would be of more benefit to cooperatives (which pay little or no Federal income tax).

Companies Subject to the Federal Income Tax

The efforts of U.S. industries to increase energy security and efficiency and to reduce growth in GHG emissions are hindered by the slow rate of capital cost recovery allowed under the U.S. Federal tax code and by the high U.S. corporate tax rate. As a new Ernst&Young international comparison shows, the U.S. ranks last or nearly last among our trading partners in terms of how quickly a dollar of investment is recovered for many key energy investments. For example, a U.S. company gets only 29.5.cents back through depreciation allowances for each dollar invested after 5 years for a combined heat and power project (see Table 1). In contrast, in China the investor gets 39.8 cents back, in Japan, 49.7 cents, in India, 55.6 cents and in Canada the investor gets 79.6 cents back after 5 years for every dollar invested. (See full report at: http://www.accf.org/pdf/Energy-Depreciation-Comparison.pdf.)

In addition to slow capital cost recovery allowances, U.S. industry faces the highest corporate income tax rates among our primary trading partners. Of the 12 countries in the E&Y survey, only Japan had a higher corporate tax rate than the U.S. Reforms to the U.S. tax code to speed up capital cost recovery allowances and reduce the corporate tax rate would reduce the cost of capital and could have a positive impact on energy sector investment, help "pull through" cleaner, less emitting new technology, increase energy efficiency and promote U.S. industrial competitiveness.

Table 1. International Comparison of Nominal Capital Costs Recovered After Five Years for Selected Energy Investments, 2006

	Electric Generation					Electric Transmission & Distribution Lines			Pollution Control Equipment	Petroleum Refining	
	Gas	Coal	Nuclear	Combined Heat & Power Generation	Self-Generated Electricity	Transmission Lines	Distribution Lines	Smart Meters	Discharge Modification	Crude Unit (Distillation Unit)	Fluid Catalytic Cracking Unit
United States	37.7%	29.5%	37.7%	29.5%	37.7%	37.7%	29.5%	29.5%	64.3%	63.1%	63.1%
Brazil	37.7%	47.5%	N/A	37.7%	63.1%	20.6%	20.6%	31.2%	89.6%	63.1%	63.1%
Canada	79.6%	79.6%	79.6%	79.6%	79.6%	31.2%	31.2%	63.1%	79.6%	79.6%	79.6%
China	39.8%	39.8%	39.8%	39.8%	39.8%	39.8%	39.8%	39.8%	41.3%	39.8%	39.8%
Germany	30.0%	30.0%	37.5%	30.0%	30.0%	33.1%	33.1%	63.1%	79.6%	72.3%	79.6%
India	55.6%	55.6%	55.6%	55.6%	55.6%	55.6%	55.6%	100.0%	100.0%	66.1%	66.1%
Indonesia	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%
Japan	49.7%	49.7%	49.7%	49.7%	45.6%	37.4%	37.4%	49.7%	76.9%	72.3%	72.3%
Rep of Korea	57.7%	57.7%	57.7%	57.7%	57.7%	57.7%	57.7%	57.7%	89.0%	89.0%	89.0%
Malaysia	100.0%	100.0%	100.0%	100.0%	100.0%	90.0%	90.0%	90.0%	100.0%	90.0%	90.0%
Mexico	46.2%	46.2%	46.2%	46.2%	46.2%	23.1%	23.1%	23.1%	101.2%	32.3%	32.3%
Taiwan	49.7%	49.7%	49.7%	49.7%	49.7%	49.7%	49.7%	49.7%	96.6%	78.5%	78.5%

Prepared by Quantitative Economics and Statistics Group, Ernst&Young LLP, May 2007.

Non-Taxable Entities

For non-taxable entities such as electric utility cooperatives other incentives could be provided to encourage the more rapid adoption of new technologies to reduce GHG emissions. For example, electric cooperatives and their consumers cannot apply or benefit from traditional tax incentives because as not-for-profit utilities, they do not have significant Federal income tax liability to offset. However, to ensure that the not-for-profit electric utility sector is able to participate in incentives for advanced low carbon technologies, incentives comparable to those offered to for profit entities can be created. One example is the successful Clean Renewable Energy Bond program that permits electric cooperatives and others to issue bonds that act as interest-free loans for the purpose of building qualified renewable generation. The CREB program can be adapted for other technologies that achieve carbon reduction goals." Grants are another avenue to assist not-for-profits in adopting new technology.

• The Role of International Partnerships in Promoting Institutional Change and Favorable Investment Climate in Developing Countries

New research by Dr. David Montgomery and Sugandha Tuladhar of CRA International makes the case that agreements such as the Asia-Pacific Partnership on Clean Development and Climate (AP6), an agreement signed in 2005 by India, China, South Korea, Japan, Australia and the United States, offers an approach to climate change policy that can reconcile the objectives of economic growth and environmental improvement for developing countries. (See www.iccfglobal.org for the full paper.) Together, the AP6 partners have 45 percent of the world's population and emit 50 percent of man-made CO_2 emissions. The projections of very strong growth in greenhouse gases in developing countries over the next 20 years mean that there is enormous potential for reducing emissions through market-based mechanisms for technology transfer.

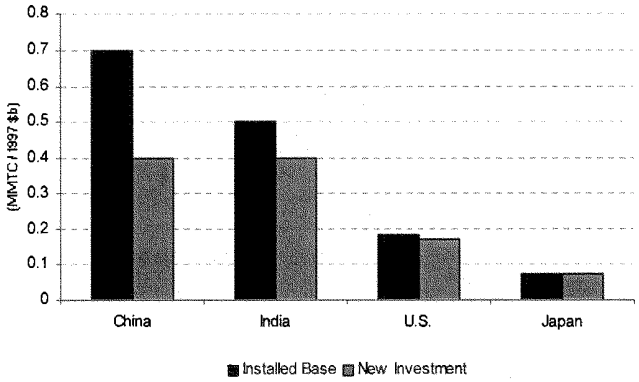
Dr. Montgomery and Tuladhar note that there are several critical factors for ensuring the success of an international agreement which relies strongly on private sector investment for success. Their research shows that institutional reform is a critical issue for the AP6, because the lack of a market-oriented investment climate is a principal obstacle to reducing greenhouse gas emissions in China, India and other Asian economies. China and India have both started the process of creating market-based economic systems, with clear benefits in the form of increased rates of economic growth. But the reform process has been slow and halting, leaving in place substantial institutional barriers to technological change, productivity growth, and improvements in emissions. The World Bank and other institutions have carried out extensive investigations about the role of specific institutions in creating a positive investment climate. These include minimizing corruption and regulatory burdens, establishing an effective rule of law, recognition of intellectual property rights, reducing the role of Government in the economy, removing energy price distortions, providing an adequate infrastructure and an educated and motivated labor force.

• Quantifying the Importance of Technology Transfer for Emission Reductions

As described above, technology is critically important because emissions per dollar of income are far larger in developing countries than in the United States or other industrial countries. This is both a challenge and an opportunity. It is a challenge because it is the high emissions intensity—and relatively slow or non-existent improvement in emissions intensity—that is behind the high rate of growth in developing country emissions.

Opportunities exist because the technology of energy use in developing countries embodies far higher emissions per dollar of output than does technology used in the United States; this is true of new investment in countries like China and India as well as their installed base (See Figure 6.) The technology embodied in the installed base of capital equipment in China produces emissions at about four times the rate of technology in use in the United States. China's emissions intensity is improving rapidly, but even so its new investment embodies technology with twice the emissions intensity of new investment in the United States. India is making almost no improvement in its emissions intensity, with the installed base and new investment having very similar emissions intensity. India's new investment also embodies technology with twice the emissions intensity of new investment in the United States.

Figure 6: Greenhouse Gas Emissions Associated with Existing and New Investment in 2001 (Million tons of Carbon per $Billion of Gross Domestic Product at Market Exchange Rates)



Source: Promoting A Positive Climate for Investment, Economic Growth and Greenhouse Gas Reductions, W. David Montgomery and Sugandha Tuladhar (see www.iccfglobal.org.)

CRAI calculations show that emission reductions can be achieved by closing the technology gap. The potential from bringing the emissions intensity of developing countries up to that currently associated with new investment in the United States is comparable to what could be achieved by the Kyoto Protocol. (See Table 2.) These are near-term opportunities from changing the nature of current investment and accelerating replacement of the existing capital stock. Moreover, if achieved through transfer of economic technologies it is likely that these emission reductions will be accompanied by overall economic benefits for the countries involved.

Table 2: Cumulative Greenhouse Gas Emission Reductions Achievable Through Technology Transfer and Increased Investment

	To 2012 (MMTCE)	To 2017 (MMTCE)
Adopt US technology for new investment in China and India	2600	5200
Adopt US technology with accelerated replacement in China and India	4200	7700
Adopt continuously improving technology with accelerated replacement in China and India	5000	9800
EU under Kyoto Protocol (without hot air)	*600*	*1400*
All Annex B countries under Kyoto Protocol (including US and hot air)	*2800*	*7300*

Source: Promoting A Positive Climate for Investment, Economic Growth and Greenhouse Gas Reductions, W. David Montgomery and Sugandha Tuladhar (see www.iccfglobal.org.)

In the first example in Table 2, the CRAI study assumed that in 2005 new investment in China and India immediately moves to the level of technology observed in the United States, and calculates the resulting reduction in cumulative carbon emissions through 2012 and 2017. This is the technology transfer case. In the second case, the CRAI analysis assumes that policies to stimulate foreign direct investment accelerate the replacement of the oldest capital with new equipment, giving even larger savings. In the third case, the assumption is that the new technology continues to improve over time, as it will if policies to stimulate R&D into less emissions-intensive technologies are also put in place. Even the least aggressive of these

policies has potential for emissions reductions comparable to those that would be possible if all countries (including the U.S.) achieved exactly the emission reductions required to meet their Kyoto Protocol targets.

• Strategies for Promoting Institutional Change

Although it is clear that there is a relationship between institutions, economic growth, and greenhouse gas emissions, there is no general formula that can be applied to identify the specific institutional failures responsible for high emissions per unit of output in a specific country. If there is to be progress on institutional reform, at a minimum the key actors or stakeholders—concerned businesses, other groups with influence on opinion and policy in China, India and other developing countries (including local and regional Governments), and national Governments—must agree on the nature and scope of the problems and on reforms required to address the problems and identify concrete actions that each Government will take to bring about institutional reforms.

For example, making progress on implementing the AP6 can be accelerated if the Governments of Australia, Japan and the United States would fund research on topics such as the investment climate, the level of technology embodied in new investment, the role of foreign direct investment and potential energy savings from technology transfer, and the nature and impacts of pricing distortions on energy supply, demand and greenhouse gas emissions in China and India. Government support for research to make clear the direct consequences of proposed reforms for energy efficiency and the benefits of a market based investment climate for the overall process of economic growth would also be helpful.

• Broadening the International Partnership to Include all Major Emitters

At the recent G—8 Summit in Germany, policymakers agreed to take a series of steps toward GHG reductions. Recognizing that 85 percent of all emissions come from about 15 countries, G—8 leaders agreed convene the major energy consuming countries to agree on a new international framework by the end of 2008. The leaders agreed to work toward a long-term global goal for reducing GHGs and to accelerate the development and deployment of clean energy technologies. They also agreed to work toward the reduction and/or elimination of tariff and non-tariff barriers to environmental goods and services through the WTO Doha negotiations. Other points of agreement included developing and implementing national energy efficiency programs and advancing international energy efficiency cooperation as well as pursuing joint efforts in key sectors such as sustainable forestry, power generation, transportation, industry, and buildings. Finally, they agreed to enhance cooperation with developing countries to adapt to climate change.

CONCLUSIONS

To be successful, international partnerships will need to bring forth a sufficient set of offers from each country to bring about meaningful changes in institutions with significant and quantifiable effects on greenhouse gas emissions. These offers would be embodied in an agreement on actions to be taken by all parties, and a framework under which actions would be monitored and additional steps could be agreed. This is the place where the current efforts of the AP6 partnership's taskforces on clean fossil energy, renewable energy and distributed generation, power generation and transmission, steel, aluminum, cement, coal mining and building and appliances to identify technologies and investments that have profit potential and could also reduce emissions would become most useful. These investments would become in a way the reward to China and India for progress on institutional reform. The voluntary nature of private sector actions in the AP6 underscores the need for institutional reform to turn these potentially profitable investments into real projects.

The Marshall Plan is a good example of such a process. After World War II, Europe pledged various actions with the money provided by the U.S. and, when it made good on those pledges, the program was extended and broadened. Exactly the same could be undertaken by the members of the Asia Pacific Partnership. Future actions by Australia, Japan and the United States desired by China and India would be contingent on success in implementing near term reforms agreed in the process.

The recent G—8 agreement suggests that developed countries are moving closer to achieving a consensus on how to reduce global GHG growth in a more cost-effective way than that embodied in the Kyoto Protocol. Extending the framework of the AP6 to other major emitters will allow developed countries to focus their efforts where they will get the largest return, in terms of emission reductions for the least cost. By focusing on the key emitters, developed countries may find they have more

resources for promoting both energy security of supply and reducing global energy poverty.

Finally, if the United States does adopt a mandatory greenhouse gas emissions reduction program, serious consideration should be given to implementing a carbon tax rather than an EU style cap and trade system. A key component of any mandatory U.S. program should be allowing emissions to increase as both economic growth and U.S. population increase.

Senator LIEBERMAN. Thank you, Doctor. Thanks very much for your testimony.

We will have rounds of questions now of 7 minutes for each member.

Mr. Profeta, let's see if we can turn some of what you have said about the proposal that was made by Senator Warner and others this morning into fact situations to help us understand it. I have been calling it an emergency off-ramp system. Is that what you all call it?

Mr. PROFETA. I think actually the naming rights are still out there. It is really an economic protection proposal to allow an off-ramp of some sort if we really have bad economic effects. So maybe we could change the title.

Senator LIEBERMAN. OK. You didn't want to see whether JP Morgan Chase or Shell wanted to make an initial bid for naming rights?

Mr. PROFETA. JP Morgan? We will have to talk later.

Senator LIEBERMAN. OK.

Let's just talk about what are the kinds of emergencies? We hope that this all works, but this is really aimed at creating a mechanism complying with a law that causes real economic dislocation. Right?

Mr. PROFETA. Yes.

Senator LIEBERMAN. I don't like to think of worst case scenarios, but what is one of them that might occur?

Mr. PROFETA. If the board decided that there was sufficient economic dislocation, if something was happening in terms of energy prices were spiking to a level that was unacceptable that low-income consumers couldn't handle even with the provisions in the bill——

Senator LIEBERMAN. Would it have to be as a result of the law?

Mr. PROFETA. Yes.

Senator LIEBERMAN. OK.

Mr. PROFETA. A result of the greenhouse gas reduction program. The board would have the authority then to go in and change the borrowing rates to allow a lot more flexibility.

Senator LIEBERMAN. The borrowing on the allowances?

Mr. PROFETA. On the firm level borrowing. I think a better example, frankly, would be if a technology wasn't penetrating quickly enough; if carbon cap sequestration wasn't coming in as we hoped and we think there is a little more time necessary, the board could go in and change each firm's level of borrowing rights, so now years in the future they could borrow at an interest rate at which they could pay back to make it a little easier for them to borrow from the future, but really in the law of supply and demand, bring more supply of future credits into the market and allow them to have lower costs of compliance.

Senator LIEBERMAN. OK. So a key component of what you are proposing is to set up this board, and the board would make judgments that are based on fact, but which are judgments at the moment, as opposed to the so-called safety valve provision which is in the Bingaman-Specter bill, which sets a price beforehand, and when you hit that price——

Why don't you talk a little bit about comparing the two, and why the proposal you have made for emergency off-ramps is preferable.

Mr. PROFETA. Let me go back to what I said in my testimony. The safety valve tries to know the unknowable. We don't know what the effect of a certain price anywhere would be. We need to make sure that there is a long-term investment, a desire to invest in technologies. Now, if the safety valve sets a price where it wasn't——

Senator LIEBERMAN. The price is set in the legislation.

Mr. PROFETA. It is set in the legislation.

Senator LIEBERMAN. And that is?

Mr. PROFETA. In the Bingaman-Specter, it is $12 rising.

Senator LIEBERMAN. It is $12 per?

Mr. PROFETA. Per tonnage of carbon dioxide equivalent.

Senator LIEBERMAN. OK.

Mr. PROFETA. If you set that safety valve at a level that isn't sufficiently high to encourage the investment in something like CCS, which we have heard here by the EPA.

Senator LIEBERMAN. CCS, for the record?

Mr. PROFETA. Carbon capture and storage.

Senator LIEBERMAN. Right.

Mr. PROFETA. Which we have heard here where EPA announced that it is absolutely essential for us to be able to address our climate situation. Then the investment won't flow now in anticipation of higher costs in the future to develop the technology. Our proposal allows that investment to flow now and if that doesn't happen as fast, and we can't know how well that will happen, but if it isn't happening as fast and it is creating economic harm, the oversight board in the future will have the discretion to change these levers on the market to make it a little bit more permissive to borrow from the future and thus make it a little easier to comply and allow the transition time, that bridge time between the imposition of the program and the penetration of technologies like carbon cap sequestration. It allows that time to move back and forth a little bit if it proves to be a harder lift than we think for our economy.

Senator LIEBERMAN. OK. So I can understand why you chose not to embrace the so-called safety valve price pre-set in the statute and hard to imagine all the circumstances that might arise. But most significantly, the pre-set price totally makes it not a market system and probably inhibits the investment of the money necessary. It eliminates the certainty and the range necessary for the money to be invested to really have the technological solutions.

What are the standards your proposal sets for the oversight board? In other words, it has the benefit of flexibility and it encourages all the market activity that we think is the best solution here. But does it have any standards that you would set in your proposal?

Mr. PROFETA. The standard longer term is just the avoidance of significant economic harm.

Senator LIEBERMAN. OK.

Mr. PROFETA. I think from the four offices' standpoint, this is an opening proposal and they are willing to look at whether that standard can be tightened up a bit. In the short term, it looks to the economic modeling data that is out there when the bill passes and says if it is above the high end of that range, that is the economic harm, so it triggers some automatic reliefs, and that is only for the first 2 years. But the offices really wanted to create some certainty that there would be relief if we were outside the bounds of what was predicted in terms of costs.

Senator LIEBERMAN. Right.

Mr. PROFETA. Beyond that first initial period, the discussion really falls to the board. But the hope is that the board will have learned the market well enough by then to realize what market and what price points it needs to avoid reaching in the market.

Senator LIEBERMAN. OK. With your indulgence, Senator, I just want to ask another related question. I would ask Ms. Masters or Mr. Edward, based on the international experience of your two companies, for instance, how, if at all, has the EU dealt with this problem? On their trading systems as they exist now, are there safety valves? Is there an emergency off-ramp? Or have they not dealt with it at all at this point?

Mr. Edward?

Mr. EDWARD. Sure. Thank you, sir. To be clear, there is no safety valve or price cap per se at all. What there is access to international markets. So there is a specific authorization by the EU for regulated companies to use credits from outside of the EU for compliance.

Senator LIEBERMAN. Right.

Mr. EDWARD. So their view would be that it is an increased source of supply which will lead to lower prices, rather than an interventionist price cap per se.

Senator LIEBERMAN. Ms. Masters?

Ms. MASTERS. I think the other point to note is that the EU framework had a trial run, if you will, in the pre-2008 period, which was intended among other things to be used as a period in which adjustments occurred and lessons were learned about not only market behavior, but costs of technology and so on. I think what is terrific about that is that we have the opportunity to learn from that experience here, in addition to European standards improving as a result of that.

There was an instance of a significant price adjustment in 2006 in the EU ETS scheme where essentially the baselines or the starting points were proven to be incorrect, resulting in a large downward price adjustment, which I don't think generally speaking is the primary source of concern in this debate. People are generally concerned about upward price spikes that could increase costs.

But in that case, that is the kind of situation that I think Tim's proposal contemplates, which is where something that was previously assumed to be facts—what is the baseline, what is the starting point for allowances—turns out to have been erroneously established. That, to my mind, would be the type of situation in

which it might make sense to have some kind of regulatory body able to make adjustments to an overall framework. I think the type of subjective judgment that, for example, $30 per son is too high, is a very slippery slope to head down and could easily be politicized and have all of the adverse consequences that both Garth and I have referred to.

Senator LIEBERMAN. Good point. Thank you very much.

Senator Warner?

Senator WARNER. If you would tell me a little bit, I started late as a lawyer, looked at a Federal circuit judge, and then into a large U.S. Attorneys office for 5 years, trying many cases of white collar problems. That experience is still with me. I am concerned that as we move forward, we have to figure out how to do it. As we move forward, and I address this to Blythe Masters and Mr. Edward, what do we do to ensure that these markets are not fraudulently manipulated? People posture themselves with all the types of things that go on. In the extraordinary experience that each of you have, what has been the system that prevent this? Perhaps it occurs, but certainly it hasn't been brought to the attention of the public, to my knowledge. How do you work this thing? Is it an honor system like we had in my college?

Ms. MASTERS. I think just a point of clarification, which is that in arguing against a safety valve involving a specific price cap, we are certainly not arguing that these markets should be unregulated altogether. On the contrary, as you point out, there is significant risk of cheating or fraudulent behavior by virtue of the fact that it is difficult to verify the existence of an otherwise invisible substance.

The best way in which to achieve an orderly market is to ensure that there are oversight mechanisms, and in particular a body or forum which establishes standards that can subsequently be independently verified. Indeed, the EU mechanism has achieved just that. There are essentially two broad categories of carbon markets that exist today. One is compliance markets, which the EU ETS scheme is one. The other are the voluntary carbon markets where certain corporations or individuals have chosen to use offsets against their activity purely for voluntary reasons.

There have been some instances of fraud, not significant, but there are instances of involuntary carbon markets which don't have the same standards of verification that the European ETS mechanisms established.

Senator WARNER. Were those instances prosecuted under the indigenous framework?

Ms. MASTERS. Not that I am aware of.

So to cut a long answer short, I think it is important that there is regulation, that there is transparency, that there are standards, that there is monitoring, and that those are uniformly applied across all instances of carbon markets.

Senator WARNER. Well, we are looking at our Federal Reserve system, which has been, as far as I know, an impeccable system in terms of anyone challenging it for wrongdoing throughout its existence.

And by the way, the off-ramp, I am guilty of that. A good deal of my State has mountains in it. As a matter of fact, just this past

weekend I was down delivering a speech to the bar association in one of the little hotels. When you come down with a heavy truck and suddenly your brakes are failing, you need an off-ramp to catch yourself and check yourself. So I don't know whether we will stick with it, but I plead guilty on off-ramps.

Mr. Edward, on the question of how do we deal with it, we are talking about a lot of money that is going to be involved.

Mr. EDWARD. Yes, Senator.

Senator WARNER. A lot of value.

Mr. EDWARD. I think the first thing is the starting point. We are talking here about environmental markets, but they are not significantly different from any other kind of market, whether they are financial or commodity markets. First of all, there is some experience, of course, in the U.S. We have traded NO_x and SO_2. We understand the way in which that is dealt. We understand the regulation around that, registry systems, validation of actual physical emissions, and indeed, for that matter, the accounting and tax treatment all around it. So there is a starting point.

Basically, emission markets will be audited in the same way as financial markets, so there is a need for everybody involved, primarily for investors, that there is integrity in the market. Obviously, my dollar of capital committed to this market would be a pointless dollar of commitment if the rules were proved to be open to abuse and open to fraud and so on. So I, as a participant in the market, have every interest in the rules being clear.

Senator WARNER. In other words, generally you have a confidence this thing can be made to work and it will gain the public trust.

Mr. EDWARD. Yes, that is the experience and that is the absolute requirement for everybody in the market.

Senator WARNER. All right. The second area where I am concerned is the goddess of the carbon capture and storage technology. Can we expedite it to build a bridge to get to what I would hope to be another level of technology? So first, do you think that this capture system largely going into old gas wells and so forth, will provide the bridge? And what is on the drawing boards out there that gives you hope that we will get another generation of concepts in the future?

Mr. PROFETA. I would regard carbon capture and storage as even more than a bridge. It is one of the essential elements of a longer term strategy. Sometimes I have said we have to bridge to it. I think we have heard from just about every witness about how essential it is. According to the EPA analysis that came today, there is no way, and every other economic modeling analysis I have seen, there is no way that this Country with its robust supplies of coal can manage this transition if we don't master this technology.

We really do need to prove carbon cap sequestration and the Government can't do it alone. We need to get the private sector investment in to make it across the bridge. And that is where I think you have heard the testimony of Ms. Masters and Mr. Edward about the fact a price cap would not get us our investment sufficiently, private capital sufficiently into this sector to get CCS here. So that has to be one of our major public/private priorities.

We have a number of studies. We are doing studies at the Nicholas Institute of the capability of laying out this technology. I think that Garth and some others would be better to talk to on some of the experiments going on around the world. We have a major demonstration project right now in Pennsylvania called Future Gen. It is not up to a full scale plan, but we are proving the workability of the technology. And we are working on sort of infrastructure would be necessary to transport the CO_2 to the depositories, because they are not everywhere. But we are looking to see if we have a pipeline that can get the CO_2 to the Appalachians and to the Gulf Coast and places we can dispose of it.

As to carbon cap sequestration, I would say there is no silver bullet technology, but there is silver buckshot. There are a number of technologies. There is a famous paper out at Princeton by Pacula and Chaloupka that talks about the various technologies that are necessary to get us there. We need to have some nuclear. We need to have some efficiency. We need to have some renewables.

Senator WARNER. I understand all that, but we have to show a path. Maybe the bridge won't be so long.

Does anybody else want to comment quickly on the new technology that could be in the works?

Mr. BAUGH. I would just add, there are certainly technologies that are out there for the more efficient burning of coal and getting more energy out of every ton of coal you use. There are companies doing that and building plants and using that. That is also bridge technology, just for greater efficiency. But the CO_2, the capture and sequestration, has got to be our Manhattan Project.

Senator WARNER. That is a good comparison.

Mr. BAUGH. We have to solve it.

Senator WARNER. We have to have a Manhattan Project.

Mr. Chairman, I think that I must leave. We have had an excellent hearing.

Senator LIEBERMAN. I totally agree. I thank you.

I want to ask one other series of questions, with your permission.

Senator WARNER. Go ahead. Yes.

Senator LIEBERMAN. Thank you very much.

Senator WARNER. If I could add, I leave with Mrs. Thorning's observation about the Chinese food and so forth. That is something we have to keep one eye open on. We can't let that invade this system.

Senator LIEBERMAN. Absolutely. Thanks, John.

Mr. Baugh, let me just take a minute or two to you and anyone else who wants to help on the panel, just to develop this question of how we deal with other countries in the world, because this is a real point of anxiety among Members of Congress on this. Even as we move, the debate over whether climate change is real is not totally over. I know not everybody agrees, but almost everybody does.

So the people are now really looking for a solution. But one of the anxieties here obviously is that we will finally take the steps to do something about this that will, some fear, affect the American economy, American jobs—although I must say that the EPA report is very encouraging today, that the risks of that are not great—while the other countries in the world, particularly China and

India, with China now by some estimates emitting more than we are, or certainly heading rapidly in that direction, whether so now or not.

So the Bingaman-Specter bill has a way to deal with this. As you described it, it starts with the executive branch negotiating with the major developing nations over implementing a system to control carbon emissions. So say a little more. What does that mean?

Mr. BAUGH. Well, I think there are probably any number of opinions of how you get at it, whether they implement a cap and trade program that is similar to ours, or whether they institute a tax regime, or another way of looking at it. I think the idea is that they have to do something comparable, and you know, I don't think it had to exactly mirror what we have, but the intent and the effect would be the same, that it would ultimately deal with the issue of carbon emissions and limiting their growth, and in fact turning back the clock on them.

Senator LIEBERMAN. Yes. And then another step is if the President of the United States deems the actions of these trading partners to be inadequate, then the U.S. Government can require that imported products from these countries purchase carbon allowances from a separate pool. In other words, basically if we determine that because those host countries are not asking the same of companies within their countries, then the U.S. has the power to compel those companies in so far as they are selling into the United States, for the right to do that, presumably at a lower price, to buy carbon allowances that would equal the price, or at least make it competitive between U.S.-produced goods and those foreign-based goods.

Do I have it right?

Mr. BAUGH. Yes, Senator. But I would also urge that the other steps that are there be considered before that.

Senator LIEBERMAN. Go ahead.

Mr. BAUGH. And that really is this conversation about what do you do in terms of negotiations and what do you put on the table in terms of carrots and incentives to make these changes, and this idea of entering into maybe forms of technology transfer. Say we solve the carbon question, all right? And we come up with an excellent solution. This becomes the technology that we own and we can export that to the rest of the world, and we should, to solve some of our trade problems.

On the other hand, we could have a very serious conversation with developing nations around we would like to have you begin to implement this technology; we want to work with you to get it done. It becomes an incentive. It is a carrot rather than the stick.

The last thing you do is actually get to the point that you want to implement the trade solution, but I frankly, given all our experience on the trade front and on this issue, is that you actually have to have the ability to take action if it is necessary for people to believe you. It happens in labor negotiations around contracts. It certainly happens in our trade dealings throughout the world. Frankly, China doesn't believe us about anything we say. They will do and continue to act in their own self-interest rather than take action.

There is a direct conflict between what is happening to their country environmentally and the country's economic policies. I said

this in front of the Senate staff when I participated in the briefing. The driving force in the Chinese economy is their economic strategy and their export platforms. That is the choice they keep making. That is where their energy investments are going. Unless there is something there to say that we will take action to make something different, they won't believe us.

So we would absolutely encourage the incentives as the way to negotiate for solving a problem for the world. On the other hand, you have to have action available.

Senator LIEBERMAN. Understood. Right.

Ms. Masters, how do you react to this proposal? And how would you distinguish it from a tariff that might be considered to be protectionist?

Ms. MASTERS. I think first of all that the notion of requiring another country to purchase allowances at presumably the prevailing market price is preferable to imposing a straightforward border tax. Implicit in that, it is a fixed price for the allowance, which we can't know today whether that will be the right price or the wrong price. So in that sense, I think there is some logic and some merit.

I think that second the overall issue of addressing the fact that in the future China, for example, or any other rapidly developing nation could swiftly become such a significant emitter of carbon as to render our own efforts meaningless is absolutely a very critical issue. It is a big hole to leave in the bucket unaddressed. So something needs to be done to address that.

I think there was one word that was referred to that, just thinking out loud, gave me pause for thought, which was the notion of this being a separate pool of allowances. I think the whole merit of a cap and trade program and the notion of trying to maximize supply into it is that there shouldn't be separate pools. Carbon molecules are fungible.

Senator LIEBERMAN. Right.

Ms. MASTERS. It doesn't matter whether carbon is contained somewhere in the United States, in Brazil, or in China, as long as it is contained. And once it is not contained and it is in the atmosphere, it sticks around for a long time.

So the notion of separating pools I think needs to be thought carefully about, and I would need to think some more.

Senator LIEBERMAN. OK. We would welcome that. There is still some time.

Mr. Profeta, I have about a minute left. Do you think this is the best answer yet to this question about the international consequences of the U.S. adopting a cap and trade system?

Mr. PROFETA. Yes, I would say that I would embrace how you asked the question, Mr. Chairman. It is the best answer yet, and it is a good first start. I think it is important to stress that it is really not a protectionist measure. It is desire is to stimulate engagement, as Mr. Baugh was saying, with these countries and find a way where we get a global trading pool like Ms. Masters desires, where we have liquidity across the markets.

So I think the key here is that it intends first to stimulate engagement, and even when it does get triggered, if it does, I think it is very important to look at the detail that was put into this about how the drafters of this bill are trying everything they can

to ensure equal treatment between the domestic manufacturers and those in the importers.

Senator LIEBERMAN. Right.

Thank you. Very interesting.

Senator Inhofe, it is all yours.

