

**EXAMINE AMERICA'S CLIMATE SECURITY ACT OF
2007**

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

—————
OCTOBER 24, 2007
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Printed for the use of the Committee on Environment and Public Works



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ONE HUNDRED TENTH CONGRESS
FIRST SESSION

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¹Note: 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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**EXAMINE AMERICA'S CLIMATE SECURITY ACT
OF 2007**

WEDNESDAY, OCTOBER 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 2:35 p.m. in room 406, Dirksen Senate Office Building, Hon. Joseph I. Lieberman (chairman of the subcommittee) presiding.

Present: Senators Lieberman, Baucus, Carper, Cardin, Sanders, Whitehouse, Warner, Voinovich, Isakson, Alexander, Craig, Bond, Inhofe and Barrasso.

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

Senator LIEBERMAN. Good afternoon, and thank you all very much for being here.

This, as you know, is a hearing on America's Climate Security Act, the legislation that Senator Warner and I introduced last week, with Senators Cardin, Casey, Coleman, Collins, Dole, Harkin and Klobuchar as original bipartisan cosponsors.

Senator Warner and I began working together on climate change earlier this year, shortly after we became chair and ranking member, respectively, of this Subcommittee on Climate Change. Since then, we have been studying, listening, talking and learning a lot.

On August 2, we released a framework description of the climate bill that we proposed to write. That proposal reflected what we had learned in the three hearings that we held on the climate problem and climate policy in this subcommittee, as well as suggestions of more than 150 outside stakeholders and more than a dozen U.S. Senators.

In fact, many of the measures described in our August framework proposal were suggested, drafted or introduced by Senators Boxer, Lautenberg, Sanders, Carper, Klobuchar, Alexander, Bingaman, Specter, Feinstein and McCain. By the time we presented our bill formally last week, it included even more new ideas and a number of contributions from Senate colleagues.

Senator Warner and I made a particular effort to hear from members of the committee over the 2 months preceding introduction. Most of the changes we made after August 2, and some were

quite significant, came at the suggestion of Senators Boxer, Baucus, Lautenberg, Sanders, Alexander and Carper.

Today, we are holding this public hearing on the bill. Next week, the seven members of the subcommittee will consider it, mark it up and vote on it. The process I just described comprises, in our opinion, the first steps—big ones—but first steps in the journey that this legislation will take through the Senate. If a majority of this subcommittee's members vote in favor of the bill next week, then it will be referred to the full Environment and Public Works Committee. There, the legislation will, of course, go through another thorough vetting, be subject to amendment. I particularly appreciate Chairman Boxer's announcement yesterday that the full EPW Committee will hold two legislative hearings following our subcommittee vote next week.

So Senator Warner and I, I believe, have moved deliberatively and openly, but we have also moved as quickly as we can, thoughtfully, because we believe that the problem of global warming grows more urgent each day and that the U.S. Government has a responsibility to be part of a solution to that problem.

Just take a look at the dramatic satellite pictures of the melting polar ice caps that were in the paper the other day and you will see with your own eyes one of the many pieces of evidence that one can see with one's own eyes today about why we must move with a real sense of purpose to get something substantial done to avert the worst possible consequences of global warming.

Senator Warner and I feel good about the bill we have introduced. If enacted, we are convinced it would achieve the greenhouse gas reductions and reduction in global warming that we need, and do so without adverse effect on America's economy. In fact, we think it will stimulate greater economic growth.

According to the now-Nobel Prize winning Intergovernmental Panel on Climate Change, keeping the atmospheric concentration of greenhouse gases below 500 parts per million will avoid a high risk of global warming that would cause severe impacts. That is the goal.

The analysis that EPA completed in July of the forerunning McCain-Lieberman climate bill found that the reductions in U.S. greenhouse gas emissions mandated by that bill would, making conservative assumptions about the pace of emissions reductions in the rest of the world, keep the concentration of greenhouse gases in the atmosphere below that threshold of 500 parts per million at the end of this century.

This bill that I have introduced with Senator Warner has mandated emissions reductions which are somewhat greater than the McCain-Lieberman bill and would therefore, we are confident, keep the concentration of greenhouse gases well below the danger level. In other words, it achieves the goal that most of the experts tell us we need to have for the protection of our environment and, in fact, our way of life.

Now, what about the economic impact of our legislation? Two economic impact analyses have just been completed, one from the Nicholas Institute at Duke University and RTI International analyzed our August 2 proposal using EPA's model. The other is from the Clean Air Task Force and on location used the Energy Informa-

tion Administration's model to analyze the actual legislative text that Senator Warner and I have just introduced.

I am very pleased to say that neither analysis shows any disruption of robust U.S. economic growth, any sharp increases in energy prices, or any jeopardy to the central role of coal in this Nation's energy portfolio from our legislation. As good as we feel about our bill, Senator Warner and I understand that it is unfinished. It is a work in progress, and that it will change, hopefully for the better as it works its way through the legislative process.

To cite one example, I am confident that we can improve on the section in the bill that enables vulnerable populations in different regions of the world to adapt to the negative impacts of global warming. That said, I believe our bill is both strong and balanced, and that it can and should be adopted in this Congress. If it were enacted today, it would be the best greenhouse gas cap and trade system on the planet. That is exactly what we need it to be to protect our country and our people and to become effective leaders in a global response to this global challenge.

[The prepared statement of Senator Lieberman follows:]

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

Good afternoon. This is a hearing to examine America's Climate Security Act, a bill that Senator Warner and I introduced last week with Senators Cardin, Casey, Coleman, Collins, Dole, Harkin, and Klobuchar as original, bipartisan cosponsors.

Senator Warner and I began working together on climate legislation early this year—studying, listening, talking. On August 2, we released a description of the climate bill that we proposed to write.

Our proposal reflected what we had learned in the three hearings that we held on the climate problem and climate policy in this subcommittee, as well as suggestions of more than 150 outside stakeholders and more than a dozen U.S. Senators.

In fact, many of the measures described in our August proposal were suggested, drafted, or, in some cases, introduced by Senators Boxer, Lautenberg, Sanders, Carper, Klobuchar, Alexander, Bingaman, Specter, Feinstein, and McCain.

By the time we presented our bill last week, it included even more ideas and a number of contributions from colleagues.

Senator Warner and I made a particular effort to hear from members of the EPW committee, and especially members of this subcommittee on climate change, over the two months preceding introduction.

Most of the changes we made after August 2—and some were very significant—came at the suggestion of Senators Boxer, Baucus, Lautenberg, Sanders, Alexander, and Carper.

Now we are holding a hearing on the bill. Next week, the seven members of this subcommittee will vote on it.

The process I just described comprises the first step in the journey that this legislation will take through the Senate. If a majority of this subcommittee's members vote in favor of the bill next week, then it will be referred to the full Environment and Public Works Committee.

There the legislation will go through another vetting. I appreciate Chairman Boxer's intention to hold two full-committee legislative hearings, on the Tuesday and Thursday of the week immediately following the subcommittee vote.

So Senator Warner and I are moving deliberatively and openly, but we are also moving as quickly as we can, because we believe that the problem of global warming grows more urgent each day, and that the U.S. government has a responsibility to be part of a solution to that problem.

Just take a look at the dramatic satellite pictures of the melting polar ice caps and you will see with your own eyes why we must move with a real sense of purpose to get something substantial done.

Senator Warner and I feel good about the bill we introduced. If enacted, we are convinced it would achieve the reductions in greenhouse gases and global warming we need, and do so without adverse affect on America's economy. In fact, we think it will stimulate greater economic growth.

According to the IPCC, keeping the atmospheric concentration of greenhouse gases below 500 ppm will avoid a high-risk of global warming that would cause severe impacts. The analysis that EPA completed in July of the McCain-Lieberman climate bill found that the reductions in U.S. greenhouse gas emissions mandated by that bill would—making conservative assumptions about the pace of emissions reductions in the rest of the world—keep the concentration of greenhouse gases in the atmosphere below 500 parts per million at the end of this century.

The Lieberman-Warner bill's mandated emissions reductions are somewhat greater than the McCain-Lieberman bill, and would keep the concentration of greenhouse gas below the danger level.

Two economic impacts analyses have just been completed. One, from the Nicholas Institute at Duke University and RTI International, analyzed our August 2 proposal using EPA's model.

The other, from the Clean Air Task Force and OnLocation, used the Energy Information Administration's model to analyze the actual legislative text that Senator Warner and I just introduced.

Neither analysis shows any disruption of robust U.S. economic growth, any sharp increases in energy prices, or any jeopardy to the central role of coal in this nation's energy portfolio from our legislation.

As good as we feel about our bill, Senator Warner and I understand that it is unfinished, and that it will change—hopefully for the better—as it works its way through the legislative process.

To cite one example, I am confident that we can improve the section in the bill that enables vulnerable populations in different regions of the world to adapt to the negative impacts of global warming.

That said, I believe our bill is both strong and balanced, and that it can and should pass in this Congress. If it were enacted today, it would be the best greenhouse gas cap-and-trade system on the planet.

And that is exactly what we need it to be to protect our country, and our people, and to become effective leaders of a global response to a global crisis.

With that, I ask Senator Warner to make an opening statement.

Senator LIEBERMAN. With that said, I am honored to call on Senator Warner, whose support for this measure has quite literally made all the difference.

Senator Warner.

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

Senator WARNER. Thank you, Mr. Chairman. I compliment you now on the leadership you have shown from the very beginning on this bill.

I thank the full committee chairman, who understandably can't be with us today, having returned to California.

I thank my very good friend, we have shared together the committee's experience on this in the Armed Service Committee for two decades. You have your differences, but I respect them and I hope the fact that we have now reached two more hearings with the full committee will in some way meet some of the legitimate concerns that you have.

I just wanted to say in addition, and I will put my statement basically in the record, I just don't think the United States of America can continue to stay on the sidelines. This is football season, and we see a lot of people sitting on the bench. We need to get on that field. This is the opportunity. Our government is three branches, three coequal branches, we proudly refer to it. The Supreme Court has spoken, and now it is time for the legislative branch, and I am anxious to see that the United States Senate will take the lead and that the House, hopefully, will likewise at some early date move forward on their initiatives. I think some interesting initiatives are being taken on the other side.

So the executive branch, of course, favors a voluntary approach. It is our conscientious belief that we cannot take that lead in the world with the voluntary, and therefore we have the provisions that I have in this bill with my Chairman.

I also want to say that hopefully this action that we initiate today can culminate in a markup with this subcommittee, followed as you say by hearings of the full committee and a markup by the full committee such that at the time the United Nations Framework Convention on Climate Change, the parties meet in Bali in December, they can see a clear signal from two of the branches, or at least one and a half branches of the United States Government, that action is on its way.

I thank you for acknowledging all of the work that has been done by our colleagues. We freely acknowledge, we sat down with each and every one of them—Senator Carper can testify to that—and pointed out, Senator, the provisions that we liked and we wanted to steal from your draft. Is that not correct? Do you verify that?

Senator CARPER. [Remarks made off microphone.]

Senator WARNER. Yes, fine. Thank you very much.

[Laughter.]

Senator LIEBERMAN. You are under oath. Be careful.

[Laughter.]

Senator WARNER. Senator Alexander, did we not do the same with you? I don't quite hear you.

Senator ALEXANDER. [Remarks made off microphone.]

[Laughter.]

Senator WARNER. But we are open 7–11, right, for business around here—24 or whatever it is.

I would like to also point out, I love to look at legislative history. President Bush, the first President Bush, he broke the logjam on the Clean Air Act by campaigning on the issue in 1988. His Administration presented the idea of a cap and trade system, one that has worked effectively in the acid rain program. My friend and I late last night on the Floor of the Senate, Senator Baucus and I reminisced about how both of us were active in that and how he specifically, Senator Baucus, stepped up and took a leadership role at that time with George Mitchell and we got the job done.

We have an urgent economic situation here with regard to our energy situation. I was taken back by the following here recently, and that is a power plant sought to get the approval of their respective State, in this case the Kansas Department of Health and Environment, and they were denied that permit simply because they could not, for whatever reason, meet the carbon dioxide emissions as a reason for rejecting.

Now, other plants across America, I am told that 16 some plants have just scrapped their plans, coal plants, coal-fired plants, and another 76 are on hold. This is why we have to move. This is why the Congress must put forth a piece of legislation enacted by the President into law so that the private sector can move forward with a degree of certainty so that they can get the necessary financing and permits and the like. So these are some of the reasons I believe it is essential to get started now.

I think that pretty well closes my remarks. I just want to thank all the members of the subcommittee who have turned out here in

force today, and that is the way it should be. Colleagues are going to come here and speak to this bill. So at this point, I happily yield the floor.

[The prepared statement of Senator Warner follows:]

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

Senator Lieberman, my fellow subcommittee members, and distinguished witnesses, I am proud to begin the America's Climate Security Act's journey through the legislative process today with this subcommittee hearing.

Senator Lieberman has accurately described the components of the bill, so I would like to address the process we have taken and will continue to undertake with regard to this bill. We are open 24-7 for ideas.

I recognize the interest my colleagues have in holding additional hearings directly related to provisions in our bill. In the interest of balancing their interest with my own, shared by Senator Lieberman, in moving this bill along, I propose we schedule two full committee hearings for the Tuesday and Thursday of the week after the subcommittee markup.

Now, a word on the bill. In brief, it is my view that America cannot afford to continue to stay on the sidelines. We need to get on the field. Our government has 3 co-equal branches of government, and one of these, the judicial branch, has spoken. In April, the United States Supreme Court ruled that greenhouse gases are air pollutants. The executive branch favors a voluntary approach to reducing greenhouse gas emissions. Now is the time for the legislative branch to begin movement on a well conceived mandatory greenhouse gas emissions reduction program. I am eager to see the Senate take the lead. And I look forward to the House proceeding.

I continue to hope that the Chairman and Ranking Member of the full committee will find the time to consider the subcommittee's markup.

If our full committee completes its markup before the United Nations Framework Convention on Climate Change Conference of Parties in Bali in December, the U.S. will emerge as a leader. It will send a rare signal from 1½ branches of government.

In short, I want to see the United States credibly enter the realm of world leadership on this issue producing legislative action here at home.

The bill before us relies heavily on the pioneering work done here by many. I point to the accomplishments of the first President Bush, as he broke the logjam on the Clean Air Act amendments by campaigning on the issue in 1988. His Administration presented the idea of a cap and trade system, one that has worked effectively in the Acid Rain Program. My friend, Senator Baucus helped hone and usher the amendments through this body, and today, the success of the Acid Rain Program speaks for itself.

To underscore the urgency of the economic and energy situation facing our nation now, one need only look at a recent permit denial for a power plant in Kansas. Last week, the Kansas Department of Health and Environment cited carbon dioxide emissions as the reason for rejecting an air permit for coal-fired power plants.

Furthermore, nationally, plans for at least 16 plants have been scrapped this year with another 76 plans on hold with a very uncertain future. This is why Congress needs to move, so the private sector has certainty.

These actions have significant economic impacts.

How are we going to meet our power needs for economic growth in this country if we do not provide the regulatory certainty to enable that growth?

Our country relies on power fueled by our nation's largest natural resource: coal. In order to create the certainty needed for further investments to occur in the power sector, in order to meet our country's growing energy needs, a federal regulatory structure for greenhouse gases needs to be enacted.

I thank the subcommittee members, all of whom Senator Lieberman and I met with personally. In the pages of our bill are many of the ideas brought to our attention in those meetings. We may not always agree on how to address the issue of climate change, but this bill is intended to provide the vehicle by which the Senate will work its will on this pressing challenge before us.

I look forward to the continued dialogue and to hearing the views of today's witnesses.

Senator LIEBERMAN. Thank very much, Senator Warner, for that excellent statement and for all you have done to bring us to this point. Senator Warner and I are accustomed to the very autocratic procedures of the Senate Armed Services Committee and the Sen-

ate Homeland Security Committee where only the chair and the ranking member get to give opening statements.

This is a much more democratic and participatory people's committee, so that in the spirit of that at this subcommittee hearing we have invited the members of the full Committee. We are going to invite every member here in order of arrival on the early bird rule to give an opening statement, hopefully of not more than five minutes.

I thought that I would start, Senator Inhofe, by reading a brief letter from Chairman Boxer, and then call on you first, and then after that we will go to the early bird rule.

"Dear Colleagues, today is a very big day for our Committee as we take the first step toward enacting a comprehensive bill to ensure that the worst ravages of global warming will be averted. Only the raging fires in my beautiful home State of California could keep me away from what I know will be a spirited and in-depth exchange of ideas encompassed in the Lieberman-Warner bill.

I look forward to being briefed by all of you upon my return. I thank you for your expressions of deep concern about the wildfires in California. I am sure you are all aware that this is just the first in a series of hearings and briefings that the Committee will undertake as we move toward markup of this legislation. I hope that each and every one of you appreciates the extraordinary work of both the chairman and the ranking member of the subcommittee on this bill"—I leave that to each of you.

"I look forward to moving this legislation along to the full U.S. Senate. We cannot leave the issue of global warming burning for another generation. It is our responsibility to act now.

Most sincerely, Barbara Boxer, Chairman."

SENATOR LIEBERMAN. I will enter that in the record.

Senator Inhofe, I welcome your comments.

Senator INHOFE. Thank you, Mr. Chairman.

One of our valuable members, Senator Bond, has some other commitments. I would like to defer to him. It is my intention to stay here for the entire time of this hearing so I will have an opportunity to give mine, even last if it is necessary.

Senator LIEBERMAN. Fine.

Senator Bond.

**STATEMENT OF HON. CHRISTOPHER S. BOND, U.S. SENATOR
FROM THE STATE OF MISSOURI**

Senator BOND. Mr. Chairman, I thank Senator Inhofe and I thank you, Mr. Chairman and Ranking Member Warner for having this legislative hearing to review the provisions of America's Climate Security Act.

As you know, I have previously submitted to you a detailed list of concerns for the people of the Midwest, including the people of Missouri whom I serve. I will tell you that all those concerns remain and they have not been addressed.

Today, I am going to focus on one particular area. I am concerned that this bill fails to protect vulnerable families and workers from hardship. The Carbon Market Efficiency Board provides no guarantee that millions of people supporting modest families across dozens of States will avoid the pain this bill will provide.

Experts agree that capping carbon will increase the cost of something no one can afford to do without, and that is energy. Families will face pain at the pump, higher home electricity and gas bills. Workers in energy-intensive sectors will face layoffs, with their jobs

going overseas to countries with lower energy costs. Hardest hit will be the weak and vulnerable, with no extra room in their budget for higher energy costs. The poor, the fixed income will suffer.

Now, I asked if the bill proponents really expect me to go back to Missouri and say to these people that I helped create a Carbon Market Efficiency Board that will protect them? Even the name implies it is less concerned with alleviating suffering than ensuring market efficiency. A white paper and associated materials by the bill's sponsors say it the cost control board is a fashion on the Federal Reserve Board. That is cold comfort to the folks back home.

I do not think there is a progressive advocate alive who thinks that the Fed protects or even has in mind the needs of the poor or the downtrodden. The Fed is more concerned with macro issues such as the stability of credit markets, the size of the money supply, inflation and the economy at large.

A story yesterday in The Wall Street Journal underlined the point. It is entitled, More Debtors Use Bankruptcy to Keep Homes. We are in the middle of a housing crisis, with millions of homeowners suffering with higher mortgage payments, tens of thousands are losing their homes to foreclosure. The story notes how many homeowners are forced into bankruptcy to save their homes.

Last month, as the Nation's housing slump continued, consumer bankruptcy filings increased almost 23 percent, representing 69,000 people, and overall consumer bankruptcy filings were up 45 percent during the first 9 months of the year. I don't see the Federal Reserve solving those problems.

Of course, we know that there were many months of homeowners suffering before the Fed took action, and only then it was because the credit markets were seizing up, not because of low-income suffering. Even now, distress continues in certain sectors of the economy, like home building and financials. That is because the Fed does not take action based on certain sectors of the economy, certain types of workers or families, or certain income levels. The Fed only acts when the entire economy is at stake. This is the same standard for action by the board proposed in this bill, to avoid "significant harm to the economy of the United States."

Anything less than significant harm to the entire economy produces no cost control or action. So we can expect under the Lieberman-Warner bill no action, even if millions of Midwestern families are suffering with higher energy bills; no action when millions of drivers are hit with more pain at the pump; no action when tens of thousands of jobs are lost in energy-dependent sectors; no action when dozens of States in the Midwest, Mountain West and South suffer from higher energy prices.

Gentlemen, I am sorry, that is not good enough for me. I believe our vulnerable families and workers deserve real protection. They deserve protection they can count on. They deserve an automatic trigger, a safety valve at a preset level.

We could take a stand now and say that pain beyond a certain level is unacceptable. That is the right thing to do for our weak and vulnerable. I would hope the committee might consider that path.

Thank you very much for your courtesies in allowing me to go forward.

Senator LIEBERMAN. Thanks very much, Senator Bond.

Going in order of arrival, Senator Alexander.

**STATEMENT OF HON. LAMAR ALEXANDER, U.S. SENATOR
FROM THE STATE OF TENNESSEE**

Senator ALEXANDER. Thank you, Mr. Chairman, and my congratulations to you and to Senator Warner for your work. Let me say, I especially welcome Kevin Anton who is here, who is the president of Alcoa Materials Management. They have a big headquarters in Knoxville, TN and a big plant in my hometown, where my Dad worked. They sent me to school on an Alcoa scholarship and they just gave 10,000 acres of land in between the Smokies and the Cherokee National Forest. So I am not objective about Alcoa and I am glad they are here.

Mr. Chairman, the question before the Senate is not whether to act on climate change or when to act, but how to act. How shall we in this Congress begin to reduce greenhouse gas emissions with the most certainty, the least complexity, and the lowest cost?

The Lieberman-Warner legislation prefers an economy-wide cap and trade approach. I prefer a sector by sector approach, that is devising the lowest cost, least complex approach, tailored to each of the three largest sectors of the economy that produce the most greenhouse gases. That would be utilities, transportation, and building efficiency.

Since 2003, first with Senator Carper and then with Senator Lieberman, I have introduced legislation to put a cap on carbon emissions. That affects 40 percent of the carbon dioxide and 33 percent of the greenhouse gases. So as time goes along, I will be suggesting that we consider at the same time a sector by sector approach, taking those three large sectors, that would work on about two thirds of all the carbon. As I understand it, the Lieberman-Warner bill would affect about three quarters of it.

I hope our focus during these hearings and debates today and in the future we have is, okay, what are we going to do about it? We still have some differences of opinion about whether there is climate change or how much humans are contributing to it, but if we spend all our time on that, we won't deal with these questions, and there are some very big questions that are difficult to understand that we Senators need to take some time on.

Do we prefer a cap and trade to a carbon tax? I prefer a cap and trade. I think it is a Republican idea. It uses the market instead of the government, but we ought to discuss that. What is the real cost? Senator Bond raised that question. One estimate of the forerunner of this legislation by experts showed that it would add 25 cents to the gas tax. That is a big difference.

On the other hand, the estimates of the cost of the acid rain legislation in 1990 and 1991 were overstated and it cost a lot less than most people thought. The upstream cap on transportation fuels in the bill that is proposed, that is an unusual proposal. I would prefer adding a low carbon fuel standard to climate change legislation and intend to broaden my utilities legislation to do just that. But that is a choice on how we deal with fuel.

Allocation, Senator Carper and I have argued about allocation. It is very complex. This proposal uses historical allocation. That is the same thing I use in my utilities bill, but then it adds an unusual

thing called load serving entity output allocation. We need to really make sure we understand that.

Auction, this bill includes nearly one quarter of the allowances would be auction. Most auctions I have been to have the purpose of getting the highest possible price, and I am wondering if this won't add to the cost of this legislation.

How to spend the money raised by the auction. These are big bucks we are potentially talking about, much more than the acid rain cap and trade. If we create a fund with billions of dollars here, this is the worst place in the world to create a fund with billions of dollars because everybody has an idea on how to spend it. That is why I think we need to understand why we need an auction and why I suggest a sector by sector approach might make more sense.

We need to understand exactly the affect we are going to have on natural gas prices so that we don't damage homeowners and farmers and our manufacturing. I wonder why we don't go ahead with a four pollutant bill such as the one Senator Carper and I worked on, and Senator Lieberman and I also worked on. We have problems still with sulphur and nitrogen and mercury. If we are going to be bold about attacking the problem, let's be bold about the solution. In my view in this generation, the solution really is aggressive conservation and aggressive nuclear power.

So these are the questions. I want to be a participant in developing this bill and I hope I can vote for it. I welcome the chance to be here today.

Thank you.

Senator LIEBERMAN. Thank you very much, Senator Alexander.

Next, we go in order of arrival and back and forth between the two parties or the three parties, in my case, and the three parties in Senator Sanders' case, but either party, you are next, Senator Sanders.

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

Senator SANDERS. Thank you very much. Let me begin by congratulating you, Senator Lieberman and Senator Warner and your staffs. I know how hard you worked and I really appreciate that effort.

Let me be as blunt as I can in telling you where I am coming from on this bill, which deals with an issue that is qualitatively different than any other issue that we are dealing with in Congress. On most of the issues that we debate, what ends up happening is somebody wants to spend \$100 million, somebody wants to spend \$50 million, and we compromise at \$75 million or whatever, and that is the way things are done in a democratic society and that is fine.

Unfortunately today on this issue, we have a qualitatively different situation. I wish it wasn't so, but it is. The issue is not what I want versus what Senator Warner wants or Senator Craig wants. The issue is one of physics and it is one of chemistry and what the best scientists in the world believe is happening to our planet because of greenhouse gas emissions. It is not my view and not your view. It is physics. It is chemistry. The issue is what we can do as a Nation, along with the international community, to reverse global

warming and to save this planet from a catastrophic and irreversible damage which could impact the lives of billions of people.

In other words, we are not debating my views or your views. We are debating science and public policy. The views that I am trying to bring forth to the best of my ability are the views of the most knowledgeable scientists in America and in fact the world, the people who among other achievements have just receive the Nobel Peace Prize.

Now, let me just go over very briefly some of my major concerns about the legislation. First, I understand that different experts are analyzing the reductions from all provisions of the bill, but it is my view that the 2020 target should be at least a 15 percent mandatory under the cap reduction from total U.S. emissions in 1990. Many are starting to say in fact that we need near-term reductions that are significantly higher than that. What scientists will tell you is they have under-estimated the problem and we probably have to be more aggressive than they thought. Additionally, the 2050 target should be at least an 80 percent mandatory under the cap reduction from total U.S. emissions in 1990.

In addition to thinking about the reduction targets and timelines, we must ensure that the latest science is periodically considered and that it informs our ongoing action, the so-called look-back process.

Second, right now, the legislation transitions to 100 percent auction or public benefit by 2036, over 20 years after enactment. The right to pollute should not be given away, at least not for so long, and thus I would like to see a 100 percent auction or public benefit by at the very least the year 2025.

Third, the bill as currently drafted allows a firm to get 15 percent of its reductions from offsets, projects that can be difficult to track and quantify, and this concerns me. It especially worries me when I consider that the legislation also allows another 15 percent of a firm's allowances to be borrowed from the future and another 15 percent to come from international markets.

Mr. Chairman, with only a few, with only a few very quantifiable exceptions, I would be hesitant to rely on offsets to meet our emission reduction goals.

Fourth, the bad news is that, as all of know, we have a major crisis in front of us, but there is some very, very good news out there, and that is as a result of exceptional work and technology breakthroughs, we now have the tools at our fingertips to reverse global warming as we move from fossil fuels to energy efficiency and such sustainable energies as wind, solar, geothermals, and others. It is out there. It is no longer in the minds of scientists. It is there right now. Our job is to take advantage of what is there.

Mr. Chairman, a recent poll entitled A Post Fossil Fuel America: Are Americans Ready To Make the Shift, found that 88 percent of the American people understand that we can move forward in a new energy paradigm and that is what we should be doing.

Now, what does this actually mean in real life? Let me just tell you what I think. Number one, it means that within 10 years, we should have at least 10 million solar rooftops producing clean, cheap and secure electricity. We could do that. It means that we should be building more solar plants. Right now, we have only two,

with one having just come online. We can do a lot, lot better than that. It means that we should produce in this country millions of small wind turbines that could be used in rural America to provide, on average, 50 percent of the electricity a household might need in addition to large wind projects.

It means that we should be seriously investing in energy efficiency. There is unbelievable potential sitting out there at our homes, in our factories as we move away from the automobile to mass transit, into a rail system. Our rail system is way behind Europe, Japan and even China right now—tremendous potential out there. By the way, as we do this, we can create millions of good paying jobs.

Mr. Chairman, if we are going to implement these bold policies and achieve these aggressive goals, if we are going to transform our energy system away from fossil fuels to energy efficiency and sustainable energy, the Federal Government will have to play a leadership role in moving our Nation forward.

The Lieberman-Warner bill creates a Climate Change Credit Corporation which will administer tens of billions of dollars. Mr. Alexander is quite right. We are talking about a huge amount of money there in auction proceeds. I am very concerned about the structure and accountability of this Climate Change Credit Corporation and whether it can accomplish what we need to see accomplished in a cost-effective and accountable manner.

Lastly, it is my view we need the Federal Government to be more than a passive grant-maker. We need a Federal entity that can be a partner with the private sector, with States and localities, and with the non-profit community, an entity that has the authority and the flexibility to transform our energy future and reverse global warming.

I look forward to working with you, Mr. Chairman and Mr. Warner and everybody else, to create that type of entity we need to efficiently and effectively move forward.

Thank you.

Senator LIEBERMAN. Thanks, Senator Sanders. You mentioned rail transportation. It reminds me, Senator Lautenberg asked me to enter into the record his regrets that he can't be here. He will try to get here, but he is managing an Amtrak bill on the Floor of the Senate.

Senator Barrasso, you are next.

**STATEMENT OF HON. JOHN BARRASSO, U.S. SENATOR FROM
THE STATE OF WYOMING**

Senator BARRASSO. Thank you very much, Mr. Chairman.

Thank you, Senator Warner, as well for your leadership on this bill.

Wherever you find yourself on this issue of climate change and energy development, I think we can agree on one important dynamic, and that is the marketplace. Change not only awaits us, it is banging at the door. Consumers are demanding more and more green energy to address the effects of global warming. More people now know that a carbon footprint isn't just a kind of new running shoe, and reducing carbon has become a mantra, a fact in the marketplace which we must recognize.

Wyoming, the State that I present, is so very blessed with many energy resources and has an economy that is based on carbon extraction. Because consumer demand leads to public policy, the public policy and regulatory actions, either taxing carbon, capping carbon, all of these are going to affect my home State, perhaps more than any one policy that is on the horizon.

While this debate can't be ignored, it can't be rejected, and I believe that Wyoming needs to be and must be at the forefront. The bottom line is that our country's energy portfolio is headed for change, and that means jobs in Wyoming will change. The writing is on the wall regardless of where you stand on the issue of climate change.

I had an old medical professor, his name was Milt Davis, and he said, John, you never want to be diagnosed with mural dyslexia. I said, what is mural dyslexia? He said, mural dyslexia is the inability to read the handwriting on the wall.

[Laughter.]

Senator BARRASSO. You can harbor doubts about the science, but the political and the market realities are under no such illusion. The handwriting is on the wall.

Now, I believe that Wyoming represents a mix of energy solutions that will be part of this country's energy future for many, many years to come with fewer impacts. We must adapt. We must make changes. We must be ready to put our money where our best hopes are. But we cannot simply shut off our current traditional energy sources.

Now, I can assure you one of the biggest threats to addressing effectively the concerns of climate change would be to significantly impede the current domestic production today in anticipation of new technologies in the future. We need to innovate. We need to prepare for changes, but we need to retain our ability to make the power that we need today so that companies have the resources they need to develop the clean energy technologies that we need for the future.

I can assure the members of this panel that we in Wyoming are learning to use a new vocabulary—carbon capture, carbon sequestration, gasification, liquefaction. Innovations and Federal investment in each of these issue areas are not only vital to Wyoming's future, they are vital to addressing the issue of global warming as a Nation.

Now, I believe we must invest in the new technologies that we will need to address the issues of climate change. I don't believe we are doing enough in this regard in terms of investments and I would like to work with Senators Lieberman and Warner to address this issue. What we must guard against is making rash policy decisions based on perceived impacts in the future using inexact scientific models. It is not a matter of whether global warming is occurring. All the best science that we now have suggests that it is. It is a matter of whether we can accurately predict its effect 25, 50 or even 100 years in the future, and whether we are passing appropriate legislation today based on such models.

I would like to work with the committee in determining how we are spending Federal money in this regard. We must ensure that we have a better understanding of the range of possible outcomes

of global warming in the future. As Senator Bond and Senator Alexander both stated, we must also have a better understanding of what we are dealing with before rushing into passing legislation that may cost jobs, may raise gasoline prices, and may negatively impact family budgets needlessly.

I look forward to working with both of you, working with the other members of the committee to ensure that we develop a sound policy and solutions to address this issue.

Thank you very much, Mr. Chairman.

Senator LIEBERMAN. Thanks very much, Senator Barrasso. I know that Senator Warner and I look forward to working with you as well. There is certainly a seat at the table for you. You have added a term to the debate, mural dyslexia, which you will hear many times during the debate. Occasionally, you will be given credit for having used it first, but we will always know that you did. Thank you.

Senator Carper is next.

**STATEMENT OF HON. THOMAS R. CARPER, U.S. SENATOR
FROM THE STATE OF DELAWARE**

Senator CARPER. Thank you very much, Mr. Chairman.

I want to join my colleagues in saluting you and Senator Warner for helping show the way here. Senator Lieberman has been a leader on this front for a long time. I think the addition of Senator Warner as your partner just really helps make what was an uphill battle something that is doable.

I have described myself since I came to the Senate about 7 years ago as a johnny-come-lately on global warming, on climate change. I don't feel like a johnny-come-lately anymore. I wasn't present at the creation, but I have put a lot of thought and time and energy into this, as some of you know. I appreciate the chance to visit with you and to share some ideas for your consideration. A couple of them made the cut, several didn't, and my hope is before we are done some of the rest will make the cut, too.

My focus has been, as several have already suggested, including Senator Alexander, my focus has been that Governor George Bush had it right. In October 2000, running for President, he was in Saginaw, Michigan and he said, we ought to reduce emissions from power plants which are major contributors of carbon dioxide, sulphur dioxide, nitrogen oxide and mercury. He said, we ought to go after all four of them. He got elected and changed his mind. The first year in office, he said we ought to go after SOx, NOx and mercury, but we will wait until another day for CO₂.

I think right here in this room, gosh, earlier this year, when the fellow who ran against Governor Bush in 2000 talked about the approach we ought to take. The question was do we just do an economy-wide bill on climate change, on global warming. He said no. He said if we are smart, we will use this as an opportunity to also address from the powerplant segment, SOx, NOx, and mercury.

Among the reasons why I think it is important that we do that, if you think about it, I don't know how many people died last year in this country from exposure to CO₂. I know that in this country this year, about 25,000 people will die from their exposure to fine particle pollution—25,000. I don't now how many people, how many

babies are going to be born this year with the possibility of brain damage from carbon dioxide, but I know that this year over 600,000 babies are going to be born who are at risk of neurological damage from the exposure from the womb, from mom's who have eaten fish with mercury in them.

I think for us to walk away from those problems, those very real threats to human health and life, at a time when we could actually do it all at once and do it well, is a mistake. There is a way—I have argued this for 6 years now—there is a way for us to reduce these emissions, to do it in a way that doesn't cost consumers an arm and a leg, to do so in a way that doesn't put the economy in a tail-spin, and for us to not seize this opportunity, as we say in Delaware, *carpe diem*, to seize the day, I think we make a grievous mistake.

I want to conclude, if I may, I have two boys. They are 17 and 19. Some of you have heard me talk about them before. I have heard Senator Warner talk about his children and grandchildren. One is in college and one is in high school. Some day, 20 or 25 years from now, I don't want them to come back to me and say, when we have reached this turning point, and frankly the situation of dire prediction for climate change and global warming, and what actually turns out is that there is a tipping point, and there is no turning back. I don't ever want them to turn back and say to me, weren't you in the Senate? What did you do about it? What did you do about it to try to avert this calamity from affecting all of us? I want to be able to look them in the eye and say, I did everything that I could; everything that I could to try to make sure that this didn't happen, doesn't happen.

I said that several years ago. I meant it then. I mean it today, too. By the same token, I want to make sure that the people that I know and you know, too, who suffer from lung damage, who have bad health, who are hospitalized today, thousands of them across the country, 25,000 are going to die because of their exposure. We have to do something about it, and we can do something about it.

All those kids, thank God, hopefully we will never have in our family someone who is going to be born with brain damage because of the ingestion of mercury by their mom. But a whole lot of kids are going to be born this year who have that problem that they face. We can do something about it, and we need to. I am going to work very hard and doggedly to make sure that before we finish with this legislation this year that we have included those considerations as well. I hope you will join with me.

Thank you.

Senator LIEBERMAN. Thank you very much, Senator Carper, for that statement. I hope everybody in the room got it when Senator Carper said in Delaware they say *Carpe diem*.

[Laughter.]

Senator LIEBERMAN. I just wanted to come back to that.

Senator CARPER. Senator, our Latin was never that good in Delaware.

Senator LIEBERMAN. Senator Inhofe, Senator Bond was going to be next.

Senator INHOFE. That is right.

Senator LIEBERMAN. So why don't you go ahead in this spot?

Senator INHOFE. I would like to ask—one of our probably most knowledgeable members over here does have to leave, that is Senator Craig, and I would like to go ahead and defer to him.

Senator LIEBERMAN. Fine.

Senator INHOFE. I will come back in line again.

Senator LIEBERMAN. He is next.

Senator Craig.

**STATEMENT OF HON. LARRY E. CRAIG, U.S. SENATOR FROM
THE STATE OF IDAHO**

Senator CRAIG. Mr. Chairman, and to Senator Inhofe, ranking of the full committee, let me thank you, and Senator Warner.

I cannot criticize anyone who takes the initiative that you gentlemen have obviously taken over an issue of this character and of this concern. I disagree with you for a lot of what I think are very clear reasons that the marketplace is already demonstrating, but I cannot disagree with your intent to try to solve a problem.

Let me suggest that if the marketplace could speak politically, and it can't, only we do, then the marketplace today would be winning, profoundly winning because America has already decided that we will accept nothing but clean forms of energy. As a result of that, for every economic unit that has been produced out of the last recession, we are one of the cleanest nations of the world. We can be cleaner and we must be cleaner, but we are substantially cleaner today for the very reasons Senator Sanders spoke: technology. Not conforming the marketplace, not forming the marketplace, but letting the marketplace work through technology.

In June, something happened that was not supposed to happen around here. We were not supposed to be second in emissions of greenhouse gas. We were first. We are 25 percent or 26 percent of the world economy, so we were big. We were emitters and we were never to become second, but we did. We became second to China. If this committee and our efforts don't focus on China as well as India, as well as our own country, then I am sorry, Senator Carper, the tipping point may come, but it will not be our fault.

The technologies that Senator Sanders talks of, that I have driven, that others are driving, is what will bring China into compliance. They will become clean when the technology allows them to. But they will not become clean and send their people to a cave with a candle and expect them to survive. The world's economy does not function that way.

I don't believe in the cap and trade schemes. You are genius if you have created one that will work. The world has already demonstrated that most don't. If you are genius, I will study it hard and give you credit for it, Mr. Chairman. Because I believe I have changed some. I am now for mandatory CAFE. I am for creating a much more robust clean energy market by 2020, and putting the money to get there in the right place.

California today by its own tragedy it is admitting more carbon into the atmosphere than it has in decades. This year, we will admit more carbon into the atmosphere because we cannot create healthy forests and manage them appropriately, and so we burned 8 or 10 million acres. If they had not burned, it would have been equivalent to taking 12 million automobiles off the road.

Now, we can do better there and we will have greater impact there because not only if you stop the forests from burning, but you make them young and youthful, they become major sequestrators of carbon. A climate change bill that does not incorporate that, Mr. Chairman, doesn't get it. Sequestration, credits for sequestration whether it is in the agricultural community, and we are marking up a farm bill today that will do that, along with forest stewardship, is going to take us much further down the road to being a very clean place.

How about clean portfolio standards? How about driving our utilities toward cleanliness through innovation, but also doing exactly what Senator Alexander talked about and what the New York Times spoke of when they looked at your bill and said it won't work without nuclear.

So there are a combination of things, Mr. Chairman, that I think are so absolutely critical in all of this. Let us not damage our economy in the way Senator Bond spoke. Let us look at some combinations like Bingaman-Specter, not a bad idea with the kind of off ramps that say if you are about to tip the economy, you back away a little bit. Trigger it in a way, if you are going to create a command and control environment that does not command and control us into recession.

Many of us argued under Kyoto that if we ratified it, it would cost us three million jobs. At the bottom of the last recession, we had lost three million jobs and we were in compliance with Kyoto by emission. That is a fact. So we weren't wrong. We were right to walk away from Kyoto.

The rest of the world did it, but they didn't do anything about it. It was politically green to do and they won great credits and accomplished little. China went ahead. India went ahead. We became cleaner because the consumer and the marketplace began to respond.

Let us move forward crafting carefully something that will allow the consumer and the marketplace the kind of response that will grow us, not slow us.

Thank you, Mr. Chairman.

Senator LIEBERMAN. Thanks very much, Senator Craig. We look forward to this discussion continuing. I do want to mention that your point about China is well taken. As you may know, Senator Warner and I actually embraced a section of the Bingaman-Specter bill in this that I think creates some real incentives. But this is a topic that we will continue to discuss. Thank you.

Senator Whitehouse is yielding at this point his spot now to Senator Baucus, who has to go on to another meeting briefly. Senator Baucus is obviously a senior member of the committee and of the subcommittee. I thank him very much for stopping by.

STATEMENT OF HON. MAX BAUCUS, U.S. SENATOR FROM THE STATE OF MONTANA

Senator BAUCUS. Thank you very much, Mr. Chairman. I thank Senator Whitehouse, too, for his deference.

Senators Lieberman and Warner, I thank you. You have done a lot of good work here. You are a real credit to your States and to the Senate and to the country, in some respects even to the world,

for all the effort you have undertaken here. You try to be balanced and reasonable here, and we thank you for taking the time and effort to come up with a bill which I think is getting us on a track to make some sense here and get some solutions.

I also thank my fellow Montanan, Will here. Will is a wheat farmer in Great Falls, Montana. He is vice president of the Montana Grain Growers. I am very happy you are here, Will. I am anxiously waiting to hear your thoughts about ag offsets within a cap and trade system, and we look forward to your testimony here. Thank you so much for taking the time to come here.

The book of Genesis tells us that the Lord God then took the man and settled him in the Garden of Eden to cultivate and care for it. Montana has taken God's call to be good stewards very seriously. This means that we must address the issue of climate change. We cannot be good stewards if we ignore the fact that climate change threatens to result in longer droughts, more severe wildfire seasons, and no glaciers in Glacier Park.

I believe it is a moral imperative to deal with climate change. Indeed, I believe we all have a moral responsibility when we leave this place to leave it in as good a shape or better shape than we found it for our kids and our grandkids. Climate change is certainly a part of that moral imperative.

That is why I intend to support America's Climate Security Act. I believe the bill that Senators Lieberman and Warner have crafted represents a reasonable approach to dealing with the issue. While I have some outstanding concerns with the bill, I am confident that we can work through them.

On balance, I think the bill strikes a good balance. The 2050 emissions reductions targets the bill sets align with the United States cap recommendations and puts the United States on path to be a leader in addressing climate change. The bill also includes strong provisions to incentivize the deployment of carbon capture and sequestration, which is so important.

Stopping coal-fired power plants will not stop climate change. Clean coal technology will stop climate change. This issue is crucial. Even if another coal-fired power plant was never built in the United States, China would continue to build their coal resources. We must therefore develop carbon capture and sequestration technology here so we can use it domestically, as well as export it abroad.

That is why I am pleased that Senators Lieberman and Warner have included several provisions to incentivize the deployment of carbon capture and sequestration. Their bill sets aside 4 percent of annual allowances through the year 2035 to go towards bonus allowances for power plants that capture and sequester their carbon.

The bill also sets aside 52 percent of auction revenues for next generation energy development. Of this amount, 28 percent is set aside for developing and deploying carbon capture and sequestration.

America's Climate Security Act also includes the best offset provisions of any of the economy-wide cap and trade bills. America's farmers and foresters have an important role to play in stopping climate change. I am pleased that the bill allows regulated entities

to satisfy up to 15 percent of their allowance obligations to domestic offsets for America's farmers and foresters.

I look forward to continuing to work with Senators Lieberman and Warner on ways to improve the bill. Specifically, I am concerned about the impact of the cap and trade system on rural electric cooperatives. Rural coops provide cost-based power to low-income areas that, unlike investor-owned utilities, lack the resources to invest in cutting edge technology to mitigate their impacts to their members. I also want to make sure that the costs to the economy are weighed carefully.

We have a moral imperative to address climate change. America's Climate Security Act is a balanced approach to a challenging issue. I look forward to working with my colleagues, with everyone interested, and I have a hunch most everyone is going to be interested in this, the issue is so important. I am just very proud to be a part of an effort to get on with it.

Thank you.

[The prepared statement of Senator Baucus follows:]

STATEMENT OF SENATOR MAX BAUCUS, U.S. SENATOR FROM THE STATE OF MONTANA

Senators Lieberman and Warner, thank you for all of your work on this critical issue and for agreeing to hold this hearing to take a closer look at the provisions in your bill. I would also like to thank all of the witnesses for agreeing to testify and share their perspectives on the issue of climate change.

I am especially excited to have a fellow Montanan here testifying. Will Roehm is a third generation wheat farmer from Great Falls, Montana. As Vice President of the Montana Grain Growers Association, Will is here to highlight the important role of agricultural offsets in any cap and trade system. Welcome Will. I look forward to your testimony.

The Book of Genesis tells us that "The Lord God then took the man and settled him in the Garden of Eden to cultivate and care for it." Montanans take God's call to be good stewards very seriously. This means that we must address the issue of climate change. We cannot be good stewards if we ignore the fact that climate change threatens to result in longer droughts, more severe wildfire seasons, and no glaciers in Glacier National Park.

I believe it is a moral imperative to deal with climate change. That is why I intend to support America's Climate Security Act. I believe the bill Senators Lieberman and Warner have crafted represents a reasonable approach to dealing with the issue.

While I have some outstanding concerns with the bill, I'm confident I can work through those issues with Senators Lieberman and Warner.

The bill strikes a good balance. The 2050 emissions reductions targets the bill sets align with the U.S. CAP recommendations and put the U.S. on path to be a leader in addressing climate change. The bill also includes strong provisions to incentivise the deployment of carbon capture and sequestration.

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I am pleased that the bill allows regulated entities to satisfy up to 15% of their allowance obligations through domestic offsets from America's farmers and foresters.

I look forward to continuing to work with Senators Lieberman and Warner on ways to improve the bill. Specifically, I'm concerned about the impact of a cap and trade system on rural electric cooperatives. Rural co-ops provide cost based power to low income areas and unlike investor owned utilities lack the resources to invest in cutting edge technology and to mitigate the impacts to their members. I also want to make sure that costs to the economy are weighed carefully.

We have a moral imperative to address climate change. America's Climate Security Act is a balanced approach to a challenging issue. I look forward to working with my colleagues keep the process moving forward.

Senator LIEBERMAN. Senator Baucus, thank you very much. I want to say first amen to your reading from Genesis. It is quite appropriate. Second to thank you for the announcement that you just made of your intention to support America's Climate Security Act. It is a tremendous boost to our efforts to get a real solution passed in this Congress. I can't thank you enough. I want to just tell you for myself and John Warner, it means a lot to us personally. We look forward to working with you. You have the stature in the Senate to play a very important role in moving this legislation forward, and responding to what you correctly call a moral imperative. So I can't thank you enough.

Senator WARNER. May I say, Mr. Chairman, to our good friend from Montana, before you arrived, I recited how you were the key in the Clean Air Act debate. I remember it. I was in the room.

Senator BAUCUS. [Remarks made off microphone.]

Senator WARNER. Well, no. The two of us were in there with George Mitchell and came up with a little formulation to make it work. Now once again, you have stepped forward and we are very honored to have you join us.

Senator BAUCUS. Well, thank you, Senator. I have very fond memories of that year when we worked on the Clean Air Act and developed the cap and trade system. It is based upon my experience with developments and with the ultimate success of cap and trade in that arena that we can certainly build on that here. Now, it is much more complicated, clearly, because cap and trade back then was sulphur dioxide, nitrous oxides and limited to power plants. But it worked, and worked very well. Although there are bigger issues here with carbon cap and trade, Europeans have had some difficulties. They have made the effort. They have tried. You can't blame them for trying. But that experience back then that you referred to is quite helpful, so thank you.

Senator LIEBERMAN. Thank you.

Senator Inhofe, Senator Craig was next, so if you want to exercise your rights.

Senator BAUCUS. I apologize for having to leave. I have something I just have to do.

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

Senator INHOFE. I have been informed by my colleagues that they are going to stay here with me for the duration, so we are going to get to you guys. Just have patience.

I have been listening. I have changed my opening statement, Mr. Chairman. I have been listening to both sides. I think Senator Craig makes a very good observation about China, when he talks about the fact that where the problem really is and the fact that

you, Mr. Chairman, have responded in saying that there is something in this bill that will address that. But when we talk about having gone 15 years without a new coal-fired, power generating plant in the United States, and China is cranking one out every 3 days, we know there is a problem out there. How do we address that?

I think the Administration in their Asian Pacific Partnership Act and now the acceleration of that into other areas is something that should be looked at because it recognizes that we have problems. There are real pollutants out there. CO₂ isn't one of them, but we have SO_x and NO_x and mercury. This addresses that, and oh by the way, it also lowers CO₂. Also, it gets into trade. So I think that these are things that should be looked at and I think will be looked at and we will discuss during the consideration of this bill.

The fact that, and it was mentioned by someone in opening statement, that it is probably a good thing that we did not get onto Kyoto at the time that we were all encouraged to do so, back a few years ago; that those countries that did, only two of the 15 Western European countries have complied with the requirements of Kyoto, with the emission requirements. So I think that we have done a far better job over here, even though we weren't a part of the treaty.

Now, I was heartened to hear, Mr. Chairman, I know, I believe you because you said it, that we are going to be a lot more deliberate in considering this than was first announced, not by either of you, but by others, in that this goes it is far too complicated, as we already have determined from these opening statements. So when you consider how long it took us for the Clean Air provisions in 1990. I think we had some 60 witnesses from across the country. During the Clear Skies, we heard from dozens of witnesses and had quite a few hearings on that. I think that this certainly is legislation that should be vetted in every possible way.

Now, every passing day brings more questions than answers. I have here a short preliminary list of questions about the rationale of various provisions that request clarification. So what I would like to do is make this as a part of the record. It is seven pages of questions for you and those who are putting this together, so we can perhaps not today, but at a later time have the benefit of the answers.

Senator LIEBERMAN. Without objection, it is part of the record.

[The referenced document follows on page 149.]

Senator INHOFE. OK, good. I think this bill was released only last week, about 6 days ago. I think it was that morning that I heard about it and I had a chance to speak on the Floor about the bill right after that. So we do need to take more time, and that is what we are going to do.

My concern is also with the fundamental construction of this bill. Our Nation is headed for an energy crisis in the next few years. Just last week, the North American Electric Reliability Corporation announced its annual 2007 long-term reliability assessment, and found that unless additional resources are brought into service, some areas could fall below their target capacity margin within 2 or 3 years. Over the next 10 years, we are expected to increase our need for electricity demand by 18 percent or 135,000 megawatts.

Within the same timeframe, our committed capacity will grow by only about 8 percent, or 77,000 megawatts. So I think we need to consider that.

We do not know how expensive the bill is going to be, but we intend to find out. We knew pretty well what the McCain-Lieberman bill would have been. As I said on the Senate Floor, the 2050 expected or mandated reductions are even more aggressive, it is my understanding, than McCain-Lieberman. So probably it would be something more than that. We will have a chance to explore that.

Senator McCain apparently has stated in his statement, in his decision not to cosponsor the bill, and I am quoting now, he said, "We can't effectively reduce our emissions without including nuclear energy, which is more efficient than the technologies in this bill." I agree with that. I know that Senator Isakson agrees with that because he and I have talked about that quite often.

So Senator McCain and I may differ on the need for climate legislation, but his point is hard to ignore. If nuclear is not a part of the path forward, then how do we plan to reduce the emissions?

As we will hear in testimony from one of our witnesses today, Mr. Paul Cicio, the unfortunate answer is that this bill will cause massive fuel switching to natural gas, driving industrial users out of the country. This is a great fear that I have. We have talked about this, and we have talked about this in detail.

So finally, I would say, Mr. Chairman, that I am glad we are considering a bill. We have had some 20 hearings about the issue, and I am glad quite frankly that we are not talking about science. We have had such a surge of science recently, and many of those on the other side of the issue have now come over and become skeptics. We want to talk about that, but not during today's hearing or during the consideration of this bill.

At its core, the bill, like all cap and trade bills, tries to obscure the real cost to our economy, and the number of jobs that we will send to China and other countries. I heard somebody say earlier that they wouldn't want to have a carbon tax. Frankly, I would rather have a carbon tax than a cap and trade. At least you know, then, and the public knows just how much it is going to cost.

So I do look forward to our witnesses and to a deliberate discussion on your bill.

Thank you.

[The prepared statement of Senator Inhofe follows:]

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

Mr. Chairman, I thank you for holding this hearing today on S. 2191. This is a much needed hearing in what should be the beginning of the process of looking at the bill, examining it in-depth, hearing from a wide-variety of stakeholders. But that process is getting short-changed. And the full Senate and the American people will be short-changed as well.

Senator Boxer has been reported in the press as saying her goal is to complete Committee action on this bill before her trip to Bali. I would ask Chairman Boxer to repudiate that idea and publicly state that her goal is to get the legislation right, not legislate for a public relations deadline.

When this Committee considered the Clean Air Act Amendment of 1990, the subcommittee and full Committee heard from over 60 witnesses from a vast cross-section of America during a series of legislative hearings examining the bill.

When we considered Clear Skies, we heard from dozens of witnesses examining the bill over a period of 2 years. We conducted staff briefings which all Committee

staff were invited to participate. We obtained analyses from EPA and the Energy Information Administration. Even through this, members of this Committee complained EPA hadn't done enough analysis to allow them to understand the implications of the bill.

Yet for this bill, the entire extent of the process prior to a subcommittee markup is to have one legislative hearing at which only one witness with grave concerns is invited. It also appears that the full Committee process will be truncated—that there will be an attempt to create the appearance of process, but no cooperation in providing Committee Members the opportunity to examine the substance of the bill.

In fact, it appears that no analysis of the massive impacts that this bill will impose on the U.S. economy has been conducted. Nor do we have an analysis of what this bill will achieve in terms of reducing global concentrations and, consequently, global temperatures—in short, the benefits. I fear the bill is all pain and no gain.

Every passing day brings more questions than answers. I have here a short preliminary list of questions about the rationale of various provisions and requests for clarification, which I request be made part of the record. This bill was released only last week, and we have had little time to analyze this bill and to hear from stakeholders, who themselves are just beginning to understand how it will affect them. I hope you will answer these questions and others that will be forthcoming before moving forward with a markup.

My concern is also with the fundamental construction of this bill. Our nation is headed for an energy crisis in the next few years. Just last week, the North American Electric Reliability Corporation (NERC) announced its annual 2007 Long-Term Reliability Assessment, and found that unless additional resources are brought into service, some areas could fall below their target capacity margins within two or three years. Over the next 10 years, we are expected to increase our need for electricity demand by 18%—or 135,000 megawatts. Over that same timeframe, our committed capacity will grow by only 8%, or 77,000 megawatts. This bill will worsen the problem.

We do not know how expensive this bill will be, but we know it will cost more than McCain-Lieberman, which itself increases gasoline and electricity prices by 22 percent cuts production in 33 out of 35 sectors of the U.S. economy.

As Senator McCain's spokesperson, Melissa Shuffield is quoted yesterday as saying in an article discussing his decision not to co-sponsor the bill:

"We can't effectively reduce our emissions without including nuclear energy, which is more efficient than the technologies in the bill."

Senator McCain and I may differ on the need for climate legislation, but his point is hard to ignore. If nuclear is not part of the path forward, how do you plan to reduce emissions?

As we will hear in testimony from one of our witnesses today, Mr. Paul Ciccio, the unfortunate answer is that this bill will cause massive fuel switching to natural gas, driving industrial users out of the country.

There are many areas of this bill to criticize, such as the creation of what is essentially a new carbon Federal Reserve board completely insulated from oversight, the manipulation of its provisions to send money to certain states for no real reason other than to gain votes, and of course, its completely unrealistic targets and timetables. But I do not have time now to go through them all.

At its core, this bill, like all cap and trade bills, tries to obscure the real costs to our economy and the number of jobs we will send to China and other countries. And based on the experience of the Kyoto Protocol, it will not work. It is a far more honest approach to simply propose a tax. Unlike this bill, it would at least work, and would be far less harmful to the economy. It may not help companies wanting windfall profits, but it would do less harm to American families.

Senator LIEBERMAN. Thanks, Senator Inhofe. I look forward to working with you.

Senator Whitehouse.

**STATEMENT OF HON. SHELDON WHITEHOUSE, U.S. SENATOR
FROM THE STATE OF RHODE ISLAND**

Senator WHITEHOUSE. Thank you, Chairman Lieberman. I appreciate being invited to the subcommittee hearing. I want to salute you and Senator Warner for your efforts. In particular as we go forward, the success of this bill will be highly dependent on both the experience and the wisdom that you and Senator Warner bring in

the ways of the Senate, and the enormous affection and high regard and esteem that you enjoy among your colleagues, and the fact that you have been willing to take those hard-built assets over many years of service and put them into the service of this initiative is something that I think we are all very grateful for.

Three quick points about where we are and three quick points about where I think we need to go. First, there does appear to be scientific virtual unanimity about what the problem is and how urgent it is. Just yesterday in this room, we had Commissioner Cooper from Tennessee who is the health officer for that State report that the National Association of State and Territorial Health Officials has come out unanimously—every single State—in favor of their recent statement on global warming. So certainly among health officials, we have unanimity, and I think among most people we also do.

Second, this is an issue, as Senator Sanders said, where there is a bar that we must get over. Exactly where that bar is we are not sure right now. It is shrouded in some uncertainty. We do know that our children and grandchildren will find out if we miss it, and it is worth protecting them by erring on the side of caution. Particularly with respect to the concern about caution about the science, it is worth noting that to the extent that there is caution about the science, that is caution on both sides of the science. We might well be underestimating the damage as likely as overestimating it.

Again, I think erring on the side of protecting our children and our grandchildren is called for. What does that mean? The three things I think we need to set as goals going forward are serious short-term target reductions, such as those that Chairman Boxer and Senator Sanders have in their proposed legislation. I am a co-sponsor of it. I think that those are wise and perhaps even need to be raised a little bit as evidence continues to come in, but they are a good starting place.

Second, we need to make sure that we put forth economic signals that do not encourage this kind of pollution. We need to make sure that we put forth economic signals that avert the well-known tragedy of the commons and that inspire the market forces that we all count on to do the right thing, rather than the wrong thing. We need to make sure that the system protects itself against gamesmanship.

Third, to the extent that we create revenues out of this economic signal, and we likely will, we need to make sure that those revenues are invested in the economic changes that we need to change to the greener economy and to provide balance for those who will bear a disproportionate share of the new costs.

I conclude by saying that it is my view that we should see this as an opportunity, that there is enormous economic potential and national security benefit to getting this right. We can embrace the future, not fear it, if we get this right. Ultimately, as I said at the beginning of my remarks, the measure of this will be what our children and great-grandchildren experience. They will look back on our efforts now either with pride or with dismay, and it is the work that we will do in the next few months that will determine whether we have earned their pride or their dismay.

I thank both of you for your efforts and for including us all in this process.

Senator LIEBERMAN. Hear, hear. Thank you, Senator Whitehouse.

Before we go to Senator Voinovich and Senator Isakson, Senator Warner I think you wanted to speak for just a moment.

Senator WARNER. Thank you, Mr. Chairman, just very briefly. Our distinguished ranking member pointed out quite accurately and properly the absence of any reference to the essential source of nuclear energy in this piece of legislation as it is laid before us. Our colleague from Idaho, and we are about to hear from our distinguished colleague from Georgia—all of them have concerns.

If I may say with a great sense of modesty, at one time I was CEO of an organization that had the largest number of nuclear plants. Those were the 5 years, 4 months and 3 days I was privileged to be in the Navy Secretariat. At that time, we had just under 100 nuclear plants operating mostly at sea, the greater majority of course, but nevertheless pilot plants ashore.

I had the privilege of knowing intimately, very well—I met with him on a weekly basis—Admiral Rickover. I take a second place to no one in recognition of the importance of nuclear energy and indeed my State has been a leader.

I think, Mr. Chairman, I can safely say, with your acquiescence, that in the due course of the committee's deliberation, that issue will be taken up, but for practical reasons at this time we made a decision not to incorporate those provisions we had in mind in the bill.

I thank you.

Senator LIEBERMAN. Thank you, Senator Warner. You have accurately reflected my views as well.

Senator Voinovich.

**STATEMENT OF HON. GEORGE V. VOINOVICH, U.S. SENATOR
FROM THE STATE OF OHIO**

Senator VOINOVICH. Thank you, Mr. Chairman, and thank you for inviting those of us who are not on this committee to testify today, or to listen.

First of all, I want to acknowledge the fact that what we are doing here is going to have a dramatic impact on our economy, our environment, and our energy needs. Second of all, it is going to, I believe, have enormous impact on the environment of the rest of the world. Whatever we do, we better do it right.

I think of this as the cart that is dealing with climate change. There is not one horse that is pushing-pulling this. It is two horses. The two horses are your concept of cap and trade; the other horse is my horse of technology, capturing carbon and sequestering it. If we are going to get this right, the both of them are going to have to be working together and going at the same pace. If we don't, I think that we are not going to be successful with this effort.

I also would like to say that as a former chairman of the subcommittee, of clean air, climate change and it was nuclear safety, that we held extensive hearings on this type of legislation. When we had Clear Skies, if you will recall that there was insistence—insistence—by Senators Obama, Carper, Baucus and Chafee that

we have extensive hearings and that all of the legislation be looked at by the EPA and EIA so that we would have an analysis of just what impact this was going to have.

I can remember when they did an analysis of the Lieberman-McCain legislation, which I think you admitted is a less stringent predecessor of this legislation, that they concluded that reductions in GDP would be on the order of several trillion dollars, significantly decreasing household income, while significantly increasing energy prices and driving businesses overseas.

But the EPA also pointed out, and I think this is really important in terms of the assumptions, that when they made those predictions that they underestimated them because in their analysis, they assumed that carbon capture and storage technologies are widely available at a reasonable cost, which they are not. I think that is one of the real issues that is going to have to be confronted, and that is, where are we in terms of technology in capturing carbon and sequestering it? There is a lot of debate out there over where we are at. Is it commercially available to us today?

The other thing that they assumed was a 150 percent increase in nuclear power generation will occur within the next 30 years, which the nuclear industry would readily admit is a political and practical impossibility. In fact, Senator Carper and I have a strategic plan we put together to try and launch the nuclear renaissance. But there is no way that we are going to reach some of these assumptions that have been made. So I think that it is important that we give consideration to this.

Last but not least, the whole issue of involving the rest of the world in this effort. Now, in your legislation you have tried to attempt to deal with what is going to be happening around the globe. This chart that I have behind me, Global CO₂ Concentrations, does an estimate of where we would be with your legislation and other legislation. The red line at the top is where we would be without any legislation. The lines just below it, these lines right here, are the result of several of the bills that have been introduced, including your piece of legislation.

If we get all of this—Group I countries, Kyoto, Russia.

If this doesn't happen, if this happens over here, if this doesn't happen, we are here. The fact of the matter is that we have to be careful about what we are doing here. Yes, we can do a good job for the United States, but at the same time we better understand, as other people have more eloquently stated, that we have to take into consideration what is happening in the world.

Mr. Chairman, I want you to know that I want to work with you, and I will say this, there is only one way that we are going to be successful with this, and we haven't done it since I have been on this committee and I have been here since 1999. That is, we have to understand that we have to harmonize our environment, our energy, and our environmental needs, with all three of them coming together. Put each other's shoes on, figure out how we can work together to do something that is really going to make a difference for our country and for the world, and deal with your concern about your children and grandchildren, as I am concerned about my children and grandchildren.

Senator LIEBERMAN. Thanks, Senator Voinovich.

Senator Warner and I have exactly the same view. We have a difference of opinion with you because we think our bill does harmonize those factors, but we will continue to work together. Hopefully, we will find a way.

The panel will be happy to hear that there is only one more Senator to speak, but it was certainly worth waiting for.

Senator Isakson.

Senator WARNER. A very important one.

STATEMENT OF HON. JOHNNY ISAKSON, U.S. SENATOR FROM THE STATE OF GEORGIA

Senator ISAKSON. I was getting ready to apologize to the panel for making them endure one more political speech, but this will not be a political speech.

I first of all want to say the Senate is fortunate that two of our most distinguished members have decided to approach this issue, and I want to thank both Senator Warner and Senator Lieberman for the time they extended to me when they were working on this to talk about their interest and what they were trying to do.

I think everybody can see from the testimony—or not testimony—the statements that have already been made that there is not a person on this committee that is not acutely interested in finding a way to move forward in a positive way in the best interests of our economy, our environment and our people.