Senator INHOFE. Thank you, Mr. Chairman.

First of all, let me apologize to our witnesses. I sometimes get scheduling conflicts and it makes it very difficult. I know all of you made a great sacrifice to be here and I appreciate it very much.

I think I kind of walked in at a time here that we were discussing something that I have not really heard discussed before. I would repeat what I said in my opening statement, just the one quote by the Deputy Director General of China's Office of Global Environmental Affairs. He said you cannot tell people who are struggling to earn enough to eat that they need to reduce their emissions.

Now, I have a lot of other quotes I could use, but I have come to the conclusion that China is not going to voluntarily do anything that is going to be helpful to us. They are the beneficiary of efforts that we have over here. I would just say to Mr. Baugh that I am kind of surprised at the AFL–CIO's position here. On the one hand, you lay out reasonable principles such as the need to include developing countries in any legislation, yet you have endorsed the Bingaman bill which unilaterally caps our own emissions, while really doing nothing to address those in China.

The Congressional Budget Office found that CO_2 allocation schemes, which is what we are talking about here, will disproportionately burden the poor, raise taxes, increase Government spending, raise gas prices, raise home energy costs, and decrease rate wages. Now, it did say decrease wages.

It is hard to imagine the CBO issuing a more devastating indictment of proposed CO_2 cap and trade schemes. How can you support such a thing?

Mr. BAUGH. Well, Senator, I think we absolutely agree that the legislation is the only one, and the first one that takes a step to address our international trading partners, and especially the developing world's non-participation in the system. Frankly, we agree with you, the Chinese aren't going to listen to us unless they have a reason to listen to us.

This is not a unilateral step. In fact, that is why we demanded language in the legislation that began to address the international aspects and provide incentives in place to move people to participate, as well as have authority to act if and when they don't.

Senator INHOFE. Are you talking about doing this with tariffs? Is this the idea?

Mr. BAUGH. It is through the purchase of carbon allowances, the equivalent of.

Senator INHOFE. I consider that to be about the same thing.

Ms. Thorning, you are the President of the International Council for Capital Formation. You know a little bit about this, and I should say Dr. Thorning. Do tariffs work?

Ms. THORNING. Tariffs will have somewhat of a negative impact in terms of price of products here in the U.S. That would, of course, mean that low-income people will be especially impacted. So in my

view, a tariff, there might be some good in terms of encouraging some change in behavior from other countries, but I am not sure about that. I know for sure it will have a drag on U.S. economic growth.

Just to digress for a minute, you know, the Wal-Mart effect that is often discussed. According to many scholars, institutions like Wal-Mart have kept our inflation rate relatively low. If we begin to put tariffs based on carbon content on imported products, it will certainly make it more difficult to sustain the kind of economic growth we need.

So I think there are probably more efficient ways to encourage developing countries to reduce their emissions. A paper on the ACCF website by CRA International, David Montgomery, demonstrates the positive impact. It encourages intellectual property reform, reduction in corruption, reduction of bureaucracy, better infrastructure. In China and India, it could have a very powerful impact on helping them get access through private sector investment in less-emitting technologies. I think that would be a more fruitful approach than imposing tariffs.

Senator INHOFE. OK. I think you have answered that.

The European Union has adopted cap and trade. Do you want to tell us how it is working there?

Ms. THORNING. Well, their current cap and trade system covers approximately 12,000 emitters and about 40 to 45 percent of all emissions. The challenge that they face is how to actually meet their Kyoto target, because they basically have imposed cap and trade on the industrial sector, but the transport sector hasn't been included and neither has the household sector. So they are faced with the issue of how to, in the second commitment period, get emissions down and, of course, if they don't meet their target in the first commitment period, that casts even further doubt.

So recently the European Commission released a paper, it was March 9th, calling for a look at carbon taxes as a way to beef up their current emission trading system, because they see that the ETS is simply not up to the job and the political uncomfortableness of having to ratchet the allocation allowances down tighter and tighter and tighter on this limited number of installations. The competitive impact is a real challenge for them. So the European Union is looking for other ways.

Senator INHOFE. What do you think about carbon taxes?

Ms. THORNING. Well, in my view, and I think most economists support this, the most efficient way to send a price signal is to tax something. So a carbon tax could be set at a rate and perhaps increased over time to provide a signal to households, to the industrial sector, energy producers, that the price of carbon was going to rise, and in time if the capital stock turns over, for example when you buy a new car, you might not buy it the next day, but 3 years down the line you might buy a car that is substantially more energy efficient. So I think a carbon tax would be a more efficient way.

Senator INHOFE. Do you think maybe a more honest way?

Ms. THORNING. Pardon?

Senator INHOFE. A more honest way?

Ms. THORNING. More honest because people would see, people in industry would see the price of emitting carbon and could respond to it. A cap and trade obfuscates that.

Senator INHOFE. Yes. What about technology transfer? We have China now passing the United States as being the major emitter.

Ms. THORNING. Well, for example, a Chinese electric utility at a coal-fired plant might have a boiler right now that is 25 percent efficient. We have boilers that are 35 percent or even more efficient. If our companies, and there are German companies or companies around the world, were willing to sell their best technology into places like China and India or Russia or other places, the technology would get transferred without the need for a Government program. So protecting intellectual property rights, according to the Montgomery study, lack of protection for intellectual property in China is the key factor that impedes high quality investment flowing in there.

So I think technology transfer is the cost-effective way. If we can incentivize behavioral changes in Chinese and Indian companies, it will be certainly more cost effective and involve the private sector in ways that a cap and trade system might not.

Senator INHOFE. I am going to go over here. Can I take a little more time?

Senator LIEBERMAN. Go ahead.

Senator INHOFE. If we were to let's say establish and try to enforce a global cap and trade system or global taxes, what problems would we have?

Ms. THORNING. I think the first problem with a global cap and trade system is guaranteeing the property right in that emission reduction credit. Because you might expect that you did a contract for emission reductions over a five, ten, or 15 year period and perhaps they might occur, but a current Government can't guarantee a future Government's or future company's performance. So the property right issue would raise the cost of capital for that type of transaction substantially. Lack of property rights would mean that a cap and trade system would probably be less effective than simply taxing carbon.

Senator INHOFE. Yes.

Ms. THORNING. And of course, there are other issues that I mentioned in my testimony. For example, the fact that cap and trade unless you auction all the allowances, it confers windfall gains on the companies that receive these allowances, and there is a lot of gaming of the system. So I think it is a more straightforward way to simply tax carbon and lets everybody know what the real price is of trying to protect the environment.

Senator INHOFE. The Kyoto clean development mechanism, I think it is called, has that worked, or how is that working?

Ms. THORNING. Well, there is a recent article by Michael Wara of Stanford University that is pointing out that so far the clean development mechanism hasn't really accomplished much net emission reduction, and in fact the Chinese are finding it so profitable.

For example, with HFCs, Wara states that it cost perhaps $31 million to actually reduce the emissions that are being produced, but the Europeans are paying between $250 million to $750 million Euros for these emission reductions. So the Europeans are paying

vastly more. It is not an efficient way of getting these emissions down. The Chinese Government, in fact, has imposed a 65 percent tax on the companies in China that are selling these CFCs. The companies can still make money even when the Chinese Government takes 65 percent of their profit away from them.

So I think that is an example of the gaming of the system that the clean development mechanism has led to. To think that we can police that sort of thing thousands of miles away I think is a real challenge.

Senator INHOFE. Yes, a real challenge.

Thank you, Mr. Chairman.

Senator LIEBERMAN. Thank you, Senator Inhofe.

I thank the panel. I want to enter a few documents in the record before we adjourn, by unanimous consent. The first is the EPA report that I mentioned earlier. The second is written testimony submitted for the record by the American Electric Power Company. The testimony is a detailed legal description of the international provision that is contained within the Bingaman-Specter climate bill which we have discussed.

The third is a statement from the European Environment Agency which reaches the conclusion that latest projections for 2010 show that the combined effect of existing and additional domestic policies and pressures, Kyoto mechanisms, and carbon sinks would bring emissions below the EU–15 base year level, which corresponds exactly to the reduction required under the Kyoto Protocol.

[The referenced information follows:]

Projections of greenhouse gas emissions and removals (CSI 011) - Assessment published Feb 2007

Key policy question

What progress is projected towards meeting the Kyoto Protocol targets for Europe for reducing greenhouse gas (GHG) emissions to 2010: with current domestic policies and measures, with additional domestic policies and measures, and with additional use of the Kyoto mechanisms?

Key message

EU-25

With existing policies and measures, EU-25 greenhouse gas emissions are projected to be approximately 2 % below 1990 level by 2010. With additional policies and measures greenhouse gas emissions are projected to be approximately 5 % below 1990 level (and slightly below 2004 level).

EU-15

Latest projections for 2010 show that the combined effect of existing and additional domestic policies and measures, Kyoto mechanisms1[1] and 'carbon sinks'2[2] would bring emissions down to 8.0 % below the EU-15 base year level. This corresponds exactly to the reduction required under the Kyoto Protocol. With existing domestic3[3] policies and measures, total EU-

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1[1] Joint implementation, clean development mechanism and emissions trading according to the Kyoto Protocol, Art. 6, Art. 12, and Art. 17. These mechanisms allow industrialised countries with emissions limitation and reduction commitments to invest in emissions-savings projects in other countries and use the resulting emission credits to help meet their Kyoto targets.

2[2] According to Articles 3.3 and 3.4 of the Kyoto Protocol, Parties can make use of CO_2 removals by land use change and forestry activities, i.e. carbon sinks, to achieve their targets.

3[3] Domestic policies and measures are those taking place within the national boundaries. Existing policies and measures are those for which one or more of the following applies: (a) national legislation is in force; (b) one or more voluntary agreements have been established; (c) financial resources have been allocated; (d) human resources have been mobilised; (e) an official government decision has been made and there is a clear commitment to proceed with implementation. Additional (planned) policies and measures are options under discussion with a realistic chance of being adopted and implemented in time to influence the emissions during the commitment period.

15 greenhouse gas emissions will only be 0.6 % below base-year levels in 20104[4]. Taking into account additional domestic policies and measures being planned by Member States, a total EU-15 emissions reduction of 4.6 % is projected. This relies on the assumption that several Member States will cut emissions by more than is required to meet their national targets. The projected use of Kyoto mechanisms by ten Member States5[5] will reduce emissions by 2010 by a further 2.6 %. Finally, the use of carbon sinks according to Articles 3.3 and 3.4 of the Kyoto Protocol would contribute an additional 0.8 % (Figures 1 and 2).

New Member States

Seven new Member States project that they will meet or even over-achieve their Kyoto targets by 2010 with existing domestic policies and measures. However, in most countries emissions will increase between 2004 and 2010. Slovenia projects that it will meet its Kyoto target with additional policies and measures, and CO_2 removals from land-use change and forestry (Figure 3). Cyprus and Malta do not have a target under the Kyoto Protocol.

Other EEA member countries

EU acceding countries and Iceland were on track to meet or even over-achieve their Kyoto targets. In 2004, Norway, Switzerland and Liechtenstein will with existing measures fall short of their target. Turkey and Croatia have ratified the United Nations framework convention on climate change (UNFCCC), but not the Kyoto Protocol.

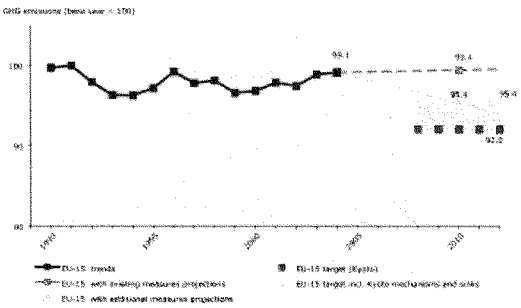

Fig. 1: Actual and projected EU-15 greenhouse gas emissions compared with the Kyoto target for 2008-2012, including Kyoto mechanisms and carbon sinks (Ver. 1.00)

Note: This graph shows the evolution of GHG emissions between 1990 and 2004 and the total projected emissions by 2010 in the EU-15 Member States.

4[4] Without existing policies and measures, total EU-15 greenhouse gas emissions would have been higher than the base-year level. The total effect of the existing policies and measures compared to a theoretical reference scenario without any measures since 1990 would be greater than the 0.6 % reduction referred to here.

5[5] Austria, Belgium, Denmark, Finland, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain.

Data source: EEA, based on EU-15 Member States greenhouse gas inventories and projections provided before 6 June 2006.
Downloads and more info

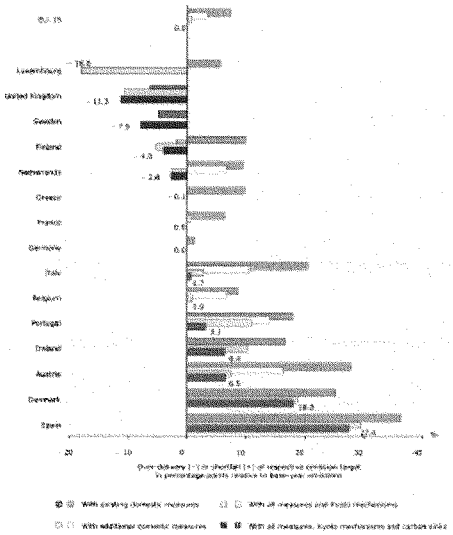

Fig. 2: Relative gaps (over-delivery or shortfall) between greenhouse gas projections based on domestic policies and measures and 2010 targets for EU-15 Member States including the effects of Kyoto mechanisms and net emissions and removals from carbon sinks (Ver. 1.00)

Note: Relative gaps for Luxembourg are based on information from 2001. More recent partial projections indicate smaller gap.

Data source: EEA, based on EU-15 Member States greenhouse gas projections provided before 6 June 2006.
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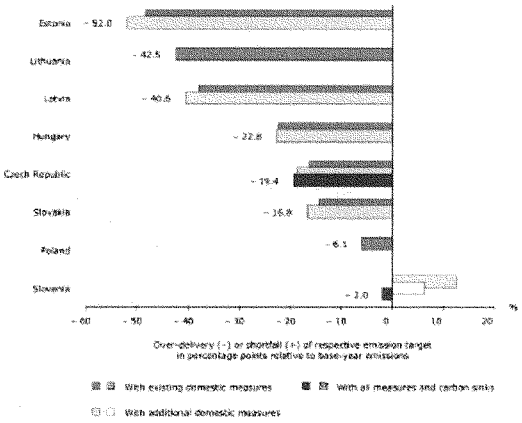

Fig. 3: Relative gaps (over-delivery or shortfall) between projections and targets for 2010 for new Member States (Ver. 1.00)

Data source: EEA, based on new Member States greenhouse gas projections provided before 6 June 2006.
Downloads and more info

Key assessment

EU-15

For the EU-15, aggregate projections of total GHG emissions for 2010 based on existing domestic policies and measures show a small fall to 0.6 % below base-year levels. The EU's Kyoto commitment of a reduction of 8 % can only be achieved by using all measures, Kyoto Mechanisms and carbon sinks.

Sweden and the United Kingdom project that existing domestic policies and measures alone will be sufficient to meet or even exceed their targets. Six more countries are anticipated to exceed (Finland, Luxembourg6[1] and the Netherlands) or meet (France, Germany and Greece) their commitment targets by additional measures, use of Kyoto mechanism, the use of carbon sinks or a combination thereof. The remaining seven Member States (Belgium, Denmark, Ireland, Spain, Austria, Italy and Portugal) are projected to miss their target despite all measure, Kyoto mechanism and the use of carbon sinks (Figure 2).

6[1] Relative gaps for Luxembourg are based on information from 2001. More recent partial projections indicate smaller gaps.

Kyoto Mechanisms are intended to be used by ten EU-15 Member States to reach their target (Austria, Belgium, Denmark, Finland, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain) and by one new Member State (Slovenia). The projected use of Kyoto Mechanisms has slightly increased compared to 2005 projections and amounts to a reduction of 2.6 percentage points (almost one third) of the required emissions reduction of 8 %.

Fourteen EU Member States (Austria, Belgium, Czech Republic, Denmark, Finland, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Slovenia, Spain, Sweden and the United Kingdom) have provided estimates of their intended us of carbon sinks. The projected use of carbon sinks for achieving the EU-15 Kyoto target is relatively small. It is estimated that the removal due to activities under Articles 3.3 and 3.4 of the Kyoto Protocol during the Kyoto commitment period will amount to about one tenth of the EU-15 target.

New Member States

All new EU Member States were on track in 2004 to meeting their Kyoto targets using existing domestic policies and measures, according to emission trends up till 2004 and 2010 projections. Slovenia was also on track and projects that it will meet its Kyoto target with additional policies and measures and by including CO2 removals from land-use change and forestry (Figure 3).

EU acceding countries and other EEA member countries

Bulgaria, Romania and Iceland were on track to meet or even over-achieve their Kyoto targets. Norway, Switzerland and Liechtenstein were not on track towards its target; however Switzerland projects to reach its target with additional measures and the use of Kyoto mechanisms, while Norway and Liechtenstein project that without using Kyoto mechanisms, they will fall short of their Kyoto targets with existing policies and measures.

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2 Specific policy question: What progress is projected towards meeting the Kyoto Protocol targets for Europe for reducing greenhouse gas (GHG) emissions to 2010 by sectors?

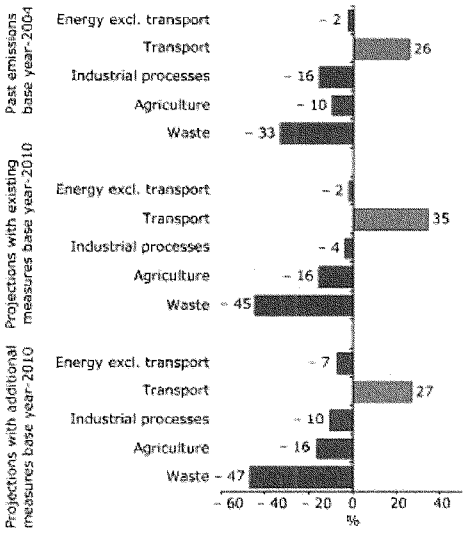

Fig. 4: Changes in EU-15 greenhouse gas emissions by sector and shares of sectors (Ver. 1.00)

Note: Several Member States did not report projections for all sectors/scenarios. Therefore, the information on the total EU-15 projections is not complete and has to be interpreted with care.

Data source: EEA, based on EU-15 Member States greenhouse gas inventories and projections provided before 6 June 2006.
Downloads and more info

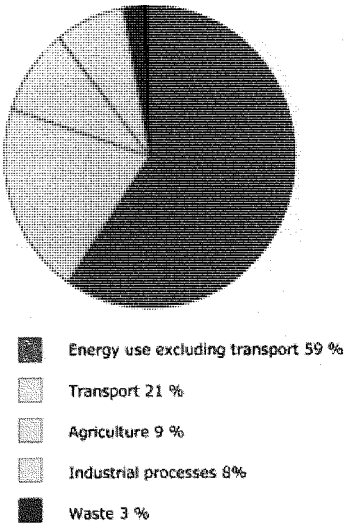

Fig. 5: Shares by sector in EU-15 greenhouse gas emissions in 2004 (Ver. 1.00)

Note: Emissions from the energy supply and use sector include emissions from energy supply industries, fugitive emissions, emissions from energy use in industry and other emissions from energy use. Although transport emissions are energy-related emissions, they are shown separately.

Data source: EEA, based on EU-15 Member States greenhouse gas inventories provided before 6 June 2006.
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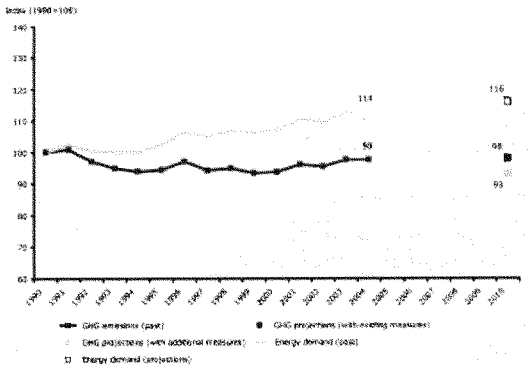

Fig. 6: EU-15 greenhouse gas emissions from energy supply and use (excluding transport) compared with energy demand (Ver. 1.00)

Note: Since sectoral emission projections for Germany were not available, greenhouse gas projections for the EU-15 are calculated on the basis of projections reported by 14 Member States. The 2004-2010 percent variation for the EU-14 was applied to Germany to obtain an EU-15 projection for 2010. No additional measures were reported for Denmark, Ireland, Luxembourg, Spain and Sweden. For these countries, the 'with existing measures' projections were used for the calculation of the EU-15 (with additional measures) projections. Past sectoral emissions are complete.

Data source: EEA, based on EU-15 Member States greenhouse gas inventories and projections provided before 6 June 2006; Eurostat.
Downloads and more info

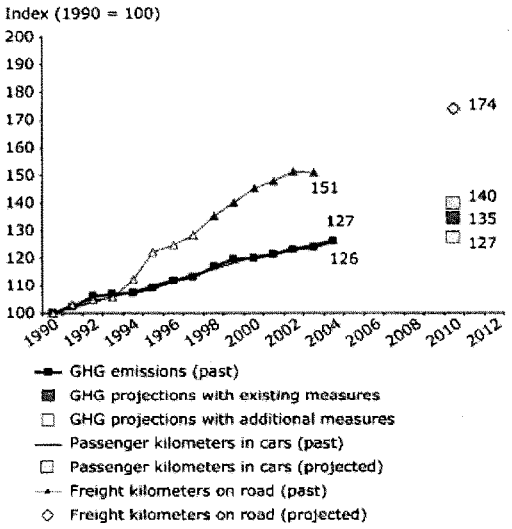

Fig. 7: EU-15 greenhouse gas emissions from transport compared with transport volumes (passenger transport by car and freight transport by road) (Ver. 1.00)

Note: Since sectoral emission projections for Germany were not available, greenhouse gas projections for the EU-15 are calculated on the basis of projections reported by 14 Member States. The 2004-2010 percent variation for the EU-14 was applied to Germany to obtain an EU-15 projection for 2010. No additional measures were reported for Denmark, Ireland, Luxembourg, Spain and Sweden. For these countries, the 'with existing measures' projections were used for the calculation of the EU-15 'with additional measures' projections. Past sectoral emissions are complete.

Data source: EEA, based on EU-15 Member States greenhouse gas inventories and projections provided before 6 June 2006; Eurostat.
Downloads and more info

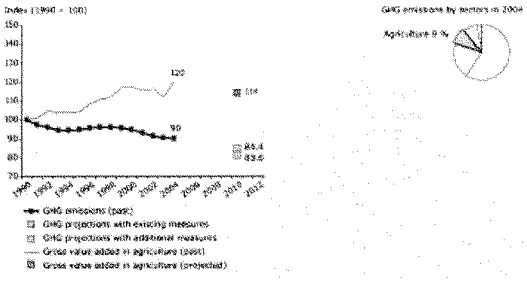

Fig. 8: EU-15 past and projected greenhouse gas emissions from agriculture and gross value added (Ver. 1.00)

Note: Left: This graph shows past (1990-2004) and projected (2010) emissions due to agriculture, and compares them with gross value added in agriculture.
Right: This graph represents the share of emissions from agriculture in total GHG emissions in the EU-15, in 2004

Data source: EEA, based on EU-15 Member States greenhouse gas inventories and projections provided before 6 June 2006; Eurostat.
Downloads and more info

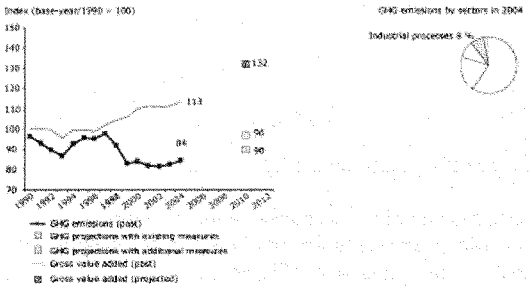

Fig. 9: Non-energy related greenhouse gas emissions from industrial processes compared with the value added and energy consumption in the EU-15 1990-2004 and share in total GHG (Ver. 1.00)

Note: Left: This graph shows past (1990-2004) and projected (2010) emissions due to industrial processes (non-energy related), and compares them with gross value added in industry.
Right: This graph represents the share of emissions from industrial processes in total GHG emissions in the EU-15, in 2004

Data source: EEA, based on EU-15 Member States greenhouse gas inventories and projections provided before 6 June 2006.
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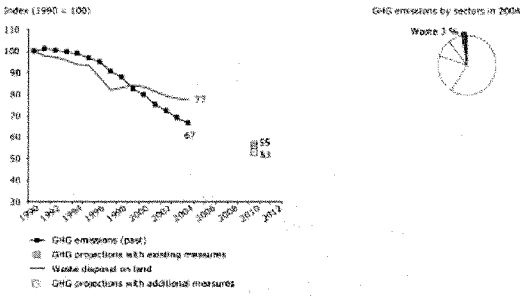

Fig. 10: EU-15 past and projected greenhouse gas emissions from waste (Ver. 1.00)

Note: Left: This graph shows past (1990-2004) and projected (2010) emissions due to waste management activities.
Right: This graph represents the share of emissions from waste management in total GHG emissions in the EU-15, in 2004

Data source: EEA, based on EU-15 Member States greenhouse gas inventories provided before 6 June 2006.
Downloads and more info

Specific assessment

This assessment is specific to the EU-15 only.

From 1990 to 2004, EU-15 greenhouse gas emissions decreased in most sectors, especially in waste management, industrial processes and agriculture. Energy supply and use, excluding transport saw lesser reductions taking place (Figure 4).

EU-15 greenhouse gas emissions from transport increased by 26 % in the same period. They are projected to increase further to 35 % above 1990 levels by 2010 if only existing policies and measures are used. EU-15 greenhouse gas emissions from energy supply and use, excluding transport, were 2.4 % below 1990 levels in 2004. They are projected to stay at roughly the same level by 2010 (2 % below 1990) if only existing policies and measures are used. EU-15 greenhouse gas emissions in most sectors are projected to decline further by 2010 compared to 2004 levels if additional domestic policies and

measures are used. At best, emissions from transport and industrial processes are projected to roughly stabilise at 2004 levels.

Energy use and supply, excluding transport

Emissions from the combustion of fossil fuels in power plants and other sectors (e.g. households and services) excluding transport represent 59 %of total EU-15 greenhouse gas emissions (Figure 5). They are projected to stabilise at 2004 levels (or 2 % below 1990 level) by 2010 with existing measures and to decrease to 7 % below 1990 levels with additional measures (Figure 6).

Between 1990 and 2004, CO_2 emissions from public electricity and heat production increased by 6 % due to an increase of 35 % in electricity production in thermal power plants. All Member States, at least to some extent, decoupled greenhouse gas emissions from energy use.

On current trends, targets for the share of renewable energies for the EU-15 (22 % of gross electricity consumption) and the EU-25 (21% of gross electricity consumption) are unlikely to be met. In order to meet the targets large increases in renewable energy are required.

CO_2 emissions from households increased by 3 % from 1990 to 2004, while the number of dwellings increased by 12 % from 1990 to 2000. Thus, decoupling was evident.

Transport

Emissions from domestic transport represent 21 % of total EU-15 greenhouse gas emissions (Figure 5). They increased by 26 % between 1990 and 2004. They are projected to increase to 35 % above 1990 levels by 2010 if only existing domestic policies and measures are used and to be 27 % above 1990 levels with additional measures (Figure 7).

Emissions from transport by road increased by 25 % between 1990 and 2004. The average carbon dioxide emissions of new passenger cars were reduced by about 12 % from 1995 to 2004. However, 21 % more cars were sold in the same period. As a result, this increase more than offset the emission reductions from new cars. EU carbon dioxide emissions from international aviation and navigation (not addressed under the Kyoto Protocol) increased by 59 % between 1990 and 2004.

Agriculture

Emissions from agriculture represent 9 % of total EU-15 greenhouse gas emissions (Figure 5). They fell by 10 % between 1990 and 2004. They are projected to decrease to 15.6 % below 1990 levels by 2010 with existing measures and to 16.4 % below 1990 levels with additional measures (Figure 8).

Industry (non energy-related)

Emissions from industrial processes (carbon dioxide, nitrous oxide and fluorinated gases) represent 8 % of total EU-15 greenhouse gas emissions (Figure 5). They were reduced by 16 % compared to base year levels. They are projected to rise again to 4 % below base year levels by 2010 with existing domestic policies and measures and to 10 % below base year levels with additional measures (Figure 9).

EU-15 nitrous oxide emissions from chemical industries decreased by 55 % between 1990 and 2004. EU-15 hydrofluorocarbon emissions from refrigeration and air conditioning (currently accounting for 1 % of total EU-15 greenhouse gas emissions) increased by a factor of nine between the base year and 2004.

Waste

Emissions from waste management represent 3 % of total EU-15 greenhouse gas emissions (Figure 5). They are projected to decrease to 45 % below 1990 levels by 2010 with existing measures and 47 % below 1990 levels with additional measures. EU-15 methane emissions from landfills fell by 38 % between 1990 and 2004 (Figure 10).

Methodology and references

How did we create this indicator?
See CSI 011 specification section for methodology, rationale and more relevant details about this indicator.

Senator LIEBERMAN. I thank each of you for the work you are doing, each in your own way in this area, and for sharing that expertise and experience with us. It is practically helpful to Senator Warner and me as we work. We have told our staff to not expect to sleep for the next seven to 10 days because we are very anxious. Senator Warner and I, however, will sleep occasionally.

[Laughter.]

Senator LIEBERMAN. We had our pajama party for the month last week. We are now going to get our normal sleep.

This has been, I want to repeat, particularly helpful as we move forward to present climate change legislation to our colleagues on this Committee, and then, I am confident, to the full Senate this fall.

I thank you all very, very much for your time and your contribution. We are going to leave the record of the hearing open for 7 days if any of the members want to submit additional questions or statements or any of you want to submit additional statements for the record.

With that, I adjourn the hearing.

[Whereupon, at 4:45 p.m., the subcommittee was adjourned.]

CONGRESSIONAL BUDGET OFFICE
U.S. Congress
Washington, DC 20515

Peter R. Orszag, Director

July 9, 2007

Honorable Jeff Bingaman
Chairman
Committee on Energy and
Natural Resources
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

Thank you for your interest in the Congressional Budget Office's (CBO's) April 25 issue brief, *Trade-Offs in Allocating Allowances for CO_2 Emissions*. The brief addressed some of the trade-offs that policymakers could face when deciding how to allocate allowances to emit carbon dioxide (CO_2) under a cap-and-trade program. Specifically, CBO's analysis quantified the near-term changes in gross domestic product that might result under six allocation scenarios and examined how each scenario might affect income for households in different income categories. In your letter of June 29, you asked whether a cap-and-trade program would harm the economy by imposing costs that could not be justified by its benefits and whether such a program would necessarily be regressive, imposing disproportionately high costs on low-income households relative to their income. Those points are addressed below.

Would a Cap-and-Trade Program Harm the Economy? An effort to limit CO_2 emissions in any given year would have two principal effects: It would produce long-term economic benefits (by avoiding damages in the future) but would impose economic costs in each year in which the limit was in effect (by restricting the use of fossil fuels, which emit CO_2 into the atmosphere when they are burned). Although CBO's issue brief acknowledged that reducing CO_2 emissions would create both costs and benefits, it was not intended to quantify those benefits. Rather, the brief explicitly took the goal of reducing emissions as a given and focused on the near-term efficiency and distributional trade-offs associated with doing so under different methods of allocating emission allowances. More specifically, each allocation scenario considered in the brief would reduce CO_2 emissions by the same amount and thus would produce the same long-term benefits, while imposing different near-term costs. Given the narrow objectives of the brief, the fact that it did not explicitly quantify the benefits of a cap-and-trade program should not be interpreted in any way as implying that CBO has concluded that the costs of such a program would outweigh the benefits.

A variety of analyses suggest that a carefully designed program to begin reducing CO_2 emissions would produce greater benefits than costs. In particular, a recent report by the Intergovernmental Panel on Climate Change has brought to light new information about the potential damages that could result from continued increases in those emissions. The magnitude of such damages remains

highly uncertain, but there is growing recognition that some degree of risk exists for the damages to be unexpectedly large, and emissions reductions would help lessen that risk. However, the U.S. economy depends heavily on fossil fuels, and substantially reducing CO_2 emissions (either by decreasing the use of those fuels or by sequestering the emissions that result from them) is likely to be costly and to take several decades. The costs of an effort to lower emissions could be minimized by using economywide incentives (such as a tax on emissions or a cap-and-trade program) and by phasing the policy in gradually so the economy had time to adjust.

Would a Cap-and-Trade Program Be Regressive? A cap-and-trade program for CO_2 emissions need not be regressive; its ultimate distributional effect would depend on policymakers' decisions about how to allocate the emission allowances. The ultimate distributional impact of such a program would be the net effect of two distinct components: the distribution of the costs of the program (including the cost of paying for the allowances) and the distribution of the allowances' value (because someone will pay for them, someone will receive income from them). Market forces would determine who bore the costs of a cap-and-trade program, but (as the April 25 issue brief emphasized) policymakers would determine who received the allowance value. The ultimate effect could be either progressive or regressive. In addition, decisions about how the allowances were allocated could have a significant impact on the overall near-term cost of the policy to the economy.

The following are the key points about distributional and efficiency effects:

- A cap-and-trade program would lead to price increases for energy and energy-intensive goods. Such price increases would occur regardless of whether the government sold the allowances or gave them away, and they would impose a larger burden (relative to income) on low-income households than on high-income households. Those price increases are essential to the success of a cap-and-trade program because they are the most important mechanism through which businesses and households are encouraged to make investments and behavioral changes that reduce CO_2 emissions.
- The policy-induced price increases would reduce demand for energy and energy-intensive goods and services, resulting in losses to some current investors and workers in those sectors (who could see their stock values decline or could face employment risks as jobs in those sectors were reduced). Stock losses would tend to be widely dispersed among investors, because shareholders typically have diversified portfolios. In contrast, the costs borne by existing workers would probably be concentrated on relatively few households, and by extension, their communities.
- The price increases and the potential losses to investors and workers are only part of the story, however. The allowances would be worth tens or hundreds of billions of dollars. Policymakers' decisions about how to allocate them would determine the ultimate distributional impact of the policy, which would reflect both households' losses from price increases, stock declines, and job losses as well as any gains to households from the

allocation method (such as described below). Furthermore, decisions about how to allocate allowances could affect the near-term costs that the program would impose on the economy.

- If they chose to do so, lawmakers could more than offset the price increases experienced by low-income households or the costs imposed on workers in particular sectors of the economy. They could do that by selling some or all of the allowances and using the revenue to compensate specific households or entities. For example, CBO found that lower-income households could be better off as a result of a cap-and-trade program (compared with no program) if the government chose to sell the allowances and used the revenue to pay an equal lump-sum rebate to each household in the United States. In that case, the size of the rebate would be larger than the average increase in low-income households' spending on energy and energy-intensive goods. High-income households would be worse off under that scenario because their average increase in spending would be larger than the rebate.
- By contrast, CBO found that giving all or most of the allowances to energy producers to offset potential losses by investors in those industries—as was done in the cap-and-trade program for sulfur dioxide emissions, which cause acid rain—would exacerbate the regressivity of the price increases. On average, the value of the CO_2 allowances that producers would receive would more than compensate them for any decline in profits caused by a drop in the demand for energy-intensive goods and services. As a result, the companies that received the allowances could experience "windfall" profits. Because those profits would not depend on how much a company produced, however, they would be unlikely to prevent the declines in production and resulting job losses that would stem from the price increases. In addition, those profits would accrue to shareholders, who are primarily from higher-income households, and would more than offset those households' increased spending on energy and energy-intensive goods and services. Low-income households, by contrast, would benefit little if allowances were given to energy producers for free, and they would still bear a disproportionate burden because of price increases. Such an allowance-allocation policy would be "strongly regressive," in that higher-income households would be better off as a result of the policy and lower-income households would be made worse off.
- Selling emission allowances would allow the government not only to compensate some households for their higher costs or workers for their lost jobs, but also to devote part of the sales revenue to reducing existing taxes that discourage economic activity (such as income or payroll taxes). Those tax reductions, like free allocations to energy producers, would tend to disproportionately benefit higher-income households. However, unlike free allocations, they would reduce the near-term cost that a cap-and-trade program would impose on the economy, perhaps substantially.
- Because giving allowances to energy producers would disproportionately benefit higher-income households and would preclude the possibility of using the allowance value to

reduce taxes on capital and labor, such a strategy would appear to rate low from both a distributional and an efficiency perspective.

I hope you find this additional information helpful. If you have further questions, please feel free to contact me at 202-226-2700, or your staff may wish to contact Terry Dinan at 202-226-2927.

Sincerely,

Peter R. Orszag
Director

cc: Honorable Pete V. Domenici
Ranking Member

U.S. Environmental Protection Agency
Office of Atmospheric Programs

EPA Analysis of The Climate Stewardship and Innovation Act of 2007

S. 280 in 110th Congress

July 16, 2007

Request for EPA Analysis of S. 280

United States Senate
WASHINGTON, DC 20510

February 5, 2007

The Honorable Stephen L. Johnson
Administrator
Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Dear Administrator Johnson:

We are writing to request that EPA estimate the economic impacts of S. 280, the Climate Stewardship and Innovation Act of 2007. A similar request is being forwarded to the Energy Information Administration.

We believe EPA's analysis of S. 280 would prove useful to us and other members of the Senate as we craft measures to combat global climate change.

We ask that EPA begin this process by meeting with our staff as soon as possible to discuss the parameters, methods, and duration of the analysis. Please call David McIntosh in Senator Lieberman's office at (202) 224-5016 or Floyd DesChamps in Senator McCain's office at (202) 224-5184.

Thank you for your assistance with this analysis.

Sincerely,

Joseph Lieberman
UNITED STATES SENATOR

John McCain
UNITED STATES SENATOR

- On February 5, 2007 Senators Lieberman and McCain requested that EPA estimate the economic impacts of S. 280, the Climate Stewardship and Innovation Act of 2007.
- This document covers the analysis of S.280 based on discussions with senate staff and internal EPA considerations.
- The analysis was conducted by EPA's Office of Atmospheric Programs.
  Contact: Francisco de la Chesnaye.
  Tel: 202-343-9010.
  Email: delachesnaye.francisco@epa.gov.

www.epa.gov/climatechange/economicanalyses.html

Key Results & Insights

S. 280 places a GHG emission cap on all GHGs in the Transportation, Electricity, Industrial, and Commercial sectors, establishes an auction and after-market for emission allowances, and allows for limited domestic offsets and international credits.

Emissions Impacts

- Under S. 280 total U.S. GHG emissions are approximately 25% lower than Reference Scenario emissions in 2030, and 44% lower in 2050.
- Purchasing international credits reduces non-U.S. emissions in 2030 by 588 $MMTCO_2e$, which is approximately six percent of U.S. Reference Scenario emissions in that year; and by 254 $MMTCO_2e$ in 2050, which is approximately two percent of U.S. Reference Scenario emissions in that year.
- Under S. 280 covered U.S. GHG emissions make up 79% of total U.S. GHG emissions in 2030, and 74% in 2050.

Economic Impacts

- In the Senate Scenario, modeled allowance prices range between $27 - 32 /tCO2e in 2030, and $70 - 85/tCO2e in 2050. In other scenarios that limit the availability of technology, modeled allowance prices range between $28 – 40 /tCO2e in 2030, and $55 – 105 /tCO2e in 2050.
- By 2030 GDP is projected to increase 112% from 2005 levels in the Reference Scenario, and by 2050 the projected increase in GDP from 2005 levels is 238%.
- Under S.280 GDP is modeled to be between 0.6% ($146 billion) and 1.6% ($419 billion) lower in 2030 and between 1.1% ($457 billion) and 3.2% ($1,332 billion) lower in 2050 than in the Reference Scenario.
- The average annual growth rate of consumption is ~ 0.04 percentage points lower. In 2030 per household average annual consumption is ~$550 lower and gasoline prices increase ~$0.26 per gallon. In 2050 per household average annual consumption is ~$1900 lower and gasoline prices increase ~$0.68 per gallon.
- Electricity prices are projected to increase 22% in 2030 and 25% in 2050, assuming the full cost of allowances are passed on to consumers (as is the case in a full auction). If allowances are given directly to power companies, the cost of those allowances would not be passed on to consumers in regulated electricity markets, so electricity price increases would be lower in much of the country.
- In our modeling market outcomes are invariant to the auctioning of allowances given the assumption of lump sum transfers of auction revenues back to households. If the auction revenues were instead used to lower distortionary taxes, the costs of the policy would be lower. Other uses of auction revenues have the potential to increase the costs of the policy.
- The use of domestic offsets and international credits reduces allowance prices and total costs. Payments for international credits are approximately ~$12 billion in 2030 and ~$13 billion in 2050, given the assumption that international credits are purchased only after the supply of domestic offsets at the market clearing price is exhausted.
- The economic benefits of reducing emissions were not determined for this analysis.

Key Results & Insights (con't)

Sector Impacts

- The greatest emission abatement under S.280 occurs in CO_2 emissions from the electricity sector.
- The transportation sector provides a relatively small proportion of CO_2 emissions abatement. This result reflects the weak and indirect price signal an upstream cap and trade program sends to the transportation sector.
  - The price signal provided by S. 280 (~$0.26 increase in the price of gasoline in 2030, ~$0.68 increase in 2050), does not overcome the market barriers in the transportation sector that prevent larger reductions in GHG emissions.
  - This analysis did not estimate the reductions that could be achieved under a direct fuel and vehicle regulatory framework.

Enabling Technologies

- The enabling technologies in this analysis for electricity generation are Carbon Capture & Storage (CCS) and Nuclear Power.
- Detailed power sector modeling suggests most existing coal plants continue to operate but are less profitable in the near-term; and while economy-wide models indicate the near-term impact on coal may be greater than the impacts in the detailed power sector models, they show that coal usage rebounds after 2030 with the deployment of CCS technology based on assumption on costs and performance of CCS in this analysis.
- CCS is not yet proven on commercial scale but is the focus of considerable R&D funding. In this analysis, while CCS is available starting in 2015, carbon allowance prices rise to a high enough level to make CCS cost-competitive in ~2030 and it is rapidly deployed thereafter.
- If CCS is not deployed, in 2030 allowance prices increase by half and GDP effects are almost doubled from the Senate Scenario.
- In the Senate scenario nuclear power grows by ~150% by 2050. If the growth of nuclear power is constrained to ~ 75% by 2050, allowance prices increase by 5% and GDP effects are increased by 4% in both 2030 and 2050.
- If neither CCS nor nuclear are available at large scales at the cost used in this analysis then the allowance prices and the costs to the economy would increase significantly.

Key Results & Insights (con't)

Greenhouse Gas Concentration Impacts

- In the reference case, global CO_2 concentration rises from 380 ppm in 2005 to 718 ppm in 2095.
- Assuming that the U.S. adopts S. 280, Kyoto countries (excluding Russia) reduce emissions to 50% below 1990 levels by 2050, and all other countries adopt GHG emissions targets in 2025 and return emissions to 2000 levels by 2035, the global CO_2 concentration in 2095, while not stabilized, is lowered to 491 ppm.
- The incremental effect of S. 280 on lowering global CO_2 concentration is between 23 and 25 ppm.

Offsets Sensitivities

- If the 30% limit on the use of offsets is lifted, the allowance price falls by 35% in every year, the effects on GDP and consumption in are reduced by about one third in both 2030 and 2050.
- If offsets are not allowed, the allowance price increases by over 150% in all years.

International Climate Policy Sensitivity

- Relaxing the GHG emissions caps that other countries are assumed to adopt under the Senate Scenario reduces the global demand for abatement, and thus decreases the price of offsets domestically. This increases the quantity of international credits demanded in the U.S., but decreases the total value of international credits purchased by the U.S.
- Because of the 30% limit on the use of offsets in the U.S., reducing the offset price does not affect the marginal cost of abatement in the U.S. Consequently, the allowance price is unaffected.

Key Uncertainties

- There are many uncertainties that affect the economic impacts of S. 280.
- This analysis contains a set of scenarios that cover some of the most important uncertainties:
  - The extent and stringency of international actions to reduce GHG emissions by developed and developing countries.
  - The availability of domestic offsets and international credits.
  - The degree to which new nuclear power is technically, politically, and socially feasible.
  - Whether or not carbon capture and storage technology will be available at a large scale.

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- Legislative Assessment and Analytical Approach
- GHG Emissions Results
- Detailed Near-Term Electricity Sector Modeling Results
- Energy Sector Modeling Results
- Economy-Wide and Sectoral Modeling Results
- Global Results: CO_2 Concentrations and International GHG Market
- Appendix 1: Additional Scenarios
- Appendix 2: Additional Information
- Appendix 3: Model Descriptions

Legislative Assessment and Analytical Approach

S. 280 Bill Summary

- Economy-wide coverage:
  - Transportation (upstream on fuels)
  - Electricity, Industrial, and Commercial sectors (downstream on emissions)
- Extensive GHG coverage: CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6
- GHG emission targets for covered sectors:

  2012: 2004 emission level, then adjusted for non-covered entities

  2020: 1990 emission level, then adjusted

  2050: 60% below 1990 emission level, then adjusted
- Establishes a market-driven system of tradable emission allowances
- Caps are placed on covered Entities that emit 10,000 tons CO_2e or more emissions per year
- Domestic offsets & international credits can be used to meet up to 30% of the emission cap level
  - S. 280 provides the EPA Administrator, in coordination with the Secretaries of Commerce, Energy, and Agriculture, discretion for setting standards for domestic and international mitigation activities

Analytical Scenarios

The first two scenarios consist of the EPA reference case, which is a business as usual scenario; and the S. 280 Senate Policy Scenario, which uses assumptions developed in consultation with Senate staff about the details of S. 280, and about other policies both domestic and international that affect the results of this analysis. The assumptions about other domestic and international policies that affect the results of this analysis do not necessarily reflect EPA's views on what is most likely to occur. Both of these scenarios were analyzed using the full suite of models used for this analysis.

1) EPA Reference Scenario

- Does not include any additional climate policies or measures to reduce international GHG emissions
- For domestic projections, benchmarked to AEO 2006
- For international projections, use CCSP Synthesis and Assessment Report 2.1 A MiniCAM Referece

2) S. 280 Senate Scenario

- Cap on covered sectors and entities, adjusted by EPA to account for emissions from exempted source categories and non-covered entities based on the U.S. GHG Inventory
- Domestic offsets and international credits constrained to 30%
- Auction / Allocation Split
  - Case 1: 30% of the 2012 allowances are auctioned, increasing at a constant annual rate to reach 90% in 20 years
  - Case 2: 70% of the 2012 allowances are auctioned, increasing at a constant annual rate to reach 90% in 20 years
- Substantial growth in nuclear power (nuclear power generation increases by ≈150% from 782 bill. kWh in 2005 to 1,982 bill. kWh in 2050) reflecting possible future policies to promote this technology in S. 280 and elsewhere
- Widespread international actions by developed and developing countries over the modeled time period. International policy assumptions are based on those used in the recent MIT report, "Assessment of U.S. Cap-and-Trade Proposals"
  - Group 1 countries (Kyoto group less Russia) follow an allowance path that is falling gradually from the simulated Kyoto emissions levels in 2012 to 50% below 1990 in 2050
  - Group 2 countries (rest of world) adopt a policy beginning in 2025 that returns and holds them at year 2015 emissions levels through 2034, and then returns and maintains them at 2000 emissions levels from 2035 to 2050

Analytical Scenarios (con't)

In the following additional scenarios, everything is the same as in the S. 280 Senate Scenario except for the specified differences. These scenarios provide important sensitivities on provisions of S. 280 and assumptions required for the analysis that have significant impacts on the cost of the policy. These scenarios were not all run by all of the models used for EPA reference scenario and the S. 280 Senate scenario due to resource and time constraints.

3) S. 280 Scenario with Low International Actions

- Developing countries do not take on GHG emissions targets over the period of the analysis
- Group 1 countries continue on a "Kyoto Forever" path

4) S. 280 Scenario Allowing Unlimited Offsets

- Removes the constraint in S. 280 that limits the usage of offsets to 30% of allowance submissions

5) S. 280 Scenario with No Offsets

- Assumes offsets are not allowed, and all reductions must come from covered entities within covered sectors

6) S. 280 Scenario with Lower Nuclear Power Generation

- Assumes less growth in nuclear power, although nuclear power still increases from reference
- Increase by ≈75% by 2050 (half of S. 280 Senate Scenario)

7) S. 280 Scenario with No Carbon, Capture & Storage Technology

- Assumes that carbon capture and storage technology is not available

EPA Models and Corresponding GHG Mitigation

S. 280 Sectors		Economy-wide Computable General Equilibrium (CGE) Models		Models Used to Provide Inputs to CGEs				Partial Equilibrium Model (Uses CGE Outputs)
		ADAGE	IGEM	NCGM	FASOM	GTM	MiniCAM	IPM
Domestic	Electricity Generation	All GHGs	All GHGs					CO_2
	Transportation	All GHGs	All GHGs					
	Industry	All GHGs	All GHGs	CH_4, N_2O, F-gases				
	Commercial	All GHGs	All GHGs					
	Agriculture (& Forestry)	All GHGs	All GHGs		CO_2, CH_4, N_2O			
	Residential	All GHGs	All GHGs	CH_4, N_2O,				
International Credits*				CH_4, N_2O, F-gases		CO_2	CO_2, CH_4, N_2O, F-gases	

* International allowance and domestic offset markets were analyzed using EPA's spreadsheet tool which combines results from the NCGM, FASOM, GTM and MiniCAM models.

ADAGE	Applied Dynamic Analysis of the Global Economy (Ross, 2007)
IGEM	Intertemporal General Equilibrium Model (Jorgenson, 2007)
IPM	Integrated Planning Model (EPA, 2007)
NCGM	EPA's non-CO_2 GHG spreadsheet tools for estimating projections and mitigation of CH_4, N_2O, and F-gases (EPA, 2005)
FASOMGHG	Forest and Agriculture Sector Optimization Model, GHG version (EPA, 2005)
GTM	Global Timber Model (Sonhgen, 2006)
MiniCAM	Mini-Climate Assessment Model (Edmonds, 2005)

EPA Models Used for Different Analytical Scenarios

Table: Models Used for Different Scenarios

1) EPA Reference Scenario			
ADAGE	IGEM	MiniCAM	
2) S. 280 Senate Scenario			
ADAGE	IGEM	MiniCAM	NCGM/FASOM/GTM/MiniCAM Offset Spreadsheet Tool
3) S. 280 Scenario with Low International Actions			
	IGEM		NCGM/FASOM/GTM/MiniCAM Offset Spreadsheet Tool
4) S. 280 Scenario Allowing Unlimited Offsets			
	IGEM		NCGM/FASOM/GTM/MiniCAM Offset Spreadsheet Tool
5) S. 280 Scenario with No Offsets			
	IGEM		
6) S. 280 Scenario with Lower Nuclear Power Generation			
ADAGE			
7) S. 280 Scenario with No Carbon, Capture & Storage Technology			
ADAGE			

ADAGE	Applied Dynamic Analysis of the Global Economy (Ross, 2007)
IGEM	Intertemporal General Equilibrium Model (Jorgenson, 2007)
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NCGM	EPA's non-CO_2 GHG spreadsheet tools for estimating projections and mitigation of CH_4, N_2O, and F-gases (EPA, 2005)
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MiniCAM	Mini-Climate Assessment Model (Edmonds, 2005)

Note: International allowance and domestic offset markets were analyzed using EPA's spreadsheet tool which combines results from the NCGM, FASOM, GTM and MiniCAM models.

Modeling Approach

- For the purpose of this analysis, we have chosen to use two separate computable general equilibrium (CGE) models: IGEM and ADAGE.
- CGE models are structural models.
  - They build up their representation of the whole economy through the interactions of multiple agents (e.g. households and firms), whose decisions are based upon optimizing economic behavior.
  - The models simulate a market economy, where in response to a new policy, prices and quantities adjust so that all markets clear.
- These models are best suited for capturing long-run equilibrium responses, and unique characteristics of specific sectors of the economy.
- The general equilibrium framework of these models allows us to examine both the direct and indirect economic effects of the proposed legislation, as well as the dynamics of how the economy adjusts in the long run in response to S. 280.
- The NCGM, FASOM, GTM, and MiniCAM models are used to provide information on abatement options that fall outside of the scope of the CGE models.
  - These models generate mitigation cost schedules for various abatement options.
- Additionally, the IPM model gives a detailed picture of the electricity sector in the short-run (through 2025), which complements the long-run (through 2050) equilibrium response represented in the CGE models.

Modeling Limitations

- The models used in this analysis do not formally represent uncertainty.
  - Confidence intervals cannot be presented for any of the results in this analysis.
  - Very few CGE models are capable of computing confidence intervals, so this limitation is currently shared with virtually all CGE models.
  - The use of two CGE models provides a range for many of the key results of this analysis; however, this range should not be interpreted as a confidence interval.
  - Alternate scenarios are presented to provided sensitivities on a few of the key determinants the modeled costs of S. 280.
- The CGE modeling approach generally does not allow for a detailed representation of technologies.
  - Since the electricity sector plays a vital role in the abatement of CO_2 emissions, we have supplemented the results from our CGE models with results from the Integrated Planning Model (IPM), which is bottom-up model of the electricity sector.
  - The CGE models do not explicitly model new developments in transportation technologies. These reductions occur as households alter their demand for motor gasoline and through broad representations of improvements in motor vehicle fuel efficiency.
- The time horizon of the CGE models, while long from an economic perspective, is short from a climate perspective.
- CGE models represent emissions of GHGs, but cannot capture the impact that changes in emissions have on global GHG concentrations.
  - In order to provide information on how S. 280 affects CO_2 concentrations throughout the 21st century, we have used the Mini-Climate Assessment Model (MiniCAM) to supplement our results.
- None of the models used in this analysis currently represent the benefits of GHG abatement.
  - While the models do not represent benefits, it can be said that as the abatement of GHG emissions increases over time, so do the benefits of the abatement.

Modeling Limitations (con't)

- The models used in this analysis do not incorporate benefit-side effects of reductions in conventional pollutants (SO_2, NOx, and Hg) , such as labor productivity improvements from gains in public health.
  - While this is an important limitation of the models, the impact on modeled costs of the policy is small because S. 280 does not impact overall emissions of conventional pollutants covered by existing cap and trade programs due to the existence of a cap.
- The costs of administering S. 280 (e.g. monitoring and enforcement) are not captured in this analysis.
- Household effects are not disaggregated.
- Both of the CGE models used in this analysis are full employment models.
  - The models do not represent effects on unemployment.
  - The models do represent the choice between labor and leisure, and thus labor supply changes are represented in the models.
- While ADAGE does include capital adjustment costs, capital in IGEM moves without cost.
- IGEM is a domestic model; ADAGE has the capability of representing regions outside of the U.S., which were used to incorporate interactions between the U.S. and Group 1 & 2 countries. For consistency across analyses, international abatement options were generated in the following fashion:
  - We used the MiniCAM model to generate the supply and demand of GHG emissions abatement internationally.
  - For Group 2 countries that are assumed to not have a cap on GHG emissions before 2025, and thus supply mitigation only through certified emissions reductions resulting from project activities, the potential energy related CO_2 mitigation supply is reduced by 90% though 2015, and by 75% between 2015 and 2025.
  - Combining the international demand for abatement from MiniCAM, the domestic demand for offsets determined by the 30% limit on offsets, and the mitigation cost schedules for the various sources of offsets generated by the NCGM, FASOM, GTM, and MiniCAM models, allows us to find market equilibrium price and quantity of offsets and international credits.

Modeling Limitations (con't)

- Since international abatement occurs outside of ADAGE and IGEM, the models do not capture emissions leakage* in this analysis. However, the potential for leakage under S. 280 is somewhat limited if the entire world adopts actions similar to that assumed in the S. 280 Senate Scenario. The potential for leakage under S. 280 is greater if there is less international action.
- The models do not represent bilateral trade, so it is not possible to determine the effect of S. 280 on trade with any particular country or region.
  - Since IGEM is a domestic model, world prices are not affected by climate policies in Group 1 and Group 2 countries. As a result of S. 280, the prices of U.S. exports rise relative to prices in the rest of the world, and export volumes fall. Since exports are price-elastic the volumes fall proportionally more than the price rises and thus the value of exports declines. Imports are reduced in part by the overall reduction in spending associated with the lower levels of consumption. Additionally, commodities directly effected by the emissions cap (e.g. oil) are reduced proportionally more than other imports due to the allowance prices embodied in their cost. Import substitution counterbalances the above two forces. U.S. prices of commodities not directly affected by the policy are relatively higher, which leads to substitution away from domestically produced goods and towards imported goods. To the extent that policies in Group 1 and Group 2 countries increase world prices of affected commodities, the relative price difference between goods produced in the U.S. and goods produced abroad will be lessened. This will reduce impact on exports, and reduce the import substitution effect, both of which are driven by the relative price differential.
  - Since ADAGE is a global model, the climate policies in Group 1 and Group 2 countries affect world prices. As a result the relative price differences between goods produced domestically and abroad are smaller than the differences in IGEM, and thus the relative price driven changes in imports and exports are smaller in ADAGE than in IGEM.

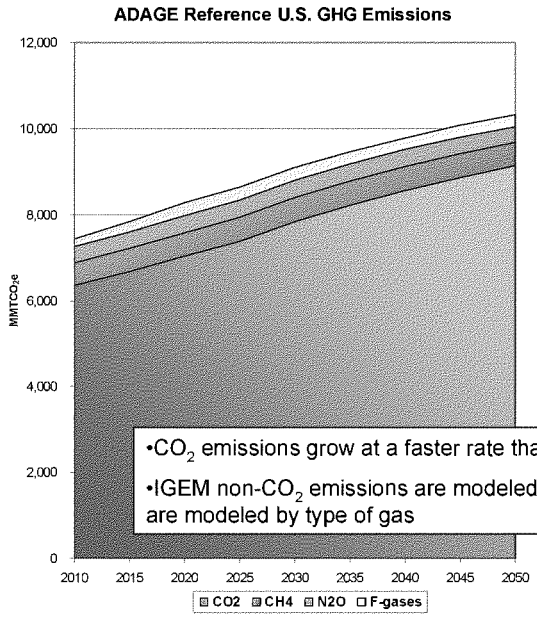
* Emissions leakage occurs when a domestic GHG policy causes a relative price differential between domestically produced goods and imported goods, which causes production of goods that domestically would have GHG allowance prices embodied in their cost to shift abroad, and thus causes an increase in GHG emissions in other countries.

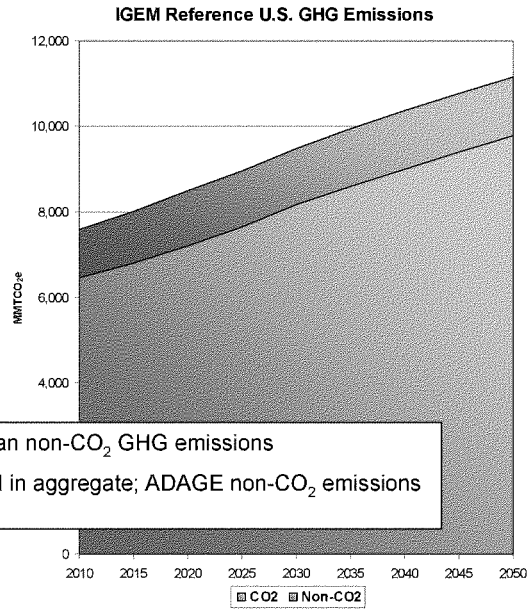
Domestic Offsets & International Credits Methodology Highlights

- EPA developed mitigation cost schedules for 24 offset mitigation categories, covering the following mitigation types:
  - Domestic non-CO_2 GHG emissions reductions
  - International non-CO_2 GHG emissions reductions
  - Domestic and international increases in terrestrial carbon sinks (soil and plant carbon stocks)
  - International energy-related CO_2 mitigation
- EPA evaluated individual mitigation options to determine potential eligibility and feasibility over time for a future mitigation program
  - Based on EPA's emissions inventory & mitigation program expertise
    - Considered a broad set of factors, including existing and emerging programs/protocols/tools, monitoring, measurement & verification (MMV), magnitude of potential, additionality, permanence, leakage, and co-effects
  - Options evaluated both domestically, internationally (by region group), and over time
  - Captured responses to rising carbon prices
    - Modeled rising carbon price pathways (vs. constant) to capture investment behavior
    - Applied in three mitigation categories: Domestic agriculture & forestry, international forestry, and international energy-related CO_2
  - Capped sector non-CO_2 and bio-energy emissions reductions are also modeled.

GHG Emissions Results

Results: Reference Scenario

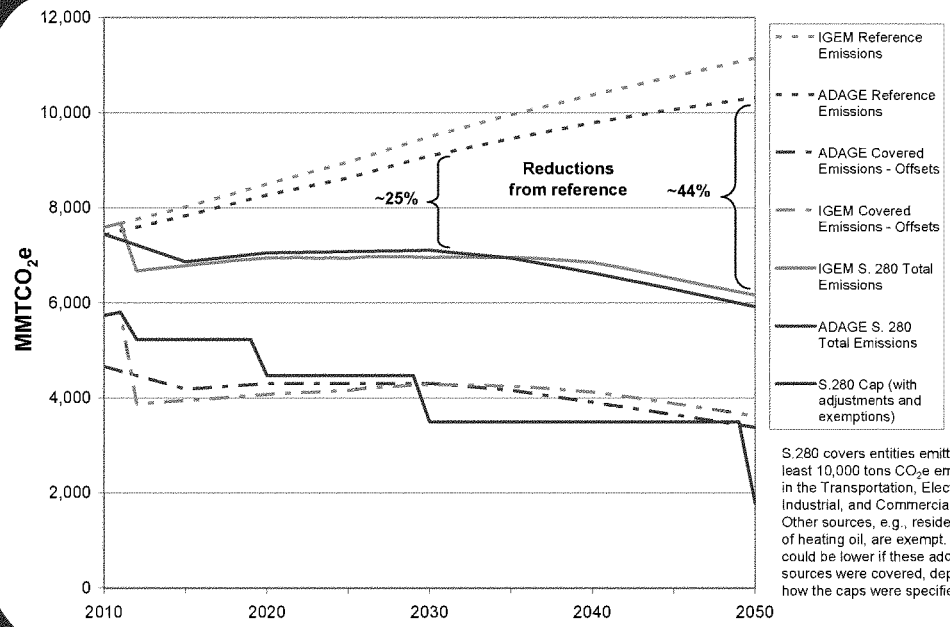




- CO_2 emissions grow at a faster rate than non-CO_2 GHG emissions
- IGEM non-CO_2 emissions are modeled in aggregate; ADAGE non-CO_2 emissions are modeled by type of gas

Results: S. 280 Senate Scenario

U.S. GHG Emissions



S.280 covers entities emitting at least 10,000 tons CO_2e emissions/yr in the Transportation, Electricity, Industrial, and Commercial sectors. Other sources, e.g., residential use of heating oil, are exempt. Costs could be lower if these additional sources were covered, depending on how the caps were specified.