To associate myself with Senator Carper's statement about his two boys, I have seven grandchildren and found out last week I am getting ready to have an eighth. I have an obligation. I tell most people in my political speeches that I am at that stage of life where the rest of my life is all about making the life for my grandchildren as good as the one I have had. I think in a position in the United States Senate, you have to think that way when you do everything.

With that said, I will focus my remarks for a second on nuclear energy. Well, no, I am going to skip to one other thing.

I have talked with Dr. Elliot at Penn State, the glaciologist, and Dr. Rosing in Denmark. I went to Greenland. I have listened to testimony from everybody in Foreign Relations, the EU ministers, the environment ministers that were here a couple of weeks ago. It is obvious to me that although nobody knows for sure the correlation of the increase in carbon or isotopes in the sequestered air in Greenland from fossil fuel has increased, and that is the only like thing that has been happening, along with the escalation of the warming. So carbon is a contributor, whether it is the cause or a part of it—big part of it, little part of it—nobody knows for sure, but it is pretty conclusive that reducing carbon would be good for the environment.

Secondly, from a geopolitical standpoint, it is extremely in the best interests of the United States of America to reduce dependence on fossil fuels. You can forget about the carbon for a minute. Just that alone would change the whole dynamics of what is going on in the world today. So I think looking for ways to reduce that carbon in the long run and the short run is very important.

I agree entirely with what Senator Voinovich said. I went to India with Senator Alexander last year, and was supportive of the U.S. civilian nuclear deal with India in large measure because of

the potential that had to produce the carbon reduction that would be coming from that country. Although I have read recent news reports of some of the difficulties we may or may not be having with that deal, I hope it works because it is exemplary of technologies that we can help infuse in other parts of the world that are going to be generating increasing amounts of carbon, meaning China and India, to help reduce them. I think innovation is critical, not just enhancing nuclear, but other areas of sequestration of carbon.

So I am here with an open mind and a willing mind to work with the members of the committee. However, for us to deal with this subject and to leave off the table a revitalization of the U.S. nuclear energy issue is just crazy to me. I know what you can do with conservation. I know there are many different forms. Senator Alexander made a brilliant speech on the Floor of the Senate about wind energy, which is great in 40 States, but we just don't happen to have it in Georgia.

So you have to put every source of alternative sources of energy on the table and energize them collectively, and I will use the word harmonize them collectively, with your efforts to reduce carbon, or you are going to cause an extremely difficult situation, maybe one that is even more punitive to our country than some of the opponents have said.

So during the course of the debate, I won't get into the details now, but during the course of this debate, I intend to focus on doing everything I can do to see to it that we can improve the climate in this country and include regulation where it is appropriate to stimulate U.S. nuclear energy and electric production from nuclear energy. To leave it off the table and try and pass mandatory areas of attainment seems to me to be foolhardy.

I will make every effort I can to be a part of this debate in a constructive way and see to it that as we seek to meet these noble goals, we give American ingenuity and American industry all of the tools that they need to be able to do it.

I thank the chairmen for their time.

Senator LIEBERMAN. Thank you very much, Senator Isakson, for that thoughtful statement. We look forward to working with you.

I apologize to the panel for the delay in turning to you, but I must say myself that I am extremely grateful and proud of the statements made by the members of the committee. People are grappling with this. Generally speaking, people are acknowledging that there is a problem here. There may be some differences of opinion about how to solve it, but the tone of the discussion has been very thoughtful. This is not going to be a pitched partisan battle, another one of those. This is going to be people wrestling with a problem and trying to fix it.

So I appreciate very much the statements. I hope that I have similarly encouraged the panel, and hopefully even informed the panel to some extent about the nature of the debate here. I thank you very much.

Senator WARNER. Could I just join you in saying we did have a very good discussion and excellent attendance.

Senator LIEBERMAN. Yes.

Senator WARNER. At this point, I have a leg that is telling me I have to move to that end.

Senator LIEBERMAN. All right.

Senator WARNER. Senator Alexander is going to take my seat.

Senator LIEBERMAN. All right. You will be able to keep an eye on me.

Senator WARNER. I just have to get it straight over here.

Senator LIEBERMAN. OK. You have been great. That leg problem has not stopped this man. He came in specifically to go onto the Floor of the Senate last Thursday, came out of his bed and introduced this bill and then went back home. So John Warner cares about this, about his grandchildren.

I think maybe when the history of this legislation, if we can get it passed, is written, it is going to be a lot about the grandchildren of Senators and how we measure ourselves by what we do for them.

OK, let's go to the panel. You have up to 10 minutes each, a very broadly representative diverse panel. First, we will go to Kevin Anton, president of Alcoa Materials Management, which apparently has a headquarters in Knoxville, TN.

Mr. ANTON. The beautiful State of Tennessee.

Senator LIEBERMAN. I couldn't have said it better myself. Thank you.

Mr. Anton.

**STATEMENT OF KEVIN ANTON, PRESIDENT, ALCOA
MATERIALS MANAGEMENT**

Mr. ANTON. Thank you, Mr. Chairman and members of the subcommittee, for this opportunity to testify regarding America's Climate Security Act of 2007. My name is Kevin Anton and I am the president of Materials Management for Alcoa, Inc.

I am here today to express Alcoa's support of S. 2191, America's Climate Security Act of 2007, and of the intention by the subcommittee and the full committee to move a climate bill to the Senate this year.

First, a few words about Alcoa. Alcoa is one of the world's largest producers of aluminum and alumina. We are active in all segments of the industry from refining, mining, smelting, to rolling and extrusions. We began in North America, but we can now be found in 44 countries with 116,000 employees. We operate 25 smelters on five continents and nine refineries on four continents. Last year, we produced 3.6 million metric tons of aluminum and 15.1 million metric tons of alumina, with revenue from all operations totaling \$30.6 billion.

In addition, Alcoa is a founding member of the U.S. Climate Action Partnership, a coalition of business and leading environmental NGOs that is calling on the Federal Government to enact quickly strong national legislation to require significant reductions of greenhouse gas emissions. Alcoa accepts the view of a great majority of scientists that enough is known about the science and the environmental impacts of climate change for us to take action now.

Moreover, much of this action must occur in the United States, which is the world's largest greenhouse gas emitter, producing 24 percent of such emissions. The U.S. needs a single, mandatory but flexible climate change program that reduces emissions from large stationary sources, transportation and energy use in commercial

and residential buildings, and put us in a realistic position to ask all the major emitting nations of the world to contribute their fair share as well.

We support S. 2191 because we believe an economy-wide cap and trade program has to be the core of a comprehensive U.S. climate program, and because the Act meets our most important criteria in establishing such a program. A cap and trade program will guarantee that emissions reduction targets are met, while simultaneously generating a price signal that stimulates investment and innovation in technologies necessary to achieve our environmental goals.

Unlike traditional command and control regulations, under a cap and trade program government sets the environmental goal and industry decides how best to achieve it. This is the right division of labor. Unlike a tax, a cap and trade program lets the market, not the government, set the price.

The Act also covers the six predominant human-generated greenhouse gases, rather than focusing solely on carbon dioxide. While most U.S. emissions are in the form of carbon dioxide from the combustion of fossil fuels, the non-CO₂ are more potent in their global warming potential than CO₂ and there are cost-effective and in some cases cost-savings opportunities to reduce these emissions.

S. 2191 establishes an ambitious schedule of reductions. It is essential to be ambitious here because the science tells us we have limited time to head off the worst impacts of climate change. We do not have the luxury of time. However, it is important that the reduction schedule be achievable since a growing economy will provide the basis for the technological innovation we will need to solve this problem efficiently.

Any program must recognize the efforts of companies such as ours to reduce emissions voluntarily. Presidents George H.W. Bush, Bill Clinton and George W. Bush all asked industry to voluntarily reduce greenhouse gas emissions. Alcoa and many others stepped forward to answer those calls, a measure of leadership that certainly should not be penalized now as we make emission reductions mandatory.

While we are pleased that S. 2191 does recognize those reductions, we hope the credit for early action provisions can be strengthened during the legislative process. The allocation of emissions allowances must be done in a way to ease the transition from an economy in which greenhouse gases can be emitted for free, to one in which there is a price signal for such emissions. This is particularly true for industries who will not be able to simply pass these cost on to their customers. Using the allocation process this way, we must cushion the impact on industry without weakening the environmental benefit of the program.

S. 2191 also complements the private sector investment in a vision that will occur as a natural result of the cap and trade program with Federal support for development and deployment of key climate-friendly technologies. This combination of a market push from the Federal technology programs and a market pull from the cap and trade program will be the best formula for getting these technologies in place.

The combination of features I have named so far will make the program cost-effective and friendly to innovation of new technologies we are going to need to tackle this problem. I believe we will all be surprised by the sources and the rate of innovation this program will unleash. If, however, the program ends up costing more than expected, there is the establishment of the Independent Carbon Market Efficiency Board to help avoid excessive costs.

Any cost containment mechanism must retain the environmental integrity of the cap and trade program. The amount of greenhouse gases we emit each year is not as important as the total we emit over a number of years. S. 2191 acknowledges this fact by allowing the Carbon Market Efficiency Board in the event of excess costs, to allow more emissions in the current year so long as it is paid back in the form of emissions reductions in the future. This creates a method for dealing with unforeseen economic problems, without destroying our ability to achieve our environmental goal.

Finally, with all these great attributes, are there things we believe could be improved in this legislation? Yes. There are improvements we would suggest that would put the United States in a stronger position in the international climate negotiations, and we look forward to offering them to you for your consideration as the Act moves through the process. But the America's Climate Security Act of 2007 is a strong enough start and climate change presents a grave enough threat that we cannot afford to let the perfect be the enemy of the good. Let us move this bill forward, fix the problems as best we can, and finally take our first genuine step to address climate change.

Thank you and I look forward to your questions.
[The prepared statement of Mr. Anton follows:]

STATEMENT OF KEVIN ANTON, PRESIDENT, ALCOA MATERIALS MANAGEMENT

Mr. Chairman and members of the subcommittee, thank you for this opportunity to testify regarding the America's Climate Security Act of 2007. My name is Kevin Anton, and I am President of Materials Management for Alcoa, Inc.

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We operate 25 smelters on 5 continents and 9 refineries on 4 continents. Last year we produced 3.6 million metric tons of aluminum and 15.1 million metric tons of alumina with revenue from all operations of \$30.6 billion in 2006.

In addition, Alcoa is a founding member of the U.S. Climate Action Partnership, a coalition of business and leading environmental NGOs that is calling on the federal government to quickly enact strong national legislation to require significant reductions of greenhouse gas emissions.

Alcoa accepts the view of the great majority of scientists that enough is known about the science and environmental impacts of climate change for us to take action now. Moreover, much of this action must occur in the United States, which is the world's largest greenhouse gas emitter, producing 24% of such emissions. The United States needs a singular mandatory but flexible climate change program that reduces emissions from large stationary sources, transportation, and energy use in commercial and residential buildings, and puts us in a realistic position to ask that all the major emitting nations of the world contribute their fair share as well.

We support S. 2191 because we believe an economy-wide cap-and-trade program has to be at the core of a comprehensive U.S. climate program, and because the Act meets our most important criteria in establishing such a program.

A cap-and-trade approach will guarantee that emissions reductions targets are met while simultaneously generating a price signal that stimulates investment and innovation in the technologies necessary to achieve our environmental goal. Unlike traditional command-and-control regulations, under a cap-and-trade program, government sets the environmental goal and industry decides how best to achieve it—which is the right division of labor. Unlike a tax, a cap-and-trade program lets the market, not the government, set the price.

The Act also covers the six predominant human-generated greenhouse gases, rather than focusing solely on carbon dioxide. While most U.S. emissions are in the form of carbon dioxide from the combustion of fossil fuels, the non-CO₂ gases are more potent in their global warming potential than CO₂ and there are cost effective—and in some case cost saving—opportunities to reduce their emissions.

S. 2191 establishes an ambitious schedule of reductions. It is essential to be ambitious here, because science tells us we have limited time to head off the worst impacts of climate change. We do not have the luxury of time. However, it is also important, that the reduction schedule be achievable, since a growing economy will provide the basis for the technological innovation we will need to solve this problem efficiently.

Any program must recognize the efforts of companies, such as ours, to reduce their emissions voluntarily. Presidents George H.W. Bush, Bill Clinton and George W. Bush all asked industry to voluntarily reduce greenhouse gas emissions. Alcoa and many others stepped forward to answer those calls, a measure of leadership that should certainly not be penalized now as we make emissions reduction mandatory. While we are pleased S. 2191 does recognize these reductions, we hope the credit for early action provisions can be strengthened during the legislative process.

The allocation of emission allowances must be done in such a way as to ease the transition from an economy in which greenhouse gases can be emitted for free to one in which there is a price signal on such emissions. This is particularly true for industrials who will not be able to simply pass these costs through to their customers. Using the allocation process this way must cushion the impact on industry without weakening the environmental benefit of the program.

S. 2191 also complements the private sector investment and innovation that will occur as a natural result of the cap-and-trade program with federal support for the development and deployment of key climate-friendly technologies. This combination of market “push” from the federal technology programs, and market “pull” from the cap-and-trade program will be the best formula for getting technologies into use.

The combination of features I have named so far will make the program cost effective and friendly to the innovation of new technologies we are going to need to tackle this problem. I believe we will all be surprised by the sources and rate of innovation this program will unleash. If, however, the program ends up costing more than expected, there is the establishment of an independent Carbon Market Efficiency Board to help avoid excessive costs.

Any cost-containment mechanism must retain the environmental integrity of the cap-and-trade program. The amount of greenhouse gases we emit each year is not as important as the total we emit over a number of years. S. 2191 acknowledges this fact by allowing the Carbon Market Efficiency Board, in the event of excessive costs, to allow more emissions in the current year, so long as this is paid back in the form of extra emission reductions a few years in the future. This creates a method of dealing with unforeseen economic problems, without destroying our ability to achieve our environmental goal.

Finally, with all these great attributes, are there things we believe would improve in this legislation? There are improvements we would suggest that would put the United States in a stronger position in the international climate negotiations, and we look forward to offering them for your consideration as the Act moves through the process. But the America’s Climate Security Act of 2007 is a strong enough start, and climate change presents a grave enough threat, that we can not afford to let the perfect be the enemy of the good. Let us move this bill forward, fix the problems as best as we can, and finally take our first genuine step to address climate change.

Thank you and I look forward to your questions.

RESPONSES BY KEVIN ANTON TO ADDITIONAL QUESTIONS FROM SENATOR CARDIN

Question 1. What measures has Alcoa taken to reduce CO₂ emissions?

Response. We have installed more precise alumina feeding systems, more advanced process control systems and intensive employee training to more closely

monitor operating conditions in our aluminum smelters. These actions dramatically reduce the emission of perfluorocarbons (PFCs).

Question 2. How have those measures impacted Alcoa's competitiveness?

Response. This has had very little impact on our competitiveness

Question 3. Do you believe that you can meet the steady reduction in caps proposed by this bill without any detrimental impact to your industry?

Response. We have several other production technologies in development that we believe will allow us to substantially reduce emissions from our smelting process. Furthermore, we believe the increased use of aluminum in the transportation sector will have a substantially positive impact on emissions from mobile sources.

RESPONSES BY KEVIN ANTON TO ADDITIONAL QUESTIONS FROM SENATOR INHOFE

Question 1. You indicated during testimony that with this bill you would receive allowances that would reward you for past actions. Could you provide the Subcommittee with the number of allowances you estimate your company will receive and the worth of these allowances?

Response. Alcoa began a program of greenhouse gas emissions reductions in 1994 responding to the EPA VIAP program. We are running our facilities at about 26% below our 1990 emissions level and expect to receive credits for early emissions reductions if a mandatory program is enacted. The amount and worth of these credits will depend on the legislation.

Question 2a. Alcoa CEO, Alain Belda, stated on February 16, 2007, that world consumption of aluminum is to double by 2020 and that most of this boom will come from China, India, Russia, and Brazil. China's aluminum consumption alone has increased more than 20 percent in 2006.

Do you see a relationship between the economic growth of the developing world and aluminum production?

Response. Yes. We see a relationship.

Question 2b. Do you think the higher energy costs embodied in this bill will increase or decrease economic growth in this country?

Response. If the bill results in substantially higher energy costs it could have a negative impact on economic growth.

Question 3. Will you commit today to purchasing allowances for the productions you have moved to these developing countries?

Response. If necessary.

Question 4a. On October 1, 2007, EPA released analysis of the Bingaman-Specter, McCain-Lieberman, and Kerry-Snowe bills. It showed that through the end of this Century, each of these bills would only reduce global greenhouse gas concentrations by less than four percent.

Do you have reason to believe that this bill would be significantly different and, are you willing to risk the economic future of this country for such an insignificant gain in global concentrations?

Response. Yes, We believe that this bill has the potential to drive meaningful reductions in global greenhouse gases.

Question 4b. Doesn't EPA's analysis demonstrate that taking unilateral action will be ineffective and could even be counterproductive since it will accelerate emissions growth in the developing nations as we export jobs to their inefficient economies?

Response. We have not studied EPA's analysis sufficiently, but we do not expect to export jobs to inefficient economies.

Question 5. As EPA's analysis shows, even if the rest of the world reduces emissions by more than 10 times that proposed for the U.S., global emissions are expected to be higher than today. Isn't this relevant as we consider action?

If the entire developed world took unilateral action to eliminate every car, closed every factory and shut down every power plant, emissions would still be higher than today within a few decades. Does this affect your support of what I believe is unilateral economic disarmament?

Response. No.

Question 6a. Regarding the overall costs and benefits of the bill:

Should there be a request made to the Energy Information Administration or other federal governmental entity to model the bill?

Response. Yes.

Question 6b. Should there be a request for a study by an econometric modeling firm?

Response. Yes.

Question 7a. For Section 1201: Do you agree with the basis for selecting a 2012 cap of 5.2 billion metric tons considering that total U.S. greenhouse gas emissions are greater than 7 billion tons? (Section 1201(d)).

Response. Yes.

Question 7b. In terms of emission reductions, what percentage should come from fuel switching, and what percentage from installation of new or replacement technologies?

Response. We would hope that the legislation evolves such that both of these choices are attractive.

Question 7c. One oft-repeated approach to emissions reductions is to “slow, stop, and reverse.” Are the emissions targets chosen consistent with this approach?

Response. Yes.

Question 8a. For coverage under the bill: Do you agree with selecting three out of six sectors of the U.S. economy for coverage under the bill?

Response. We support an economy-wide scope to climate change legislation.

Question 8b. Do you think the three sectors were not covered because it would not be cost-effective to include them within the cap?

Response. We do not know the rationale for sectors included in the bill.

Question 8c. If cost-effectiveness was a criterion, what cost in dollars per metric ton should be used as a cutoff?

Response. We are not economic experts in a position to answer this question.

Question 9a. A “new entrant” is defined as a facility that commences operation on or after January 1, 2008. (Section 4(19))

Do you agree with the selecting that date as the cutoff?

Response. This would depend on the date of enactment of the legislation.

Question 9b. Do you agree with requiring commencement of operations instead of commencement of construction as used in the Clean Air Act?

Response. Yes.

Question 9c. Has the difference in the number of qualifying facilities between these two definitions been evaluated?

Response. We do not know if this evaluation has been performed.

Question 10a. For the definition of “facility”: What do you think “any activity . . . at a facility” means?

Response. We believe this means any action directly linked to the conduct of business for which the facility exists.

Question 10b. Could this include coal mining operations or the transport of coal to a facility via train, truck, barge, etc.?

Response. These activities could be included in the definition.

Question 10c. Do you think the definition of “facility” to include “any activity or operation” also includes fugitive emissions that are not under the direct control of the facility?

Response. No.

Question 11a. Under the bill, allowances can be borrowed for a period of up to 5 years. (Section 2302)

Do you agree with the 5 years as an appropriate time limit?

Response. Yes.

Question 11b. Would 6 or more years provide more flexibility for sources that find it necessary to borrow allowances?

Response. Yes.

Question 11c. What considerations are more important than that additional flexibility that necessitate the more restrictive time period?

Response. The urgency to initiate the reduction of GHG emissions.

Question 11d. Since the allowances become increasingly scarce over time, which creates a sliding upward pressure on price, to what degree is it anticipated the borrowing mechanism will mitigate allowance price increases?

Response. The borrowing mechanism will mitigate allowance price increases

Question 11e. If future allowance prices exceed market prices for current allowances, will this mechanism be effective?

Response. Yes.

Question 12. The bill seems to indicate that the interest rate on borrowed allowances is 10%. (Section 2302) Should the interest compound annually?

Response. No.

Question 13a. Under certain conditions, the bill allows covered facilities to satisfy up to 15% of its allowance submission requirement with allowances or credits from foreign GHG trading markets. (Section 2501) One of these conditions is that the foreign government's program be of "comparable stringency" to the U.S. program. (Section 2502(b)(2)).

What criteria should EPA use in determining whether the emission caps, for example, of another country are "comparable" to those of a U.S. program?

Response. We believe the criteria should be negotiated with the objective of equal incentive to reduce global emissions.

Question 13b. Should this "comparable stringency" be based on regulatory requirements or on compliance?

Response. We believe that comparability should be based on regulatory requirements.

Question 14a. Under Section 2603, a Carbon Market Efficiency Board shall carry out one or more of six "cost relief measures" if the board determines that the emissions allowance market "poses a significant harm to the economy of the United States."

Should the board be empowered under the bill to provide cost relief measures if the economy of a region or an individual state faced significant economic harm?

Response. No.

Question 14b. What criteria should the board use to make a significant harm determination?

Response. Harm should be significant.

Question 14c. How should the board determine which measures and the precise extent of those measures that would be adequate to mitigate significant economic harm?

Response. Such measures should mitigate significant economic harm.

Question 14d. How should the board coordinate its activities with the Federal Reserve board in decision-making to relieve inflationary pressures on the economy, and which would be lead as between them in decision-making?

Response. CMEB should have the lead and should coordinate its activities with the FR.

Question 14e. What allowance price is contemplated to pose significant risk of harm to the economy?

Response. A price that would pose a significant risk of harm to the economy.

Question 14f. Is it contemplated that the CMEB will provide the same level of certainty for investors in advanced technologies as a tax or safety valve?

Response. Hopefully, it will.

Question 15a. Section 3402 requires EPA to allocate extra allowances to states that enact statewide GHG reduction targets that are more stringent than the targets established under the bill.

What do you think the basis is for providing an explicit inducement for states to adopt more stringent requirements?

Response. We do not believe states should adopt more stringent reduction targets.

Question 15b. Could this lead to inconsistencies among state programs that reduce the potential cost-effectiveness of a nationwide program?

Response. Yes.

Question 15c. What do you think is the basis for an allocation level of 2% of the allowances for this purpose?

Response. We do not know the basis for the stated allocation.

Question 16. Section 3501 allocates 10% of the allowance account annually to load serving entities, which are overseen by state regulatory bodies. Section 3503(c)(3) prohibits the exercise of certain prerogatives on the part of these state regulatory bodies such as requiring the filing of rate cases in order to pass through the credit from the sale of allowances. Do you agree with this provision and why/ (not)?

Response. We believe that oversight agencies should have a role in determining the treatment of allowances sold by load serving entities.

Question 17. Title III, Subtitle F provides bonus allowances for carbon capture and geological sequestration projects. Section 3604 limits these bonus allowances to the first 10 years of operation. Do you agree with limiting the incentive to 10 years?

Response. No.

Question 18a. Title II, Subtitle D states that domestic offsets have to be permanent. What exactly does that term mean in terms of biologic sequestration?

Response. We believe that lands established for offsets should be permanently managed to capture intended sequestration.

In your opinion, what are the anticipated impacts to food prices associated with providing incentives to farmers to convert cropland to grassland or rangeland?

Response. We have not evaluated this impact.

Question 18b. What would be the impact of such incentives to production of ethanol and the cost of ethanol?

Response. We have not evaluated this impact.

Question 19. Section 3903(b) distributes allowances to rural electric cooperatives equal to their 2006 emissions. Do you agree with giving preferential treatment to rural electric cooperatives?

Response. No.

Question 20a. Regarding Section 1103(d): What methods are facilities contemplated to employ to determine complete and accurate data for the years 2004 through 2007 where no data was collected or readily available?

Response. If no data was collected, it will be impossible to determine.

Question 20b. Also for Section 1103(d), how are facilities that currently do not have monitoring systems in place going to be able to submit quarterly data starting in 2008?

Response. The practicality of these dates will be a function of the effective date of the legislation.

Question 20c. Should the \$25,000 per day for each violation apply to these facilities for these time periods?

Response. No.

Question 20d. What is the process, and who should be the authority, for determining what constitutes complete and accurate data for these time periods?

Response. We believe it best for the government to decide who and how best to evaluate the completeness of emission data.

Question 21. Based on EPA's 2005 U.S. greenhouse gas inventory, the electric generating sector accounted for 46% of the proposed 2012 cap level of 5.2 billion metric tons. Between allocations to generators and load serving entities, the bill allocates 30% of the total allowances to that sector, and reducing the sector's subsequently. Do you agree with this differential treatment of the electric sector?

Response. Yes.

Question 22. The allowance allocation to electric generating units in the first year of the program represents approximately 44% of that sector's 2005 emissions based on EPA's inventory. Electric demand is anticipated to increase, and reducing emissions by replacing current plants with lower or non-emitting plants will take years to achieve. Based on this, does the bill contemplate some mechanism, or set of mechanisms, whereby emissions will be reduced during this timeframe or allowances will be available, or will allowances have to be purchased?

Response. We cannot determine how utilities will meet this requirement.

Question 23a. Section 3803 allocates 3 percent of allowances to projects in other countries for forest carbon activities.

What should be the projected subsidy to other countries under this provision?

Response. We believe that the allowances should apply to owners of projects in other countries, not to those countries.

Question 23b. China's carbon dioxide emissions now exceed that of the United States and are projected to increase. Should China or other countries whose emissions eclipse those of the United States in the future be eligible for these allocations?

Response. No.

Question 24a. Regarding Section 8001: This Section calls for a national assessment of carbon dioxide storage capacity. Presumably, this assessment would determine whether the U.S. has sufficient capacity to geologically sequester the carbon dioxide that would have to be captured to comply with the bill. Absent the results of this survey which has not been undertaken yet, do you agree with assuming the U.S. has adequate storage capacity?

Response. No, we do not know that such an assumption has been made.

Question 24b. How do you envision the program addressing the long term oversight of the carbon storage sites?

Response. We expect the regulatory process to address this.

Question 24c. This Section provides EPA with the legal authority to develop a permitting program for carbon storage through the Safe Drinking Water Act's Underground Injection Control program. Long term monitoring and particularly in the west, property rights, are just two of the several issues that will need to be taken into consideration under any regulatory regime. (i) Is the bill's approach sufficient to address these issues? (ii) Should there be a statutory role for the states?

Response. We have no opinion on this.

Question 25a. Subtitle G, Section 4702(b)(1)(F) stipulates money is available for adaptation activities in accordance with recovery plans for threatened and endangered species. Does the bill envision that all existing recovery plans will be rewritten to address all climate change related effects? If so, will the monies in the adaptation fund be available to Fish and Wildlife Service (FWS) to re-write the recovery plans or will FWS have to bear that cost from other monies?

Response. No.

Question 25b. Within Subtitle G, how does the bill contemplate FWS will prioritize species to receive adaptation funds? (i) Is it based on their overall threatened or endangered status or the degree to which they are affected by climate change? (ii) Are plants and animals not affected by climate change eligible for these funds? (iii) How should the Department of the Interior distinguish those ecological processes that are due to man-made climate change from those that are due to normal species development and evolution?

Response. We assume this provision affects species impacted by climate change.

RESPONSES BY KEVIN ANTON TO ADDITIONAL QUESTIONS FROM SENATOR BARRASSO

Question 1. What impact will Lieberman-Warner have on Liquefied Natural Gas imports to the U.S.?

Response. We would like to see an increase in the availability of natural gas through domestic production as well as imports.

Question 2. With increasing demand for energy both in America and around the world as a result of increased economic growth, technological solutions will be essential for countries to meet their energy demands while limiting greenhouse gas emissions. However, there are tremendous uncertainties about what technologies will most effectively address these issues.

As Congress continues to examine technological solutions to combat climate change, do you believe we have enough information to identify which technologies hold promise and therefore warrant investment?

Response. We believe there are a number of promising new technologies and that there is enough information to identify the most promising. We also believe that effective legislation, with a market driven mechanism to achieve emission reductions will more rapidly generate even more new technologies to evaluate and deploy.

Question 3. What do you think should be Congress' funding priorities?

Response. We do not have an opinion of which technologies Congress should fund.

Question 4. What are the costs to family budgets for middle class and low income people of implementing Lieberman-Warner in terms of energy bills and gasoline prices in the next five to 10 years?

Response. We have no more idea on what the impact on family budgets will be if Lieberman-Warner is adopted than we do if it is not and climate change continues unabated.

Question 5. In 2050, how much cooler will the planet be if we adopt Lieberman-Warner?

Response. We expect the planet will be cooler in 2050 if Lieberman-Warner is adopted than if it is not.

Question 6. Following up on my question during the hearing, could you elaborate further regarding whether Alcoa will offshore North American jobs if energy prices increase for Alcoa because of the Lieberman-Warner bill?

Response. As evidenced by our investment of over \$1 B in U.S. operations, we fully expect to maintain our North American operations. We do expect to grow additional aluminum production capacity and expect most of that growth to occur outside North America regardless of Lieberman-Warner.

Senator LIEBERMAN. Thank you very much, Mr. Anton, for a very thoughtful statement. Thanks for your expression of support for the Climate Security Act.

Next is Ms. Frances Beinecke, president of the Natural Resources Defense Council, one of America's leading environmental groups.

Ms. Beinecke, thank you.

STATEMENT OF FRANCES BEINECKE, PRESIDENT, NATURAL RESOURCES DEFENSE COUNCIL

Ms. BEINECKE. Thank you, Mr. Chairman, for the opportunity to testify today regarding America's Climate Security Act. I am Frances Beinecke. I am the president of the Natural Resources Defense Council. NRDC is a national environmental organization of lawyers, scientists and environmental specialists dedicated to protecting public health and the environment.

Founded in 1970, we have over 1.2 million members and activists, and we have made curbing global warming our number one institutional priority. We have been working with mayors, legislators, and governors across the country, and we are a founding member of the United States Climate Action Partnership, along with Alcoa and many of America's largest businesses.

Chairman Lieberman and Ranking Member Warner, let me congratulate you both on the introduction of this very important bill on global warming. We view the legislation as a strong start on enacting comprehensive global warming legislation and look forward to working with you, Chairman Boxer, members of the subcommittee and the committee, to report legislation to the full U.S. Senate.

The time for action on global warming is now. Many of you have spoken about that already. Every day, we learn more about the ways in which global warming is already affecting our planet. Chairman Lieberman referenced the article in the *Washington Post* this week indicating that 40 percent of the summer ice in the Arctic has melted since 1979, an extraordinary amount of melt which really indicates that the consequences of disruptive climate are with us now. They are not issues for the future.

Climate scientists have warned us that we must act now to begin making serious emission reductions if we are to truly avoid the most serious consequences of global warming. Because carbon dioxide remains in the atmosphere for so many decades, the climate change impacts from today's pollution will last well into this century and into the next century as well.

A growing body of scientific opinion has formed that we face extreme dangers if global average temperatures are allowed to increase by more than 2 °F from today's levels. To prevent such increases, we need to halt U.S. emissions growth in the next few years, and then cut emissions by as much as 80 percent by mid-century.

The goal is ambitious, but it is achievable. It can be done if we start now and reach an annual rate of emissions reductions that ramps up to four percent a year. But if we delay and the emissions continue to grow on the business-as-usual trajectory over the next 10 years, the annual emission reduction rate that will be required

to stay on the path of 450 parts per million would double to 8 percent per year. As shown in this figure, basically a slow start means a crash finish. We cannot afford to wait until we are faced with the need to cut emissions at that 8 percent rate.

Waiting also means that billions of dollars will be misspent on outmoded technology that will lock in high carbon emissions for many decades to come. More than \$20 trillion will be spent globally on new energy technologies between now and 2030. How this money is invested over the next decade will determine whether we can realistically avoid the worst effects of global warming. We do have the solutions. Many of you referenced them—cleaner energy sources, new vehicle technologies, cleaner industrial processes, and greatly enhanced energy efficiency. But right now, we lack the policy framework that will incentivize investments in the business sector in the right way to get these solutions in place and in the hands of consumers.

America's Climate Security Act is a major step towards establishing that framework. We greatly appreciate, Mr. Chairman and Senator Warner, the improvements that have been made in this bill since the outline first came out in August, in particular, increasing the emission reductions required by 2020 from 10 percent to 15 percent. We believe that sends a strong signal that now is the time to invest in clean technologies.

We also appreciate that the bill includes mechanisms to manage abatement costs without resorting to the so-called safety valve. The fundamental problem with the safety valve is it busts the cap without ever making up for the excess emissions, as Mr. Anton referenced. We urge you to continue to reject the efforts to include a safety valve in this legislation and look at alternatives.

There are many other positive features of your bill, but I know time is short, so I just want to identify five areas in which we would like to see improvements as you go through this process.

The No. 1, is scientific review of targets. The bill requires the National Academy of Sciences to assess whether the emission reductions required by the bill are being achieved and whether such reductions will be sufficient to avoid dangerous global warming. However, there is no provision for adjustments of the reduction goals if needed based on the science. So we would recommend that the bill should be revised to allow EPA to act and take all necessary actions to avoid dangerous global warming impacts by requiring additional reductions if the science so indicates.

No. 2, coverage. The bill would cover approximately 75 percent of U.S. greenhouse gas emissions, thereby reducing total greenhouse gas by up to 19 percent by 2020 and 63 percent by 2050. Since additional reductions will be needed to keep pace with science, coverage of the bill should be increased. Senator Sanders and Senator Whitehouse referenced this. This could happen, for example, by covering natural gas that is used in buildings right now, which is not part of the current coverage.

No. 3, is to incorporate complementary performance standards. Performance standards for key sectors are an important complement to the cap, and the bill does include some, but we would recommend some others. The Sanders–Boxer bill contained two

complementary performance standards for coal plants, which we would encourage you to include in S. 2191.

The first is a CO₂ emissions standard that applies to new power investments that would be achievable with carbon capture and storage, and is based on a standard already used in the State of California.

The second standard is a low carbon generation obligation for coal-based power which would encourage companies to invest early in deploying carbon capture and storage technologies, and then coal-based electricity generators would have to get some of their power or purchase credits equivalent to such power from coal-fired power plants that actually capture and dispose of the greenhouse gases, thereby spreading the cost of new CCS plants throughout the coal-fired generation sector.

Other complementary policies should also be considered in sectors such as transportation and renewables, and we urge Congress to act on an energy bill that would include the CAFE standards adopted in the Senate bill and the renewable electricity standards passed by the House. We also support the low carbon fuels standard such as the one included in Senator Boxer's advanced clean fuels legislation.

No. 4, is allocation of allowances. The Lieberman-Warner bill devotes substantial allowances to important public purposes, but the bill initially provides too many free allowances to emitters. Although we appreciate the substantial improvements that have been made in this bill since August, including eliminating the perpetual free allocation to emitters, we still recommend further reducing the starting percentage of free allowances to emitters and phasing them out faster, within 10 to 15 years of enactment. This will free up needed resources for other important purposes.

No. 5, global warming and national security. One final point I would like to make relates to the issue of global leadership. The impacts of global warming will be felt to a much greater extent by vulnerable communities abroad, particularly those in the least developed countries that bear the smallest share of responsibility for the global warming emissions that we are now faced with.

In America, per capita we are responsible for many times more emissions than people who live in the poorest nations, and providing assistance for international adaptation is not only the right thing to do, but it is in the national interest. Global warming is a destabilizing force that will act against our hopes for the advancement of human rights and democracy. It will elevate the risk of displacement, famine and poverty, the kind of conditions in which violence, oppression and radical ideologies can flourish.

But our motive for helping should not rest solely on whether these countries are a security threat, but because it is also the right thing to do and because we have a crucial opportunity to ameliorate worldwide suffering by assisting these nations in adopting more sustainable development paths.

So Mr. Chairman and Senator Warner, you have stepped forward at a key moment in history and we congratulate you for your vision, for your courage and for your leadership in this profoundly important global issue. Together with the Senators here today, with Chairman Boxer and other members of the committee, we

look forward to working with you and your staff as this bill goes through subcommittee so that it can be improved and we can get consensus and move this important issue forward.

We look forward to further progress and we stand ready to assist you, and I look forward to answering questions later on.

Thank you.

[The prepared statement of Ms. Beinecke follows:]

STATEMENT OF FRANCES BEINECKE, PRESIDENT, NATURAL RESOURCES
DEFENSE COUNCIL

Thank you for the opportunity to testify today regarding America's Climate Security Act. My name is Frances Beinecke. I am the President of the Natural Resources Defense Council (NRDC). NRDC is a national, nonprofit organization of scientists, lawyers and environmental specialists dedicated to protecting public health and the environment. Founded in 1970, NRDC has more than 1.2 million members and on-line activists nationwide, served from offices in New York, Washington, Los Angeles and San Francisco, Chicago and Beijing.

Chairman Lieberman, and Ranking Member Warner, let me congratulate you both on the introduction of your global warming bill, America's Climate Security Act. NRDC views your legislation as an important, initial step toward enactment of comprehensive global warming legislation and we look forward to working closely with you, and the other members of the Subcommittee and the Committee, to report legislation to the full United States Senate.

The time for action on global warming has already been delayed too long. Every day we learn more about the ways in which global warming is already affecting our planet. As described in a full page story in Monday's Washington Post, dramatic new satellite pictures show that summertime arctic ice has declined by 40 percent since 1979 (Figure 1). The UN Intergovernmental Panel on Climate Change (IPCC) found that 11 of the past 12 years are among the 12 hottest years on record. The Greenland and West Antarctic ice sheets are losing mass at accelerating rates. Rising sea surface temperatures correlate strongly with increases in the number of Category 4 and 5 hurricanes. Increases in wildfires, floods and droughts are predicted to occur as global warming continues unabated. Our oceans are warming and becoming more acidic. Everywhere one looks, the impacts of a disrupted climate are confronting us.

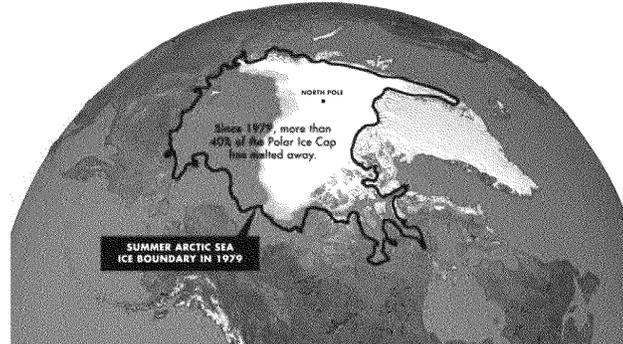


Figure 1: ARCTIC MELTDOWN - Arctic summer sea ice extent in 1979 and 2007. Source: NASA.

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

In the past year, stories about global warming have appeared on the covers of Time, Newsweek and Sports Illustrated. And recent polls show very high levels of

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

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

Since the start of the industrial revolution, carbon dioxide concentrations have risen from about 280 parts per million (ppm) to more than 380 ppm today, and global average temperatures have risen by more than one degree Fahrenheit over the last century. A growing body of scientific opinion has formed that we face extreme dangers if global average temperatures are allowed to increase by more than 2 degrees Fahrenheit from today's levels. We may be able to stay within this envelope if atmospheric concentrations of CO₂ and other global warming gases are kept from exceeding 450 ppm CO₂-equivalent and then rapidly reduced. However, this will require us to halt U.S. emissions growth within the next few years and then cut emissions by approximately 80% over the next 50 years.

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

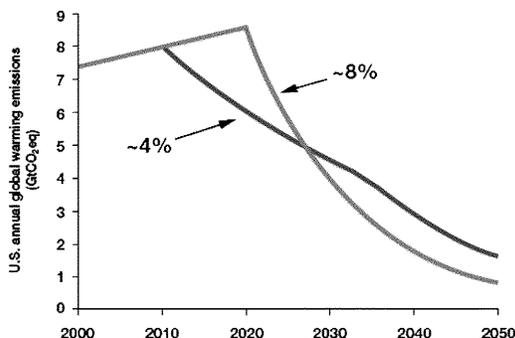


Figure 2: SLOW START... CRASH (OR BURN) FINISH

Source: Union of Concerned Scientists.

It is critical to recognize that continued investments in old technology will “lock in” high carbon emissions for many decades to come. This is particularly so for the next generation of coal-fired power plants. Power plant investments are large and long-lasting. A single plant costs around \$2 billion and will operate for 60 years or more. If we decide to do it, the United States and other nations could build and operate new coal plants that return their CO₂ to the ground instead of polluting the atmosphere. With every month of delay we lose a piece of that opportunity and commit ourselves to 60 years of emissions. The International Energy Agency (IEA) forecasts that more than 20 trillion dollars will be spent globally on new energy technologies between now and 2030. How this money is invested over the next decade, and whether we will have the proper policies in place to drive investment into cleaner technologies, which can produce energy from zero and low carbon sources, or that can capture and dispose of carbon emissions, will determine whether we can realistically avoid the worst effects of global warming.

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

The Lieberman-Warner bill, America’s Climate Security Act (S. 2191), is a major step towards putting our country on an emissions pathway consistent with avoiding extremely dangerous global warming. The bill caps and cuts emissions of three sectors—electricity, transportation, and industry—that together account for about 75 percent of U.S. greenhouse gas emissions. It calls for a 15 percent reduction in covered emissions by 2020 and for a 70 percent reduction in covered emissions by 2050. The bill also includes features to reduce emissions from the uncovered sectors, principally a set of energy efficiency measures for buildings and key energy-using activities, and a “set-aside” of allowances from within the cap to encourage emission reductions and sequestration in the agriculture and forestry sectors. Our calculations indicate that this combination will result in reducing total U.S. emissions by approximately 13–19 percent by 2020 and approximately 51–63 percent by 2050. In order to assure that we get on, and stay on, the necessary emission reduction pathway, NRDC believes the coverage of the bill and the total amount of emissions reductions should be increased.

S. 2191 would implement its cap and reductions through an allowance trading system. NRDC agrees that—combined with complementary policies, some of which are contained in this bill and in other legislation, such as the pending energy bill—this is the most effective and efficient approach to curbing global warming pollution. As the sponsors are aware, a cap and trade system requires attention to how the emissions allowances are allocated, and for what purposes. It is important to distinguish between the abatement cost of a cap and trade system and its distributional implications. The abatement cost will be significant, but far less than the cost of inaction. At the same time, the value of the pollution allowances created by the law will be much higher: some estimates place their value between \$30 and \$100 billion per year.

NRDC believes these pollution allowances are a public trust. They represent permission to use the atmosphere, which belongs to all of us, to dispose of global warming pollution. As such, they are not a private resource owned by historical emitters and such emitters do not have a permanent right to free allowances. The value of the allowances should be used for public purposes including promoting clean energy solutions, protecting the poor and other consumers, ensuring a just transition for workers in affected industries, and preventing human and ecosystem impacts both here and abroad, especially where they can lead to conflicts and threats to security.

S. 2191 embraces the principle that these pollution allowances should be used for public purposes but it implements the principle too slowly. NRDC believes that over the first 25 years of the program the bill gives away more allowances to the biggest emitting firms than is needed to fully compensate such firms for the effects of their compliance obligations on the firms’ economic values. The result is that there are not enough available to fully meet public needs. As discussed more fully below, the allowance allocations in the bill can be substantially improved.

S. 2191 also allows the owner or operator of a covered facility to satisfy up to 15 percent of a given year’s compliance obligation using “offsets” generated within the United States. These offsets would come from activities that are not covered by the emissions cap. The 15 percent limitation is essential to ensure the integrity of the emissions cap in the bill and to spur technology innovation. The total amount of offsets allowed should not be increased. In addition, further changes to the bill should be made regarding the types of offsets that should be allowed and the conditions for such offsets.

We are pleased to note that the Lieberman/Warner legislation includes “cost containment” provisions that protect the integrity of the emissions cap and preserve incentives for technology innovation. In particular, we commend your rejection of the misnamed “safety valve” concept that would allow the government to print unlimited pollution allowances at a set price.

The fundamental problem with the safety valve is that it breaks the cap without ever making up for the excess emissions. Simply put, the cap doesn’t decline as needed or, worse, keeps growing. “Safety valve” is actually a misleading name. In boiler design, the role of a safety valve is to allow pressures to build within the vessel to working levels, well above atmospheric pressure. A safety valve’s function is to open on the rare occasion when the boiler is pressured beyond its safe operating range, to keep it from exploding. In the life of a well-run boiler, the safety valve may never open. Imagine, however, a boiler designed with a valve set to open just slightly above normal atmospheric pressure. The valve would always be open, and the boiler would never accomplish any useful work. That is the problem with the

safety valve design in other legislative proposals. The valve is set at such a low level that it is likely to be open virtually all the time.

In addition to breaking the U.S. cap, a safety valve also would prevent U.S. participation in international trading systems. If trading were allowed between the U.S. and other capped nations, a major distortion would occur. Firms in other countries (acting directly or through brokers) would seek to purchase U.S. lower-priced allowances. Their demand would almost immediately drive the U.S. allowance price to the safety valve level, triggering the “printing” of more American allowances. Foreign demand for newly-minted U.S. safety valve allowances would continue until the world price dropped to the same level. The net result would be to flood the world market with far more allowances—and far less emission reduction—than anticipated.

Although NRDC believes that the primary and most effective cost containment device in any mandatory legislation will be the cap and trade system itself, NRDC also supports other means of providing flexibility. Banking has long been a feature of cap and trade systems. We also support the bill’s provisions allowing firms to borrow allowances with appropriate interest and payback guarantees. The bill includes a further provision, nicknamed the Carbon Fed, based upon a proposal developed by Senators Warner, Graham, Lincoln and Landrieu. The board created under this provision is charged with monitoring the carbon market and is authorized to change the terms of allowance borrowing, including the interest rate and the time period for repayment. Crucially, however, the Carbon Fed does not have the authority to change the cumulative emissions cap. Under such a proposal, the environment is protected and cost volatility is minimized.

While S. 2191 provides a solid framework for sound global warming legislation, there are some significant areas in which it can and should be substantially improved. A more detailed discussion of these areas follows:

COVERAGE OF EMISSIONS

As I mentioned, scientists are telling us that we will need reductions in total U.S. emissions on the order of 80% by 2050 in order to do our proportional part in a global program of preventing catastrophic impacts. Our calculations indicate that the bill will result in reducing total U.S. emissions by approximately 51–63 percent by 2050. In order to ensure that overall reductions keep pace with the science, NRDC believes that the bill’s coverage should be increased. The most important source of emissions that is not covered is the commercial and residential use of natural gas.

SCIENTIFIC REVIEW OF TARGETS

The bill as introduced includes a provision under which the National Academy of Sciences would assess the extent to which emissions reductions required under the Act are being achieved, and would determine whether such reductions are sufficient to avoid dangerous global warming. However, unlike the similar provisions of the Sanders/Boxer legislation, S. 2191 does not authorize the Environmental Protection Agency to respond to the NAS assessments and reports by adjusting the applicable targets. The bill should be revised to allow EPA to take all necessary actions to avoid dangerous global warming by requiring additional reductions, including by changing applicable targets or through increasing the coverage of the bill.

COMPLEMENTARY PERFORMANCE STANDARDS

Performance standards for key sectors are an important complement to the overarching cap on emissions. The bill recognizes the importance of performance standards for building codes and appliance efficiency and contains standards for these energy consuming activities. But energy producers also need performance standards to avoid counterproductive investments in the early years of the program.

Perhaps the most important performance standard for the production sector is for coal-fired electric generation. As I described above, new coal plants cost billions of dollars and will operate for 60 years or more. It is critical that we stop building new coal plants that release all of their carbon dioxide to the air. The bill contains several incentive provisions to reward developers who incorporate carbon capture and geologic disposal systems for new coal plants. NRDC supports such incentives but believes they should be coupled with performance standards to assure we do not build more coal plants that are uncontrolled for carbon dioxide.

The Sanders-Boxer bill contains two complementary performance standards for coal plants and we recommend the Subcommittee and Committee incorporate these concepts into S. 2191. The first standard is a CO₂ emissions standard that applies to new power investments. California enacted such a measure in SB1368 last year.

It requires new investments for sale of power in California to meet a performance standard that is achievable by coal plants using CO₂ capture.

The second standard is a low-carbon generation obligation for coal-based power. Similar in concept to a renewable performance standard, the low-carbon generation obligation requires an initially small fraction of sales from coal-based power to meet a CO₂ performance standard that is achievable with carbon capture. The required fraction of sales would increase gradually over time and the obligation would be tradable. Thus, a coal-based generating firm could meet the requirement by building a plant with carbon capture, by purchasing power generated by another source that meets the standard, or by purchasing credits from those who build such plants. This approach, when combined with the allowance incentives in S. 2191, has the advantage of speeding the deployment of carbon capture systems while avoiding the “first mover penalty.” Instead of causing the first builder of a commercial coal plant with carbon capture to bear all of the incremental costs, allowance incentives and the tradable low-carbon generation obligation would spread those costs over the entire coal-based generation system. With such performance standards included, the bill could—at no added cost—prevent construction of new uncontrolled coal power plants and free up some of the incentive allowances for other purposes.

Some have argued that key technologies, such as carbon capture and storage (CCS) are not yet available or are only available now at exorbitant cost. Such arguments are incorrect. All the elements of CCS systems are actually in use today. But arguments about what is available today, under today’s market conditions, fundamentally miss the point, because global warming legislation is about setting the market conditions for technological progress going forward from today. Taking a frozen snapshot of the cost of carbon control technologies today is also misleading. Think how wrong such an assessment would have been if applied to computer technology at any point in the last thirty years. Speed and capacity have increased by orders of magnitude as costs plummeted. We now carry more computing power in our cell phones than the Apollo astronauts carried to the moon. Once market signals are in place, it will be the same for technologies such as carbon capture and storage. I attach an Appendix to my testimony prepared by David Hawkins, Director of NRDC’s Climate Center, which discusses the current availability of carbon capture and disposal in detail.

Other complementary policies should also be considered for sectors such as the transportation area. NRDC supports a Low Carbon Fuel Standard, which would cut greenhouse gas emissions from fuels by 10% from today’s levels by 2020 and spur development and use of cellulosic ethanol and other low carbon fuels. Senator Boxer’s bill, the Advanced Clean Fuels Act of 2007, includes a Low Carbon Fuel Standard and we would support inclusion of such a performance standard in S. 2191. It is also important to note that other ongoing efforts in the Senate, such as the Corporate Average Fuel Economy measures included in the Senate Energy bill, could lead to substantial reductions in greenhouse gas emissions and if enacted, will provide another important complement to the provisions in S. 2191.

OFFSETS

America’s Climate Security Act allows the owner or operator of a covered facility to satisfy up to 15 percent of a given year’s compliance obligation using “offsets” generated within the United States. These offsets would come from activities that are not covered by the emissions cap.

While there are many emission reduction activities outside the cap that are worth encouraging, many experts have worked for more than 30 years in an attempt to produce reliable, workable offset programs in both the clean air and global warming contexts but there is little reason for satisfaction with the results. Even if criteria for measurability and enforceability are met, offsets still have the potential to break the cap because of difficulties in assuring that actions being credited are actually “additional”—i.e., that they are not simply actions that would have taken place anyway in the absence of credit.

The additionality problem is not readily soluble, because it is extraordinarily difficult to devise workable rules for determining business-as-usual baselines at the project level. In some areas, credits may leverage new actions that would not have occurred, with a minimum of credit bestowed on “anyway” actions. But far more often, “anyway” actions make up a large—even dominant—fraction of the reductions credited. If offsets represent even a small percentage of “anyway” tons, climate protection actually moves backwards. A full ton is added to the cap in exchange for an action that may represent only 0.9 ton of reduction—or worse, 0.1 ton of reduction. With each offset, net emissions increase.

Offsets also can delay key industries' investments in transformative technologies that are necessary to meet the declining cap. For instance, unlimited availability of offsets could lead utilities to build high-emitting coal plants instead of investing in efficiency, renewables, or plants equipped with carbon capture and storage.

For these reasons, NRDC has proposed setting aside a portion of the allowances from within the cap to incentivize mitigation actions from sources, like agriculture, that are outside the cap. Since the allowances would come from within the cap, they do not run the risk of expanding actual emissions as a result of rewarding this activity. Another acceptable approach would be to allow only a limited quantity of offsets in the cap-and-trade design.

The Lieberman/Warner bill takes both approaches. The bill includes a "set aside" for agricultural reductions which would provide allowances from within the cap, and the bill also limits domestic offsets from outside the cap to 15 percent of a facility's annual compliance obligation.

NRDC believes that there are some additional changes needed in the offset provisions to remove certain types of offsets where additionality fundamentally cannot be guaranteed. A number of other safeguards need to be strengthened. We will be glad to continue working with your staff regarding these provisions.

ALLOCATION OF ALLOWANCES

The Lieberman/Warner bill recognizes that allowances can and should be used to achieve important public purposes, but the bill provides too many allowances for free to emitters in the early years of the program.

The bill provides allowances for public purposes in two ways:

(1) auctioned allowances, with the proceeds of the auction going for such purposes as climate-friendly technologies, low income energy consumers, wildlife adaptation, national security/global warming measures and worker training.

(2) free allowances to electricity consumers, state and tribal governments, and U.S. farmers and foresters, for a range of designated public purposes.

But the bill also initially gives 40 percent of the allowances for free to emitters in the electric and industrial sectors. These free allowances to emitters continue to gradually reduced rates until 2036 when they are terminated. The amount of allowances that are auctioned for public purposes grows from 24 percent in 2012 to 73 percent in 2036.

NRDC appreciates the substantial changes that have been made to the bill since the bill outline was released in August. These changes include eliminating the perpetual free allocation to industrial emitters and removing free allowances to oil and coal companies.

The current bill's allocation to electric power and industrial emitters, however, is still much higher than justified under "hold-harmless" principles and will result in windfall profits to the shareholders of emitters. For example, an economic analysis by Larry Goulder of Stanford University suggests that in an economy-wide upstream cap and trade program, only 13% of the allowances will be needed to cover the costs that fossil-fuel providers would not be able to pass on to their customers. Similar analyses, with similar results, have been conducted by Resources for The Future and the Congressional Budget Office.

As a result, NRDC believes that the bill should be improved substantially by reducing the starting percentage of free allowances to emitters and phasing them out faster—within 10–15 years of enactment. This would allow a greater percentage of the allowances to be devoted to public purposes from the start and over time. In particular, reducing the free allocations to emitters would allow for more resources to be directed to states, to low-income consumers in the United States, and to the most vulnerable among us, both here and abroad.

INTERNATIONAL COOPERATION

The bill includes a provision to encourage other nations to join in action to reduce greenhouse gas emissions, and to protect American businesses and workers from unfair competition if specific nations decline to cooperate. Under this provision, the United States would seek to negotiate for "comparable emissions reductions" from other emitting countries within 8 years of enactment. Countries failing to make such commitments would be required to submit greenhouse gas allowances for certain carbon intensive products. NRDC supports this provision, while bearing in mind that the U.S., as the world's greatest contributor to the burden of global warming pollution already in the atmosphere, needs to show leadership in meeting the global warming challenge.

ADAPTATION ISSUES

The sad truth is that if we do our utmost to cut global warming pollution starting tomorrow, people, and the sensitive ecosystems we depend on, will still suffer serious impacts due to the emissions that are already in the air and those “in the pipeline.” We must do what we can now to ensure that communities and natural ecosystems are best prepared to withstand and adapt to ongoing and expected change. To that end, NRDC would like to thank Senators Warner and Lieberman for inclusion of language establishing an adaptation fund to assist Federal, State, and tribal entities to develop and adopt adaptation strategies.

I would also like to mention a bill introduced last week by Senator Whitehouse, with Senator Boxer. This bill, the Global Warming Wildlife Survival Act, addresses ongoing and expected impacts to our oceans, wildlife, and endangered species associated with global warming and ocean acidification. We are particularly excited to see that Senators Whitehouse and Boxer have elevated the issue of the threats facing our ocean ecosystems and resources, calling for the development and implementation of a National Ocean, Coastal, and Great Lakes Resiliency Strategy and for development of climate change resiliency plans under the Coastal Zone Management Act. These are the types of approaches we need to ensure that our oceans are as healthy as possible, so that they are better able to withstand the adverse effects of warming and acidification. We look forward to working with the Committee to incorporate these approaches into the final bill.

Chairman Lieberman and Ranking Member Warner, you have stepped forward at a key moment in history and you are to be commended for your vision, leadership and courage on this profoundly important issue. Together with Chairman Boxer, and the other members of the Committee, the work that you and your staff have done on this bill marks an important milestone in the movement toward enactment of strong, bipartisan global warming legislation. We look forward to further progress as your legislation moves through the Subcommittee and the full Environment and Public Works Committee, and we at NRDC stand ready to assist in anyway possible.

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

APPENDIX

IS CCD READY FOR BROAD DEPLOYMENT?

DAVID HAWKINS, DIRECTOR, CLIMATE CENTER, NATURAL RESOURCES DEFENSE
COUNCIL

KEY QUESTIONS ABOUT CCD

I started studying CCD in detail 10 years ago and the questions I had then are those asked today by people new to the subject. Do reliable systems exist to capture CO₂ from power plants and other industrial sources? Where can we put CO₂ after we have captured it? Will the CO₂ stay where we put it or will it leak? How much disposal capacity is there? Are CCD systems “affordable”? To answer these questions, the Intergovernmental Panel on Climate Change (IPCC) decided 4 years ago to prepare a special report on the subject. That report was issued in September, 2005 as the IPCC Special Report on Carbon Dioxide Capture and Storage. I was privileged to serve as a review editor for the report’s chapter on geologic storage of CO₂.

CO₂ CAPTURE

The IPCC special report groups capture or separation of CO₂ from industrial gases into four categories: post-combustion; pre-combustion; oxyfuel combustion; and industrial separation. I will say a few words about the basics and status of each of these approaches. In a conventional pulverized coal power plant, the coal is combusted using normal air at atmospheric pressures. This combustion process produces a large volume of exhaust gas that contains CO₂ in large amounts but in low concentrations and low pressures. Commercial post-combustion systems exist to capture CO₂ from such exhaust gases using chemical “stripping” compounds and they have been applied to very small portions of flue gases (tens of thousands of tons from plants that emit several million tons of CO₂ annually) from a few coal-fired power plants in the U.S. that sell the captured CO₂ to the food and beverage industry. However, industry analysts state that today’s systems, based on publicly available information, involve much higher costs and energy penalties than the principal demonstrated alternative, pre-combustion capture.

New and potentially less expensive post-combustion concepts have been evaluated in laboratory tests and some, like ammonia-based capture systems, are scheduled for small pilot-scale tests in the next few years. Under normal industrial development scenarios, if successful such pilot tests would be followed by larger demonstration tests and then by commercial-scale tests. These and other approaches should continue to be explored. However, unless accelerated by a combination of policies, subsidies, and willingness to take increased technical risks, such a development program could take one or two decades before post-combustion systems would be accepted for broad commercial application.

Pre-combustion capture is applied to coal conversion processes that gasify coal rather than combust it in air. In the oxygen-blown gasification process coal is heated under pressure with a mixture of pure oxygen, producing an energy-rich gas stream consisting mostly of hydrogen and carbon monoxide. Coal gasification is widely used in industrial processes, such as ammonia and fertilizer production around the world. Hundreds of such industrial gasifiers are in operation today. In power generation applications as practiced today this “syngas” stream is cleaned of impurities and then burned in a combustion turbine to make electricity in a process known as Integrated Gasification Combined Cycle or IGCC. In the power generation business, IGCC is a relatively recent development—about two decades old and is still not widely deployed. There are two IGCC power-only plants operating in the U.S. today and about 14 commercial IGCC plants are operating globally, with most of the capacity in Europe. In early years of operation for power applications a number of IGCC projects encountered availability problems but those issues appear to be resolved today, with Tampa Electric Company reporting that its IGCC plant in Florida is the most dispatched and most economic unit in its generating system.

Commercially demonstrated systems for pre-combustion capture from the coal gasification process involve treating the syngas to form a mixture of hydrogen and CO₂ and then separating the CO₂, primarily through the use of solvents. These same techniques are used in industrial plants to separate CO₂ from natural gas and to make chemicals such as ammonia out of gasified coal. However, because CO₂ can be released to the air in unlimited amounts under today’s laws, except in niche applications, even plants that separate CO₂ do not capture it; rather they release it to the atmosphere.

Notable exceptions include the Dakota Gasification Company plant in Beulah, North Dakota, which captures and pipelines more than one million tons of CO₂ per year from its lignite gasification plant to an oil field in Saskatchewan, and ExxonMobil's Shute Creek natural gas processing plant in Wyoming, which strips CO₂ from sour gas and pipelines several million tons per year to oil fields in Colorado and Wyoming.

Today's pre-combustion capture approach is not applicable to the installed base of conventional pulverized coal in the U.S. and elsewhere. However, it is ready today for use with IGCC power plants. The oil giant BP has announced an IGCC project with pre-combustion CO₂ capture at its refinery in Carson, California. When operational the project will gasify petroleum coke, a solid fuel that resembles coal more than petroleum to make electricity for sale to the grid. The captured CO₂ will be sold to an oil field operator in California to enhance oil recovery. The principal obstacle for broad application of pre-combustion capture to new power plants is not technical, it is economic: under today's laws it is cheaper to release CO₂ to the air rather than capturing it. Enacting laws to limit CO₂ can change this situation, as discussed in my testimony.

While pre-combustion capture from IGCC plants is the approach that is ready today for commercial application, it is not the only method for CO₂ capture that may emerge if laws creating a market for CO₂ capture are adopted. I have previously mentioned post-combustion techniques now being explored. Another approach, known as oxyfuel combustion, is also in the early stages of research and development. In the oxyfuel process, coal is burned in oxygen rather than air and the exhaust gases are recycled to build up CO₂ concentrations to a point where separation at reasonable cost and energy penalties may be feasible. Small scale pilot studies for oxyfuel processes have been announced. As with post-combustion processes, absent an accelerated effort to leapfrog the normal commercialization process, it could be one or two decades before such systems might begin to be deployed broadly in commercial application.

Given, the massive amount of new coal capacity scheduled for construction in the next two decades, we cannot afford to wait and see whether these alternative capture systems prove out, nor do we need to. Coal plants in the design process today can employ proven IGCC and pre-combustion capture systems to reduce their CO₂ emissions by about 90 percent. Adoption of policies that set a CO₂ performance standard now for such new plants will not anoint IGCC as the technological winner since alternative approaches can be employed when they are ready. If the alternatives prove superior to IGCC and pre-combustion capture, the market will reward them accordingly. As discussed in my testimony, adoption of CO₂ performance standards is a critical step to improve today's capture methods and to stimulate development of competing systems.

I would like to say a few words about so-called "capture-ready" or "capture-capable" coal plants. Some years ago I was under the impression that some technologies like IGCC, initially built without capture equipment could be properly called "capture-ready." However, the implications of the rapid build-out of new coal plants for global warming and many conversations with engineers since then have educated me to a different view. An IGCC unit built without capture equipment can be equipped later with such equipment and at much lower cost than attempting to retrofit a conventional pulverized coal plant with today's demonstrated post-combustion systems. However, the costs and engineering reconfigurations of such an approach are substantial. More importantly, we need to begin capturing CO₂ from new coal plants without delay in order to keep global warming from becoming a potentially runaway problem. Given the pace of new coal investments in the U.S. and globally, we simply do not have the time to build a coal plant today and think about capturing its CO₂ down the road.

Implementation of the Energy Policy Act of 2005 approach to this topic needs a review in my opinion. The Act provides significant subsidies for coal plants that do not actually capture their CO₂ but rather merely have carbon "capture capability." While the Act limits this term to plants using gasification processes, it is not being implemented in a manner that provides a meaningful substantive difference between an ordinary IGCC unit and one that genuinely has been designed with early integration of CO₂ capture in mind. Further, in its FY2008 budget request, the administration seeks appropriations allowing it to provide \$9 billion in loan guarantees under Title XVII of the Act, including as much as \$4 billion in loans for "carbon sequestration optimized coal power plants." The administration request does not define a "carbon sequestration optimized" coal power plant and it could mean almost anything, including, according to some industry representatives, a plant that simply leaves physical space for an unidentified black box. If that makes a power plant "capture-ready" Mr. Chairman, then my driveway is "Ferrari-ready." We should not

be investing today in coal plants at more than a billion dollars apiece with nothing more than a hope that some kind of capture system will turn up. We would not get on a plane to a destination if the pilot told us there was no landing site but options were being researched.

GEOLOGIC DISPOSAL

We have a significant experience base for injecting large amounts of CO₂ into geologic formations. For several decades oil field operators have received high pressure CO₂ for injection into fields to enhance oil recovery, delivered by pipelines spanning as much as several hundred miles. Today in the U.S. a total of more than 35 million tons of CO₂ are injected annually in more than 70 projects. (Unfortunately, due to the lack of any controls on CO₂ emissions, about 80 per cent of that CO₂ is sourced from natural CO₂ formations rather than captured from industrial sources. Historians will marvel that we persisted so long in pulling CO₂ out of holes in the ground in order to move it hundreds of miles and stick it back in holes at the same time we were recognizing the harm being caused by emissions of the same molecule from nearby large industrial sources.) In addition to this enhanced oil recovery experience, there are several other large injection projects in operation or announced. The longest running of these, the Sleipner project, began in 1996.