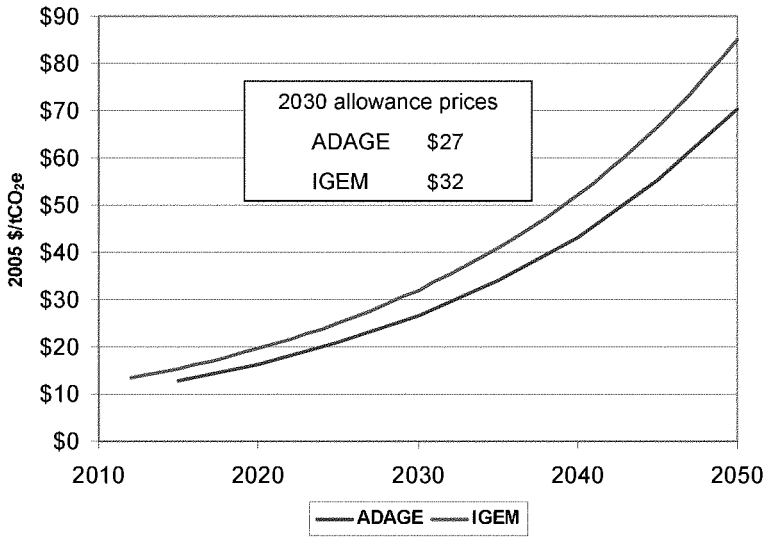
Results: S. 280 Senate Scenario

U.S. GHG Emissions

- The previous chart shows the emissions results of S. 280.
- The two dotted lines at the top are the Reference Scenario emissions of IGEM and ADAGE.
- At the bottom of the chart, the black "stair step" line is the cap on covered sector emissions (note that this cap level is lower than the quantities specified in the bill, as it has been adjusted for uncovered entities).
- The dashed blue and green lines show the emissions of covered sectors, taking into account purchases of offsets and international credits (note that these emissions are equivalent to the total emissions allowed under the cap, but the time path reflects the banking of allowances in the early years, as entities "over comply" to avoid higher allowance prices in later years).
- The solid blue and green lines show total U.S. emissions under S. 280. These levels include emissions from non-covered and exempt entities.
  - In 2030, total U.S. emissions under S. 280 are reduced in IGEM by 2,540 $MMTCO_2e$ from the Reference Scenario (27 percent reduction) and 1,983 $MMTCO_2e$ in ADAGE (22 percent reduction).
  - In 2030, total U.S. emissions under S. 280 are 3% below 2000 levels in IGEM, and 1% below 2000 levels in ADAGE.
  - In 2050, total U.S. emissions under S. 280 are 1% below 1990 levels in IGEM, and 5% below 1990 levels in ADAGE.
- S. 280 results in reductions of non-U.S. GHG emissions through U.S. purchases of international credits, so the bill actually reduces global GHG emissions by more than the solid blue and green lines indicate. The bill results in the purchase of 596 $MMTCO_2e$ of international credits in 2030, which is approximately six percent of the U.S. Reference Scenario emissions.

Results: S. 280 Senate Scenario

GHG Allowance Prices



- The $27 - 30 range of 2030 allowance prices only reflects differences in the models and does not reflect other scenarios or additional uncertainties discussed elsewhere.

Comparison with Other Analyses

- The recent MIT report, "Assessment of U.S. Cap-and-Trade Proposals" analyzed several scenarios, none of which directly corresponded to S. 280.
- For comparison, we ran one of the MIT scenarios (203 bmt) with the ADAGE model.
- For the 203 bmt scenario, the MIT analysis gave an allowance price of $41 in 2015 rising at 4%, while the ADAGE model gave a price of $40 in 2015 rising at 5%.

Results: S. 280 Senate Scenario

GHG Allowance Prices

- The previous chart shows the allowance prices from ADAGE and IGEM under S. 280.
- The allowance price is equal to the marginal cost of abatement in the U.S.
- S. 280 allows the banking of allowances, as a result the allowance prices in both models grow at the exogenously set 5% interest rate.
  - If instead the allowance price were rising faster than the interest rate, firms would have an incentive to increase abatement in order to hold onto their allowances, which would be earning a return better than the market interest rate. This would have the effect of increasing allowance prices in the present, and decreasing allowance prices in the future. Conversely, if the allowance price were rising slower than the interest rate, firms would have an incentive to draw down their bank of allowances, and use the money that would have been spent on abatement for alternative investments that earn the market rate of return. This behavior would decrease prices in the present and increase prices in the future. Because of these arbitrage opportunities, the allowance price is expected to rise at the interest rate.
- The terminal year for banking is assumed to be 2050 in this analysis. If later terminal year for banking was used instead, or if the terminal year for banking was endogenously determined, the allowance prices and costs of the policy would be higher, as a non-zero bank of emissions in 2050 would imply greater total emissions reductions.
  - A terminal ear for banking of 2050 ensures that the cumulative covered emissions less offsets over the time period from 2012 – 2050 are equal to the cumulative emissions allowed under the cap. An assumption about the terminal year for banking is required for the models used in this analysis, and the assumption of 2050 is consistent with the time horizon of the models. If the terminal year for banking were not fixed, we would expect an increase in the allowance price beginning in 2012, so that in whichever year the bank of allowances is exhausted, the allowance price would not have to increase more than the usual 5% in order to meet the cap. The 2050 terminal year for banking used in this analysis is consistent with the treatment of banking through 2050 in the recent MIT report, "Assessment of U.S. Cap-and-Trade Proposals".
- IGEM runs in annual time steps, so the policy is implemented in 2012. ADAGE runs in 5 year time steps, so the policy is implemented in 2015.
- Note that the range of allowance price presented here simply represents the results of the two models and should not be interpreted as a confidence interval.

Scenario Comparison

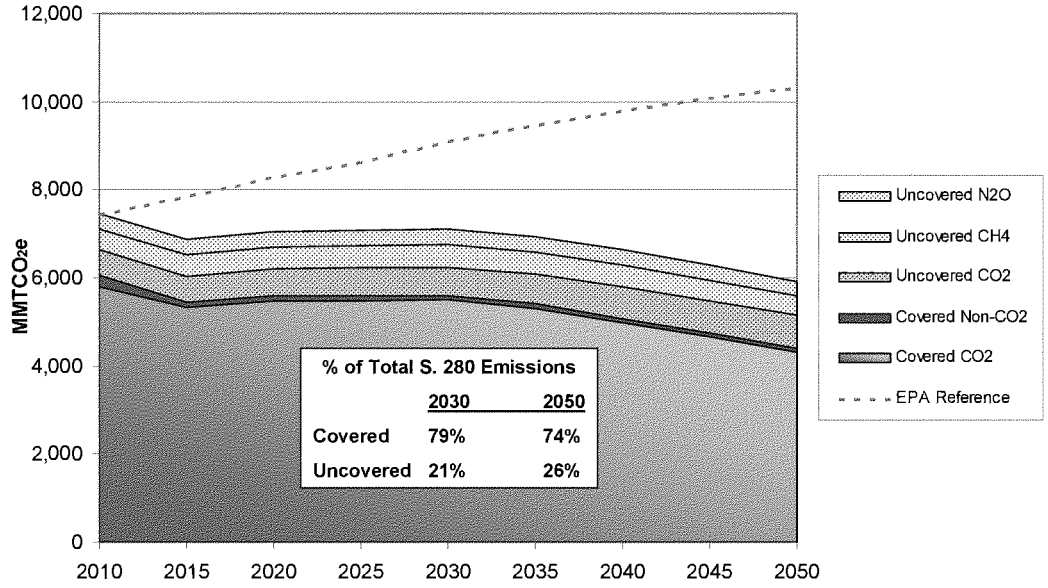
GHG Allowance Prices

Table: Allowance Price Comparisons (2005 $/tCO2e)

	2015	2020	2025	2030	2035	2040	2045	2050
2) S. 280 Senate Scenario								
ADAGE	$13	$16	$21	$27	$34	$43	$55	$70
IGEM	$15	$20	$25	$32	$41	$52	$67	$85
3) S. 280 Scenario with Low International Actions								
ADAGE	$13	$16	$21	$27	$34	$43	$55	$70
IGEM	$15	$20	$25	$32	$41	$52	$67	$85
4) S. 280 Scenario Allowing Unlimited Offsets								
ADAGE								
IGEM	$10	$13	$16	$21	$26	$34	$43	$55
5) S. 280 Scenario with No Offsets								
ADAGE								
IGEM	$40	$51	$65	$82	$105	$134	$171	$219
6) S. 280 Scenario with Lower Nuclear Power Generation								
ADAGE	$14	$17	$22	$28	$36	$46	$58	$74
IGEM								
7) S. 280 Scenario with No Carbon, Capture & Storage Technology								
ADAGE	$19	$25	$31	$40	$51	$65	$83	$105
IGEM								

Results: S. 280 Senate Scenario

Total U.S. GHG Emissions (ADAGE)

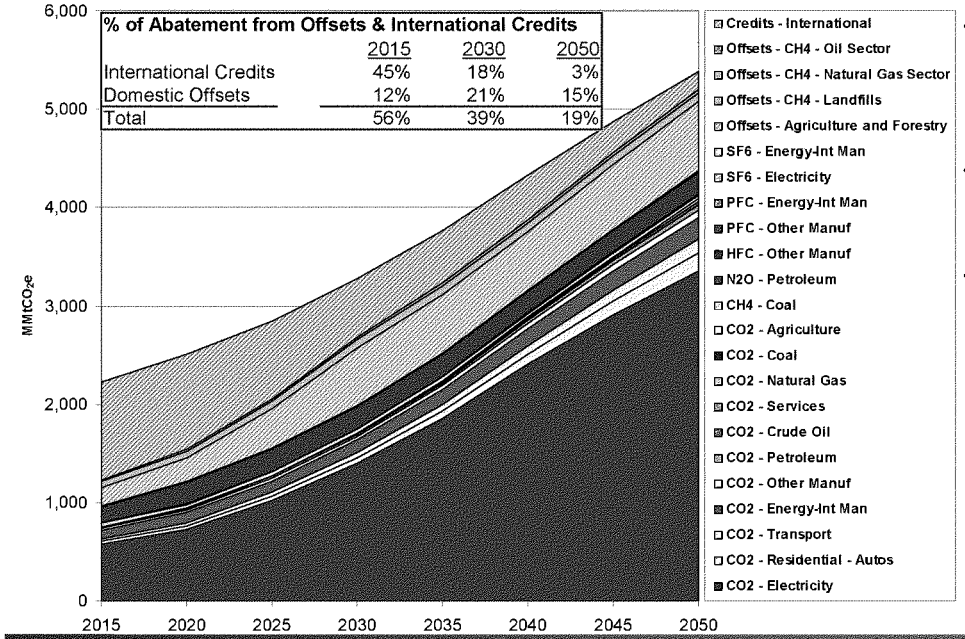


% of Total S. 280 Emissions

	2030	2050
Covered	79%	74%
Uncovered	21%	26%

Results: S. 280 Senate Scenario

Sources of GHG Abatement (ADAGE)



% of Abatement from Offsets & International Credits

	2015	2030	2050
International Credits	45%	18%	3%
Domestic Offsets	12%	21%	15%
Total	56%	39%	19%

- S. 280 allows offsets and international credits to make up 30% of the total allowance submissions requirement.
- The quantity of offsets allowed decreases as allowance submissions decrease.
- Since the quantity of offsets allowed is decreasing over time and the quantity of abatement is increasing over time, offsets make up a large fraction of abatement in the early years of the policy, and there contribution to total abatement decreases over time.

Results: S. 280 Senate Scenario

Sources of GHG Abatement (ADAGE)

- The previous chart shows the sources by sector of GHG abatement under S. 280.
- CO_2 emissions from the electricity sector (the blue area at the bottom) represent the largest source of domestic reductions.
- The area toward the top of the chart shaded with hashed lines show emissions reductions from non-covered sectors (offsets) and international credits.
- International credits (the hashed area at the very top) are the largest source of abatement in 2012, but decrease in absolute and percent terms through time as the rising price of offsets increase the domestic supply of offsets, which displace the demand for international credits.
- Among domestic offsets, the agricultural and forestry sector (the yellow hashed area) supplies the most abatement, and this supply increases through time.
- Commercial transportation and personal vehicles ("residential autos") are represented by the solid light blue and green areas above the electricity sector. Note that ADAGE does not explicitly model new developments in transportation technologies – these reductions occur in the model due to the price changes resulting from the imposition of the upstream cap on emissions from the petroleum sector.
- Since the electricity sector plays a key role in GHG abatement and the CGE models have a limited representation of technology, we used the IPM model to examine the electricity sector in more detail through 2025.

Detailed Near-Term Electricity Sector Modeling Results

Detailed Electricity Sector Modeling with IPM

Motivation for Using IPM:

- The CGE models used for this analysis do not have detailed technology representations; they are better suited for capturing long-run equilibrium responses than near-term responses.
- Since the electricity sector plays a key role in GHG mitigation, and the near-term response in the electricity sector is of particular interest, we have employed the Integrated Planning Model (IPM) model to shed further light on the near-term impact of S. 280 on the electricity sector as a complement to the broader picture presented by the CGE models.

Power Sector Modeling (IPM v3.01):

- IPM is a detailed, least-cost power plant dispatch and emissions forecasting model used by EPA. The model assumptions incorporate the best available information and undergo stakeholder comment.
- This version builds off recently released EPA Base Case v3.0 using IPM, w/ the following updates for purposes of modeling carbon policies:
  - Carbon capture and storage (for new and existing plants)
  - Biomass co-firing retrofit option
  - Constraints on new nuclear and renewable capacity builds

Modeling Approach:

For this analysis, EPA's Base Case v3.01 using IPM was used and incorporated two sets of data from the ADAGE model:

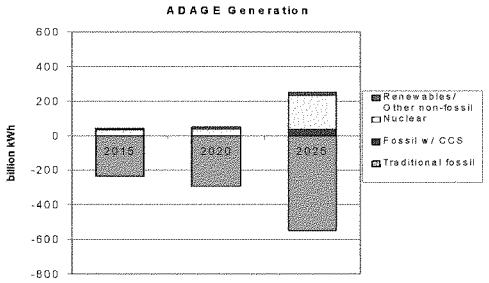
- CO_2 allowance price projections
- Percent change in electricity demand

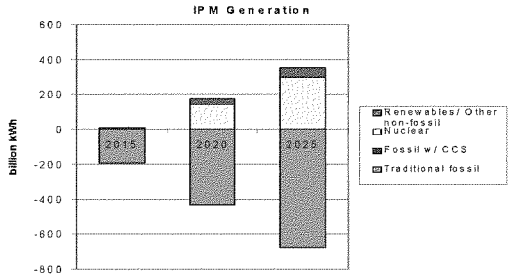
Key Insights from IPM Results for the Near Term

- The reduced demand levels provided by ADAGE produce the largest share of reductions in the early years.
- GHG allowance prices (at the projected levels of S. 280) will not be high enough to justify significant penetration of carbon capture and storage technology (CCS) in the near-term; however, the carbon price incurred by various emitting technologies (e.g., coal) makes new nuclear plants more economic to build.
- S. 280 does not impact overall emissions of conventional pollutants (SO_2, NOx, and Hg) covered by existing cap and trade programs (because of the existence of a cap), but can change the timing of emission reductions.
- Allowance allocation methodology can impact retail electricity prices (and thus the magnitude of demand-side response).
  - In 2025 electricity prices increase between 10 and 16 percent depending upon the allowance allocation methodology.
- In the near-term, most existing conventional coal plants continue to operate at the projected allowance prices of S. 280, although they will be less profitable and some less efficient plants do retire (about 2.2% of existing capacity).

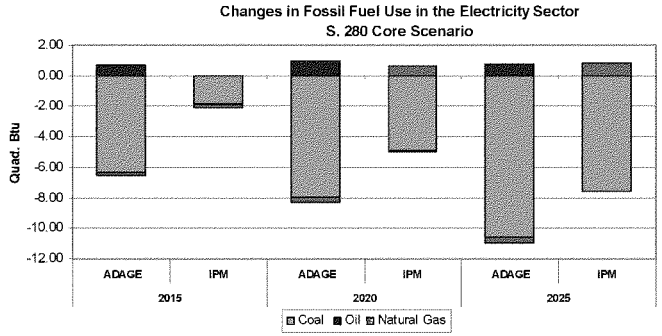
Change in generation in IPM and ADAGE is similar in 2015 through 2025

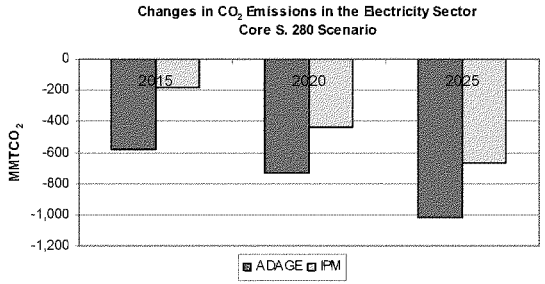
- In 2015 decreased demand in fossil fuel use compared to the reference case is consistent with the decrease in overall electricity demand.
- In 2020, projected decreased fossil fuel use from the IPM run results from a combination of both decreased generation and increased non-fossil generation. In ADAGE, it is more because of decreases in overall generation.
- By 2025, decreased demand in fossil fuel use is due to both decrease in overall electricity demand and increase in non-fossil generation.





Changes in Fossil Fuel Use and CO_2 Emissions



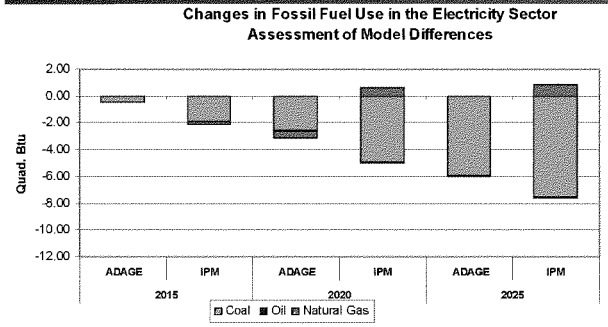


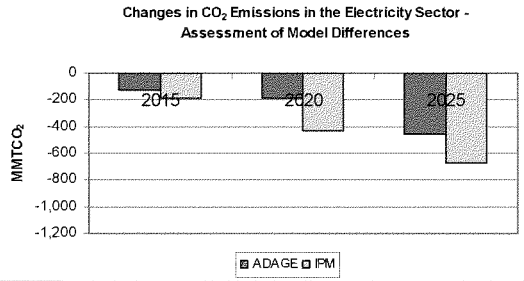
- While IPM has slightly greater reduction in fossil generation, it has less reduction in electricity sector fossil fuel use compared to ADAGE.
- This results in fewer CO_2 reductions in IPM than in the electricity sector in ADAGE.

Changes in Fossil Fuel Use and CO_2 Emissions

- CO_2 changes in ADAGE and IPM are not exact due to differences in:
  - Analysis time frame:
    - In IPM, the electricity sector responds to allowance prices out to 2030.
    - In ADAGE, the electricity sector responds with perfect foresight to allowance prices out to 2050.
  - Model detail, structure, and coverage:
    - IPM is a detailed bottom-up electricity sector model.
    - ADAGE is an economy-wide top-down model that does not model the electricity sector in detail.
  - Modeling technological change, including heat rate improvements:
    - IPM models details of the existing capital structure of the electricity sector, which inhibit quick fuel switching responses and capital turnover.
    - The modeling approach to the electricity sector in ADAGE is based on the MIT EPPA model. The elasticity that allows for efficiency improvements in ADAGE is slightly more flexible than MIT and less flexible than Charles River Associates MRN model.
- Since the IPM and ADAGE models show significantly different near-term CO_2 changes in the electricity sector, we evaluated the effect of this difference on the economy-wide impact of S. 280.

Assessment of Model Differences on Economic Impacts of S. 280



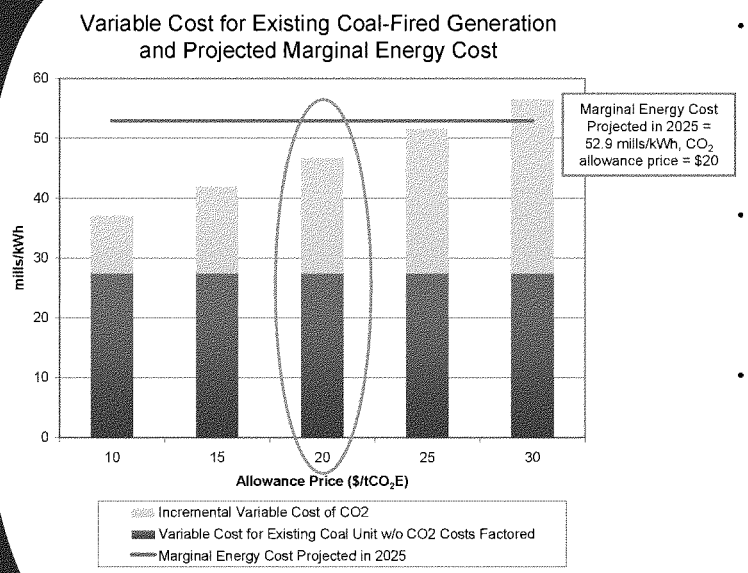


- This assessment provides an estimate of the effect of the differences between IPM and ADAGE on allowance prices.
- The most appropriate way to evaluate the impacts of the model differences, given the CGE structure of ADAGE, was to approximate the near-term IPM electricity sector CO_2 emission abatement in ADAGE.

Results of Assessment

- The resulting allowance price in 2015 was approximately $1.50 higher than in the S. 280 Senate Scenario, and $3 higher in 2030.
- In 2030 the GDP effect is 0.06 percentage points ($16 billion) greater than in the S. 280 Senate Scenario.
- These differences are smaller than the differences between the results of the two CGE models in the S. 280 Senate Scenario.

Near-Term Coal Usage

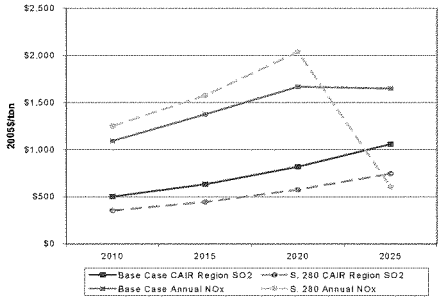


- To illustrate the economics of operating existing coal plants, the chart shows the incremental operating cost of a coal plant when the projected CO_2 allowance prices are included.
- Projected CO_2 allowance prices of roughly $20 ton in 2025 increase variable costs, but these costs are still below the marginal energy costs of producing electricity.
- Although cost of producing electricity form coal would significantly increase, most plants would not retire in the near-term since the variable cost of producing electricity is less than the marginal energy cost.*

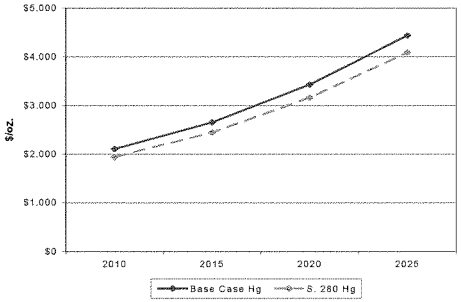
* For this illustrative calculation, EPA used a conservative efficiency metric (11,000 Btu/kWh), at which roughly 85% of existing coal plants currently operate or exceed, by capacity. EPA also assumed that the illustrative existing unit does not have advanced pollution controls for SO_2, NOx, or Hg removal (must purchase allowances), and the unit burns lower-sulfur coal. The marginal energy cost is defined as the cost of production of the most expensive unit operating in that hour. It includes the cost of fuel, variable O&M cost and the cost of environmental allowances.

CAIR and CAMR Allowance Prices Comparison

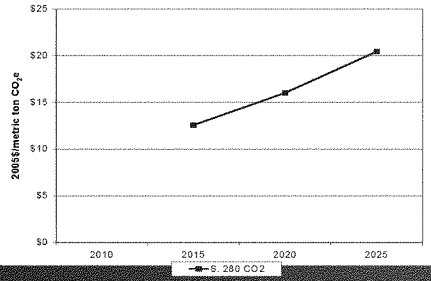
Projected Allowance Price of SO_2 and NOx under CAIR



Projected Allowance Price of Hg under CAMR



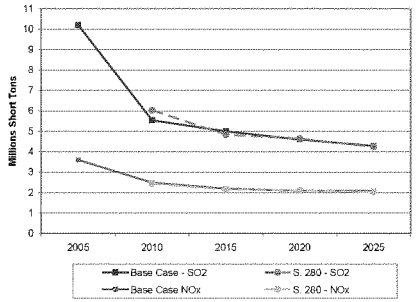
Projected Allowance Price of CO_2 (inputs to IPM)



Note: SO_2 allowance prices are for CAIR affected sources on a $/ton of emissions basis; Title IV allowance prices are not shown separately, but would be a fraction of this amount. The CO_2 allowance price is an input to IPM.

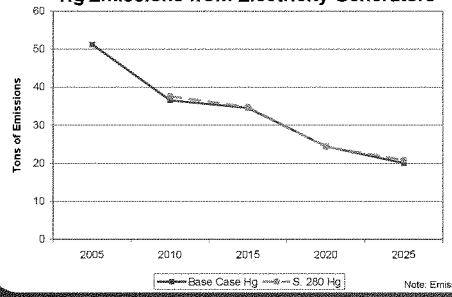
Power Sector Emissions

SO_2 and NOx Emissions from Electricity Generators

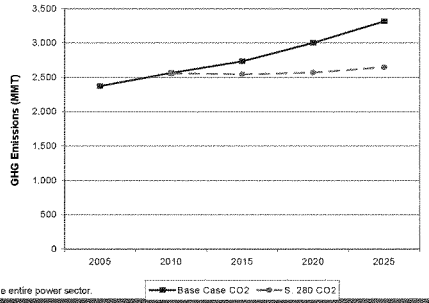


- CO_2 allowance prices projected in S. 280 influence the timing of SO_2 and Mercury emissions because of existing cap and trade programs and emission banking provisions of the CAIR and CAMR programs.

Hg Emissions from Electricity Generators

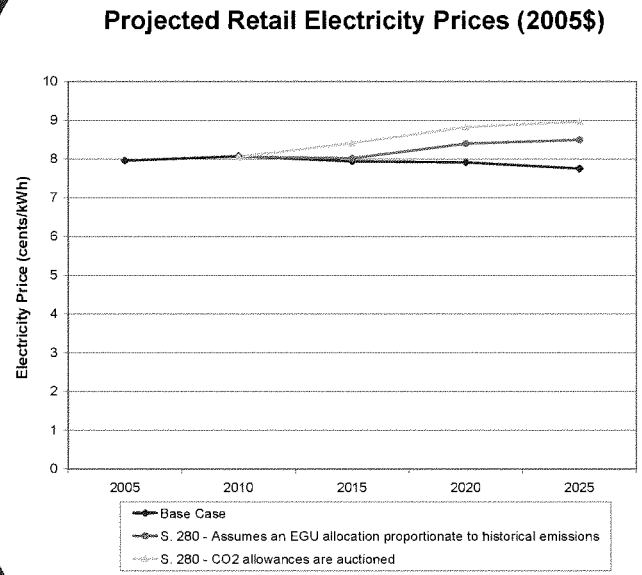


GHG Emissions from Electricity Generators



Note: Emission shown here are for the entire power sector.

Projected Retail Electricity Prices



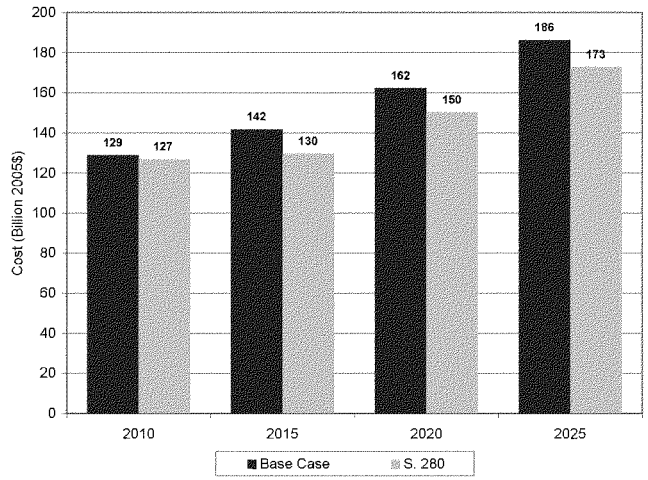
- This slide presents the average national impact. Regional impacts will vary.
- Because regulated utilities generally do not pass through cost of allowances that are allocated, the allocation methodology will have an impact on retail electricity price (and demand response).
- Regions with deregulated electricity markets (which represents about 1/3 of total generation) will see the similar price impacts which will be more similar to an auction, regardless of the allocation methodology.

Notes: 2005 data from EIA. For illustrative purposes, EPA made an assumption as to the allocation for the power sector to demonstrate the effect on retail electricity prices. S. 280 does not specify an allocation methodology.

Generation Costs to Electricity Sector

Total Power Sector Production Cost for Electricity Generation

(does not include cost of allowances or offsets)

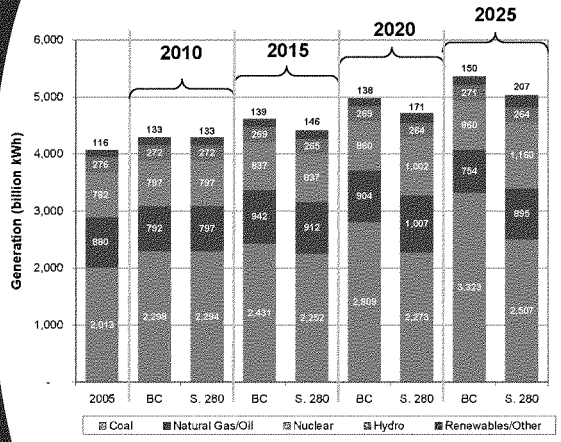


The production cost, as reported in IPM, is the cost of meeting electricity demand and includes the annualized capital costs of new investment decisions (includes control equipment costs and new plant costs), fuel costs, and the total variable and fixed operation and maintenance (O&M) costs of power plants.

- The graphic at left shows a comparison of generation costs for the electricity sector to meet lower demand using different electric generation mix in response to S. 280.
- There will be costs and savings in other segments of the economy that lower electric demand in various ways (e.g., purchase of more efficient appliances).
- There will be shifts in capital investment in generation capacity (e.g., movement from new coal capacity to nuclear).

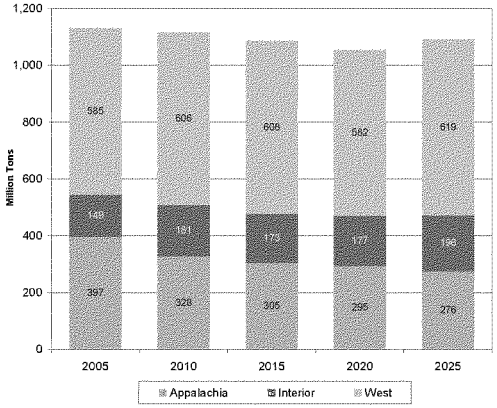
Electricity Generation Mix and Coal Production

Projected Generation Mix in 2010, 2015, 2020, and 2025 with S. 280



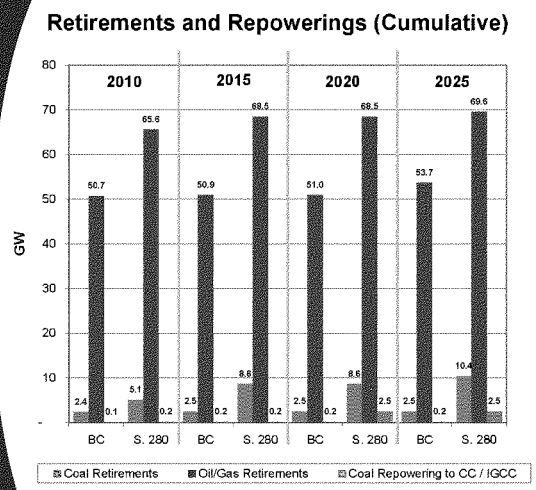
Note: 2005 data from EIA. Electricity demand is an input to IPM. Electricity demand for S. 280 was developed by taking the percent change in electricity demand from EPA's economy-wide model(s) and applying that change to the IPM base case electricity demand.