But the largest of these projects injects on the order of one million tons per year of CO₂, while a single large coal power plant can produce about five million tons per year. And of course, our experience with man-made injection projects does not extend for the thousand year or more period that we would need to keep CO₂ in place underground for it to be effective in helping to avoid dangerous global warming. Accordingly, the public and interested members of the environmental, industry and policy communities rightly ask whether we can carry out a large scale injection program safely and assure that the injected CO₂ will stay where we put it.

Let me summarize the findings of the IPCC on the safety and efficacy of geologic disposal. In its 2005 report the IPCC concluded the following with respect to the question of whether we can safely carry out carbon injection operations on the required scale:

“With appropriate site selection based on available subsurface information, a monitoring programme to detect problems, a regulatory system and the appropriate use of remediation methods to stop or control CO₂ releases if they arise, the local health, safety and environment risks of geological storage would be comparable to the risks of current activities such as natural gas storage, EOR and deep underground disposal of acid gas.”

The knowledge exists to fulfill all of the conditions the IPCC identifies as needed to assure safety. While EPA has authority to regulate large scale CO₂ injection projects its current underground injection control regulations are not designed to require the appropriate showings for permitting a facility intended for long-term retention of large amounts of CO₂. With adequate resources applied, EPA should be able to make the necessary revisions to its rules in two to 3 years. We urge the members of this Committee to support legislation to require EPA to undertake this effort this year.

Do we have a basis today for concluding that injected CO₂ will stay in place for the long periods required to prevent its contributing to global warming? The IPCC report concluded that we do, stating:

“Observations from engineered and natural analogues as well as models suggest that the fraction retained in appropriately selected and managed geological reservoirs is very likely to exceed 99% over 100 years and is likely to exceed 99% over 1,000 years.”

Despite this conclusion by recognized experts there is still reason to ask about the implications of imperfect execution of large scale injection projects, especially in the early years before we have amassed more experience. Is the possibility of imperfect execution reason enough to delay application of CO₂ capture systems to new power plants until we gain such experience from an initial round of multi-million ton “demonstration” projects? To sketch an answer to this question, my colleague Stefan Bachu, a geologist with the Alberta Energy and Utilities Board, and I wrote a paper for the Eighth International Conference on Greenhouse Gas Control Technologies in June 2006. The obvious and fundamental point we made is that without CO₂ capture, new coal plants built during any “delay and research” period will put 100 per cent of their CO₂ into the air and may do so for their operating life if they were “grandfathered” from retrofit requirements. Those releases need to be compared to hypothetical leaks from early injection sites.

Our conclusions were that even with extreme, unrealistically high hypothetical leakage rates from early injection sites (10% per year), a long period to leak detec-

tion (5 years) and a prolonged period to correct the leak (1 year), a policy that delayed installation of CO₂ capture at new coal plants to await further research would result in cumulative CO₂ releases twenty times greater than from the hypothetical faulty injection sites, if power plants built during the research period were “grandfathered” from retrofit requirements. If this wave of new coal plants were all required to retrofit CO₂ capture by no later than 2030, the cumulative emissions would still be four times greater than under the no delay scenario. I believe that any objective assessment will conclude that allowing new coal plants to be built without CO₂ capture equipment on the ground that we need more large scale injection experience will always result in significantly greater CO₂ releases than starting CO₂ capture without delay for new coal plants now being designed.

The IPCC also made estimates about global storage capacity for CO₂ in geologic formations. It concluded as follows:

“Available evidence suggests that, worldwide, it is likely that there is a technical potential of at least about 2,000 GtCO₂ (545 GtC) of storage capacity in geological formations. There could be a much larger potential for geological storage in saline formations, but the upper limit estimates are uncertain due to lack of information and an agreed methodology.”

Current CO₂ emissions from the world’s power plants are about 10 Gt (billion metric tons) per year, so the IPCC estimate indicates 200 years of capacity if power plant emissions did not increase and 100 years capacity if annual emissions doubled.

RESPONSES BY FRANCES BEINECKE TO ADDITIONAL QUESTIONS
FROM SENATOR CARDIN

Question 1. Could the impacts of not covering the commercial and residential use of natural gas be accounted for by mandated increased efficiencies in residential and commercial appliances and heating/cooling systems?

Response. NRDC supports the efficiency standards in the bill and agrees that such standards can lead to significant reductions in greenhouse gas emissions from commercial and residential gas usage. Such policies can work effectively in a complementary fashion with a cap and trade program to maximize available reductions. However NRDC also believes that the coverage of the bill should be increased, in particular by including commercial and residential natural gas usage within the cap.

Question 2. If natural gas used in residential and commercial settings were covered with a cap, how would that impact homeowners and small businesses?

Response. NRDC believes that if natural gas is covered, the point of regulation should be the local distribution company and that allowances should also be provided to the local distribution company. This would avoid placing a regulatory requirement on individual homeowners and small businesses. Local distribution companies should be given incentives to help their customers use natural gas more efficiently, thus reducing their gas bills.

RESPONSES BY FRANCES BEINECKE TO ADDITIONAL QUESTIONS FROM
SENATOR INHOFE

Question 1a. You mention that this bill has a provision for the U.S. to encourage other nations to reduce emissions. But would this really have an effect, as China is building a new coal plant every three days? Don’t you find it troubling that the provisions of the bill apply to U.S. companies many years before it applies to China, in effect, accelerating the flow of jobs and emissions to China?

Response. The best way to bring China and India on board is to take leadership. We are the world’s most powerful economy. We are responsible for more of the global warming pollution now in the atmosphere than any other country. We have the most technological know-how. The best way to get global action is to start acting at home, and to negotiate reciprocal action from other countries. Simply put, they will remain skeptical and reluctant as long as they see this country doing nothing and pointing fingers.

The one thing the U.S. program should not do is condition our own action on first achieving formal agreements with developing countries. That would put U.S. policy in the hands of the Chinese or Indian governments. It would also be seen as finger-pointing by the largest emitter with the most capability to act. That would only set back progress towards international agreements. We believe the international provisions in the bill will be an effective negotiating tool for the U.S. to engage produc-

tively with these countries to act in the coming decade. In the near term we do not believe U.S. industries will be competitively disadvantaged. Initially the carbon price will be low and in the bill a large number of the allowances are allocated to the industrial sector. Furthermore, helping our industries become more efficient will make them more competitive in the global market for the long term.

We've done this before. Twenty years ago, industrial nations took the lead in a binding treaty to phase-out ozone-depleting CFCs. In just 3 years, developing countries came on board. Led by China and India, they accepted binding limits on their own CFC production. We've marched together—developed and developing—ever since, and have already eliminated 95% of the ozone-depleting chemicals. China and India agreed to a new round of mandatory cuts in ozone-depleting chemicals just this past September.

What's missing on global warming is our leadership. We are the only major industrial country that has refused to limit its own emissions. It's time to act.

Question 2. On October 1, 2007, EPA released analysis of the Bingaman-Specter, McCain-Lieberman, and Kerry-Snowe bills. It showed that through the end of this Century, each of these bills reduce would only reduce global greenhouse gas concentrations by less than four percent.

Do you have reason to believe that this bill would be significantly different and are you willing to risk the economic future of this country for such an insignificant gain in global concentrations?

Doesn't EPA's analysis demonstrate that taking unilateral action will be ineffective and could even be counterproductive since it will accelerate emissions growth in the developing nations as we export jobs to their inefficient economies?

Response. EPA's analysis shows that emission reductions similar to those in the Lieberman-Warner bill in concert with action by other countries would reduce the build up of heat-trapping pollution in the atmosphere by more than 200 parts per million.

The results of recent economic studies, which have analyzed the energy costs of several global warming cap and trade bills, actually have shown how affordable these climate bills can be for consumers and the U.S. economy as a whole, while still significantly cutting our global warming pollution. We need to focus on designing global warming legislation smartly.

- Establishing a firm pollution cap will spur innovation.
- Trading allows emission reductions to be made at least-cost.
- Using the value of emission allowances in the public interest makes it possible to offset any increases in energy costs for low and middle-income consumers.

The Lieberman-Warner bill includes all of these features. It could be improved further by reducing the initial free allocation to emitters and speeding the transition to 100% public benefit which would allow additional resources to be devoted to helping vulnerable communities at home and abroad adapt to the impacts of global warming. This would make the bill more fair and more effective in cementing new international agreement needed to tackle global warming.

The EPA analysis finds that reducing global warming pollution will have an imperceptible affect on economic output overall. With respect to energy prices, changes would be far smaller and less disruptive than those consumers have experienced in recent years. There would be modest impacts on electricity and gasoline prices, and natural gas prices would not be significantly affected. The EPA model projects that the price of CO₂ allowances would add 23 cents per gallon to the price of gasoline. But unlike recent, much larger, price increases, the money won't go to OPEC or Exxon. The Lieberman-Warner bill uses most of the value of allowances for public benefits, such as paying for rebates on more fuel-efficient vehicles, homes, and appliances.

The Nicholas Institute at Duke has modeled the Lieberman-Warner bill using the same model that EPA has used in the past. OnLocation has modeled the Lieberman-Warner bill using the EIA model. These studies show that the economic effects of the Lieberman-Warner bill would be similar to those of S. 280, which has been modeled by both EPA and EIA.

Question 3. As EPA's analysis shows, even if the rest of the world reduces emissions by more than 10 times that proposed for the U.S., global emissions are expected to be higher than today. Isn't this relevant as we consider action here? In fact, if the entire developed world took unilateral action to eliminate every car, closed every factory and shut down every power plant, emissions would still be higher than today within a few decades. Does this affect your support of what I believe is unilateral economic disarmament?

Response. EPA's analysis shows that emission reductions similar to those in the Lieberman-Warner bill in concert with action by other countries would reduce the

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Question 4. Regarding the overall costs and benefits of the bill: Should there be a request made to the Energy Information Administration or other federal governmental entity to model the bill? Should there be a request for a study by an econometric modeling firm?

Response. EPA's analysis shows that emission reductions similar to those in the Lieberman-Warner bill in concert with action by other countries would reduce the build up of heat-trapping pollution in the atmosphere by more than 200 parts per million.

The results of recent economic studies, which have analyzed the energy costs of several global warming cap and trade bills, actually have shown how affordable these climate bills can be for consumers and the U.S. economy as a whole, while still significantly cutting our global warming pollution. We need to focus on designing global warming legislation smartly.

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Warner bill using the EIA model. These studies show that the economic effects of the Lieberman-Warner bill would be similar to those of S. 280, which has been modeled by both EPA and EIA.

Question 5. For Section 1201: Do you agree with the basis for selecting a 2012 cap of 5.2 billion metric tons considering that total U.S. greenhouse gas emissions are greater than 7 billion tons? (Section 1201(d)). In terms of emission reductions, what percentage should come from fuel switching, and what percentage from installation of new or replacement technologies? One oft-repeated approach to emissions reductions is to “slow, stop, and reverse.” Are the emissions targets chosen consistent with this approach?

Response. The Lieberman-Warner bill represents a good start. In particular, the emission reductions required by 2020 are in line with what is needed. There are ways we would like to see the bill improved as discussed in my testimony, but we need to move forward on global warming legislation now and this bill represents a critical and important step in the right direction. Every year we delay more CO₂ spewing power plants will be built and more CO₂ will be pumped into the atmosphere. The Lieberman-Warner bill is consistent with the need to slow, stop and reverse our global warming emissions.

More than 20 trillion dollars will be spent globally on new energy technologies between now and 2030. How this money is invested over the next decade will determine whether we can realistically avoid the worst effects of global warming.

We have the solutions—cleaner energy sources, new vehicle technologies and industrial processes and enhanced energy efficiency. We just lack the policy framework to push business investments in the right direction and to get these solutions in the hands of consumers. The Lieberman-Warner bill, America’s Climate Security Act (S. 2191), is a major step towards establishing that framework.

Question 6. For coverage under the bill: Do you agree with selecting three out of six sectors of the U.S. economy for coverage under the bill? Do you think the three sectors were not covered because it would not be cost-effective to include them within the cap? If cost-effectiveness was a criterion, what cost in dollars per metric ton should be used as a cutoff?

Response. The Lieberman-Warner bill is a strong bill that can be made stronger through three key changes. They are:

- Ensure that the emission reductions keep pace with the science through a robust science review every 5 years that reassess the targets and timetables in light of the most recent climate research, EPA should have the authority based on the conclusions of the review to adjust the emission reduction targets as necessary to avoid dangerous global warming.

- Increase coverage of the bill’s cap to include emissions from natural gas used in buildings. NRDC appreciates that the 2020 target was strengthened from the August 2nd outline. We also appreciate the energy efficiency standards and incentives included in the bill. We recognize that these energy efficiency measures will help reduce emissions in the residential and commercial sectors. In addition, we recognize that the allowance set-aside for forest and agriculture activities will produce emission reductions in addition to those accomplished by the cap. However, it remains a concern that the direct emissions of the residential and commercial sectors—some 10 percent of total emissions—are not subject to the cap. In addition to the gap in emission coverage, this will produce a distortion between electricity (whose emissions are covered at the generator) and natural gas.

- Phase out free allocations to emitters faster. NRDC appreciates the phasing out of free allocations to industry and the electric utilities. But utilities and industry are still allocated much more than “hold harmless” principles would justify. As a result, there are not enough resources available through the auction, state allocations, and load serving entities allocations to protect consumers, especially low-income consumers, and to provide for humanitarian assistance to vulnerable populations affected by global warming.

We also appreciate that the bill includes mechanisms to manage abatement costs without resorting to a so-called “safety valve.” The fundamental problem with the safety valve is that it breaks the cap without ever making up for the excess emissions.

Question 7. A “new entrant” is defined as a facility that commences operation on or after January 1, 2008. (Section 4(19)) Do you agree with the selecting that date as the cutoff? Do you agree with requiring commencement of operations instead of commencement of construction as used in the Clean Air Act? Has the difference in the number of qualifying facilities between these two definitions been evaluated?

Response. We have not evaluated the difference in the number of qualifying facilities based on alternative definitions of new entrant facilities.

Question 8. For the definition of “facility”: What do you think “any activity . . . at a facility” means? Could this include coal mining operations or the transport of coal to a facility via train, truck, barge, etc.? Do you think the definition of “facility” to include “any activity or operation” also include fugitive emissions that are not under the direct control of the facility?

Response. The Administrator will determine coverage by rule.

Question 9. Under the bill, allowances can be borrowed for a period of up to 5 years. (Section 2302) Do you agree with the 5 years as an appropriate time limit? Would 6 or more years provide more flexibility for sources that find it necessary to borrow allowances? What considerations are more important than that additional flexibility that necessitate the more restrictive time period? Since the allowances become increasingly scarce over time, which creates a sliding upward pressure on price, to what degree is it anticipated the borrowing mechanism will mitigate allowance price increases? If future allowance prices exceed market prices for current allowances, will this mechanism be effective?

Response. In our estimation, the greatest fear of many in industry is that short-run costs will fluctuate unexpectedly, much as natural gas prices have spiked in recent years. Setting a long-term declining emissions cap opens the door to borrowing emissions allowances from future years, using them early in times of unexpected cost pressure, and paying them back when short-term spikes recede.

Other legislative proposals already allow firms to make reductions in advance when prices are lower than expected and bank allowances for future use. Borrowing opens the opposite possibility.

Absent borrowing, firms can comply only with current or banked allowances. Allowance prices thus reflect the current marginal cost of compliance, and that price can spike in response to short-term conditions (e.g., a delay in bringing on a new technology, or a surge in economic activity). Borrowing would let firms use emissions allowances from future years, stabilizing prices against unexpected short-term fluctuations. The long-term cap will be maintained, because borrowed allowances will be repaid, with interest, by releasing fewer emissions later when the short-run pressures are relieved. Together, banking and borrowing can stabilize long-term costs and eliminate the risk of price spikes while preserving the environmental integrity of the long-term caps.

The combination of a long-term emissions pathway and borrowing has a clear advantage over the safety valve because it does not break the cap and permanently allow excess emissions. (Proposals allowing unlimited “offsets”—credits for emission reductions not covered by the cap—also have the potential to break the cap if credits are awarded for actions taking place anyway, a problem endemic to past offset programs.)

Borrowing does need to include certain safeguards. First, there needs to be an interest payment pegged to be slightly higher than commercial lending rates in order to discourage businesses from treating allowance-borrowing as a no-interest alternative to regular financing. Second, there need to be appropriate mechanisms to secure repayment and guard against defaults. The requirement to repay borrowed allowances within 5 years is one such safeguard.

Question 10. The bill seems to indicate that the interest rate on borrowed allowances is 10%. (Section 2302) Should the interest compound annually?

Response. Reference should be section 2303 “Repayment with Interest”? See Answer to Question No. 9. Interest should compound annually and could be pegged to 5 percentage points higher than the Federal Funds rate, rather than being a fixed number.

Question 11. Under certain conditions, the bill allows covered facilities to satisfy up to 15% of its allowance submission requirement with allowances or credits from foreign GHG trading markets. (Section 2501) One of these conditions is that the foreign government’s program be of “comparable stringency” to the U.S. program. (Section 2502(b)(2)). What criteria should EPA use in determining whether the emission caps, for example, of another country are “comparable” to those of a U.S program? Should this “comparable stringency” be based on regulatory requirements or on compliance?

Response. EPA can establish the criteria for comparable emission reductions which could be based on regulatory requirements as well as on compliance.

Question 12. Under Section 2603, a Carbon Market Efficiency Board shall carry out one or more of six “cost relief measures” if the board determines that the emis-

sions allowance market “poses a significant harm to the economy of the United States.” Should the board be empowered under the bill to provide cost relief measures if the economy of a region or an individual state faced significant economic harm? What criteria should the board use to make a significant harm determination? How should the board determine which measures and the precise extent of those measures that would be adequate to mitigate significant economic harm? How should the board coordinate its activities with the Federal Reserve board in decision-making to relieve inflationary pressures on the economy, and which would be lead as between them in decision-making? What allowance price is contemplated to pose significant risk of harm to the economy? Is it contemplated that the CMEB will provide the same level of certainty for investors in advanced technologies as a tax or safety valve?

Response. The CMEB will develop criteria and procedures for making the determinations it is responsible for, just as the Federal Reserve Board has developed criteria and procedures for setting interest rates. The CMEB has a great deal of flexibility so that it can respond appropriately as more is learned about the carbon market. See response A9 regarding the level of economic certainty provided by the CMEB through borrowing.

Question 13. Section 3402 requires EPA to allocate extra allowances to states that enact statewide GHG reduction targets that are more stringent than the targets established under the bill. What do you think the basis is for providing an explicit inducement for states to adopt more stringent requirements? Could this lead to inconsistencies among state programs that reduce the potential cost-effectiveness of a nationwide program? What do you think is the basis for an allocation level of 2% of the allowances for this purpose?

Response. State leadership on global warming has been very important both substantively and politically. States should be allowed to take effective action to reduce global warming emissions faster than the national program if they so chose.

Question 14. Section 3501 allocates 10% of the allowance account annually to load serving entities, which are overseen by state regulatory bodies. Section 3503(c)(3) prohibits the exercise of certain prerogatives on the part of these state regulatory bodies such as requiring the filing of rate cases in order to pass through the credit from the sale of allowances. Do you agree with this provision and why/(not)?

Response. NRDC supports this provision. Load serving entities are required to use the value of allowances allocated to them in the public interest to improve energy efficiency and provide rebates to low-income consumers. This is appropriate because pollution allowances are a public trust. They represent permission to use the atmosphere, which belongs to all of us, to dispose of global warming pollution. The capacity of the atmosphere to absorb carbon is extremely limited. This limited carrying capacity is not a private resource owned by historical emitters. Private entities should not have a right to dump harmful pollution in the public’s atmosphere for free.

Emissions allowances will be worth tens of billions of dollars per year, and their value will increase over the first decades of the program as the pollution cap declines. Providing more than a small fraction of the allowances for free to pollution sources would give their shareholders an enormous and undeserved financial windfall. Economics dictate that most firms will raise their prices to reflect the market value of these allowances, passing that cost onto consumers even if the allowances were received for free.

For these reasons, NRDC opposes permanent grandfathering of emissions allowances to firms based on historical emissions, heat input, fuel sales, or other factors. Grandfathering the allowances would generate huge windfalls and transfers of wealth. Economists at the Congressional Budget Office, Resources for the Future (RFF) and other institutions have determined that grandfathering all emissions allowances would give the recipient companies an asset worth seven times the costs that they could not pass on to energy consumers. Those companies would become billions of dollars wealthier at consumer expense.

Stanford University and RFF economist Larry Goulder has shown that in an economy-wide upstream cap and trade program, it would require only 13% of the allowances to cover the costs that fossil-fuel providers would not be able to pass on to consumers.¹ Dallas Burtraw and RFF colleagues have shown similar results for a cap and trade program on electricity generators.² The Congressional Budget Office

¹Morgenstern et al., “The Distributional Impacts of Carbon Mitigation Policies,” Issue Brief 02-03 (Resources for the Future, Feb. 2002), <http://www.rff.org/Documents/RFF-IB-02-03.pdf>.

²Morgenstern et al., *supra*.

has reached the same conclusion.³ In the United Kingdom, the government has determined that free allocation of allowances to electric generators has resulted in windfall profits of over \$500 billion.⁴ Congress should not repeat this mistake.

Claims that regulated industries deserve allowances for free ignore the fact that they can pass on most program costs to consumers. Even compensating them for the limited costs they cannot pass on is really a quite extraordinary concept that runs against our deeply rooted legal tradition that industry should bear the responsibility for the harms done by releasing dangerous pollution. Complying with pollution control laws and regulations is part of the cost of doing business. Some of this cost can be passed on to consumers. But that portion which cannot be passed on is properly absorbed by company shareholders.

To avoid these windfalls, allowances should be held in trust for the public and distributed in ways that will produce public benefits.

This can be done through an auction, with the revenue dispersed according to legislated formulae and criteria, or by distributing the allowances themselves according to the same formulae and criteria. In either approach, the legislation should provide for a public trustee (like the Climate Change Credit Corporation in the Lieberman-Warner bill) to administer the allowances.

The overarching goals should be (1) to keep the cost of the program as low as possible for residential, commercial and industrial consumers (especially low-income consumers), by encouraging investment in end-use energy efficiency measures and by avoiding wealth transfers from consumers to upstream entities, and (2) to encourage deployment of the technologies needed to significantly reduce emissions in key sectors (e.g., mainstreaming carbon capture and disposal in the electric sector; retooling the auto industry to produce hybrids and other low-emitting vehicles; accelerating deployment of sustainable low-carbon motor fuels and renewable electricity).

Question 15. Title III, Subtitle F provides bonus allowances for carbon capture and geological sequestration projects. Section 3604 limits these bonus allowances to the first 10 years of operation. Do you agree with limiting the incentive to 10 years?

Response. The bonus allowance program is intended to jump-start carbon capture and storage during the early years of the program. Please see the Appendix to my testimony for a more detailed discussion of carbon capture and disposal issues.

Question 16. Title II, Subtitle D states that domestic offsets have to be permanent. What exactly does that term mean in terms of biologic sequestration? In your opinion, what are the anticipated impacts to food prices associated with providing incentives to farmers to convert cropland to grassland or rangeland? What would be the impact of such incentives to production of ethanol and the cost of ethanol?

Response. The Lieberman-Warner bill allows covered sources to satisfy up to 15 percent of a given year's compliance obligation using "offsets" generated within the United States. These offsets would come from activities that are not covered by the emissions cap. The 15 percent limitation is generous enough to provide a robust market for agricultural carbon sequestration. This limit is essential to ensure the integrity of the emissions cap in the bill and to spur technology innovation. *The total amount of offsets allowed should not be increased.* We also strongly support robust criteria to ensure that the offsets are real, additional, verifiable, permanent and enforceable. Changes in forest management are very difficult to evaluate against these criteria and some forest management practices aimed at earning carbon credits could have negative ecological consequences. Hence we favor addressing forest management through the allowance set-aside program in Title III rather than through offsets.

Farmers will decide the most economic use of their land among food production, biofuels production, and carbon sequestration, and in many cases they can achieve multiple objectives simultaneously. Under the Lieberman-Warner bill "permanent" effectively means that any offset allowances generated by biological sequestration must be replaced if the carbon sequestration is reversed (e.g. by switching back from no-till to conventional tillage).

Question 17. Section 3903(b) distributes allowances to rural electric cooperatives equal to their 2006 emissions. Do you agree with giving preferential treatment to rural electric cooperatives?

³ See e.g., Terry Dinan, "Shifting the Cost Burden of a Carbon Cap-and-Trade Program," (Congressional Budget Office, July 2003); CBO, "Issues in the Design of a Cap-and-Trade Program for Carbon Emissions," (Nov. 25, 2003).

⁴ House of Commons, Environmental Audit Committee, "The International Problem of Climate Change: UK Leadership in the G8 and EU," p. 17 (Mar. 16, 2005).

Response. See Answer to Question #14. In addition, the Sanders-Boxer bill contains two complementary performance standards for coal plants that we support and would pertain to rural electric cooperatives.

The first standard is a CO₂ emissions standard that applies to new power investments and is based on a standard already in place in California.

The second standard is a low-carbon generation obligation for coal-based power, which would encourage companies to invest early in deploying carbon capture and disposal (CCD) technologies. Coal based electricity generators would have to get some of their power (or purchase credits equivalent to such power) from coal fired-power plants that actually capture and dispose of their greenhouse gases, thereby spreading the cost of new CCD plants throughout the coal-fired generation sector.

Question 18. Regarding Section 1103(d): What methods are facilities contemplated to employ to determine complete and accurate data for the years 2004 through 2007 where no data was collected or readily available? Also for Section 1103(d), how are facilities that currently do not have monitoring systems in place going to be able to submit quarterly data starting in 2008? Should the \$25,000 per day for each violation apply to these facilities for these time periods? What is the process, and who should be the authority, for determining what constitutes complete and accurate data for these time periods?

Response. The Administrator will establish these reporting requirements by rule, taking into account widely used reporting protocols that have already been developed. Electricity generators already report their emissions under provisions of the Clean Air Act. Other covered facilities will be able to estimate their baseline emissions from fuel consumption and other data that they already collect for other purposes.

Question 19. Based on EPA's 2005 U.S. greenhouse gas inventory, the electric generating sector accounted for 46% of the proposed 2012 cap level of 5.2 billion metric tons. Between allocations to generators and load serving entities, the bill allocates 30% of the total allowances to that sector, and reducing the sector's subsequently. Do you agree with this differential treatment of the electric sector?

Response. S. 2191 embraces the principle that pollution allowances should be used for public purposes but it implements the principle too slowly. NRDC believes that over the first 25 years of the program the bill gives away more allowances to the biggest emitting firms than is needed to fully compensate such firms for the effects of their compliance obligations on the firms' economic value.

Question 20. The allowance allocation to electric generating units in the first year of the program represents approximately 44% of that sector's 2005 emissions based on EPA's inventory. Electric demand is anticipated to increase, and reducing emissions by replacing current plants with lower or non-emitting plants will take years to achieve. Based on this, does the bill contemplate some mechanism, or set of mechanisms, whereby emissions will be reduced during this timeframe or allowances will be available, or will allowances have to be purchased?

Response. In a market based cap and trade program, emissions reductions will occur throughout the system wherever they can be achieved at the lowest possible cost. Significant reductions can be achieved through conservation, increased energy efficiency, and through the use or development of alternative sources of power such as renewable energy, use of biomass or use of lower carbon fuels. In addition, technologies such as carbon capture and disposal can also be used to achieve emission reductions while allowing for increased generation of electricity. Purchasing some allowances or offset credits may also be part of an individual company's approach to ensuring that they have sufficient allowances to cover their actual emissions.

Question 21. Section 3803 allocates 3 percent of allowances to projects in other countries for forest carbon activities. What should be the projected subsidy to other countries under this provision? China's carbon dioxide emissions now exceed that of the United States and are projected to increase. Should China or other countries whose emissions eclipse those of the United States in the future be eligible for these allocations?

Response. As noted above, section 3803 allocates 3 percent of the emission allowance account for forest carbon activities in countries other than the United States. We believe that this program has the potential to achieve substantial environmental benefits at low cost.

Please see the answer to your first question for NRDC's position regarding China.

Question 22. Regarding Section 8001: This Section calls for a national assessment of carbon dioxide storage capacity. Presumably, this assessment would determine whether the U.S. has sufficient capacity to geologically sequester the carbon dioxide

that would have to be captured to comply with the bill. Absent the results of this survey which has not been undertaken yet, do you agree with assuming the U.S. has adequate storage capacity? How do you envision the program addressing the long term oversight of the carbon storage sites? This Section provides EPA with the legal authority to develop a permitting program for carbon storage through the Safe Drinking Water Act's Underground Injection Control program. Long term monitoring and particularly in the west, property rights, are just two of the several issues that will need to be taken into consideration under any regulatory regime. (i) Is the bill's approach sufficient to address these issues? (ii) Should there be a statutory role for the states?

Response. EPA has recently announced its intention to develop regulations addressing the issue of geologic disposal of carbon dioxide and we urge EPA to move forward in this regard. Sufficient storage capacity does exist both worldwide and in the United States. According to a 2006 report by Battelle Labs "[t]he United States is fortunate to have an abundance of theoretical storage potential. Our preliminary and ongoing assessment of candidate geologic CO₂ storage formations reveals that the formations studied to date contain an estimated storage capacity of 3,900 GT CO₂ within some 230 candidate geologic storage reservoirs." For comparison, U.S. total GHG emissions are now about 7 billion tons of CO₂ equivalent. In short, storage capacity in the U.S. is not a constraint.

See the Appendix to my testimony for a more detailed discussion of these issues, including information regarding worldwide geologic disposal capacity.

Question 23. Subtitle G, Section 4702(b)(1)(F) stipulates money is available for adaptation activities in accordance with recovery plans for threatened and endangered species. Does the bill envision that all existing recovery plans will be rewritten to address all climate change related effects? (i) If so, will the monies in the adaptation fund be available to Fish and Wildlife Service (FWS) to re-write the recovery plans or will FWS have to bear that cost from other monies? Within Subtitle G, how does the bill contemplate FWS will prioritize species to receive adaptation funds? (i) Is it based on their overall threatened or endangered status or the degree to which they are affected by climate change? (ii) Are plants and animals not affected by climate change eligible for these funds? (iii) How should the Department of Interior distinguish those ecological processes that are due to man-made climate change from those that due to normal species development and evolution?

Response. The bill would provide needed funding for activities that would assist fish and wildlife, their habitat and associated ecological processes that are impacted by global warming. The funding for such activities is to be used to carry out adaptation activities "in accordance" with recovery plans for threatened and endangered species and other fish and wildlife conservation strategies.

RESPONSES BY FRANCES BEINECKE TO ADDITIONAL QUESTIONS
FROM SENATOR BARRASSO

Question 1. What impact will Lieberman-Warner have on Liquefied Natural Gas imports to the United States?

Response. Projections for liquefied natural gas imports are based on a number of factors, including overall demand for natural gas, manufacturing cycles, weather patterns and issues related to LNG terminal siting. Although some increased demand for natural gas is projected to occur in the years ahead, the energy efficiency gains realized as a result of standards and incentives in the Lieberman/Warner bill, and more rapid deployment of renewable energy and carbon capture and disposal technologies, flowing from the bill's provisions for use of allowances and allowance proceeds, are likely to reduce growth in natural gas demand in both the short and long-term timeframes, compared to business as usual forecasts.

Question 2. With increasing demand for energy both in America and around the world as a result of increased economic growth, technological solutions will be essential for countries to meet their energy demands while limiting greenhouse gas emissions. However, there are tremendous uncertainties about what technologies will most effectively address these issues.

As Congress continues to examine technological solutions to combat climate change, do you believe we have enough information to identify which technologies hold promise and therefore warrant investment?

Response. Yes. There are numerous technologies and solutions to combat global warming, from increased energy efficiency, to renewable energy sources such as wind and solar, vehicle technologies, such as plug in hybrid electric vehicles, and technologies such as carbon capture and disposal systems for coal fired power

plants. However, the role of federal policy is not to choose particular technologies but to provide a policy framework that creates market opportunities and rewards for energy and other products and services that emit little or no global warming pollution. A market-based cap and trade system combined with performance standards and complementary incentives will spur investment in a wide range of profitable, cleaner technologies.

Question 3. What do you think should be Congress' funding priorities?

Response. With regard to the use of allowances in the Lieberman/Warner bill, NRDC believes these pollution allowances are a public trust. They represent permission to use the atmosphere, which belongs to all of us, to dispose of global warming pollution. As such, they are not a private resource owned by historical emitters and such emitters do not have a permanent right to free allowances. The value of the allowances should be used for public purposes including promoting clean energy solutions, protecting the poor and other consumers, ensuring a just transition for workers in affected industries, and preventing human and ecosystem impacts both here and abroad, especially where they can lead to conflicts and threats to security.

Question 4. What are the costs to family budgets for middle class and low income people of implementing Lieberman-Warner in terms of energy bills and gasoline prices in the next 5 to 10 years?

Response. The Lieberman/Warner bill would direct substantial amounts of allowances to low income energy consumers throughout the United States, including 19 percent of the auction allowances, which begin at 24 percent of the total allowance pool and rise to 73 percent of the total allowance pool. In addition, 10 percent of the allowance pool is available to electricity consumers through Load Serving Entities and 9 percent to state and tribal governments. These allowances can be used to assist in preventing increases in energy bills for consumers, while deployment of energy efficient products and services can help to lower total energy bills, as has been demonstrated in states such as California.

Question 5. In 2050, how much cooler will the planet be if we adopt Lieberman-Warner?

Response. Because greenhouse gases, such as CO₂, remain in the atmosphere for many decades, or longer, we are experiencing the effects of warming from greenhouse gases emitted decades ago. That warming will continue for decades even if all emissions were halted today. However, with leadership action by the United States to cap and reduce our emissions, followed by responses in other major emitting countries, we can halt global emissions growth and cut global emissions in half from today's levels by 2050. This would make it possible to limit additional global warming to no more than 2 degrees Fahrenheit, compared with expected warming of 4 degrees or more in the absence of effective action. This program will enable us to prevent an ever escalating increase in temperatures and disruption of our climate.

Question 6. You mention in your testimony the dangers we face if global average temperatures are allowed to increase by more than 2 degrees Fahrenheit from today's level.

Does the Lieberman-Warner bill, if enacted, prevent that increase of 2 degrees? If not, what fraction of that 2 degrees we need to reduce will come from enacting the Lieberman-Warner bill?

Response. Current science indicates that an atmospheric concentration of 450 parts per million CO₂ equivalent will provide us with approximately a 50% chance of avoiding a 2 degree Fahrenheit increase from today's levels. As I mentioned, scientists are telling us that we will need reductions in total U.S. emissions on the order of 80% by 2050 in order to do our proportional part in a global program of preventing catastrophic impacts. Our calculations indicate that the bill will result in reducing total U.S. emissions by approximately 51–63 percent by 2050. Continued review of progress by the National Academies of Science combined with authority to make additional emission reductions dictated by the science would ensure that the Lieberman-Warner bill can serve as the cornerstone of an effective strategy to avoid catastrophic disruption of our climate.

RESPONSES BY FRANCES BEINECKE TO ADDITIONAL QUESTIONS
FROM SENATOR LAUTENBERG

Question 1. You state in your testimony that the targets to reduce emissions still need to be *strengthened* in part because the bill does not cover emissions from *all*

sectors. Would including emissions from the *natural gas* sector increase coverage enough to get us on the right track?

Response. NRDC believes the bill should be changed to include emissions from the commercial and residential use of natural gas. This would be important in gaining additional needed reductions and can be done by making local natural gas distribution companies responsible for emissions from the natural gas they sell and providing an appropriate amount of allowances to such companies to protect consumers and finance energy efficiency programs.

Question 2. The National Resource Defense Council believes the 2020 target in this legislation may be as low as 13 percent. I believe that the *short-term* target is the most important because it sets us on the path to make needed long-term reductions. Does a 13 percent reduction by 2020 put us on track to make an *80 percent* reduction by 2050 feasible without a crash finish?

Response. NRDC estimated that the bill would achieved a reduction of 13 to 19 percent by 2020, however this estimate did not account for the additional reductions the bill would achieve because it does not authorize exemptions within covered sources that EPA assumed in its analysis of S. 280. As I said in my testimony, NRDC believes that the bill as introduced is a strong start, but that it should be strengthened as it moves through Committee.

Question 3. In your testimony, you argue that legislation should move to full action and away from *free* permits provided by the government *sooner* than 2035. You also argue that the legislation gives away *more* free permits than many companies will actually *need*. If those two issues are not fixed, what will be the effect on the actual emission reductions that are achieved and will it *slow* the development of new technology to reduce emissions?

Response. The amount of actual reductions to be achieved is based on the emission caps in the bill and is not directly affected by the allowance allocation provisions. If too many free allowances are given to emitters, then fewer will be available for public purposes and for the development of new, clean technologies. This would have the effect of inappropriately rewarding the shareholders of companies that receive excess allowances, while raising the overall cost of the program to consumers and society in general.

RESPONSE BY FRANCES BEINECKE TO A QUESTION DURING THE HEARING FROM
SENATOR ISAKSON

Question. During the hearing you asked for additional information on federal subsidies for nuclear power in the context of climate change legislation.

Response. NRDC's overall view is that the most economically efficient way to address whether nuclear will remain a significant part of our energy future is through a "carbon cap" that sets a market price on carbon emissions, rather than through additional federal "subsidies".

While we are not unalterably opposed to new nuclear power plants under all circumstances, when compared to the opportunities presented by the new generation of renewable energy and end-use efficiency technologies, nuclear power has significant drawbacks that have proven quite intractable over the decades, and no doubt these issues are familiar to you high capital costs, environmental contamination from uranium mining and milling, unresolved nuclear waste disposal pathways, physical security and proliferation concerns that have been accentuated by the threat of terrorism, environmentally harmful dissipation of large quantities of reject heat to the local aquatic environment, and the continuing small risk of a high-consequence reactor accident.

At the same time, we also note that nuclear power has enjoyed a very long sojourn at the public till while proving itself quite resistant to the expected "learning curve" phenomenon and mass production "economies of scale" normally associated with public efforts to subsidize market penetration of new technologies, until the point at which they become self-propagating in the private marketplace. In view of this record, we think the time has come to give pride of place to a fast developing suite of simpler, cleaner, more flexible, sustainable and universally exportable energy technologies that are not burdened with all the excess baggage of nuclear power. That said, given the enormity and immediacy of the climate change problem, we do not foresee, nor would we welcome nuclear power fading away any time soon, but given the aforementioned liabilities, we believe our modest expectations for the technology are grounded in reality. We conclude that federal low-carbon "market transformation" efforts in the electricity sector will yield both greater near- and

long-term benefits if directed toward cutting-edge renewable energy, cogeneration, and end-use efficiency technologies.

To repeat, the strongest tonic for what ails the nuclear industry would be a swiftly rising price on carbon emissions. Assuming that determined industry and regulatory efforts would yield further significant progress in reducing the liabilities I have noted, nuclear could conceivably play a constructive future role in replacing existing or planned coal-burning capacity in those regions of the U.S. (and other countries) that:

(a) have exhausted the potential for efficiency gains and renewable energy available at lesser or equal cost; and

(b) are environmentally, technologically, and geopolitically suited to safely hosting new nuclear power plants.

Very few if any areas of the world today meet this description—hence our present reluctance to either forecast or favor an expanding role for nuclear in combating climate change.

For example, the American Southeast is often cited as a region that will soon “need” the deployment of new nuclear power plants. But it is also a region with a poor record in capitalizing on opportunities for energy efficiency improvements, from which many thousands of megawatts of additional energy services may be extracted at negative or low cost to utilities and consumers. Nor can the already overburdened fresh water resources of the Southeast easily withstand the additional reject heat and evaporative losses from scores of new large base-load thermal power plants. There is also a vast untapped regional potential for grid-tied distributed photovoltaics that, when brought to scale over the next decade may compete effectively with the retail delivered cost of new central station nuclear electricity. In short, an economically rational and environmentally tolerable expansion of nuclear power faces some significant challenges, even in areas that historically have been supportive of the technology.

Stepping back for a moment, as you are probably aware, both the U.S. and foreign commercial nuclear industries have received massive government support over many decades. In most foreign countries, the commercial nuclear fuel cycle is a state-owned, state-run, or heavily state-subsidized industry, and indeed most of these industries may be fairly characterized as “state-socialist” enterprises that are in fact arms of their national governments.

In the U.S. the commercial nuclear power industry has developed somewhat more independently, in keeping with the tenets of our economic system, but the government role nonetheless has been very substantial, and in recent years the distinctions between U.S. private and foreign state-supported nuclear industries have been largely eroded through mergers, acquisitions and partnerships. Westinghouse was recently absorbed by Toshiba, GE’s nuclear division is working in partnership with Hitachi to build the next generation boiling water reactor, and the French state-owned corporation Areva is partnered with Constellation Energy while also being a player in its own right in the U.S. nuclear marketplace, and is even represented in the U.S. by a former U.S. Secretary of Energy.

Were it not for the U.S. government’s willingness beginning in the 1950’s to cap private liability in the event of a serious nuclear accident and assume the remaining financial risk, it’s probably fair to say that there would not be a commercial nuclear industry in the United States today. So in this narrow sense, commercial nuclear power in the United States has always depended on the standby support of the federal treasury for its very existence. But there are other longstanding and significant forms of federal subsidization of the nuclear industry, both past and present, which are at times difficult to quantify precisely in dollar terms, but have been of critical importance to the industry’s development.

During the industry’s first four decades, for example, nuclear fuel was enriched in huge government owned enterprises at Oak Ridge, TN, Portsmouth, Ohio, and Paducah, KY that have cost many billions of public dollars to construct, operate, decommission, and clean-up. Many of these costs were never recouped in the price for enrichment services sold to nuclear utilities, and thus represent a longstanding subsidy to the nuclear industry. According to the GAO, federal clean-up costs will continue until around 2044, by which time taxpayers will have spent on the order of \$10 billion cleaning-up and decommissioning the first generation of uranium enrichment facilities.¹ Electricity to run these plants was supplied under long-term favor-

¹“URANIUM ENRICHMENT: Decontamination and Decommissioning Fund Is Insufficient to Cover Cleanup Costs,” GAO-04-692, July 2004. Since 1994, the government’s Uranium Enrichment Decontamination and Decommissioning Fund has received a total of \$9.3 billion, of which \$5.3 billion (57%) has come from taxpayers, \$2.7 billion (29%) has come from an assessment on utilities, and the remainder (\$1.3 billion) from interest earnings on the fund balance. Appropria-

able contracts by the TVA, another quasi-governmental public power enterprise. Mining and concentration of the natural uranium feedstock needed to feed these plants has left a huge environmental legacy of radioactive and heavy metals pollution in the U.S., Canada, and other nations, much of which still remains to be cleaned up, again requiring billions in public expenditures over several decades.

In the mid 1990's, the DOE spun off the Portsmouth and Paducah plants into a private entity, the U.S. Enrichment Corporation (USEC), but kept most of the huge environmental clean-up bill associated with these plants for the taxpayers, on the grounds that these plants once produced highly enriched material for nuclear weapons and the reactors of naval warships. Soon after privatizing USEC, DOE also transferred its most advanced centrifuge enrichment technology to the company for a small fraction of what it cost the taxpayers to develop it. In a similar vein, the Navy's continuing requirement for highly trained and carefully screened reactor operators has created a steady stream of skilled and screened personnel with much of the background needed to operate civilian plants once they leave the service.

Moreover, a global U.S. and now multinational nuclear power industry, freely conducting its activities in the commercial marketplace, could not have come into being without—and continues to be sustained by—a massive governmental undertaking to ensure the nonproliferation of sensitive nuclear materials and technology. Over the decades this combined diplomatic, intelligence, export control, international safeguards, and physical security effort has cost many tens of billions of taxpayer dollars. Without these public expenditures, a global nuclear power industry would have posed too great a weapons proliferation threat, and would never have been allowed to prosper. Even despite such major public efforts to sever the links between the civil and military applications of nuclear energy, at some basic level these connections are irreducible, creating an enduring concern in the minds of many citizens and security experts alike about the wisdom of promoting nuclear power as a global solution to climate change.

While the sum total of direct and indirect financial support provided by the U.S. government to the nuclear power industry over many decades is probably not known with any degree of precision, everyone agrees it exceeds \$100 billion, and when all the myriad government costs of safeguarding the civil nuclear fuels cycle against weapons proliferation are included, it exceeds at least \$200 billion or possibly even as much as \$500 billion in current dollars. In June 2005, the Congressional Research Service tabulated just direct federal research and development expenditures for civil nuclear power and came up with the figure of \$75 billion through fiscal year 2004, accounting for more than half of all DOE energy R&D expenditures, far more than any other individual energy technology. [Source: Congressional Research Service, CRS-IB10041, June 2005].

Since 2004 some significant new sources of support have been added to this vast historical total, primarily by the Energy Policy Act of 2005. EPACT includes a 1.8 cent per kilowatt-hour production tax credit for energy generated from new nuclear power plants. This credit provides up to \$125 million per 1,000 MWe of new capacity. Each plant is eligible to receive the credit for 8 years, which amounts to a \$1 billion tax credit per 1,000 MWe of new capacity, up to a total of 6,000 MWe. IRS rules provide that this \$6 billion tax credit may be distributed among all the reactors that have applied for a combined construction and operating license by the end of 2008 and begun construction by January 1, 2014.

EPACT also sought, but as a legal matter did not quite succeed in granting the Secretary of Energy independent authority to approve loan guarantees for up to 80 percent of the cost of "innovative technologies" that "avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases." This definition includes new advanced-design nuclear power plants, as well as reduced emissions coal technologies and the full gamut of renewable energy technologies.

At issue in recent months has been whether it is wise, as provided in the current Senate energy bill, to strip the House and Senate appropriations committees of their obligations under current law to specifically limit an agency's annual budget authority for loan guarantees. This has become a matter of significant public concern and debate between the Senate and the House, which has not passed a similar provision. NRDC believes the course of action contemplated for nuclear in the current Senate energy bill is both fiscally irresponsible and ill-advised as a matter of policy, par-

tions from the fund to date have totaled \$4.9 billion, and the GAO reported in 2004 that completing the D&D program would require another \$3.5-\$5.7 billion (\$6.5 billion in FY 08 dollars) through 2044, of which industry's share is likely to be on the order of 30%, based on the present rate of assessment. So the taxpayers total estimated share is \$5.3 billion + (0.7 x \$6.5) = \$9.85 billion, and GAO considers that even this maximum estimate may be low, given the uncoded requirement for long-term environmental monitoring at some sites.

ticularly when DOE has a history of insufficient due diligence in the administration of loan guarantees and major energy demonstration projects. You may recall that its synthetic fuels program from the early 1980's ultimately left taxpayers with a bill for billions of dollars to cover defaulted loans.

EPACT also created another kind of special "regulatory risk insurance" for those engaged in building new reactors, which is intended to offset the costs of unforeseen federal, state, and local regulatory delays for as many as six new nuclear reactors built under the Nuclear Regulatory Commission's (NRC) new combined construction and operating license (COL) process. I am not aware of any other energy technology that is covered by taxpayer-paid insurance against the financial impacts of U.S. federal and state agencies and courts fulfilling their mandates to protect workers, the public, and the environment from the health, safety, and environmental impacts posed by construction and operation of power plants. This counterweight to the risk of potential delays covers 100 percent of the cost of delay for the first two new plants, up to \$500 million each, and 50 percent of the delay costs, up to \$250 million each, for the next three plants to be built.

Another DOE program—Nuclear Power 2010—evenly shares the costs incurred by the first two "new-nuclear-build" consortiums to obtain NRC "Early Site Permits" and/or Combined Construction-Operating Licenses. The taxpayer's share of this effort is likely to exceed \$500 million for the period 2005–2011. No other energy technology that I am aware of merits 50/50 cost sharing from the federal government for the costs incurred in obtaining the permits necessary to site, build, and operate a plant safely.

In addition to the incentives for new commercial nuclear plant construction, the Energy Policy Act of 2005 contains provisions for other nuclear programs not directly related to current "new-build" commercial reactors. These provisions included authorization of over \$2 billion for advanced reactor concepts, nuclear hydrogen production (for fueling our transportation system of the future), plant security, medical isotopes, and university nuclear engineering programs.

Our considered view of all this is that the longstanding federal effort to boost nuclear power has reached the point of diminishing returns, because it has proven very difficult by means of such expenditures to affect the fundamental characteristics of nuclear power that continue to limit the scope of its application:

- high capital costs;
- large centralized units that have not captured economies of scale;
- the use of intrinsically hazardous materials requiring high levels of technical competence, radiation safety, and security;
- the very small but nonetheless continuing probability of a high consequence nuclear accident;
- the lack of a scientifically credible and politically agreed pathway for the long term isolation of spent fuel;
- the continuing possibility of internal sabotage or external attack by a new breed of terrorists fully willing to die in the attempt, making such attacks very difficult to prepare for or defeat;
- the persistent threat of further nuclear weapons proliferation as a consequence of the spread of nuclear power technology and expertise;
- the vast quantities of reject heat that must be discharged into already overheated lakes and rivers, or otherwise dissipated using costly air-cooling systems;
- the continuing harmful environmental impacts from the mining, milling, and enrichment of uranium;
- the continuing requirement for competent, conscientious, and truly independent safety regulation and enforcement, a capacity that is in short supply around the world and sometimes even in our own country.

While none of these obstacles are immune to further incremental progress, taken together they continue to comprise a significant barrier to the further growth of nuclear power. Our view is therefore that over the next 20 years, U.S. and indeed foreign public investment in energy technology would be better spent on developing and catalyzing new markets for decentralized, clean, flexible, and environmentally sustainable energy technologies, technologies that can safely find near universal application around the world.

It's not that I believe nuclear power has "failed"—although I can understand why in light of its problems many people take that view—but rather that it has not truly succeeded on a level that suggests it could or should become the focus of government and private investment to combat climate change. We think there are some obvious energy technology winners out there, like solar, wind and energy efficiency, which, if we're smart, we can build right now to create a new energy economy and new high-tech export industries supporting American workers.

Here at home, what nuclear needs most at the present juncture is not more federal R&D and subsidies, but a high carbon price that will significantly and permanently improve its competitive position relative to coal and natural gas. In support of this proposition I note that the period of greatest operational improvement and capacity utilization in the U.S. nuclear industry, since the mid-1990's, coincides with a period of minimal involvement by the federal government in financially supporting the activities of the commercial nuclear industry. Instead of looking to the federal government, the industry focused on getting its own house in order, and as a result made substantial improvements in the reliability and cost of its own operations. There may be a lesson here suggesting that once again enlarging the federal government's role in the industry, as the recent and pending legislation would do, may not be the best way to ensure its future viability.

That said, nuclear power's future role also critically depends on how our regional and national electricity grids are structured. If we take measures that encourage the swift development of a more decentralized power system, in which almost any homeowner, condo-developer, small business, or industrial generator can easily connect to their local grid and feed low-carbon power into it, then all new sources of non-sustainable centralized base load power, including nuclear, could face significant competition, and it is by no means foreordained that nuclear will come out on top. Structuring that kind of open, level competitive environment is supposed to be what America does best, and now climate change has given all of us an urgent reason to get on with the task.

Senator LIEBERMAN. Thank you very much, and we look forward, obviously, to continuing to work with you and your organization.

Next, we have Dr. William Moomaw, who is the director of the Tufts University Institute for the Environment.

Doctor, thanks for being here.

**STATEMENT OF WILLIAM R. MOOMAW, DIRECTOR OF THE
FLETCHER SCHOOL CENTER FOR INTERNATIONAL ENVI-
RONMENT AND RESOURCE POLICY, TUFTS UNIVERSITY**

Mr. MOOMAW. Thank you very much, Senator Lieberman and Senator Warner. I want to first congratulate you on bringing this legislation forward and to thank you for holding these hearings, and to thank the Chair of the full committee, Senator Boxer, for her leadership in bringing this issue forward.

I am Professor William Moomaw. I am a chemist and a policy scientist at Tufts University. I have studied the implications of climate change over the past 20 years. I served as a lead author on the current Intergovernmental Panel on Climate Change report and on the two previous ones. I was a coordinating lead author of the chapter on the technological and economic potential for emissions reduction on energy supply. I have also served as the lead author on the carbon dioxide capture and storage report.

As we have all heard and it seems pretty clear, the time to act on climate change is now. It is absolutely critical that as we choose the path by which the United States will reduce its emissions that we carefully protect both the global climate and the U.S. economy.

I would like to just make some comments about particular items here. More detailed comments are in my written testimony.

First of all, the scope and timetable for this is really important, and setting a long-term target for 2050 and then identifying decreasing specific levels of allowances for each year is an excellent way to keep the economy on track as it transitions to a sustained low-carbon future. Businesses can innovate and plan, as can each citizen.

It is also important to have a near-term goal, because one of the points that not everyone seems to be familiar with is that the half

life of carbon dioxide in the atmosphere is about 100 years. So every time I burn a gallon of gas or a gallon of heating oil, I put 20 pounds of carbon dioxide in the atmosphere, but 100 years from now 10 of those pounds will still be here and 200 years from now there will still be several pounds of that original carbon dioxide in the atmosphere.

Several independent studies and analyses have suggested that keeping concentrations below 450 parts per million would be desirable in order to keep the temperature from rising above about 3.6 °F. I note that the goal here is more like 500 parts per million. On the suggestion of a colleague, I took a look at the standards for indoor air quality for carbon dioxide. It is recommended they be kept below 600 parts per million in indoor conditions for comfort. Beyond that, we become uncomfortable and the standard is 1,000 parts per million, because that is when people start to get drowsy. So the notion that we might end up with a sleepy planet if we keep on this track is really something we ought to keep in mind. So I would urge the committee to consider whether or not the levels of reduction are at an appropriate level.

Let me just say something about the effectiveness of intervention points. In order to really meet this goal, we have to address both supply and demand, and this legislation does that. From the point of view of supply and particularly for fuels, it seems to me that the most effective place to do this is as far upstream as possible. This is easier to implement. There is less bureaucratic rulemaking and the higher up you can go, the better you can do. For example, with electric power generation, there are, as we have heard, many ways to encourage technologies that will reduce emissions. I cite in my testimony a study that shows that we could be producing 19 percent of current U.S. electricity without adding a single bit of carbon dioxide simply by tapping currently wasted energy that is available to do so. So there are a lot of things we can do in addition to adding new technology in the process.

One result of my own research that is not reflected in the legislation is the tremendous potential for distributed energy, combined heat, power and cooling. In fact, the city of Hartford is one of the exemplars of just that kind of technology. It is a very low cost way to reduce the carbon dioxide because the waste heat which is typically one half to two thirds of the total energy in the fuel, instead of simply being wasted is actually used constructively either for industrial heat, for space heating, or in absorption chillers.

Another advantage is while we focus on supply, more than half of our capital investment in this country is in the transmission and distribution system, that is wires. Generating electricity locally actually does not require us to add any extra wires at great cost savings. Anyone who has ever tried to site a new transmission line knows that that is not an easy thing to do.

Let me just mention two other points on this. The first is how new fossil fuel plants are treated. Let me make the point that virtually all of America's old and inefficient fleet of existing power plants will be replaced over the next half century. The median age of coal plants in the United States is over 40 years of age, meaning half are younger and half are older. The average efficiency of all

those plants is about 32 percent, and it has not changed since the early 1960s. It is quite stunningly low.

So the question is, how are they to get their allocations under this system? While I think it is very good that new plant allocations come out of the fixed pot of allocations, it might be possible to improve new power plants even more by requiring either that they do some form of carbon capture and storage, or that they meet higher efficiency standards. It is possible now to do coal plants in the mid to high 40 percent efficiency range, possibly over 50 percent.

The second is to make sure that when we talk about carbon dioxide capture and storage that we not limit it to the traditional notion we will somehow capture it and put it in the ground or put it somewhere else. I came across some very interesting and promising technology that uses the carbon dioxide from power stacks to grow algae. The algae can either be just simply stored underground or, since half of its dry weight is diesel fuel, and 40 percent of the remainder can be turned into ethanol—much more efficiently in terms of land and water relative to other biofuel crop—this might be something that we should look at. I don't know whether this is going to be a great technology option or not. It is being tested on power plants in Arizona and in South Africa right now. But I would hate to see the legislation drawn or interpreted in a way that would exclude a lot of good potential ideas.

On the demand side, let me just say something about the low-hanging fruit. This is mentioned in this bill and it is very, very important, building standards and building codes. I know Senator Lautenberg has had an interest in this and other members of the committee have as well.

I would like to share a personal experience. My wife and I 3 years ago decided we wanted to build the most efficient house we could. We looked at Energy Star standards. An Energy Star house uses 70 percent of the energy of a code built house. The house that we have built has just been certified as using less than 20 percent of the energy of a code built house. That allows us to actually run the house on solar energy in Massachusetts right on the Vermont border. The winters are still cold, despite global warming, but nevertheless the house is there.

The question I ask is, did this cost the U.S. GDP anything for me to build this house? The answer is unfortunately it did, because in order to meet the standards we had to buy the windows, the doors, and the heat recovery systems from Canada. They are not available in the United States. Our solar panels, we almost could not buy from an American manufacturer because they are all being exported to Europe. The company when we finally got them announced it was building its next factory in Germany, rather than in the United States, because the demand was greater there. So we are losing out on economic opportunities by not having a stronger press for these kinds of technologies.

On the allocation of the allowances, giving them away may seem like it is free because the treasury doesn't have to print dollars for it. On the other hand, these are worth a lot, and some estimates suggest they might be worth in the first 10 years in the range of \$50 billion to \$100 billion a year. I think the question is, does this

create a windfall? Does this create two classes of companies, those that get them and those who don't? We need to really think about how we might best channel allowances to address the concerns that were expressed about low-income people and the rest.

Finally, I would just like to say that I think it is very important to have this legislation in place when we go to Bali in December. It would make a very strong statement about the United States and its position.

Let me just conclude by pointing out that we have been through an energy transition like this just 100 years ago. When Thomas Edison developed his lamp, the New York Times editorialized that it was a clever invention, but it would find only limited use and could not compete with cheap gas lamps. By 1905, 3 percent of U.S. homes had electricity and Henry Ford had started producing Model T cars on his assembly line.

Who could have imagined that by the mid-20th century, virtually every American home would have electricity and lighting, and that the automobile would redefine American lifestyles as suburban living?

Fast forward to 2005, just under three percent of electricity was generated by non-hydro renewable sources. There was just a handful of efficient gasoline electric hybrid vehicles in the marketplace. Does it seem impossible that by mid-21st century, after all existing power stations have been replaced and all existing vehicles will have been replaced three times over, that a low-carbon future could be a reality that is economically viable?

To achieve such transformation will require forward-looking legislation of the type that is being proposed today. I want to encourage Senator Lieberman, Senator Warner and other members of the committee to work to strengthen this legislation and to help create a new low carbon economy for America.

Thank you very much. I will be glad to answer questions.

[The prepared statement of Mr. Moomaw follows:]

STATEMENT OF WILLIAM R. MOOMAW, DIRECTOR OF THE FLETCHER SCHOOL CENTER FOR INTERNATIONAL ENVIRONMENT AND RESOURCE POLICY, TUFTS UNIVERSITY

I wish to thank the chair of this subcommittee, Senator Lieberman, and the Ranking Minority Member, Senator Warner, for introducing the very comprehensive "America's Climate Security Act of 2007" and for holding these hearings today. I also wish to thank Senator Boxer, the Chair of the full Committee on Environment and Public Works for her leadership in moving the issue of climate change forward on the legislative agenda.

I am Prof. William Moomaw. I am a chemist and policy scientist who is the Director of The Fletcher School Center For International Environment and Resource Policy at Tufts University. I have studied the implications of climate change and the options for dealing with it for the past 20 years. I have served as a lead author on the current and two previous Intergovernmental Panel on Climate Change Assessments and was a coordinating lead author examining the technological and economic potential to reduce emissions of the 2001 Report. I also served as a lead author of the Carbon Dioxide Capture and Storage Special Report.

As several thousand scientific research papers now demonstrate, and as the Intergovernmental Panel on Climate Change has confirmed, the earth is getting warmer, and it is with high certainty that a major cause is the billions of tons of heat trapping gases poured into the atmosphere each year. The United States releases nearly one-quarter of these gases, and it is clear that we must choose our strategy for reducing those emissions carefully so as to protect both the global climate system and the U.S. economy.

I would like to address briefly the following provisions:

- (1) Scope and timetables

- (2) Effectiveness of regulation points
- (3) Allocation of allowances and other incentives
- (4) Specific policies to effect reductions
- (5) Implementation and Enforcement
- (6) International Implications
- (7) Capturing economic opportunities

(1) *Scope and Timetables.*—This legislation recognizes that establishing a long-term target with annual benchmarks along the way is essential for creating a clear set of expectations. Hence setting a target for 2050, and identifying specific levels of allowances for each year is the best way to get the economy on track to a sustained low carbon future. Businesses can innovate and plan as can each citizen.

Several independent analyses find that if we are to have a reasonable probability of keeping global average temperatures from rising more than 3.6 °F (2 °C), above preindustrial levels, it will be necessary to keep atmospheric concentrations of carbon dioxide equivalents below 450ppm^{1,2}. To achieve this goal will require reducing U.S. emissions by at least 80 percent below current levels by mid-century along with comparable aggressive reductions in emissions by other nations. This will avoid the most severe impacts of global warming on the U.S. economy^{3,4}. The lower we can draw down our emissions, the less we will have to pay for adaptation or outright damages from a significantly altered climate.

ACSA sets a reduction target of 70 percent for 2050 for covered sources, which currently represent about three-quarters of total U.S. GHG emissions. If emissions in these uncovered sectors increase, or even if they decrease at a slower rate than is required for covered sources, the level of economy-wide emissions reductions will be less than 70 percent in 2050. The legislation utilizes a complex set of policies to achieve reductions in these uncovered sectors, and it is difficult to estimate whether these policies will be as effective as a binding cap in achieving the same level of emissions reductions as in the capped sectors.

I welcome the requirement in ACSA for periodic reports by the National Academy of Sciences on the effectiveness of actions taken by the U.S. and other major emitting countries, as well as the availability and cost of climate-friendly technologies. I believe the EPA should be authorized to take appropriate action in response to these reports, such as modifying the emissions reduction requirements, expanding the scope of coverage, or revising the set of policies and incentives aimed at achieving emissions reductions in the uncapped sectors. Any such changes should be made through a formal rulemaking process; Congress would retain its existing authority under the Congressional Review Act to review and if necessary overrule, any such changes.

I would urge this committee to consider increasing the 2050 emissions reduction target to 80 percent. I would also encourage broadening the range of sources that are capped, in particular natural gas used for purposes other than electricity generation. The legislation regulates all of the known major heat trapping gases, and it would be appropriate to add authority for EPA to designate and control the release of any other gases that may later be found to have significant global warming potential.

(2) *Effectiveness of Intervention Points.*—Since energy use is diffused throughout the economy, it is important to find the most effective points for intervention. For fuels, this is as far upstream as possible. Hence addressing electric power generation by encouraging the use of low and zero carbon technologies or else removing carbon dioxide from the exhaust stream makes the most sense. Data have been assembled that demonstrate that an amount of electricity equal to 19 percent of current U.S. production could be provided from currently available waste energy

¹M.G.J. den Elzen and M. Meinshausen, 2005 “Meeting the EU 2 °C Climate Target: Global and Regional Emission Implications” Netherlands Environmental Assessment Agency

²Intergovernmental Panel on Climate Change, 4AR, 2007, WG I, Chapter 10, p. 791, Cambridge University Press. A slightly different formulation is provided by IPCC, “. . . stabilising atmospheric CO₂ at 450 ppm, which will likely result in a global equilibrium warming of 1.4 °C to 3.1 °C, with a best guess of about 2.1 °C, would require a reduction of current annual greenhouse gas emissions of 52 percent to 90 percent by 2100.”

³“The U.S. Economic Impacts of Climate Change and the Costs of Inaction” 2007, The Center of Integrative Environmental Research, University of Maryland.

⁴Frank Ackerman and Elizabeth Stanton, “Climate Change—The Cost of Inaction” Global Development and Environment Institute, Tufts University, Medford, MA.

sources without releasing any additional carbon dioxide at costs in the range of a few cents per kilowatt hour.⁵

One result of my own research that is not reflected in the legislation is the potential to reduce emissions by 40 percent or more by removing the barriers to distributed energy systems that can provide electricity, heating and cooling. These systems can be installed in refineries, industrial parks, at universities, hospitals and business parks to generate electricity on site. Since typically more than half of the fuel energy from the burned fossil fuel is released as heat rather than as electricity, one can use that heat at the site for industrial purposes, or to provide hot water and space heating and cooling. Producing electric power where it is used also dramatically reduce the need for additional transmission and distribution wires, but any excess production can be sold and exported for use by the power utility and its customers. While we usually focus on the generation of electric power, approximately 54 percent of our capital investment is in the wires and systems that transmit and distribute that power.

I also have two suggestions for provisions in the legislation. The first is how new fossil fuel power plants are treated. Virtually all of America's old and inefficient fleet of existing power plants will be replaced over the next half century. The question is what will they be replaced with? As designed, the legislation allocates allowances for the entry of new coal burning power plants from the available number of allowances. This is important, but there is an opportunity with new plants to obtain even greater emissions reductions. This can be done by requiring higher levels of efficiency for new coal and other fossil fuel plants, requiring removal of carbon dioxide from the waste stream, or requiring the purchase of additional allowances to make new plants comparable to lower carbon dioxide emission sources. Without such additionality for new fossil power plants, the United States could lock-in higher emissions for an additional half-century.

The second suggestion is to expand the options for carbon dioxide removal from power plants and industrial processes. The technology of carbon dioxide capture and storage that is currently being considered is not the only option. While working on the IPCC Special Report on Carbon dioxide Capture and Storage, I learned of a system of biological capture of carbon dioxide from power plant stacks by algae that also removed large quantities of polluting nitrogen oxides. The algae produce over 50 times the biodiesel and ethanol per acre that traditional crops can produce with just a few percent of the water. These systems can be retrofitted to existing power plants and are being tested right now on large gas and coal plants. This process requires no transportation or long-term storage of carbon dioxide.⁶ I do not know if this technology will be successful or if any other clever options will arise, but I would not want to see such options excluded because of a restrictive definition of "carbon dioxide capture and storage."

In trying to lower demand, it is important to set incentives and standards further downstream for end users. Based upon the research that I have done independently and jointly with expert colleagues in evaluations for the Intergovernmental Panel on Climate Change, there are several important opportunities that are in the bill, that can be strengthened.

First, the "low hanging fruit" on the demand side is in improving building efficiency. I know that Senator Lautenberg has taken a strong interest in strengthening building codes, which is essential for achieving the overall goals of this legislation. My wife and I have just constructed a zero net energy home in Massachusetts. According to our contractor, building Energy Star homes that use just 70 percent of the energy of a code built house cost not a dollar more! Our house has received Energy Star certification that it will require less than 20 percent of the energy of a code built house. While our home cost a bit more to construct, the payback period decreases every day oil and other energy prices rise. Unfortunately, building our more comfortable, healthy house that does not contribute to global warming or our excessive dependence on fuels from unstable and hostile regions of the world did cost the U.S. GDP. To meet our standards, we had to purchase doors, windows, energy-recovery ventilator and waste water heat recovery units from Canada, and most of our appliances from Europe. We almost could not purchase domestically made solar panels because they were all being shipped to Europe where the demand and high valued currency made this a more attractive market. In fact the European

⁵ Owen Bailey and Ernst Worrell, 2005, "Clean Energy Technologies A Preliminary Inventory of the Potential for Electricity Generation" Lawrence Berkeley National Laboratory, LBNL-57451.

⁶ Carbon Dioxide Capture and Storage, 2005, Intergovernmental Panel on Climate Change, Special Report, Cambridge University Press.

market is so attractive that this American company has announced it is building its new factory there instead of here.

The opportunity for domestic job creation has recently been well described by Van Jones, a community organizer in Oakland, CA, as quoted in a recent column by Thomas Friedman.⁷ He points out that the more we require homes and offices to be more efficient, and require more solar panels and wind turbines, the more jobs will be created that can not be outsourced. “You can’t take a building you want to weatherize, put it on a ship to China and then have them do it and ship it back.” He argues that training of inner city youth to become what he calls “green collar” workers will show them that “You can make more money if you put down that hand gun and pick up a caulk gun. If you can do that, you just wiped out a whole bunch of problems.” He is right. This legislation can not only address climate change, but also enhance economic opportunities through the Energy Technology Deployment provision and create jobs through the Climate Change Worker Training program, which appears to be related to the efforts of Senator Sanders to increase the number of job opportunities in building a more efficient America.

So my recommendation is to make certain that the provisions for improving the performance of buildings through enhanced building codes and performance standards be strengthened. Since building to Energy Star standards seems to add no cost to construction and reduces energy use by 30 percent below building code standards, this could be implemented immediately. To be effective requires a program to train and certify contractors and building inspectors, and building supply industry should be encouraged to make new building technology available as soon as possible. I also support a program that would create a kind of Energy Extension Service to help homeowners and commercial building owners to initiate actions to retrofit their existing building. It is also essential that the provision in the bill that assures that states retain the right to enact stronger measures for buildings, power plants and transportation and that they be rewarded, remain in the final legislation.

(3) *Allocation of Allowances and Other Incentives.*—The legislation distributes many of the allowances based on past emissions, and only auctions some of them. While there may be situations where this would encourage more rapid reduction of emissions, it is important to recognize that this is the same as handing out cash subsidies. Allowance may seem free because the Treasury does not print currency to issue them. But they are property that is just like a currency. I have seen some estimates that awarding allowances rather than auctioning them could give away value of the order of \$100 billion dollars per year for the first 10 years of this program. This includes the allocations awarded to new fossil fuel power plant entries to the market. It is important to assess the implications of this and to decide whether it might not be better to capture more of this value as has been done in allocating the communications spectrum by increasing the fraction of allowances that are auctioned.

Specifically, I would encourage the committee to consider reducing the free allocation of allowances to the electric generation and industry sectors from the current 20 percent each to no more than 10 percent each, and to phase out such free allocations no later than 2025. This still would represent extremely generous transition assistance to these sectors. The allowances saved should be added to the pool allocated to the Climate Change Credit Corporation, to be auctioned with the revenues used for the various public purposes outlined in the bill.

Offsets can play a useful role in lowering the cost of making the transition to a low carbon economy. The bill tries to assure that offsets actually achieve real reductions through a high level of certification and verification. I have advised one firm in the voluntary offset business and another that is planning to start up, and have emphasized the importance of transparency, additionality and verifiability of real reductions through offsets. A colleague of mine at Tufts University has done a careful analysis of air travel offset firms and ranked them. Another analysis was conducted by an organization on whose Board I serve. I realize that voluntary offsets are not considered in this legislation but refer the Committee to those studies to see the potential for using offsets and how to avoid problems with them.^{8,9} My recommendation is that offsets be specifically designated for activities where it is difficult to reduce emissions. To assure that real reductions are achieved through off-

⁷Thomas Friedman, October 17, 2007, “The Green Collar Solution,” New York Times.

⁸Voluntary Carbon Offsets Portal, Tufts Climate Initiative and Stockholm Environment Institute, Tufts University <http://www.tufts.edu/tie/tci/carbonoffsets/> Anja Kollmus and Benjamin Bowell, 2007 “Voluntary Offsets for Air-Travel Carbon Emissions”, http://www.tufts.edu/tie/tci/pdf/TCI_Carbon_Offsets_Paper_April-2-07.pdf

⁹“A Consumers Guide to Retail Carbon Offset Providers,” 2006. Clean Air Cool Planet, <http://www.cleanair-coolplanet.org/ConsumersGuidetoCarbonOffsets.pdf>

sets, the legislation establishes procedures for identifying qualifying offsets that would count towards reduction commitments.

(4) *Specific Policies to Effect Reductions.*—An important component of the proposed legislation is that after setting targets and goals, it establishes specific policies to move the economy in the direction of lower heat trapping emissions. I have already alluded to the enhanced new building code standards that should be complemented by a system of enhancing the efficiency of existing buildings and certifying the performance of all buildings so that buyers and renters will have “truth in energy use.” The provisions in the legislation for improving the efficiency of heating and cooling equipment can be made more explicit to include appliances and end use efficiency through continuous improvement, and performance based standards. It is useful to remember that the standard, large American refrigerator of 1973 used 4 times as much electricity as today’s Energy Star model (which is 10 percent larger) because of ever-tightening appliance standards. The efficiency of this appliance could be doubled again.

Policies that encourage new technological innovations will assure that American products are the best and most desired in the world. Including incentives for improved private and public transportation systems and the reduction of sprawl will take time to implement, but they are essential for reducing our emissions in the long term. Rewarding early action is especially important in creating incentives for others to act quickly as well. Since the half-life of carbon dioxide is approximately a century, it may be useful to give larger incentives to actions initiated in the earlier years (before 2020) so as to avoid releasing these gases in the near term.

(5) *Implementation and Enforcement.*—The legislation has a complex set of mechanisms including a Carbon Efficiency Board, domestic and international offset credits and the potential for borrowing from future emission allowances and paying back with interest. As the legislation moves forward, some assessment of the implementation costs and ability to enforce all of these provisions might be made. It is difficult to assess at this time the ease or difficulty or the relative effectiveness of all of these multiple moving parts. Perhaps, there could be a built-in assessment process within the provision of the role of the NAS to evaluate the different provisions for effectiveness in achieving their goals.

(6) *International Implications.*—There is understandable concern over what action other nations will take to address climate change, and what will be the outcome of the negotiations that begin in December in Indonesia. Just 15 years ago this month, the United States Senate took decisive action to unanimously ratify the UN Framework Convention on Climate Change. The convention was signed by President George H.W. Bush at the Rio summit, and submitted by him to the Senate for ratification. The United States was the fifth nation of what are now 192 nations to ratify this important treaty. Among the important provisions of this agreement is that industrial nations should lead the way in addressing climate change, and should work with developing countries to meet their common but differentiated responsibilities” to do the same. Unfortunately, little has been done by any industrial country to implement this goal, and as a result most nations have been adding increasing amounts of heat trapping greenhouse gases to the atmosphere. It is important to our nation’s interest as well as to the global climate system that the United States enter the discussions in December from a position of strength. We will have much more credibility over the coming years of negotiation if we have taken the lead to create policies that will reduce our emissions of greenhouse gases. This action more than any other will encourage developing countries to take the issue seriously and work with us to redirect their development away from a form that threatens the atmosphere just as we will be doing.

(7) *Capturing Economic Opportunity.*—While we cannot expect a free ride for this energy transition, it is important to note that economic studies are finding that the cost of addressing climate change is in the range of 1 percent of GDP. There are many ways to achieve the 3 percent annual reductions required to meet the emission reduction goals needed to keep heat trapping gas concentrations within 450 ppm carbon dioxide equivalents.¹⁰

It may also be useful to look to history. The United States has undergone a similar energy revolution just 100 years ago. Soon after Thomas Edison invented the electric lamp, the New York Times editorialized that while it was a clever invention, it would find only limited use, and could not compete with cheap gas lamps.

By 1905, 3 percent of U.S. homes had electricity, and Henry Ford started producing Model T cars on his assembly line. Who could have imagined then that by

¹⁰Moomaw, W., and L. Johnston. 2008. Mitigation and Adaptation Strategies for Global Change. In press http://www.northeastclimateimpacts.org/pdf/miti/moomaw_and_johnston.pdf

the mid-twentieth century virtually every American home would have electricity and lighting, and that the automobile would redefine American lifestyles as suburban living? Fast forward to 2005. Just under 3 percent of electricity was generated by non-hydro renewable sources. There were just a handful of efficient gasoline-electric hybrid vehicles in the market place. Does it seem so impossible that by mid-twenty-first century after all existing power stations have been replaced and all existing vehicles will have been replaced three times over, that a low carbon future could be a reality that is economically viable? To achieve such a transformation will require forward-looking legislation of the type that is being proposed today.

I encourage Senator Lieberman and Senator Warner to continue strengthening this legislation to address some of the points that I and other witnesses have raised so that we can reduce our risks from climate change, enhance our economic and national security, strengthen our hand internationally and create the New American Economy.

I wish to thank the Senators for this opportunity, and look forward to working with them and other members of this committee to enact effective climate protection legislation.

RESPONSE BY WILLIAM MOOMAW TO AN ADDITIONAL QUESTION
FROM SENATOR CARDIN

Question. You suggest that the legislation should encourage the development of “end use efficiencies” through continually tightening appliance standards. Taken alone, how much could implementation of these increased efficiency standards decrease emissions?

Response. Recent studies by DOE and by the American Council for an Energy Efficient Economy have found that major appliances account for 24% of home electricity use, while other miscellaneous appliances account for another 14%. These latter devices are projected to double in electricity use in the next 20 years. Alternatively, if the efficiency of these two categories were to double, electricity use and related carbon dioxide emissions would decline from 38% to 19% of home electricity use. Lighting accounts for 18% of home electricity use so improving lighting efficiency can make even greater inroads since it accounts for nearly one-third of all electricity use in the US. More importantly, the development of highly efficient appliances of all types, including computers, would affect not just homes, but commercial operations as well, creating markets and jobs within the U.S. Finally, American ingenuity could set the standard for the performance of appliances throughout the world, led by U.S. designs and exports.

RESPONSES BY WILLIAM MOOMAW TO ADDITIONAL QUESTIONS FROM SENATOR INHOFE

Question 1a. On October 1, 2007, EPA released analysis of the Bingaman-Specter, McCain-Lieberman and Kerry—Snowe bills. It showed that through the end of this century, each of these bills only reduce global greenhouse gas concentrations by less than 4%.

Do you have reason to believe that this bill would be significantly different and are you willing to risk the economic future of this country to achieve such an insignificant gain in global concentrations?

Response. The Lieberman-Warner bill would achieve slightly different emissions reductions than the other bills mentioned. Scientific studies indicate that to have a reasonable chance of preventing temperatures from rising another 2 degrees Fahrenheit, we must stabilize atmospheric concentrations globally at 450 ppm CO₂eq. Other industrialized and developing nations must cut emissions, but the U.S., which has double the emissions per capita of other industrial nations, must do its part, not only to cut emissions, but also to demonstrate leadership for the rest of the world.

Because the rate of removal of carbon dioxide is so slow, it is necessary to reduce industrialized country emissions by about 80% by mid-century in order to stay in the range where we are currently.

Question 1b. Doesn't EPA analysis demonstrate that taking unilateral action will be ineffective and could even be counterproductive since we will accelerate the emissions growth in the developing nations as we export jobs to their inefficient economies?

Response. Some unilateral efforts can be effective, since the U.S. is such a large producer of heat trapping greenhouse gases. In 1977, the U.S. unilaterally removed ozone-depleting substances from spray cans and global releases dropped by 25%. Eventually, the rest of the world followed suit, and we are well on our way to restor-

ing the ozone layer. There would be a similar drop in carbon dioxide emissions were we to take actions on our own GHG emissions today.

In my testimony, I also cited two studies that find that not taking action will have greater economic costs than will taking action to reduce our emissions. I know of no rigorous study that shows either that taking such action will accelerate job exports to developing countries or that it will lead to increased emissions in those countries. I pointed out in my testimony that it is possible to produce 19% more electric power than we do now without adding any carbon dioxide at a very small cost. Reducing energy waste improves American competitiveness as reports from the consulting firm, McKinsey and Deutsche Bank demonstrate.

One of the two countries mentioned by the Senator at the hearing that will meet its Kyoto target is Germany. Per capita and per dollar of GDP emissions are half those of the U.S. and the entire economy is much more efficient than is ours. It is interesting that despite stringent action to address climate change, Germany is the world's largest exporter of economic value through the products that it makes, even though its population is only 7% that of China. Note that the U.S. steel industry is touting that its emissions are 240% lower than the Kyoto target, which I assume they are doing for economic reasons.

Question 2. As EPA's analysis shows, even if the rest of the world reduces emissions by more than 10 times that proposed for the U.S., global emissions are expected to be higher than today. Isn't this relevant as we consider action here?

In fact, if the entire developed world took unilateral action to eliminate every car, closed every factory and shut down every power plant, emissions would still be higher than today within a few decades. Does this affect your support of what I believe is unilateral economic disarmament?

Response. Please see response to question 1.

Question 3a. Regarding the overall costs and benefits of the bill, should there be a request made to the Energy Information Administration or other federal governmental entity to model the bill?

Response. It is always useful to model the economic and environmental implications of any legislation.

Question 3b. Regarding the overall costs and benefits of the bill, should there be a request made to the Energy Information Administration or other federal governmental entity to model the bill, should there be a request for a study by an economic modeling firm?

Response. This could be done, but the most advanced analyses of costs of action and inaction seem to lie with independent research institutes and at universities.

Question 4a. For Section 1201: Do you agree with the basis for setting a 2012 cap of 5.2 billion metric tons considering that total U.S. greenhouse gas emissions are greater than 7 billion tons? (Section 1201(d)).

Response. The 2012 emissions reduction target is set at a 2005 baseline only for the covered sectors.

Question 4b. In terms of emission reductions, what percentage should come from fuel switching, and what percentage from installation of new or replacement technologies?

Response. I believe that it is generally not a good idea to be too prescriptive in allocating reductions from different sources, fuels, technologies or demand reduction. For example setting standards for energy efficiency end use, zero emission technologies including renewables, and requiring carbon dioxide capture and storage can help to meet goals cost effectively, but setting percentage goals from specific options may prove costly. Setting overall goals and identifying places for policy interventions that will help to meet those goals may be the best strategy.

Question 4c. One oft-repeated approach to emission reductions is to "slow, stop and reverse." Are the emission targets chosen consistent with this approach?

Response. Any climate bill should establish emissions reductions targets at a level that will help avoid temperature increases that will lead to dangerous and expensive impacts. The emissions reduction targets in this bill are set at a level that will set us on that path. As I stated in my testimony, I believe that the goals set by this legislation should be strengthened, and that the exemption of natural gas used outside the electric sector may cause distortions.

Question 5a. For the coverage under the bill: Do you agree with selecting three out of six sectors of the U.S. economy for coverage under the bill?

Response. My preference is to include all sectors.

Question 5b. Do you think the three sectors were not covered because it would not be cost-effective to include them within the cap?

Response. No. As mentioned previously, I believe that including non-electric sector natural gas consumption in the cap would be more effective and be cost effective.

Question 5c. If cost effectiveness were a criterion, what cost in dollars per metric ton should be used as a cut off?

Response. I am not an economist. However, there are many ways to effect reductions in each sector. Setting overall reduction requirements while allowing market mechanisms, such as emissions trading, to be used in meeting those requirements in the most cost effective manner is a good approach. However, other considerations such as national security might cause a less cost effective option to be considered.

Question 6a. A new entrant is defined as a facility that commences operation on or after January 1, 2008. (Section 4(19)) Do you agree with selecting that date as a cut off?

Response. An early date has the advantage of capturing more potential entrants, and avoiding taking advantage of an opportunity to avoid taking action.

Question 6b. Do you agree with requiring commencement of operations instead of commencement of construction as used in the Clean Air Act?

Response. I do not know which would be better.

Question 6c. Has the difference in the number of qualifying facilities between these two definitions been evaluated?

Response. I do not know.

Question 7a. For the definition of "facility": What do you think "any activity . . . at a facility" means?

Response. I assume it means any activity that produces heat trapping greenhouse gases.

Question 7b. Could this include coal mining operations or the transport of coal to a facility by train, truck, barge etc.?

Response. Given that emissions from fuels used in the industrial and transportation sectors are covered under the bill, such activities would be included either directly or indirectly.

Question 7c. Do you think that the definition of "facility" to include "any activity or operation" also includes fugitive emissions that are not under the direct control of the facility?

Response. I do not know.

Question 8a. Under the bill, allowances can be borrowed for a period of up to 5 years, (Section 2302): Do you agree with the 5 years as an appropriate time limit?

Response. Borrowing on an annual basis does introduce flexibility to account for unforeseen circumstances. A limit of 5 years to pay it back is reasonable for a short-term loan of this type.

Question 8b. Would 6 or more years provide more flexibility for sources that find it necessary to borrow allowances?

Response. Longer times may provide more flexibility, but they come with a potential cost of effectiveness in meeting the goals.

Question 8c. What considerations are more important than that additional flexibility that necessitate the more restrictive time period?

Response. The longer the term, the more likelihood is that it will not be paid back, and the goal of the bill will become subverted. There may be alternatives to borrowing to address special circumstances.

Question 8d. Since the allowances become increasingly scarce over time, which creates a sliding upward pressure on price, to what degree is it anticipated the borrowing mechanism will mitigate allowance price increases?

Response. Each entity will weigh the option of borrowing with interest compared to direct reductions or allowance purchases in part based on its own expectation of future allowance price rises. The availability of the borrowing option may help mitigate allowance price spikes, while letting the market determine overall allowance prices.

Question 8e. If future allowance prices exceed market prices for current allowances, will this (borrowing) mechanism be effective?

Response. Entities will use borrowing to the extent that they expect repaying borrowed allowances (with interest) in the future will be less costly than submitting current allowances to cover their emissions in any given year. Thus, market forces will determine how much borrowing takes place.

Question 9. The bill seems to indicate that the interest rate on borrowed allowances is 10%. (Section 2302) Should the interest compound annually?

Response. The bill's approach seems reasonable.

Question 10a. Under certain conditions, the bill allows covered facilities to satisfy up to 15% its allowance submission requirement with allowances or credits from foreign GHG trading markets. (Section 2501) One of these conditions is that the foreign government's program be of comparable stringency to the U.S. program (Section 2502 (b)(2)).

What criteria should EPA use in determining whether the emission caps, for example, of another country are comparable to those of a U.S. program?

Response. It is difficult to specify the detailed conditions, but the foreign country program should meet the performance standards of the U.S. and should not be advantaged by extra subsidies or other factors.

Question 10b. Should this comparable stringency be based on regulatory requirements or on compliance?

Response. Compliance and performance.

Question 11. Under Section 2603, a Carbon Market Efficiency Board shall carry out one of more of six "cost relief measures" if the board determines that the emissions allowance market "poses a significant harm to the economy of the United States."

Response. Note, I do not feel qualified to comment on the operations of this Board, and so will not answer any of the subsections of this question. I have not read any analysis of how it might work, nor have I done any research on this topic myself. If cost containment could be effected without compromising emissions reductions, then developing an appropriate procedure might be useful.

Question 12a. Section 3402 requires EPA to allocate extra allowances to states that enact statewide GHG reduction targets that are more stringent than the targets established under the bill.

What do you think the basis is for providing an explicit inducement for states to adopt more stringent requirements?

Response. I assume it is to encourage greater reductions in states that are working to obtain greater reductions.

Question 12b. Could this lead to inconsistencies among state programs that reduce the potential cost-effectiveness of a national program?

Response. It seems designed to encourage competition among states to find more effective means to achieve reductions.

Question 12c. What do you think is the basis for an allocation level of 2% of the allowances for this purpose?

Response. I have no way of knowing how this was decided, but it is a very small portion of the total.

Question 13. Section 3501 allocates 10% of the allowance account annually to load serving entities, which are overseen by state regulatory bodies. Section 3503-(3) prohibits the exercise of certain prerogatives on the part of these state regulatory bodies such as requiring the filing of rate cases in order to pass through the credit from the sale of allowances. Do you agree with this provision and why /not?

Response. This provision appears aimed at helping energy consumers, through greater energy efficiency and assistance to low-income Americans. I am unfamiliar with details of regulated utility law.

Question 14. TITLE III Subtitle F provides bonus allowances for carbon capture and geological sequestration projects. Section 3604 limits these bonus allowances to the first 10 years of operation. Do you agree with limiting incentives to 10 years?

Response. I assume this provision is aimed at helping commercialize this technology during a transition period. In addition to receiving bonus allowances, advanced coal and sequestration technologies get slightly more than 15% of all auction revenues, the total amount of which increases over time as auction revenues grow.

Question 15a. Title II Subtitle D states that domestic offsets have to be permanent. What exactly does that mean in terms of biological sequestration?

Response. If by biological sequestration one means storing carbon in biomass of forests, permanent pastures and in soils, then one needs to measure this in terms of the total storage in the system. While these systems are open and release some carbon as carbon dioxide, they are also taking up carbon dioxide on a constant basis. (Note that the ocean is likewise a vast reservoir of carbon dioxide, which is also dynamic in its storage mechanism). The world's forests and soils contain twice the amount of carbon that is found in the atmosphere as carbon dioxide even though there is carbon being absorbed and released all the time. If the annual inputs and releases are approximately equal, then the amount stored is a known and fixed amount. It is therefore possible to have reliable and verifiable storage through biological sequestration.

Question 15b. In your opinion, what are the anticipated impacts on food prices associated with providing incentives to farmers to convert cropland to grassland and rangeland?

Response. Such conversion is not necessary to store carbon in soils. For example, the introduction of “no till agriculture” for crops has led to increased carbon storage in cropland, lower energy use, lower carbon emissions and lower production costs.

Question 15c. What would be the impact of such incentives to the production of ethanol and the cost of ethanol?

Response. This will depend strongly on the future choice of biofuel crops and the technology of converting biomass into modern biofuels. If switch grass were used, which has the potential to produce larger amounts of ethanol per acre than corn, the opportunities for soil storage would likely increase and the cost of bioethanol would decrease. It may be that the future lies with algae production, which could produce even more fuel per acre than any conventional crop.

Question 16. Section 3903(b) distributes allowances to rural electric cooperatives equal to their 2006 emissions. Do you agree with giving preferential treatment to rural electric cooperatives?

Response. The options are to auction all allowances, or allocate all of them or to auction some and allocate some. From a market efficiency point of view, full auctioning is the most effective option, as it sends the strongest market signal to GHG emitting sectors to find lower cost options for emission reductions. However, there are socially useful organizations such as rural electric cooperatives and municipally owned utilities that could not compete in an auction against commercial interests, and I would support reducing the bill’s free allocation of allowances to all emitting sectors.

Question 17a. Regarding Section 1103(d):

What methods are facilities contemplated to employ to determine complete and accurate data for the years 2004 through 2007 where no data was collected or readily available?

Response. Corporations, cities and states that have faced this problem utilize a combination of fuel bills and some generally accepted estimation techniques.

Question 17b. Also for Section 1103(d), how are facilities that currently do not have monitoring systems in place going to be able to submit quarterly data starting in 2008?

Response. Baseline emissions data will be based on fossil fuel consumption and the use of other greenhouse gases without need for monitoring. All entities should have records of how much fuel they used for a given year, using fuel bills.

Question 17c. Should the \$25,000 per day for each violation apply to these facilities for these time periods?

Response. A clear set of incentives and penalties need to be in place, and appropriately applied.

Question 17d. What is the process and who should have the authority for determining what constitutes complete and accurate data for these time periods?

Response. Creating a certified auditing office would be essential. They would audit the energy records and verify that they were accurately reported. This is being done in both public systems such as RGGI and in private systems.

Question 18. Based on EPA’s 2005 U.S. greenhouse gas inventory, the electric generating sector accounted for 46% of the proposed 2012 cap level of 5.2 billion metric tons. Between allocations to generators and load serving entities, the bill allocates 30% of the allowances to the sector, and reducing the sector’s (allowances?) subsequently. Do you agree with this differential treatment of the electric sector?

Response. The EPA 2005 U.S. GHG Inventory indicates that the electric utility sector is equivalent to approximately 33% of that year’s U.S. emissions. The amount of allowances provided directly to the electric utility sector and not passed through to benefit consumers is 20% of the allowances. Providing this level of free allowances could drive down the value of the allowances, thus undermining the market-based incentives for reducing pollution and investing in clean technologies. As noted in my testimony, I would support lower initial allocations and a more rapid phase-out of free allocations to both the electric generating and industry sectors.

Question 19. The allowance allocation to electric generating units in the first year of the program represents approximately 44% of that sector’s 2005 emissions based on EPA’s inventory. Electric demand is anticipated to increase, and reducing emissions by replacing current plants with lower or non-emitting plants will take years to achieve. Based on this, does the bill contemplate some mechanism, or set of mech-

anisms, whereby emissions will be reduced during this timeframe or allowances will be available, or will allowances have to be purchased?

Response. By incorporating a price in the market for emissions of carbon dioxide, the bill will provide an incentive for investment in lower-emitting technologies as well as greater energy efficiency by end-use consumers. Combined with the bill's incentives for energy efficiency investments by load-serving entities and states, it is quite possible that overall electric demand could increase at a slower rate, or decrease. The potential is huge; the state of California has demonstrated that it is indeed possible to hold per capita electricity use constant for several decades.

Question 20. Section 3803 allocates 3 per cent of allowances to projects in other countries for forest carbon activities.

Response. Tropical deforestation currently accounts for 20% of global greenhouse gas emissions. A solution for global warming must address these emissions. While 3% of the overall allowances is a relatively small amount compared to the size of the problem, it is an important tool to provide leverage to encourage developing countries to participate in mandatory emission reductions. The very first project to absorb carbon dioxide from a new coal power plant through reforestation in a developing country was initiated in 1989 by a U.S. power plant.

Question 21a. Regarding Section 8001:

This section calls for a national assessment of carbon dioxide storage capacity. Presumably, this assessment would determine whether the U.S. has sufficient capacity to geologically sequester the carbon dioxide that would have to be captured to comply with the bill. Absent the results of this survey which has not been undertaken yet, do you agree with assuming that the U.S. has adequate storage capacity?

Response. As I indicated in my testimony, we should take a broad look at possibilities for capturing carbon dioxide from power plants and industrial facilities, and not presume that long-term storage is the only option. Having said that, the answer is that significant amounts of research have in fact been done and are summarized and cited in the IPCC report on "Carbon Dioxide Capture and Storage." A number of storage areas are identified for the U.S. in that report that would be adequate for many decades.

Question 21b. How do you envision the program addressing the long-term oversight of the carbon storage sites?

Response. One model is to utilize the substantial experience with deep well injection of hazardous chemical waste. The more intensive proposed structure for long-term management of nuclear waste is also a possibility. EPA and other appropriate agencies should have responsibility for ensuring such oversight and monitoring, and the costs should be borne by those entities operating the storage sites.

Question 21c(i). This Section provides EPA with the legal authority to develop a permitting program for carbon storage through the Safe Drinking Water Act's Underground Injection Control Program. Long term monitoring and particularly in the west, property rights, are just two of the several issues that will need to (be) taken into consideration under the regulatory regime.

Is the bill's approach sufficient to address these issues?

Response. This depends upon the strategy for designing the regulations. An examination of how well existing underground injection programs have worked would help to decide this matter.

Question 21c(ii). Should there be a statutory role for the states?

Response. While EPA has the legal authority, states should certainly have input into the process.

Question 22a. Subtitle G, Section 4702(b)(1)(F) stipulates money is available for adaptation activities in accordance with recovery plans for threatened and endangered species.

Does the bill envision that all existing recovery plans will be rewritten to address all climate change effects?

Response. The bill calls for coordinated efforts between multiple agencies and between the federal government and the states.

Question 22a(i). Does the bill envision that all existing recovery plans will be rewritten to address all climate change related effects?

Response. It appears that that the intent is for all recovery plans to incorporate knowledge of climate change related effects. It is important that the funds be made available to FWS to achieve this goal. It appears that the adaptation fund must be made available to implement this legislation.

Question 22b(i). Within Subtitle G, how does the bill contemplate FWS will prioritize species to receive adaptation funds?

Is it based on their overall threatened or endangered status or the degree to which they are affected by climate change?

Response. The details of this type of management should be left to the experts in ecosystem and wildlife management.

Question 22b(ii). Are plants and animals not affected by climate change eligible for these funds?

Response. The management is more likely to be at the ecosystem level than at the level of individual species so this distinction is not likely to be a practical management issue.

Question 22b(iii). How should the DOI distinguish those ecological processes that are due to man-made climate change from those that (are) due to normal species development and evolution?

Response. Other than bacteria and insects, we are not likely to see any evolutionary changes on the time scales being considered here. Appropriate research should be able to determine which factors are responsible for a species that is becoming endangered.

RESPONSES BY WILLIAM MOONMAW TO ADDITIONAL QUESTIONS
FROM SENATOR BARRASSO

Question 1. What impact will Lieberman-Warner have on Liquefied Natural Gas imports to the U.S.?

Response. As I stated in my testimony, exempting natural gas from all sectors other than electric power could cause distortions that would increase demand for natural gas that would need to be met with increased imports. If the caps extend all the way up at the fuel source, such distortions are less likely, and the shifting of demand towards natural gas would be reduced.

Question 2. With increasing demand for energy both in America and around the world as a result of increased economic growth, technological solutions will be essential for countries to meet their energy demands while limiting greenhouse gas emissions. However, there are tremendous uncertainties about what technologies will most effectively address these issues. As Congress continues to examine technological solutions to combat climate change, do you believe we have enough information to identify which technologies hold promise and therefore warrant investment?

Response. Yes, I believe that we know enough to get started even if we cannot know what will be available in 2050. Any technologies that we are likely to use in a major way over the next two decades are already here, and the most cost effective are simple things like improving building insulation in existing buildings and requiring major upgrades in the energy performance of new structures. Buildings being constructed today already require 80% less energy for heating and cooling than code built structures. This is the case for the home my wife and I have just completed, so I know that it can be done. These options have very large near term paybacks as has been demonstrated in research summarized by the IPCC, and in the climate cost report of the accounting firm McKinsey. Removing barriers to distributed power using combined heat, power and cooling can make large reductions at low cost. I also referred to a study that found that there is enough wasted energy in our current system that it is possible to provide 19% of our current electricity with no increase in carbon dioxide for a few cents per kwh. Finally, there are many options for reducing non-energy greenhouse gases. For example the decision by the Montreal Protocol parties in September (with U.S. and Chinese endorsement) to accelerate the phase out of this chemical thereby not only protecting the ozone layer, but reducing future warming by an amount 15 times greater than what was called for by the Kyoto Protocol. The U.S. could follow the lead of the EU and phase this and other global warming chemicals out completely ahead of the treaty requirements. I would be pleased to work with you and the Committee if you would like additional information.

Question 3. What do you think should be Congress' funding priorities?

Response. The use of auction revenues or allocation of allowances would be best used for measures that can benefit the climate and the public, such as investments in energy efficiency and renewable energy technologies, such as solar, wind, geothermal storage and biological sequestration, to provide adaptation assistance for vulnerable populations at home and internationally, provide economic transition assistance for workers in carbon-intensive jobs, and to lower costs for low and middle-income energy consumers.

Question 4. What are the costs to family budgets for middle class and low-income people of implementing Lieberman-Warner in terms of energy bills and gasoline prices in the next 5 to 10 years?

Response. This bill would increase the price of fossil-fuel based energy sources, but there are specific provisions aimed at reducing energy demand and providing support for low and middle-income consumers. Experience in California and other states demonstrates that effective energy efficiency initiatives can hold down overall energy bills even as energy prices increase, by helping consumers consume less energy. Increased efficiency standards, whether for new vehicles, appliances, or buildings, can also help mitigate the impact of higher prices.

Question 5. In 2050, how much cooler will the planet be if we adopt Lieberman-Warner?

Response. How much the global average temperature will rise depends both on the cumulative global emissions out to 2050 and on climate sensitivity (the response of the climate system to increased atmospheric greenhouse gas concentrations), both of which are subject to some uncertainty. However, an analysis by the Union of Concerned Scientists (Avoiding Dangerous Climate Change: A Target for U.S. Emissions Reductions, UCS 2007), shows that, to have a medium chance of staying below a global average temperature increase of 3.6 degrees Fahrenheit above pre-industrial levels, atmospheric concentrations of greenhouse gases need to be stabilized at 450 ppm CO₂eq. To meet that goal, the U.S. must cut its emissions at least 80% by 2050, other industrialized countries must make deep reductions, and major developing nations must also take action to slow and then reduce their emissions. The Lieberman-Warner bill sets us on a path to achieve those emissions reductions, but must be strengthened by including non-electric sector natural gas and achieving greater reductions for the long-term target. So even under this legislation, the planet will get warmer, but its policies will save us from suffering severe disruption of the climate system.

RESPONSES BY WILLIAM MOOMAW TO ADDITIONAL QUESTIONS
FROM SENATOR LAUTENBERG

Question 1. You state in your testimony the need to reduce emissions by 80 percent by 2050. What is the significance of this target as opposed to a target of 50 or 60 percent? Is it more important to have a strong short-term target for 2020 to get us on track for future years?

Response. Substantial scientific evidence indicates that an increase in the global average temperature of more than two degrees Celsius (°C) above pre-industrial levels (i.e., those that existed prior to 1860) poses severe risks to natural systems and human health and well-being. Sustained warming of this magnitude could, for example, result in the extinction of many species and extensive melting of the Greenland and West Antarctic ice sheets—causing global sea level to rise between 12 and 40 feet over the long term. In light of this evidence, policy makers in the European Union have committed their countries to a long-term goal of limiting warming to no more than 2 °C above pre-industrial levels.

Scientific studies indicate that, to have a medium, or 50/50, chance of preventing temperatures from rising above this level, we must stabilize the concentration of heat-trapping gases in the atmosphere at or below 450 parts per million CO₂-equivalent (450 ppm CO₂eq—a measurement that expresses the concentration of all heat-trapping gases in terms of CO₂).

An analysis by the Union of Concerned Scientists (Avoiding Dangerous Climate Change: A Target for U.S. Emissions Reductions, UCS 2007), shows that, even if we assume that developing nations pursue the most aggressive reductions that can reasonably be expected of them, the world's industrialized nations will have to reduce their emissions an average of 70 to 80 percent below 2000 levels by 2050.

Given that the 450 ppm target only gives us a 50/50 chance of avoiding the 3.6 degrees Fahrenheit target and that the United States, has historically emitted more than any other nation, reductions here at home must be even steeper. In fact, even if we continue to emit more than every other industrialized nations, we must cut our emissions by at least 80% below 2000 levels by 2050.

The costs of delay are high. To meet this minimum target, the United States must reduce its emissions an average of 4 percent per year starting in 2010. If, however, U.S. emissions continue to increase until 2020—even on the “low-growth” path projected by the Energy Information Administration (EIA)—the United States would have to make much sharper cuts later: approximately 8 percent per year on average from 2020 to 2050, or about double the annual reductions that would be required if we started promptly. The earlier we start, the more flexibility we will have later.

Moreover, it is extremely important from a policy standpoint that the short-term target send a clear signal to the investment community that investments in clean energy technologies will be valuable, and to emitting industries that it no longer pays to build high-emitting conventional coal-fired power plants.

Question 2. Do you believe that the denial by the state of Kansas of a permit to build a new coal fired power plant is a major development regarding the use of coal in the U.S.? What technologies currently exist or are in development to reduce emissions from coal-fired power plants?

Response. Kansas' denial of the Sunflower Coal Plant marks the first time in the U.S. that such a state has denied such a permit because of carbon dioxide emissions. Specifically, Roderick L. Bremby, secretary of the Kansas Department of Health and Environment, said, "I believe it would be irresponsible to ignore emerging information about the contribution of carbon dioxide and other greenhouse gases to climate change and the potential harm to our environment and health if we do nothing."

The implications of this decision are quite significant. It indicates the extent to which an ever-growing number of states are recognizing that, to protect the health and welfare of their citizens, they must take steps to mitigate climate change. Together with the prospect of action at the federal level, whether under this president and Congress or the next, pressure is mounting on utilities to forego investments in new conventional coal plants and instead move towards cleaner technologies.

While cleaner coal technologies such as Integrated Gasification Combined Cycle plants already exist, they are more expensive than conventional coal plants in the absence of any market price on carbon pollution. Combined with carbon capture and storage, such technologies offer the potential for greatly reducing emissions from coal. Of course, energy efficiency remains the most cost-effective option for reducing emissions, and renewable energy technologies are becoming more competitive, even without incorporating any price for carbon emissions.

Senator LIEBERMAN. Thanks, Doctor, very interesting and hopeful testimony. I appreciate it.

We now go to Will Roehm, who is vice president of the Montana Grain Growers Association. We appreciate your coming out. Obviously in a direct sense, this bill sets up a cap and trade system for power plants, transportation and industrial sectors of the economy, but it affects almost every other sector and person in the economy, including obviously agriculture. So your voice at the table is an important one and we appreciate your presence.

**STATEMENT OF WILL ROEHM, VICE PRESIDENT, MONTANA
GRAIN GROWERS ASSOCIATION**

Mr. ROEHM. I thank you for the invitation.

Mr. Chairman, Ranking Member Warner and members of the committee, my name is Will Roehm and I am vice president of the Montana Grain Growers Association and a third generation farmer from Great Falls, MT.

On behalf of the National Association of Wheat Growers, I would like to commend you, Chairman Lieberman and Senator Warner, for developing legislation to control greenhouse gas emissions that recognizes the important role that agriculture can play in capturing and storing greenhouse gases. I believe that your proposed legislation takes an important first step in providing the necessary infrastructure for agriculture to be recognized for the immediate, cost-effective and real greenhouse reductions and offsets our industry can provide.

The American farmer has long been a careful steward of the land and the environment, and contributing to the reduction of greenhouse gases is a logical extension of what we see as our stewardship responsibility. I can state today that the National Association of Wheat Growers, or NAWG, intends to actively support your ef-

forts. We look forward to working with you and your staff as the process moves forward.

We are also very supportive of your decision to not require farmers to purchase and submit allowances or credits or permits for their greenhouse gas emissions. Farmers are not like electric utilities and this type of regulation would be very disruptive for our producers. I do have to say that we have producers that are experimenting with capturing carbon as it comes out of the tractor as we are doing our work. So we as an entire sector are not just sitting on our laurels. We are experimenting with things that 10 years ago we would never have thought of. So this is not completely new to our industry.

We also strongly support your decision to not only invite farmers to participate in the offset program, but also to set aside what we would hope to be an increasing portion of the allowances within the emission allowance account for distribution to farmers who undertake new efforts to reduce their greenhouse gas emissions and increase the amount of carbon they sequester biologically.

We in agriculture are constantly seeking out value-added opportunities and an uninhibited offset market presents just such an opportunity. The carbon offset program should generate real, measurable and, most importantly, verifiable emission reductions or offsets, but should not limit the market's ability to utilize agriculture as an important tool to reduce greenhouse gas emissions. To that end, one significant improvement to your legislation would be to remove the 15 percent limit that would be applied to the offset market.

I understand there are some critics who believe agriculture offsets should not be allowed because these same critics view them as unreliable or difficult to verify. A report commissioned by NAWG noted one of the key differences moving into a mandatory system will be the need, in fact the demand, by buyers to have projects that are able to pass measurement and verification tests. In NAWG's role as a potential aggregator, we intend to follow the measurement verification and monitoring requirement set forth in the field manual put out by Duke University Press titled *Harnessing Farms and Forests in a Low-carbon Economy*, commonly referred to as the Duke standard. The scientific consensus that supports this work should provide answers to those critics that claim agriculture offsets are unreliable.

The potential for agriculture offsets in the United States is enormous. The Pew Center for Global Climate Change reported that agriculture soils currently sequester approximately 20 million metric tons per year of carbon. Based on research in the field, there is the potential for field soils to sequester 3 to 10 times more under soil conservation practices. This could also provide up to 12 percent to 40 percent of the reductions that would be needed for the United States to return expected 2010 greenhouse gas emissions to 1990 levels.

The potential value for producers is also significant. At the national level, the market is estimated at \$408 million annually just for wheat acres alone. Keep in mind that the practices that create the carbon crop also increase soil fertility, water quality, and wildlife habitat.

I hope that you will support agriculture offset policies that not only allow us to help solve pressing national problems, but also generate new revenue streams for agriculture. I strongly believe that a market-based system that treats carbon as a commodity would spur new technologies and generate significant revenue for agricultural practices that sequester carbon. However, a key to our ability to fully participate in this new market, which could be one of the five largest agriculture commodities in the United States, are policies that do not limit our ability to participate or cap prices.

In closing, Mr. Chairman, I want to again return to the idea that we see our contribution to help reduce greenhouse gas levels as part of an ongoing stewardship responsibility practice by U.S. agriculture. That responsibility was best summed up by one of the great conservation presidents of the 20th century, Theodore Roosevelt, who in 1910 observed, "I ask nothing of this Nation except that it so behave as each farmer here behaves with reference to his own children. That farmer is the poor creature who skins the land and leaves it worthless to his children. The farmer is a good farmer who, having enabled the land to support himself and to provide for the education of his children, leaves it to them a little better than he found it himself." I believe the same thing as a Nation.

I urge you to adopt policies that create opportunities for us to leave the land a little better than we have found it ourselves. I have to add that agriculture has been extremely good to my family and hopefully my kids' families. It is a great industry and I think we have a lot to offer to this national issue.

Thank you for your consideration. I look forward to your questions.

[The prepared statement of Mr. Roehm follows:]

STATEMENT OF WILL ROEHM, VICE PRESIDENT, MONTANA GRAIN
GROWERS ASSOCIATION

Mr. Chairman, Ranking Member Warner and Members of the Committee:

My name is Will Roehm, I am Vice President of the Montana Grain Growers Association and a third generation wheat farmer from Great Falls Montana with my crop selection focusing primarily on winter wheat.

On behalf of the National Association of Wheat Growers and the agricultural sector generally, I would like to commend you Chairman Lieberman and Senator Warner for developing legislation to control greenhouse gas emissions that recognizes the important role that agriculture can play in capturing and storing greenhouse gasses.

I believe your proposed legislation takes an important first step in providing the necessary infrastructure for agriculture to be recognized for the immediate, cost effective and real greenhouse reductions and offsets our industry can provide. The American farmer has long been a careful steward of the land and the environment and contributing to the reduction of environmentally harmful levels of greenhouse gasses is a logical extension of what we see as our stewardship responsibilities.

I can state today that the National Association of Wheat Growers intends to actively support your efforts and we look forward to working with you and your staff as the process moves forward.

There are many critics of U.S. farm programs, and while we believe many of these criticisms are not well founded and a strong farm safety net program is essential to maintaining our ability to stay on and work the land, we are also constantly seeking out entrepreneurial value-added opportunities.

A robust, uninhibited offset market presents just such an opportunity. The carbon offset program should generate real, measurable and verifiable emissions reductions or offsets but should not limit the market's ability to utilize this important tool to reduce greenhouse gas emissions. To that end, one significant improvement to your legislation would be to remove the 15% limit that would be applied to the offset market.

I understand there are some critics who believe agriculture offsets should not be allowed because they are unreliable or difficult to verify.

The National Association of Wheat Growers (NAWG) Board of Directors three weeks ago unanimously voted to move forward with a business plan that would establish NAWG as a carbon aggregator. I was a member of our Environment and Renewable Resource policy committee that likewise voted unanimously to make this recommendation to our Board. A report commissioned to provide direction on moving forward with this endeavor noted “Thus, one of the key differences moving into a mandatory system, will be the need—in fact the demand by buyers, to have projects that are able to pass measurement and verification tests.”

In moving forward in our role as a potential aggregator, we intend to follow the measurement, verification and monitoring requirements set forth in the field manual put out by Duke University Press titled “Harnessing Farms and Forests in the Low Carbon Economy.”, commonly called the “Duke Standard”. The scientific consensus that supports this work should provide answers to those critics that claim agricultural offsets are unreliable.

And the potential for agricultural offsets in the U.S. is enormous. The Pew Center for Global Climate Change reported that agricultural soils currently sequester approximately 20 million metric tons (MMTC) of carbon per year. Based on research in the field, there is the potential for soils to sequester 60 to 200 MMTC/yr more under soil conservation practices providing 12 to 40% of the reduction that would be needed for the U.S. to return expected 2010 greenhouse gas emissions to 1990 levels.

The potential value for producers is also significant. In my state of Montana, if one were to assume .45 MMT per acre \$15/ton and further assume a limited enrollment of 10% of eligible producers we would realize a significant market of \$3.5 million annually. If half the state wheat acres are enrolled at that price, the income would be an estimated \$18 million. This is not an unreasonable expectation since the report notes that 93% of Montana Grain Growers surveyed expressed an interest in aggregating their carbon tons with NAWG.

At the national level, using the same assumptions as above the market is valued at \$408 million just for wheat alone. Keep in mind that the practices that create the carbon crop also increase soil fertility, water quality and wildlife habitat.

It is apparent why agriculture should support, and actively pursue, as open and unrestricted greenhouse gas cap and trade market as possible. To that end, I would like to offer the following policy recommendations:

- Provide adjustment funds to help defray the cost of measurement, monitoring and verification.
- Encourage USDA to establish standardized measurement, monitoring and verification protocols to determine changes in soil carbon for market-based applications;
- Avoid policy that forces agriculture and forestry offsets to compete for limited market pools. Create markets that are large enough for all verifiable and measurable offsets to come to the market.
- Remove any artificial limits on the potential carbon offset market. The carbon offset market should be unlimited.
- Oppose any artificial price cap on carbon. This would have the effect of capping the price for carbon credits as well and drive away buyers who would treat the price cap as a carbon tax rather than offsetting or reducing emissions.
- Support dramatic and immediate expansion of agriculture greenhouse gas mitigation research. Expanding the carbon “crop” to its full potential will mean more research on various practices and crops that store carbon more efficiently and knowledge about how best to model and measure carbon gains in a cost efficient manner.

I hope that you will support agricultural offset policies that not only allow us to help solve pressing national problems, but also generate new revenue streams for agriculture. I strongly believe that a market-based system that treats carbon as a commodity would spur new technologies and generate significant revenue for agricultural practices that sequester carbon. However, a key to our ability to fully participate in this new market—which would be one of the five largest agricultural commodities in the United States—are policies that do not limit our ability to participate or cap prices.

In closing Mr. Chairman, I want to again return to the idea that we see our contribution to help reduce greenhouse gas levels as part of an ongoing stewardship responsibility practiced by U.S. agriculture. That responsibility was best summed up by one of the great conservation President’s of the 20th century, Theodore Roosevelt who in 1910 observed:

“I ask nothing of this nation except that it so behave as each farmer here behaves with reference to his own children. That farmer is a poor creature who skins the land and leaves it worthless to his children. The farmer is a good farmer who, having enabled the land to support himself and to provide for the education of his children, leaves it to them a little better than he found it himself. I believe the same thing of a nation.”

I urge you to adopt policies that create opportunities for us to leave the land a little better than we found it ourselves. Thank you for your consideration.

RESPONSE BY WILL ROEHM TO AN ADDITIONAL QUESTION FROM SENATOR CARDIN

Question. Confidence in any market is a necessary characteristic for that market to be successful. One of the biggest concerns for farmers and landowners interested in participating in a carbon market by providing offsets is ensuring that their efforts are verifiable. Businesses need confidence that their emissions are being offset before they consider working with agricultural offsets. In the model you proposed for an agricultural offset program you would identify the National Association of Wheat Growers (NAWG) as a carbon aggregator.

Would you propose that NAWG also be the verifier of these agricultural offsets? Or, in order to increase the confidence of the buyers of these offsets, should a third party provide the verification of the effectiveness of these offsets?

Response. While we are still in the process of putting together a business plan to structure NAWG’s role as a carbon aggregator, you are quite correct in pointing out the need to maintain the highest level of business confidence. We agree that there should be independent third-party verification supported by the Duke Standard protocols, which are discussed in the next answer.

RESPONSE BY WILL ROEHM TO AN ADDITIONAL QUESTION FROM SENATOR INHOFE

Question. Mr. Roehm, I have found that the carbon offset market is not a true solution. The most popular type of offsets, planting trees and forests, would take a full century of growth and prosperity to full capture the carbon emitted by one car in a year. If you truly see global warming as a problem that can be stopped, how can you put your support behind a system that is and will remain largely unregulated and creates many unintended and undesirable results?

Response. I would urge you to talk with soil carbon researchers at Oklahoma State University as well as the consortium of nine state universities who have been researching this issue for the past 5+ years through federal funding obtained by Sen. Pat Roberts (R-KS). The group, called the Consortium for Agricultural Soils Mitigation of Greenhouse Gases (CASMGs) conducts research and analysis about the potential for agricultural soil carbon sequestration of greenhouse gases and other agricultural-based GHG reductions.

Members of this consortium are:

- Montana State University
- Kansas State University
- Colorado State University
- Iowa State University
- Michigan State University
- Ohio State University
- University of Nebraska
- Purdue University
- Texas A&M University
- Pacific NW National Laboratory

For further information about the true potential of agriculture to reduce greenhouse gases, I urge you to contact the agronomy departments at these fine institutions.

Agriculture is the currently only known system for rapidly reducing emissions through existing technologies. The Pew Center for Global Climate Change reported that agricultural soils currently sequester approximately 20 million metric tons (MMTC) of carbon per year. Based on research in the field, there is the potential for soils to sequester 60 to 200 MMTC/yr more under soil conservation practices providing 12 to 40% of the reduction that would be needed for the U.S. to return expected 2010 greenhouse gas emissions to 1990 levels.

Farmers have tested soils for soil organic matter and C content for many decades as a measure of soil health and to determine fertilizer needs. Numerous scientifically sound methods exist to measure soil C,¹ and a suite of robust, cost-effective technologies are in development. Cost-effective, accurate, rapid means of measuring,

monitoring and verifying changes in soil C can prepare the agricultural sector to participate in C markets through the sale of “charismatic C” credits.

Question 2. Many environmentalists continue living a high carbon emitting life while feeling good about themselves. Case in point is Al Gore, whose total personal energy use is tens to hundreds of times about that of the average American, but he claims he is carbon neutral simply because he buys offsets. Yet I would not that he still refuses to take the personal energy ethics pledge to emit no more than the average American. Is this really reducing emission, or does it just look good on paper?

Response. I have no knowledge of former Vice President Gore’s personal lifestyle. If your concern is whether the offsets market can be a real, reliable means of reducing greenhouse gas emissions, then you should approve of the policy infrastructure that the Lieberman-Warner bill establishes, since this is the first bill to set any kind of actual standard to the carbon offset market.

Right now, anyone may claim they are reducing emissions, and as you say, “look good on paper,” however, if there were an actual offset market with the measurement, monitoring and verification protocols called for in the Lieberman-Warner bill, this would no longer be a problem. For more information on how this measurement system is constructed in the bill, I refer you to the “Duke Standard” published by Duke University Press (copy attached).

While the National Association of Wheat Growers are still in the process of putting together a business plan to structure NAWG’s role as a carbon aggregator, you are quite correct in pointing out the need to maintain the highest level of business confidence and we intend to follow best management practices outlined by the scientific community.

Unlike other techniques of carbon sequestration being considered (i.e. oceans), terrestrial sequestration is a proven technique with scientific research, measurement, and verification practices in place to support its development as a viable sector within the national carbon market.

Key to the success in establishing a profitable with environmental integrity will be to find the right balance of modeling and actual measurement. Just this year, this issue has seen significant scientific consensus in the form of a field manual put out by Duke University Press called *Harnessing Farms and Forests in the Low-Carbon Economy*. This work, commonly referred to as “The Duke Standard,” outlines and provides answers to some of the most difficult agriculture and forest sequestration measurement questions. It is worth noting that the authors and advisory committee members include top soil scientists and agriculture economists from the following institutions:

- Texas A&M University
- Colorado State University
- University of New Hampshire
- Environmental Resources Trust
- Duke University
- Princeton University
- Kansas State University
- Stanford University
- Brown University
- Environmental Defense (editors)

Because of the scientific consensus that has emerged with this work, we now have a clear understanding of verification and monitoring requirements that could be developed as part of a mandatory cap-trade offset market. A critical first step in the development of a carbon aggregation market is project design. Many factors must go into a project’s development, implementation and ultimate success at accurately offsetting GHG emissions in the global marketplace. Some questions to consider when designing the project are:

- What types of processes will be used to sequester carbon?
- How many acres will be used in the project? Over what time period?
- Is the project an additional sequestration?

These questions and many others are explored in more detail with the Duke Standard manual. To give a brief overview, the following figure explains the overall process for producing valid and marketable offsets.

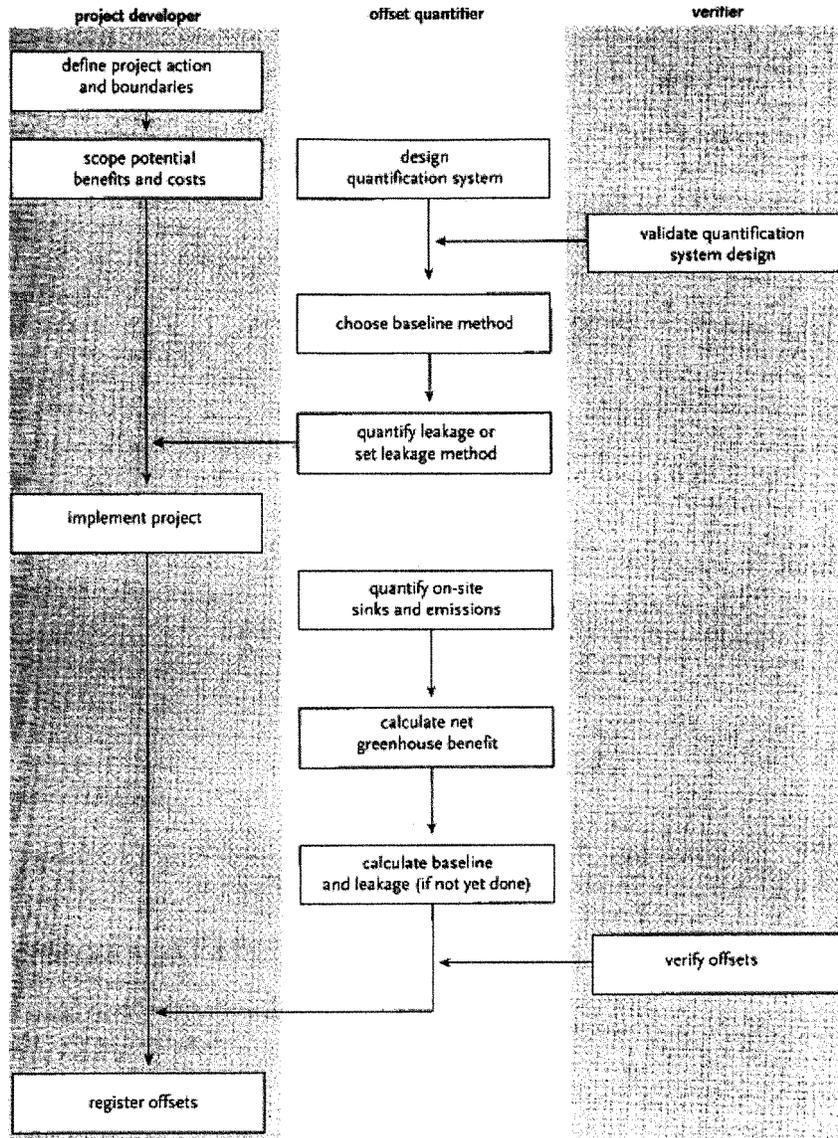


Figure 2.1 The process of producing offsets. Before committing to a project, landowners and buyers alike will want reasonable assurance that it will provide the offsets they seek. To obtain such assurance, participants must navigate a complex series of steps.

*Source: The Duke Standard (*Harnessing Farms and Forests in the Low-Carbon Economy*)

Carbon sequestration can be measured in million metric tons of carbon (MMTC) which is most often utilized for soil carbon sequestration. However, many studies have used million metric tons of carbon dioxide (MMTCO₂) or million metric tons of carbon equivalents (MMTCE) or carbon dioxide equivalents (MMTCO₂e), which take into account other compounds that contribute to GHG emissions (i.e. nitrogen).

What is important about these measurements is not the difference between them but that in a national carbon market system, participants must have a uniform way of quantifying the impact of the offsets they buy and sell.

The research conducted by Duke University in the Duke Standard recommends expressing carbon offsets in terms of Global Warming Potential (GWP) units. This type of system compares the impact of different GHG emissions on the climate over a 100-year period. It allows for the differential impact of various greenhouse gases and compares those impacts to a standard unit of 1 (for CO₂), or carbon dioxide equivalents (CO₂e). This gives the producer, aggregator, verifier, buyer, and seller a unit of measure that is comparable to a wide variety of sequestration projects while allowing for carbon additionally and potential leakage to be measured and taken into account in the projects. The table below presents the global warming potentials of the compounds most relevant to land management practices, carbon dioxide, methane, and nitrous oxide.

100-Year Global Warming Potentials

Gas	1995 GWP	2001 GWP
Carbon dioxide	1	1
Methane	21	23
Nitrous oxide	310	296

*Source: Intergovernmental Panel on Climate Change (1995, 2001)

Simple conversions can be made to quantify and measure the carbon and nitrogen most often measured in soils to these units. The formulas for calculating these are presented below:

(Biomass of C in soil) * [molecular weight of CO₂/molecular weight of C]

Example: 100 tons of C measured in soil * [44/12] = 367 tons of CO₂e

Once measured, it is the verification and aggregation of offsets that are the next crucial steps in the process of marketing carbon offsets.

Question 3a. On October 1, 2007, EPA released analysis of the Bingaman-Specter, McCain-Lieberman, and Kerry-Snowe bills. It showed through the end of this Century, each of these bills reduce would only reduce global warming greenhouse gas concentrations by less than four percent.

Do you have reason to believe that this bill would be significantly different and are you willing to risk the economic future of this country for such an insignificant gain in global concentrations?

Response. I believe the economic future of our country will remain sound particularly if our wheat growers are able to participate in a vibrant greenhouse gas emissions cap and trade market.

Question 3b. Doesn't EPA's analysis demonstrate that taking unilateral action will be ineffective and could even be counterproductive since it will accelerate emissions growth in the developing nations as we export jobs to their inefficient economies?

A journey of a thousand miles begins with a single step. I have no control over what other nations do or do not do. I can only work to ensure that U.S. agriculture has a meaningful role to play in whatever cap and trade policies our government adopts.

Question 4. As EPA's analysis shows, even if the rest of the world reduces emissions by more than 10 times that proposed for the U.S., global emissions are expected to be higher than today. Isn't this relevant as we consider action here?

In fact, if the entire developed world took unilateral action to eliminated every car, closed every factory and shut down every power plant, emissions would still be higher than today within a few decades. Does this affect your support of what I believe is unilateral economic disarmament?

Response. I refer you to my answer above.

Questions 5a. Regarding the overall costs and benefits of the bill:

Should there be a request made to the Energy Information Administration or other federal governmental entity to model the bill?

Response. I believe this is a matter for the authors of the legislation or other Members of the House or Senate to determine.

Question 5b. Should there be a request for a study by an econometric modeling firm?

Response. Regarding both sections a and b: I believe this is a matter for the authors of the legislation or other Members of the House or Senate to determine.

Question 6a. For Section 1201:

Do you agree with the basis for selecting a 2012 cap of 5.2 billion metric tons considering that total U.S. greenhouse gas emissions are greater than 7 billion tons (Section 1201(d)).

Response. I am interested in the greenhouse gas credit market side of this issue and am not qualified to opine on the emissions aspect of the issue. This line of questioning is perhaps more appropriately focused at agencies such as DOE and EPA who are the experts in terms of emissions laws.

Question 6b. In terms of emission reductions, what percentage should come from fuel switching, and what percentage from installation of new or replacement technologies?

Response. I am interested in the greenhouse gas credit market side of this issue and am not qualified to opine on the emissions aspect of the issue. This line of questioning is perhaps more appropriately focused at agencies such as DOE and EPA who are the experts in terms of emissions laws.

Question 6c. One oft-repeated approach to emissions reductions is to “slow, stop, and reverse.” Are the emissions targets chosen consistent with this approach?

Response. I am interested in the greenhouse gas credit market side of this issue and am not qualified to opine on the emissions aspect of the issue. This line of questioning is perhaps more appropriately focused at agencies such as DOE and EPA who are the experts in terms of emissions laws.

Question 7a. For coverage under the bill:

Do you agree with selecting three out of six sectors of the U.S. economy for coverage under the bill?

Response. I refer you to my answer above.

Question 7b. Do you think the three sectors were not covered because it would not be cost-effective to include them within the cap?

Response. I refer you to my answer above.

Question 7c. If cost-effectiveness was a criterion, what cost in dollars per metric ton should be used as a cutoff?

Response. As a capitalist, I believe that the dollar value per metric ton should be determined by a free, open, and unrestricted market.

Question 8a. A “new entrant” is defined as a facility that commences operation on or after January 1, 2008. (Section 4(19))

Do you agree with the selecting that date as the cutoff?

Response. I am not qualified to speak on behalf of the regulated community.

Question 8b. Do you agree with requiring commencement of operation instead of commencement of construction as used in the Clean Air Act?

Response. I am not qualified to speak on behalf of the regulated community.

Question 8c. Has the difference in the number of qualifying facilities between these two definitions been evaluated?

Response. I am not qualified to speak on behalf of the regulated community.

Question 9a. For the definition of “facility”:

What do you think “any activity . . . at a facility” means?

Response. I refer to my answer above.

Question 9b. Could this include coal mining operation or the transport of coal to a facility via train, truck, barge, etc.?

Response. I refer to my answer above.

Question 9c. Do you think the definition of “facility” to include “any activity or operation” also include fugitive emissions that are not under the direct control of the facility?

Response. I refer to my answer above.

Under the bill, allowances can be borrowed for a period of up to 5 years. (Section 2302)

Question 10a. Do you agree with the 5 years as an appropriate time limit?

Response. I refer to my answer above.

Question 10b. Would 6 or more years provide more flexibility for sources that find it necessary to borrow allowances?

Response. I refer to my answer above.

Question 10c. What considerations are more important than that additional flexibility that necessitate the more restrictive time period?

Response. I refer to my answer above.

Question 10d. Since the allowances become increasingly scarce over time, which creates a sliding upward pressure on price, to what degree is it anticipated the borrowing mechanism will mitigate allowance price increases?

Response. I refer to my answer above.

Question 10e. If future allowance prices exceed market prices for current allowances, will this mechanism be effective?

Response. I refer to my answer above.

Question 11. The bill seems to indicate that the interest rate on borrowed allowances is 10%. (Section 2302) Should the interest compound annually?

Response. I refer to my answer above.

Question 12a. Under certain conditions, the bill allows covered facilities to satisfy up to 15% of its allowance submission requirement with allowances or credits from foreign GHG trading markets. (Section 2501) One of these conditions is that the foreign government's program be of "comparable stringency" to the U.S. program. (Section 2502 (b)(2)).

What criteria should EPA use in determining whether the emission caps, for example, of another country are "comparable" to those of a U.S. program?

Response. I believe the 15% allowance cap should be removed but cannot speak for covered facilities.

Question 12b. Should this "comparable stringency" be based on regulatory requirements or on compliance?

Response. I believe the 15% allowance cap should be removed but cannot speak for covered facilities.

Question 13a. Under Section 2603, a Carbon Market Efficiency Board shall carry out one or more of six" cost relief measures" if the board determines that the emissions allowance market "poses a significant harm to the economy of the United States."

Should the board be empowered under the bill to provide cost relief measures if the economy of a region or an individual state faced significant economic harm?