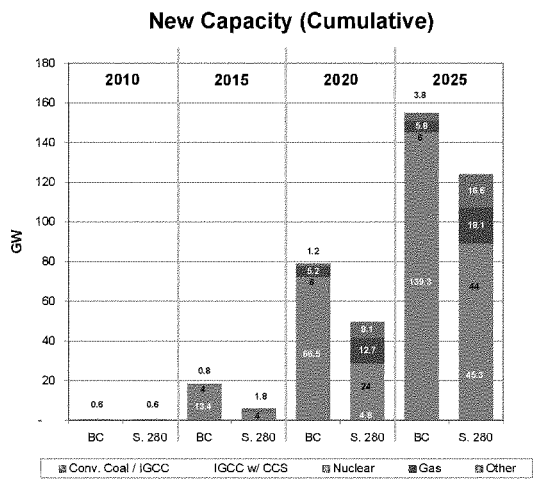
Coal Production for All Sectors (Historical and Projected) with S. 280



Note: 2005 data from EIA.

Retirements, Repowering, and New Capacity





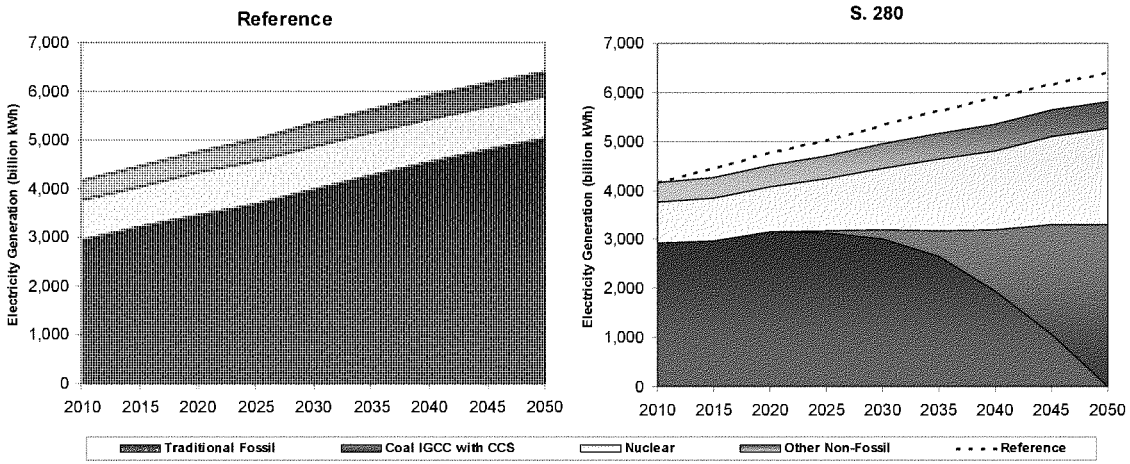
IPM Modeling Limitations

- IPM model timeframe only goes through 2025.
  - Model does not see longer term changes in electricity demand and CO_2 allowance prices (due to lowering of the cap post-2025).
  - This can affect projections for new capacity additions and retrofit decisions in later years.
- The "cost" of demand response as currently implemented is not captured by IPM.
- In this analysis, electricity demand was an input to IPM. Hence, the impacts of likely complementary state and federal policies on other sectors that could affect electricity demand are not modeled.
- EPA's Base Case v3.01 does not incorporate several technological innovations that can become available over time (e.g., ultra-supercritical coal, advanced renewables).
- The recent labor/material shortfalls on future construction prices and the timing of power system adjustments have not been modeled.
- Geographic deployment, cost and performance of CCS is highly uncertain.
- Allowance allocation and auctioning are not fully accounted for in the modeling.
- While IPM endogenously builds new nuclear capacity, the model places an exogenous constraint on the total amount of new nuclear capacity builds. The assumed limitations on new nuclear capacity reflect the recent EPRI analysis "Electricity Technology in a Carbon-Constrained Future".
  - There are non-economic considerations for significant expansion of nuclear power capacity which are not reflected in IPM.

Energy Sector Modeling Results

Results: S. 280 Senate Scenario

U.S. Electricity Generation, mid-term results (ADAGE)



Note: Other non-fossil includes hydro, geothermal, wind, solar, biomass and municipal solid waste.

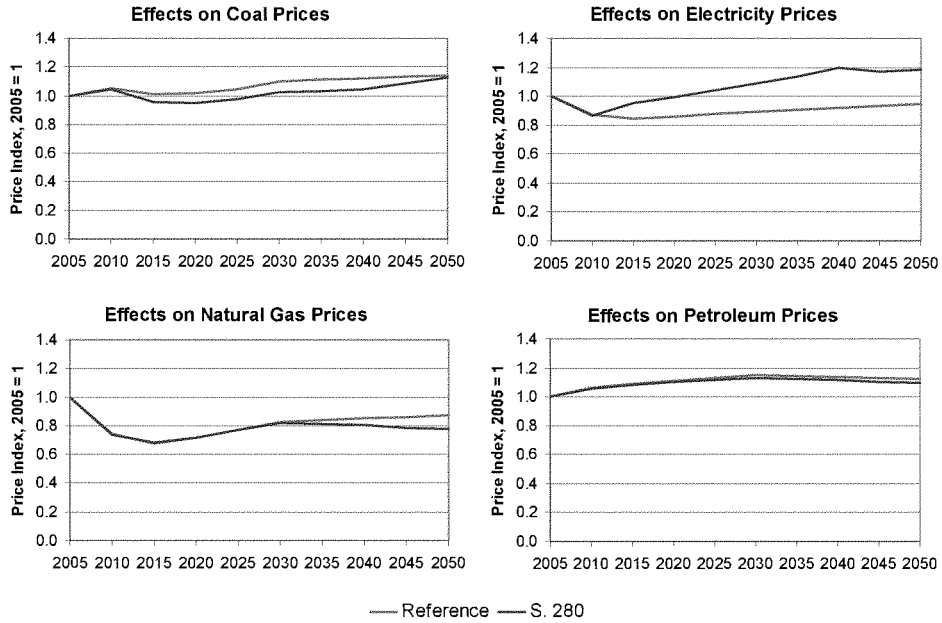
Results: S. 280 Senate Scenario

U.S. Electricity Generation, mid-term results (ADAGE)

- Electricity generation grows at a slower rate under S. 280 due to efficiency gains and reduced consumption.
- Generation technology mix shifts towards non-GHG-emitting technologies such as nuclear and CCS.
- By 2030 advanced coal with CCS begins to deploy and by 2050 CO_2 emissions from all fossil-fuel generated electricity are being captured and stored. This result is similar to the recent MIT report, "Assessment of U.S. Cap-and-Trade Proposals."
- Cost assumptions for transportation and storage of CO_2 are based on the Battelle 2006 report "Carbon Dioxide Capture and Geologic Storage." Capture costs are based on AEO 2006 assumptions.
- Nuclear generation increases by ~150% by 2050 based on exogenous assumptions from the U.S. CCSP Synthesis and Assessment Report 2.1a (MiniCAM Level 1 Scenario), which are consistent with the IPM nuclear assumptions.

Results: S. 280 Senate Scenario

Fuel Prices (ADAGE)



Results: S. 280 Senate Scenario

Fuel Prices (ADAGE)

- The S. 280 electricity price reflects the full allowance price the consumer would face.
- S. 280 electricity prices are 22% higher than in the Reference Scenario in 2030 and 25% higher in 2050, reflecting a shift in fuel mix from coal to gas in the earlier years, the adoption of carbon capture and storage technology in later years, and the increased prices the consumers of coal and gas face due to the price of allowances.
- For coal, natural gas, and petroleum, the price effect of S. 280 before adding in the allowance price is shown. This is the price producers of these fuels would face.
- Coal prices in the S. 280 Senate Scenario are lower than the Reference Scenario by 7% in 2030, reflecting decreased demand for coal in the earlier years as fuel switching to natural gas occurs in response to S. 280. As carbon capture and storage technology deploys from 2030 to 2050, coal prices rise back to the Reference Scenario levels in response to increased coal demand.
- Lower demand for fossil fuel drives petroleum and natural gas prices lower than in the Reference Scenario.

Results: S. 280 Senate Scenario

Fuel Price Adders

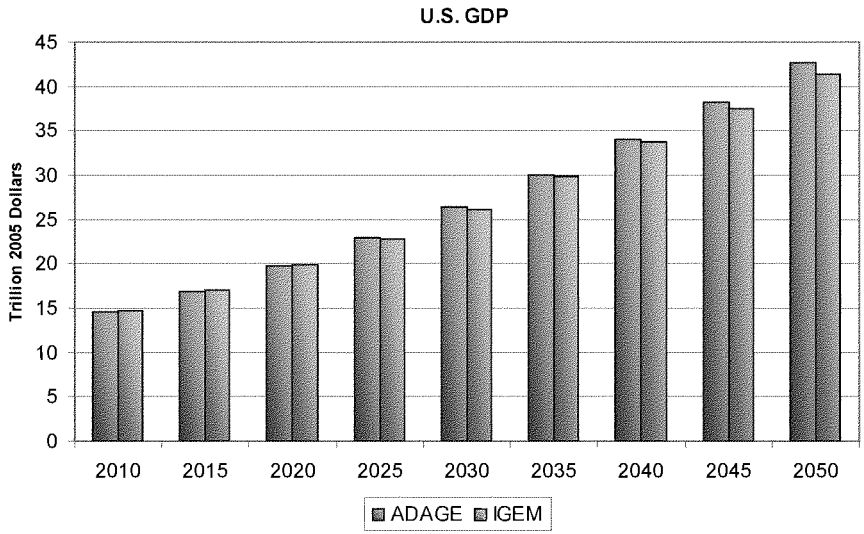
	2005 Price	2030 Producer Price	2030 Cost of Carbon Content	2030 End - User Price
Metric Ton of CO_2	n/a		$29.30 *	
Metric Ton of Carbon	n/a		$107.44	
Barrel of Oil	$50.28	$56.92	$12.54	$69.46
Gallon of Gasoline	$2.34	$2.65	$0.26	$2.91
Short Ton of Coal	$36.79	$37.70	$64.77	$102.47
Short Ton of Coal w/ CCS	$36.79	$37.70	$6.48	$44.18
tCf of Natural Gas	$7.51	$6.16	$1.59	$7.75

* Average of ADAGE and IGEM allowance prices

- The 2030 price is obtained by multiplying the 2030 index price in ADAGE by the 2005 price from EIA's 2006 Monthly Energy Review.
- The cost of carbon content is simply the product of the physical carbon content of the fuel and the allowance price.
- The consumer price is simply the sum of the price and the cost of carbon content.
- CCS technology for coal fired power generation captures and stores 90% of carbon emissions, which lowers the cost of carbon content by 90%, and lower the consumer price accordingly.
- The cost of the carbon content increases the price of gasoline by 9%, increases the price of oil by 20%, increases the price of natural gas by 23%, increases the price of coal by 156%, and increases the price of coal used with CCS by 16%.

Economy-Wide and Sectoral Modeling Results

Results: Reference Scenario

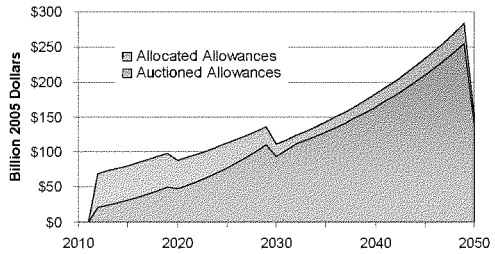


- GDP growth to 2030 is benchmarked to AEO2006
- Average annual GDP growth from 2010 to 2030 is ≈3%.
- Differences in GDP growth in the later years are due to differences in underlying model assumptions

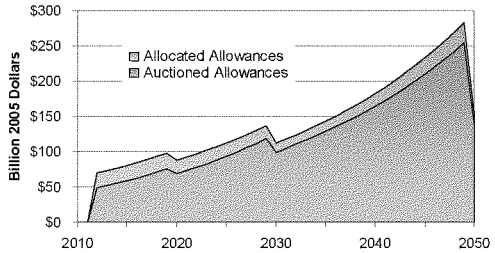
Results: S. 280 Senate Scenario

Value of Allocated and Auctioned Allowances (IGEM)

Case 1



Case 2



- The share of allowances that are to be auctioned versus allocated is not specified in S. 280
- In consultation with Senate staff, EPA ran two cases:
  - Case 1 – the share of allowances that are auctioned starts at 30% in 2012 and increases linearly to 90% over 20 years
  - Case 2 – the share of allowances that are auctioned starts at 70% in 2012 and increases linearly to 90% over 20 years

Value of Allowances (Billion 2005 Dollars)

		2012	2030	2050
Case 1	Allocated	$49	$18	$15
	Auctioned	$21	$94	$137
Case 2	Allocated	$21	$13	$15
	Auctioned	$49	$99	$137

- In IGEM we assume that the policy is deficit and revenue neutral, which implies that the market outcomes are invariant to the auction / allocation spilt
  - Private sector revenues from allocated allowances accrue to employee-shareholder households, and the government adjusts taxes lump sum to maintain deficit and spending levels.
  - Allowance auction revenues flow to the U.S. government, and are redistributed to households lump sum to the extent that deficit and spending levels are maintained. If auction revenues were directed to special funds instead of returned directly to households as modeled, the impact on household annual consumption and GDP would be greater. If the auction revenues were instead used to lower distortionary taxes, the costs of the policy would be lower.
- In IPM the auction / allocation split affects market outcomes because regulated electric utilities, which are explicitly modeled, are allowed to pass on the cost of auctioned allowances to consumers, but are not allowed to pass on the cost of allocated allowances.

Results: S. 280 Senate Scenario

GDP

Table: **Impact of S. 280 on U.S. GDP (Billion 2005 Dollars)**

	2010	2020	2030	2040	2050	Average Annual Growth (2010 - 2050)
Reference						
ADAGE	$14,609	$19,821	$26,452	$33,979	$42,723	2.72%
IGEM	$14,733	$19,851	$26,173	$33,716	$41,372	2.61%
S.280						
ADAGE	$14,606	$19,749	$26,306	$33,750	$42,266	2.69%
IGEM	$14,678	$19,645	$25,754	$32,937	$40,040	2.54%
Absolute Change						
ADAGE	-$3	-$72	-$146	-$229	-$457	*-0.03 Percentage Points*
IGEM	-$55	-$206	-$419	-$779	-$1,332	*-0.07 Percentage Points*
% Change						
ADAGE	-0.02%	-0.36%	-0.55%	-0.67%	-1.07%	
IGEM	-0.37%	-1.04%	-1.60%	-2.31%	-3.22%	

Results: S. 280 Senate Scenario

Consumption

Table: **Impact of S. 280 on U.S. Consumption (Billion 2005 Dollars)**

	2010	2020	2030	2040	2050	Average Annual Growth (2010 - 2050)
Reference						
ADAGE	$10,791	$14,644	$19,722	$25,346	$31,878	2.75%
IGEM	$9,222	$12,346	$16,231	$20,921	$25,838	2.61%
S.280						
ADAGE	$10,834	$14,630	$19,647	$25,174	$31,571	2.71%
IGEM	$9,236	$12,315	$16,138	$20,725	$25,486	2.57%
Absolute Change						
ADAGE	$43	-$14	-$75	-$172	-$306	*-0.04 Percentage Points*
IGEM	$14	-$31	-$93	-$197	-$351	*-0.04 Percentage Points*
% Change						
ADAGE	0.40%	-0.10%	-0.38%	-0.68%	-0.96%	
IGEM	0.15%	-0.25%	-0.57%	-0.94%	-1.36%	
Annual Change per Household (2005 Dolllars)						
ADAGE	$331	-$100	-$489	-$1,067	-$1,822	
IGEM	$115	-$230	-$625	-$1,211	-$1,990	

Results: S. 280 Senate Scenario

2030 Selected Sectoral Results (IGEM)

Sector	2007	2030				
		Reference		S. 280		
	Output ($Billions)	Output ($Billions)	Percent Change from 2007	Output ($Billions)	Percent Change from 2007	Percent Change from Reference
Personal and business services	4304	8108	88%	8088	88%	0%
Finance, insurance and real estate	2642	6075	130%	6038	129%	-1%
Transportation and warehousing	681	1284	89%	1257	85%	-2%
Food and kindred products	565	1155	104%	1183	109%	2%
Motor vehicles	513	1095	114%	1063	107%	-3%
Electric utilities (services)	384	548	43%	499	30%	-9%
Petroleum refining	296	389	31%	344	16%	-11%
Gas utilities (services)	51	60	20%	56	11%	-8%
Coal mining	29	40	39%	25	-13%	-37%

- Detailed near-term electricity sector modeling in IPM indicates that the decrease in coal usage may be smaller than the decrease shown in the economy-wide models.
- The results for all 35 sectors and for 2050 are available in Appendix 2.

Results: S.280 Senate Scenario

2030 Selected Sectoral Results (IGEM)

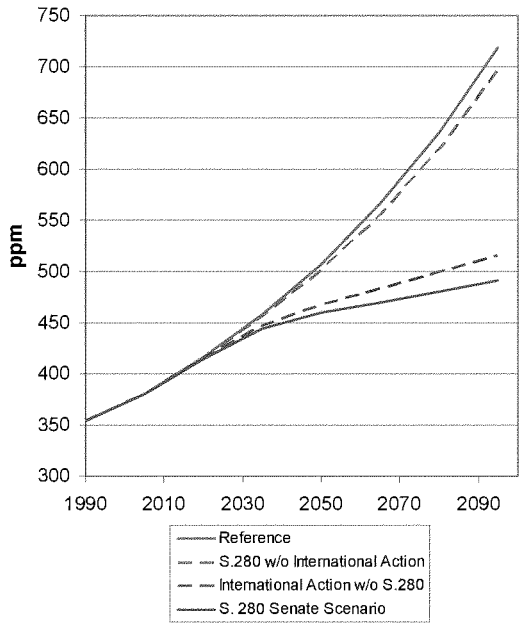
- The previous slide shows the impacts of S.280 on the value of output of nine of the 35 IGEM sectors. These sectors correspond roughly to the two digit NAICS classification. (Results for the remaining sectors are presented in the appendix).
- The largest sectors in IGEM (personal and business services and finance, insurance and real estate) account for some fourteen trillion dollars of economic activity in 2030 and are only modestly affected by the policy.
- Transportation (freight and warehousing) and motor vehicle manufacturing do experience reductions in the value of their output, as consumers and other sectors substitute away from energy consumption. The model does not explicitly represent technology, and does not show the possible impact of new transportation technologies.
- In response to S. 280, the food and kindred products sector is an example in IGEM of a sector which experiences a growth in demand, as consumers substitute away from other goods which may be more energy intensive.
- The energy production and transformation sectors experience reduction in output as other industries and consumers substitute capital, labor, and non-energy inputs.[1]

[1] Note that the coal industry shows large declines in output by 2030. Most domestic coal is consumed by the electricity sector, and IGEM does not explicitly represent generation technologies such as carbon capture and sequestration. The ADAGE model does represent generation technologies, and also shows that coal output decreases by 2030, but after 2030, all fossil generation is eventually replaced by coal fired integrated combined cycle and gasification plants with carbon capture and sequestration technologies, and coal output increases. See slide in Appendix on Primary Energy Use from ADAGE.

Global Results:
CO_2 Concentrations
and International GHG Market

Results: S. 280 Senate Scenario

Global CO_2 Concentration (MiniCAM)



S. 280 Senate Scenario

- USA adopts S. 280.
- Group 1 countries (Kyoto group less Russia) follow an allowance path that is falling gradually from the simulated Kyoto emissions levels in 2012 to 50% below 1990 in 2050.
- Group 2 countries (rest of world) adopt a policy beginning in 2025 that returns and holds them at year 2015 emissions levels through 2034, and then returns and maintains them at 2000 emissions levels from 2035 to 2050.
- After 2050, all countries hold emissions caps constant at 2050 levels.

CO_2 Concentration Results

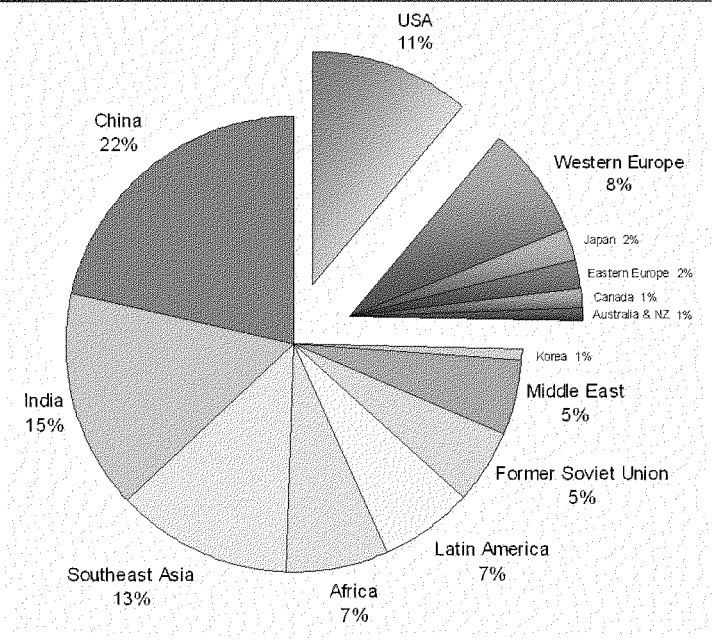
- In the reference scenario, Global CO_2 concentrations rise from historical levels of 354 parts per million (ppm) in 1990 to 718 ppm in 2095
- In the Senate scenario, CO_2 concentrations are 481 ppm in 2095.
- While CO_2 concentrations are significantly reduced in the Senate scenario, they are not on a stabilization trajectory.

Incremental Effect of S. 280

- If the U.S. adopts S. 280 and no other countries adopt emissions caps, then CO_2 concentrations in 2095 are 23 ppm lower than the reference scenario.
- If the U.S. does not cap emissions, and all other countries take on the targets from the Senate scenario, then CO_2 concentrations in 2095 are 25 ppm higher than the Senate scenario.
- The larger incremental effect when the U.S. acts alone is, in part, due to the fact that the U.S. is able to achieve more of its carbon-equivalent emissions reductions through non-CO_2 greenhouse gas abatement.
- This is counterbalanced by a smaller marginal effect on ocean uptake from the U.S. emissions reductions when the U.S. acts alone.

Results: S. 280 Senate Scenario

Share of Cumulative GHG Abatement in the 21st Century (MiniCAM)

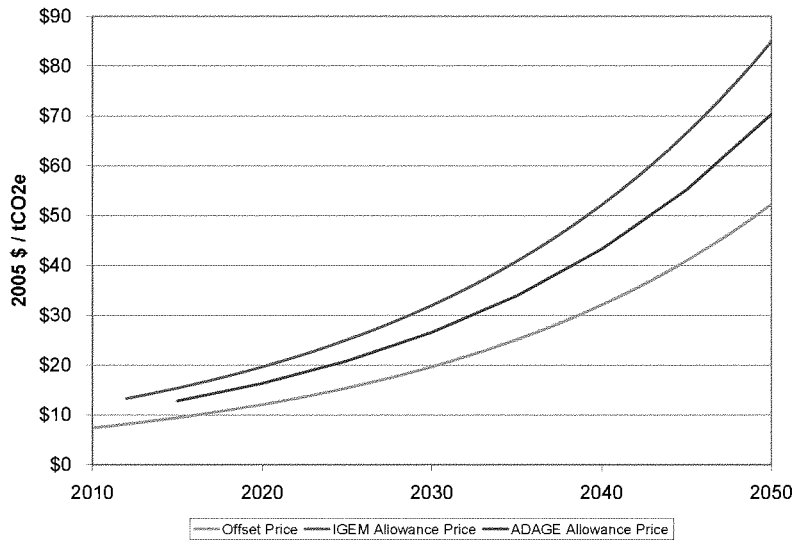


- Abatement is determined by the cap levels set in each country, so abatement associated with the purchase of international credits is attributed to the country that purchases the credits to meet its cap, not the country that sells the credits.
- US abatement from the implementation of S. 280 through the end of the century makes up 11% of global GHG emissions abatement.
- All Group 1 countries combined account for 14% of cumulative abatement over the century.
- Group 2 countries make up 75% of cumulative abatement.

Share of 21st Century Reference GHG Emissions	
USA	13%
Group 1	16%
Group 2	71%

Results: S. 280 Senate Scenario

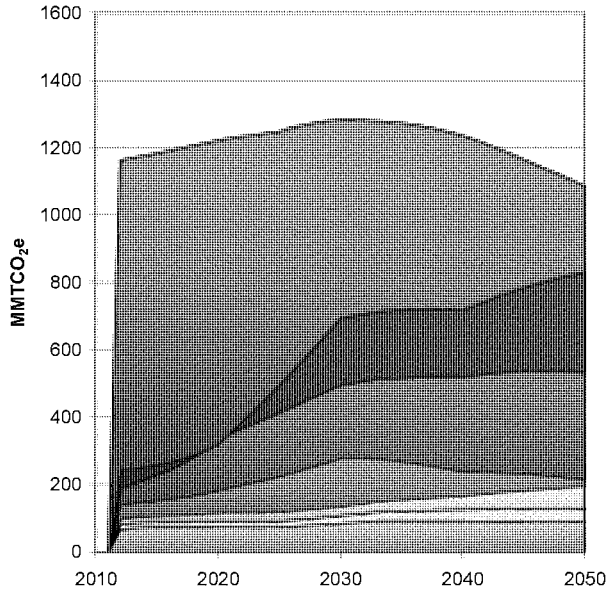
Market Clearing Offset / International Allowance Price



- Offset sources include:
  1. Tradable allowances from another nation's market in greenhouse gas emissions;
  2. A registered net increase in sequestration;
  3. Registered greenhouse gas emissions reductions by non-covered entities;
  4. Certified emissions reductions resulting from project activities in developing countries.
- Since offset sources include internationally traded allowances, there will be a single world price that clears the market for offsets and international credits.
- Since the offset price is always lower than the allowance price, the 30% limit on offsets is a binding constraint.

Results: S. 280 Senate Scenario

Sources of Offsets

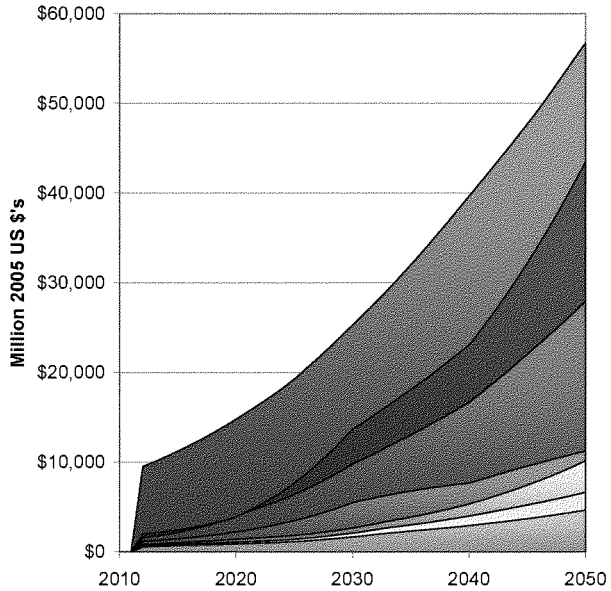


Note: CH_4 from coal mining and F-gases are capped.

- International credits are assumed in this analysis to be purchased only after the supply of domestic offsets at the market clearing price is exhausted.
- Initially, international credits make up the majority of offsets, as the domestic supply is limited.
- As the offset price rises, the domestic supply of offsets increases, and international credits make up a smaller share of offsets.
- 1.5% of allowance submissions are required to come from domestic agriculture soil sequestration.
- From 2019 – 2043 agriculture soil sequestration accounts for over 1.5% of allowance submissions.
- Outside of this time frame, a separate and higher price would emerge for agriculture soil sequestration in order to meet the 1.5% requirement.

Results: S. 280 Senate Scenario

Offset Payments



Note: CH_4 from coal mining and F-gases are capped.

- Total payments for offsets are approximately $25 billion dollars in 2030, and $57 billion dollars in 2050.
- Since the quantity of international credits is falling over time while the price is rising, the value of the payments for international offsets remains relatively constant, ranging between $8 billion dollars in 2012 and $16 billion dollars in 2040.
- Payments to domestic sources of offsets rise dramatically over time as both the quantity and price are increasing

Results: S. 280 Senate Scenario

Total Abatement Costs

Table: **Abatement Cost Calculations**

	2015	2020	2025	2030	2035	2040	2045	2050
Domestic Covered Abatement (MMTCO2e)								
ADAGE	969	1,217	1,553	1,986	2,514	3,156	3,776	4,369
IGEM	971	1,230	1,524	1,845	2,282	2,802	3,460	4,150
Domestic Offset Abatement (MMTCO2e)								
ADAGE	259	322	498	695	720	719	796	832
IGEM	259	322	498	695	720	719	796	832
International Credits (MMTCO2e)								
ADAGE	996	968	793	596	528	453	298	182
IGEM	924	900	749	588	553	517	369	253
Allowance Price ($/tCO2e)								
ADAGE	$13	$16	$21	$27	$34	$43	$55	$70
IGEM	$15	$20	$25	$32	$41	$52	$67	$85
Offset Price ($/tCO2e)								
ADAGE	$9	$12	$15	$20	$25	$32	$41	$52
IGEM	$9	$12	$15	$20	$25	$32	$41	$52
Domestic Covered Abatement Cost (Billion 2005 Dollars)								
ADAGE	$6	$10	$18	$26	$43	$68	$104	$154
IGEM	$7	$12	$19	$30	$47	$73	$115	$176
Domestic Offset Abatement Cost (Billion 2005 Dollars)								
ADAGE	$1	$2	$4	$7	$9	$12	$16	$22
IGEM	$1	$2	$4	$7	$9	$12	$16	$22
International Credit Payments (Billion 2005 Dollars)								
ADAGE	$9	$12	$12	$12	$13	$15	$12	$10
IGEM	$9	$11	$12	$12	$14	$17	$15	$13
Total Abatement Cost (Billion 2005 Dollars)								
ADAGE	$17	$24	$32	$45	$65	$94	$133	$185
IGEM	$17	$25	$35	$48	$70	$101	$147	$211

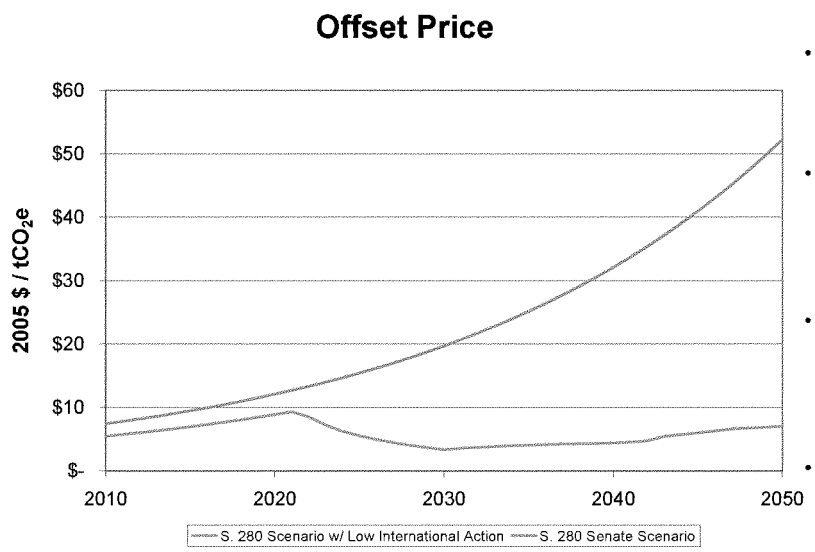
Results: S. 280 Senate Scenario

Total Abatement Costs

- The allowance price is equal to the marginal cost of abatement by covered entities in covered sectors in the U.S.
- The offset price is the marginal cost of abatement internationally and for uncovered sectors and entities in the U.S.
- Domestic covered abatement cost is approximated for each model as the product of domestic covered GHG emissions abatement and the allowance price divided by two.
  - Division by 2 is assumed to represent the fact that most reduction measures are not implemented at the S. 280 marginal allowance price but at lower prices. In most cases, the relationship between emission reduction and the marginal price is a concave curve – which implies a value larger than 2. The value of 2, used here for simplicity leads to an overestimation of abatement costs.
- Domestic offset abatement cost is approximated for each model as the product of domestic offset abatement and the offset price divided by two.
- International credit payments are calculated for each model as the product of the amount of international credits purchased and the offset price (which is equal to the price of international allowances).
  - Unlike the abatement costs associated with domestic covered abatement and domestic offsets, there is no need for dividing by two when calculating the costs of international credits as all international credits are purchased at the full price of international allowances and those payments are sent abroad.
- Total abatement cost is simply the sum of domestic covered abatement cost, domestic offset abatement cost, and payments for international credits.