Response. I am not qualified to comment on the structure of the Carbon Market Efficiency Board.

Question 13b. What criteria should the board use to make a significant harm determination?

Response. I am not qualified to comment on the structure of the Carbon Market Efficiency Board.

Question 13c. How should the board determine which measures and the precise extent of those measures that would be adequate to mitigate significant economic harm?

Response. I am not qualified to comment on the structure of the Carbon Market Efficiency Board.

Question 13d. How should the board coordinate its activities with the Federal Reserve board in decision-making to relieve inflationary pressures on the economy, and which would be lead as between the in decision-making?

Response. I am not qualified to comment on the structure of the Carbon Market Efficiency Board.

Question 13e. What allowance price is contemplated to pose significant risk of harm to the economy?

Response. I am not qualified to comment on the structure of the Carbon Market Efficiency Board.

Question 13f. Is it contemplated that the CMEB will provide the same level of certainty for investors in advanced technologies as a tax or safety valve?

Response. I am not qualified to comment on the structure of the Carbon Market Efficiency Board.

Question 14a. Section 3402 requires EPA to allocate extra allowances to states that enact statewide GHG reduction targets that are more stringent than the targets established under the bill.

What do you think the basis is for providing an explicit inducement for states to adopt more stringent requirements?

Response. I am in favor of policies which will create the most robust greenhouse gas cap and trade market without interfering with the effectiveness of a nationwide program.

Question 14b. Could this lead to inconsistencies among state programs that reduce the potential cost-effectiveness of a nationwide program?

Response. I am in favor of policies which will create the most robust greenhouse gas cap and trade market without interfering with the effectiveness of a nationwide program.

Question 14c. What do you think is the basis for an allocation level of 2% of the allowances for this purpose?

Response. I am in favor of policies which will create the most robust greenhouse gas cap and trade market without interfering with the effectiveness of a nationwide program.

Question 15. Section 3501 allocates 10% of the allowance account annually to load serving entities, which are overseen by state regulatory bodies. Section 3503(c)(3) prohibits the exercise of certain prerogatives on the part of these state regulatory bodies such as requiring the filing of rate cases in order to pass through the credit from the sale of allowances. Do you agree with this provision and why/(not)?

Response. I cannot speak on behalf of load serving entities.

Question 16. Title III, Subtitle F provides bonus allowances for carbon capture and geological sequestration projects. Section 3604 limits these bonus allowances to the first 10 years of operation. Do you agree with limiting the incentive to 10 years?

Response. I am not qualified to answer questions on geologic sequestration.

Question 17a. Title II, Subtitle D states that domestic offsets have to be permanent. What exactly does that term mean in terms of biological sequestration?

Response. Permanence, in respect to biological sequestration, is guaranteed reduction of atmospheric CO₂e. To protect against accidental release, for example in the case of a disaster like a forest fire, the farmer or forester selling the offset could either guarantee the emission reductions through a physical or financial mechanism. For example, a farmer could set aside additional land that would sequester carbon. Alternatively, a farmer—or even a purchaser of an offset allowance could purchase an insurance policy that, in the case of an accidental release, would provide funds to replace the amount of allowances that the farmer intended to supply.

Question 17b. In your opinion, what are the anticipated impacts to food prices associated with providing incentives to farmers to convert cropland to grassland or rangeland?

Response. I believe these incentives will have a minimal impact on wheat prices as compared to world wide weather conditions which are a much more significant driver of wheat prices and the fact that even at \$8 a bushel the cost of wheat makes up less than 10 cents of the cost of a loaf of bread.

Question 17c. What would be the impact of such incentives to production of ethanol and the cost of ethanol?

Response. I believe these incentives will have a minimal impact on wheat prices as compared to world wide weather conditions which are a much more significant driver of wheat prices and the fact that even at \$8 a bushel the cost of wheat makes up less than 10 cents of the cost of a loaf of bread.

Question 18. Section 3903(b) distributes allowances to rural electric cooperatives equal to their 2006 emissions. Do you agree with giving preferential treatment to rural electric cooperatives?

Response. I cannot speak on behalf of the regulated community.

Question 19a. Regarding Section 1103(d): What methods are facilities contemplated to employ to determine complete and accurate data for the years 2004 through 2007 where no data was collected or readily available?

Response. I refer to my answer above.

Question 19b. Also for Section 1103(d), how are facilities that currently do not have monitoring systems in place going to be able to submit quarterly data starting in 2008?

Response. I refer to my answer above.

Question 19c. Should the \$25,000 per day for each violation apply to these facilities for these time periods?

Response. I refer to my answer above.

Question 19d. What is the process, and who should be the authority, for determining what constitutes complete and accurate data for these time periods?

Response. I refer to my answer above.

Question 20. Based on EPA's 2005 U.S. greenhouse gas inventory, the electric generating sector accounted for 46% of the proposed 2012 cap level of 5.2 billion metric tons. Between allocations to generators and load serving entities, the bill allocates 30% of the total allowances to that sector, and reducing the sector's subsequently. Do you agree with this differential treatment of the electric sector?

Response. I cannot speak on behalf of the electric generating sector.

Question 21. The allowance allocation to electric generating units in the first year of the program represents approximately 44% of that sectors' 2005 emissions based on EPA's inventory. Electric demand is anticipated to increase, and reducing emissions by replacing current plants with lower or non-emitting plants will take years to achieve. Based on this, does the bill contemplate some mechanism, or set of mechanisms, whereby emissions will be reduced during this timeframe or allowances will be available, or will allowances have to be purchased?

Response. I refer to my answer above.

Question 22a. Section 3803 allocates 3 percent of allowances to projects in other countries for forest carbon activities. What should be the projected subsidy to other countries under this provision?

Response. I cannot speak on behalf of forestry activities.

Question 22b. China's carbon dioxide emissions now exceed that of the United States and are projected to increase. Should China or other countries whose emissions eclipse those of the United States in the future be eligible for these allocations?

Response. I cannot speak on behalf of forestry activities.

Question 23a. Regarding Section 8001: This Section calls for a national assessment of carbon dioxide storage capacity. Presumably, this assessment would determine whether the U.S. has sufficient capacity to geologically sequester the carbon dioxide that would have to be captured to comply with the bill. Absent the results of this survey which has not been undertaken yet, do you agree with the assuming the U.S. has adequate storage capacity?

Response. I support soil carbon sequestration incentives and a robust greenhouse gas cap and trade market. I am not involved in underground carbon injection.

Question 23b. How do you envision the program addressing the long term oversight of the carbon storage sites?

Response. I support soil carbon sequestration incentives and a robust greenhouse gas cap and trade market. I am not involved in underground carbon injection.

Question 23c. This Section provides EPA with the legal authority to develop a permitting program for carbon storage through the Safe Drinking Water Act's Underground Injection Control program. Long term monitoring and particularly in the west, property rights, are just two of the several issues that will need to be taken into consideration under any regulatory regime.

Response. I support soil carbon sequestration incentives and a robust greenhouse gas cap and trade market. I am not involved in underground carbon injection.

Question 24a. Subtitle G, Section 4702(b)(1)(F) stipulates money is available for adaption activities in accordance with recovery plans for threatened and endangered species. Does the bill envision that all existing recovery plans will be rewritten to address all climate change related effects? If so, will the monies in the adaptation fund be available to Fish and Wildlife Service (FWS) to re-write the recovery plans or will FWS have to bear that cost from other monies?

Response. I am not familiar with recovery plans for threatened and endangered species.

Question 24b. Within Subtitle G, how does the bill contemplate FWS will prioritize species to receive adaptation funds?

Response. I am not familiar with recovery plans for threatened and endangered species.

Question 24b(i). Is it based on their overall threatened or endangered status or the degrees to which they are affected by climate change?

Response. I am not familiar with recovery plans for threatened and endangered species.

Question 24b(ii). Are plants and animals not affected by climate change eligible for these funds?

Response. I am not familiar with recovery plans for threatened and endangered species.

Question 24b(iii). How should the Department of Interior distinguish those ecological processes that are due to man-made climate change from those that are due to normal species development and evolution?

Response. I am not familiar with recovery plans for threatened and endangered species.

RESPONSES BY WILL ROEHM TO ADDITIONAL QUESTIONS FROM SENATOR BARRASSO

Question 1. What impact will Lieberman-Warner have on Liquefied Natural Gas imports to the U.S.?

Response. I am not an analyst of Liquefied Natural Gas imports.

Question 2. With increasing demand for energy both in America and around the world as a result of increased economic growth, technological solutions will be essential for countries to meet their energy demands while limiting greenhouse gas emissions. However, there are tremendous uncertainties about what technologies will most effectively address these issues.

As Congress continues to examine technological solutions to combat climate change, do you believe we have enough information to identify which technologies hold promise and therefore warrant investment?

Response. The market has been an effective force to generate investment in promising technologies.

Question 3. What do you think should be Congress' funding priorities?

Response. For agriculture, Congress should consider using some of the "adjustment funds" suggested to accompany climate legislation to help defray the cost of measurement, monitoring and verification development.

Congress should support dramatic and immediate expansion of agriculture-GHG mitigation research. Federal funding of this research has ended. Expanding the carbon "crop" to its full potential will mean more research on various practices and crops that store carbon more efficiently and knowledge about how best to model and measure carbon gains in a cost efficient manner.

Question 4. What are the costs to family budgets for middle class and low income people of implementing Lieberman-Warner in terms of energy bills and gasoline prices in the next 5 to 10 years?

Response. I am not an economist and have no expertise in energy prices.

Question 5. In 2050, how much cooler will the planet be if we adopt Lieberman-Warner.

Response. I am not a climatologist with the expertise to answer this question.

Senator LIEBERMAN. Thanks, Mr. Roehm. You do indeed, and thank you for what you do. Don't think that we take for granted in Connecticut what you do, what you produce in Montana.

I know that Senator Warner wants to say something now.

Senator WARNER. Well, last night we had one of our late night sessions in the Senate. It gave me an opportunity to re-read and study each of the statements that these wonderful witnesses have put in. I was back off the anteroom of the chamber reading your testimony, and along comes my good friend, Senator Tester, who is very proud of the fact that he is not only a Montanan, but a farmer. I said, look at this. Do you know this fellow? He read it through and he took that quote, and he said, that witness and that quote, you have my vote on this bill. Bang. He walked out.

[Laughter.]

Senator LIEBERMAN. Mr. Roehm, you may have helped us with two votes today.

[Laughter.]

Senator LIEBERMAN. Senator Warner was a little restrained in what he just said, because earlier in the day he did a dramatic rendition in the voice that he imagined Teddy Roosevelt would have used in reciting that series of thoughts. It was quite moving actually. I think John may represent the Bull Moose Party here in the Senate.

Mr. Cicio, thank you very much. Paul Cicio is the Executive Director of the Industrial Energy Consumers of America. Thanks for your patience, and we look forward to your testimony now.

**STATEMENT OF PAUL N. CICIO, PRESIDENT, INDUSTRIAL
ENERGY CONSUMERS OF AMERICA**

Mr. CICIO. Thank you, Senator. It is pretty hard to follow that. Chairman Lieberman, Ranking Member Warner, members of the committee, we are grateful for the opportunity to testify before you. I will not pretend to be a climate expert because I am not, particularly as it pertains to legislative details. I do know a little bit about energy, particularly natural gas and electricity markets, some of which I will share with you today.

IECA is a non-profit, nonpartisan cross-industry trade association whose members are exclusively from the manufacturing sector. For a variety of reasons, the industrial sector emissions, greenhouse gas emissions, are below 1990, while all other sectors are on average up 31 percent. It is essential that climate change be addressed, and we look forward to working with you.

This legislation is very complex with significant implications for our country, the environment and consumers. We admit having had great difficulty going through the legislation on short notice to prepare for this hearing. Many important questions about the cost of this legislation and how it would be implemented remain unanswered until the official legislative language has been provided, and we look forward to receiving it and providing comments.

In our review, an essential ingredient to reducing absolute greenhouse gas emissions is by increasing the supply, the affordability and the reliability of low carbon-intensive energy. Setting a cap does not remove government or technology barriers. We are concerned that this legislation sets a near-term greenhouse gas cap. It is only 4 years away without the supply and without the technology in place.

We need increased supply of the entire mix of energy options, but with technology's help so that less greenhouse gas emissions are produced. Importantly, we must increase domestic supply of natural gas. We must also help the electric utility industry build nuclear plants, develop less carbon-intensive electricity from coal using IGCC and carbon capture and storage technology, and help renewable energy be more affordable.

Also, nothing in this legislation would prevent the power generation industry from fuel switching from coal to natural gas. If this occurred, natural gas and electricity prices would rise substantially.

Lastly, the legislation would not provide a level playing field against energy-intensive product importers, who would not be burdened by this legislation. It does not achieve global reach.

We have been surprised that this committee has not had hearings on the implications that a carbon cap would have on our constrained domestic supply of low carbon-intensive energy and the implications of electric power generation fuel switching from coal to natural gas. The implications on energy costs for consumers are enormous as I will detail for you in this testimony.

IECA's, starting point for dealing with climate change legislation appears to be very different than that of the proposed legislation. We already see high rising energy costs that are impacting our competitiveness and our jobs. We know that all costs of compliance under this legislation will be paid for by us, the consumer. Elec-

tricity utility costs will be passed through to us, so we pay twice. Homeowners and farmers are already suffering from high heating, cooling, transportation and fertilizer costs. For example, consumers paid \$76 billion more in 2006 for natural gas and \$65 billion more for electricity than they did in 2000.

The October 20, 2007 *Washington Post* article compared prices from a year ago. It shows that diesel prices are up 29 percent, fuel oil up 41 percent, gasoline up 47 percent, and propane up 61 percent. Natural gas prices have increased 76 percent since 2000. Yesterday, when I checked the New York Mercantile's price of natural gas, it was \$6.76 per million. As I look at the 2008 NYNEX prices, it is up 16 percent from today's level, and I look at the 2009 prices, it is up another 7 percent on top of that. Senators, prices are moving higher, not lower.

Since 2000, high natural gas prices reduced consumer demand for natural gas by a total of 1.9 percent. Residential demand is down 12 percent: commercial demand is down 9 percent. Industrial demand, mostly through demand destruction, is down 19 percent since 2000.

However, the electric power sector increased their demand increased by 19 percent. This upward constant growing demand by the power sector negated all of the benefits of energy efficiency and conservation by us consumers.

Now, FERC, the Federal Energy Regulatory Commission, says electricity prices are rising across the country as a direct result of higher demand and price for natural gas by the power sector. It is important for you to know that natural gas sets the marginal price of electricity. So when natural gas prices go up, so does the price of electricity.

The Electric Power Research Institute, EPRI, said that, and this is a quote, "Even though natural gas is used to produce only 20 percent of the electricity, natural gas accounts for 55 percent of the entire electricity industry's expense." Natural gas cost is \$50 billion out of the \$91 billion total.

Further accelerating our concern is that according to EIA, 73 percent of all new electric generating capacity built in 2006 was based on natural gas. EIA's estimate for 2007 jumps up to 78 percent, and the 2008 forecast is more of the same. For your information, one 500 megawatt gas-fired power plant uses the equivalent in natural gas to fuel 842,308 homes. So natural gas is going to go either for power generation or it is going to heat homes and keep manufacturing plants running.

If there is anything from this testimony that I hope you will remember is this single point. According to the EIA, there is 436,991 megawatts of natural gas-fired capacity in the United States. Not all of that is being used. If climate change legislation, and I am not saying it is your legislation, but if climate change legislation provides the economic incentives for electric utilities to fuel switch, that capacity would consumer an equivalent of 21 trillion cubic feet of natural gas.

Senators we use a little over 21 trillion cubic feet as an entire country. Given this, it is very important that climate change policy not incentivize it.

The potential for fuel switching is accentuated by the 2012 starting date of the emission cap, and 2012 is only 4 years away. This is exactly what happened in Europe with the EU emissions trading scheme. I am going to repeat a quote that was given by Shell Oil in a Senate Energy and Natural Resources Committee hearing on March 26, 2007. Shell said, “The bulk of emission reductions in the EU are made actually by coal to natural gas fuel switching in power stations. Any price will start to change the dispatch of power plants and start change away from coal to natural gas.”

All of this, of course, would not be a problem if natural gas supplies were growing. From 2000 to 2006, production is down four percent. Canadian supply has been flat to declining since 2000 and supply fell by three percent in 2006. LNG imports have increased since 2000, but remain only 2.7 percent of our Nation’s supply—actually in 2006, LNG imports fell 7.5 percent.

A relatively small increase in demand or a small drop in production means a lot to the price that every consumer pays. I will give you a real life example. When Katrina hit, it took out 5 percent of U.S. production for only 5 months. In that 5 months, the price of natural gas went up and it cost consumers \$40.8 billion. Consumers paid \$40.8 billion more for natural gas compared to the same months the previous year, and that was only a 5 percent change. A 5 percent increase in demand thru fuel switching would have the same effect.

In conclusion, we are requesting that Congress do not cap greenhouse gas emissions until there is an abundant and affordable and reliable supply of low carbon energy. Without it, the cost to the economy and the cost to consumers we fear, will be significant.

Thank you, Senator.

[The prepared statement of Mr. Cicio follows:]

STATEMENT OF PAUL N. CICIO, PRESIDENT, INDUSTRIAL ENERGY
CONSUMERS OF AMERICA

Chairman Lieberman, Ranking Member Warner and Committee Members, we are grateful for the opportunity to testify before you on this important and timely topic.

As you know, one of the greatest environmental legislative accomplishments was the enactment of the Clean Air Act of 1990 which took 10 years and passed overwhelmingly with bipartisan support. While its complexity is well noted, it pales in complexity to comprehensive climate change legislation and its implication to our country’s economic health and future. Much is at stake and we encourage you to take the time to do it right. Doing so will yield the greatest possible greenhouse gas (GHG) reductions based on a coherent strategy.

We are not on opposite sides of the debate. We are in this together. IECA member companies support action by Congress to increase energy efficiency and lower greenhouse gas emissions (GHG) to reduce the threat of climate change. We also support mandatory reporting. IECA is concerned about the availability of low GHG emitting energy supply and the availability of technology that will be needed given the legislation’s time table.

IECA’s starting point for dealing with climate legislation appears to be very different than that of the proposed legislation. We already see high and rising energy costs that are impacting our competitiveness and jobs. Homeowners and farmers are suffering from high heating, cooling and transportation costs. And, while the cost of this legislation is not transparent, home owners, farmers and manufacturers will pay for the CO₂ auctions and the higher costs of natural gas, heating oil, electricity and gasoline. Consumers will pay for all of the hidden transaction costs as well because the proposed legislation allows non-regulated entities to buy, sell, hold or retire carbon allowances. As we have already seen in a number of commodity markets, adding financial or other participants to a market historically made up of suppliers and users will add volatility and add a price premium when that commodity is in

short supply. Higher energy costs and compliance costs are inflationary which will reduce disposable income.

All consumers are already reeling from high energy prices. Consumers paid \$76 billion more in 2006 for natural gas and \$65 billion more for electricity as compared to 2000. The below price comparison was featured in a Saturday, October 20, 2007 Washington Post article which illustrates how much more consumers are paying for energy since last October.

Energy Product	Change
Crude oil, WTI	+56%
Diesel	+39%
Fuel Oil, NY	+41%
Gasoline, Reg NY	+47%
Propane, NTET, MB	+61%
Natural Gas	—

Without EIA economic modeling that uses realistic supply, demand and price assumptions, it is impossible to tell how this legislation will impact energy costs or the economy. In that regard, it is essential that Congress review an article that is attached to our testimony entitled “Betting on Bad Numbers”. The article was written by two Penn State professors who prove that the EIA modeling is systematically flawed. It is critical this be corrected as soon as possible.

FIVE KEY POINTS

1. The only way for the U.S. and the world to reduce absolute GHG emissions is to increase the supply of affordable and reliable low carbon intensive energy. The world is growing at a rate of 70 million people per year which will increase demand for energy. It is critical that this energy be less carbon intensive. This legislation does not increase low carbon energy supply. (Ongoing conservation and energy efficiency will continue to play an important role.)

2. No one disagrees that natural gas will play a vital role in the U.S. as the “bridge fuel”. At best, our supply situation is fragile. In our opinion, this legislation would accelerate demand for natural gas that does not exist.

3. Nothing in this legislation will prevent the power generation industry from fuel switching from coal to natural gas which will increase the price of natural gas and electricity from all consumers. Cap and trade policy increases the potential for this to occur as it did in Europe with the EU ETS (Emissions Trading Scheme).

4. There are at least three major mandatory options to control GHG emissions from carbon intensive industries: cap & trade; carbon taxes; and various GHG performance standards. Of these three, in general, cap and trade is the least preferred by the industrial sector. A declining cap challenges our ability to grow and supply the market with the products we produce. We provide products needed for economic growth and enabling solutions to reduce GHG emissions for the market. Products such as insulation, composite plastics, high performance light weight steels and fertilizer to grow crops for biofuels. It is counterproductive to limit our output. Doing so drives our production facilities offshore and results in job losses.

5. We are on record that the AEP-IBEW Proposal that is embodied in these provisions *will not* provide a level playing field against energy intensive product importers who will not be burdened by this legislation. It does not achieve global reach and we stand by our analysis, which I would like to provide for the record. This provision will not work. If there is any doubt about this, look at the timeline. Under the bill, domestic firms will face higher energy prices, obligations to acquire allowances, and reduce emissions beginning in 2012. Our major foreign competitors doing business in the U.S. are not required to do anything until 8 years later in 2020. I am no trade lawyer, but I understand that to significantly reduce this period of time may jeopardize any hope of making the provision WTO-compliant. Further, we are concerned that even if the President triggers the requirement for importers to obtain allowances from the international pool as provided in title VI, that foreign states will simply cross-subsidize the purchase of allowances. For example, eight of the ten largest Chinese steel groups are 100% owned or controlled by the Chinese government, while 19 of the 20 largest steel groups are majority owned or controlled by the government. Bringing trade cases to combat this hidden subsidy would be very difficult and time-consuming.

One more point deserves your attention. The bill invites the states to impose even tougher cap and trade programs than the federal program. What mechanism will the states use to prevent putting domestic manufacturers at a competitive disadvantage with foreign importers? Can states impose allowance requirements on foreign firms? Isn't this a federal issue?

IECA believes the following elements are essential to sound climate policy.

- Reduce GHG emissions cost effectively;
- Be transparent in order to achieve clear market signals;
- Not create winners or losers;
- Ensure that U.S. industry is not disadvantaged from competing with foreign imports of energy intensive products;
- Recognize that each sector is different and that tailored incentives combined with appropriate performance standards can achieve maximum GHG reductions at the lowest cost;
- Accelerate technology research, development and deployment to lower the carbon intensity of energy; broadens our supply options; and position the U.S. as the world's leading provider of low carbon intensive energy supply technology.
- Efficient cogeneration of steam and electricity should not become disadvantaged.

For the industrial sector, energy is a significant cost and reducing that cost is an important component of competing globally. If we fail to reduce energy costs we will fail to compete globally and cease to exist. It's just that simple. We compete in a ruthless competitive global market and the industrial sector is unique in this regard.

Manufacturers want and need to continually reduce energy consumption and it is in our government's interest to work in partnership to continue the success we have shown over the last 20 years.

Regulating carbon regulates energy consumption and regulating energy consumption regulates the economy. This would be a significant new responsibility for the EPA. These new responsibilities must be examined and delegated with great care.

America's Climate Security Act of 2007 (ACSA) is a comprehensive climate change bill. Even though our sector's GHG emissions are below 1990, we would find ourselves regulated under this bill and would be placed in a competitive disadvantage with our global competitors. The bill would require industrials to reduce GHG emissions in our internal operations and/or buy allowances through an auction. As we do, capital is expended for the purchase of carbon allowances instead of R&D, plant expansions or employee benefits.

We also find ourselves being thrown into the auction pool having to compete with electric utilities for allowances. At this point it is not clear that the necessary allowances and natural gas will be available to allow continued operation of our members' facilities in the United States. If the utilities move more electricity production to natural gas allowances should be available, but natural gas will not. If utilities continue to use coal as a fuel then emission allowances will be prohibitively expensive for industrial use.

Unlike the electric utilities, when IECA members purchase carbon allowances, it is a cost that is not recoverable unless global competitors raise the price of their products which would allow recovery of the costs. If competitors raise prices, the increased price becomes increased profit to them. For us, the increased price allows cost recovery—not increased profits.

The industrial sector 2005 GHG emissions are below those of 1990. The industrial sector is not the problem for the U.S. emission profile now or going forward and should not be placed under a cap as this legislation does. Other specific policy measures tailored to our sector will be more effective, less costly, without product market distortions and loss of jobs. Even if we are not placed under a cap, the industrial sector would bear significant increased energy costs that will impact our global competitiveness.

Climate policy by Congress can induce a move of industrial production facilities to locations outside the U.S. that provide lower costs. Companies have already demonstrated the need to move overseas to compete on a global basis. The loss of 3.1 million manufacturing jobs or 18 percent since 2000 provides evidence of this fact. Carbon costs can have the same effect.

Cap and trade climate policy rations energy use and without an existing abundant supply of low carbon intensive energy will significantly impact energy costs and the economy in ways that are impossible to predict.

This is accentuated by the starting date of 2012 and an emissions cap at the 2005 level. This is only 4 years away! Few economical actions can be taken in this short time frame other than fuel switching from coal to natural gas by the electric utility sector. This is exactly what happened in Europe with the EU ETS as reported by

Garth Edwards, Shell Oil, Trading Manager, Environmental Products, London, England.

Mr. Edward's made the following comment during a March 26, 2007 Senate Committee on Energy & Natural Resources Hearing on European Union's Emissions Trading Scheme. He said, "The bulk of emission reductions in the EU are made actually by coal to gas (natural gas) fuel switching in power stations. And any price will start to change the dispatch of power plants . . . and start change away from coal into gas (natural gas)."

Fuel switching from coal to natural gas would not be a problem if it were not for the fact our supply of natural gas is very fragile. Production is down 4% since 2000 despite record well completions, imports from Canada are down since 2001 and imports of LNG are both expensive and unreliable. Utilities have alternatives such as coal, renewable and nuclear energy, industrial consumers do not. This legislation must require that power generators cannot fuel switch until there is better availability.

One important concern about this legislation and cap & trade in general is that it does not necessarily reduce GHG emissions. It regulates and adds costs. For example, the EU has not seen a reduction in GHG emissions but has seen increased costs of energy. We do know that using more low carbon intensive energy will reduce emissions.

Cap & trade does not increase the supply of low carbon intensive energy. Cap & trade does not remove the government or technological barriers that will increase domestic supply of natural gas from federal lands; increase LNG import capacity; facilitate the construction of the Alaska Natural Gas Pipeline; or facilitate the construction of a new generation of nuclear plants, IGCC (Integrated Combined Cycle) or carbon capture and sequestration. Not one.

A cap & trade mandate could be implemented and these barriers will still be in place which would significantly raise the cost of energy for home owners, farmers and manufacturers and accelerate the movement of the manufacturing sector out of the U.S.

Countries do not play fair when it comes to trade. Countries subsidize their manufacturing industries in many different ways for purposes of job creation and trade currency. Energy is high on the list of subsidies. There is little doubt that these same countries will provide carbon allowance subsidies. Subsidies are a significant factor in developing countries. Even EU countries are doing it today by buying carbon offsets through the Clean Development Mechanism and Joint Implementation programs.

In this regard, a suggestion that this subcommittee plans to markup this bill without first obtaining a political and technically realistic economic analysis and moving through appropriate hearings is troubling. The economic consequences of such legislation could be devastating.

The industrial energy users strongly encourage the committee to hold more hearings on this legislation for there are many unanswered questions and unknown consequences that need to be examined in greater detail. Here are just a few of the areas we believe need to be further explored before action is taken on this legislation.

1. What will be the impact on energy prices, specifically, electricity, oil and petroleum products, natural gas and coal for each year between 2012 and 2050?

2. Furthermore, it is imperative that a hearing be held that looks at all the ramifications of this legislation on the commodity markets. It is well known that use of the commodity markets has soared in the last few years. This legislation could result in the creation of a market for billions of units with a value in the trillions of dollars. What safeguards are needed to prevent another Enron? What percentage of those trillions of dollars will be siphoned off by the commodity traders and speculators? Should a government trading operation be established as the sole venue for trading allowances?

INDUSTRIAL ENERGY CONSUMERS OF AMERICA (IECA)

IECA is a 501 (C) (6) national non-profit non-partisan cross-industry trade association whose membership is exclusively from the manufacturing sector and is dedicated exclusively to energy and environmental issues. Corporate board members are top energy and environmental managers who are leaders in their industry, technical experts and strongly committed to energy efficiency and environmental progress. Membership companies are from diverse industries which include: paper, steel, chemicals, plastics, food processing, industrial gases, cement, brewing, construction products, brick, aluminum, fertilizer, automotive products and pharmaceutical.

POSITION ON CAP AND TRADE POLICY AND LEGISLATION

IECA's objective is to work with Congress to implement policies that reduce GHG emissions without loss of manufacturing competitiveness. IECA has not taken a position in support or opposition to cap and trade as a policy, nor specific legislation that includes the policy.

However, IECA has on numerous occasions communicated to Congress the serious concerns such legislation causes the industrial sector. Our testimony today will reflect these same and growing concerns about the potential impacts.

Individual industrial companies vary in their views on policy such as cap & trade. In general, those who are mostly domestic producers exhibit the most concern about cap & trade because it can place them at a competitive disadvantage to non-U.S. producers. Other U.S. companies with large non-U.S. operations or those who have moved their energy intensive operations offshore are less fearful because capping U.S. emissions provides a competitive advantage.

BACKGROUND ON THE INDUSTRIAL SECTOR

There are about 350,000 manufacturing facilities in the U.S. It is estimated that about 7,800 facilities would emit 10,000 tons of CO₂ per year. By itself, regulating the industrial sector presents a significant regulatory challenge for the federal government.

Energy intensive industries include chemicals, plastics, fertilizer glass/ceramics, brick, steel, aluminum, pulp and paper, cement, food processing and refining. Energy is used as both fuel and feedstock. Feedstock means the energy source (natural gas, crude oil) becomes the actual product thus there are no GHG emissions. It is for this reason that energy used as a feedstock should be exempt. Some industrial processes are very electricity intensive.

The manufacturing sector competes globally in an environment of unfair competition. Other countries value their manufacturing sector and often subsidize energy costs, provide incentives and otherwise protect the manufacturing sector.

For U.S. energy intensive industries, reducing energy consumption per unit of product produced is essential. We either continually reduce our energy cost per unit of product or we will cease to be competitive.

The performance of the manufacturing sector in reducing energy consumption and resulting GHG emissions is not new. We already have two price signals: energy prices and global competition. Energy is a significant cost of competing globally. This is one important reason that a less heavy regulatory hand is not needed. Manufacturers want to reduce energy consumption and it is to governments' advantage to work in partnership to continue this success. This is why the industrial sector does not need an additional carbon price signal.

In many ways, the industrial sector provides the U.S. with a significant success story in reducing energy consumption and GHG emissions. Total energy consumption by the industrial sector has increased only .017% since 1990.

The industrial sector's total direct and indirect carbon dioxide emissions in 2005 are below their 1990 level while GHG emissions from the residential sector increased 31.4%; commercial +34.6%; transportation +25% and electricity +31.7%. Industrial direct GHG emissions decreased by 3.4% and indirect emissions have increased by 5.4%. In 1990, the industrial sector represented 21% of the U.S. emissions and now only 17%.

The industrial sector has a history of continuous improvement in energy efficiency since the 1970's and the first oil embargo. In the 1990's when natural gas became relatively low cost, many industrial sites converted their facilities from coal to natural gas. Low natural gas prices also resulted in significant growth in the use of cogeneration of steam and power. The pulp and paper industry increased its use of biomass as a fuel and also increased its use in cogeneration facilities to more efficiently produce both steam and power. These combined actions lowered both energy consumption and GHG emissions.

Since 2000, high energy costs, particularly high natural gas costs and now rising electricity prices, have been a significant factor for the energy intensive industries. The manufacturing sector has lost 3.1 million high paying jobs or 18% of the total. To our knowledge, this is the first time in U.S. history where we have lost manufacturing jobs despite robust economic growth for four straight years. We are fearful that if Congress does not increase the availability and affordability of domestic energy, more manufacturing plants will move offshore.

Because U.S. natural gas costs have been, on average, the highest in the world and because of Congressional uncertainties regarding future supply, investment in U.S. manufacturing plants have been extremely low with the exception of energy efficiency projects. There have been almost no major energy intensive grass root

plants built since 2000 and only incremental production increases. Also, high natural gas prices are making some cogeneration plants uneconomic and these industrial companies are now buying electricity for the grid which is more carbon intensive.

Lastly, the primary manufacturing processes for these industries are near their thermal limits. Significant R&D investment is necessary to achieve the next generation of processes. In the mean time, significant energy efficiency achievements are not anticipated.

IECA recommends the following climate policy options that do not cost consumers anything; present no risk to the economy; provide for increased supply of affordable and reliable low carbon intensive supply of energy; reduces GHG emissions; increases energy security; and increases the competitiveness of the U.S.

- Support mandatory reporting for domestic and non-U.S. based companies.
- Increase supply of affordable and reliable low carbon intensive energy. Remove government barriers to increased supply of natural gas in federal lands and the Outer Continental Shelf; expedite the Alaska Natural Gas Pipeline; facilitate approval of LNG import terminals; facilitate construction of a new generation of technology nuclear plants;
- Accelerate research, development and deployment of carbon capture and sequestration for use by coal fired power plants and IGCC technology for production of synthetic natural gas, feedstock and electricity.
- Take a sector approach. Each sector is different. Tailor incentives to accelerate energy efficiency in each sector. Energy efficiency is the “fifth fuel”. It is particularly important to include the commercial and residential sectors where demand for electricity is soaring.
- The key to improving energy efficiency in the industrial sector is capital stock turnover. Tax credits and faster depreciation are the best options.
- Facilitate removal of regulatory barriers that impede energy efficiency in each sector. Example: New Source Review.
- Pay for the R&D and tax incentives by increasing access to the OCS which would produce significant federal revenues and increase supply of natural gas.

ADDITIONAL INFORMATION

Natural gas supply is very fragile and demand by the power generation sector is increasing.

Reserve production capacity is almost non-existent. Inventory levels are good right now but can change rapidly based on weather conditions. Supply is down 4% since year 2000 despite record well completions. Canadian imports are down by 4.9% since 2001. New Gulf of Mexico leases will not increase supply for the next 5 years or so. The Alaska Natural Gas Pipeline has not shown any progress. LNG remains unreliable and a potential new cartel is on the horizon.

The Rocky Mountain Region has increased its production primarily due to EPAct 2005 provisions that have helped to streamline the permit process among other provisions. These are the same provisions that are slated for repeal under the currently debated energy bill. Increases in the Rocky Mountain Region have helped offset production decreases in the Gulf of Mexico.

Demand for natural gas by the power sector continues to increase the price for all consumers. Power sector natural gas demand has increased 19% since 2000 while other sectors have reduced their demand: Residential -12%; Commercial -9%; Industrial -19%.

Natural gas fired power generation impacts on all consumers. For example, a single 500 MW rankine cycle power plant (10,000 Btu/kwh) will use the equivalent natural gas volume used to fuel 842,308 homes each year.

Power demand for our limited supply of natural gas is slated to increase even more. Proposed 2007 power plants include 16,892 MW that are natural gas fired compared to only 1,589 MW for coal and no nuclear plants. Based on 2005 EIA information, there is 436,991 MW of natural gas fired power capacity in the U.S. If utilized, they would consume about 21 trillion cubic feet of natural gas, an amount nearly equivalent to our national consumption. Congress must ensure climate legislation does not give the power generation sector an incentive to use this capacity.

High natural gas prices are impacting the price of electricity across the country. The Electric Power Research Institute said that “Even though natural gas is used to produce only 20 percent of the electricity, it accounts for 55% of the electric industry’s entire fuel expense (\$50B out of \$91B).”

The U.S. cannot grow its economy or sustain the high quality of life that we are accustomed to without greater use of products from the industrial sector. Under a cap, the question is whether the products are produced in the U.S. or in foreign markets. A cap could restrict domestic production of these products; increase imports and GHG emissions from those imports; accelerate manufacturing job loss; increase the U.S. trade deficit and the balance of payments.

Examples of how energy intensive products are used and are integral to the growth of the U.S. economy:

- The aerospace/defense industry uses steel, aluminum, plastics and chemicals.
- The air transport industry uses steel, aluminum, plastics and chemicals.
- The auto and truck industries use steel, aluminum, plastics, chemicals.
- The beverage industry uses aluminum, steel, paper, glass and plastic.
- The biotechnology industry uses chemicals.
- The commercial and home building construction industry uses brick, steel, aluminum, wood, cement and glass.
- The oil and gas industry uses steel, chemicals, cement.
- The chemical industry uses chemicals, steel, cement and glass.
- The computer industry uses plastics, chemicals, and glass.
- The electrical equipment industry uses steel.
- The electric and gas utility sector uses steel and cement.
- The food industry uses fertilizer, chemicals, plastics and paper.
- The home furnishing industry uses wood, glass, chemicals.
- The heavy construction industry uses steel and rubber.
- The home appliance industry uses steel, aluminum, glass and wood.
- The household products industry uses chemicals, plastic; paper, glass.
- The machinery industry uses steel, chemicals and plastics.
- The maritime industry uses steel.
- The packaging industry uses plastics, paper, aluminum and steel.
- The paper/forest products industry uses steel and chemicals.
- The refining industry uses steel, chemicals and cement.
- The pharmaceutical industry uses chemicals, glass and steel.
- Railroads use steel.
- The toiletries/cosmetics industry uses chemicals, plastics, paper, and glass.

Industrial sector products are a major solution to reducing GHG emissions. It takes energy to save energy. Our products use energy in the production process but save energy when used by the commercial and retail consumer. Placing a GHG cap on the industrial sector and requiring absolute GHG reductions restricts our ability to increase production of these products in the U.S.

It takes energy to save energy. For example, insulation can be made from glass, plastic or paper, all of which is energy intensive. When used to insulate commercial and home buildings, significant amounts of energy saved go well beyond the energy to produce the product. Double pane windows are another example. Double pane windows use twice the amount of glass but save an enormous amount of energy over the life of a building. Other examples include light weighting of autos, trucks and aircraft. Key solutions are greater use of aluminum, composite plastics and different grades of steel. All are energy intensive.

“A good example comes from one of our member companies and it’s ‘Near Zero-Energy Home’ in Paterson, New Jersey. This project demonstrates how good chemistry helps make healthy, energy-efficient and affordable homes better. Chemistry helps the building materials in the near-zero-energy home not only deliver superior thermal insulation, but also contributes to the missing performance ingredient—resistance to uncontrolled air leakage that can waste up to 40 percent of the energy used to heat and cool a home.”

“The demonstration project scored an impressive 34 on the HERS Index, a tool used by ENERGY STAR® to measure a building’s energy performance, making it 80% more efficient than a typical home. The project was the first on the East Coast to receive a Platinum score from the U.S. Green Building Council LEED for Homes rating system and is currently serving as a model for several hundred homes being built in an economically challenged neighborhood in East Parkside, Philadelphia.”

IECA companies have many more examples that can be shared with the Congress.

The EU Emissions Trading Scheme (EU ETS) significantly increased the price of electricity from about 34 to 69 euros per kwh or 76%.

The EU ETS started in January of 2005. The European Commission (EC) granted carbon allowances to the electric utilities, in fact, too many of them. The utilities priced the market value of these carbon allowances into the price of their electricity which increased the price of electricity to consumers even though the European

Commission gave them to the utilities at no charge. The higher the price of carbon went up—the higher the electricity prices rose. This raises the question of whether U.S. electric utilities will be able to do the same thing.

Prices of electricity in the EU rose from January 2005 to April 2006 as follows in euros per mwh:

Country	Price in January 2005	Price in April 2006	Percent Change
Germany	34	61	+79%
France	34	63	+85%
Netherland	38	51	+34%
Skandanavia	25	51	+104%
UK	41	83	+102%

In this same time period high carbon prices provided an incentive for electric utilities to switch from coal to natural gas which increased natural gas demand significantly and increased the price of natural gas throughout the market for electricity generators but also for every home owner, farmer and manufacturer who uses natural gas.

The high prices of carbon provided an incentive for the utilities to fuel switch from coal to natural gas lowering their carbon emissions and allowed them to either sell carbon allowances or help them keep under their GHG reduction obligation to the European Commission.

This is consistent with comments by Garth Edwards, Shell Oil, Trading Manager, Environmental Products, London, England. Mr. Edward's made the following comment during a March 26, 2007 Senate Committee on Energy & Natural Resources Hearing on European Union's Emissions Trading Scheme. He said, "The bulk of emission reductions in the EU are made actually by coal to gas (natural gas) fuel switching in power stations. And any price will start to change the dispatch of power plants?and start change away from coal into gas (natural gas).

There is more to it. Just like in the U.S., natural gas-fueled power generation sets the electricity market marginal price. The higher the natural gas price goes, the higher the electricity marginal price becomes.

The marginal price of electricity is the last increment of power that is needed by the grid to fulfill consumer demand. The price of this last increment sets the price of electricity for not just that portion of the power, but for *all* of the power that is sold to consumers for a given period of time. If a utility is a low cost producer using coal or nuclear, they want to see natural gas prices go up and natural gas fired generation setting the marginal price of electricity because it increases their profitability. In the U.S. as well as in the EU the cost of producing electricity from coal or nuclear is significantly below that of natural gas fired generation.

EU industrial companies report that later, after relatively high marginal prices were set, the electric utility industry began to maximize coal-based generation with lower costs to maximize profits. This would also increase GHG emissions. Please note the electricity market in the EU and in the U.S. is not transparent such that anyone other than the ISO operators really know what prices are bid by the electric utilities or what specific production units were utilized.

On April 25, 2006, the EC released their report that concluded too many allowances were given to the utility sector and the price of carbon fell sharply from about 30 to 12 euros per ton. Although electricity prices fell, they did not fall as much and later continued their upward climb. Interestingly, natural gas demand and prices fell. It appears that with lower carbon prices, more money could be made from low cost coal generation than selling carbon. There is a strong correlation between carbon prices and natural gas demand from fuel switching. Higher carbon prices means more demand for natural gas.

In the October, 2006 timeframe, the Langeled Norwegian natural gas pipeline began to deliver supplies to the UK which resulted in lower natural gas and electricity prices across the EU. This example further illustrates the importance of increased natural gas supply. Greater supply means lower prices.

Core industrial sector processes (the processes used to make our products) are near their energy efficiency engineering limits. Significant investment in technology is needed to achieve new technology that will allow significant GHG reductions.

This legislation does not direct recycled auction income to assist the industrial sector in developing such technology and we encourage it to do so.

Section 3401 Revenue Decoupling Will Not Promote Industrial Energy Efficiency—Stick to traditional utility rate making.

Advocates of utility rates based on “revenue decoupling” believe it will remove economic incentives that work against energy efficiency. The rate design for regulated utilities typically rewards utilities for selling more power, while energy efficiency projects result in decreased power sales. “Revenue decoupling” would break—or “decouple”—the link between the amount of power sold and the revenue (and profit) realized by utilities, thereby supposedly removing the economic incentives against energy efficiency. The advocates are wrong.

Industrial companies have made great strides in improving their energy performance and reducing their reliance on fossil fuels. Revenue decoupling, however, would penalize future industry energy efficiency efforts:

With decoupling, utilities are supposedly compensated for revenue lost when customers’ efficiency projects reduce demand. However, measurement and verification protocols often cannot distinguish between lower sales generated by energy efficiency from other causes. Hence, utilities also are often compensated for reduced power sales due to factors unrelated to efficiency, such as weather that depresses sales or economic downturns, or even customer funded energy efficiency projects.

Because it is difficult to track where savings come from, utilities are often simply compensated for lost revenue generally. Industrial consumers therefore often lose the financial reward and a primary motivator of efficiency projects—reduced energy bills. For example, if a manufacturing company installed more efficient boilers in response to rising fuel prices, it would purchase less power from its utility, and should see lower bills. However, because the utility is to be compensated for the lost revenue, that same facility would end up paying a higher rate on a lesser level of purchases under decoupling, thereby totally undermining the motivation for the investment in the energy efficiency project.

Eight states have established third-party entities whose mission is to promote incentives for energy efficiency for industrial and other power consumers. If Congress desires a mechanism to promote energy efficiency, it should investigate the programs in these states to learn more about programs that treat all stakeholders fairly and provide incentives—instead of penalties—for industrial users.

It is important that coal stay in the supply mix and compete with other alternative energy sources for power generation. It is both important to help keep the cost of electricity down but it is also an energy security issue. However, the technology, costs, transportation, permitting and liability issues must be resolved before implementation of a cap and trade system for the power generation industry.

These five critical elements must be achieved before implementation of a cap and trade program on the power sector. Without them, the cost of electricity will rise unnecessarily.

- *CO₂ capture technologies must be widely deployable.*—Current CO₂ capture technology is limited to small demonstration projects. Commercial scale demonstrations are needed to help prove which capture technologies are technically feasible, economically sound and available from multiple competitive vendors.

- *Energy penalties must be reduced.*—Current capture technologies reduce net energy output by 15-35%. Additional research and technology advances are needed to bring down these penalties otherwise more new generators will need to be built.

- *A dedicated CO₂ transportation system must be built in areas beyond the current EOR zones.*—A new and expanded pipeline infrastructure dedicated to transport captured CO₂ must be sited, permitted and constructed to provide ready access by power plants.

- *CO₂ storage permitting & liability must be in place.*—Suitable geologic storage areas must be identified and tested. Once located, these sites need to be permitted for commercial operation at federal, state and local levels, and long-term storage liability must be assumed by the Federal Government. Pipeline access must be assured.

- *GHG regulations must be uniform and provide for preemption.*—The creation of one overriding federal regulatory regime will not only result in enforcement efficiency, it will provide business certainty.

LEGISLATION SPECIFICS

- The legislation does not have a safety value, an essential element of any cap and trade system.

- The criteria to be used to award any such extra allowances to the states, if these are to awarded at all, should be based on how the manufacturing industries subject to global competition in that state are projected to fare under a cap and

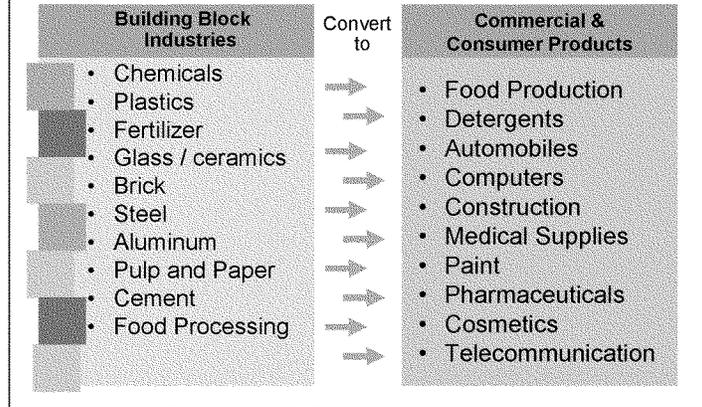
trade regime. So presumably states whose economies may be jeopardized because they have industries at risk, can use the allowances to retain jobs.

- The legislation does not preempt states from establishing their own climate programs. In fact, the legislation gives states an incentive to establish their own GHG reduction programs with tougher reduction targets than at the federal. This leads to higher costs for every manufacturer.

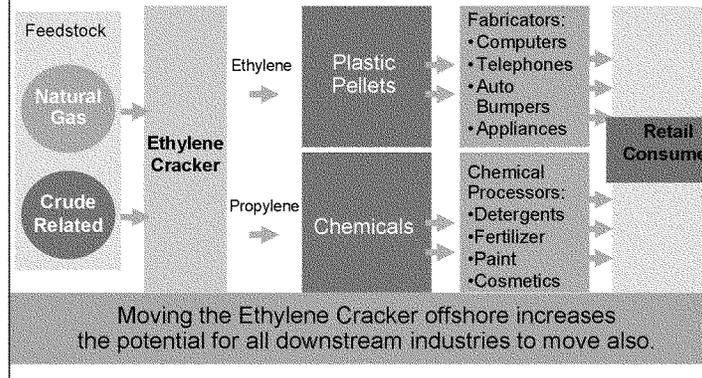
- Section 3301 provides credit for early action with a base year of 1994. Projects that resulted in GHG reductions that early were not done with climate change in mind. We encourage use of 2000.

- Money raised from auctioning should be used to compensate industries such that will incur significant “stranded costs” when certain pieces of equipment are retired before they have lived their useful lives.

Who Are Energy Price Sensitive Industries?



When Plants Move Over Seas, They Often Take Their Customers With Them Example



3.1 Million Manufacturing Jobs Lost (Millions)

2000	2001	2002	2003	2004	2005	2006	Difference
17.2	16.4	15.2	14.5	14.3	14.2	14.1	-18%

Source: U.S. Dept. of Labor

Natural Gas Prices Around the World 2006 Average (\$US per million BTUs)



Planned Nameplate Capacity Additions from New Generation (MW)

Energy Source	2006	2007	2008
Coal	602	1589	1056
Petroleum	269	78	168
Natural Gas	10657	16892	15050
Other gases	0	391	1160
Nuclear	0	0	0
Hydro	8	3	4
Other Renewable	3027	2454	695
Total	14573	21407	18133

Source: EIA

Natural Gas Prices

(Dollars per Thousand Cubic Feet)

	2000	2001	2002	2003	2004	2005	2006	Difference
<i>Residential</i>	7.8	9.6	7.9	9.6	10.8	12.8	13.8	+77%
<i>Commercial</i>	6.6	8.4	6.6	8.4	9.4	11.6	12.0	+82%
<i>Industrial</i>	4.5	5.2	4.0	5.9	6.5	8.6	7.9	+76%
<i>Electric Power</i>	4.4	4.6	3.7	5.6	6.1	8.5	7.1	+61%

Source: EIA

Electricity Retail Prices

(cents per kwh, including taxes)

	2000	2001	2002	2003	2004	2005	2006	%
<i>Residential</i>	8.24	8.58	8.44	8.72	8.95	9.45	10.40	+26%
<i>Commercial</i>	7.43	7.92	7.89	8.03	8.17	8.67	9.36	+26%
<i>Industrial</i>	4.64	5.05	4.88	5.11	5.25	5.73	6.09	+31%

Source: EIA

Existing Electricity Generation Capacity 2005 (MW)

Full utilization of the 436,991 MWs of natural gas fired power plant capacity would consume about 21 TCF of natural gas, an amount nearly equal to our national consumption.

Energy Source	Nameplate Capacity
Coal	335,892
Petroleum	64,845
Natural Gas	436,991
Other Gases	2,293
Nuclear	105,585
Hydro	77,354
Other Renewable	23,553
Pumped Storage	19,569
Other	928
Total	1,067,010

Source: EIA

Natural Gas Production

(Volumes in Trillion Cubic Feet)

	2000	2001	2002	2003	2004	2005	2006	Difference
<i>Dry Production</i>	19.2	19.6	18.9	19.1	18.6	18.1	18.5	- 4%

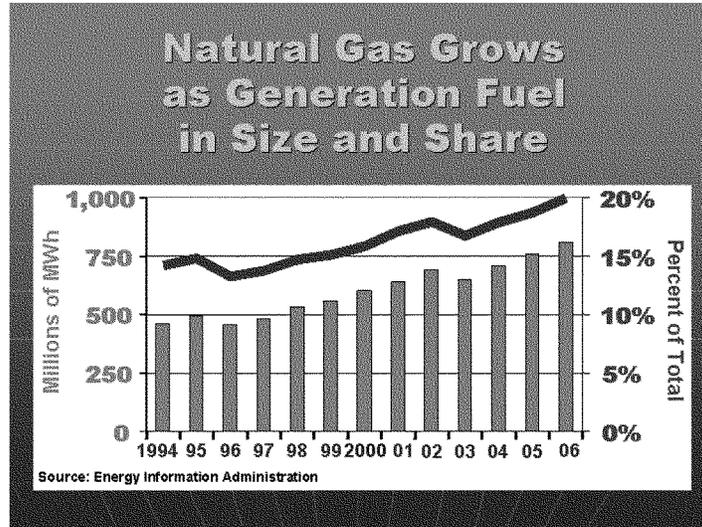
Source: EIA

Natural Gas Consumption by End Use

(Trillion Cubic Feet)

	2000	2001	2002	2003	2004	2005	2006	Difference
<i>Total Consumption</i>	21.5	22.2	23.0	22.3	22.4	22.2	21.9	+1.9%
<i>Residential</i>	5.0	4.8	4.9	5.1	4.9	4.8	4.4	-12%
<i>Commercial</i>	3.2	3.0	3.1	3.2	3.1	3.1	2.9	-9%
<i>Industrial</i>	8.1	7.3	7.5	7.2	7.2	6.7	6.6	-19%
<i>Electric Power</i>	5.2	5.3	5.7	5.1	5.5	5.9	6.2	+19%

Source: EIA



Total "Direct" Carbon Dioxide Emission (Million Metric Tons of Carbon Dioxide)

	1990	2005	Difference
Residential	339.5	368	+8.4%
Commercial	223.5	229.5	+2.7%
Industrial	1055.2	1019.5	-3.4%
Transportation	1566.8	1953.2	+24.7%
Electricity	1803.1	2375	+31.7%
TOTAL	4988.1	5945.2	+19%

Source: EIA

Total "Indirect" Carbon Dioxide Emission
(Million Metric Tons of Carbon Dioxide)

	1990	2005	Difference
Residential	614.2	885.8	+44.2%
Commercial	557.2	821.1	+47.4%
Industrial	628.4	662.8	-5.4%
Transportation	3.2	5.4	+68.8%

Source: EIA

Total Carbon Dioxide Emission
(Million Metric Tons of Carbon Dioxide)

	1990	2005	Difference
Residential	953.7	1253.8	+31.4%
Commercial	780.7	1050.6	+34.6%
Industrial	1683.6	1682.3	< 0%
Transportation	1566.8	1958.6	+25%
Electricity	1803.1	2375	+31.7%

Source: EIA

Industrial Energy Consumption (Trillion BTUs)

Year	Coal	Natural Gas	Renewable	Electricity	Petroleum	TOTAL
1990	2756	8451	1716	3226	8278	24,427
2005	1954	8064	1636	3477	9714	24,845
Difference	-802	-387	-80	+251	+1436	+418
						+0.17%

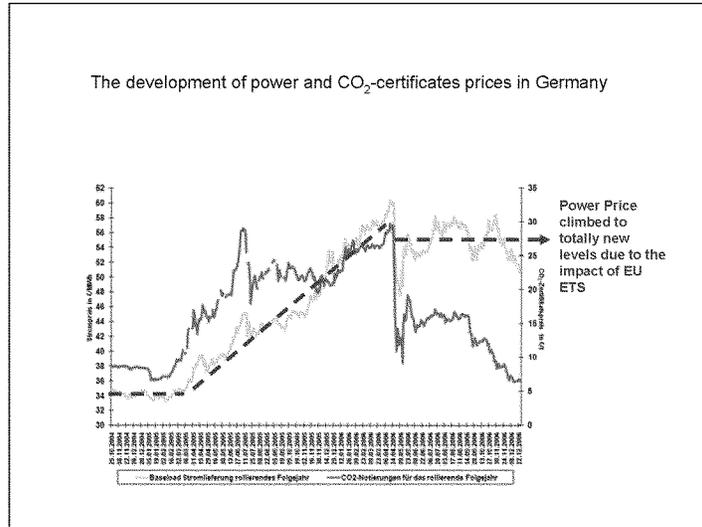
Source: EIA

Power Price development in the EU electricity markets since start of Eu ETS



Trading date Quelle: European Energy Exchange (EEX)

The development of power and CO₂-certificates prices in Germany





Industrial Energy Consumers of America
The Voice of Industrial Energy Consumer

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September 25, 2007

The Honorable Barbara Boxer
 Chairman
 Committee on Environment and Public Works
 U.S. Senate
 Washington, DC 20510

The Honorable John D. Dingell
 Chairman
 Committee on Energy and Commerce
 U.S. House of Representatives
 Washington, DC 20515

The Honorable James M. Inhofe
 Ranking Member
 Committee on Environment and Public Works
 U.S. Senate
 Washington, DC 20510

The Honorable Joe Barton
 Ranking Member
 Committee on Energy and Commerce
 U.S. House of Representatives
 Washington, DC 20515

The Industrial Energy Consumers of America (IECA), whose membership competes globally and are from the energy intensive industrial sector have significant concerns about the well intentioned AEP-IBEW Proposal that is designed to achieve "global reach" in U.S. climate legislation. It will not assure a level playing field between U.S. produced energy intensive products and those that are imported. The U.S. industrial sector carbon emissions are below 1990 levels.

IECA is a 501 (C) (6) national non-profit non-partisan cross-industry trade association whose membership is exclusively from the industrial sector. IECA membership represents a diverse set of industries including: plastics, cement, paper, food processing, aluminum, chemicals, fertilizer, brick, insulation, steel, glass, industrial gases, pharmaceutical, construction products, automotive products and brewing.

There are several major reasons why the AEP-IBEW Proposal as conceptualized in S.1766, will not provide a level playing field or provide "global reach".

First, while climate greenhouse gas reduction caps on U.S. manufacturers would be highly prescribed and enforceable, the requirements on our foreign competitors importing into the U.S. are highly uncertain. Will the President seek carbon allowance requirements on them at all? What requirements, if any, will survive lengthy multilateral and bilateral international negotiations? Will the program achieve the necessary GATT exception to be deemed GATT compliant?

Second, the playing field will be tilted against us. While we are affected as early as 2012, nothing affects foreign competitors until 2020. Many U.S. companies will have been damaged by then. It took only six years (2000 – 2006) to lose 3.1 million manufacturing jobs. There is no obligation on foreign competitors if their ghg emissions from national production of a given energy intensive product post 2020, remains below their average emissions from that product's national production for the period 2012-

2014. This incentivizes them to expand capacity and keep their old polluting facilities to raise their ghg baseline by 2014, just the opposite of what we want. Foreign competitors get credit for carbon allowances given to domestic manufacturers to offset higher U.S. energy costs under cap and trade, even though foreign competitors do not have these costs. They can use their own foreign carbon allowances and credits with scant U.S. review or recourse from us. Also, we cannot expect the subsidized purchase of carbon allowances that their state-owned or controlled firms will enjoy.

Third, in the case of S. 1766, which does not now impose emissions caps on the industrial sector other than for coal, adopting the Proposal will require modification of the bill to impose cap and trade requirements on domestic manufacturers. Otherwise, the Proposal is, with certainty, not GATT compliant.

The industrial sector carbon dioxide emissions in 2005 are below 1990 levels. This is a terrific track record when one considers that the total industrial value of shipments (in 2000 dollars) increased by 31.6 percent in that same time frame. Total carbon dioxide emissions from other sectors of the U.S. have not performed as well. Comparing 1990 versus 2005, total direct and indirect carbon dioxide emissions are: residential +31.4%; commercial +34.6 transportation +25%; and electricity +31.7%.

The U.S. industrial sector must be assured of a level playing field with energy intensive imports. If not, more high paying manufacturing jobs will be lost; global greenhouse gas emissions will rise as they shift to other countries who are most likely less energy efficient than U.S. industry; U.S. imports of energy intensive products will continue to surge increasing the trade deficit and balance of payments; and the U.S. industrial sector will be penalized for the tremendous investment and success in reducing energy consumption and carbon dioxide emissions.

Lastly, IECA member companies continue to be of the belief that no U.S. climate legislation can be successful until affordable supplies of low or no greenhouse gas emitting fuels like natural gas are expanded.

Sincerely,

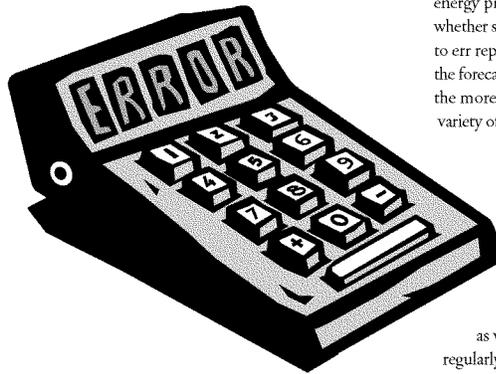
Paul N. Cicio
President

cc: Members of the Senate Committee on Environment & Public Works
Members of the House Committee on Energy and Commerce
The Honorable Jeff Bingaman, Chairman, Senate Committee on Energy and Natural Resources
The Honorable Pete V. Domenici, Ranking Member, Senate Committee on Energy and Natural Resources
The Honorable Samuel W. Bodman, Secretary, U.S. Department of Energy

Gas-Market Forecasts

BETTING ON BAD NUMBERS

Why predictions from the Energy Information Administration may contain systematic errors.



The difficulties of predicting future trends in energy are widely recognized (*see Reference [4], p. 61*). Even the most sophisticated of forecasting models cannot account fully for a myriad of complex and generally uncontrollable variables. Thus, energy policy-makers necessarily must anticipate a wide range of possible outcomes in formulating energy plans.

The issue here, however, is not how difficult it is to predict energy prices, supply, and demand. Our question, rather, is whether systematic biases are built into forecasts, causing them to err repeatedly in the same direction. And the more visible the forecast (and the more likely also that it will be used), then the more likely it is that the error will be compounded in a variety of settings.

In the case of the U.S. Energy Information Administration (EIA), for example, natural gas (NG) data and projections are used widely in regulatory proceedings, energy planning, scientific research, investment decisions, litigation, and legislation. In such cases, systematic bias can have profound socioeconomic implications—not only within the United States but in other nations as well. Indeed, the National Energy Board of Canada regularly includes EIA NG forecasts in its projections. Even OPEC scholars use EIA projections as a benchmark in their research.

This widespread use of EIA forecasts follows the organization's own view of its nature and purpose. In fact, the EIA has

BY TIMOTHY J. CONSIDINE, PH.D. AND FRANK A. CLEMENTE, PH.D.

indicated that it designs its forecasts specifically to aid policy-makers by providing "a policy-neutral reference case that can be used to analyze policy initiatives." However, while the EIA may strive to make its reference case forecasts "policy neutral," the question still remains: Are they "substantively neutral" in a forecasting sense? In other words, are they removed from the sort of systematic bias in which predictions deviate from actual observations in a distinct pattern?

Over the past decade, it increasingly has become apparent that EIA forecasts for NG differ substantially from actual outcomes. Some commentators [1] have suggested that EIA forecasts present a consistently "optimistic" view of NG that, for instance, underestimate price and overestimate supply. On the surface, this concern has face validity based upon forecasts from the EIA's *Annual Energy Outlook* series:

- In 2002, the EIA projected the cost of NG to electric generators in 2006 would be \$ 3.82 per thousand cubic feet (Mcf). Actual cost per Mcf was \$7.15 (all in 2006 dollars)
- In 2003, the EIA overestimated domestic NG production in 2006 by almost 2 trillion cubic feet—more than the annual production of Oklahoma.
- In 2005, the EIA projected liquefied natural gas (LNG) imports would reach 1,140 bcf in 2006. Actual imports in 2006 were only 583 Bcf—off by more than 550 Bcf just one year out.

To shed light upon the question of bias, we conducted an error decomposition analysis of EIA NG projections of key variables—price, supply, and consumption—from 1998 to 2006. Error-decomposition analysis is used commonly to evaluate economic forecasting models by identifying those components of the forecast errors or the proportions attributed to bias, the model, or randomness. A reliable model would display random errors with no discernable pattern of consistent under- or over-predictions. Thus, the proportions of forecast errors attributed to bias and model components would be minimal.

In our case, we evaluated one-, two-, three-, and four-year-ahead forecasts made by EIA from 1998 to 2006 for six key variables: (1) wellhead price; (2) price to electric generators; (3) consumption by electric generators; (4) domestic production; (5) imports from Canada; and (6) LNG imports.

Selecting Data for Review

Bolinger and Wiser [5] provides a graphical illustration of how EIA wellhead-gas prices forecasts going back to 1985 track actual prices. Their graph clearly illustrates that price forecasts during the 1980s turned out to be too high while forecasts made during the early 2000s appear too low. Graphical tech-

niques, however, do not quantify the size or systematic tendencies of these forecasts errors. This study attempts to extend their analysis by applying the error decomposition methods discussed above.

During December of each year, EIA publishes a forecast that forms the basis of the *Annual Energy Outlook*, or *AEO*, [8] for the subsequent year. (Note: The EIA each year releases its reference case in December. Then in the following February, the EIA releases its full report, with sensitivity cases.)

So, for example, the 2006 *AEO* report released in December 2005 [9] contains a forecast of 2006 prices. This study examines their forecasts published from 1998 to 2006 because EIA posts the detailed forecast tables on its Web site, which is accessible to the public. Auffhammer [2] uses a larger sample and finds that the EIA forecasts of NG consumption, production, imports, and prices do not exhibit the necessary conditions for rationality under symmetric loss. (Note: *The EIA uses the National Energy Modeling System, or NEMS. See "Appendix: Methods of Forecast Evaluation," p. 58, describing our evaluation of EIA's forecasting methods.*)

While each EIA forecast extends 20 years or more, the maximum length of the forecast horizon examined in this study is four years. A three- to four-year forecast for prices is likely of most interest to industry because natural-gas-fired electricity generating plants take roughly three years to build. Moreover, going any more than four years out would not be meaningful given the small size of our sample. Given the sample of forecasts from 1998 to 2006, there are nine one-year-ahead forecasts, eight two-year forecasts, seven three-year forecasts, and six four-year forecasts. While comparing each published *AEO* forecast with actual data over its entire forecast horizon is insightful, economists typically stratify forecasts by length of time not necessarily when they are made. Hence, the forecasts are sorted by length of forecast horizon.

Evaluating the EIA Forecasts

To keep the analysis manageable and comprehensible, our decomposition analysis is conducted for three pairs of variables in the natural-gas market involving prices, domestic flows, and imports. The two prices are the average wellhead price and prices paid for natural gas by electricity producers. The flow variables include dry natural-gas production and consumption by electricity producers. The later was selected because the electricity sector comprises the most dynamic, market-sensitive component of natural-gas consumption along with industrial sector use. Imports include those from Canada and imports of LNG.

Prices. The EIA forecasts natural-gas prices in constant dollars. To establish a consistent basis for comparison, these

constant price forecasts are inflated by the corresponding forecasts for the price deflator for gross domestic product (GDP). Once the forecasts are sorted, the prices are converted back to 2006 dollars using the latest GDP price deflator.

The forecast evaluation metrics for the one- through four-year-ahead forecasts from 1998 to 2006 appear in Table 1. On average, the one-year-ahead average percentage forecast error for the wellhead natural-gas price is 16 percent with an absolute error of \$1/Mcf. These errors steadily rise and reach more than 45 percent with the four-year-ahead forecast and \$2.60/Mcf.

The RMSE (root mean squared error), which penalizes large errors more severely than the average percentage error (see "Appendix," p. 58 for full explanation), is almost 35 percent for the one-year-ahead forecast. Like the average percentage error, it too rises with the forecast horizon, reaching more than 57 percent with the four-year-ahead forecasts.

The decomposition of the MSE (mean squared error) for the one-year-ahead wellhead natural-gas price forecast errors indicates that 54.7 percent of the errors can be attributed to systematic bias. This bias crests to almost 88 percent for the three-year-ahead forecasts. While random disturbances are substantial for the one-year-ahead forecast, the large proportion attributed to bias is noteworthy. A plot of the actual time series for wellhead natural-gas prices and the four different forecasts appears in Fig. 1 and illustrates the tendency of the EIA price forecasts to systematically under-predict actual prices. The results for electric generator's natural-gas costs are very similar to those for wellhead natural-gas prices.

Market Flows. Table 2 shows the forecast errors for natural-gas consumption by electricity generators and for dry natural-gas production. The forecast errors are much smaller than those associated with the forecast errors for prices, which is a common phenomenon. Price forecasting often is more difficult than forecasting demand and production series, which

TABLE 1 EVALUATION OF EIA NATURAL GAS-PRICE FORECASTS, 1998-2006

	Years Ahead			
	One	Two	Three	Four
Average Wellhead NG Prices				
Average Percentage Error	-16.0%	-30.3%	-41.8%	-45.5%
Average Absolute Error (\$/Mcf)	1.055	1.749	2.340	2.652
Root Mean Squared Error	34.9%	48.9%	54.3%	57.3%
Decomposition of MSE (proportion)				
Bias	0.547	0.651	0.876	0.845
Model	0.006	0.013	0.029	0.027
Random	0.447	0.336	0.095	0.128
Electric Generator's NG Prices				
Average Percentage Error	-16.0%	-29.1%	-39.5%	-43.0%
Average Absolute Error (\$/Mcf)	1.153	1.893	2.537	2.861
Root Mean Squared Error	33.4%	44.8%	50.8%	52.5%
Decomposition of MSE (proportion)				
Bias	0.565	0.672	0.868	0.854
Model	0.024	0.006	0.022	0.014
Random	0.412	0.322	0.110	0.131

TABLE 2 EVALUATION OF EIA GAS CONSUMPTION AND PRODUCTION FORECASTS, 1998-2006

	Years Ahead			
	One	Two	Three	Four
Electric Generator's NG Consumption				
Average Percentage Error	-15.3%	-15.0%	-14.6%	-14.7%
Average Absolute Error (TCF)	0.913	0.871	0.800	0.816
Root Mean Squared Error	19.7%	21.4%	20.1%	17.9%
Decomposition of MSE (% Contribution)				
Bias	0.575	0.548	0.577	0.704
Model	0.353	0.390	0.348	0.234
Random	0.072	0.062	0.075	0.062
Dry NG Production				
Average Percentage Error	1.6%	4.1%	5.5%	7.8%
Average Absolute Error (TCF)	0.590	1.053	1.152	1.527
Root Mean Squared Error	3.9%	6.1%	7.0%	9.2%
Decomposition of MSE (% Contribution)				
Bias	0.189	0.444	0.615	0.707
Model	0.472	0.417	0.285	0.221
Random	0.340	0.139	0.100	0.07

often contain a sizeable trend component or signal. Nevertheless, the forecast errors for these two key natural-gas market flows are substantial.

The EIA forecasts for natural-gas consumption in electricity generation consistently are below actual observations of gas use in this sector (see the average percentage errors in Table 2). This is somewhat counter-intuitive because given that EIA under-estimates prices paid for natural gas by electric generators, it would seem that lower prices would imply higher, not lower, natural-gas consumption, all other things held equal. One of the big changes affecting the electricity sector's use of fuels has been the sulfur-dioxide emissions-trading program. That program has exerted a dramatic effect on the opportunities for fuel substitution in power generation, as shown by Considine and Larson [6]. Whether the NEMS correctly mod-

TABLE 3: EVALUATION OF EIA NATURAL GAS IMPORT FORECASTS, 1988-2006

	Years Ahead			
	One	Two	Three	Four
NG Imports from Canada				
Average Percentage Error	-4.4%	-3.1%	2.0%	4.9%
Average Absolute Error (TCF)	0.184	0.245	0.285	0.347
Root Mean Squared Error	8.1%	8.9%	8.8%	10.9%
Decomposition of MSE (% Contribution)				
Bias	0.464	0.126	0.044	0.205
Model	0.246	0.613	0.669	0.625
Random	0.290	0.261	0.287	0.170
LNG Imports				
Average Percentage Error	-11.2%	-5.6%	-7.1%	-25.1%
Average Absolute Error (TCF)	0.146	0.160	0.193	0.155
Root Mean Squared Error	65.6%	53.4%	67.4%	59.8%
Decomposition of MSE (% Contribution)				
Bias	0.151	0.104	0.093	0.420
Model	0.455	0.255	0.515	0.036
Random	0.394	0.641	0.393	0.544

els the role of permits in power-sector fuel demand and fuel switching could be an important question.

The absolute error for the one-year-ahead forecast for electric generators natural-gas consumption is more than 900 billion cubic feet, which is more than 15 percent of consumption in this sector. In addition, the RMSEs are around 20 percent, nearly four times the errors found in econometric forecasting models of energy demand. [7] Like prices, the error decomposition analysis for natural-gas consumption by electric generators reveals a substantial bias across all four forecast horizons.

The forecast errors for dry natural-gas production reveal further problems. As the average percentage errors indicate, EIA consistently over-predicts dry natural-gas production. The absolute errors are quite sizeable in relation to marginal supplies of gas, specifically imports of LNG. For example, the one-year-ahead forecast error for production is 590 billion cubic feet, which is about equal to LNG imports in 2006. The two- through four-year-ahead forecast errors exceed one trillion cubic feet.

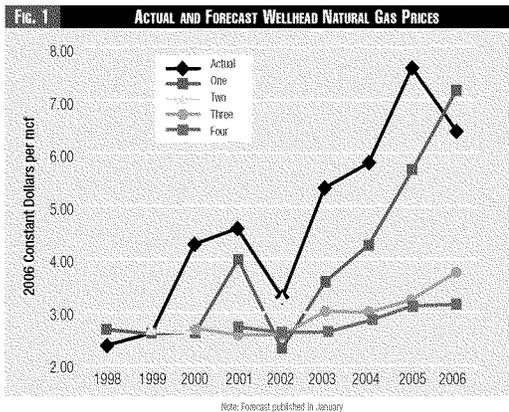
The mean squared error decomposition for natural-gas production also reveals sizeable bias, especially for the three- and four-year forecasts. Unlike prices and consumption forecast errors, the model component of the errors is more than 40 percent for the one- and two-year forecasts. This fact suggests that the model itself is generating systematic errors for the near-term forecast horizon. The time path of each forecast depicted in Fig. 2 illus-

trates that even though EIA has been scaling back its projections of natural-gas production, the model still portrays an upward track for production albeit from a lower base during each forecast year.

Imports. Another important factor influencing natural-gas markets is imports. The largest external source of natural gas into the United States is Canada, although EIA expects imports of LNG to become significant in the future. Among the forecast errors examined in this study, those associated with EIA's projection of imports from Canada are the lowest. Similar to the other forecast errors, however, the forecasts contain either bias or systematic errors arising from the model.

The projections of LNG imports are not as accurate as those for Canadian imports. The RMSEs are quite large and, while the bias components are relatively small, the proportion of the forecast errors associated with the model remains substantial, especially for the first and third year-ahead forecasts. This finding could be associated with the rather idiosyncratic nature of the LNG import forecasts.

To understand what is happening in the LNG forecast error decomposition, a scatter plot of the actual versus predicted LNG imports appears in Fig. 3. A perfect forecast in which the predictions are equal to the actual observations is plotted on the solid line. A "good" forecasting model should generate



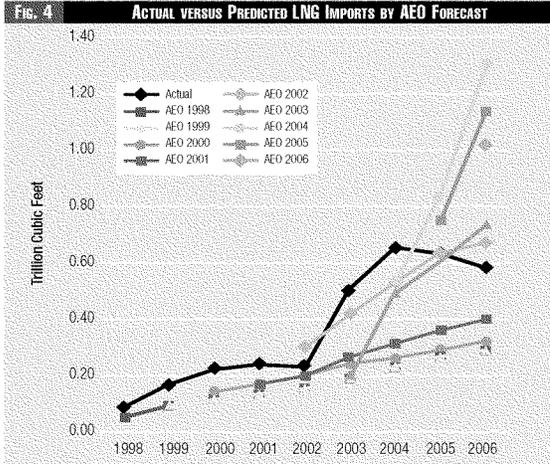
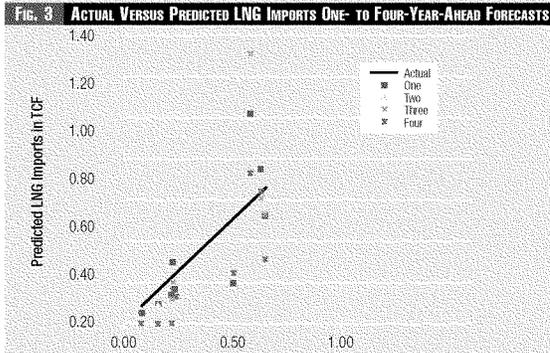
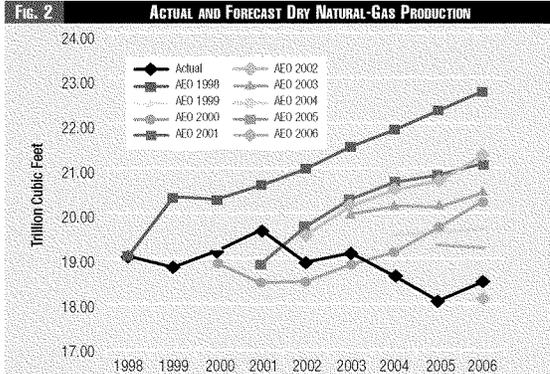
forecasts close to the line of perfect forecasts and randomly scattered around it. As Fig. 3 illustrates, there are several very large over-predictions of LNG imports. The small number of these very large errors most likely accounts for the erratic swings in the mean squared error components reported above in Table 3. Indeed, as Fig. 4 illustrates EIA substantially over-estimated LNG imports in each of the preceding three years.

Policy Implications

As the independent research branch of the Department of Energy, the EIA forecasts for NG possess an imprimatur that stretches across the panorama of energy policy and analysis. Thus, the socioeconomic implications of systematic bias are profound indeed.

Several important conclusions can be drawn from this research. First, the NEMS model used by EIA to generate the AEO forecasts tends to over-estimate NG production and to under-estimate NG consumption by electricity producers. While EIA forecasts of NG imports from Canada fare somewhat better, projections of LNG imports are over-estimated substantially. These errors are associated with significant under-predictions of market prices. Hence, the overall optimistic picture of ample NG supplies, and growing consumption with either falling or constant real prices has not been supported by actual experience.

Moreover, an error-decomposition analysis demonstrated that the variation in EIA's forecast errors generally are not reflective of random chance but instead contain evidence of systematic bias, either arising from a fixed, linear bias or



APPENDIX

METHODS OF FORECAST EVALUATION

There are a variety of metrics available to evaluate forecasts. No one measure tells the complete story but rather a suite of metrics and graphics must be employed to evaluate forecasts.

Since the National Energy Modeling System (NEMS) used by EIA to generate its forecasts equilibrates supply and demand, it seems most appropriate here to employ methods of economic-forecast evaluation in order to evaluate EIA forecasts of natural-gas markets. These methods all involve the computation of a variety of metrics that compare actual observations with predicted values.

The first metric is the average percent error defined as:

$$APE_t = \frac{1}{n} \sum_{t=1}^n 100 \cdot \frac{(P_t - A_t)}{A_t}$$

where t denotes the time period for a forecast horizon of n periods, P_t is the prediction from the model for period t , and A_t is the actual realized value of the variables in that period. As Auffhammer (see Reference [2], p. 67) observes, the problem with this metric is that large positive and negative values can cancel each other out. A similar metric is the average absolute error:

$$AAE = \frac{1}{n} \sum_{t=1}^n |A_t - P_t|,$$

which provides an estimate of the average magnitude of the forecast errors.

The third measure employed in this

study is the mean squared error, which is defined as

$$MSE = \frac{1}{n} \sum_{t=1}^n \left(\frac{P_t - A_t}{A_{t-1}} \right)^2 = \frac{1}{n} \sum_{t=1}^n (D_t - a)^2$$

where $D_t = (P_t - A_{t-1})/A_{t-1}$ and $a_t = (A_t - A_{t-1})/A_{t-1}$. Notice unlike the common average percent error, the mean square error compares predicted versus actual changes. In addition, squaring the errors has the effect of disproportionately penalizing large errors, either negative or positive. The square root of the mean squared error, often referred to as the root mean squared error (RMSE), is more commonly reported because the square root operator on changes closely approximates percent change.

Ideally, model forecast errors should be random, displaying no discernible tendencies to either over or under-predict, or no patterns of either getting smaller or larger over time. Economists and statisticians have developed a variety of methods to determine whether forecast errors exhibit randomness or systematic bias. These methods involve decomposing the mean squared error into various error components. There are a variety of methods to decompose the MSE into its various components. An approach devised by Theil [14], and later recommended by Maddalla [13], and subsequently used in many studies since involves the computation of the following three components:

$$B = Bias = \frac{(\bar{P} - \bar{A})^2}{MSE}$$

$$M = Model = \frac{(S_p - rS_a)^2}{MSE}$$

$$R = Random = \frac{(1 - r^2)S_a^2}{MSE}$$

where S_p is the population standard deviation of p , r is the correlation coefficient between p and a and S_a is the standard deviation of a , and all three measures sum to one, i.e. $B + M + R = 1$. Maddalla and Theil note that the bias and the model components measure what can be called "systematic" errors. If B is large, then the average predicted change deviates substantially from the actual average change. This is a serious error because forecasters should be able to reduce such errors in the course of time. In short, if B is close to 1, the forecast is considered biased. The model component of the forecast error reflects the linear association between the actual and predicted values. If M is relatively large then this would suggest that the model itself is generating systematic errors. In a perfect forecast, both M and B would be zero so that if the following regression was estimated:

$$A_t = \alpha + \beta P_t$$

$\hat{\alpha} = 0$ and $\hat{\beta} = 1$ so that $A_t = P_t$. A regression model is not estimated in this study because our sample of forecasts is relatively small. Therefore, we do not attempt to estimate statistical confidence intervals around our forecast evaluation metrics because the power of these tests would be weak given the small sample. —TJC, FAC

from a systematic error coming from the model itself. This evidence of forecast bias arising from perhaps the most comprehensive energy market forecasting system in the world illustrates the enormous difficulty of forecasting these markets. The emergence of a natural-gas cartel will add even greater uncertainty to the forecasting.

These results offer several lessons and suggest certain concerns about current and future forecasts at EIA:

1. **Gas Production.** First, the consistent over-predictions of NG production in the United States should raise serious

questions about the reliability of the premise that large supplies would become available with higher prices.

2. **Gas Use for Generation.** Second, the under-prediction of NG use in electric-power production even with unrealistically low prices suggests that other factors, such as sulfur-dioxide pollution permit costs, may be stimulating NG use in this sector. (This lesson suggests that the NEMS may not be adequately modeling factors that determine the electric-power sector's consumption of NG.)

3. **LNG Imports.** Third, the large over-estimates of LNG

imports suggest fundamental problems with the trade side of the model. Each of these three problems presents daunting challenges for energy market modelers.

4. A Bias Toward Optimism. Current EIA forecasts exhibit a continuing optimism. In the 2007 AEO, for example, NG prices are forecasted to decline over the next decade—despite the fact that wellhead prices have increased more than 100 percent in the last five years and that the EIA did not project the vast bulk of those increases. Further, the EIA forecasts that NG production will increase 11 percent by 2020. Yet the EIA has overestimated production substantially in virtually every forecast since 1998.

5. A Failure to Recognize the Problem. Despite the biased divergence between their NG forecasts and actual outcomes, the EIA has published virtually nothing on the question of asymmetrical error. In fact, EIA's model evaluation methodology may itself camouflage the problem. For example, Auffhammer [2] has commented that, "The EIA conducts its own forecast evaluation...[but] this type of evaluation ignores potentially persistent biases in the forecasting model."

The analysis reported here suggests that considerable caution should be exercised when using EIA forecasts relating to the future price, supply, and consumption of NG. Similar caution should be exercised when using NEMS to assess the broader economic impacts of energy policy initiatives, e.g., carbon cap-and-trade programs.

Climate-change proposals currently before Congress [3] depend heavily on predictions of the response of natural-gas supply and prices to carbon-permit prices. The actual capability of the NG supply network both here and abroad will be a critical factor in how economies adjust to such climate-change policies. Overestimating the supply capabilities of this network (as EIA has done over the past decade) could lead to underestimating the costs of carbon regulations. ■

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RESPONSE BY PAUL N. CICIO TO AN ADDITIONAL QUESTION FROM SENATOR INHOFE

Question. Based on the discussion on the hearing, is there anything else you would like to add?

Response. In our opinion, all previous EIA or EPA economic analysis on climate change legislation does not adequately address the issue of electric utility fuel switching from coal to natural gas and the costs implications to higher natural gas and electricity prices or the loss of resulting manufacturing jobs.

Much of the concern regarding natural gas supplies for industrial consumers is related to the impact legislation with near term emission targets will have on the availability of natural gas for manufacturing. Between now and 2012 there are few achievable options that will slow the electric utility need for natural gas.

Given forecasted supplies, this added demand by the electric utilities can only be obtained from natural gas currently used in the manufacturing sector. In 2005 the manufacturing sector used 6.6 trillion cubic feet (TCF) of natural gas. Short of a significant recession, to achieve 2005 emission levels in 2012 the electric utility sector will need additional quantities of natural gas that exceed the amount used in total by the manufacturing sector. They can do so because they can pay any price for natural gas, no matter how high and pass the costs onto their ratepayers. This is why we are concerned with emission targets which begin before additional supply of natural gas, new technologies or other efficiency improvements can be put into practice.

We will not succeed long term at reducing ghg emissions without increasing our use of low carbon intensive energy. That being said, it is essential that we increase the supply of affordable and reliable low carbon intensive energy. A "ghg cap" does not increase the supply of low carbon intensive energy because government and technology barriers prevent these products from getting to the market.

For example, setting a ghg cap will not increase the supply of natural gas from federal lands or waters that is off-limits due to Congressional moratorium. GHG caps will not build our Alaska Natural Gas Pipeline, increase LNG terminal import capacity or build new nuclear plants. We are concerned that we will face ghg reduction targets and none of the government or technology barriers will be removed in time to provide relief.

Removing these barriers is essential because it takes long periods of time to develop the resources. For example, we have about a 100-year supply of natural gas in our offshore areas currently off-limits but establishing a new field could take upwards to 5–8 years.

 RESPONSES BY PAUL N. CICIO TO ADDITIONAL QUESTIONS FROM SENATOR BARRASSO

Question 1. What impact will Lieberman-Warner have on Liquefied Natural Gas imports to the U.S.?

Response. Lieberman-Warner will significantly increase the demand for natural gas. We would expect the price of natural gas to rise significantly as well. Higher prices will be necessary to attract more LNG imports, if supply is available. Availability is not certain. While there is ongoing expansion of supply, demand is growing even faster. The potential formation of a LNG cartel is concerning.

LNG imports have increased since 2000 but remain only 2.7% of our nation's supply and actually decreased by 7.5% in 2006. Our full import capacity has not been utilized in recent years because we have been unable to compete in global markets for the LNG. In general, other countries regularly buy it away from companies who would bring it to U.S. terminals. Country governments have intervened to buy whatever quantities are needed at sometimes very high prices to supply their country's needs. These same countries are expanding their import capacity without the problems we have in the U.S.

The legislation would place higher demand on LNG because U.S. production of natural gas is being constrained by Congressional moratoriums. Higher demand above our domestic supply and the quantity that is imported from Canada would theoretically be LNG imports. Even though there have been dozens of attempts to greatly expand import terminal capacity only minor increases have occurred and mostly at existing terminals because of NIMBY.

The investments necessary for building a U.S. receiving terminal and the corresponding overseas production terminal are very large and take considerable time to move through both the financing and construction phases. As we have seen over the past few years it is much easier for the United States to import the products produced by IECA member companies. This trend will continue for a number of years and as the facilities are built or expanded to produce these materials overseas jobs are lost in the United States. If LNG facilities are later built it is unlikely that

the manufacturing jobs lost earlier will return to the U.S. This is similar to the situation described by Alcoa involving “stranded energy”.

Question 2. With increasing demand for energy both in America and around the world as a result of increased economic growth, technological solutions will be essential for countries to meet their energy demands while limiting greenhouse gas emissions. However, there are tremendous uncertainties about what technologies will most effectively address these issues.

As Congress continues to examine technological solutions to combat climate change, do you believe we have enough information to identify which technologies hold promise and therefore warrant investment?

Response. Important technology solutions do exist and can be very helpful in a relatively short period of time. Our favorite is industrial gasification. In fact, IECA supports language reported out by the Senate Finance Committee on June 27, 2007 that would enhance Section 48B industrial gasification (IG) incentives and which would provide new incentives for carbon capture and sequestration under Section 450. While generally supportive of the Finance Committee’s gasification proposals, we also suggest below, certain modifications that we believe will improve program operations and enhance public benefits.

For the past decade, U.S. environmental and energy policies have created new demand for natural gas use particularly in the generation of electricity. Tight supplies and the rising demand have resulted in natural gas price escalation and volatility with major adverse economic consequences to manufacturing. Many U.S. operations have been driven overseas to regions such as the Persian Gulf where fuel and feedstock prices are low. Section 48B was intended to help U.S. industry transition to domestic plentiful and low-cost alternative fuels and feedstocks in lieu of natural gas. The Section 48B incentives offer a tool to stem the loss of American industrial jobs, enhance our economic and national security, and serve domestic and global environmental goals.

From an environmental perspective, IG offers the quickest near-term, and most cost-effective commercial deployment of carbon capture and geologic sequestration (CCS) technology at economic scale. The first such plants can be operational within 3 years. From an economic perspective, IG with CCS will allow companies to substitute relatively inexpensive industrial waste such as wood chips or black liquor in the forest products sector, petroleum residues from refineries, or coal, for example, in lieu of natural gas.

Substituting lower-cost feedstock will help U.S. industry succeed in a globally competitive economy. Dampening natural gas demand by industry, the largest gas consuming sector, will also reduce prices for all direct and indirect consumers of natural gas. Because several CCS deployments at economic scale are needed to fully commercialize the technology, new authority is urgently needed largely as reported by the Senate Finance Committee in June of this year (i.e., increase investment tax credit ceiling by \$1.5 billion, increase the credit rate from 20% to 30%, and creation of CO₂ production or sequestration tax credits, etc.).

In addition to the increased authority reported by Senate Finance, we also have suggestions to improve the original Section 48B provisions beyond the Senate Finance Committee-reported amendments (see attached list). These suggestions include: (a) transparent, competitive process for selecting 48B ITC “winners;” (b) doubling Section 815 production tax credits to 150,000,000 tons of carbon dioxide emissions captured and sequestered (CCS) in deep geologic formations (automatically made available to 48B projects); and (c) indemnification of project sponsors who participate appropriately in federal incentive programs to test and demonstrate these novel carbon sequestration projects. Additionally, we recommend SNG and CO₂ pipeline incentives.

We believe that a carefully constructed industrial gasification incentives program will accomplish two important goals: diversification of energy use to sustain essential and innovative manufacturing sectors in the U.S. while lowering prices for all consumers; and development of critical environmental performance experience on which to build both an informed carbon emissions regulatory program and an accompanying liability framework worldwide.

IECA Supports the following:

48B Investment Tax Credit

- Support additional \$1.5B as reported from Senate Finance in June 2007
- Support increased ITC rate from 20% to 30% and accept CCS equipment requirement (but link Sec. 48B and Sec. 450) as reported from Senate Finance in June, 2007
- Add SNG producers to list of “eligible entities”
- Add codified DOE role to assure transparent and meritorious

- Awards process (operate under procedures similar to competitive contract solicitation)
 - Closing Agreement process must permit project improvements
 - Increase eligible investment from \$630M to \$1B (EPC cost increases of 50%)
- Production Tax Credit for CO₂ Sequestration (Amendment to Sec. 450 as provided in Sec. 815 of Senate Finance Committee-reported bill)
 - Increase cap on PTCs for CCS to 150 million tons (double that reported by Senate Finance)
 - \$10/ton EOR (as in Senate Finance-reported bill)
 - \$20/ton non-EOR (as in Senate Finance-reported bill)
 - Linkage: Amend Senate Finance bill to qualify 48B projects automatically for CO₂ PTC
- 45L—Refined Coal Credit
 - Contract volumes of SNG to electricity should qualify for refined coal PTC
- CO₂ Pipeline Depreciation
 - Support accelerated depreciation (7 years) as proposed in Senate Finance-reported bill June 2007
- CO₂ Regulation/Liability
 - Expedite permitting for early CCS actors
 - “Hold harmless” or indemnify PTC recipients from liability when “best efforts” have been applied
- Federal Loan Guarantees
 - Open to industrial gasification (section 1703 (c)), including SNG
 - Remove program dollar cap for self-pay projects

Lastly, for a globally competitive manufacturing sector in this country the competition for energy between the electric utility and manufacturing sectors must be reduced. Utilities have more alternatives for producing electricity than manufacturing has for producing its products. Nuclear energy and coal need to be a growing component of the fuel mix used by utilities to produce electricity. Renewables like wind and solar are important also but between their cost, intermittent nature and infrastructure requirements leave the energy needs of the manufacturing sector at risk for a significant period of time.

We cannot overemphasize that our concern is energy and feedstock supplies over the next 10-year period and the permanent impact this will have on U.S. manufacturing. Energy efficiency especially as it relates to our existing structures both residential and commercial offers the nearest term opportunity to reduce demand on existing energy supplies. Business, especially energy intensive business continually look at energy efficiency investments, but residential and commercial especially leased buildings have a harder time making investments that will improve energy efficiency.

Question 3. What do you think should be Congress’ funding priorities?

Response. More can be done to increase the availability and affordability of low carbon intensive energy by “policy decisions” than by funding decisions. (See the answer to Senator Inhofe’s question above.) With that aside, we offer the following areas.

- (a) Sufficient funding to create an adequate permanent storage solution for nuclear waste;
- (b) Much increased incentives for energy efficiency across all sectors. Residentials need much larger tax incentives to economically justify the cost of energy efficiency improvements. Energy intensive manufacturers continue to do what is cost justified. Significant hurdles remain where productive capital should be replaced to improve energy efficiency. For these types of investments to be justified it will take an acceleration of remaining depreciation on capital to be retired and faster depreciation on new lower energy consuming replacements. Tax incentives are needed to increase use of cogeneration, the most energy efficient way of producing energy and power. Both the faster depreciation and tax incentives for cogeneration and use of waste energy are high priorities;
- (c) Carbon sequestration;
- (d) Electricity transmission infrastructure.

Question 4. What are the costs to family budgets for middle class and low income people of implementing Lieberman-Warner in terms of energy bills and gasoline prices in the next 5 to 10 years?

Response. All direct and indirect costs of the legislation eventually get passed onto the consumer.

MIT completed a report¹ this summer that concluded the Lieberman bill would result in carbon costs of \$40/ton in the initial years and \$160/ton by the time the final cuts were realized in 2050, resulting in significant consumer energy cost increases as follows:

	Initial Year	Final Year
Petroleum Products (gasoline/diesel) \$/gal	0.40	1.60
Natural Gas \$/MM Btu	2.10	8.40
Electricity ¢/KWH	2.5	10

Secondly, in our opinion, all previous EIA or EPA economic analysis on climate change legislation does not adequately address the issue of electric utility fuel switching from coal to natural gas and the costs implications to higher natural gas and electricity prices nor the loss of resulting manufacturing jobs.

Lastly, while it is true that many new jobs will be created related to energy efficiency and renewable energy, it will be very difficult for the country to increase its productivity if the average cost of energy increases relative to today. Without increases in productivity the country will not be able to improve or possibly maintain its current standard of living. That has to translate into a portion of our population being worse off than they are today. For all consumers direct energy costs will be higher so home utilities and transportation costs will go up. The costs of products that contain energy like those produced by our members will go up. Imported versions of our products could be sold at lower cost if they are produced in parts of the world that have lower energy and labor costs than currently exist in the United States, which would serve as an offset to some of the direct energy cost increases.

Question 5. In 2050, how much cooler will the planet be if we adopt Lieberman-Warner?

Response. Unilateral action by the United States will not have a measurable impact because it does not achieve global reach. The legislation's provisions under Title VI will not work and compel countries like China to reduce its ghg emissions. Importantly, Title VI will not protect U.S. energy intensive industries from unfair competition.

With or without Lieberman-Warner no one knows what the planet's temperature will be in 2050. While it may be prudent to minimize emissions of greenhouse gases that can only be done if we create growing sources of low cost, low or non-emitting energy. Most of the products that are manufactured provide efficiency in meeting the needs of our population. Larger gains in emission reductions will be obtained looking at how we meet those needs than in how we produce individual products.

Senator LIEBERMAN. Thank you. Thanks, Mr. Cicio, I appreciate your thoughtful testimony.

I will now go to a round of questions, 5 minutes per Senator. I am going to begin by asking unanimous consent to enter six documents into the record that are statements by various organizations on the Climate Security Act, and two economic estimates of the Act.

[The referenced documents follow on page 156.]

Mr. Anton and Ms. Beinecke, to some extent you both expressed support for the Climate Security Act in whole or in part, and each made some recommendations of how you thought you would like it to be changed or improved from your perspective.

I want to ask you a kind of inverse question, because when you are writing a bill, as Senator Warner and I did, you are essentially answering questions. Do we include this? Do we include this that much? I wanted to ask you each to name one or two decisions that if had made differently you wouldn't have been able to be supportive of the Climate Security Act.

¹MIT Joint Program on the Science and Policy of Global Change. Report No. 146, April 2007.

Mr. ANTON. Mr. Chairman, as we reviewed the bill, the number one thing that we focused on and are pleased with is the credit for the early adoption. Alcoa plus other companies in the aluminum industry recognized this issue years ago and we took changes, altered our processes, and resulted in significant reductions in greenhouse gases. It is important to us that we are not penalized for that early adoption.

So our support would wane if the early adoption was dropped or the auctioning of credits immediately. We need that phase-in so we can work on our technology, continue to work on our improvements, and be competitive for the long term.

Senator LIEBERMAN. Interesting.

Ms. Beinecke.

Ms. BEINECKE. What I was saying is that we would be concerned if the caps were any looser. The caps in our view are about the minimum that would be required. As we were saying earlier, the scientists tell us we need an 80 percent reduction by 2050. So beginning down that road is very important.

The other is that if the phase-out of allowances were any slower, between the August version and this version, they tightened up, but if they got any looser that would be a serious problem for us.

Senator LIEBERMAN. One of the things we tightened up was the cap for 2020. Part of the reason we did that was in a meeting we had with the NRDC and other environmental groups, that was the one thing you said from our August draft you most wanted to see happen. Could you briefly explain why that is so important to NRDC?

Ms. BEINECKE. It is very important because getting on the right pathway, and if you looked at one of the charts that I had up, which showed if you start soon, you can get on the right trajectory for emission reductions, but the slower the start, the harder it is. So the mid-term cap is very, very important. We have the science now that tells us where we need to go.

In response actually to the comments about natural gas, we think that the cap and trade program will incentivize new technologies, more investment in renewables, and more investment in cleaner coal technology. So the sooner we put the cap and move forward in that direction, the sooner those investments will be made and will be able to transition the energy sector to be low carbon.

Senator LIEBERMAN. Thanks. Good point.

Dr. Moomaw, in your testimony, you suggested that "we broaden the range of sources that are capped, in particular natural gas used for purposes other than electricity generation." I think that is an intriguing idea, and I want to ask you to just say in a moment or two a little bit more about the mechanics of how that might work.

Mr. MOOMAW. Well, my concern is that if we exclude an entire fossil fuel sector, then we do create a kind of imbalance among the fossil fuels in the economy. Despite the legitimate concerns about the limited nature of natural gas, we know it is not going to last forever, so we are really looking at both natural gas and petroleum as kind of an intermediate fuel for the next few decades. By 2050, those will not be major contributors, in my view, because I don't think there will be enough of it available for them to be so.

If we do put a cap on it, then basically the trading is extended over into natural gas. That has the potential, then, actually to reduce some of the concerns that everything would shift to natural gas, because there is now a market both in the—for example, what are the other areas? Well, obviously home heating is one such area.

Senator LIEBERMAN. Right.

Mr. MOOMAW. I assume that one of the reasons that it was excluded is we didn't want to put burdens on homeowners and small businesses and so forth.

On the other hand, there are two schools of thought on it. One is the one that you have adopted here, which is well we just won't make them bear that burden. But I think they are going to bear it anyway because the price of natural gas is going to go up as we get the fuel switching. So I am not sure that excluding it solves that problem.

Whereas if it is included in the overall cap, then there will be incentives to find more efficient ways of using not only natural gas, but other substitutes, of going over to the demand side. I mean, if every home in America—my building contractor told me that to build an Energy Star house that uses 70 percent of the energy of a code built house—cost his customers not one cent more.

So you know, why don't we push down on that end as well as worry about—

Senator LIEBERMAN. Thank you. I am going to ask our staff to continue that conversation with you.

Mr. MOOMAW. OK. I would be glad to.

Senator LIEBERMAN. I appreciate the idea.

My time is up.

Senator Warner.

Senator WARNER. Mr. Chairman, I would like to yield to Senator Voinovich, who has a pressing need to depart.

Senator LIEBERMAN. Very well.

Senator Voinovich.

Senator VOINOVICH. Thank you, Mr. Chairman.

Mr. Cicio, your testimony indicates that the international provisions contained in this legislation will not work in providing global reach and protect you as companies from energy-intensive imported products. I have some idea of what you are talking about because I closely watch the chemical industry in this country. Several years ago, we were exporting about \$9 billion worth of chemicals. Today, we are a net importer of chemicals.

Could you elaborate more on your concern in terms of non-competitiveness of our country's businesses, as contrasted to, say, businesses across the pond?

Mr. CICIO. The provision that is in the bill will not work. We have had lawyers with 30-plus years of trade law experience, look at the provisions that you have in the bill. They won't work. I will just point to a couple of things. We (U.S. manufacturers) would be obligated to begin to reduce ghg emissions, starting in 2012. That is only 4 years away. The provision calls for obligations from energy-intensive importers of product to start in 2020. That is 8 years later. We have lost 3.1 million manufacturing jobs in just 6 years, from 2000 to 2006. With the additional costs of this legislation, we

fear that more manufacturers will move offshore. To significantly reduce the 8 years will violate WTO rules.

It simply will just not work. We would like to discuss alternatives with you, if possible.

Senator VOINOVICH. Thank you.

Mr. Roehm, we received a letter from the National Association of Wheat Growers, a 2005 letter. "Since 2000 when natural gas price levels and volatility began to increase, agriculture has spoken out at every forum available warning of a looming crisis because of public policies that create demand for certain energy resources like natural gas, while restricting access to supply sources. We have pointed out that the only way to solve this problem is to increase supply and reduce demand."

Further, the letter states, "While gasoline prices surely hurt consumers, the high and volatile natural gas prices affect agriculture's ability to produce an abundant food supply. This trend cannot continue."

Now, as an Ohioan, I am familiar with agriculture. We know that the cost of fertilizer has gone up dramatically in terms of our people. We know that many fertilizer companies have gone out of business because of the high cost of natural gas.

How do you balance that up against what you testified to today in terms of the benefits that you see from sequestration?

Mr. ROEHM. That is a very good question. We still are paying historically high fertilizer prices, but I have to say that the price of natural gas is actually off of its high, and yet we are still paying ultimate high prices in fertilizer. So the correlation between natural gas prices and fertilizer prices as of today is not correlating in the same direction.

Yes, natural gas is the primary source of fertilizer and it is very dependent on that price. Today, with different crop rotations that have been put in by market forces, i.e. a record number of corn acres, it has increased the supply of fertilizer. So we have more or different aspects of market forces affecting the price of fertilizer.

So I am aware of your concern. We have the same concern. I guess we would be favorable to finding any reasonable way of increasing supply of natural gas. We understand that it is a limited resource also, but the United States pays quite a bit more for natural gas than other countries in the world do. So there is probably some middle ground to solve that problem.

Senator VOINOVICH. I just want to comment and say to you that if this causes fuel switching on the part of those people that are producing energy in this country to more natural gas, I can guarantee you that your cost of fertilizer will go up. As Mr. Cicio says, we are going to lose a lot more jobs than we already have, and the folks in my city of Cleveland where I live are going to see their gas prices that have already increased over 300 percent, even go higher because of that. So that is a concern that we have with this legislation.

Mr. ROEHM. Well, I have to agree. I mean, it is a concern of the ag industry. Fuel and fertilizer are our two highest expenses, so this is an issue that we are not taking lightly. But I believe that the bigger picture and the whole aspect of it has to be looked at.

It is a national issue that is being discussed and agriculture needs to take a part of it.

Senator VOINOVICH. Thank you.

Senator LIEBERMAN. Thanks, Senator Voinovich.

Mr. Cicio, I noted your comment that the trade provision that we have, a provision to incentivize other countries was unworkable. Senator Warner and I took that provision from the Bingaman-Specter bill. If it works, we want it to be considered the Lieberman-Warner provision. If it doesn't, you should think of it as the Bingaman-Specter.

[Laughter.]

Senator LIEBERMAN. Senator Sanders.

Senator SANDERS. Thank you very much, Mr. Chairman.

Dr. Moomaw, you mentioned something interesting, how 100 years ago people grossly underestimated the potential of how electricity could transform our country. I think the same case could be made that in 1941 when this country was attacked at Pearl Harbor, nobody believed that within a year we could be producing the armaments, the planes, the tanks, to defeat Nazism and Imperial Japan. In the early 1960s, President Kennedy had the audacious dream to say that we could send a man to the moon. What a crazy idea that was, which took place a few years ago.

In just the last few years, I have seen things in my State and around this country. I have driven a retrofitted Toyota Prius that gets 150 miles per gallon. I have talked to people who live a few blocks away from here who through solar power are producing more electricity in a normal home than they are consuming.

In Vermont, I visited a landfill where methane gas is providing electricity to thousands of homes. In Addison County, Vermont, a methane digester is converting fertilizer to methane gas to electricity for hundreds of homes. In my city of Burlington, as a result of some of the actions we took when I was the Mayor back in 1989, not 1889. I am not that old.

[Laughter.]

Senator SANDERS. The city is now consuming less electricity than it did back then. In California, per capita I think electricity consumption hasn't risen because of energy efficiency. I have talked to manufacturers who tell us that small wind turbines can be manufactured and the fee is \$15,000, sold for \$15,000 a turbine.

My question for both Ms. Beinecke and Dr. Moomaw, is, in your judgment—I mean, I have been hearing a lot about nuclear energy, a lot of problems associated; coal sequestration, no one knows quite how to do it. I don't hear a whole lot about the potential of solar, the potential of wind, the potential of energy efficiency. Would either of you please, or maybe both of you comment? Dr. Moomaw, start.

Mr. MOOMAW. Yes. Just for example with regard to buildings. I mean, having worked with these experts from around the world over a 3-year period, I was struck by the fact that we identified several hundred things that could be done in buildings to make them more efficient. Basically, buildings in the United States today are like leaky buckets, and we can keep pouring more water in it, and we can probably fill it up if we put enough water in and keep it flowing, but a lot of it is just flowing out.

Senator SANDERS. The potential is enormous in terms of—

Mr. MOOMAW. The potential for energy savings is enormous. There is no question about it. When it comes to other technologies, you mentioned wind and solar power. Over the last 15 years, they have been growing at a compound average rate of over 25 percent a year for 15 years. Wind is now close to producing one percent of all the electricity in the world. It basically was not even around until the late 1980s.

A student of mine did an analysis of wind power, and in 1989 90 percent of all the wind power in the world was in California. There was none in Germany. Germany now produces more than twice as much as we do.

Senator SANDERS. You made the point—I am sorry to interrupt you; my time is limited—that the products that you needed to improve your own house are not even manufactured in the United States. So when people talk about economic dislocation, the potential for us to be producing solar and wind technologies is in my view enormous.

Ms. Beinecke?

Ms. BEINECKE. Yes, I would have to agree with Dr. Moomaw. There is tremendous eagerness in this country among the business community to get these things going. We have companies coming into NRDC literally every day who want to make investments in renewables, in efficiency technologies. There is tremendous opportunity. What there is not is predictability.

I think that is where this bill really comes in, where it can incentivize and give predictability over a period of time so companies are prepared to make the investments. I mean, we are all familiar with the production tax credits in the wind industry that change every single year. Well, you can't make the investment you are going to make if you don't have an assured future and policy commitment.

Senator SANDERS. Would you agree that if we put almost a small percentage of the kind of subsidies that we have given to nuclear and to fossil fuels we could radically change energy in America to sustainable energy?

Ms. BEINECKE. I absolutely think so. I mean, to echo Dr. Moomaw, I recently got back from a trip to Denmark where 20 percent of their electricity comes from wind power. There are many countries in this world that are getting a significant amount of their electricity from renewables because they have a cap and trade program, they have a renewable energy standard that they have committed to, and they have made it public policy.

I think if we can make it public policy here, I am saying there is tremendous eagerness in the business community to get going, but they need policies to help them move forward.

Senator SANDERS. Say a brief word on public transportation and a new rail system to break our dependency on the automobile and what that would do to energy consumption in this country.

Ms. BEINECKE. Well, I think that there is a tremendous need both to improve fuels and improve efficiency of cars, but also to reduce vehicle miles traveled. The only way to do that is through smart growth techniques and also incentivizing more public transportation.

I happen to live in New York City. We have great public transportation. People can get everywhere. That is not typical across the country, and the more we can make it available, the more we will reduce our demand on foreign oil and be able to give people alternatives.

Senator SANDERS. Dr. Moomaw, did you want to add anything?

Mr. MOOMAW. The only thing I would add is that in terms of inter-city rail, for example, being in the Boston area, I never go to New York by either driving or by air anymore. I take the train. However, the train by European standards is a little pathetic. On the other hand, it is vastly more comfortable and you don't have to spend all that time going through all that security stuff to get on it.

Senator SANDERS. Right. Absolutely. Let me just conclude, Mr. Chairman, by saying that we can create millions of good paying jobs as we move toward energy sustainability and energy efficiency.

Thank you.

Senator LIEBERMAN. Thanks, Senator Sanders.

Senator Inhofe.

Senator INHOFE. Thank you, Mr. Chairman.

First of all, I would think that Senator Barrasso would be wondering in his mind why is it, since he is the newest one here, why is it we have a hearing where four out of five of the witnesses are in support of the legislation and only one would be opposed to it, when you have heard it is not quite the same ratio up here at this table. But I do understand how that takes place, and I am not saying that in a critical vein. But I want the record to reflect that. I think that is very important.

Mr. Anton, let me ask you a question. I have here a projection of your company's report on global growth opportunities. I see that you envision no new growth or new production in America, but do envision many opportunities around the globe. I look at this, and I see Ghana, Guinea, Saudi Arabia, Vietnam, Madagascar—all around the world, but there is not one dot of growth in the United States.

Now, knowing this, would you say the increased costs of production in America would enhance or diminish the likelihood of your company moving this production overseas?

Mr. ANTON. First of all, we do have a significant manufacturing base in the United States.

Senator INHOFE. OK. Just answer the question. I am going to run out of time.

Mr. ANTON. Yes. We are committed to the United States, and in the United States, our strategy is to maintain our share, and overseas the biggest driver in the cost of aluminum is the cost of electricity. What we do is we try to find pockets—what we call stranded electricity—which is available where there is—

Senator INHOFE. That is fine, Mr. Anton. I appreciate that. I want to enter into the record this chart, because it shows no growth in the United States of America. It shows around the world where the growth would be.

[The referenced document follows on page 227.]

Senator INHOFE. Now, just yes or no, do you plan on calling for a cap and trade in these other countries as well as you are calling on for here?

Mr. ANTON. Yes.

Senator INHOFE. You are. All right.

I would like to put the chart back up, the EPA chart that we looked at earlier, if I can find where my references are. It happens that back during the discussion, back during the Clinton–Gore Administration, the discussion that took place as to whether or not we would be a part of the treaty, Senator Gore, or Vice President Gore at that time, had commissioned a study. Tom Wiggly, who is a very well known scientist at that time, was posed with the question that if all developed nations signed onto and complied with the emission requirements of Kyoto, how much would that reduce the temperature over a 50-year period? At that time, it came out with seven one hundredths of 1 °C.

Now, this chart here is really very similar to that. I would like to ask any of the witnesses—how about you, Mr. Roehm? Do you agree that with the costs that we have discussed that are associated with this, that this is an ambitious goal to have, to try to achieve? About a four percent increase?

Mr. ROEHM. Well, I am going to have to say that I know agriculture issues, and that is a scientific-based argument that I am not an expert in. I would have to defer to the scientists on that topic.

Senator INHOFE. What do you think, Mr. Cicio? Have you had a chance to look at this chart and what do you think about the cost of this relative to the benefits?

Mr. CICIO. I am sorry. I am not really prepared to answer that question.

Senator INHOFE. OK. If I understand correctly from your testimony, the only reason power companies don't combust an amount equal to our entire national consumption, and we are talking about natural gas right now, is that it is currently too expensive relative to coal. Is that accurate?

Mr. CICIO. They dispatch coal but natural gas is used as a peaking source of electricity.

Senator INHOFE. So if we significantly raised the cost of burning coal and create powerful incentives to shift to powering our electric grid using natural gas, what would be the consequences to our industrial base?

Mr. CICIO. The industrial base is already in a difficult competitive situation because the prices of natural gas in the United States have been on average the highest in the world. So we compete globally, and the high prices puts us at a disadvantage and that is why we are losing jobs.

Senator INHOFE. Would you say where those jobs are likely to go? Where are the plants likely to relocate? Like in Alcoa's case, will they be shipped to the developing world where they have that are shown on this map right here?

Mr. CICIO. Most certainly. We find that in many places around the world, and particularly the developing world, but not exclusively, that energy is subsidized to the manufacturing sector. Other countries really value the manufacturing sector as a place to in-

crease employment and for trade currencies. So they subsidize energy and manufacturing in other ways, which makes it difficult for U.S.-based operations.

Senator INHOFE. I think when Mr. Roehm said something about the lack of a correlation between the price of natural gas and fertilizer, you were shifting a little uncomfortably. Do you have any comments to make on that?

Mr. CICIO. Well, yes, because we have shut down something like I think it is 40 percent of all of the fertilizer capacity in the United States. So what is happening we are simply importing it. There is higher demand for fertilizer, but it is being produced in other places around the world, probably in processes that would produce it with less energy efficiency had it been produced here in the United States.

Senator INHOFE. Well, I agree with that. I am from Oklahoma. That is an Ag State and that is all I hear around is the cost of fertilizer as the single greatest increasing cost in terms of what their profitability is. It makes me wonder about why things are so different in Montana, but I am not asking you that question.

You stated also that the 2012 starting date is not reasonable. Would you elaborate a little bit on that?

Mr. CICIO. A 2012 starting date is too soon and will result in fuel switching to natural gas. We are here saying we want action by Congress. Actually, we demand action and we have been demanding action, saying we need more low cost, low carbon-intensive energy. We use a lot of natural gas, so we have been asking for Congress's help to remove barriers in that regard.

Senator INHOFE. Such as IGCC, coal and nuclear.

Mr. CICIO. Sure, more energy alternatives are needed.

Senator INHOFE. All right.

Thank you, Mr. Chairman.

Senator LIEBERMAN. Thank you, Senator Inhofe.

Senator Cardin, welcome. You are here for the second half of the game.

Senator CARDIN. Well, I got here in time to listen to the witnesses, rather than my colleagues.

Senator LIEBERMAN. That was very wise.

[Laughter.]

Senator LIEBERMAN. That was not a comment on Mr. Cicio's report that there was a deficit in the country in fertilizer.

[Laughter.]

Senator CARDIN. No, it wasn't.

Mr. Chairman, I must tell you, I did listen to all five of our witnesses here. It just reinforces the decision I made to join you and Senator Warner on this bill, because I think this bill is well balanced. I think it is a bill that speaks to what we need to do as a Nation, not only for the United States, but for international leadership.

It speaks to a concern that I think is universal, universally agreed to in America, and that is we need to do something about carbon emissions, greenhouse gases. We need to do it for our environment. If not for our environment, we need to do it for our national security because we are so dependent upon imported oil. If not for that, we need to do it for our economy because we have such

unpredictable pricing of energy that companies literally go out of business, as they have in Maryland because of the uncertainty of energy supply in my State.

So for any one of those reasons, we need to take action. I think this bill is well balanced. I notice that yes, we want to have alternative fuels that are available that are better for our economy and for our environment. We want to energize conservation efforts. It seems to me a cap and trade puts the right incentives in to accelerate that. Yes, there might be consequences that we cannot fully predict today. The proceeds from the auction will give us some financial ability to deal with that.

So I think the authors of this legislation have tried to put together a bill that addresses the concerns and does it in a way that brings us to where we need to be on a national commitment to reduce greenhouse gases.

So Mr. Chairman, I just want to ask a question to all of our witnesses, and that is, if you were sitting where I am sitting, and would have a chance to offer amendments to this legislation, and I am only given one amendment, what would that one amendment be in order to address what you think is something that needs to be strengthened or changed in this legislation?

Mr. ROEHM. Senator, I will start. I would amend by removing the 15 percent cap on ag offsets. Ag offsets could be and potentially will be a remedy for some of the fuel switching. If we can have an effective cap and trade and using offsets, you would not have to switch from coal to natural gas as quickly as some suggest.

Senator CARDIN. Thank you.

Mr. ANTON. Senator, I think where Alcoa would be is we appreciate that there is some protections to protect energy-intensive industries in the United States from import competition, but we are not sure that those are sufficient enough. We are working through the coalition with U.S. cap and we expect to be able to make recommendations to the committee through that avenue.

Senator CARDIN. I am not sure I totally know where you are heading. What are the alternatives you are looking at?

Mr. ANTON. Quite frankly, we don't have clearly delineated alternatives yet, but we recognize that as currently crafted, it can put the United States at a disadvantage, specifically in energy-intensive industries, from imports from outside the United States.

Senator CARDIN. I will be very interested to see your recommendations in that area.

Ms. BEINECKE. Senator, our number one recommendation, as I mentioned in my testimony, would be to ensure that the science look-back provision is coupled with authority by EPA to take action as the science gets clearer and time goes on to change the targets and timetables if that is merited going forward.

Senator CARDIN. I think that is a very good suggestion. We are having some fights right now with EPA on some authority that we gave them that we thought would have been exercised by now, the California waiver being one.

Ms. BEINECKE. We would agree.

Senator CARDIN. The time that they are taking on making that decision is just outrageous. I think that it should have been granted, and Maryland is directly affected by it because we are part of

that group. So I agree with your point, but I would hope that we would be pretty clear about the changes that we need to be where we want to be, and let it be dictated more by science, I agree.

Ms. BEINECKE. Thank you.

Mr. MOOMAW. I think the thing that I would encourage the most is setting a reduction target by 2050 down to 80 percent, rather than where it is, and to move to achieve that by really total coverage of the fossil fuel market, and getting those gains by strengthening the demand side features of this legislation. I think there is a lot to be mined there, a lot of energy savings to be mined.

Senator CARDIN. You acted just like a Senator. I said one suggestion, and you gave me three.

Mr. MOOMAW. I am sorry.

[Laughter.]

Mr. CICIO. Senator, we would recommend that you simply delay the cap until there is an abundant supply of low-carbon energy, including the technologies to deliver the use of vital resources like clean coal and nuclear energy, and affordable renewable energy.

Senator CARDIN. I would just respond that I think if we were to adopt that approach, we would just delay the availability of those sources of energy.

Thank you, Mr. Chairman.

Senator LIEBERMAN. Thank you very much, Senator Cardin.

Senator BARRASSO.

Senator BARRASSO. Thank you very much, Mr. Chairman.

As we are going forward to full committee hearings, I am hoping, Mr. Chairman, since local governments that rely on fossil fuel extraction in their local communities are significantly impacted, if we could possibly include one of those folks from a local community to testify.

Senator LIEBERMAN. It is a good idea. I will mention it to Chairman Boxer.

Senator BARRASSO. Thank you very much, Mr. Chairman.

Mr. CICIO AND MR. Roehm, the Billings newspaper, Associated Press article just last week said at least 16 coal-fired power plant proposals across the United States have been scrapped in recent months, and more than three dozen have been delayed as utilities face increasing pressure due to concerns over global warming and rising construction costs. It goes on to say, combined, the cancelled and delayed projects represent enough electricity to power approximately 20 million homes.

So it seems that one sector of fossil fuels is right now contributing less in a Nation where we need all the energy, all the sources—the renewables, as well as the fossil fuels.

Mr. Cicio, could you comment on that and the impact, and where that other fuel is going to come? Because I know in my community, people want to be able to turn on the lights, have it come on, and have it be inexpensive.

Mr. CICIO. In fact since those plants have been announced that they would not be moving forward, there has been a series of announcements that natural gas plants are moving forward. So that is the immediate response. Electric utilities have enormous responsibility to serve the public. They are going to build natural gas

plants if they can't build coal plants. It is reliable. It is low carbon, and it is a great alternative.

So that is what is happening and what is what will continue to happen unless we allow coal to be used.

Senator BARRASSO. Then do you see the technology coming on the line, where coal can be used by effective development of coal-to-gas, coal-to-liquid technology to allow the prices to stay down?

Mr. CICIO. The technology is coming along very well. I am not a scientist or an engineer in this regard, but we do need time to get the technology for carbon capture and carbon sequestration. We are going to probably need, I understand, 15 or 20 years to get the technology economical. But the technology is moving along fine. IGCC is moving along real well, and we have great hopes for its use to produce synthetic natural gas, and also as a feedstock, a feedstock for fertilizer, feedstock for the chemical industry.

Senator BARRASSO. Mr. Roehm, we talked about wind, and I know there was a large wind project that was ready to be built in Montana and it recently was rejected. I think there were some folks that protested just because of the look of the wind turbines. I know in Wyoming, we actually did some tax relief for the folks that want to build that, because we are looking for all the sources of energy.

We heard from others testifying that wind could get to a point where it is 20 percent of the electricity. Do you have any experience of what happened recently in Montana with that major—it was supposed to be the largest wind project in the country?

Mr. ROEHM. There has been development of wind energy in Montana. It is called the Judith Gap project. I think there are 93 wind turbines that were produced. It is on line.

You are correct. There was a program or project that was cancelled, and that was cancelled because of lack of transmission capacity, as simple as that. So other than that, I am no more informed on wind energy than what you read in the papers.

Senator BARRASSO. Then for the two that are proposing additional wind energy, there are issues of siting and then transmission. Transmission lines cost about \$1 million a mile, and usually where the wind is is not right in the large cities where the electricity is needed. I know there are some folks that are protesting even that very usable and renewable source.

Any comments on that please?

Mr. MOOMAW. Yes, my comment would be that, you know, we faced a similar situation when we began building large hydro projects in the 1930s and 1940s and 1950s. There was not a lot of population either along the Colorado River or in the Pacific Northwest. Yet when we did finally build, we built those dams, the Bonneville Project and so forth. I mean, that is where I believe Alcoa played a very major role, along with Boeing and other companies which made it possible for us to build all of the machinery that helped us in the Second World War.

So I wouldn't say that not having immediate access to the transmission lines is disqualifying. I think we have to look at it very carefully and decide if we want to put a lot of these out, say, in the Great Plains, which has a huge amount of wind, then we would

need to really back that up by putting the transmission lines there to bring it to population and industrial centers.

Senator BARRASSO. Thank you.

This is the last question for Mr. Anton, if energy prices increase for Alcoa because of the bill and the questions that we have raised, will your company offshore North American jobs overseas?

Mr. ANTON. Our goal is to maintain stability and maintain our U.S. employment. We obviously can't do that if we are not profitable. So as we said before, our goal is to maintain the U.S. jobs and grow overseas.

Senator BARRASSO. Thank you, Mr. Chairman.

Senator LIEBERMAN. Thanks, Senator Barrasso.

Senator Carper.

Senator CARPER. Thank you, Mr. Chairman.

To our witnesses, thanks again for being here, for sitting through all of our remarks and for sharing your own with us and your responses.

Ms. Beinecke, I said earlier in my statement, I mentioned Saginaw, Michigan. It was October of 2000, when then-Governor George Bush called for the next Congress to pass legislation, sector-specific, focus on power plants, and to reduce sulphur dioxide and nitrogen oxide, mercury and CO₂ emissions. Governor Bush became President, as we all know, and he offered legislation that they called Clear Skies. I always suggested we should replace that with Clearer Skies or Really Clear Skies.

But in any event, that proposal, as you know, had some problems. One issue in particular was that the Clear Skies failed to include, as we know, CO₂ emissions.

On your Web site—and I don't know how often you look at your Web site—but NRDC states, and this is a quote from your Web site, it says, "This is a serious mistake that will have serious consequences," that is the exclusion of CO₂. "If new legislation is passed affecting the electric power plant industry, plant owners will use it as a blueprint for the type of investments they make in coming years. Failing to include reductions in global warming pollution in that blueprint now will only raise the cost and difficulty of achieving them later." That is the quote from your Web site.

Let me just say, I completely agree. I have a similar concern that if we move the Lieberman-Warner legislation without simultaneously addressing sulphur dioxide, nitrogen oxide and mercury pollution from power plants, we will greatly hinder our ability to achieve and address those other pollutants later on.

Not long ago, I received a letter—in fact, I suspect some of my colleagues did, too—a letter from several environmental and health advocacy groups who share this concern. Among the folks who signed onto the letter were the American Lung Association, the Clean Air Task Force, and the National Parks Conservation Association. Their letter stated in part, and this again is a quote, "Climate legislation alone will not necessarily result in reduction in power sector nitrogen oxide, sulphur dioxide and mercury. We need additional power sector reductions to protect public health and the environment. It is clear that climate policy alone will not deliver these reductions."

It is a long windup. Here is the pitch. Ms. Beinecke, does the NRDC believe that air pollution from power plants is still a problem and that we need to address all four pollutants at the same time?

Ms. BEINECKE. Yes, Senator Carper, we do. Clearly, SO_x, NO_x and mercury continue to be a serious problem. They are a public health problem in the United States and we applaud your leadership and your continuing diligence to call for action on those issues.

We also, as I said earlier, think that carbon emissions, global warming pollution, is a serious global problem and needs to be addressed also.

So we look forward to working with you to make sure that these things are both addressed in the most effective way possible because clearly air pollution is not only a U.S. problem, it is a global problem. In fact, lots of pollution comes into the United States from other places as well. So we look forward to working with you in the future on this. We thank you for continuing to bring this up and remind us how important these issues are to public health in the country.

Senator CARPER. All right. Thank you.

Mr. Roehm? Will Roehm?

Mr. ROEHM. Yes?

Senator CARPER. Mr. Roehm, I have really more of a statement, than a question. Sometimes we are guilty of that. You may have noticed.

I introduced legislation earlier this year to address pollution from power plants and to establish a cap and trade program with respect to CO₂. The National Wheat Growers sent me a supportive letter because they believe that our bill, and I think there are a number of cosponsors, including the Chairman of our subcommittee, but the Wheat Growers were good enough to send a supportive letter because they felt that our bill does many of the things that you outlined in your recommendations today, such as unlimited carbon offset market and funding for agricultural practices that sequester or reduce greenhouse gases.

I believe these are important, and I just want you to know that I look forward to, and I don't know if I can speak for everybody who has cosponsored our four pollutant bill, but we look forward to working with you and other members of the agriculture community to make these changes to the Lieberman-Warner bill. I would welcome any thought that you have in response to that comment.

Mr. ROEHM. Well, we appreciate your leadership and we look forward to working with you and the entire committee on how agriculture can help address this pressing issue.

Senator CARPER. One of the things I just say to my colleagues—I have run out of time.

Senator LIEBERMAN. Oh, go ahead.

Senator CARPER. Are you sure?

Senator LIEBERMAN. I am not sure, but—

[Laughter.]

Senator CARPER. Mr. Kevin Anton, Mr. Anton, my son's best friend in his Boy Scout Troop is Kevin Anton. He spells it just the way you do. They are about to both become Eagle Scouts. We are real proud of them both.

You mentioned in your testimony that you are dissatisfied with the early action provisions of the Lieberman-Warner bill. An underlying theme in my efforts is to reward those who have already stepped up and recognized the need to address global warming, which is why I am a little concerned with several provisions of the bill that seem to reward what I would term inaction instead of those that have been leaders in providing action.

What do you recommend should be changed to improve the early action credit provision of the legislation authored by Senators Lieberman and Warner?

Mr. ANTON. We are looking for the actions to be recognized the earlier back we can go back to as a starting point. The aluminum industry, through the voluntary program with the EPA that we started in the mid-1990s is when the aluminum industry actually woke up to this issue. Since that point in time, we have been able to reduce our direct emissions by over 25 percent.

Senator CARPER. Good for you.

Mr. ANTON. That is what we want to get rewarded for.

Senator CARPER. All right.

Mr. Chairman, you have been generous. Thanks very much.

Again, thanks to our panelists.

Senator LIEBERMAN. Thanks, Senator Carper.

Senator Warner, Senator Voinovich was next. Would you like to go now? We will go to Senator Isakson and then you will wind it up.

Senator Isakson, thanks for hanging in there.

Senator ISAKSON. These guys have hung in there, and none of them have run to the restroom. I have been twice already.

[Laughter.]

Senator ISAKSON. Let me follow up on two answers to questions. I guess having a scientist and a chemist, Dr. Moomaw, I will ask you this first. I would assume you would agree with Senator Carper in terms of the ideal goal of reducing SO_x, NO_x, mercury, carbon, et cetera, from the electric generation.

Mr. MOOMAW. I believe that would be the most cost-effective way of doing it because basically if we have to go back a few years from now and have to retrofit after we have already spent a lot of money to get rid of the three pollutants, and then have to retrofit to do the fourth, I think that will be far more expensive.

Senator ISAKSON. Well, on that point, to the extent that you are familiar with the generation of electricity using nuclear fuel, would you not agree as compared to coal that we would be a quantum leap ahead by generating electric energy with nuclear rather than coal, in reduction of all four of those?

Mr. MOOMAW. There is no question about it, that it would reduce emissions. The question is, of course, the cost and the fact we have not solved the waste problem yet. Those are the two issues which really need to be addressed.

Senator ISAKSON. Right on target. We will get back to that in just a second.

Mr. Anton, when you were answering the question about the location of future facilities of Alcoa, I might interject. As a businessman, most major American companies as their market share matures in a developed country like ours seek to expand markets

overseas. So I am not looking at that as a negative, but you made a very interesting comment when you described why you were going, or one of the reasons you were going. I believe I heard you say we are going to locations where we have found pockets of available energy.

Mr. ANTON. Yes. The term we use in our industry is stranded energy, where there are large sources, preferably hydro, of electricity and not a significant population or other industrial base. It is very similar to what the doctor discussed with the BPA. It is the same model that is moving around the world.

Senator ISAKSON. It is also precisely what Mr. Cicio is talking about in terms of what drives American manufacturing and American business to invest is reliable, relatively cheap and abundant sources of energy, which brings me back to my nuclear question, because it is important to expand the mature market of the United States of America both from a standpoint of jobs and readily available energy. It seems to me like if we are going to talk about these very noble goals and important things to accomplish and leave out that one singular source which addresses both the SOx, NOx, mercury, et cetera, as well as the reliability, that we would be making a serious mistake.

So that was an editorial comment. As Mr. Carper said, we are all guilty of doing it.

My last comment on this is this. Dr. Moomaw made a great statement regarding the two questions are disposal of spent fuel and cost. If we were to take the nuclear title that exists today in the United States of America and our law, and address both that issue of storage, as well as financing guarantees and arbitration in the process of developing nuclear energy, we could make a major impact on both the cost aspect as well as a creative look at the storage aspect.