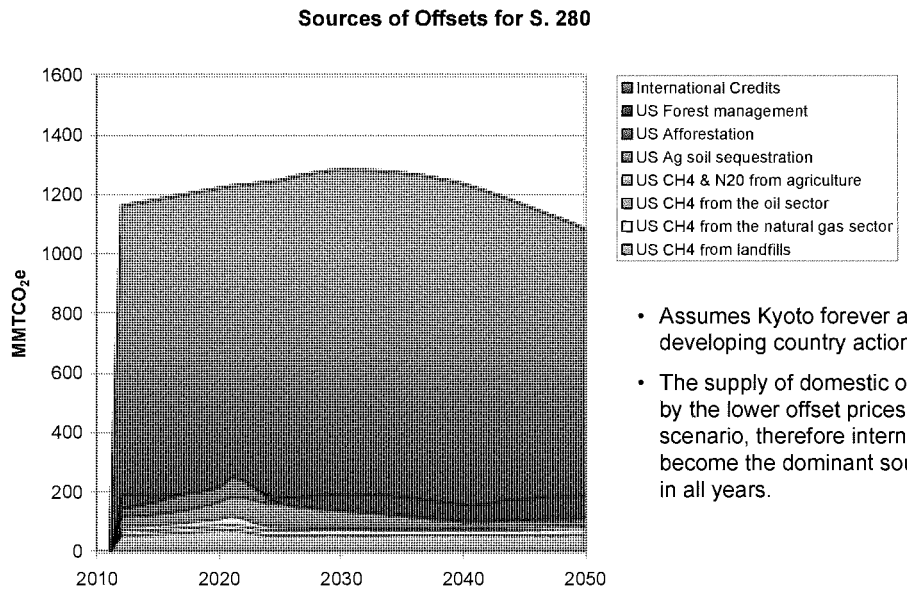
Appendix 1: Additional Scenarios

Results: Additional Scenarios
(3) Low International Action



- Assumes Kyoto forever and no developing country action.
- Since the international demand for abatement is so much lower, the price of offsets is much lower.
- The price does not rise at the 5% interest rate over the entire time frame because while banking is allowed, borrowing is not.
- Since the 30% limit on offsets still applies, the marginal price of abatement remains the same, and thus the allowance price is unaffected.
- The GDP impact will be slightly smaller than in the Senate scenario due to the lower cost of offsets and international credits.

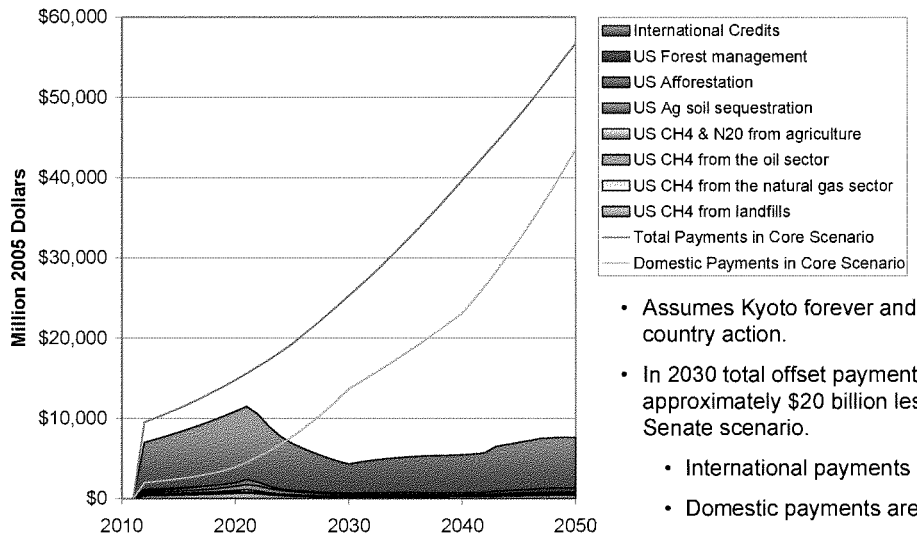
Results: Additional Scenarios
(3) Low International Action



- Assumes Kyoto forever and no developing country action.
- The supply of domestic offsets is limited by the lower offset prices in this scenario, therefore international credits become the dominant source of offsets in all years.

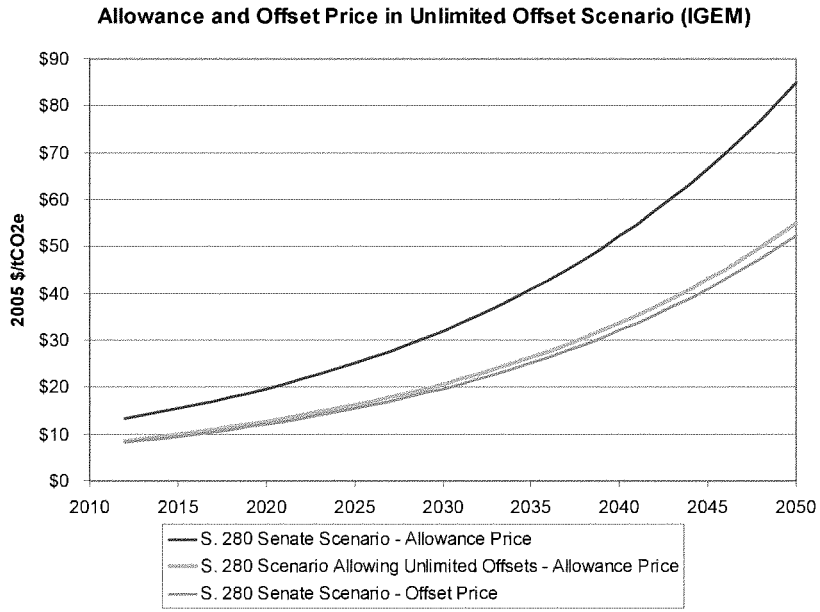
Results: Additional Scenarios
(3) Low International Action

Offset Payments



- Assumes Kyoto forever and no developing country action.
- In 2030 total offset payments are approximately $20 billion less than in the Senate scenario.
  - International payments are $8 billion less.
  - Domestic payments are $12 billion less.

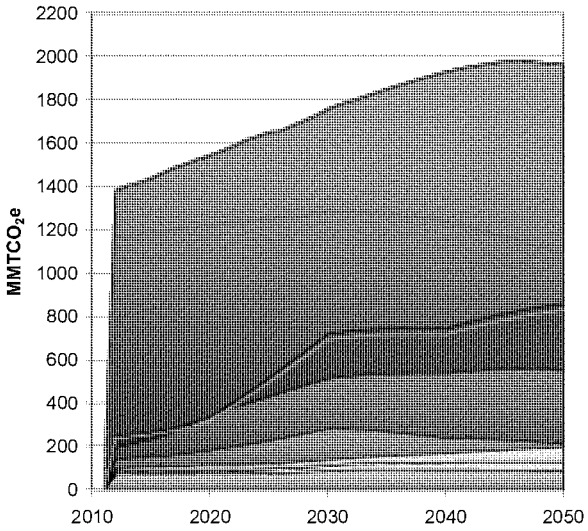
Results: Additional Scenarios
(4) Unlimited Offsets



- Assumes no limits are placed on the usage of domestic offsets and international credits.
- Instead of separate allowance and offset prices as we saw in the Senate scenario, there is a single world price.
- The small increase in world demand for abatement associated with the increased demand from the U.S. results in a small increase in the world price.
- Domestically, allowing unlimited offsets reduces the allowance price by 35%.

Results: Additional Scenarios
(4) Unlimited Offsets

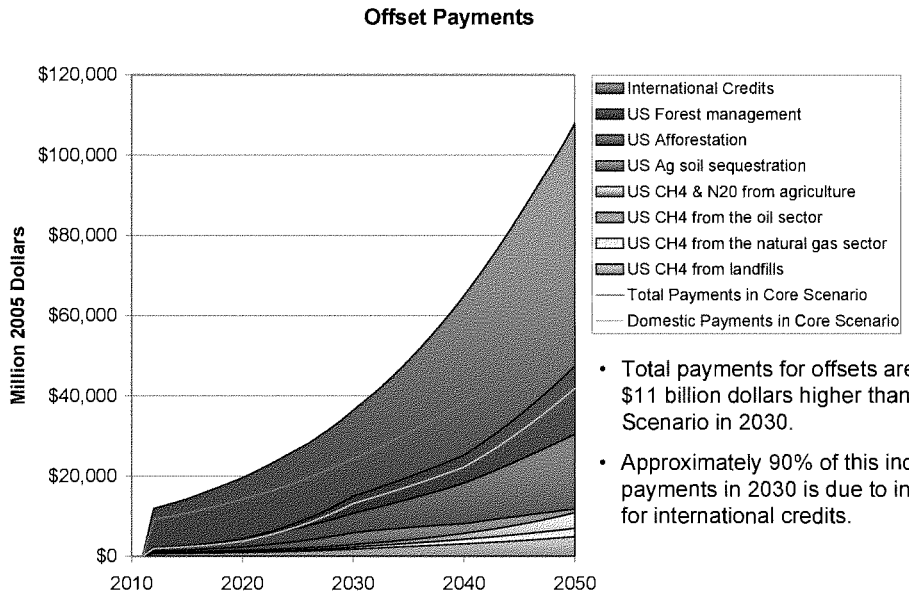
Sources of Offsets for S. 280



- International Credits
- US Forest management
- US Afforestation
- US Ag soil sequestration
- US CH4 & N20 from agriculture
- US CH4 from the oil sector
- US CH4 from the natural gas sector
- US CH4 from landfills
- Total Offsets - Core Scenario
- Domestic Offsets - Core Scenario

- Assumes the use of offsets is unrestricted.
- Since the offset price only increase slightly in this case, the supply of domestic offsets only sees a small increase.
- The increased use of offsets is made up almost entirely of increased purchases of international credits.

Results: Additional Scenarios
(4) Unlimited Offsets



- Total payments for offsets are approximately $11 billion dollars higher than in the Senate Scenario in 2030.
- Approximately 90% of this increase in offset payments in 2030 is due to increased payments for international credits.

Results: Additional Scenarios
(4) Unlimited Offsets

Table: **IGEM - Impact of S. 280 on U.S. GDP (Billion 2005 Dollars)**

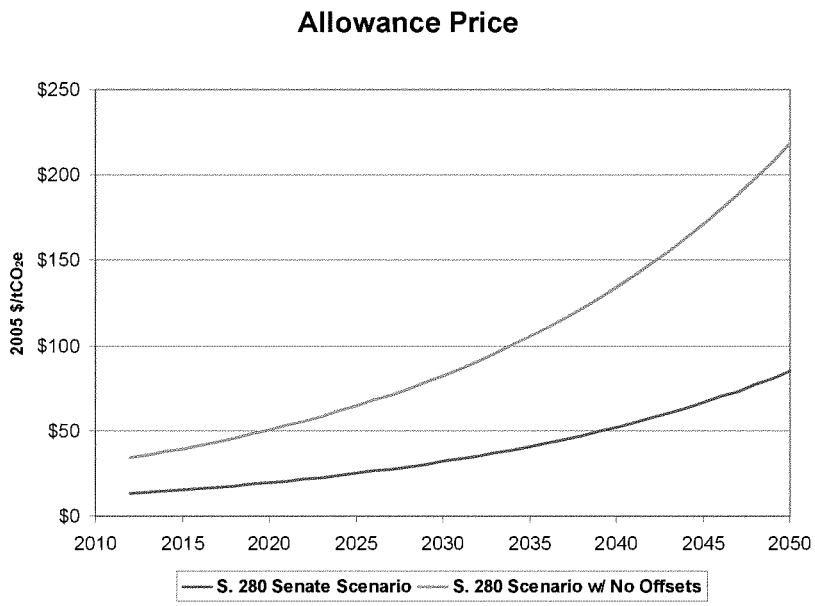
	2010	2020	2030	2040	2050	Average Annual Growth (2010 - 2050)
Reference						
	$14,733	$19,851	$26,173	$33,716	$41,372	2.61%
S.280						
Core	$14,678	$19,645	$25,754	$32,937	$40,040	2.54%
Unlimited Offsets	$14,696	$19,710	$25,893	$33,183	$40,441	2.56%
Absolute Change						
Core	-$55	-$206	-$419	-$779	-$1,332	*-0.07 Percentage Points*
Unlimited Offsets	-$37	-$141	-$280	-$533	-$931	*-0.05 Percentage Points*
% Change						
Core	-0.37%	-1.04%	-1.60%	-2.31%	-3.22%	
Unlimited Offsets	-0.25%	-0.71%	-1.07%	-1.58%	-2.25%	

Table: **IGEM - Impact of S. 280 on U.S. Consumption (Billion 2005 Dollars)**

	2010	2020	2030	2040	2050	Average Annual Growth (2010 - 2050)
Reference						
	$9,222	$12,346	$16,231	$20,921	$25,838	2.61%
S.280						
Core	$9,236	$12,315	$16,138	$20,725	$25,486	2.57%
Unlimited Offsets	$9,233	$12,328	$16,169	$20,787	$25,600	2.58%
Absolute Change						
Core	$14	-$31	-$93	-$197	-$351	*-0.04 Percentage Points*
Unlimited Offsets	$10	-$19	-$62	-$134	-$238	*-0.03 Percentage Points*
% Change						
Core	0.15%	-0.25%	-0.57%	-0.94%	-1.36%	
Unlimited Offsets	0.11%	-0.15%	-0.38%	-0.64%	-0.92%	
Change per Household (2005 Dollars)						
Core	$115	-$230	-$625	-$1,211	-$1,990	
Unlimited Offsets	$84	-$138	-$416	-$825	-$1,346	

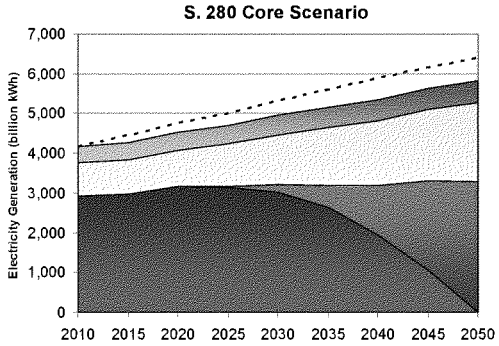
- Assumes no limits are placed on the usage of domestic offsets and international credits.
- In 2030, removing the restriction on the amount of offsets that may be used reduces the impact on both GDP and household consumption by approximately one third.

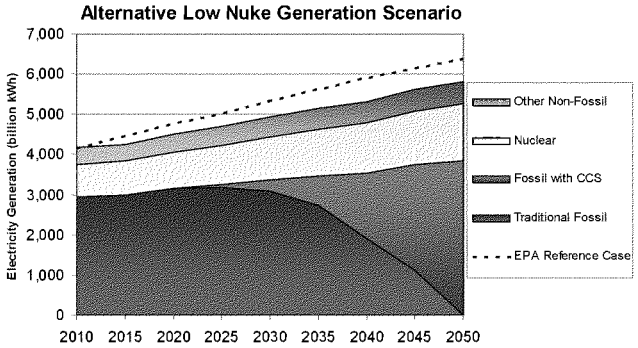
Results: Additional Scenarios
(5) No Offsets



- Assumes that no offsets or international credits are allowed.
- In 2030, the allowance price is approximately $82, which is 157% higher than in the allowance price in the Senate Scenario.

Results: Additional Scenarios
(6) Lower Nuclear Power Generation (ADAGE)



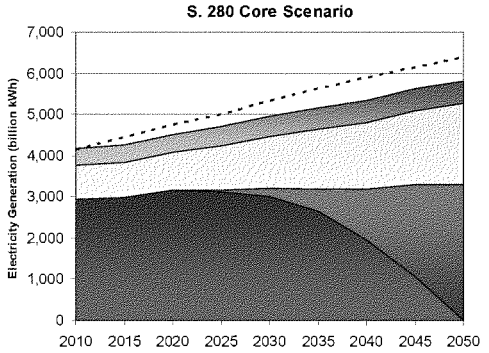


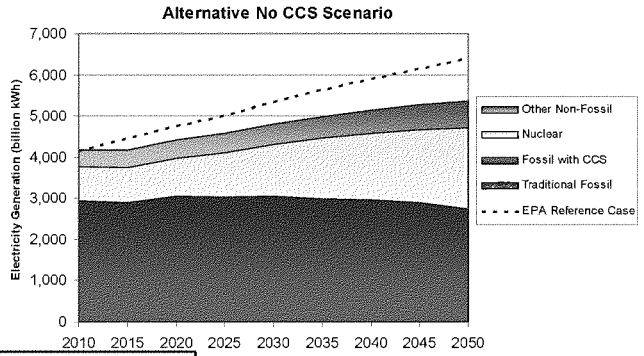
	2030		2050	
	S. 280 Senate Scenario	S. 280 Low Nuke Scenario	S. 280 Senate Scenario	S. 280 Low Nuke Scenario
GDP (% change from BAU)	-0.55%	-0.58%	-1.07%	-1.11%
Allowance Price (2005 $/t$CO_2$e)	$26.59	$28.00	$70.33	$74.03

Note: Other non-fossil includes nuclear, hydro, geothermal, wind, solar, biomass and municipal solid waste.

- Assumes nuclear power generation increase by ≈75% by 2050 (half of Senate Scenario)
- Compensating increases in fossil with CCS generation reduce the economic impact of the lower nuclear capacity

Results: Additional Scenarios
(7) No CCS Technology (ADAGE)





	2030		2050	
	S. 280 Senate Scenario	S. 280 No CCS Scenario	S. 280 Senate Scenario	S. 280 No CCS Scenario
GDP (% change from BAU)	-0.55%	-0.97%	-1.07%	-1.82%
Allowance Price (2005 $/t$CO_2$e)	$26.59	$39.90	$70.33	$105.23

- Assumes no CCS technology is available
- Results in 50% higher allowance prices
- Results in reduced electricity generation

Note: Other non-fossil includes nuclear, hydro, geothermal, wind, solar, biomass and municipal solid waste.

Scenario Comparison

GHG Allowance Prices

Table: Allowance Price Comparisons (2005 $/tCO2e)

	2015	2020	2025	2030	2035	2040	2045	2050
2) S. 280 Senate Scenario								
ADAGE	$13	$16	$21	$27	$34	$43	$55	$70
IGEM	$15	$20	$25	$32	$41	$52	$67	$85
3) S. 280 Scenario with Low International Actions								
ADAGE	$13	$16	$21	$27	$34	$43	$55	$70
IGEM	$15	$20	$25	$32	$41	$52	$67	$85
4) S. 280 Scenario Allowing Unlimited Offsets								
ADAGE								
IGEM	$10	$13	$16	$21	$26	$34	$43	$55
5) S. 280 Scenario with No Offsets								
ADAGE								
IGEM	$40	$51	$65	$82	$105	$134	$171	$219
6) S. 280 Scenario with Lower Nuclear Power Generation								
ADAGE	$14	$17	$22	$28	$36	$46	$58	$74
IGEM								
7) S. 280 Scenario with No Carbon, Capture & Storage Technology								
ADAGE	$19	$25	$31	$40	$51	$65	$83	$105
IGEM								

Scenario Comparison

Offset Prices

Table: Offset Price Comparisons (2005 $/tCO2e)

	2015	2020	2025	2030	2035	2040	2045	2050
2) S. 280 Senate Scenario								
	$9	$12	$15	$20	$25	$32	$41	$52
3) S. 280 Scenario with Low International Actions								
	$7	$9	$6	$3	$4	$4	$6	$7
4) S. 280 Scenario Allowing Unlimited Offsets								
	$10	$13	$16	$21	$26	$34	$43	$55
5) S. 280 Scenario with No Offsets								
	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
6) S. 280 Scenario with Lower Nuclear Power Generation								
	$9	$12	$15	$20	$25	$32	$41	$52
7) S. 280 Scenario with No Carbon, Capture & Storage Technology								
	$9	$12	$15	$20	$25	$32	$41	$52

Scenario Comparison

GDP Impacts (Percentage Change)

Table: GDP Comparisons (% Change from Reference)

	2015	2020	2025	2030	2035	2040	2045	2050
2) S. 280 Senate Scenario								
ADAGE	-0.22%	-0.36%	-0.40%	-0.55%	-0.61%	-0.67%	-0.69%	-1.07%
IGEM	-0.79%	-1.04%	-1.32%	-1.60%	-1.94%	-2.30%	-2.73%	-3.21%
3) S. 280 Scenario with Low International Actions								
ADAGE								
IGEM	-0.79%	-1.05%	-1.31%	-1.60%	-1.94%	-2.30%	-2.73%	-3.19%
4) S. 280 Scenario Allowing Unlimited Offsets								
ADAGE								
IGEM	-0.54%	-0.71%	-0.89%	-1.07%	-1.31%	-1.58%	-1.88%	-2.25%
5) S. 280 Scenario with No Offsets								
ADAGE								
IGEM	-1.76%	-2.26%	-2.78%	-3.31%	-3.93%	-4.58%	-5.30%	-6.08%
6) S. 280 Scenario with Lower Nuclear Power Generation								
ADAGE	-0.23%	-0.38%	-0.42%	-0.58%	-0.63%	-0.70%	-0.72%	-1.11%
IGEM								
7) S. 280 Scenario with No Carbon, Capture & Storage Technology								
ADAGE	-0.57%	-0.70%	-0.83%	-0.97%	-1.14%	-1.34%	-1.58%	-1.82%
IGEM								

Scenario Comparison

GDP Impacts (Absolute Change)

Table: GDP Comparisons (Billion 2005 $ Change from Referene)

	2015	2020	2025	2030	2035	2040	2045	2050
2) S. 280 Senate Scenario								
ADAGE	-$37	-$72	-$92	-$146	-$183	-$229	-$263	-$457
IGEM	-$134	-$206	-$301	-$419	-$580	-$776	-$1,025	-$1,328
3) S. 280 Scenario with Low International Actions								
ADAGE								
IGEM	-$135	-$208	-$299	-$419	-$579	-$774	-$1,024	-$1,321
4) S. 280 Scenario Allowing Unlimited Offsets								
ADAGE								
IGEM	-$91	-$141	-$202	-$280	-$392	-$531	-$705	-$931
5) S. 280 Scenario with No Offsets								
ADAGE								
IGEM	-$300	-$449	-$634	-$867	-$1,173	-$1,544	-$1,986	-$2,516
6) S. 280 Scenario with Lower Nuclear Power Generation								
ADAGE	-$40	-$75	-$96	-$152	-$191	-$239	-$276	-$473
IGEM								
7) S. 280 Scenario with No Carbon, Capture & Storage Technology								
ADAGE	-$97	-$138	-$189	-$257	-$342	-$456	-$602	-$776
IGEM								

Scenario Comparison

Consumption Impacts (Percentage Change)

Table: Consumption Comparisons (% Change from Reference)

	2015	2020	2025	2030	2035	2040	2045	2050
2) S. 280 Senate Scenario								
ADAGE	0.02%	-0.10%	-0.23%	-0.38%	-0.53%	-0.68%	-0.79%	-0.96%
IGEM	-0.05%	-0.25%	-0.41%	-0.57%	-0.75%	-0.94%	-1.13%	-1.36%
3) S. 280 Scenario with Low International Actions								
ADAGE								
IGEM	-0.05%	-0.24%	-0.40%	-0.55%	-0.73%	-0.90%	-1.08%	-1.31%
4) S. 280 Scenario Allowing Unlimited Offsets								
ADAGE								
IGEM	-0.02%	-0.15%	-0.27%	-0.38%	-0.51%	-0.64%	-0.77%	-0.92%
5) S. 280 Scenario with No Offsets								
ADAGE								
IGEM	-0.15%	-0.58%	-0.93%	-1.27%	-1.64%	-2.01%	-2.40%	-2.84%
6) S. 280 Scenario with Lower Nuclear Power Generation								
ADAGE	0.00%	-0.12%	-0.26%	-0.42%	-0.57%	-0.73%	-0.84%	-1.00%
IGEM								
7) S. 280 Scenario with No Carbon, Capture & Storage Technology								
ADAGE	-0.08%	-0.24%	-0.41%	-0.62%	-0.82%	-1.03%	-1.32%	-1.62%
IGEM								

Scenario Comparison

Consumption Impacts (Absolute Change)

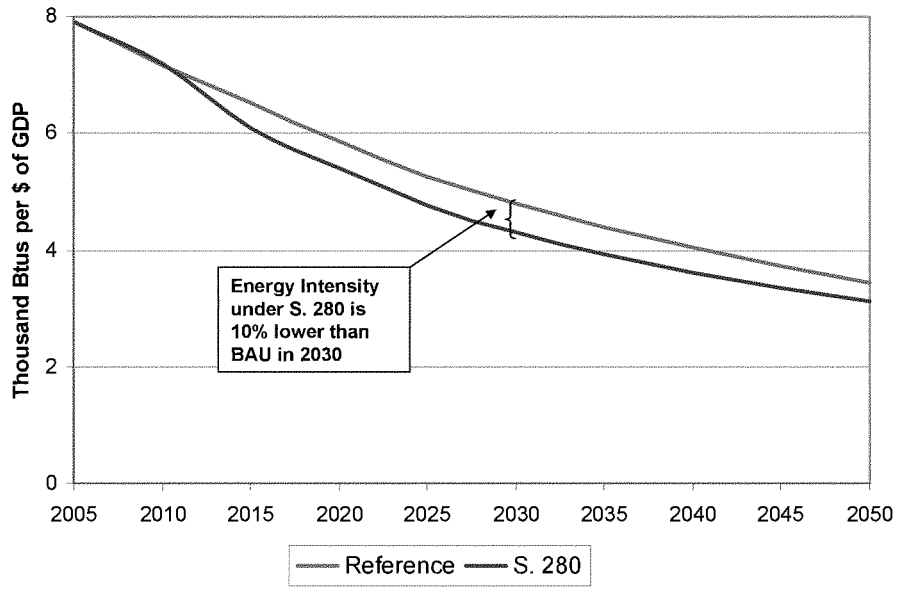
Table: Consumption Comparisons (Billion 2005 $ Change from Referene)

	2015	2020	2025	2030	2035	2040	2045	2050
2) S. 280 Senate Scenario								
ADAGE	$2	-$14	-$39	-$75	-$119	-$172	-$225	-$306
IGEM	-$5	-$30	-$58	-$93	-$138	-$196	-$264	-$350
3) S. 280 Scenario with Low International Actions								
ADAGE								
IGEM	-$5	-$30	-$56	-$89	-$135	-$189	-$252	-$338
4) S. 280 Scenario Allowing Unlimited Offsets								
ADAGE								
IGEM	-$2	-$19	-$38	-$62	-$95	-$133	-$181	-$238
5) S. 280 Scenario with No Offsets								
ADAGE								
IGEM	-$16	-$71	-$132	-$207	-$304	-$420	-$561	-$735
6) S. 280 Scenario with Lower Nuclear Power Generation								
ADAGE	$0	-$18	-$44	-$82	-$128	-$185	-$238	-$320
IGEM								
7) S. 280 Scenario with No Carbon, Capture & Storage Technology								
ADAGE	-$10	-$35	-$71	-$122	-$184	-$262	-$375	-$515
IGEM								

Appendix 2: Additional Information

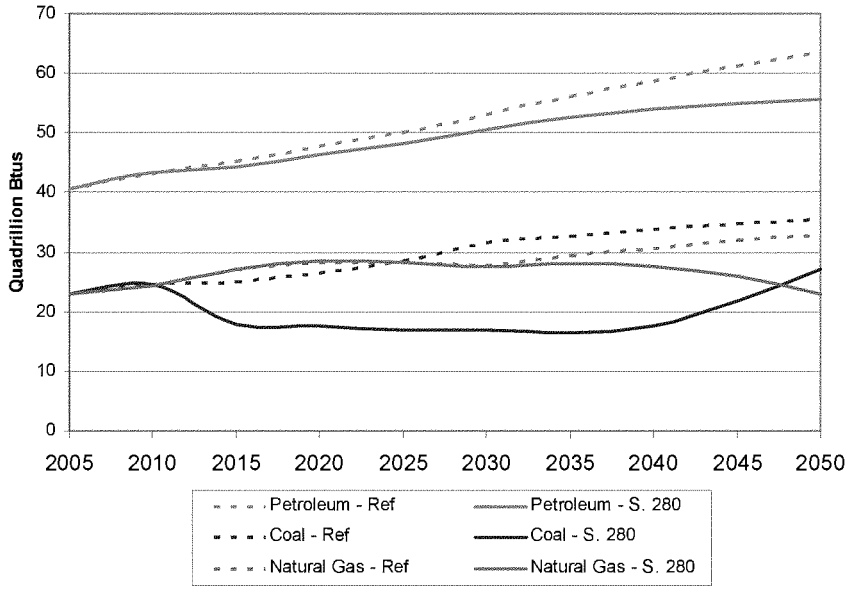
Results: S. 280 Senate Scenario

Energy Intensity (ADAGE)



Results: S. 280 Senate Scenario

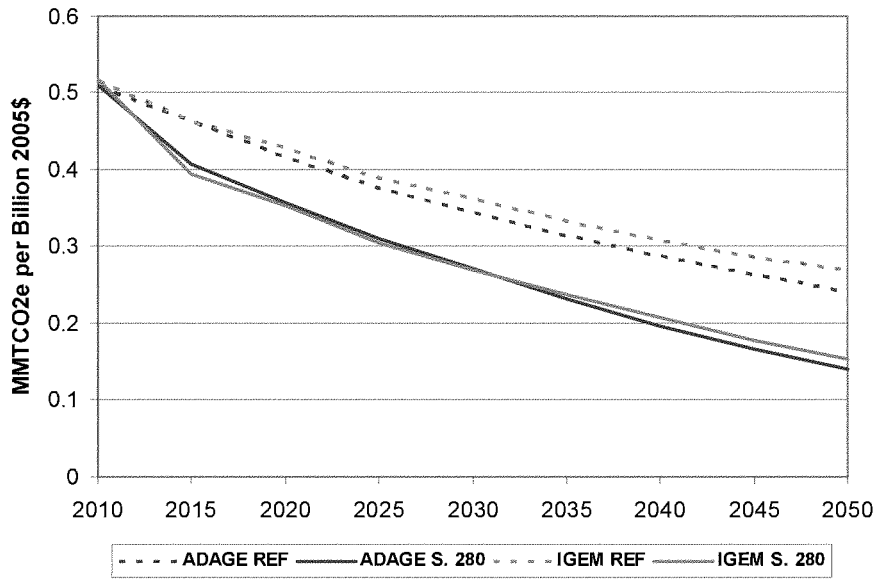
Primary Energy Use (ADAGE)



- Growth in petroleum use is less under S. 280 than in the Reference Scenario.
- Coal use falls as S. 280 is implemented and fuel-switching to natural gas occurs, then rises again in the later years as coal-fired gasification plants with CCS are deployed.
  - Note that the IPM analysis shows a much smaller impact on near-term coal usage.
- The natural gas use trend follows an opposite path to the coal use trend. Natural gas use increases in the earlier years as fuel-switching occurs, and then falls in the later years as CCS is deployed.

Results: S. 280 Senate Scenario

GHG Intensity



Results: S. 280 Senate Scenario

Fuel Price Adders for 2050

	2005 Price	2050 Producer Price	2050 Cost of Carbon Content	2050 End - User Price
Metric Ton of CO_2	n/a		$77.63 *	
Metric Ton of Carbon	n/a		$284.65	
Barrel of Oil	$50.28	$55.08	$33.23	$88.31
Gallon of Gasoline	$2.34	$2.56	$0.68	$3.25
Short Ton of Coal	$36.79	$41.35	$171.61	$212.96
Short Ton of Coal w/ CCS	$36.79	$41.35	$17.16	$58.51
tCf of Natural Gas	$7.51	$5.86	$4.22	$10.08

* Average of ADAGE and IGEM allowance prices

- The 2050 price is obtained by multiplying the 2050 index price in ADAGE by the 2005 price from EIA's 2006 Monthly Energy Review.
- The cost of carbon content is simply the product of the physical carbon content of the fuel and the allowance price.
- The consumer price is simply the sum of the price and the cost of carbon content.
- CCS technology for coal fired power generation captures and stores 90% of carbon emissions, which lowers the cost of carbon content by 90%, and lower the consumer price accordingly.

Results: S. 280 Senate Scenario

2030 Sectoral Results (Sectors 1 - 18) (IGEM)

Sector	2007	2030				
		Reference		S. 280		
	Output ($Billions)	Output ($Billions)	Percent Change from 2007	Output ($Billions)	Percent Change from 2007	Percent Change from Reference
Agriculture, forestry, fisheries	492	991	101%	987	101%	0%
Metal mining	80	158	98%	152	91%	-4%
Coal mining	29	40	39%	25	-13%	-37%
Crude oil and gas extraction	159	232	46%	220	39%	-5%
Non-metallic mineral mining	16	14	-11%	14	-15%	-5%
Construction	1151	1578	37%	1544	34%	-2%
Food and kindred products	565	1155	104%	1183	109%	2%
Tobacco manufactures	32	58	79%	60	86%	4%
Textile mill products	83	230	178%	225	173%	-2%
Apparel and other textile products	78	218	180%	215	177%	-1%
Lumber and wood products	148	331	124%	321	118%	-3%
Furniture and fixtures	100	225	125%	219	119%	-3%
Paper and allied products	217	555	156%	540	149%	-3%
Printing and publishing	243	440	81%	435	78%	-1%
Chemicals and allied products	515	1400	172%	1335	159%	-5%
Petroleum refining	296	389	31%	344	16%	-11%
Rubber and plastic products	218	550	152%	536	146%	-2%
Leather and leather products	13	34	167%	33	162%	-2%

Results: S. 280 Senate Scenario

2030 Sectoral Results (Sectors 19 - 35) (IGEM)

Sector	2007	2030				
		Reference		S. 280		
	Output ($Billions)	Output ($Billions)	Percent Change from 2007	Output ($Billions)	Percent Change from 2007	Percent Change from Reference
Stone, clay and glass products	116	249	114%	241	107%	-3%
Primary metals	205	448	119%	424	107%	-5%
Fabricated metal products	317	625	97%	604	91%	-3%
Non-electrical machinery	631	2387	278%	2310	266%	-3%
Electrical machinery	448	3276	631%	3177	609%	-3%
Motor vehicles	513	1095	114%	1063	107%	-3%
Other transportation equipment	219	420	92%	412	89%	-2%
Instruments	252	566	125%	555	121%	-2%
Miscellaneous manufacturing	66	176	166%	172	161%	-2%
Transportation and warehousing	681	1284	89%	1257	85%	-2%
Communications	517	1137	120%	1135	119%	0%
Electric utilities (services)	384	548	43%	499	30%	-9%
Gas utilities (services)	51	60	20%	56	11%	-8%
Wholesale and retail trade	2495	4703	89%	4606	85%	-2%
Finance, insurance and real estate	2642	6075	130%	6038	129%	-1%
Personal and business services	4304	8108	88%	8088	88%	0%
Government enterprises	449	842	87%	832	85%	-1%

Results: S. 280 Senate Scenario

2050 Sectoral Results (Sectors 1 - 18) (IGEM)

Sector	2007	2050				
		Reference		S. 280		
	Output ($Billions)	Output ($Billions)	Percent Change from 2007	Output ($Billions)	Percent Change from 2007	Percent Change from Reference
Agriculture, forestry, fisheries	492	1459	197%	1438	192%	-1%
Metal mining	80	246	208%	228	186%	-7%
Coal mining	29	51	77%	22	-25%	-58%
Crude oil and gas extraction	159	313	97%	275	73%	-12%
Non-metallic mineral mining	16	18	15%	17	7%	-7%
Construction	1151	2189	90%	2106	83%	-4%
Food and kindred products	565	1788	216%	1903	237%	6%
Tobacco manufactures	32	91	183%	102	214%	11%
Textile mill products	83	394	377%	382	363%	-3%
Apparel and other textile products	78	397	411%	387	398%	-3%
Lumber and wood products	148	609	313%	576	290%	-5%
Furniture and fixtures	100	339	239%	322	222%	-5%
Paper and allied products	217	973	348%	921	325%	-5%
Printing and publishing	243	686	182%	667	174%	-3%
Chemicals and allied products	515	2530	391%	2316	349%	-8%
Petroleum refining	296	460	55%	348	17%	-24%
Rubber and plastic products	218	868	298%	826	279%	-5%
Leather and leather products	13	60	367%	57	349%	-4%

Results: S. 280 Senate Scenario

2050 Sectoral Results (Sectors 19 - 35) (IGEM)

Sector	2007	2050				
		Reference		S. 280		
	Output ($Billions)	Output ($Billions)	Percent Change from 2007	Output ($Billions)	Percent Change from 2007	Percent Change from Reference
Stone, clay and glass products	116	451	287%	434	273%	-4%
Primary metals	205	739	261%	664	224%	-10%
Fabricated metal products	317	985	211%	924	192%	-6%
Non-electrical machinery	631	4465	608%	4200	566%	-6%
Electrical machinery	448	7466	1567%	7040	1472%	-6%
Motor vehicles	513	1818	255%	1723	236%	-5%
Other transportation equipment	219	677	210%	655	200%	-3%
Instruments	252	861	242%	833	231%	-3%
Miscellaneous manufacturing	66	317	379%	306	362%	-4%
Transportation and warehousing	681	1932	184%	1851	172%	-4%
Communications	517	1849	258%	1844	257%	0%
Electric utilities (services)	384	704	83%	575	50%	-18%
Gas utilities (services)	51	64	27%	53	4%	-18%
Wholesale and retail trade	2495	7024	182%	6752	171%	-4%
Finance, insurance and real estate	2642	9879	274%	9777	270%	-1%
Personal and business services	4304	12226	184%	12184	183%	0%
Government enterprises	449	1249	178%	1219	171%	-2%

Appendix 3: Model Descriptions

Intertemporal General Equilibrium Model (IGEM)

- IGEM is a model of the U.S. economy with an emphasis on the energy and environmental aspects.
- It is a dynamic model, which depicts growth of the economy due to capital accumulation, technical change and population change.
- It is a detailed multi-sector model covering 35 industries.
- It also depicts changes in consumption patterns due to demographic changes, price and income effects.
- The model is designed to simulate the effects of policy changes, external shocks and demographic changes on the prices, production and consumption of energy, and the emissions of pollutants.
- The main driver of economic growth in this model is capital accumulation and technological change. It also includes official projections of the population, giving us activity levels in both level and per-capita terms.
- Capital accumulation arises from savings of a household that is modeled as an economic actor with "perfect foresight."
- This model is implemented econometrically which means that the parameters governing the behavior of producers and consumers are statistically estimated over a time series dataset that is constructed specifically for this purpose.
- This is in contrast to many other multi-sector models that are calibrated to the economy of one particular year.
- These data are based on a system of national accounts developed by Jorgenson (1980) that integrates the capital accounts with the National Income Accounts.
- These capital accounts include an equation linking the price of investment goods to the stream of future rental flows, a link that is essential to modeling the dynamics of growth.
- The model is developed and run by Dale Jorgenson Associates for EPA.
- Model Homepage: http://post.economics.harvard.edu/faculty/jorgenson/papers/papers.html

Applied Dynamic Analysis of the Global Economy (ADAGE)

- ADAGE is a dynamic computable general equilibrium (CGE) model capable of examining many types of economic, energy, environmental, climate-change mitigation, and trade policies at the international, national, U.S. regional, and U.S. state levels.
- To investigate policy effects, the CGE model combines a consistent theoretical structure with economic data covering all interactions among businesses and households.
- A classical Arrow-Debreu general equilibrium framework is used to describe economic behaviors of these agents.

- ADAGE has three distinct modules: International, U.S. Regional, and Single Country.
- Each module relies on different data sources and has a different geographic scope, but all have the same theoretical structure.
- This internally consistent, integrated framework allows its components to use relevant policy findings from other modules with broader geographic coverage, thus obtaining detailed regional and state-level results that incorporate international impacts of policies.
- Economic data in ADAGE come from the GTAP and IMPLAN databases, and energy data and various growth forecasts come from the International Energy Agency and Energy Information Administration of the U.S. Department of Energy.
- Emissions estimates and associated abatement costs for six types of greenhouse gases (GHGs) are also included in the model.

- The model is developed and run by RTI International for EPA.
- Model Homepage: http://www.rti.org/adage

Non-CO_2 GHG Models

- EPA develops and houses projections and economic analyses of emission abatement through the use of extensive bottom-up, spreadsheet models.
- These are engineering–economic models capturing the relevant cost and performance data on over 15 sectors emitting the non-CO_2 GHGs.
- For the emissions inventory and projections, all anthropogenic sources are covered. For mitigation of methane, the sources evaluated include coal mining, natural gas systems, oil production, and solid waste management.
- For mitigation of HFC, PFC, and SF6, the sources evaluated include over 12 industrial sectors.
- For mitigation of nitrous oxide, sources evaluated include adipic and nitric acid production.
- Only currently available or close-to-commercial technologies are evaluated.
- The estimated reductions and costs are assembled into marginal abatement curves (MACs).
- MACs are straightforward, informative tools in policy analyses for evaluating economic impacts of GHG mitigation. A MAC illustrates the amount of reductions possible at various values for a unit reduction of GHG emissions and is derived by rank ordering individual opportunities by cost per unit of emission reduction. Any point along a MAC represents the marginal cost of abating an additional amount of a GHG.
- The total cost of meeting an absolute emission reduction target can be estimated by taking the integral of a MAC curve from the origin to the target.
- Global mitigation estimates are available aggregated into nine major regions of the world including the U.S. and are reported for the years 2010, 20015 and 2020.
- The data used in the report are from *Global Mitigation of Non-CO_2 Greenhouse Gases* (EPA Report 430-R-06-005). www.epa.gov/nonco2/econ-inv/international.html

Forest and Agriculture Sector Optimization Model-GHG

- FASOM-GHG simulates land management and land allocation decisions over time to competing activities in both the forest and agricultural sectors. In doing this, it simulates the resultant consequences for the commodity markets supplied by these lands and, importantly for policy purposes, the net greenhouse gas (GHG) emissions.
- The model was developed to evaluate the welfare and market impacts of public policies and environmental changes affecting agriculture and forestry. To date, FASOMGHG and its predecessor models FASOM and ASM have been used to examine the effects of GHG mitigation policy, climate change impacts, public timber harvest policy, federal farm program policy, biofuel prospects, and pulpwood production by agriculture among other policies and environmental changes.
- FASOMGHG is a multiperiod, intertemporal, price-endogenous, mathematical programming model depicting land transfers and other resource allocations between and within the agricultural and forest sectors in the US. The model solution portrays simultaneous market equilibrium over an extended time, typically 70 to 100 years on a ten year time step basis.
- The results from FASOMGHG yield a dynamic simulation of prices, production, management, consumption, GHG effects, and other environmental and economic indicators within these two sectors, under the scenario depicted in the model data.
- The principal model developer is Dr. Bruce McCarl, Department of Agricultural Economics, Texas A&M University.
- The data used in the report are from *Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture* (EPA Report 430-R-05-006). http://www.epa.gov/sequestration/greenhouse_gas.html.
- Model Homepage: http://agecon2.tamu.edu/people.faculty/mccarl-bruce/FASOM.html

Global Timber Model (GTM)

- GTM is an economic model capable of examining global forestry land-use, management, and trade responses to policies. In responding to a policy, the model captures afforestation, forest management, and avoided deforestation behavior.
- The model estimates harvests in industrial forests and inaccessible forests, timberland management intensity, and plantation establishment, all important components of both future timber supply and carbon flux. The model also captures global market interactions.
- The model is a partial equilibrium intertemporally optimizing model that maximizes welfare in timber markets over time across approximately 250 world timber supply regions by managing forest stand ages, compositions, and acreage given production and land rental costs. The model equates supply and demand in each period, and predicts supply responses to current and future prices. The 250 supply regions are delineated by ecosystem and timber management classes, as well as geo-political regional boundaries. The model runs on 10-year time steps.
- The model has been used to explore a variety of climate change mitigation policies, including carbon prices, stabilization, and optimal mitigation policies.
- The principal model developer is Brent Sohngen, Department of Agricultural, Environmental, and Development Economics, Ohio State University. Other key developers and collaborators over the life of the model include Robert Mendelsohn, Roger Sedjo, and Kenneth Lyon. For this analysis, the model was run by Dr. Sohngen for EPA.
- Website for GTM papers and input datasets: http://aede.osu.edu/people/sohngen.1/forests/ccforest.htm#gfmod

Mini-Climate Assessment Model (MiniCAM)

- The MiniCAM is a highly aggregated integrated assessment model that focuses on the world's energy and agriculture systems, atmospheric concentrations of greenhouse gases (CO_2 and non-CO_2) and sulfur dioxide, and consequences regarding climate change and sea level rise.
- It has been updated many times since the early eighties to include additional technology options. MiniCAM is capable of incorporating carbon taxes and carbon constraints in conjunction with the numerous technology options including carbon capture and sequestration.
- The model has been exercised extensively to explore how the technology gap can be filled between a business-as-usual emissions future and an atmospheric stabilization scenario.
- The MiniCAM model is designed to assess various climate change policies and technology strategies for the globe over long time scales. It is configured as a partial equilibrium model that balances supply and demand for commodities such as oil, gas, coal, biomass and agricultural products.
- The model runs in 15-year time steps from 1990 to 2095 and includes 14 geographic regions.
- The model is developed and run at the Joint Global Change Research Institute, University of Maryland. Model Homepage: http://www.globalchange.umd.edu

The Integrated Planning Model (IPM)

- EPA uses the Integrated Planning Model (IPM) to analyze the projected impact of environmental policies on the electric power sector in the 48 contiguous states and the District of Columbia.
- IPM is a multi-regional, dynamic, deterministic linear programming model of the U.S. electric power sector.
- The model provides forecasts of least-cost capacity expansion, electricity dispatch, and emission control strategies for meeting energy demand and environmental, transmission, dispatch, and reliability constraints.
- IPM can be used to evaluate the cost and emissions impacts of proposed policies to limit emissions of sulfur dioxide (SO_2), nitrogen oxides (NOx), carbon dioxide (CO_2), and mercury (Hg) from the electric power sector.
- The IPM was a key analytical tool in developing the Clean Air Interstate Regulation (CAIR) and the Clean Air Mercury Rule (CAMR).
- IPM provides both a broad and detailed analysis of control options for major emissions from the power sector, such as power generation adjustments, pollution control actions, air emissions changes (national, regional/state, and local), major fuel use changes, and economic impacts (costs, wholesale electricity prices, closures, allowance values, etc.).
- The model was developed by ICF Resources and is applied by EPA for its Base Case. IPM® is a registered trademark of ICF Resources, Inc.
- EPA's application of IPM Homepage: http://www.epa.gov/airmarkets/progsregs/epa-ipm/index.html

National Energy Modeling System (NEMS)

- When Senators Lieberman and McCain requested that EPA analyze S. 280, they sent a similar request to the Energy Information Administration (EIA).
- EIA is using NEMS for its analysis of S. 280.
- NEMS is also used to produce the Annual Energy Outlook (AEO).
- NEMS represents domestic energy markets by explicitly representing the economic decision making involved in the production, conversion, and consumption of energy products.
- Where possible, NEMS includes explicit representation of energy technologies and their characteristics.
- NEMS is organized and implemented as a modular system.
  - For each fuel and consuming sector, NEMS balances the energy supply and demand, accounting for the economic competition between the various energy fuels and sources.
  - The modules represent each of the fuel supply markets, conversion sectors, and end-use consumption sectors of the energy system.
  - NEMS also includes a macroeconomic and an international module.
  - For purposes of S.280 analysis, NEMS is augmented with a representation of greenhouse gas emissions outside of the energy sector and uses marginal abatement curves to represent opportunities to reduce them.
- NEMS includes regional detail (nine Census divisions).
- NEMS runs in annual time steps through 2030.

Differences between NEMS and IGEM / ADAGE

- Analysis Time Frame
  - ADAGE and IGEM report through 2050
  - NEMS reports through 2030
- Technology Detail
  - ADAGE and IGEM are top-down models with limited technology detail
  - NEMS is a bottom-up model with extensive technology detail
- Macroeconomic Effects
  - NEMS Macroeconomic Activity Module is based on the Global Insight Model of the U.S. Economy, which is a macroeconomic forecasting model.
    - Based on estimated relationships at an aggregate level, using adaptive rather than rational expectations.
    - Forecasts effects at the aggregate level, such as how GDP and unemployment, are affected by changes in inflation or fiscal and monetary policies.
    - These types of models can capture short- and medium-term disequilibrium adjustments in response to exogenous shocks. They can address short and medium-term transition costs of energy policies as the economy transitions to a long-run growth path. They have more detailed government sectors and a well-defined set of fiscal policies. In addition, they can incorporate accommodating monetary policies.
  - IGEM and ADAGE are Computable General Equilibrium models
    - Structural models based on microeconomic foundations.
    - They build up their representation of the whole economy through the interactions of multiple agents (e.g. households and firms), whose decisions are based upon optimization.
    - These models are best suited for capturing long-run equilibrium responses, and unique characteristics of specific sectors of the economy.

JULY 23, 2007

Testimony of
American Electric Power submitted to
Senate Subcommittee on Private Sector and
Consumer Solutions to Global Warming and Wildlife Protection

The United States Congress is contemplating legislation that would impose a mandatory cap-and-trade program for U.S. greenhouse gas (GHG) emissions. This legislation must also provide leverage to ensure that emissions in other countries, particularly rapidly developing countries such as China or India, do not undermine these efforts to protect the environment. To provide effective leverage, the U.S. legislation must be compliant with the Agreement Establishing the World Trade Organization (WTO). American Electric Power is submitting for inclusion in the record the following legal analysis on the WTO-consistency of an allowance requirement on imports in conjunction with a U.S. cap-and-trade program.[1]

I. Summary

Where governments take action to address environmental protection, WTO law favors doing so through consensual and multilateral procedures, rather than unilateral trade measures. However:

- if the United States made **good faith efforts** with **all** nations but was unable to negotiate procedures on reducing greenhouse gas emissions, then
- the United States could **require imports** of goods to be accompanied (electronically) by emissions **allowances**,
- in the context of a broader requirement that **domestic producers** have emission allowances.

Analyzing the WTO-consistency of an allowance requirement on imports is a two-step process: (1) is the requirement, as a measure, **consistent** with the relevant obligations of the WTO, and if not; (2) is it covered by a WTO **exception**?

One could argue that a tradable allowance requirement on imports should be considered as part of the overall U.S. cap-and-trade program. As such, it would be consistent with the WTO national treatment obligation set forth in GATT Article III:4, because it would be administered to accord imported goods treatment no less favorable than the treatment accorded "like" domestic goods. Even if that argument were not successful, however, the allowance requirement would be covered by the WTO exception set forth in GATT Article XX(g) for measures relating to the conservation of

[1] The International Brotherhood of Electrical Workers and American Electric Power have proposed such a requirement. Materials describing the IBEW-AEP proposal are attached hereto.

exhaustible natural resources. The allowance requirement, under which allowances submitted with imports would be retired from further use, just as allowances assigned to domestic production would be, is closely related to the conservation objective of the overall climate change program.

The relevant WTO provisions are included in an Appendix attached to this memorandum, and the following chart illustrates the results of the WTO analysis:

WTO ANALYSIS	ALLOWANCE REQUIREMENT ON IMPORTS
1. Is measure consistent with WTO obligations?	
(a) Issue	**Either** it is considered as a border measure . . .
- Applicable provisions	GATT Articles II or XI
- Outcome	Not WTO-consistent if the measure imposes charges in excess of scheduled duties or border restrictions.
(b) Issue	. . . **or** it is judged as part of internal regulation
- Applicable provision	GATT Article III
- Outcome	WTO consistent if judged in the context of overall domestic regulation, affords national treatment, *i.e.*, treatment to imported goods no less favorable than that accorded to "like" domestic goods
2. If the measures is not WTO consistent, then is measure covered by a WTO exception?	
(a) Issue	Is measure relating to the conservation of exhaustible natural resources ?
- Applicable provision	GATT Article XX(g)
- Outcome	Yes, it is closely related to the objective of conservation
(b) Issue	Is the measure applied in a manner that does not arbitrarily or unjustifiably discriminate between countries where the same conditions prevail, or is not a disguised restriction on trade?
- Applicable provision	Article XX chapeau
- Outcome	Yes, focusing on top emitting countries, and only those that had not addressed GHG emissions, would be justified because of clear link to GHG emission reduction goals; measure is flexible and not "capricious" or "random."
3. Result?	**YES, MEASURE IS PERMISSIBLE UNDER WTO RULES**

II. Description of Measures

The domestic context for GHG-related trade measures would be a **cap-and-trade program** under which the U.S. Government would determine a **quantitative cap** for GHG emissions, and establish quantitative **emission allowances,** the sum of which would equal the U.S. GHG emissions cap. This system would be modeled on the EPA's existing U.S. cap-and-trade program in its Acid Rain Program,[2] with some differences. The government would issue allowance certificates (each with a unique serial number for tracking and safeguards against counterfeiting) to show the amount of GHG emissions allowed. The certificates could then be transferred or sold in an **allowances market**. A firm emitting more GHGs than its existing allowances would have to procure additional allowances or would be penalized for exceeding its allowances. All firms generating GHGs would have to continually monitor and report their emissions.

A domestic cap-and-trade program, implemented without measures to address GHG emissions from outside the United States, would be ineffectual in addressing the full range of GHG emissions affecting the environment. An allowance requirement imposed on imports would help to secure the environmental benefits of the overall program.

There would be six possible scenarios in such a cap-and-trade system, four of which would be relevant in analyzing WTO-consistency:

1. a product is produced in the United States, and consumed in the United States;

2. a product is produced in the United States, and consumed in a capped system;

3. a product is produced in the United States, and consumed in a non-capped system.

4. a product is produced outside the United States (whether in a capped or non-capped system), and consumed outside the United States (whether in a capped or non-capped system).

5. a product is produced in a capped system, and consumed in the United States.

6. a product is produced in a non-capped system, and consumed in the United States.

In scenario 1, the product is not traded internationally, and its treatment will not in itself trigger international trade rules. In scenario 4, the good is produced and traded outside of U.S. jurisdiction. In scenarios 2 and 5, where the trading partners on both

[2] Described at http://pubweb.epa.gov/air/clearskies/captrade.html, last visited July 22, 2007.

sides have cap-and-trade programs, the United States would need to pursue negotiations toward an agreement on which program will apply to the goods. The partners could agree, for example, that goods subject to a cap-and-trade system in their country of origin will be exempt from the cap-and-trade system in the country of destination. Or, they could agree to other rules to avoid a duplicative application of cap-and-trade systems. The many bilateral income tax treaties show that governments *can* negotiate and reach agreements to avoid duplicative applications of government measures (such as income taxes) that affect producers.

In scenario 3, the U.S. product may be at a competitive disadvantage vis-à-vis the product manufactured in a non-capped system. However, our trading partners could argue that any attempt by the U.S. Government to correct the disadvantage by providing financial benefits linked to exporting could constitute a prohibited subsidy under WTO rules. In addition, providing financial benefits to exporters to enable their products to better compete in non-capped systems would have the manifest purpose of protecting U.S. commercial interests, not the environment. This qualification on the application of the cap-and-trade system to U.S. products might make it more difficult to defend the entire system under GATT Article XX exceptions. In any event, the United States should not need to extend WTO-inconsistent benefits to exporters; the cap-and-trade system would create enough leverage to encourage voluntary participation on the part of major markets.

In scenario 6, the importer would be required to provide allowances corresponding to the GHGs emitted when the imported goods were produced in the country of origin. The U.S. Government would use a multiplier in setting the number of allowances required for imported goods. This multiplier would reflect the portion of allowances that domestic producers receive at no cost in relation to the allowances that domestic producers procure by auction, and contribute to ensuring that the treatment accorded to imports is no less favorable than that accorded to like domestic products.[3]

Which imported goods would be subject to the requirement? The scope of imported goods subject to the allowances requirement could be set to match as nearly as possible the scope of the domestic requirement. Thus, if the requirement were to apply only to the production of carbon-intensive goods, or only to "upstream" rather than "downstream" products, then the scope of imports covered by the requirement could be set accordingly. This contributes to ensuring non-discriminatory treatment of imports.

What would be the source of these certificates? Under one approach, importers would secure allowances from the normal supply of allowances made available for U.S. entities to satisfy their obligations under the U.S. cap-and-trade system. Thus, importers could obtain U.S. emissions allowances from the producer/exporter or brokers operating generally in the marketplace. Alternatively, the U.S. Government could establish a separate supply of allowances that would only be used by importers. Finally, the U.S. Government could permit importers to satisfy their obligations using allowances (and credits) generated under the cap-and-trade systems of other countries.

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[3] See GATT Article III:4.

The WTO analysis below largely relates to scenario 6.

III. Is the Measure Compliant with U.S. International Obligations?

In order to effectively persuade major newly industrializing economies to participate in GHG reduction, U.S. legislation must be permissible under WTO rules.[4] Two key principles of WTO law are germane to assessing the WTO legality of measures that could be used as part of a cap-and-trade program:

- each WTO Member government must obey its market access commitments on import tariffs, and cannot otherwise block imports (GATT Articles II, XI);
- it also may not use its domestic taxes, or **any** domestic regulations, so as to discriminate in favor of domestic goods compared to like imported products, or in favor of imported goods from one foreign country rather than another (GATT Articles I, III).

In accordance with these principles, the legal status of a measure under the GATT may be different depending on whether it is a border measure or whether it is an internal measure enforced at the border. GATT Article II:1(b) prohibits new import charges, and Article XI:1 prohibits bans or quantitative restrictions on imports. A measure that comes under either GATT article would likely be WTO-inconsistent. However, under GATT Article III, a WTO Member is entitled to regulate all products that are sold in its market provided that internal regulation does not afford protection to domestic over imported goods.

Thus, notwithstanding the prohibitions embedded in Articles XI:1 and II:1(b), a restrictive internal regulation (such as a residue limitation or product ban) or a prohibitive internal excise tax can be enforced on imports at the border, and be judged under GATT Article III, rather than Articles XI or II. In other words, the border-enforced internal measure would be completely GATT-consistent as long as it is non-discriminatory. The Note to Article III shows how the GATT draws the line between border measures and border-enforced internal measures. The Note identifies two issues that must be considered: does the tax, charge or regulatory requirement apply **both** to an imported product and to the like domestic product, and is it collected or enforced "at the time or point of importation"? The stated policy purpose of a measure is not relevant, nor is its categorization by domestic law.[5]

The following analysis examines whether the allowance requirement on imports is consistent with the WTO market access commitments and non-discrimination obligations for trade in goods. GATT law considers the regulation of imported goods either as a border measure, or as part of an overall program of internal regulation, but not both. There are good arguments that the allowance requirement is best understood

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[4] We focus here only on WTO rules, as the WTO Agreement is the only agreement that binds both the United States and major countries of concern to Congress. Other U.S. treaties would also apply to climate change legislation, but the basic principles would not differ.

[5] *EC – Regulation on Imports of Parts and Components*, GATT BISD 35S/37 (1990), paras. 5.6-5.7.

as part of internal regulation, but it is a very close question. We review both sets of arguments below.

A. Consistency with WTO Market Access Commitments

To simplify this analysis, we consider an allowance requirement as it applies to a hypothetical ton of steel produced and exported from Country X and a "like" ton of steel (*i.e.*, same physical characteristics and uses) produced in the United States. Of course, actual trading patterns may be more complex, involving multi-stage processing across borders, and some imported products are not produced in the United States.

As stated above, Articles II:1(b) and XI:1 are the GATT provisions that are relevant in assessing whether an allowance requirement on imports is a border measure, and as such, whether it is consistent with the WTO **market access** commitments of the United States. First, GATT Article II:1(b) prohibits the imposition of any new extra charges or surcharges on products that are subject to tariff concessions—and close to 100 percent of U.S. imports are now under such concessions. If the allowance requirement program mandated that only importers—as opposed to importers and domestic producers—buy allowance certificates or pay an extra charge, it would constitute a new border charge, and as such, it would violate GATT Article II:1(b). Second, GATT Article XI:1 prohibits any border measure restricting imports other than duties, taxes or other charges. By requiring that importers present allowance certificates as a condition for importation, the allowance requirement program could cause a decrease in the volume of imports. As a result, the program would constitute a border measure that imposes a quantitative limitation on imports in violation of GATT Article XI:1.

If the allowance requirement on imports is a border measure under either GATT Article II or Article XI, it will not be consistent with the WTO market access commitments of the United States. To have a chance of surviving WTO scrutiny, the allowance requirement must be justifiable as an internal measure that falls in line with the WTO non-discrimination obligations of the United States.

B. Consistency with WTO Non-Discrimination Obligations

GATT Article III is the most important provision, for the purposes of this analysis, embodying the non-discrimination principle of the WTO.

In contrast to the interpretation described above, the United States could argue that the allowances requirement should be considered an internal regulation subject to the national treatment obligation set forth in GATT Article III:4. To ensure compliance with Article III:4, the United States could adjust the scope of imported goods covered by the allowances requirement, and the number of allowances required to be submitted for particular imported goods. A WTO dispute settlement panel might point out, however, that the allowances program is a regulation on U.S. **producers**, whereas, the allowances requirement on imports is a regulation on imported **products**. On that basis, the Note to Article III might rule out classifying the allowances requirement on

imports as an internal regulation subject to Article III.[6] But the United States could respond that the scope of Article III has been interpreted more flexibly than a hard-and-fast, line-drawing exercise would permit. For example, a measure, such as this one, regulating whether and how products, including domestic products, can be sold constitutes an internal regulation for purposes of Article III.