So I understand both those two challenges of nuclear, but they are somewhat handcuffed, solutions to that, by current United States law with regard to licensing and authorizing the construction of nuclear power plants. That was another editorial comment.

One last thing. Ms. Beinecke, you didn't make any comments one way or another. You talked about renewable sources of energy and alternatives and the reduction goals. Do you have a problem with the use of nuclear energy to accomplish that?

Ms. BEINECKE. Well, as Dr. Moomaw said, we have three issues with nuclear power. One is waste. One is security issues. The other is having nuclear compete head to head with other energy sources. So our view is that the way to address whether nuclear is a significant part of the future is through the carbon cap that sets a market on carbon, rather than through subsidies. It is a mature industry that has been around for quite a while, and 20 percent of our power comes from it, and we are not supporting subsidies that would further incentivize it. We think the incentives need to be in the technologies that are not yet mature.

Senator ISAKSON. What subsidy are you referring to?

Ms. BEINECKE. In the former Lieberman-McCain bill, there were proposed subsidies to incentivize more nuclear plants.

Senator ISAKSON. What kind of subsidy was that?

Ms. BEINECKE. I have to ask my crew. Loan guarantees and a direct investment subsidy. Why don't I provide answers to you?

Senator ISAKSON. I would appreciate that. I think Senator Carper wanted to ask me a question.

Senator CARPER. I just wanted to say, I realize there is some concerns with respect to nuclear, but there also is great potential here as we enter this century. The legislation that we had authored and introduced on four pollutants, we actually provide incentives for nuclear to try to make sure that we don't squander this opportunity. I hope that as this legislation moves forward that we will have a chance to revisit this.

Senator ISAKSON. Thank you, Senator.

Thank you, Mr. Chairman.

Senator LIEBERMAN. Thanks, Senator Isakson. You know, my recollection is, and I will go back and look at the bill that I had with Mr. McCain, is that it was primarily money to incentivize the creation of a new generation of nuclear power plants. In that bill, it wasn't subsidies. There were subsidies in the Energy Policy Act of 2005. That was separate, though.

Thanks very much.

Mr. MOOMAW. Those primarily were loan guarantees. It really didn't go to the utilities because they advocate raising the cap. They went to some of the niche providers, if I am not mistaken in that. But we will check on that and see.

Senator LIEBERMAN. I thought Ms. Beinecke's answer was interesting, which is that your hope is that the carbon cap will create a market incentive that will make nuclear attractive because it doesn't emit carbon.

Ms. BEINECKE. I didn't say that exactly. I said that a carbon cap would create a market incentive and demonstrate whether the nuclear industry would compete head to head with other sources.

Senator LIEBERMAN. OK.

Ms. BEINECKE. I didn't say make it attractive.

Senator LIEBERMAN. Got it. Maybe I was——

Mr. MOOMAW. Senator Lieberman, it is very interesting in this new report that just came out from the Nicholas Institute at Duke University.

Senator LIEBERMAN. Right.

Mr. MOOMAW. It shows that basically without ever mentioning nuclear or renewables specifically in your proposed legislation, that in fact just looking at this graph, I would say by 2050 there is three times as much nuclear simply by dealing with the cap, in other words, by setting the cap. Renewables are about twice as much as they would be just by setting the cap. So there is this, it may seem indirect, but it is actually a very powerful incentive for non-carbon emitting——

Senator LIEBERMAN. Once you create a carbon cap.

Mr. MOOMAW. It is the carbon cap that does it.

Senator ISAKSON. Mr. Chairman, I don't necessarily disagree with that. I understand that. But if the nuclear title and the NRC is so encumbered that getting there is not possible, then that doesn't do you a whole lot of good. Which is why I am very interested in seeing that we modernize the nuclear title as it exists.

Senator LIEBERMAN. Thank you.

Senator John Warner.

Senator WARNER. Thank you.

Senator LIEBERMAN. The Senator from Virginia.

Senator WARNER. I appreciate that.

I would say to my colleagues on this nuclear, I laid the foundation. We will address that issue. I will tell you. I want to also bring to the attention of all that the United States Navy has done a major amount of research in the time that elapsed, and it has been almost 20 years since our last reactor. We have some new science and new safety measures. Of course, the Navy has an extraordinary safety record on nuclear energy. So we will get there, I say to my good friend from Georgia. It is just that the Chairman and I have some considerations we had to take at this time not to put it in.

But I want to go to my good friend sitting down here at the end. I really enjoyed that dissertation about natural gas. Now, you noticed I am hobbling around here a little today with this old cane that I use on my farm. I broke it out. The last time I used it was June, and I was the leader on the Floor to get a bill through to put one natural gas drilling 100 miles off the shore of Virginia using surface on the ocean fixtures which were actually foolproof if a hurricane came along and took the rig off. The Floor sent me home beaten, battered, bloody and bruised.

[Laughter.]

Senator LIEBERMAN. Yes, but that was before you had that cane in your hand.

[Laughter.]

Senator WARNER. Yes. Where were you when I needed you?

[Laughter.]

Senator WARNER. You know, we really have to come to grips with the natural gas thing. I think there will be another day.

But I was interested in you responding to colleagues' good questions. By the way, Mr. Chairman, as you know, I am one of the older bulls around here. I am ending up my career here in another year or so. I have really not been to a better hearing, and I have seen about as many hearings as anybody around the United States Senate. This has been a good hearing.

Sure, the members got a little long-winded in the beginning, but that shows the level of interest in this thing. The superb response by the panel and written statements, they are all in the record fully, are they not?

Senator LIEBERMAN. Yes.

Senator WARNER. We have allowed that to be put in.

But you were talking about the international situation, how your squads of lawyers with 30 years of experience looked at him and said they won't work. Well, I will accept that premise, with a question: what will work, in your judgment? To deal with question number one in the minds of America, if we move forward and some of the other major industrial nations, and leading them, of course, is China and India, do not move forward, and take more of our jobs and our GNP away from us. While we are asleep, they are working night and day to take everything we have, both of them, in a competitive way. I am not suggesting too much unfairness. What do we do?

Mr. CICIO. Senator, you are right. This is a very difficult issue. The fact is that, as I mentioned earlier, energy costs, particularly natural gas, is cheaper in other countries. Manufacturing will respond to their shareholders and protect their interests by moving where they can grow.

Senator WARNER. But the question is, what do we do if we are going to move ahead, which I think is essential. As a matter of fact, I am excited about this hearing so much that this is my top priority for the next 14 months I am blessed to be in this Senate.

Senator LIEBERMAN. Hear, hear.

Senator WARNER. We are going to get it done. What do we do? Do you have a better provision? I really and respectfully say show it to us.

Mr. CICIO. The problem is that foreign countries don't play fair. Companies in a lot of places around the world—that my companies that my companies compete with—are state-owned or partially state-owned. As I said earlier, these countries subsidize these companies for a lot of reasons, particularly jobs and exports. The hard part is that if they are subsidizing energy and providing protective tariffs and such now, when it comes to carbon allowances, they are also going to subsidize carbon allowances for those companies. I don't know how to get around that.

Senator WARNER. All right. That is fair enough.

I am going to ask Ms. Beinecke. I have followed your organization many, many years. As a matter of fact, one of my five elections you were determined to whip me and get me out of business, but I beat you anyway.

[Laughter.]

Ms. BEINECKE. I don't think so.

Senator WARNER. I forgot what I had done, but it was something.

Ms. BEINECKE. That wasn't us.

Senator WARNER. That was a long time ago.

What do we do about this foreign issue? We have to address it, and your outfit has really spent a lot of time on these issues.

Ms. BEINECKE. Yes, Senator Warner. What I think is very important is for the United States to really demonstrate leadership. We are the largest emitter. We have been for a century and we need to show the pathway that will get the world there, I think.

As I mentioned earlier, there is a lot of eagerness and a lot of people in the business community who are looking at opportunities for the United States to develop the technologies and import them. I think it is an opportunity for us to be an economic powerhouse in showing the pathway.

I also think, as I mention in my testimony, that on the international side, we have a responsibility as well because I think global warming is a serious environmental issue, but it is a humanitarian issue also. We have to take responsibility for the emissions that we are generating, that Dr. Moomaw said will be in the atmosphere for literally centuries to come that will have impacts on poor people around the world, and are having them now.

I recently returned from a trip to South Africa, which is a brand new democracy struggling with supplying education, housing, health care to its citizens, and yet they are diverting money to deal

with adaptation issues from global warming—sea level rise, water shortages, other things.

So I think on the international issues, the best way to deal with it is to provide leadership and to show the pathway and encourage other nations to join us as we go forward.

Senator WARNER. Well, we will do that.

One last little question here to Professor Moomaw. I will bet you put on some of your final exams this question. The question would be, we hear much about the costs of implementing a mandatory cap and trade program. Can you address the cost of inaction?

Mr. MOOMAW. That is a great question. I will put it on my exam at the end of this term.

[Laughter.]

Mr. MOOMAW. Yes, in fact there are some really interesting new studies, one by the University of Maryland that just came out a couple of weeks ago and other analyses which look at the cost of inaction. The costs of inaction are high and most of these studies conclude that the cost of inaction on climate change will be higher than the cost of action.

I think there is a lot of background information to support that. As I said, I have reference to two of those studies in my testimony. I could get you more if you are interested.

Senator WARNER. Good. Thank you.

My time is up. I would ask that among the documents that you put into the record that I place in this from the European Commission. Some colleagues have asserted their failure in dealing with this, and I think this is a good rebuttal piece.

[The referenced document follows on page 192.]

Senator WARNER. I certainly thank this panel. Wish us well. We may have you return for our anniversary a year from now when we are about ready to get a final passage.

Senator LIEBERMAN. Thanks, Senator Warner. To hear you say that this is going to be your top priority for the remaining 14 months of your extraordinary career of service to our Nation is going to mean a lot to everybody who cares about seeing this done. Your decision to come to the leadership of this effort has made every difference. It has made passage of a strong climate change bill possible. I just can't say enough.

Senator WARNER. Time out, time out.

Senator LIEBERMAN. Time out. All right.

[Laughter.]

Senator WARNER. This is a top priority in between our trips regularly to Iraq and Afghanistan.

Senator LIEBERMAN. Yes, that is true. We have done that, too.

I just want to say a word about John's last question about leading. In the best of all worlds, wouldn't it be rational if the President of the United States could sit down with the President of China and the Prime Minister of India and say, colleagues, the United States is going to go first because we have been doing this for a long time emitting greenhouse gases, but I want your promise that by X date the two of you are going to follow.

It is probably not going to happen, but let's hope that without that kind of agreement, that that will be the effect when we take action. We are not doing it for them. We are doing it for us because

our country and our people are going to be grievously affected if we don't take the leadership in this global effort to stop the warming of the planet.

I thank you very much. It has been a long hearing. It has been constructive. It has been educational. You have helped us understand. We have good exchange. I would say for Senator Warner and myself that our doors are open for additional comments and input. This is, as I said earlier, a work in progress.

We are going to set a deadline for written questions to the witnesses. Members sometimes do that. They must be submitted by Friday and we are going to ask you for your responses by next Tuesday. We intend to go to markup, so-called, consideration of this proposal, the America's Climate Security Act next Thursday in the subcommittee.

I thank you very, very much. There has been a real spirit. Senator Barrasso happens to be the last one with me here. Your statements have been very thoughtful, typical of people coming at it in a way from different places of origin, but everybody acknowledges there is a problem here. Maybe the problem is so serious we are going to figure out how to forget party labels and everything else, and just do something right and good for the country and even the world.

So I thank you all.

The hearing is adjourned.

[Whereupon, at 5:45 p.m. the committee was adjourned.]

[Additional material submitted for the record follows.]

STATEMENT OF HON. BENJAMIN L. CARDIN, U.S. SENATOR FROM THE
STATE OF MARYLAND

Mister Chairman, thank you.

First of all, let me join the chorus of those congratulating Senators Lieberman and Senator Warner for the great work they have done in crafting the bill we have before us today.

I use the word 'crafting' to describe their work intentionally.

The America's Climate Security Act of 2007 represents a combination of ideas that are present in a number of other bills that had already been introduced. In addition, these Senators met with scores of people from inside the Senate and across America in refining the bill from the version that they first described earlier this summer.

Like the good statesmen that they are, Senators Lieberman and Warner have drawn upon the good work that others have advanced. They are generous in pointing out the provisions that were originally drafted by others and giving them due credit.

But the bill we have today is more than a combination of separate elements.

It is a cohesive piece of legislation that finally give us a solid framework to address the most compelling environmental, energy independence and national security issue facing our nation.

The bill requires that greenhouse gas emissions in America be slashed to just one-third of 1990 levels by 2050.

More than half of the emissions allocations under the cap-and-trade provisions will be auctioned off to the highest bidder with the proceeds being used for a number of public benefits including

- energy assistance for low-income Americans,
- developing new 'green' technologies, and
- protecting and restoring natural resource lands such as the Chesapeake Bay.

Importantly, the bill requires the National Academies of Science to review the most up-to-date scientific findings every 3 years. This will give the Congress and the American people an opportunity to strengthen the provisions in the bill in a timely fashion.

This is a major step forward for all of us who want to act now to curb the explosive growth in greenhouse gas emissions. It is comprehensive and bi-partisan and

everyone agrees that this bill represents our best hope of enacting meaningful global warming legislation during this Congress.

I will work to further strengthen this strong bill as it moves through the Environment and Public Works Committee and the Senate floor. I am a sponsor of S. 309, the Sanders-Boxer global warming bill which has more stringent mandatory targets than the America's Climate Security Act of 2007.

I would like to see a greater percentage of the emissions credits auctioned off and have those auctions phased in sooner. There are other provisions that I hope will be stronger as we go forward.

Mister Chairman, we have had 20 hearings on global warming.

- We have examined the science in detail.
- We have explored policy options.
- We have heard about the prospects for significant employment growth in the so-called 'green jobs' sector.
- We have heard from the faith community about the need to respect and nurture what God has given us.
- We have heard about the impacts on human health.
- We have seen the impacts of global warming that are visible today in Greenland and here in our own Chesapeake Bay.

I think there are ways in which we can make this strong bill even better.

The time to act is now, however, and I am proud to serve as an original cosponsor of the America's Climate Security Act of 2007.

I look forward to hearing from today's witnesses, and moving this legislation quickly to the full Committee and on to the floor of the Senate. The people of Maryland and the nation are waiting.

Questions about Lieberman-Warner
(S.1291 “America’s Climate Security Act of 2007”)

S.1291 was introduced on October 18, 2007. Based on an initial review of the bill through October 23, 2007, below are a small number of preliminary questions that require clarification or explanation regarding the construction the bill’s provisions. Upon further review and after an opportunity for stakeholders to comment, additional questions are expected to be raised.

1. Regarding the overall costs and benefits of the bill:
 - a. Has the bill been modeled by an econometric modeling firm?
 - b. Has a request been made to the Energy Information Administration or other federal governmental entity to model the bill?
 - c. If a request has been made from any entity, who is conducting the analysis and when is a response anticipated?

2. For Section 1201:
 - a. What is the basis for selecting a 2012 cap of 5.2 billion metric tons considering that total U.S greenhouse gas emissions are greater than 7 billion tons? (Section 1201(d)).
 - b. In response to a Bingaman-Specter request July 26, 2007, on October 1, 2007, EPA presented has an analysis of the global CO₂ impacts of several senate climate change bills. This analysis suggests that very stringent early phase reductions are projected to have marginal environmental improvements over climate bills with more gradual reductions during the early phases. Was this analysis considered in the selection of the early phase reductions?
 - c. From where is it anticipated that the early phase reductions will come from in terms of sectors and emission source types?
 - d. In terms of emission reductions, what percentage is anticipated to come from fuel switching, and what percentage from installation of new or replacement technologies?

- e. One oft-repeated approach to emissions reductions is to “slow, stop, and reverse.” Are the emissions targets chosen consistent with this approach?
3. For coverage under the bill:
 - a. What is the basis for selecting three out of six sectors of the U.S. economy for coverage under the bill?
 - b. Were the three sectors not covered because it would not be cost-effective to include them within the cap?
 - c. If cost-effectiveness was a criterion, what cost in dollars per metric ton that was used as a cutoff?
 4. A “new entrant” is defined as a facility that commences operation on or after January 1, 2008. (Section 4(19))
 - a. What is the basis for selecting that date as the cutoff?
 - b. What is the rationale for requiring commencement of operations instead of commencement of construction as used in the Clean Air Act?
 - c. Has the difference in the number of qualifying facilities between these two definitions been evaluated?
 5. For the definition of “facility”:
 - a. What does “any activity... at a facility” mean?
 - b. Could this include coal mining operations or the transport of coal to a facility via train, truck, barge etc.?
 - c. Does the definition of “facility” to include “any activity or operation” also include fugitive emissions that are not under the direct control of the facility?
 6. Under the bill, allowances can be borrowed for a period of up to 5 years. (Section 2302)

- a. Why was 5 years considered an appropriate time limit?
 - b. Would 6 or more years provide more flexibility for sources that find it necessary to borrow allowances?
 - c. What considerations are more important than that additional flexibility that necessitate the more restrictive time period?
 - d. Since the allowances become increasingly scarce over time, which creates a sliding upward pressure on price, to what degree is it anticipated the borrowing mechanism will mitigate allowance price increases?
 - e. If future allowance prices exceed market prices for current allowances, will this mechanism be effective?
7. The bill seems to indicate that the interest rate on borrowed allowances is 10%. (Section 2302) Is the interest compounded annually?
8. Under certain conditions, the bill allows covered facilities to satisfy up to 15% of its allowance submission requirement with allowances or credits from foreign GHG trading markets. (Section 2501) One of these conditions is that the foreign government's program be of "comparable stringency" to the U.S. program. (Section 2502(b)(2)).
- a. What criteria would EPA use in determining whether the emission caps, for example, of another country are "comparable" to those of a U.S program?
 - b. Would this "comparable stringency" be based on regulatory requirements or on compliance?
9. Under Section 2603, a Carbon Market Efficiency Board shall carry out one or more of six "cost relief measures" if the board determines that the emissions allowance market "poses a significant harm to the economy of the United States."
- a. Would the board be empowered under the bill to provide cost relief measures if the economy of a region or an individual state faced significant economic harm?

- b. What criteria would the board use to make a significant harm determination?
 - c. How would the board determine which measures and the precise extent of those measures that would be adequate to mitigate significant economic harm?
 - d. How would the board coordinate its activities with the Federal Reserve board in decision-making to relieve inflationary pressures on the economy, and which would be lead as between them in decision-making?
 - e. What allowance price is contemplated to pose significant risk of harm to the economy?
 - f. Is it contemplated that the CMEB will provide the same level of certainty for investors in advanced technologies as a tax or safety valve?
10. Section 3402 requires EPA to allocate extra allowances to states that enact statewide GHG reduction targets that are more stringent than the targets established under the bill.
- a. What is the basis for providing an explicit inducement for states to adopt more stringent requirements?
 - b. Could this lead to inconsistencies among state programs that reduce the potential cost-effectiveness of a nationwide program?
 - c. What is the basis for an allocation level of 2% of the allowances for this purpose?
11. Section 3501 allocates 10% of the allowance account annually to load serving entities, which are overseen by state regulatory bodies. Section 3503(c)(3) prohibits the exercise of certain prerogatives on the part of these state regulatory bodies such as requiring the filing of rate cases in order to pass through the credit from the sale of allowances. What is the purpose of this provision?

12. Title III, Subtitle F provides bonus allowances for carbon capture and geological sequestration projects. Section 3604 limits these bonus allowances to the first ten years of operation. What is the basis for limiting the incentive to ten years?
13. Title II, Subtitle D states that domestic offsets have to be permanent. What exactly does that term mean in terms of biologic sequestration?
 - a. What are the anticipated impacts to food prices associated with providing incentives to farmers to convert cropland to grassland or rangeland?
 - b. What would be the impact of such incentives to production of ethanol and the cost of ethanol?
14. Section 3903(b) distributes allowances to rural electric cooperatives equal to their 2006 emissions. What is the basis for giving preferential treatment to rural electric cooperatives?
15. Regarding Section 1103(d):
 - a. What methods are facilities contemplated to employ to determine complete and accurate data for the years 2004 through 2007 where no data was collected or readily available?
 - b. Also for Section 1103(d), how are facilities that currently do not have monitoring systems in place going to be able to submit quarterly data starting in 2008?
 - c. Is the \$25,000 per day for each violation going to apply these facilities for these time periods?
 - d. What is the process, and who is the authority, for determining what constitutes complete and accurate data for these time periods?
16. Based on EPA's 2005 U.S. greenhouse gas inventory, the electric generating sector accounted for 46% of the proposed 2012 cap level of 5.2 billion metric tons. Between allocations to generators and load serving entities, the bill allocates 30% of the total allowances to that

sector, and reducing the sector's subsequently. What is the rationale for this differential treatment of the electric sector?

17. The allowance allocation to electric generating units in the first year of the program represents approximately 44% of that sector's 2005 emissions based on EPA's inventory. Electric demand is anticipated to increase, and reducing emissions by replacing current plants with lower or non-emitting plants will take years to achieve. Based on this, does the bill contemplate some mechanism, or set of mechanisms, whereby emissions will be reduced during this timeframe or allowances will be available, or will allowances have to be purchased?
 - a. If purchased, have preliminary cost estimates to electric generators and their customers been calculated?
 - b. At least one preliminary estimate indicates that the cost of allowances alone could be close to \$500 for average households in the early years for some generators. Have cost estimates of electricity price increases to households through the purchase of allowances been calculated or modeled?
18. Section 3803 allocates 3 percent of allowances to projects in other countries for forest carbon activities.
 - a. What is the projected subsidy to other countries under this provision?
 - b. China's carbon dioxide emissions now exceed that of the United States and are projected to increase. Will China or other countries whose emissions eclipse those of the United States in the future be eligible for these allocations?
19. Regarding Section 8001:
 - a. This Section calls for a national assessment of carbon dioxide storage capacity. Presumably, this assessment would determine whether the US has sufficient capacity to geologically sequester the carbon dioxide that would have to be captured to comply with the bill. Absent the results of this survey which has not been undertaken yet, what is the basis for assuming the U.S has adequate storage capacity?

- b. How do you envision the program addressing the long term oversight of the carbon storage sites?
 - c. This Section provides EPA with the legal authority to develop a permitting program for carbon storage through the Safe Drinking Water Act's Underground Injection Control program. Long term monitoring and particularly in the west, property rights, are just two of the several issues that will need to be taken into consideration under any regulatory regime.
 - i. Is the bill's approach sufficient to address these issues?
 - ii. Should there be a statutory role for the states?
20. Subtitle G, Section 4702(b)(1)(F) stipulates money is available for adaptation activities in accordance with recovery plans for threatened and endangered species.
- a. Does the bill envision that all existing recovery plans will be rewritten to address all climate change related effects?
 - i. If so, will the monies in the adaptation fund be available to FWS to re-write the recovery plans or will FWS have to bear that cost from other monies?
 - b. Within Subtitle G, how does the bill contemplate FWS will prioritize species to receive adaptation funds?
 - i. Is it based on their overall threatened or endangered status or the degree to which they are affected by climate change?
 - ii. Are plants and animals not affected by climate change eligible for these funds?
 - iii. How does the Department of Interior distinguish those ecological processes that are due to man-made climate change from those that are due to normal species development and evolution?

**American Fisheries Society * American Sportfishing Association * Association of Fish & Wildlife Agencies * BASS/ESPN * Bear Trust International * Berkeley Conservation Institute * Boone & Crocket Club * Catch-A-Dream Foundation
The Campfire Club of America * Congressional Sportsmen's Foundation Conservation Force * Dallas Safari Club * Ducks Unlimited * Federation of Fly Fishers * International Hunter Education Association * The Mule Deer Foundation
National Assembly of Sportsmen's Caucuses * National Trappers Association National Wildlife Federation * Pheasants Forever * Pope & Young Club * Quail Forever * Quality Deer Management Association * Rocky Mountain Elk Foundation
Theodore Roosevelt Conservation Partnership * Trout Unlimited * Wildlife Forever
Wildlife Management Institute * The Wildlife Society**

October 18, 2007

Honorable John Warner
United States Senate
Senate Russell Office Building
Washington, DC 20510

Honorable Joe Lieberman
United States Senate
Senate Hart Office Building
Washington, DC 20510

Dear Senators Warner and Lieberman:

The organizations on the letterhead, representing millions of hunters, anglers and other conservationists, very sincerely appreciate your willingness to add a balanced and thoughtful fish and wildlife conservation funding proposal to your climate change legislation. Your carefully-crafted proposal will help ensure the long-term survival of fish and wildlife by providing important new resources through direct spending to address the impacts of climate change.

State fish and wildlife agencies and the federal natural resources agencies will be instrumental in implementing conservation strategies to mitigate the impacts of climate change on fish and wildlife resources and their habitats. Funding for these efforts should be delivered through existing programs with track records of success in on the ground conservation, as called for under your proposal. At the state level, the long-standing and successful fish and wildlife restoration programs provide the most appropriate means of delivering many of the needed conservation benefits.

We particularly appreciate the fact that you intend to provide forty percent under direct spending of the natural resource conservation funding available under your legislation to be spent through the Wildlife Conservation and Restoration Account established under the Pittman-Robertson Wildlife Restoration Act for comprehensive programs to remediate impacts from climate change to all fish and wildlife species. The state cost share requirement of ten percent will help ensure that states can utilize these funds immediately to implement conservation actions and put needed habitat on the ground. By funding state fish and wildlife agencies in this manner, your legislation will effectively and efficiently support critical activities that enhance the resiliency and sustainability of fish and wildlife and their habitats to climate change.

Federal agencies also will play an important role in assisting fish and wildlife to adapt to the impacts of climate change and we applaud your efforts to provide direct

spending resources for a wide range of important federal programs, including implementing cooperative grant programs that benefit fish and wildlife.

In conclusion, our organizations, representing millions of American sportsmen and sportswomen, thank you again for working with us to help address the challenge of climate change by both reducing emissions of greenhouse gases and providing important new resources to assist fish and wildlife survive in the face of this unprecedented challenge. We look forward to working with you and your staff on this very crucial and complex issue as your legislation moves forward.


AGRICULTURAL CARBON MARKET WORKING GROUP

Agriculture addressing climate markets

October 18, 2007

Senator Joe Lieberman
706 Hart Office Building
Washington, DC 20510

Dear Senator Lieberman:

As members of the Agricultural Carbon Market Working Group, we are writing to thank you for your work to date on a climate bill that provides opportunities for the agriculture industry. The Agricultural Carbon Market Working Group is unique for our industry in that it is comprised of national farm leaders from all three major commodities, the biofuels industry, and other key agricultural stakeholders. Together, we have spent the last two years studying and addressing potential carbon offset markets for agriculture that could result from national policy. We have also worked with our respective agricultural organizations to begin addressing issues related to climate markets for the agricultural sector.

Your bill with Senator Warner takes an important first step in providing the necessary infrastructure for agriculture to be recognized for the immediate, cost effective and real greenhouse gas reductions and offsets our industry can provide. We are particularly pleased to see the agriculture industry presented with the option of pursuing a carbon offset market – which we believe is the right policy for both the environment and for launching a new agricultural commodity: carbon. We strongly believe in agriculture's ability to help mitigate the climate change problem. As such, we urge you and your colleagues to remove the 15% limit that applies to the offset market. The carbon offset program should generate real, measurable and verifiable emissions reductions or offsets – and then it should not limit the market's ability to utilize this important tool to reduce greenhouse gas emissions.

It is our hope that you would support agricultural offset policies that not only allow us to help improve global climate conditions, but also to generate new revenue streams for agriculture. While we understand that Congress is examining several policy alternatives, it is our position that a market-based system that treats carbon as a commodity would spur new technologies and generate significant revenue for agricultural practices that reduce emissions and sequester carbon. However, a key to our ability to fully participate in this new market—which could be one of the five largest agricultural commodities in the United States—are policies that do not limit our ability to participate or cap prices.

In addition, we would ask you to consider policies that would:

- Encourage USDA to establish standardized Measurement Monitoring and Verification protocols to verify changes in soil carbon for market-based applications;
- Treat agriculture and forestry offsets separately and distinctly; some have proposed treating them as one source of offsets, since both offer emissions reductions from terrestrial or biological carbon sinks.
- Consider policies that do not penalize those among us who are early adopters of conservation tillage.

Thank you for the opportunity to address some of these issues. We would encourage you to view us as resource in the future and we wish you success as you move forward.

Sincerely,

The Agricultural Carbon Market Working Group Steering Committee
(see attached)

AGRICULTURAL CARBON MARKET WORKING GROUP

Agriculture addressing climate markets

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Christine Hamilton is president and CEO of Christiansen Land and Cattle, located in Kimball, S.D. She also serves on the board of Powering the Plains (a Great Plains Institute project), which is spearheading renewable energy ideas and policies in Minnesota and the Dakotas. Christine is also on the board of the SDSU Foundation and is former state director on the Parks and Game Commission.

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Dick Wittman farms, ranches and has extensive timber holdings on the family operation in Idaho. The former president of the Pacific Northwest Direct Seed Association, Dick has had experience in direct carbon market trades.

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Carl Mattson

Carl is a wheat producer in Northcentral Montana and has been involved in conservation issues for several years. Carl also serves as Conservation and Farm Program Associate for the Montana Grain Growers Association.

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Lance Woodbury

Partner, Kennedy & Coe

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Chuck Rice, director, CASMGS

CASMGS is a nine-state University consortium dedicated to carbon sequestration and other technologies that include agriculture as a potential solution to climate change. The consortium is housed at Kansas State University.

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October 23, 2007

The Honorable Joseph I. Lieberman
 United States Senate
 706 Hart Senate Office Building
 Washington, DC 20510

The Honorable John Warner
 United States Senate
 225 Russell Senate Office Building
 Washington, DC 20510

Dear Sirs:

The U.S. Climate Action Partnership (USCAP) would like to thank you for advancing Congress' efforts to forge comprehensive climate legislation by your introduction of S. 2191, America's Climate Security Act. In particular, USCAP commends you for your plan to hold a hearing followed by a markup in your subcommittee on a greenhouse gas reduction bill, and urges the subcommittee and the full Environment and Public Works Committee to act this year to report out a bill that can be taken up and passed by the Senate in this Congress. We look forward to working with you, Chairman Boxer, and other committee members toward the accomplishment of that goal.

USCAP has pledged to work with the President, the Congress, and all other stakeholders to enact an environmentally effective, economically sustainable, and fair climate change program consistent with USCAP's principles at the earliest practicable date. These principles are articulated in the USCAP "Call for Action," available at www.us-cap.org.

We are confident that the environmental and economic objectives described in the Call for Action are attainable if we promptly enact an economy-wide, market-driven approach that includes, among other things, a well-crafted cap-and-trade program that places specified limits on greenhouse gas emissions, robust cost-containment measures, complementary policies and measures, and a fully funded federal technology research, development, demonstration and deployment program for climate-friendly technologies.

While we have not yet completed a detailed review of The America's Climate Security Act of 2007, we believe it addresses many of our recommendations. These areas include:

- Timelines for reductions that are guided by the USCAP recommendations.
- A mandatory program, including cap-and-trade, which places a limit on six greenhouse gases (GHG), with a scope of coverage that includes emissions from large stationary sources and from transportation.
- A GHG registry.
- Inclusion of cost control measures, such as cap-and-trade, borrowing, and the use of domestic offsets and allowances from other country programs.

- Provisions to recognize those firms that have acted to reduce GHG emissions.
- Use of public/private partnerships to promote climate-friendly technology, including carbon capture and storage, with a stable revenue stream independent of Congressional appropriations, to include funding for demonstration projects.
- A requirement for the Environmental Protection Agency (EPA) to develop and promulgate regulations promptly to permit long-term geologic sequestration of carbon dioxide.
- Complementary policies to realize the potential of energy efficiency as a high priority resource and cost-effective means of reducing greenhouse gas emissions.
- Provisions that would strongly urge the Administration to safeguard U.S. interests by engaging in international climate negotiations, and to establish a post-2012 international framework for limiting GHG emissions worldwide.

The Act includes much more detailed provisions than contained in the Call for Action. USCAP members are continuing to discuss the issues raised by a number of these provisions, such as:

- Scope of coverage and complementary policies and measures.
- Sector-specific emission reduction timelines and targets.
- Allocation of allowances.
- Cost containment measures.
- Credit for early action.
- Domestic offsets.
- International offsets.
- Relationship of state and federal GHG programs.
- Implementation of the GHG registry.
- Addressing disproportionate economic impacts.

USCAP will review these provisions and work to develop additional recommendations that reflect USCAP's commitment to enactment of climate legislation as soon as possible that is environmentally effective, economically sustainable and fair to all economic sectors, geographic regions and stakeholders.

USCAP's recommendations also include other measures that are not currently in the bill. Additional elements USCAP recommends as the Congress considers comprehensive climate legislation include:

- Provisions assuring economy-wide greenhouse gas reductions through market mechanisms and complementary measures, including policies to cost-effectively promote lower carbon transportation fuels and new low emission vehicles and to efficiently decrease vehicle miles traveled.
- Provisions that would recognize and address the need for adaptation assistance to vulnerable populations, boost support for climate-friendly technology in developing countries, and use of verified emissions offsets from projects outside the U.S.

On behalf of all USCAP members, we look forward to working with you to advance comprehensive climate legislation. For additional information, please have your staff contact Merribel Ayres, Coalition Coordinator, at 202-822-2000.

Respectfully submitted by:

Alcan, Inc.

Richard Evans
President, Chief Executive Officer &
Director
Montreal, Quebec

Alcoa

Alain Belda
Chairman and Chief Executive Officer
New York, NY

American International Group, Inc.

Martin Sullivan
President and Chief Executive Officer
New York, NY

Boston Scientific Corporation

Paul LaViolette
Chief Operating Officer
Natick, MA

BP America, Inc.

Robert Malone
Chairman and President
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Caterpillar Inc.

James Owens
Chairman and Chief Executive Officer
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Chrysler LLC

Robert Nardelli
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Auburn Hills, MI

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The Dow Chemical Company

Andrew Liveris
Chairman and Chief Executive Officer
Midland, MI

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Chairman, President & Chief Executive
Officer
Charlotte, NC

DuPont

Charles Holliday, Jr.
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Environmental Defense

Fred Krupp
President
New York, NY

Exelon Corporation

John Rowe
President & Chief Executive Officer
Chicago, IL

Ford Motor Company

Alan Mulally
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Dearborn, MI

FPL Group

Lewis Hay III
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Juno Beach, FL

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General Motors Corporation

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Johnson & Johnson

William Weldon
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New Brunswick, NJ

Marsh, Inc.

Michael Cherkasky
Acting Chief Executive Officer
New York, NY

National Wildlife Federation

Larry Schweiger
President and Chief Executive Officer
Reston, VA

Natural Resources Defense Council

Frances Beinecke
President
New York, NY

NRG Energy

David Crane
President & Chief Executive Officer
Princeton, NJ

PepsiCo North America

John Compton
Chief Executive Officer
Purchase, NY

Pew Center on Global Climate Change

Eileen Claussen
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PG&E Corporation

Peter Darbee
Chairman, Chief Executive Officer, and
President
San Francisco, CA

PNM Resources

Jeffry Sterba
Chairman, President & Chief Executive
Officer
Albuquerque, NM

Rio Tinto

Preston Chiaro
Chief Executive Officer
London, UK

Shell Oil Company

John Hofmeister
President and Country Chair
Houston, TX

Siemens Corporation

George Nolen
President and Chief Executive Officer
New York, NY

The Nature Conservancy

Stephanie Meeks
Acting President (Chief Operating Officer)
Arlington, VA

World Resources Institute

Jonathan Lash
President
Washington, DC

Xerox Corporation

Ursula Burns
President
Rochester, NY

CLEAN AIR TASK FORCE

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 F 617.624.0230
 www.catf.us

To: David McIntosh, Counsel and Legislative Assistant
 Office of Senator Joseph Lieberman

From: Joe Chaisson, Research and Technical Director
 Clean Air Task Force

Date: October 23, 2007

Re: Preliminary Analysis of S. 2191, America's Climate Security Act (ACSA)

CATF commissioned OnLocation to analyze key provisions of ACSA using the NEMS model, which EIA uses to analyze proposed climate policies. The model is capable of making projections only out to 2030.

Here are the key results:

	Year 2020	Year 2025	Year 2030
Net US GHG Emissions (in mmt CO ₂ e)	5733	5553	5524
Price of an Emission Allowance (in 2005 dollars)	26.27	38.60	56.71
Average Electricity Price (in 2005 cents per kwh)	8.95	9.41	10.39
Average Natural Gas Price (in 2005 dollars per mcf)	8.15	8.65	9.71
Real GDP (in billion 2000 dollars, chain-weighted)	17,030	19,638	22,394

Attached is a memo from OnLocation to CATF, describing how these preliminary results were prepared.

We are available to provide more refined analysis of ACSA as might be useful.



OnLocation, Inc.
Energy Systems Consulting

Memo

To: Joe Chaisson, Clean Air Task Force
 From: Sharon Showalter, OnLocation, Inc.
 Date: October 23, 2007
 Re: Warner-Lieberman Bill
 NEMS Modeling Analysis

On October 2, the Clean Air Task Force (CATF) requested that OnLocation use the National Energy Modeling System (NEMS) model to analyze the projected impacts of the Lieberman-Warner bill titled "America's Climate Security Act of 2007." OnLocation modeled the new Lieberman-Warner bill using the latest Energy Information Administration (EIA) version of the NEMS.

This analysis simulates most, although not all, of the major provisions of the Lieberman-Warner bill. The key assumptions provided by CATF and used in the analysis include the following:

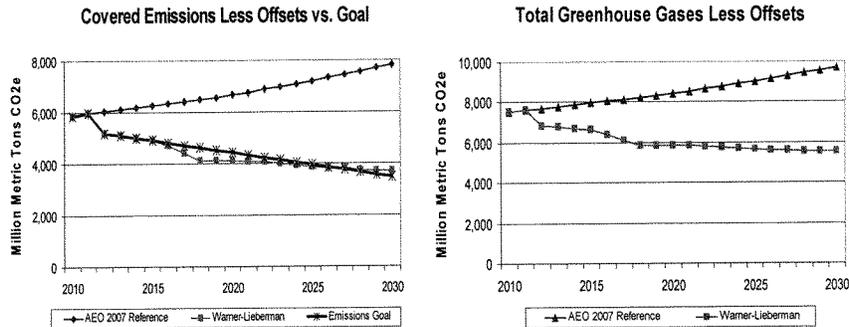
- Caps on greenhouse gas emissions with tradable allowances are established for covered entities with a linear decline assumed between target years:
 - 5,200 mmtCO₂e by 2012
 - 4,432 mmtCO₂e by 2020
 - 3,472 mmtCO₂e by 2030 (last year of model output)
 - 1,560 mmtCO₂e by 2050
- Covered entities include the electricity generation, transportation (through refineries), and industrial sectors, but not the residential, commercial, and agricultural sectors. Most commercial entities are expected to emit less than 10,000 metric tons at any single facility, and therefore the commercial sector was treated as exempt in the analysis.
- Covered gases include energy-related carbon dioxide, non-energy related carbon dioxide from cement and lime production, methane from coal mining (other methane emissions are assumed to be exempt due to the 10,000 metric ton threshold provision), nitrous oxide excluding mobile sources (includes adipic and nitric acid) and fluorinated gases (HFCs, SF₆, PFCs).
- Covered entities can satisfy up to 30 percent of their annual allowance obligation through offsets. Offsets are defined as (1) emission reductions from non-covered entities (domestic); (2) increases in net biological carbon sequestration; and (3) international emissions reductions. Assumptions for the cost and availability of these offsets are the ones most currently used by EIA.
- Allowances in excess of compliance requirements can be banked for use in future years.
- A portion of the funds raised through allowance auctions is used to stimulate technology development and deployment. This was represented by using EIA's AEO2007 High

Memo to Joe Chaisson (CATF) re: Warner-Lieberman Bill NEMS Modeling Analysis

Technology case assumptions along with the inclusion of rebates and subsidies for highly efficient end-use equipment in the residential and commercial building sectors.

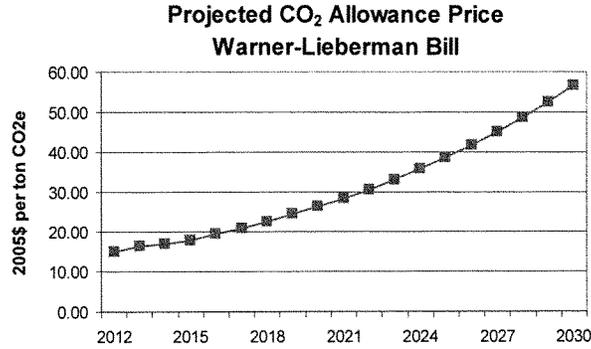
- Incentives for electric generators to build coal with sequestration facilities and new wind turbines were included in the analysis. These incentives, to be funded with proceeds from the auction of allowances, were structured in the model as production tax credits to be paid annually to each qualifying plant for the first 10 years of operation. The incentives are provided to the first 80 GW of coal with sequestration built between 2012 and 2030, and to the first 50 GW of new wind capacity built in the same time period. The payment for coal with sequestration plants was set to about 1.25 cents per KWh in 2005\$, and the existing wind production tax credit of about 1.9 cents per KWh (2005\$) was extended to 2030. A limit on new biomass generating capacity of about 10.5 GW by 2030 was also included in the analysis.

Our analysis projects that covered GHG emissions decline at roughly the same rate as the cap but with some banking of allowances between 2016 and 2026 for use in future years as the emissions cap continues to decline. Total GHG emissions from all sources less offsets are projected to decline to 5525 MMTCO₂e by 2030 compared to the projected growth in EIA's Annual Energy Outlook 2007 (AEO 2007) reference case in which emissions are projected to increase to over 9700 MMTCO₂e.

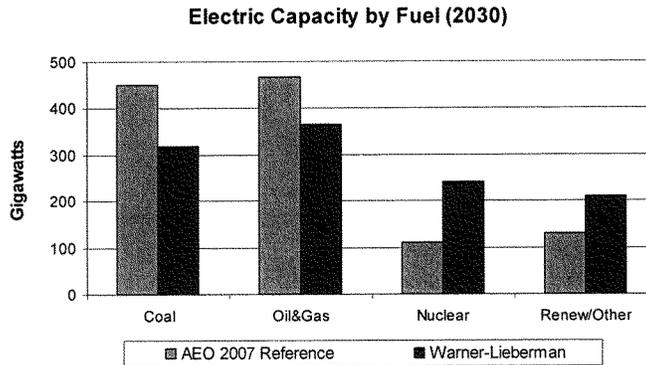


Memo to Joe Chaisson (CATF) re: Warner-Lieberman Bill NEMS Modeling Analysis

Allowance prices are projected to reach about \$56 per ton of CO₂-equivalent by 2030 as illustrated below.



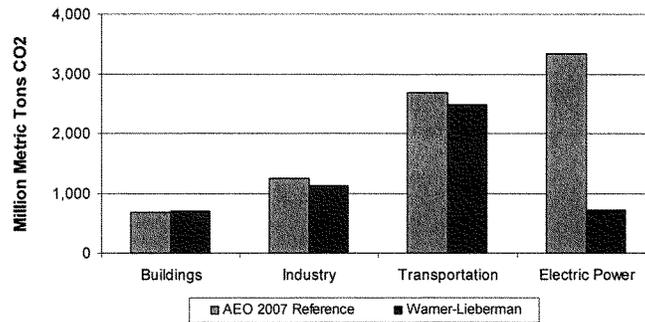
The penalty on GHG emissions has a significant impact on projected electric capacity fuel mix. By 2030, roughly 180 GW of existing coal capacity is projected to retire while coal with sequestration capacity increases to almost 180 GW stimulated by the allowance price and the incentives for the technology. Wind capacity also increases significantly to about 85 GW by 2030, and total renewable capacity increases by almost 80 GW relative to the AEO2007. Nuclear capacity increases to roughly 240 GW. The following figure illustrates the electric capacity mix in comparison to the reference case.



Memo to Joe Chaisson (CATF) re: Warner-Lieberman Bill NEMS Modeling Analysis

The following figure illustrates covered emissions by sector in 2030 compared to the reference case. The electricity sector bears most of the burden of emissions reductions, cutting emissions by almost 80 percent relative to the reference case and 70 percent below the 2006 level by 2030. Emissions in the transportation and industry sectors also decline (by 7 percent and 10 percent respectively) while direct emissions (excluding electricity) in the exempt or non-covered residential and commercial building sectors are basically unchanged.

CO2 Emissions by Sector (2030)



Attached is a summary table of NEMS model results of the Lieberman-Warner bill analysis.

Memo to Joe Chaisson (CATF) re: Warner-Lieberman Bill NEMS Modeling Analysis

**Preliminary NEMS Analysis of the Proposed Lieberman-Warner Bill
Summary of Results**

	2020	2025	2030
Carbon Dioxide Emissions (mmtCO₂e)			
Buildings (non-electric, exempt)	661	674	690
Industry (non-electric, excludes agriculture, construction)	954	972	988
Transportation (non-electric)	2,239	2,361	2,481
Electricity	1,854	1,254	710
Covered Energy-Related CO ₂ (excludes buildings)	5,047	4,587	4,179
Other Covered GHG	386	462	566
Less Offsets	1,331	1,186	1,041
Total Covered Emissions Less Offsets	4,102	3,863	3,704
Covered Emissions Goal	4,432	3,952	3,472
Total Greenhouse Gases Less Offsets	5,826	5,633	5,525
CO ₂ Allowance Price (2005\$/ton CO ₂)	26.27	38.60	56.71
CO ₂ Offset Price (2005\$/ton CO ₂)	20.83	13.93	19.72
Domestic Offsets			
Noncovered GHG Offsets	94	80	100
US Ag/Forestry Sequestration	259	177	365
International Offsets	978	929	576
Total Offsets (mmtCO ₂ e)	1,331	1,186	1,041
Total Offsets (% of cap)	30.0%	30.0%	30.0%
Delivered Energy Prices (2005\$) and GDP			
Average Electricity Price (cents per kWh)	8.95	9.41	10.39
Average Natural Gas Price (\$ per mcf)	8.15	8.65	9.71
Real GDP (billion 2000\$ chain-weighted)	17,030	19,638	22,394
Electric Capacity by Fuel/Tech (Gigawatts)			
Coal	312	371	319
<i>Conventional</i>	273	219	140
<i>Coal with Sequestration</i>	38	152	178
Oil/Gas	389	361	366
Nuclear	122	158	241
Renewables/Other	203	207	210
<i>Biomass</i>	6	9	12
<i>Wind</i>	85	85	86
<i>Hydro/Other</i>	112	112	113
Total	1,025	1,097	1,136
Net Electric Generation by Fuel (Billion kWh)			
Coal	1,805	2,103	1,738
Petroleum	29	19	15
Natural Gas	836	538	483
Nuclear Power	959	1,230	1,870
Renewable Sources/Other	900	835	765
Total	4,527	4,725	4,872

October 24th, 2007

This document compiles statements from the following organizations regarding S. 2191, America's Climate Security Act.

Business Council for Sustainable Energy
Environmental Defense
Exelon Corporation
League of Conservation Voters
National Association of Clean Air Agencies
National Environmental Trust
National Tribal Environmental Council
National Wildlife Federation
Natural Resources Defense Council
Nature Conservancy
PG & E Corporation
World Resources Institute



For Immediate Release

Contact:

Lisa Jacobson, Executive Director
Phone: (202) 785-0507 or (202) 494-5133 (cell)

October 18, 2007

Introduction of America's Climate Security Act Lauded as Significant Step towards Real Action by Congress on Climate Change

Clean Energy Industries Welcome Introduction of Legislative Road Map for Market-Based Solutions

Washington, DC – The Business Council for Sustainable Energy (BCSE), America's largest and most diverse coalition of clean energy industry interests, today lauded the introduction of America's Climate Security Act as a sign that Congress will move decisively to enact legislation to deal with climate change. The bill's introduction, led by Senators Joe Lieberman (I-CT) and John Warner (R-VA), with backing from the Senate Environment and Public Works Committee, offers the most promise for legislative action concerning climate change.

"The Council is very pleased to see this important process starting in Congress with the introduction of America's Climate Security Act today," said Lisa Jacobson, the Council's Executive Director. "We look forward to working with Senator Lieberman and Senator Warner, as well as the Senate Environment and Public Works Committee on a market-based, federal program that reduces greenhouse gas emissions and deploys existing clean energy options and technologies, such as renewable energy, natural gas and supply-side and demand-side energy efficiency."

The Climate Security Act provides an essential foundation for Congress and the public to consider the issues associated with establishment of a national, economy-wide program to address climate change. "The time has come for action by Congress on climate change, and the Council stands ready to work with others to expand upon this important proposal," Jacobson stated.

The Council, which is comprised of natural gas, renewable energy and energy efficiency companies and trade associations, seeks a climate change program that:

- 1) Is national in scope. A federal program is preferable to the current patchwork of state and regional programs, both regulatory and voluntary. Such a program would enlarge the pool of participants, thereby lowering compliance costs, creating stronger price signals for clean energy options and offering greater compliance flexibility while advancing national security objectives.
- 2) Incorporates a mandatory, economy-wide and market-based approach. A federal program should include a cap-and-trade or project-based approach that efficiently achieves both energy and climate objectives. These types of approaches provide long-term signals to the economy, versus a command and control approach, and also offer compliance flexibility.
- 3) Expands alternative energy resources from clean energy and energy efficiency technologies. Such a program should increase energy supply from sources such as on-site combined heat and power and renewable energy. It also should increase energy efficiency to mitigate rising energy demand and fuel price volatility.
- 4) Recognizes improvements in energy efficiency. A federal program should reward energy efficiency in existing and replacement energy infrastructure to fully maximize market-driven incentives for energy and environmental improvements.

- 5) Establishes near-term and long-term targets to signal the marketplace and drive technology investment and innovation.
- 6) Establishes linkages with international programs. The federal program should establish international linkages at the outset of the program. These linkages should be comparable, verifiable and transparent. The program should permit trading with compatible cap-and-trade programs and project-based initiatives in other parts of the world.

The Council urges Congress to adopt a national climate change program to send strong market-signals to the economy toward clean energy technologies. More wide-scale use of existing clean energy technologies will reduce greenhouse gas emissions, enhance energy security, independence and reliability, improve air quality and offer the opportunity to create millions of new jobs in the United States.

For more details on the Council's positions, please see the attached Council position statement on climate change policy.

####

About the BCSE

The Business Council for Sustainable Energy is a broad-based coalition of energy efficiency, natural gas and renewable energy and electric utility industries that advocates energy and environmental policies that expand markets for clean, efficient and sustainable energy products and services. The Council's coalition includes power developers, equipment manufacturers, independent generators, green power marketers, gas and electric utilities, and retailers, as well as several of the primary trade associations in these sectors.

For more information about BCSE please visit: www.bcse.org

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Press Release

Environmental Defense Praises Bipartisan Plan to Cap and Cut Global Warming Pollution

Posted: 17-Oct-2007; Updated: 17-Oct-2007

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FOR IMMEDIATE RELEASE

Contact:

Tony Kreindler, Environmental Defense, 202-572-3378 or 202-210-5791 (cell)

(Washington – October 17) Senators Joe Lieberman and John Warner tomorrow will introduce comprehensive, bipartisan climate change legislation that would cap and cut U.S. greenhouse gas emissions while protecting the economy and American consumers.

“Lieberman and Warner have paved the way for a historic committee vote on a bill that promises to make great strides toward climate security and economic growth,” said [Steve Cochran, national climate campaign director at Environmental Defense](#). “Thanks to their thoughtful approach we’re moving beyond talk and quickly toward action.”

America’s Climate Security Act would require that covered sectors (about 80% of the U.S.

economy) reduce emissions by 15% below 2005 levels in 2020, a strong target that helps put the U.S. on the path to much deeper reductions by the middle of the century. The sponsors estimate that energy-efficiency policies also included in the bill would generate additional reductions, for a total economy-wide reduction of up to 18% by 2020. Responding to environmental concerns the senators tightened their short-term target from earlier proposals. This new target is at a level that would send a clear signal to companies and markets to begin investing now in new low-carbon technologies, and would make sure America is on the path necessary to achieve the long term goals required by global warming science.

The centerpiece of the bill is a mandatory cap on emissions from the electric power, transportation, and manufacturing sectors, coupled with emissions trading provisions that will help companies meet the cap at the lowest cost. The cap requires a 70% reduction from these covered sources. The sponsors estimate that the bill's energy-efficiency policies, when combined with the cap, would produce overall reductions of up to 63% compared to 2005 levels.

"The emissions goal is aggressive in the short-term and that will have a real impact on investment decisions made now. Most scientists say we need to cut U.S. emissions by about 80 percent, and we continue to believe that deeper reductions are needed long-term. This bill is a good start in that direction, and we will continue to work toward those longer term reductions," Cochran said.

Importantly, Lieberman and Warner's bill contains an effective approach to managing costs that minimizes economic impacts without compromising climate protection. Other cost management proposals would jettison emissions caps if the price of reducing emissions reached an arbitrary ceiling. Instead, Lieberman and Warner would allow companies to bank emissions allowances as well as borrow emissions allowances from future years.

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Statement by John W. Rowe

Chairman and CEO, Exelon Corporation

On the Lieberman – Warner "America's Climate Security Act"

"As an early and vocal advocate for climate change legislation, Exelon applauds the bipartisan leadership of Senators Lieberman and Warner to introduce a bill that will help reduce greenhouse gas emissions to address global warming as soon as possible," said John Rowe, Chairman and CEO of Exelon Corporation, one of the nation's largest utilities. "The legislation represents another important step towards developing the bipartisan consensus necessary to enact legislation this Congress. We are especially pleased that the bill recognizes the need to protect electricity consumers by allocating part of the allowances to local utilities for the benefit of their customers."



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10/18/07

FOR IMMEDIATE RELEASE

Contact: Kristin Lee, (202) 785-8683 or kristin_lee@lcv.org

League of Conservation Voters Statement on Lieberman-Warner Global Warming Bill

WASHINGTON, DC - League of Conservation Voters (LCV) President Gene Karpinski issued this statement following Senator Joe Lieberman (I-CT) and Senator John Warner's (R-VA) introduction of America's Climate Security Act:

"Today's introduction of America's Climate Security Act marks an important step by this Congress to address the urgent problem of global warming. We applaud Senators Joe Lieberman and John Warner for their leadership and for their bipartisan commitment to moving America closer to real solutions to this very urgent problem.

The challenge of global warming is great - and the political will grows stronger every day to address it. Our response to solving this challenge will dictate what kind of world we leave our children and it is critical that we get it right. We commend Senators Lieberman and Warner for their continued willingness to improve key provisions of the legislation to move us closer to where science tells us we need to be.

We look forward to working with Senators Lieberman and Warner, as well as Chairman Boxer and the rest of the members of the Environment and Public Works Committee, to strengthen this bill as it moves forward. Specifically, we will continue to work to increase the reduction targets and the sectors covered in both the near and long term. We will also work to significantly increase the amount of allowances toward our goal of 100 percent auction, while ensuring that the auction revenues go to directly helping consumers, to increasing renewable energy and energy efficiency, and to helping impacted populations adapt to global warming both at home and abroad.

In the coming months we will also work closely with the House and the Senate to pass important energy legislation that includes vehicle fuel efficiency and renewable electricity standards, which, along with an economy wide cap-and-trade bill, will help meet the global warming pollution reductions required to help our country secure a brighter future."

The nonprofit League of Conservation Voters (LCV) is the independent political voice for the environment. To secure the environmental future of our planet, LCV's mission is to advocate for sound environmental policies and to elect pro-environmental candidates who will adopt and implement such policies.

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2007 The League of Conservation Voters, Inc.
1920 L Street, NW, Suite 800, Washington, DC, 20036

October 18, 2007

S. William Becker
Executive Director
National Association of Clean Air Agencies

"In introducing America's Climate Security Act, Senators Lieberman and Warner have set the stage for a productive, bipartisan debate of national global warming legislation with a mandatory cap-and-trade program. NACAA particularly commends the Senators for seeking to protect states' rights to adopt and enforce more stringent measures to reduce greenhouse gases. Using the bill as starting point, we look forward to working in partnership with the sponsors and other members of the Senate to strengthen and improve this legislation and this nation's response to global warming."

S. William Becker
Executive Director
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202-624-7863 (fax)
www.4cleanair.org

From: Brandon MacGillis
Sent: Thursday, October 18, 2007 10:59 AM
To: Brandon MacGillis
Cc: John Anthony
Subject: NET Statement on America's Climate Security Act of 2007 Introduction

For Immediate Release
Tuesday, October 16, 2007

CONTACT: Brandon MacGillis or John Anthony, 202-887-8800

Statement from Philip E. Clapp, President, National Environmental Trust on
America's Climate Security Act of 2007 Introduction

Washington, DC - Philip E. Clapp, President of the National Environmental Trust issued the following statement on the introduction of the America's Climate Security Act of 2007, by Senators Lieberman (I-Conn.) and Warner (R-Va).

"This is a huge shift in Congress' center of gravity on global warming. With cosponsors from Senator Dole to Senator Harkin, this bill really marks the start of serious efforts in both parties to grapple with the issue. It needs improvements, but the bill takes the debate where it needs to go: away from the President's voluntary approach which is rightly consigned to the history books. Congress is now working to come up with a mandatory, market-based way to cut carbon pollution.

"Senators Lieberman and Warner have outlined a plan to reduce pollution, use energy more efficiently, invest in new technology, and protect consumers. Their bill sets up the right framework to limit emissions from the country's biggest sources. We look forward to working with the committee to strengthen the bill to make sure our nation's emissions goals keep pace with the latest science. The committee should also ensure investments in technology are cost-effective and environmentally sound.

"We now know that by mid-century global warming will cause more than a billion people to face water shortages and hunger, while another 150-200 million people will be displaced by rising seas, more frequent floods and more intense droughts. To avoid this looming catastrophe the United States must reduce our emissions and show leadership abroad. This initiative by Senators Lieberman and Warner sets the stage for the Senate to do its part."

#

Brandon MacGillis
National Environmental Trust
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FOR IMMEDIATE RELEASE
October 19, 2007

Contact: Bob Gruenig
 505-242-2175

National Tribal Environmental Council Applauds Senators Lieberman and Warner for Action on Global Warming and Tribal Concerns

The National Tribal Environmental Council (NTEC), on behalf of its 184 federally-recognized member tribes, commends Senators Joseph Lieberman (I-CT) and John Warner (R-VA) for developing bipartisan climate change legislation that takes measurable steps to address global warming and move the nation away from a course of uncontrolled greenhouse gas (GHG) emissions.

"We are particularly encouraged" said Kirk Francis, chairman of NTEC's board of directors and Chief of the Penobscot Nation of Maine, "for the Senators' recognition in their bill of federally-recognized tribes and the need of our nation's tribes for resources to address the adverse impacts of global warming currently facing their communities."

The bill, "America's Climate Security Act" (S. 2191), would take a step in the right direction by capping 75 percent of the nation's GHG emissions, as generated by the electric power, industrial and transportation sectors. The cap for these sources would be reduced below 2005 emissions levels by 15 percent in 2020, and 70 percent in 2050. With these reductions and more expected as a result of energy efficiency provisions in the bill, total U.S. GHG emissions would be expected to decline 53 - 61 percent by 2050.

NTEC and its member tribes, in all regions of the nation, consider climate change to be the most pressing environmental issue of our time, with strong impacts on air, water, land and the overall ecosystem. Federally-recognized tribes -- sovereign nations with certain rights ensured by the U.S. Constitution, treaties and legal precedence -- are facing the immediate, adverse impacts of global warming. As often has been the case, tribal communities shoulder a disproportionate burden of negative environmental consequences created by commercial and industrial operations, and in this case, those created by global warming.

"This is why we are so pleased that Senators Lieberman and Warner have drafted progressive, inclusive climate change legislation that both acknowledges the adverse impacts of global warming facing tribes, and provides us with resources to address these impacts," added Chairman Francis.

Native communities nationwide are currently facing the impacts of global warming. Most notably, certain Native villages in Alaska will have to relocate due to storm surges, flooding, and erosion. Furthermore, tribes in the Pacific Northwest are being forced to consider alternatives to the salmon on which they have subsisted for centuries, but now face possible extinction. And a number of western tribes with drought-ridden lands are finding that these lands can no longer support a number of animals and plants on which their people depend on for culture and subsistence. Significant public resources are needed to reverse such global warming impacts; the Lieberman-Warner bill is a critical first step toward authorizing these resources.

Now that this essential first step has been taken, NTEC believes that in view of our nation's late start in this direction, tribes and others need to continue their persistent effort to protect all Americans from the adverse impacts of global warming.

"Senators Lieberman and Warner have begun a long and likely arduous journey down a path our nation needs to take, and we give them great credit for that," added Chairman Francis. "Tribal nations deserve the opportunity the Senators have provided us to join in, and now we look forward to working with them and their colleagues step by step, to make an already positive bill even better for

NTEC Index

<http://www.ntec.org/newsAlert.htm>

federally-recognized tribes," he concluded.

For additional information, please contact Bob Gruenig at 505-242-2175 ext.103 or bgruenig@ntec.org.

The National Tribal Environmental Council (NTEC) was formed in 1991 as a membership organization dedicated to working with and assisting tribes in the protection and preservation of tribal environments. The organization's membership is open to any federally-recognized tribe throughout the United States. Although NTEC is a membership organization, its services are provided to all federally-recognized tribes. [\[Click here for document\]](#)

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"Bipartisan Legislation Could Break Senate Logjam on Global War... <http://www.nwf.org/news/story.cfm?pagelid=B313F485%2DF1F6%...>

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"Bipartisan Legislation Could Break Senate Logjam on Global Warming"

Statement by Larry Schweiger, National Wildlife Federation President & CEO
Published October 18, 2007

On introduction of the America's Climate Security Act of 2007
by Senator Joe Lieberman (I-CT) and John Warner (R-VA).

The Senators are the chairman and ranking Republican, respectively, on the Senate Environment and Public Works Committee's Subcommittee on Private Sector and Consumer Solutions to Global Warming and Wildlife Protection.

Related Documents

[NWF Assessment of America's Climate Security Act of 2007](#) - [\[PDF Help\]](#)

[Sportsmen Applaud Bipartisan Legislation](#) - [\[PDF Help\]](#)

The letter sent to Senator Warner and Senator Lieberman from organizations representing millions of hunters and anglers.

Washington, DC (October 18) "This is a bipartisan breakthrough on global warming that takes us a giant step closer to a historic vote in the United States Senate. I commend Senator Lieberman and Senator Warner for drafting a strong bill to protect people and wildlife from global warming. And I commend Senator Dole (R-NC) for cosponsoring the legislation and adding her support to the call for action after a careful and thoughtful review of the issues. The prospects for Congress passing legislation with real solutions to global warming are getting better day by day.

"This legislation comes just in time. We need bipartisan leadership to break the logjam in Congress and force action on global warming. The clock is ticking on the single greatest threat to the future of wildlife, and too many members of Congress have been fast asleep.

"The defining issue of the 21st century is whether or not we will muster the political will to confront global warming. Senators Warner and Lieberman have shown us that confronting global warming is not an issue of left or right; it is an issue of right or wrong.

"As this bill moves to the Senate floor, it will mark the first head-on Senate debate about what is really needed to tackle global warming. While there have been other votes in 2003 and 2005 on Senate global warming bills, they were focused on first steps to get started. Meanwhile, report after report from the scientific community has made clear that we have run out of time.

"Senator Boxer (D-CA), chair of the full Environment Committee, has been a tireless advocate for action and I thank her for her leadership to advance this issue. And we applaud Majority Leader Reid (D-NV) for expressing his desire to move bipartisan legislation reported from the committee to a full Senate debate and vote.

"Of critical importance to National Wildlife Federation, this bill will reduce U.S. global

"Bipartisan Legislation Could Break Senate Logjam on Global War... <http://www.nwf.org/news/story.cfm?pageId=B313F485%2DF1F6%..>

warming pollution by approximately two percent every year from major emitters in the coming decades. It provides significant funding to implement federal, state and tribal strategies that help wildlife survive the climate changes that can no longer be avoided. And it provides needed protections for low- and moderate-income families.

"Even though we are encouraged by this bill and the prospects for action, we should not lose sight of the need for swift action on the energy bill, which can provide a strong down payment on global warming action. Congress needs to quickly deliver the energy bill to the president's desk with fuel economy improvements for cars and with renewable electricity standards."

The National Wildlife Federation is America's conservation organization inspiring Americans to protect wildlife for our children's future.

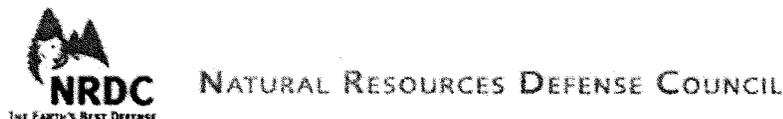
Immediate Release
October 18, 2007

Jeremy Symons, Executive Director, National Wildlife Federation Global Warming Program,
202-939-3311, symons@nwf.org

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Press contact: Eric Young, NRDC, 202-289-2373 or 703-217-6814 (cell)

If you are not a member of the press, please write to us at nrdcinfo@nrdc.org or see our [contact page](#)

Statement by Frances Beinecke, president of the Natural Resources Defense Council (NRDC) on the Introduction of America's Climate Security Act by Senators Joe Lieberman and John Warner

"The introduction and planned markup of America's Climate Security Act by Senators Joe Lieberman (I-Conn.) and John Warner (R-Va.) represents an important step forward in the overdue process to enact comprehensive, mandatory global warming legislation. Committee consideration of this legislation will help move us toward the substantial reductions in global warming pollution we need to protect our climate. The bill also recognizes the need to direct proceeds from the pollution allowance market to important policy objectives, including promoting clean energy solutions, protecting the poor and other consumers, ensuring a just transition for workers in affected industries, and preventing impacts abroad that lead to conflicts and threats to security.