As an internal regulation, the allowance requirement on imports would be subject to GATT Article III:4, under which the United States must accord to imported products "treatment no less favourable than that accorded to like products of national origin in respect of all laws, regulations and requirements affecting their internal sale, offering for sale, purchase, transportation, distribution or use." A note to Article III provides that "[a]ny internal tax or other internal charge, or any law, regulation or requirement . . . which applies to an imported product and to the like domestic product and is collected or enforced in the case of the imported product at the time or point of importation, is nevertheless to be regarded as an internal tax or other internal charge, or a law, regulation or requirement . . . and is accordingly subject to the provisions of Article III."[7] When an internal tax (such as VAT or an excise tax) is collected on imports at the border, that is called a *border tax adjustment.*

These provisions mean that if the U.S. imposes a regulation (such as the EPA's rules on gasoline composition under the Clean Air Act), the regulation must treat imported products no less favorably than like U.S. products. The internal U.S. measure can be enforced on imports at the border, but it must not discriminate against imports. In determining whether a measure discriminates against imports, WTO panels look to its effect on the conditions of competition between the domestic product and imported like products.[8]

Finally, there are two more non-discrimination requirements in the GATT that would be relevant. The most-favored nation (MFN) clause in GATT Article I:1 prohibits discrimination between foreign sources of supply. The MFN clause applies to border charges of any kind, to internal taxes or regulations, and to border enforcement of internal taxes or regulations. Under Article I:1, whenever a WTO Member grants an advantage, favor, privilege or immunity to a product from any country, it must accord that advantage, favor, privilege or immunity to the like product of any WTO Member. In

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[6] The distinction between a regulation of U.S. *producers* and a regulation of imported *products* is based on the product-process doctrine. Under the doctrine, the line is not drawn between regulations of products on the one hand and regulations of producers and production processes on the other. Rather, it is drawn between regulations of products and regulations of producers and production processes that affect characteristics of the product on the one hand, and regulations of producers and production processes that do **not** affect characteristics of a product on the other. See Robert Hudec, *The Product-Process Doctrine in GATT/WTO Jurisprudence* in M. Bronckers and R. Quick, *eds.*, NEW DIRECTIONS IN INTERNATIONAL ECONOMIC LAW, 187, 191-92.

[7] GATT, Note *Ad* Article III. The "*Ad* Notes" to the GATT have coequal status with the main GATT text.

[8] The focus on "conditions of competition" is a consistent theme in cases applying GATT Article III since 1957; as one example, *see Korea – Measures Affecting Imports of Fresh, Chilled and Frozen Beef* ("*Korea – Beef*"), WT/DS161/AB/R, WT/DS169/AB/R, 11 December 2000, at para. 135, finding that treatment no less favorable under Article III "means...according *conditions of competition* no less favourable to the imported product than to the like domestic product."

addition, GATT Article XIII requires non-discriminatory application of any quantitative restrictions on imports.

If all imported steel from any foreign country were equally subject to the tradable allowances program and received equal treatment, then the measure would be consistent with Article I:1. If an imported ton of steel from Country X were subject to the allowances measure but a "like" ton of steel from Country Y were not (for example because Country Y has a different set of arrangements with the U.S. to meet the objectives of GHG emission reduction), then it would raise questions under GATT Article I:1. However, the United States could argue that, under GATT Article I:1, it is entitled to impose conditions on the importation of products, provided that those conditions apply in the same way to imported products from all sources.[9] The United States could exclude from the allowance requirement of imports from WTO Members whose GHG emissions are below a *de minimis* threshold, which would capture most of the WTO Members that are considered by the United Nations to be least-developed countries.[10] With respect to the largest GHG emitting countries, the United States might point out that the climate change-related objective is the same, but the treatment of Country X and Country Y steel differs because the objective is being met in different ways. The Appellate Body might consider this argument under GATT Article I:1, just as it has in cases applying GATT Article III:4.[11] However, this would be a novel argument in relation to Article I:1, and textual differences between Articles I and III would need to be taken into account in applying this argument to Article I.

IV. Applicability of WTO Exceptions

This portion of the analysis focuses on whether any of the general WTO exceptions for trade in goods would permit the United States to maintain the allowance requirement on imports.

Even if a government measure would ordinarily conflict with the market access and non-discrimination provisions of the GATT, the violation may be excused by one of the ten special policy-based exceptions provided in GATT Article XX. These exceptions apply when a measure is taken for particular purposes or under particular circumstances listed in Article XX. To prevent abuse, these exceptions are all subject to

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[9] *Panel* Report, *Canada – Certain Measures Affecting the Automotive Industry*, WT/DS139/R, WT/DS142/R, adopted 19 June 2000, modified by Appellate Body Report, WT/DS139/AB/R, WT/DS142/AB/R, DSR 2000:VII, 3043, paras. 10.23-10.24.

[10] Described at http://www.unctad.org/Templates/Page.asp?intItemID=3618&lang=1, last visited July 23, 2007.

[11] For instance, in one case, the WTO Appellate Body found that the detrimental effect of a measure on imports may be "explained" – and thereby justified under Article III – "by factors or circumstances unrelated to the foreign origin of the product." Appellate Body Report, *Dominican Republic – Measures Affecting the Importation and Internal Sale of Cigarettes*, WT/DS302/AB/R, adopted 19 May 2005, at para. 96. To recall, the Appellate Body here was expanding on a line of reasoning it started in *Chile - Alcohol* and *Korea – Beef* in which it found that "[a] formal difference in treatment between imported and like domestic products is...neither necessary, nor sufficient, to show a violation of Article III:4. [Rather, the question is] whether a measure modifies the conditions of competition...to the detriment of imported products," at para. 137.

two safeguards provided in a general opening clause ("*chapeau*") to Article XX. The WTO Appellate Body has developed a standard "two-tiered" method for applying Article XX: first, examine whether a measure falls within one of these policy-based exceptions; second, determine whether it complies with the anti-abuse safeguards in the *chapeau*.[12] The following analysis concentrates on paragraph (g) of Article XX, which has been used in similar situations. Paragraph (b) of Article XX, covering measures "necessary to protect human, animal or plant life or health," could also apply to the measures described above. The "necessary" condition under paragraph (b) has been interpreted strictly in WTO jurisprudence; accordingly, it is less likely to be relied upon than paragraph (g).[13]

A. Does an Exception in GATT Article XX Apply?

Article XX(g) provides an exception for "measures . . . relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption." The United States has already successfully argued in WTO dispute settlement that U.S. import restrictions on shrimp, which are tied to domestic restrictions on shrimp harvesting designed to protect sea turtles, are justified under Article XX(g). Article XX(g) would be the logical focus for justifying any trade measures on climate change that are otherwise inconsistent with GATT's market access or non-discrimination rules. Under the analysis used in the *US-Shrimp* case, the United States would need to demonstrate that:

- the resources to be protected, *e.g.*, clean air or dry land, are "**exhaustible**,"
- the measures at issue are measures "**relating to**" the conservation of the resource, and
- these measures are "made effective in conjunction with restrictions on domestic production or consumption."

First, in current circumstances, we believe that a WTO dispute settlement panel would agree that clean air and dry land are "exhaustible natural resources" in the sense of Article XX(g). The panel in *U.S. – Gasoline* explicitly found that clean air is a

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[12] Appellate Body Report, *United States – Import Prohibition of Certain Shrimp and Shrimp Products ("U.S. – Shrimp (AB)")*, WT/DS58/AB/R, 12 October 1998, paras. 118-119 (citing *US—Gasoline* case).

[13] In Panel Report, *Brazil – Measures Affecting Imports of Retreaded Tyres* ("*Brazil – Tyres*"), WT/DS332/R, June 12, 2007 (not yet adopted), at para. 7.104, the panel stated: "the necessity of a measure should be determined through 'a process of weighing and balancing a series of factors', which usually includes the assessment of the following three factors: the relative importance of the interests or values furthered by the challenged measure, the contribution of the measure to the realization of the ends pursued by it and the restrictive impact of the measure on international commerce (footnote omitted). Once all those factors have been analyzed, the Appellate Body said a comparison should be undertaken between the challenged measure and possible alternatives. In performing this comparison, the Appellate Body also stated that the weighing and balancing process of the factors informs the determination of whether a WTO-consistent alternative measure, or a less WTO-inconsistent measure, which the Member concerned could reasonably be expected to employ, is available."

resource that is natural and capable of depletion, even if it is renewable.[14] Later, in *U.S. – Shrimp*, the Appellate Body stated "[w]e do not believe that 'exhaustible' natural resources and 'renewable' natural resources are mutually exclusive."[15] It also found that paragraph (g) must be "read ... in the light of contemporary concerns of the community of nations about the protection ...of the environment."[16] At present, no concern about the protection of the environment is more important and uniting than the need to reduce GHG emissions, and the fact that the Convention on Climate Change was ratified by all but four UN Members States bears witness to that.[17]

Next, to be a measure "relating to" conservation, the allowance requirement must be crafted to bear a relationship with its stated goals, and must be designed to achieve those goals. Indeed, the Appellate Body has interpreted the phrase "relating to" to mean "primarily aimed at",[18] or evidencing a means and ends relationship.[19] In *U.S. – Gasoline*, the Appellate Body found that the measure at issue permitted "scrutiny and monitoring" of compliance with its environmental objectives. It therefore concluded that the measure, although inconsistent with national treatment, was truly designed to achieve clean air conservation and thus fell within the exception.[20] Likewise, in *U.S. – Shrimp*, the Appellate Body focused on the "design and structure" of the measure at issue and was satisfied to find that the measure was narrow enough in scope that it did not constitute a "simple, blanket prohibition" against importation. Consequently, the measure bore a "close and real relationship" with its stated objectives.[21]

Finally, to show that the allowance requirement program is "made effective in conjunction with restrictions on domestic production or consumption," the U.S. would have to show that if and where a requirement for allowances burdens imports, these allowances also burden domestic goods.[22] This test requires only "even-handedness,"[23] not "equality of treatment."[24] If a measure did not accord less favorable treatment to imports than it did domestic goods, it would not offend Article III, and therefore, would not need to be justified under an exception. On the other hand, a measure that solely burdens imports is not likely to be considered as even-handed, and

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[14] Panel Report, *US – Gasoline*, at para. 6.37.
[15] *US – Shrimp (AB)*, at para. 128.
[16] *Id.*, para. 129.
[17] See Status of Ratification, available at http://unfccc.int/files/essential_background/convention/status_of_ratification/application/pdf/unfccc_ratification_22.11.06.pdf, last visited April 23, 2007.
[18] Appellate Body Report, *US- Gasoline*, WT/DS2/AB/R, 29 April 1996, p. 16, 18-19.
[19] *US – Shrimp (AB)*, at para. 141.
[20] *US – Gasoline (AB)*, p. 19.
[21] *US – Shrimp (AB)*, at para.141.
[22] For example, in *U.S. – Shrimp*, the United States required shrimp trawlers to use turtle excluder devices (TED) to exclude turtles from their nets when fishing in waters that are likely to be turtle habitat. Exporting countries had to demonstrate their use of TEDs in order to be certified to export to the United States. Domestically, the United States required that shrimp trawlers use TEDs and imposed civil and criminal penalties (later changed to civil penalties and monetary sanctions) on offenders. See *U.S. – Shrimp (AB)*, at para. 144.
[23] *U.S. – Gasoline (AB)*, p. 20-21; *US-Shrimp (AB)*, at paras. 144-45.
[24] *U.S. – Gasoline (AB)*, p. 21.

would not find shelter under paragraph (g).[25] The rationale for the trade component of the tradable allowances program is not to impose on foreign producers all or a disproportionate amount of the program's costs—it is to achieve appropriate burden-sharing in the shared fight against global warming. And even-handedness, because of the balance it strikes, sets a standard that the United States can meet in crafting climate change legislation.

An emissions allowances requirement falls within the policy-based exception for conservation in Article XX(g). As discussed above, the United States should encounter no difficulty arguing that clean air or dry land or other environmental resources put at risk by climate change are exhaustible natural resources threatened with depletion by GHG emissions. As for the second element under Article XX(g), "relating to," the Appellate Body has interpreted it in the *U.S. – Gasoline* and *U.S. – Shrimp* cases in a way that leads us to conclude that the United States could satisfy the standard it sets—since the allowances requirement is designed to effectively limit emissions by requiring presentation of allowance certificates.

Lastly, the United States could meet the requirement of even-handedness by applying the allowances requirement to domestic industry and enforcing the domestic program to compel producer reporting and compliance with the emissions caps. No WTO panel will accept a U.S. GHG reduction program that shifts all or a disproportionate part of the burden of GHG reduction to foreign producers, by restricting imports while giving a break to domestic producers. Even-handedness also rules out free rides—the United States must exempt from the allowances requirement all those countries that have adopted meaningful and satisfactory emission reductions. On the other hand, the United States could exempt from coverage countries whose GHG emissions are below some *de minimis* level, as imposition of the allowance requirement to goods of such countries would not contribute to the non-trade policy objective of the program.

B. Does the Measure Satisfy the GATT's Safeguards Against Abuse?

As discussed above, all of the GATT's policy-based exceptions are subject to two safeguards provided in a general opening clause ("*chapeau*") to Article XX. This clause provides that measures that fall within the policy-based exceptions in Article XX may not be **applied in a manner** which would constitute **arbitrary or unjustifiable discrimination** between countries where the same conditions prevail, or a **disguised restriction on international trade**. The issue here is not the substance of a measure, but how it is applied. A WTO panel or the Appellate Body may agree entirely that a measure is a legitimate use of Article XX, but at the same time find that the way this legitimate measure is applied constitutes arbitrary or unjustified discrimination or disguised protectionism.

"Arbitrary *or* unjustifiable discrimination" in this context is discrimination not between products, but between countries where the same conditions prevail. The

[25] *U.S. – Gasoline (AB)*, p. 21.

discrimination in question can be discrimination between the United States and one or more foreign countries, or it can be discrimination between different foreign countries. Different treatment of countries is permissible and even appropriate where these countries have objectively different conditions.[26] In practice, this proviso has been interpreted to bar an importing country from using an economic embargo to require its trading partners to adopt "essentially the same comprehensive regulatory program, to achieve a certain policy goal, as that in force within the Member's own territory, *without* taking into account different conditions which may occur in the territories of those other Members."[27]

The ban on arbitrary discrimination has also been interpreted to require that advantages offered to one trading partner must be equally available to other similarly situated trading partners. For instance, in the *US—Shrimp* case, the United States adopted a cooperative approach and negotiated an agreement on sea turtle protection with Caribbean nations, but did not pursue any negotiations with other WTO Members, including nations of the Western Pacific. The Appellate Body found that to avoid arbitrary or unjustifiable discrimination, the United States had to provide all exporting countries similar opportunities to negotiate an international agreement, by engaging in "serious, across-the board negotiations with the objective of concluding bilateral or multilateral agreements" on sea-turtle protection.[28] Nevertheless, although the United States had to make good faith efforts to reach agreements that are comparable from one forum of negotiation to another, its failure to reach comparable agreements did not constitute arbitrary or unjustifiable discrimination.[29]

The transparency and predictability of a measure are also relevant. In the *U.S. – Shrimp* case, the Appellate Body found the "informal" and "casual" nature of the certification process deprived it of basic fairness and due process, tarnished its transparency and predictability, and therefore, rendered it discriminatory in an arbitrary and unjustifiable manner.[30]

The requirement that the measure not constitute a "disguised restriction on international trade" has been defined as including restrictions that are actually

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[26] For example, in *Brazil – Tyres*, Brazil initially applied an import ban on tires from all origins, but then provided an exemption to tires from MERCOSUR countries. The panel found that the exemption constituted discrimination, but that the discrimination "[did] not seem to be motivated by capricious or unpredictable reasons." It found rather that the discrimination was due "to a ruling within the MERCOSUR framework [with] binding legal effects for Brazil." Panel Report, *Brazil – Tyres*, at para. 7.272. More importantly, the panel found that notwithstanding the ban, retreaded tires from non-MERCOSUR countries were still entering Brazil along with tires from MERCOSUR countries. The panel thus concluded that the discrimination resulting from the ban was arbitrary or unjustifiable under Article XX. Panel Report, *Brazil – Tyres*, at para. 7.306.

[27] *U.S. – Shrimp (AB)*, at para. 163-164; see also para. 177.

[28] *U.S. – Shrimp (AB)*, para. 166.

[29] *U.S. – Shrimp (AB)*, para. 166; Appellate Body Report, *United States – Import Prohibition of Certain Shrimp and Shrimp Products: Recourse to Article 21.5 of the DSU by Malaysia ("US – Shrimp (21.5 AB)*, WT/DS58/AB/RW, 22 October 2001, at paras. 122-134.

[30] *U.S. – Shrimp (AB)*, at paras. 180-81.

discriminatory but are taken under guise of a legitimate Article XX exception: in effect, a form of stealth protectionism.[31]

Of the six scenarios discussed on page four of this memorandum, scenario 1 would involve no international trade and scenario 4 would not involve the United States. Scenarios 2 and 5 would involve trade between the United States and a trading partner with a cap-and-trade system, and scenarios 3 and 6 would involve trade between the United States and a trading partner without a cap-and-trade system. In scenario 6, *i.e.*, the case involving imports into the United States from a non-cap-and-trade country, U.S. climate change legislation might treat products of the non-cap-and-trade countries less favorably than imports from a cap-and-trade country. This difference in treatment might be permitted by WTO law, and specifically by Article XX(g) of the GATT. But in that case, the ban on arbitrary discrimination in the opening clause (*chapeau)* of Article XX would require that, if the United States were to negotiate with some countries before imposing the measure, that it undertake "serious, across-the board negotiations with the objective of concluding bilateral or multilateral agreements" on GHG reduction, with *all* concerned parties. The United States would not have to reach agreements with all of these countries, but it would have to make a non-discriminatory, good faith effort for each. Second, the United States would have to take its trading partners' differences in circumstances into account in devising and implementing its measures. Finally, the U.S. measures would have to be implemented with due process and fairness. These are standards that climate change legislation should be able to meet.

As we have discussed, the United States would appear to be in a strong position to defend a requirement that importers of goods from a non-cap-and-trade country must present emission allowance certificates to cover the GHG emissions represented by the goods. First, such a measure is clearly linked to the purpose of GHG emissions reduction. Second, this would be a flexible measure adaptable to the circumstances of each exporting country, and therefore devoid of arbitrary or unjustifiable discrimination. Each exporting country would have a choice to embrace any GHG emission reduction program as an alternative to presenting allowance certificates, and trading partners would be given a phase-in period to achieve compliance. Third, the design, architecture, and structure of such an allowances requirement would demonstrate that the system has no purpose other than to cause the reduction of GHG emissions. Consequently, the *chapeau* of Article XX would pose no obstacle to deployment of a U.S. allowances program to combat climate change.

Attachments

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[31] *U.S. – Gasoline (AB)*, p. 25.

APPENDIX OF RELEVANT WTO PROVISIONS

1. GATT Article I: General Most-Favored-Nation Treatment

1. With respect to customs duties and charges of any kind imposed on or in connection with importation or exportation...any advantage, favour, privilege or immunity granted by any [Member] to any product originating in or destined for any other country shall be accorded immediately and unconditionally to the like product originating in or destined for the territories of all other [Members].

2. GATT Article II: Schedules of Concessions

1. (a) Each [Member] shall accord to the commerce of the other [Member] treatment no less favorable than that provided for in the appropriate Part of the appropriate Schedule.

(b) The products described in Part I of the Schedule...shall, on their importation into the territory to which the Schedule relates...be exempt from ordinary customs duties in excess of those set forth and provided therein. Such products shall also be exempt from all other duties or charges of any kind imposed on or in connection with the importation in excess of those imposed thereafter by legislation in force in the importing territory on that date.

3. GATT Article III: National Treatment on Internal Taxation and Regulation

1. The [Members] recognize that internal taxes and other internal charges, and laws, regulations and requirements affecting the internal sale, offering for sale, purchase, transportation, distribution or use of products, . . . should not be applied to imported or domestic products so as to afford protection to domestic production.

2. The products of the territory of any [Member] imported into the territory of any other [Member] shall not be subject, directly or indirectly, to internal taxes or other internal charges of any kind in excess of those applied, directly or indirectly, to like domestic products. . . .

4. The products of the territory of any [Member] imported into the territory of any other [Member] shall be accorded treatment no less favourable than that accorded to like products of national origin in respect of all laws, regulations and requirements affecting their internal sale, offering for sale, purchase, transportation, distribution or use. . . .

4. GATT Note Ad Article III

Any internal tax or other internal charge, or any law, regulation or requirement of the kind referred to in paragraph 1 which applies to an imported product and to the like domestic product and is collected or enforced in the case of the imported product at the

time or point of importation, is nevertheless to be regarded as an internal tax of other internal charge, or a law, regulation or requirement of the kind referred to in paragraph 1, and is accordingly subject to the provisions of Article III.

5. GATT Article XI: General Elimination of Quantitative Restrictions

1. No prohibitions or restrictions other than duties, taxes or other charges, whether made effective through quotas, import or export licences or other measures, shall be instituted or maintained by any [Member] on the importation of any product of the territory of any other [Member] or on the exportation or sale for export of any product destined for the territory of any other [Member].

6. GATT Article XIII: Non-Discriminatory Administration of Quantitative Restrictions

1. No prohibition or restriction shall be applied by any [Member] on the importation of any product of the territory of any other [Member] or on the exportation of any product destined for the territory of any other [Member], unless the importation of the like product of all third countries or the exportation of the like product to all third countries is similarly prohibited or restricted.

7. GATT Article XX: General Exceptions

Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any [Member] of measures:

* * *

(b) necessary to protect human, animal or plant life or health;

* * *

(g) relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption.

8. Marrakesh Agreement Article IX: Decision-Making

3. In exceptional circumstances, the Ministerial Conference may decide to waive an obligation imposed on a Member by this Agreement or any of the Multilateral Trade Agreements, provided that any such decision shall be taken by three fourths of the Members unless otherwise provided for in this paragraph (footnote omitted). . . .

ATTACHMENT

IBEW-AEP International Proposal

Congress is considering a mandatory national cap-and-trade program for greenhouse gas (GHG) emissions. To be successful, it must ensure that emissions from China, India and other developing nations do not undermine America's effort to address climate change, while also adhering to our World Trade Organization (WTO) obligations.

We must address the soaring greenhouse emissions of major emitting nations in the developing world. To unilaterally cap America's emissions, while ignoring other major emitting nations, is a fatally flawed approach that will seriously harm the global environment while compromising our competitiveness and jeopardize American jobs.

An approach proposed by Edwin D. Hill, International President of the International Brotherhood of Electrical Workers, and Michael G. Morris, Chairman, President and Chief Executive Officer of American Electric Power, is designed to meet WTO tests and ensure that the failure by some countries to reduce their emissions is directly addressed in US law. The IBEW and AEP propose as a condition of the sale of goods in the US, that sellers/producers hold emission allowances to offset carbon emitted in production of those goods, regardless of origin. Under the IBEW-AEP proposal, these major emitting nations would likely join a climate regime and reduce their GHG emissions rather than buy large numbers of allowances, and would derive even greater environmental benefits in the process. This envisions:

- America would develop tools that address the impact on the environment and on our competitiveness if developing countries fail to implement comparable GHG controls thereby reducing their products cost relative to 'capped' US products;

- This would include statutory provisions that would automatically be applied to imported goods from those countries that enter the US, requiring that imports have allowances that cover their GHG emissions, and allowance requirements would be set by US regulation, on a country-specific basis;

- These nations would purchase those allowances from a special reserve of international allowances or secure verified emissions credits or foreign allowances from another nation's recognized cap-and-trade program; and

- Allowances assigned to US manufacturers that shut down would no longer be available unless that manufacturer opens a new plant in the US; preventing the transfer of allowances -- and jobs -- to a new factory in a developing nation that has refused to reduce their emissions.

This approach addresses competitive issues caused by the U.S. taking a cap and other major emitting nations failing to do likewise, and respects WTO ground-rules when doing so, which require:

- That the US first exhausts any alternative that is less trade restrictive, such as direct negotiations. The US would therefore vigorously pursue a good-faith effort to negotiate bilateral or multilateral climate agreements to include these nations, and the US would only implement these 'automatic' procedures after those negotiations have failed;

- Imported goods would be treated similarly as domestic goods because both must hold emission allowances; and

- That America's remedy be directly related to the objective of curbing GHG emissions, (for example, requiring that imports to be accompanied by emission allowances actually addresses the environmental objective);

- This approach does not simply attach a tariff or border adjustment tax on top of the cap-and-trade regulatory system, since under the WTO a border adjustment tax can only be used to compensate for an equivalent domestic tax. If America adopted a national carbon tax as a direct substitute for a cap-and-trade program, border adjustment taxes might be appropriate. However, in anticipation of a cap and trade regulatory system the IBEW/AEP allowance requirement has been specifically designed to be consistent with the WTO and ensure international action.

This common-sense approach is grounded upon Americans' inherent sense of fair play, and enables the US to work with other nations to meaningfully address global warming. This recognizes that trade is, indeed, the key to climate change.

How IBEW-AEP International Proposal Operates Within a Cap-and-Trade Program

What are the objectives?

- The goal is to establish a framework that protects the environment and U.S. jobs.
- The framework seeks to –
  - find a global solution to the global climate change problem, and
  - prevent the shifting of U.S. jobs to foreign countries that have lower manufacturing costs because they refuse to limit their greenhouse gas (GHG) emissions.

How does the allowance requirement work?

- U.S. importers must hold "international reserve allowances" or foreign allowances to cover emissions from imported goods.
  - International reserve allowances are issued by the President and are separate from the domestic allowances used for compliance under the domestic cap-and-trade program.
  - Foreign allowances include those allowances or other such emissions credits that another country issues under a comparable GHG regulatory program.
- Failure to submit allowances bars entry of imported goods into the U.S.
- The allowance requirement –
  - applies five years after the start of the U.S. cap-and-trade program (around 2020), and
  - strives to mirror allowance requirement that the U.S. program imposes on producers of domestic goods.

Which goods are covered?

- The allowance requirement applies only to "greenhouse gas intensive" goods from countries that are found to have not taken comparable action as the US.
- Covered goods include –
  - primary goods (such as iron and steel, aluminum, cement, bulk glass, and paper) and
  - Other goods sold in bulk that are determined to have substantial amounts of GHG emissions.
- Goods not covered include finished products and other goods that do not generate substantial amounts of GHG emissions (on emissions per dollar basis) during their manufacture.

Which countries are covered?

- The allowance requirement only applies to foreign countries that are –
  - large-emitters of GHG emissions, and
  - not taking action to address their emissions.
- Foreign countries are excluded if they –
  - Have taken "comparable action" to limit their GHG emissions,
  - Are a least-developed developing country, or
  - Have de minimis levels of GHG emissions.

How is the allowance requirement set?

- The allowance requirement is –
  - set for each category of covered goods from each covered foreign country,
  - applied on a per unit basis to each good,
  - adjusted each year to reflect production changes in the foreign country,
  - adjusted to ensure consistency with WTO requirements (see next slide).

What are WTO adjustments?

- To ensure WTO compliance, adjusts are made to each category of covered goods.
- The WTO adjustments are intended to –
  - avoid discrimination between countries where the same conditions prevail.
    - Example: Take into account the level of economic development of the foreign country.
  - maintain rough comparability in burden on imported and domestic goods.
    - Example: Lower international allowance requirement to reflect "free" allowances given to domestic producers. (This ensures that imported goods are "not treated less favorable" than domestic goods.)

How do countries comply?

- Countries may comply with the allowance requirement by –
  - purchasing "*international reserve allowances*" from a separate pool that is reserved only for this purpose (see next slide).
  - obtaining certified emissions credits issued pursuant to the U.S. program or other foreign GHG regulatory program, or
  - making "safety valve" payments, in lieu of submitting allowances (if the program contains a safety valve).

What are the key features of international reserve allowances work?

- The allocation of international reserve allowances will not reduce the number of allowances allocated for domestic compliance.
- The international reserve allowances –
  - cannot be used for domestic compliance, and
  - can only be used for meeting the allowance requirement applicable to imported covered goods.
- The price of the international reserve allowances would be pegged at the U.S. market price for domestic allowances.
- International reserve allowances may be traded and banked for future use.

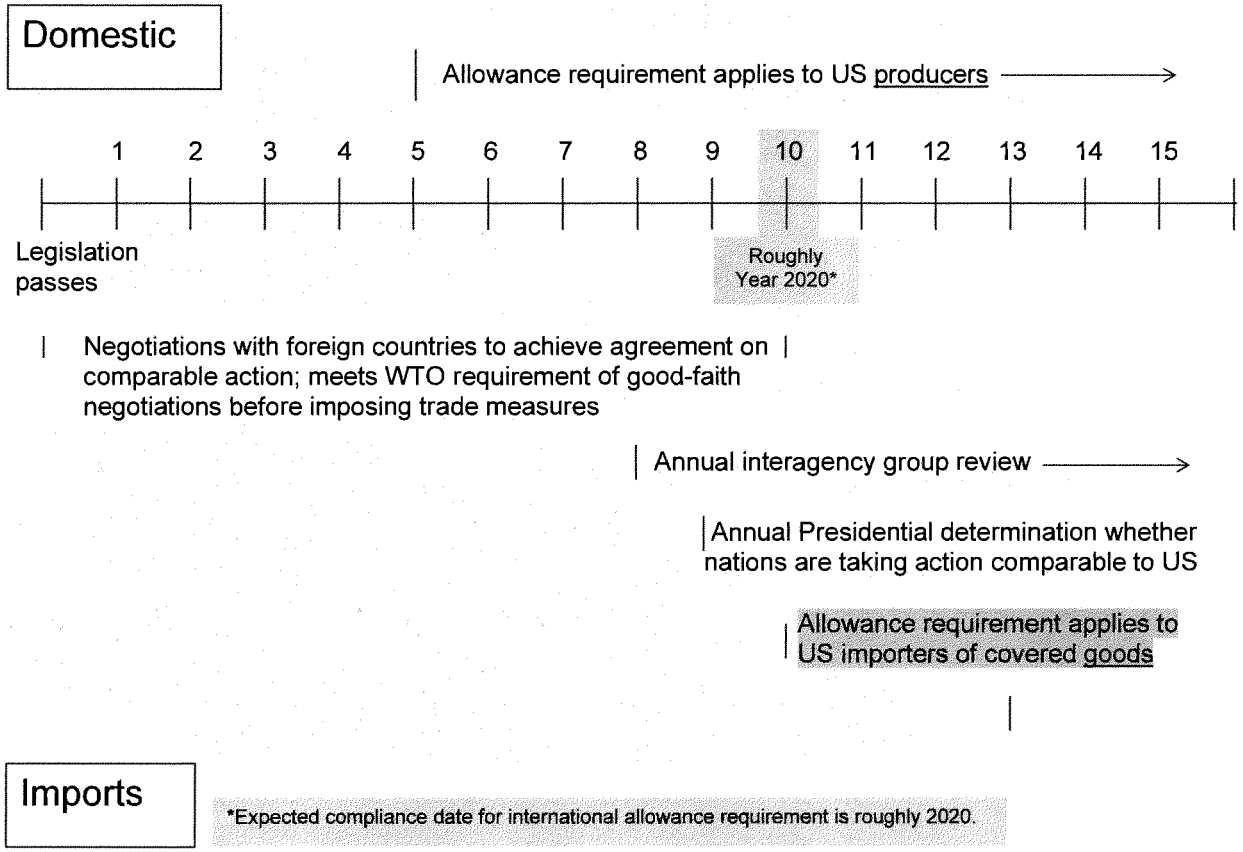
When does allowance requirement apply?

- The allowance requirement is a measure of last resort that applies five years after the U.S. cap-and-trade program begins – **specifically in 2020** – allowing ample time for negotiations.
  - Until then, the U.S. first must make good faith efforts to get foreign countries to limit their GHG emissions.
  - The President will have ten years from enactment date to negotiate a GHG agreement with these other countries.

- The allowance requirement applies to imported goods of a foreign country only if—
  - the U.S. fails to negotiate GHG agreement with that country; and
  - the President determines that the country is not taking comparable action to limit its GHG emissions.

Can the allowance requirement be adjusted?

- The President can increase the stringency of the international allowance requirement or take other appropriate action to address GHG impacts of imports.
- Either action is authorized if –
  - the President determines the current requirement is insufficient to address GHG impacts, and
  - the adjusted requirement complies with WTO laws.
- The President also may make adjustments to address concerns raised in WTO challenges lodged by foreign countries.


Domestic
Allowance requirement applies to US producers
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Legislation passes
Roughly Year 2020*
Negotiations with foreign countries to achieve agreement on comparable action; meets WTO requirement of good-faith negotiations before imposing trade measures
Annual interagency group review
Annual Presidential determination whether nations are taking action comparable to US
Allowance requirement applies to US importers of covered goods
Imports
*Expected compliance date for international allowance requirement is roughly 2020.

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