"We cannot afford to wait any longer to cap and reduce U.S. emissions of global warming pollutants. Each day we delay means more global warming pollution, more investment in high-emitting energy sources, and more global warming impacts. We are pleased by the bipartisan commitment of the Chairman and Ranking Member of the subcommittee with jurisdiction to report global warming legislation for consideration by the full Senate Environment and Public Works Committee in the immediate weeks to come.

"Capping carbon will lead investment to a clean energy future which will not only help reduce global warming but also improve our health, reduce medical bills, increase energy security, and create thousands of good new jobs.

"Although this bill is a strong start, NRDC supports changes that would improve the bill by ensuring that emission reductions keep pace with the science, and by reducing free allocations and directing additional resources to provide more support for critical program features, including consumer and low-income protections, safeguards for affected workers, and faster deployment of energy efficiency and renewable energy solutions.

"We applaud the leadership on this critical issue provided by Senator Boxer, who Chairs the Senate Environment and Public Works Committee, and look forward to working closely with her, Senators Lieberman and Warner, and all the other members of the Committee, to develop sound, bipartisan legislation that can be considered as soon as possible by the full U.S. Senate."

The Natural Resources Defense Council is a national, nonprofit organization of scientists, lawyers and environmental specialists dedicated to protecting public health and the environment. Founded in 1970, NRDC has 1.2 million members and online activists, served from offices in New York, Washington, Chicago, Los Angeles, San Francisco and Beijing.



Statement

October 18, 2007
For Immediate Release

Contact
Bridget Lowell, 703.841.4531, blowell@tnc.org

Nature Conservancy Welcomes Lieberman-Warner Bill on Climate Change

ARLINGTON, VA -- The following statement was issued today by Stephanie Meeks, acting president and CEO of The Nature Conservancy:

"We commend Senators Lieberman and Warner for their vital leadership on this critical issue, the most important environmental issue of our time.

Time is short. The planet is already changing; and people and nature are already feeling the impacts. Congress must act quickly to pass strong climate legislation that significantly reduces emissions from all sectors of the economy. The Lieberman-Warner bill offers a strong starting point for action.

A cap-and-trade approach, such as that reflected in the Lieberman-Warner bill, provides the greatest assurance that emissions will be reduced as needed and is likely to be the most cost-effective way to address climate change.

Conservation has a critical role to play in addressing the climate crisis, from reducing emissions from deforestation to finding ways for people and wildlife to adapt to a changing world.

Provisions to help wildlife and ecosystems

"We are especially pleased by the commitment to conservation and protecting wildlife and habitat reflected in the bill. Senators Warner and Lieberman have been leaders in recognizing the magnitude of the challenge climate change poses for the natural world and for all of us.

We all rely on nature – for water, air, food and shelter. Nature will change as the climate does, and we must help nature adapt for our own survival.

The bill would dedicate 20 percent of the expected revenues from the sale of emissions allowances, representing an estimated \$2 billion or more per year in dedicated conservation funding in the early years of the program, increasing over time as the scope of climate change impacts is likely to become more evident. We look forward to working with Senators Lieberman and Warner to develop a comprehensive planning and science framework to ensure that this funding is directed to the greatest conservation needs.

Forest Carbon

"Globally, deforestation and forest degradation account for close to 20 percent or more of greenhouse gas emissions. Protecting forests and reforesting once-forested areas have critical roles to play in reducing emissions and unleashing a host of climate change, biodiversity, and other environmental, social and

MORE

economic benefits. The cost-effective potential for reducing emissions through these activities is very large, and as yet untapped.

The bill introduced Thursday by Senators Warner and Lieberman would grant forest and land-use activities in the U.S. access to the carbon market provided that they can demonstrate real emission reductions or carbon storage. We are encouraged by the bill's recognition of the important role these activities can play. We look forward to working with the bill authors, the Environment and Public Works Committee, and the Congress to ensure that the U.S. fully leverages the power of its carbon market to conserve forests in those parts of the world where the greatest emissions are occurring.

Emission Caps

"The bill establishes strong caps in the early years of the program, though greater emission reductions will be needed over the long term. We look forward to working with the Congress as the bill advances to ensure that the caps in the bill reflect the best available scientific information about what will be needed to protect nature and those who depend on it from unacceptable risks of serious harm."

For more information on the Conservancy's climate change efforts, visit <http://www.nature.org/initiatives/climatechange/>.

###

The Nature Conservancy is a leading conservation organization working around the world to protect ecologically important lands and waters for nature and people. To date, the Conservancy and its more than one million members have been responsible for the protection of more than 15 million acres in the United States and have helped preserve more than 102 million acres in Latin America, the Caribbean, Asia and the Pacific. Visit The Nature Conservancy on the Web at www.nature.org.

October 17, 2007

Steven Kline
Vice President Corporate Environmental and Federal Affairs

PG&E Corporation

“We believe America’s Climate Security Act provides a solid starting point for constructively advancing a comprehensive, national response to and policy on climate change. Senators Lieberman and Warner have developed a thoughtful proposal that recognizes the urgent need for action by designing a program to achieve significant emission reductions from all sectors of the economy. The bill includes provisions that prioritize energy efficiency and technology development and deployment, as well as innovative ideas to protect electricity consumers, manage overall program costs, and provide states with the resources to help address the unique needs of their communities and citizens as we transition to a low-carbon economy and adapt to a changing environment. America’s Climate Security Act takes significant steps toward recognizing that a national program must balance the economic, technology, and environmental challenges of combating climate change.

“We look forward to working with Senators Lieberman and Warner, Chairman Boxer and the other members of the Environment and Public Works Committee to further refine these concepts, ensuring that the final bill that emerges from the Committee is environmentally effective, economically sustainable and both encourages and supports the rapid development and deployment of the most efficient, lowest-emitting technologies throughout the economy.”

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Senate Proposal Signals Positive Movement Toward Comprehensive Climate Legislation

WASHINGTON, DC, October 18, 2007 – Climate change legislation introduced today by Senators Joe Lieberman (I-Conn.) and John Warner (R-Va.) sends a strong signal that the U.S. is moving toward reducing its greenhouse gas emissions.

With a nod to earlier legislative proposals, the Lieberman-Warner bill has adopted provisions from other bills and expanded to cover more of the U.S. economy. The bill also represents a significant step toward domestic policies that will be required for effective global action against the greatest consequences of climate change.

The bill's proposed mandatory, economy-wide greenhouse gas reductions come as the international community prepares for a new round of climate change negotiations this December in Bali, Indonesia. It is widely understood that without U.S. action on the issue in the next several years, a successful international agreement on climate change will be difficult, if not impossible, to achieve by 2012.

"The U.S. Congress urgently needs to review and pass climate policy to unleash innovation and transition to a low-carbon future," said Jonathan Lash, president of the World Resources Institute (WRI). "The international community understands the importance of U.S. action and they will take note of this and other developments in Congress."

The latest refinements to the Lieberman-Warner bill outline a cap-and-trade strategy to reduce emissions from covered sectors by 15 percent by 2020 and 70 percent by 2050. In doing so, it establishes useful rules for investors and businesses, many of whom have been seeking clear, long-term U.S. goals to guide their decisions domestically and internationally.

In addition, the bill has incorporated components of several other bills and proposals including agricultural sequestration of carbon, improved building codes, and carbon capture and storage. Additional policies such as automobile efficiency, renewable energy standards and energy efficiency, currently passed by the House and Senate in the energy bill, may also complement a cap-and-trade program, an approach long sought by leaders such as Senators Jeff Bingaman (D-N.M.) and Arlen Specter (R-Pa.) as they scoped their legislative proposal earlier this year.

WRI plans to release further analysis of the Lieberman-Warner bill, its complementary policies and interaction with a cap-and-trade program in the coming weeks.

-30-

The World Resources Institute (www.wri.org) is an independent, non-partisan and nonprofit organization with a staff of more than 100 scientists, economists, policy experts, business analysts, statistical analysts, mapmakers, and communicators developing and promoting policies that will help protect the Earth and improve people's lives.



EUROPEAN UNION
DELEGATION OF THE EUROPEAN COMMISSION

Head of Delegation

FEB 22 2007
D/272

The Honorable Barbara Boxer
Chairman, Committee on Environment and Public Works
United States Senate
Washington, D.C. 20510

Dear Madame Chairman,

In recent publications in the media and in statements by U.S. Administration officials as well as at the Hearing on the U.S. Climate Action Partnership report, which you organized in the Senate Committee on Environment and Public Works on February 13, 2007, incorrect or incomplete information has been presented about the European Union (EU) climate policy. In particular, this concerns the EU's achievements to date by comparison to achievements in the U.S., and whether the EU will meet its obligation under the Kyoto Protocol, which is to reduce its emissions by 8% by 2012.

This letter is intended to put the facts before you¹.

To start, I would like to address one major misunderstanding in the discussions in the U.S.: we hear statements such as those from Senator Inhofe that only a few EU countries are on target to meet their Kyoto obligations and that other EU members will fail to do so, thus implying that the EU will not meet its Kyoto obligations. That is not correct. The EU is on track to meet its Kyoto commitment.

Of course, the performances of individual EU member states vary, but under the Kyoto Protocol, it is the 15 countries that were EU Member States when the Kyoto Protocol was signed in 1997 (EU-15) that have a joint commitment to reduce emissions by 8% by 2012². Individual EU-15 Member States do also have individual targets but these are EU internal targets in the framework of our joint commitment. This joint commitment allows some EU countries to increase their emissions, while others reduce theirs significantly. The contributions of each Member State to achieving the 8% reduction are set down in EU law and are legally binding. It is thus inappropriate to assess the EU's overall performance on the basis of the performance of a few individual Member States. If the U.S. ratified the Kyoto Protocol with its foreseen 7% reduction target, I doubt if the U.S. would agree that its overall performance should be assessed by focusing on a few individual states rather than the overall U.S. performance.

¹ See also the 2006 Progress Report COM(2006)658 at http://ec.europa.eu/environment/climat/pdf/kyotoreport_en.pdf

² Since 2004, 12 new countries have become members of the EU, most recently Bulgaria and Romania in January 2007. Ten of these twelve have Kyoto targets ranging between -6 and -8% reductions on 1990 levels. Cyprus and Malta do not have targets.

In the year 2000, the 15 EU Member States had stabilized greenhouse gas emissions at 1990 level and by 2004 they had reduced their emissions by 0.8% compared to 1990.

In the U.S., emissions grew by 15.8% between 1990 and 2004. The U.S. still lags far behind the EU which has seen its economy grow with a far lesser effect in terms of emissions.

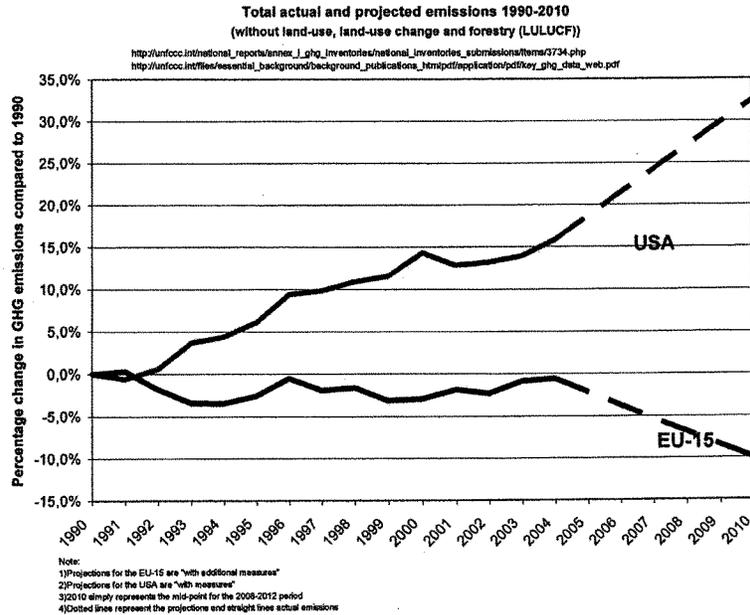
Between 1990 and 2002, greenhouse gas (GHG) emissions per unit of GDP decreased proportionately more in the EU than they did in the U.S., although they were at similar levels back in 1990. It seems that despite its improvement in recent years, the U.S. is not fully exploiting its potential for emission reductions.

When examining other important indicators such as energy use per capita or GHG emissions per capita which take into account the significant population increase in the U.S. in recent years the energy use and GHG emission figures for the U.S. have remained almost double of what they are for the EU. Increasing energy efficiency would decrease GHG emissions whilst reducing fuel imports.

The 2000-2004 time period

During the period 2000-2004, recently chosen as a reference period by the U.S. Administration, emissions in the U.S. grew more slowly than in the EU. However, in absolute terms the U.S. increase in GHG over that period was still more than in any other country in the world or than the EU as a whole (US: 29 million tonnes of CO₂, EU-27: just under 21 million tonnes of CO₂).

The selection of the limited 2000-2004 period for comparison of progress in reducing GHG emissions is far from representative. It is the longer term that is relevant in terms of successfully addressing climate change. The chart below, based on official UNFCCC data, shows how US and EU emissions have evolved and are projected to evolve between 1990 and 2010.



Furthermore, despite the developments in relative GHG emissions trends in the U.S. over the last couple of years, the future is not promising. By 2010, emissions in the U.S. are projected to be 32.4% above 1990 levels.

In contrast, the action taken at the EU level and currently under implementation at the national Member State level, is projected to result in an absolute reduction in emissions of 10.8 % from the base year 1990 by 2010 across the 25 Member States and by 8% for the EU-15 when existing (0.6%) and additional measures (4%) as well as the use of Kyoto mechanisms (2.6%) and carbon sinks (0.8%) are taken into account.

Amongst other measures such as a wide range of energy efficiency, renewable energy targets, vehicle emission and fuel standards to reduce greenhouse gas emissions, the EU has introduced a EU-wide cap and trade system which provides industry with the necessary (financial) incentives to take action and innovate in the most cost effective way.

The EU Emission Trading System (ETS) started January 1, 2005 for a three year pilot phase. Currently, it involves more than 10,000 companies, covering around 2 billion tonnes of CO₂ emissions (half of EU's total CO₂ emissions) with transactions valued at \$ 19 billion in 2006. Emissions trading has two main advantages: it introduces climate change considerations in industry's financial bottom line and through the linking directive it opens up markets to Clean Development Mechanism projects in developing countries. Currently, credits from emission-

reducing projects in 169 countries representing more than 90% of the global population can be used by companies to meet part of their reduction objectives.

In addition to industry, the EU member states are also making use of the Kyoto mechanisms. The projected use of Kyoto mechanisms by 10 Member States is expected to amount to 110.6 million tonnes of CO₂eq. per year of the commitment period. This amount corresponds to over 30% of the total required emission reduction for the EU-15 of about 342 million tonnes CO₂ equivalents per year during the first commitment period. The total budget already allocated by member states amounts to about 3 billion EURO.

The EU ETS pilot phase has shown that there is room for improvement in the initial allocation, which is being addressed. An over-allocation of emissions permits in some Member States and in small and medium sized sectors for this initial period, resulting from the use of projected emissions and from a lack of data on actual emissions when the system was launched, has led to a relative drop in permit prices for the 2005-7 period. On the other hand, these price movements alongside high trading volumes are an indication that the market mechanism itself is functioning as it should. Thanks to reporting required under the EU ETS, we have the data to improve allocations for the second trading period which runs from 2008 and 2012. This is already reflected in the forward price for second phase permits. EU ETS is a very important tool for the future. We are currently working on streamlining its design for trading from 2013 onwards and expanding it to more sectors and other GHGs.

For your information, I attach some annexes with an overview of EU policies and measures, and a recent table on the EU performance under Kyoto.

The way forward

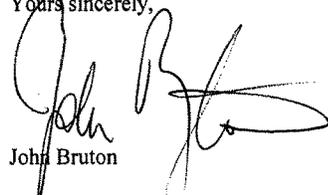
The EU is pleased to see that the climate debate is gaining momentum in Congress, in many states and with other stakeholders, and that the U.S. as a whole has started to make progress in reducing the growth of its emissions. The EU is certainly keen to exchange experiences with all interested parties in the U.S. regarding new and existing policies and measures, research programs and other initiatives and assess what is the best way forward in tackling the pressing and long term challenge of climate change. The EU has gained a lot of experience of using market-based measures such as emissions trading, and is keen to share this experience and avoid any need for the US to "reinvent the wheel" when it comes to the building blocks of emissions trading such as monitoring requirements and electronic registries.

On the basis of the scientific assessment of man-made climate change impacts, the EU's objective is to limit the average increase in global temperature to a maximum of 2 degrees Celsius (3.6 Fahrenheit) above pre-industrial levels. If the world stays within this threshold, we will still see some serious impacts, but we would have a reasonable chance of avoiding catastrophic consequences. A 3.6 degree Fahrenheit target would translate into making sure that global GHG emissions peak by 2020 and then fall drastically – by around 50% over 1990 levels to ensure that atmospheric concentrations stabilize at around 450 ppm. The EU's own calculations show that these concentrations could be achieved if developed countries as a group were to reduce their emissions by 30% by 2020 and by 60% - 80% by 2050, and if developing countries with some support limit their growth in emissions before 2020 and to reduce them in absolute terms thereafter.

The EU is looking for a shared vision amongst major GHG emitters of what needs to be done to tackle climate change. We propose these objectives and reduction paths as a framework to guide action. To underline its commitment to action, the EU has agreed an independent reduction target of at least 20% by 2020, if there is no outcome of the negotiations on a global binding post-2012 agreement.

The EU is open to discussing the details of this framework and of the actions needed with other countries and with the US in particular. One thing is nonetheless certain: time is running short and decisions need to be made as soon as possible.

Yours sincerely,



John Bruton
Ambassador

Annex I:**European Climate Change Programme (ECCP)****Status of implementation of important ECCP I identified policies and measures**

Measure	Reduction potential EU-15, 2010 (Mt. CO ₂)	Entry into force	Starting to deliver
EU emission trading scheme	~ NAP2	2003	2005
Link Joint Implementation (JI)/ Clean Development Mechanism (CDM) projects to emission trading	~ NAP2	2004	2005/2008
F-Gases Regulation and Directive on Mobile Air Conditioning	23	2006	2008
Dir. on the promotion of electricity from renewable energy sources	100-125	2001	2003
Directive on the promotion of Cogeneration of Heat and Power (CHP)	65	2004	2006
Directive on energy performance of buildings	35-45	2003	2006
Directive on the promotion of transport bio-fuels	35-40	2003	2005
Directive on the promotion of energy efficiency and energy services	40-55	2003	2006
ACEA voluntary agreement	75-80	1998	1999
Energy labeling directives	20	1992	1993
Total	393-453		

Note: The emission reduction potential for the various ECCP measures are (ex-ante) estimates. The 'ex ante' ECCP evaluation of the potential of a certain measure does not necessarily coincide with the actual realisation in the field, as not all of the detailed provisions of the proposals or adopted measures have been taken into account in the pre-evaluation. Another reason is that the estimated potential is sometimes based on reaching certain (indicative) targets, which will need to be proven in practice (eg., CHP and biofuels proposals).

Annex II: the EU's Kyoto performance

Greenhouse gas emissions trends and Kyoto Protocol targets for 2008-2012
(source: European Environment Agency, 2006)

MEMBER STATE	Base year ⁽¹⁾	2004	Change base year-2004	Change 2003-2004	Change 2003-2004	Targets 2008-12 under Kyoto Protocol and "EU burden sharing"	Distance to target indicator (index points) in brackets, excluding Kyoto mechanisms and sinks
	(million tonnes)	(million tonnes)	(%)	(million tonnes)	(%)	(%)	(%)
Austria	78.9	91.3	+15.7 %	-1.2	-1.3 %	-13.0 %	+17.9 (+24.8)
Belgium	146.9	147.9	+0.7 %	0.3	+0.2 %	-7.5 %	+1.8 (+5.9)
Cyprus ⁽²⁾	6.0	8.9	+48.2 %	-0.3	-3.0 %	no target	no target
Czech Republic	196.3	147.1	-25.1 %	-0.5	-0.3 %	-8.0 %	-19.9 (-19.5)
Denmark	69.3	68.1	-1.8 %	-6.0	-8.1 %	-21.0 %	+7.9 (+12.9)
Estonia	42.6	21.3	-50.0 %	0.1	+0.7 %	-8.0 %	-44.4
Finland	71.1	81.4	+14.5 %	-4.2	-4.9 %	0.0 %	+13.1 (+14.5)
France	567.1	562.6	-0.8 %	1.5	+0.3 %	0.0 %	-1.2 (-0.8)
Germany	1230.0	1015.3	-17.5 %	-9.1	-0.9 %	-21.0 %	-2.8
Greece	111.1	137.6	+23.9 %	0.3	+0.3 %	+25.0 %	+6.4
Hungary	122.2	83.1	-32.0 %	-0.2	-0.2 %	-6.0 %	-27.8
Ireland	55.8	68.5	+22.7 %	0.1	+0.1 %	+13.0 %	+6.5 (+13.6)
Italy	519.6	582.5	+12.1 %	5.1	+0.9 %	-6.5 %	+9.9 (+16.7)
Latvia	25.9	10.7	-58.5 %	0.0	+0.4 %	-8.0 %	-52.9
Lithuania	50.9	20.3	-60.1 %	3.1	+17.9 %	-8.0 %	-54.5
Luxembourg	12.7	12.7	+0.3 %	1.3	+11.3 %	-28.0 %	+3.3 (+19.9)
Malta ⁽²⁾	2.2	3.2	+45.9 %	0.1	+4.2 %	no target	no target
The Netherlands	214.3	217.8	+1.6 %	2.5	+1.1 %	-6.0 %	-0.7 (+5.8)
Poland	565.3	386.4	-31.6 %	3.7	+1.0 %	-6.0 %	-27.4
Portugal	60.0	84.5	+41.0 %	0.9	+1.0 %	+27.0 %	+14.6 (+22.1)
Slovakia	73.2	51.0	-30.3 %	-0.1	-0.1 %	-8.0 %	-24.7
Slovenia	20.2	20.1	-0.8 %	0.4	+2.0 %	-8.0 %	-1.0 (+4.8)
Spain	289.4	427.9	+47.9 %	19.7	+4.8 %	+15.0 %	+31.2 (+37.4)
Sweden	72.5	69.9	-3.6 %	-1.1	-1.5 %	+4.0 %	-8.4 (-6.4)
The United Kingdom	767.9	659.3	-14.1 %	1.3	+0.2 %	-12.5 %	-5.8 (-5.4)
EU-15	4266.4	4227.4	-0.9 %	11.5	+0.3 %	-5.0 %	-4.1 (-4.7)
EU-10	1104.0	782.2	-31.9 %	0.5	+0.2 %	no common target	no common target
EU-25	5370.4	4999.6	-7.3 %	18.1	+0.4 %	no common target	no common target

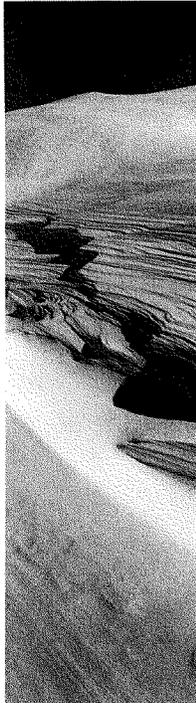
⁽¹⁾ For EU-15 the base year for CO₂, CH₄ and N₂O is 1990; for the fluorinated gases 13 Member States have indicated to select 1995 as the base year, whereas Austria and France have chosen 1990. As the EC inventory is the sum of Member States' inventories, the EC base year estimates for fluorinated gas emissions are the sum of 1995 emissions for 13 Member States and 1990 emissions for Austria and France.

⁽²⁾ Cyprus and Malta did not provide GHG emission estimates for 2004, therefore the data provided in this table is based on gap filling.

The base-year emissions reported in this table are the latest data available from national greenhouse gas inventories (6 June 2006). Final data will be available in the report on the EU's assigned amount (pursuant to Article 3, Paragraphs 7 and 8 of the Kyoto Protocol) under the UNFCCC, due end of 2006.

Note: Malta and Cyprus do not have Kyoto targets.

POLICY BRIEF



The Lieberman-Warner America's Climate Security Act: A Preliminary Assessment of Potential Economic Impacts

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The Lieberman-Warner America's Climate Security Act: A Preliminary Assessment of Potential Economic Impacts

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BACKGROUND

On August 2, 2007 Senator Lieberman and John Warner (R-VA) introduced a framework for *Lieberman-Warner America's Climate Security Act of 2007*. The proposal, which we refer to here as the “Lieberman-Warner” bill, calls for the United States to make substantial cuts in greenhouse gas (GHG) emissions below current levels by 2050. Such GHG emissions cuts will contribute to global efforts aimed at reducing atmospheric concentrations of GHG and mitigating harm to our climate system. The most recent assessment report of the *Intergovernmental Panel on Climate Change* provides a scientific basis for the world’s countries to take strong action to mitigate the threats of climate change.

The stated purpose of the GHG cuts out to 2050 in the Lieberman-Warner bill is to “avert catastrophic impacts of climate change, and to do so while preserving robust economic growth in the US economy and avoiding the imposition of hardship on US citizens.” Toward that end, this paper briefly summarizes how the actions necessary to meet the requirements of the proposed Lieberman-Warner bill might affect general and specific economic indicators using a model of the U.S. economy. Actions to fight the risks of climate change require a commitment of resources and investment and deployment of low-carbon technologies that cut across virtually all sectors of the economy. Because these resources are diverted from other uses in the economy, they entail opportunity costs, which are estimated and described below. It is important to recognize that our

¹ We acknowledge the research assistance of Kevin Fritze, Duke University. The analysis herein was done collaboratively by the two authors under a strategic alliance between Duke University and RTI International. All opinions are their own and should not be interpreted as the views or positions of their research institutions.

analysis does not consider or monetize the many potential economic benefits from successfully addressing climate change risks, including foregone damages to human health, ecosystems and human infrastructure, all of which are important to consider along with the costs evaluated here.

PROPOSED POLICY

The Lieberman-Warner framework issued in August, 2007 called for the electric power, transportation, and industrial sectors of the economy to cut emissions to 70% below 2005 levels by 2050, according to the following periodic benchmarks along the way (Table 1).

Table 1. Emission Reduction Benchmarks: Lieberman-Warner

Year	Emissions below 2005 levels
2012	0%
2020	-10%
2030	-30%
2040	-50%
2050	-70%

Small entities within the three sectors are exempt from coverage subject to the following size thresholds in Table 2:

Table 2: Coverage Size Thresholds by Sector: Lieberman-Warner

Sector	Coverage Size Threshold
Electric power	10 megawatts
Transportation	10,000 tons, CO2 equivalent
Industry	10,000 tons, CO2 equivalent

To determine the emissions trajectory allowed under the Lieberman-Warner bill, we set the 2012 emissions cap equal to the 2005 GHG emissions from the US EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005 (US EPA 2007a). We further reduced the cap to account for entities falling below the thresholds indicated in Table 2. The electric power and transportation sectors have virtually all of their emissions covered by the cap, the industrial sector has approximately 84% of its emissions covered, which is consistent with a recent estimate by the Nicholas Institute (2007). Netting out uncovered sectors and entities gives a target covered emissions rate of approximately 5,450 million tons of CO₂ equivalent emissions capped in 2012. Together the covered entities account for just over 75 percent of the GHG emissions in the U.S. economy.

Figure 1 depicts the capped emissions trajectory, following the benchmarks defined in Table 1, as well as reference case emissions under "Business-as-Usual" (BAU), estimated by the ADAGE model used for this analysis (see below).

The L-W targets to 2050 are contrasted with the expected emissions under a BAU reference case presented in Exhibit 1.

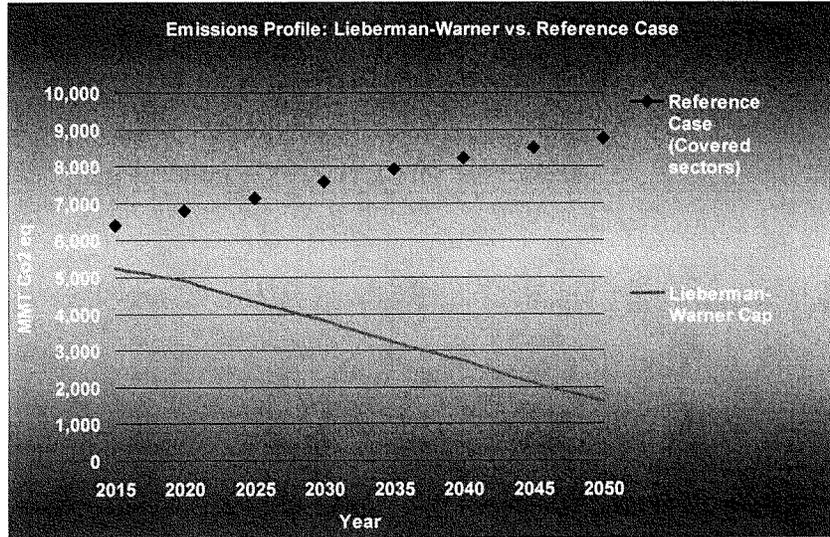


Figure 1. Emissions Profile: Lieberman-Warner Cap vs. Reference Case

While the analysis prepared here is based on the emissions targets defined in the August, 2007 framework proposal, we recognize that a detailed version of the proposal was released on October 18, 2007 with somewhat different targets than those outlined here. We expect that more comprehensive analyses of that detailed proposal will be conducted by the economic modeling community in the months to come. This analysis, therefore, can be best viewed as a preliminary quick glance at the potential impacts of the legislation, serving as a point of departure for the more detailed analyses to follow.

ADAGE MODEL

To examine the potential impacts of the Lieberman-Warner proposal, we use the ADAGE economic model developed by RTI International (Ross, 2007). The *Applied Dynamic Analysis of the Global Economy* (ADAGE) model 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. The focus of this analysis is at the national level for the U.S. To investigate policy effects, the CGE model combines a consistent theoretical structure with economic data covering all interactions among businesses and households in the economy. Economic data in ADAGE come from the Global Trade Analysis Project (GTAP) and IMPLAN model 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 (GHG) are also included in the model. For more detail on the ADAGE model including data sources, see Ross (2007).

ADAGE is also used by US EPA to provide economic analysis of proposed climate legislation and policy (see, for example, US EPA, 2007(b) analysis of The Climate Stewardship and Innovation Act of 2007, <http://www.epa.gov/climatechange/downloads/s280fullbrief.pdf>) and thereby provides an appropriate frame of reference for analyzing provisions of newly introduced legislation, such as the Lieberman-Warner bill.

MODELING RESULTS SUMMARY

The ADAGE model was run to generate reference case (BAU baseline) and policy scenarios for the Lieberman-Warner bill. The difference between a baseline run and a policy run is that in the latter, the economy is constrained to meet its emission target, whereas in the former, there are no constraints imposed on the economy and no incentives to cut GHGs. Detailed results are found in both tabular and graphic form in the appendix for a whole range of economic variables tracked by the model, with a special emphasis on the following variables over the time period 2015-2050

- GHG emissions
- Allowance prices
- Gross Domestic Product (GDP)
- Primary Energy Use (fossil and non-fossil)
- Energy Prices (fuels and electricity)
- Electricity generation mix

The key results are highlighted here, first for the core run of the Lieberman-Warner scenario, then for variations on the core run that tighten the stringency and expand the scope of coverage, then comparatively to the results for the economic analysis done by EPA for *The Climate Stewardship and Innovation Act of 2007* (S.280).

Core Lieberman-Warner Scenario

The core scenario holds the covered sectors to the target outlined above, while allowing entities to achieve these targets through allowance trading, offsets from domestic offsets and international credits to the full extent allowed, and banking and borrowing over time as needed. The key results from this scenario are briefly summarized below.

- **The policy generates substantial emissions reductions across the economy.** Total U.S. GHG emissions (including capped and uncapped sectors) are projected to be approximately 27% lower than Reference Case emissions in 2030, and 44% lower in 2050.
- **The capped sectors rely significantly on domestic offsets and international credits to achieve their net emission reduction targets.** Offsets bring in less expensive emission reductions from uncapped sources and thereby allow

compliance at a lower cost than could be achieved by the covered sectors acting alone.

- **Allowance prices** are projected at \$18/t CO₂e in 2015, \$38 /tCO₂e in 2030, and \$101 /tCO₂e in 2050.
- **Compliance with the targets has a small effect on rising GDP.** By 2030 GDP is projected to increase 112% from 2005 levels in the Reference Case, and by 2050 the projected increase in GDP from 2005 levels is 238%. Under Lieberman-Warner, GDP is estimated by the model to be 0.5% (\$75 billion) lower in 2015, 0.9% (\$245 billion) lower in 2030 and 1.5% (\$658 billion) lower in 2050 than in the Reference Case.
- **Mitigation involves a heavy switch from fossil to non-fossil energy in the near term, but a return of fossil energy as carbon capture and storage (CCS) becomes viable.** Coal use drops substantially in the early years of the policy (42% below baseline in 2020) but recovers from 2030-2050 as CCS networks are assumed to develop. Natural gas consumption stays roughly on its baseline track in the early years, as direct reduced demand is buffeted by fuel-switching from coal. But in the long run, natural gas use falls below the reference case as the energy sector becomes more decarbonized. Nuclear generation rises substantially over the course of the policy.
- **By 2045, 90 percent of CO₂ emissions from the electricity sector are being captured through CCS technologies.** Thus, additional reductions must come from other sectors, where abatement comes at a higher cost.
- **Fossil energy “demand” (or consumer) prices all rise once the GHG allowance price is incorporated. “Supply” (or producer) prices may fall in response to reduced demand.** For example, in 2030 the final demand price for petroleum is about 9% higher than the Reference Case, but the market supply price declines by about 4%.
- **Electricity prices are expected to rise.** As the electric power moves to decarbonized electricity, the price per kilowatt hour (kwh) will rise over time – 18% above the reference case in 2015, 30% above in 2030, and 27% above in 2050.

Sensitivity to changes in stringency and scope

We considered variations on the Lieberman-Warner cap that accelerates the pace of required reductions between 2012 and 2020 (“tighter cap”) as well as the possibility of including the residential and commercial sectors under the cap (they are not covered in the main results). Results from these sensitivity runs are:

- **A tighter cap moderately raises the allowance price** from \$18 to \$20/t CO₂e in 2015, from \$38 to \$42 in 2030, and from \$101 to \$111 in 2050.
- **Expanding coverage to include emissions in residential and commercial sectors reduces the allowance price somewhat, but raises the GDP impact.** Expanding the cap to include emissions from natural gas and heating oil used in homes and buildings provides more mitigation options and therefore reduces the marginal cost of allowances, yielding allowance price of \$16/t CO₂e in 2015, \$33

in 2030, and \$88 in 2050. GDP effects, though, would be slightly higher than in the core scenario: -0.51% vs -0.45% in 2015, -1.00% vs. -0.93% in 2030, and -1.59% vs -1.54% in 2050.

Comparison to EPA Results for S280

The results in this analysis are compared to the results from the EPA analysis (US EPA, 2007) using the ADAGE model to evaluate the effects of *The Climate Stewardship and Innovation Act of 2007* (S.280). The key differences are highlighted here.

- **Lieberman-Warner emission cuts are deeper than S.280.** Sector coverage under the proposed Lieberman-Warner cap is somewhat different than under S.280, and cumulative emissions allowed under the cap are around 10% less than S.280, in large part due to the requirement of a steadily declining cap under Lieberman-Warner, rather than the ratcheted or “stair step” cap under S280.
- **Projected allowance prices are higher under Lieberman-Warner.**

	2015	2030	2050
Lieberman-Warner	\$18	\$38	\$101
S.280	\$13	\$27	\$70

- **GDP impacts are larger, but still small relative to rising GDP levels in the economy.** GDP effects relative to the GDP Reference Case are

	2015	2030	2050
Lieberman-Warner	-0.45%	-0.93%	-1.54%
S.280	-0.22%	-0.55%	-1.07%

- **Under Lieberman-Warner, the pace of adoption of CCS accelerates and the scale expands relative to S.280.** CCS is not expected to be commercially viable at a large scale until around 2025. Starting in 2025, the adoption of CCS is more aggressive under the Lieberman-Warner proposal due to the more stringent target.

CONCLUSIONS

The draft framework for *Lieberman-Warner America’s Climate Security Act of 2007*, proposed on August, 2, 2007 calls for substantial cut in GHG emissions, with a target of 2005 emissions levels by 2012 and 70% below that level by 2050. Though modeled in many ways after *The Climate Stewardship and Innovation Act of 2007* (S.280), the targets go a bit deeper. As a result, the economic impacts are expected to be somewhat more pronounced than under S.280, though still small relative to the scale of economic activity in the economy. Because meeting these targets is largely an energy sector task, energy price effects are larger proportionally than overall GDP effects, but this is the price signal that drives increases in energy efficiency necessary to meet the targets. Achieving these emission reductions will require a substantial shift in the way that energy

is produced and used in this country, for instance requiring an almost completely decarbonized electric power sector by 2050. Cuts in the rest of the economy are a bit more difficult to achieve and there is likely to be a heavy reliance on offsets from uncapped sectors to attain national compliance. If these offsets do not materialize, costs would go up. On the other hand, if offsets – or any form of mitigation in the capped sectors - are cheaper than the models estimate, compliance costs would go down. The actual realized cost of the policy will depend significantly on the development and deployment of low-carbon technologies that are not widely in use today. Indeed, it may involve deployment of technologies not yet on the drawing board. It is difficult to predict and model how these developments will occur, but some mix of public and private investment will likely be necessary to further develop the portfolio of options. Moreover, complementary policies focused on accelerating the pace of adoption may also be considered. Capturing these factors in the long-term economic assessment of climate policy remains the focus of the economic modeling community's continued efforts.

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- Table A-1. Reference Case
- Table A-2. Lieberman-Warner Core Scenario
- Table A-3. Lieberman-Warner Residential-Commercial Scenario
- Table A-4. Lieberman-Warner Tighter Cap Scenario

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- Figure A-2. Allowance Price: Warner-Lieberman
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- Figure A-8: Allowance Prices: Lieberman-Warner Sensitivity Cases
- Figure A-9: GDP Effects: Lieberman-Warner Sensitivity Cases

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- Figure A-10. Total Emissions: Lieberman-Warner vs S.280
- Figure A-11. Allowance Prices: Lieberman-Warner vs S.280
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- Figure A-13. Electricity Generation Mix over Time: Lieberman-Warner vs S.280

Table A-1. Reference Case

	2010	2015	2020	2025	2030	2035	2040	2045	2050
Macroeconomic									
Population (millions)	308.9	322.4	335.8	349.4	363.6	373.8	383.1	391.6	399.6
GDP (billion 2005\$)	\$14,620	\$16,910	\$19,819	\$22,953	\$26,438	\$30,046	\$33,958	\$38,171	\$42,697
% Change in GDP	--	--	--	--	--	--	--	--	--
Consumption (bill 2005\$)	\$10,783	\$12,398	\$14,638	\$17,030	\$19,721	\$22,418	\$25,350	\$28,505	\$31,887
% Change in Consump	--	--	--	--	--	--	--	--	--
Allowance Price - \$/tCO₂e									
	--	--	--	--	--	--	--	--	--
Energy Prices - delivered (with allowance price)									
Coal (\$ per MMBtu)	\$1.59	\$1.53	\$1.54	\$1.59	\$1.67	\$1.68	\$1.70	\$1.71	\$1.73
Electricity (\$ per kWh)	\$0.071	\$0.069	\$0.071	\$0.072	\$0.073	\$0.074	\$0.075	\$0.076	\$0.078
Natural Gas (\$ per MMBtu)	\$7.16	\$6.55	\$6.89	\$7.46	\$7.99	\$8.10	\$8.21	\$8.32	\$8.42
Petroleum (\$ per MMBtu)	\$15.38	\$15.84	\$16.15	\$16.43	\$16.69	\$16.61	\$16.53	\$16.44	\$16.34
% Change in Coal	--	--	--	--	--	--	--	--	--
% Change in Electricity	--	--	--	--	--	--	--	--	--
% Change in Natural Gas	--	--	--	--	--	--	--	--	--
% Change in Petroleum	--	--	--	--	--	--	--	--	--
GHG Emissions - mmt CO₂e									
CO ₂	6,342.5	6,678.4	7,024.1	7,376.6	7,827.5	8,206.9	8,555.0	8,864.2	9,133.4
CH ₄	526.4	532.2	546.5	552.7	560.6	560.8	561.6	554.3	547.4
N ₂ O	374.4	383.1	394.2	403.3	412.7	403.7	395.1	377.2	360.3
HFC	154.3	212.7	275.9	269.8	263.9	256.7	249.7	248.3	246.8
PFC	11.7	10.8	10.6	11.0	11.4	11.8	12.2	12.3	12.3
SF ₆	14.2	13.3	13.0	12.9	12.8	12.5	12.3	12.2	12.1
Total	7,423	7,830	8,264	8,628	9,089	9,452	9,786	10,068	10,312
% Change	--	--	--	--	--	--	--	--	--
Primary Energy Use - Quadrillion Btu									
Coal	24.6	25.1	26.5	28.5	31.5	32.8	33.9	34.8	35.5
Natural Gas	24.3	27.1	28.3	28.2	27.9	29.3	30.7	31.9	33.0
Petroleum	43.0	45.3	47.7	50.2	53.2	56.0	58.7	61.2	63.5
Nuclear	8.5	8.7	9.1	9.1	9.1	9.1	9.1	9.1	9.1
Renewable Elec.	4.2	4.3	4.5	4.7	4.9	4.9	5.0	5.1	5.2
Total *	104.6	110.5	116.1	120.8	126.5	132.2	137.4	142.1	146.3
% Change	--	--	--	--	--	--	--	--	--
Energy Intensity - total *									
1000 btu per \$ of GDP	7.16	6.53	5.86	5.26	4.79	4.40	4.05	3.72	3.43
Electricity Generation - billion kWh									
Fossil Fuels w/o CCS	2,936	3,208	3,449	3,676	3,981	4,265	4,536	4,787	5,017
Nuclear	816	837	879	879	879	879	879	879	879
Other Non-Fossil	408	414	433	452	470	477	484	491	499
Fossil with CCS	0	0	0	0	0	0	0	0	0
Total	4,160	4,460	4,761	5,007	5,330	5,621	5,898	6,157	6,395
% Change	--	--	--	--	--	--	--	--	--
* Note: only renewable energy used in electricity generation is included.									
Emissions									
	2010	2015	2020	2025	2030	2035	2040	2045	2050
Total	7,423.5	7,830.5	8,264.2	8,626.3	9,088.9	9,452.5	9,785.7	10,068.4	10,312.4
CO ₂	6,342.5	6,678.4	7,024.1	7,376.6	7,827.5	8,206.9	8,555.0	8,864.2	9,133.4
CH ₄	526.4	532.2	546.5	552.7	560.6	560.8	561.6	554.3	547.4
N ₂ O	374.4	383.1	394.2	403.3	412.7	403.7	395.1	377.2	360.3
HFC	154.3	212.7	275.9	269.8	263.9	256.7	249.7	248.3	246.8
PFC	11.7	10.8	10.6	11.0	11.4	11.8	12.2	12.3	12.3
SF ₆	14.2	13.3	13.0	12.9	12.8	12.5	12.3	12.2	12.1
Total	6,039.9	6,408.8	6,805.7	7,146.2	7,582.8	7,924.3	8,236.7	8,518.1	8,762.5
CO ₂	5,764.9	6,080.9	6,412.8	6,757.7	7,198.5	7,549.3	7,870.9	8,156.3	8,404.7
CH ₄	51.1	46.4	46.4	46.0	45.7	44.6	43.6	43.3	43.0
N ₂ O	43.8	44.7	47.0	48.8	50.5	49.3	48.1	45.7	43.5
HFC	154.3	212.7	275.9	269.8	263.9	256.7	249.7	248.3	246.8
PFC	11.7	10.8	10.6	11.0	11.4	11.8	12.2	12.3	12.3
SF ₆	14.2	13.3	13.0	12.9	12.8	12.5	12.3	12.2	12.1
Total	1,383.5	1,421.7	1,458.5	1,480.1	1,506.1	1,528.2	1,549.0	1,550.4	1,550.0
CO ₂	577.6	597.5	611.3	618.9	629.0	657.6	684.1	707.8	728.7
CH ₄	475.3	485.8	500.1	506.6	514.9	516.2	518.0	511.0	504.4
N ₂ O	330.6	338.4	347.1	354.6	362.1	354.5	347.0	331.5	316.8
HFC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PFC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SF ₆	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table A-2. Lieberman-Warner Core Scenario

Note: all percent change is from reference case

	2010	2015	2020	2025	2030	2035	2040	2045	2050
Macroeconomic									
Population (millions)	308.9	322.4	335.8	349.4	363.6	373.8	383.1	391.6	399.6
GDP (billion 2005\$)	\$14,583	\$16,835	\$19,672	\$22,749	\$26,193	\$29,743	\$33,578	\$37,689	\$42,039
% Change in GDP	-0.25%	-0.45%	-0.74%	-0.89%	-0.93%	-1.01%	-1.12%	-1.26%	-1.54%
Consumption (bill 2005\$)	\$10,776	\$12,311	\$14,514	\$16,894	\$19,562	\$22,229	\$25,119	\$28,255	\$31,567
% Change in Consump	-0.07%	-0.70%	-0.85%	-0.80%	-0.80%	-0.85%	-0.91%	-0.88%	-1.00%
Allowance Price - \$/CO₂e		\$18.1	\$23.1	\$29.6	\$37.8	\$48.4	\$61.8	\$78.9	\$100.7
Energy Prices - delivered (with allowance price)									
Coal (\$ per MMBtu)	\$1.59	\$3.17	\$3.64	\$4.30	\$5.16	\$6.19	\$7.53	\$9.23	\$11.33
Electricity (\$ per kWh)	\$0.072	\$0.082	\$0.086	\$0.090	\$0.095	\$0.100	\$0.104	\$0.097	\$0.098
Natural Gas (\$ per MMBtu)	\$7.16	\$7.55	\$8.15	\$8.85	\$9.70	\$10.16	\$10.76	\$11.82	\$12.88
Petroleum (\$ per MMBtu)	\$15.34	\$16.77	\$17.32	\$17.61	\$18.25	\$18.73	\$19.37	\$20.27	\$21.47
% Change in Coal	-0.2%	106.4%	137.2%	171.2%	208.7%	267.7%	343.3%	438.9%	556.1%
% Change in Electricity	0.6%	18.2%	21.5%	24.7%	29.6%	34.8%	38.1%	26.7%	27.0%
% Change in Natural Gas	-0.1%	15.3%	18.4%	18.7%	21.3%	25.4%	31.1%	39.7%	52.9%
% Change in Petroleum	-0.3%	5.9%	7.3%	7.2%	9.4%	12.8%	17.2%	23.3%	31.3%
GHG Emissions - mmt CO₂e									
CO ₂	6,345.9	5,697.2	5,809.3	5,762.5	5,698.4	5,438.8	5,001.9	4,879.1	4,913.0
CH ₄	491.2	497.9	508.5	500.4	503.6	493.7	474.7	451.8	438.6
N ₂ O	395.3	396.9	404.6	397.1	405.8	396.5	387.5	369.9	352.8
HFC	13.0	39.0	45.7	40.3	35.7	31.5	27.8	25.0	22.6
PFC	5.3	6.3	6.0	6.0	6.0	6.0	6.0	5.9	5.7
SF ₆	4.8	6.1	5.6	5.3	5.0	4.7	4.3	4.2	4.0
Total	7,265.6	6,643.4	6,760.2	6,712.6	6,664.4	6,371.1	6,002.2	6,736.6	6,737.3
% Change	-2.3%	-15.2%	-18.0%	-22.2%	-26.8%	-32.6%	-39.7%	-43.0%	-44.4%
Primary Energy Use - Quadrillion Btu									
Coal	24.6	15.9	15.2	14.7	15.3	16.2	20.8	25.7	25.5
Natural Gas	24.2	27.0	28.1	27.4	26.3	25.5	22.9	21.5	21.5
Petroleum	43.2	43.7	45.6	47.8	50.1	51.8	53.1	54.0	54.6
Nuclear	8.6	9.5	10.2	12.0	14.2	16.7	18.6	20.1	22.2
Renewable Elec.	4.2	4.4	4.6	4.9	5.2	5.4	5.6	5.5	5.6
Total *	104.8	100.5	103.8	106.9	111.0	116.7	120.9	126.9	129.6
% Change	0.1%	-9.0%	-10.6%	-11.5%	-12.3%	-12.5%	-12.0%	-10.7%	-11.5%
Energy Intensity - total *									
1000 btu per \$ of GDP	7.18	5.97	5.27	4.70	4.24	3.89	3.60	3.37	3.08
Electricity Generation - billion kWh									
Fossil Fuels w/o CCS	2,923	2,843	2,989	2,814	2,509	1,816	613	0	0
Nuclear	825	918	979	1,154	1,362	1,606	1,787	1,935	2,138
Other Non-Fossil	407	425	449	477	507	526	538	534	546
Fossil with CCS	0	0	0	147	443	1,061	2,261	3,112	3,089
Total	4,155	4,186	4,417	4,593	4,822	5,009	6,200	6,582	6,773
% Change	-0.1%	-6.1%	-7.2%	-8.3%	-9.5%	-10.9%	-11.8%	-9.3%	-9.7%

* Note: only renewable energy used in electricity generation is included.

		2010	2015	2020	2025	2030	2035	2040	2045	2050
Emissions		7,265.6	6,643.4	6,779.7	6,711.6	6,664.4	6,371.1	6,002.2	6,736.6	6,737.3
USA (total)	CO ₂	6,345.9	5,697.2	5,809.3	5,762.5	5,698.4	5,438.8	5,001.9	4,879.1	4,913.0
	CH ₄	491.2	497.9	508.5	500.4	503.6	493.7	474.7	451.8	438.6
	N ₂ O	395.3	396.9	404.6	397.1	405.8	396.5	387.5	369.9	352.8
	HFC	13.0	39.0	45.7	40.3	35.7	31.5	27.8	25.0	22.6
	PFC	5.3	6.3	6.0	6.0	6.0	6.0	6.0	5.9	5.7
	SF ₆	4.8	6.1	5.6	5.3	5.0	4.7	4.3	4.2	4.0
	Total	6,834.9	5,194.2	6,299.2	6,234.6	6,160.8	4,847.3	4,368.6	4,216.1	4,221.0
USA (covered)	CO ₂	5,764.0	5,094.1	5,182.5	5,133.3	5,054.0	4,757.4	4,284.5	4,136.8	4,149.0
	CH ₄	4.2	5.9	4.9	3.9	3.3	2.9	3.2	3.5	3.0
	N ₂ O	43.6	42.8	44.5	45.8	46.8	44.8	42.7	39.7	36.7
	HFC	13.0	39.0	45.7	40.3	35.7	31.5	27.8	25.0	22.6
	PFC	5.3	6.3	6.0	6.0	6.0	6.0	6.0	5.9	5.7
	SF ₆	4.8	6.1	5.6	5.3	5.0	4.7	4.3	4.2	4.0
	Total	1,420.8	1,449.2	1,480.6	1,477.0	1,603.6	1,623.8	1,633.7	1,620.8	1,616.8
USA (uncovered)	CO ₂	581.9	603.2	616.8	629.2	644.4	681.4	717.5	742.2	764.0
	CH ₄	487.0	492.0	503.6	496.5	500.3	490.7	471.5	448.3	435.5
	N ₂ O	351.7	354.1	360.1	351.3	359.0	351.7	344.7	330.2	316.1
	HFC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	PFC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	SF ₆	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	1,420.8	1,449.2	1,480.6	1,477.0	1,603.6	1,623.8	1,633.7	1,620.8	1,616.8

Table A3: Lieberman-Warner Residential-Commercial Scenario

Note: all percent change is from reference case

	2010	2015	2020	2025	2030	2035	2040	2045	2050
Macroeconomic									
Population (millions)	308.9	322.4	335.8	349.4	363.6	373.8	383.1	391.6	399.6
GDP (billion 2005\$)	\$14,581	\$16,823	\$19,853	\$22,729	\$26,173	\$29,720	\$33,551	\$37,654	\$42,016
% Change in GDP	-0.26%	-0.51%	-0.84%	-0.98%	-1.00%	-1.09%	-1.20%	-1.36%	-1.59%
Consumption (bill 2005\$)	\$10,769	\$12,306	\$14,509	\$16,889	\$19,558	\$22,224	\$25,112	\$28,231	\$31,549
% Change in Consump	-0.13%	-0.75%	-0.88%	-0.83%	-0.83%	-0.86%	-0.94%	-0.96%	-1.06%
Allowance Price - \$/tCO2e									
	\$15.7	\$20.1	\$25.7	\$32.9	\$42.1	\$53.7	\$68.6	\$87.6	
Energy Prices - delivered (with allowance price)									
Coal (\$ per MMBtu)	\$1.59	\$2.94	\$3.35	\$3.94	\$4.69	\$5.59	\$6.75	\$8.24	\$10.08
Electricity (\$ per kWh)	\$0.072	\$0.080	\$0.084	\$0.088	\$0.092	\$0.097	\$0.101	\$0.098	\$0.097
Natural Gas (\$ per MMBtu)	\$7.16	\$7.34	\$7.89	\$8.56	\$9.35	\$9.76	\$10.25	\$11.03	\$12.05
Petroleum (\$ per MMBtu)	\$15.35	\$16.66	\$17.17	\$17.42	\$18.00	\$18.40	\$18.93	\$19.68	\$20.68
% Change in Coal	-0.2%	91.8%	118.5%	148.2%	181.7%	232.3%	297.6%	380.8%	483.4%
% Change in Electricity	0.6%	15.8%	18.7%	21.5%	26.0%	30.6%	34.5%	28.2%	25.7%
% Change in Natural Gas	0.0%	12.1%	14.6%	14.8%	16.9%	20.4%	24.9%	32.6%	43.1%
% Change in Petroleum	-0.2%	5.2%	6.4%	6.0%	7.9%	10.8%	14.5%	19.7%	26.6%
GHG Emissions - mmt CO2e									
CO2	6,344.1	5,750.1	5,867.5	5,844.5	5,801.1	5,577.9	5,168.1	4,881.8	4,883.7
CH4	491.2	497.5	507.6	499.5	502.8	494.2	478.4	447.2	429.4
N2O	395.5	397.2	405.0	397.5	406.2	397.0	388.0	370.2	353.3
HFC	13.0	41.3	48.3	42.6	37.8	33.3	29.4	26.4	23.8
PFC	5.3	6.4	6.1	6.1	6.1	6.1	6.1	6.0	5.8
SF6	4.8	6.3	5.8	5.5	5.2	4.8	4.5	4.3	4.1
Total	7,264	6,699	6,840	6,796	6,769	6,513	6,074	5,736	5,700
% Change	-2.3%	-14.5%	-17.2%	-21.2%	-25.6%	-31.1%	-37.9%	-43.0%	-44.7%
Primary Energy Use - Quadrillion Btu									
Coal	24.6	16.5	15.9	15.2	15.5	15.8	19.0	25.1	25.9
Natural Gas	24.2	26.8	27.9	27.4	26.3	25.8	23.8	20.9	20.4
Petroleum	43.1	43.7	45.7	47.9	50.2	52.1	53.4	54.4	55.0
Nuclear	8.6	9.5	10.1	11.9	14.1	16.6	18.5	20.2	22.2
Renewable Elec.	4.2	4.4	4.6	4.9	5.2	5.4	5.5	5.5	5.6
Total *	104.7	101.0	104.2	107.3	111.3	115.7	120.3	126.0	129.1
% Change	0.1%	-8.6%	-10.2%	-11.2%	-12.0%	-12.5%	-12.5%	-11.4%	-11.7%
Energy Intensity - total *									
1000 btu per \$ of GDP	7.18	6.00	5.30	4.72	4.25	3.89	3.59	3.35	3.07
Electricity Generation - billion kWh									
Fossil Fuels w/o CCS	2,922	2,879	3,033	2,915	2,668	2,110	1,071	93	0
Nuclear	825	913	973	1,147	1,354	1,597	1,778	1,939	2,133
Other Non-Fossil	407	423	447	474	502	519	535	535	544
Fossil with CCS	0	0	0	99	348	844	1,874	3,001	3,143
Total	4,154	4,216	4,453	4,635	4,872	5,070	5,268	5,569	5,821
% Change	-0.1%	-5.5%	-6.5%	-7.4%	-8.6%	-9.8%	-10.9%	-9.5%	-9.0%

* Note: only renewable energy used in electricity generation is included.

	2010	2015	2020	2025	2030	2035	2040	2045	2050
Emissions									
Total	7,264.0	6,698.8	6,840.2	6,796.6	6,769.1	6,513.3	6,074.6	5,735.9	5,700.2
CO ₂	6,344.1	5,750.1	5,867.5	5,844.5	5,801.1	5,577.9	5,168.1	4,881.8	4,883.7
CH ₄	491.2	497.5	507.6	499.5	502.8	494.2	478.4	447.2	429.4
N ₂ O	395.5	397.2	405.0	397.5	406.2	397.0	388.0	370.2	353.3
HFC	13.0	41.3	48.3	42.6	37.8	33.3	29.4	26.4	23.8
PFC	5.3	6.4	6.1	6.1	6.1	6.1	6.1	6.0	5.8
SF ₆	4.8	6.3	5.8	5.5	5.2	4.8	4.5	4.3	4.1
Total	6,360.3	5,800.4	5,926.3	5,899.0	5,849.7	5,616.9	5,196.6	4,901.3	4,893.9
CO ₂	6,289.3	5,697.1	5,815.1	5,794.7	5,750.1	5,523.5	5,110.4	4,820.9	4,819.7
CH ₄	4.2	6.5	5.3	4.2	3.6	3.0	3.1	3.6	3.3
N ₂ O	43.6	42.9	44.6	46.0	47.1	45.2	43.2	40.1	37.1
HFC	13.0	41.3	48.3	42.6	37.8	33.3	29.4	26.4	23.8
PFC	5.3	6.4	6.1	6.1	6.1	6.1	6.1	6.0	5.8
SF ₆	4.8	6.3	5.8	5.5	5.2	4.8	4.5	4.3	4.1
Total	893.8	898.6	916.0	896.6	909.4	897.4	877.9	834.6	806.4
CO ₂	54.8	53.1	52.3	49.8	51.0	54.4	57.8	60.9	64.0
CH ₄	487.1	491.0	502.3	495.3	499.2	491.1	475.3	443.6	426.2
N ₂ O	351.9	354.4	360.4	351.5	350.1	351.8	344.8	330.1	316.2
HFC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PFC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SF ₆	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
USA (uncovered)									

Table A4: Lieberman-Warner Tighter Cap Scenario

Note: all percent change is from reference case									
	2010	2015	2020	2025	2030	2035	2040	2045	2050
Macroeconomic									
Population (millions)	308.9	322.4	335.8	349.4	363.6	373.8	383.1	391.6	399.6
GDP (billion 2005\$)	\$14,580	\$16,828	\$19,656	\$22,735	\$26,180	\$29,724	\$33,551	\$37,656	\$41,996
% Change in GDP	-0.27%	-0.48%	-0.82%	-0.95%	-0.98%	-1.07%	-1.20%	-1.35%	-1.64%
Consumption (bill 2005\$)	\$10,778	\$12,307	\$14,507	\$16,884	\$19,549	\$22,210	\$25,097	\$28,235	\$31,540
% Change in Consump	-0.05%	-0.74%	-0.89%	-0.86%	-0.87%	-0.93%	-1.00%	-0.95%	-1.09%
Allowance Price - \$/tCO_{2e}	\$20.0	\$25.5	\$32.6	\$41.8	\$53.4	\$68.2	\$87.1	\$111.1	
Energy Prices - delivered (with allowance price)									
Coal (\$ per MMBtu)	\$1.59	\$3.35	\$3.87	\$4.59	\$5.53	\$6.66	\$8.14	\$10.01	\$12.33
Electricity (\$ per kWh)	\$0.072	\$0.083	\$0.087	\$0.092	\$0.097	\$0.103	\$0.106	\$0.097	\$0.099
Natural Gas (\$ per MMBtu)	\$7.16	\$7.65	\$8.28	\$9.01	\$9.90	\$10.41	\$11.09	\$12.07	\$13.46
Petroleum (\$ per MMBtu)	\$15.34	\$16.89	\$17.47	\$17.81	\$18.51	\$19.06	\$19.80	\$20.83	\$22.18
% Change in Coal	-0.2%	118.0%	152.2%	189.7%	232.2%	296.2%	379.4%	484.6%	613.8%
% Change in Electricity	0.6%	19.9%	23.5%	27.0%	32.4%	38.0%	40.8%	27.2%	27.8%
% Change in Natural Gas	-0.1%	16.8%	20.3%	20.9%	23.9%	28.5%	35.2%	45.1%	59.7%
% Change in Petroleum	-0.3%	6.6%	8.2%	8.4%	10.9%	14.8%	19.8%	26.7%	35.7%
GHG Emissions - mmt CO_{2e}									
CO ₂	6,345.9	5,634.1	5,738.3	5,685.2	5,614.4	5,346.1	4,909.6	4,813.9	4,830.8
CH ₄	491.2	497.1	507.5	499.3	502.2	491.4	470.8	448.9	435.1
N ₂ O	395.2	396.3	403.9	396.2	404.7	395.3	386.2	368.6	351.4
HFC	13.0	37.5	43.9	38.7	34.3	30.2	26.7	24.0	21.7
PFC	5.3	6.2	5.9	5.9	5.9	5.9	5.9	5.8	5.6
SF ₆	4.8	6.0	5.5	5.2	4.9	4.6	4.3	4.1	3.9
Total	7,255	6,677	6,705	6,630	6,566	6,274	5,803	5,665	5,648
% Change	-2.3%	-16.0%	-18.9%	-23.1%	-27.8%	-33.6%	-40.7%	-43.7%	-45.2%
Primary Energy Use - Quadrillion Btu									
Coal	24.6	15.4	14.7	14.1	14.7	15.9	20.7	25.6	25.3
Natural Gas	24.2	26.9	28.0	27.4	26.1	25.2	22.4	21.2	21.1
Petroleum	43.2	43.5	45.4	47.5	49.7	51.3	52.4	53.3	53.7
Nuclear	8.6	9.6	10.2	12.0	14.2	16.8	18.7	20.2	22.3
Renewable Elec.	4.2	4.4	4.7	5.0	5.3	5.5	5.6	5.5	5.7
Total *	104.8	99.9	103.0	106.0	110.1	114.7	119.9	126.7	128.0
% Change	0.1%	-9.6%	-11.3%	-12.2%	-13.0%	-13.3%	-12.8%	-11.5%	-12.5%
Energy Intensity - total *									
1000 btu per \$ of GDP	7.19	5.93	5.24	4.66	4.20	3.86	3.57	3.34	3.05
Electricity Generation - billion kWh									
Fossil Fuels w/o CCS	2,923	2,816	2,956	2,774	2,459	1,742	529	0	0
Nuclear	825	921	982	1,158	1,368	1,613	1,793	1,938	2,142
Other Non-Fossil	407	426	451	480	511	532	542	536	547
Fossil with CCS	0	0	0	149	447	1,080	2,297	3,098	3,063
Total	4,155	4,163	4,390	4,661	4,784	4,966	5,161	5,571	5,753
% Change	-0.1%	-6.7%	-7.8%	-8.9%	-10.2%	-11.7%	-12.5%	-9.5%	-10.0%

* Note: only renewable energy used in electricity generation is included.

	2010	2015	2020	2025	2030	2035	2040	2045	2050
Emissions									
Total	7,255.4	6,677.1	6,705.0	6,630.4	6,566.4	6,273.5	5,803.5	5,665.4	5,648.5
CO ₂	6,345.9	5,634.1	5,738.3	5,685.2	5,614.4	5,346.1	4,909.6	4,813.9	4,830.8
CH ₄	491.2	497.1	507.5	499.3	502.2	491.4	470.8	448.9	435.1
N ₂ O	395.2	396.3	403.9	396.2	404.7	395.3	386.2	368.6	351.4
HFC	13.0	37.5	43.9	38.7	34.3	30.2	26.7	24.0	21.7
PFC	5.3	6.2	5.9	5.9	5.9	5.9	5.9	5.8	5.6
SF ₆	4.8	6.0	5.5	5.2	4.9	4.6	4.3	4.1	3.9
Total	6,834.8	6,128.4	6,225.2	6,154.4	6,064.1	4,751.8	4,273.9	4,149.0	4,138.1
CO ₃	5,763.9	5,030.7	5,121.3	5,055.6	4,969.6	4,664.1	4,191.9	4,072.7	4,068.1
CH ₃	4.2	5.5	4.5	3.6	3.1	2.8	3.1	3.4	2.9
N ₂ O	43.6	42.5	44.2	45.4	46.3	44.2	42.1	38.9	35.9
HFC	13.0	37.5	43.9	38.7	34.3	30.2	26.7	24.0	21.7
PFC	5.3	6.2	5.9	5.9	5.9	5.9	5.9	5.8	5.6
SF ₇	4.8	6.0	5.5	5.2	4.9	4.6	4.3	4.1	3.9
Total	1,420.6	1,448.7	1,479.8	1,476.0	1,502.3	1,521.7	1,529.6	1,616.4	1,610.4
CO ₄	582.0	603.4	617.0	629.5	644.8	682.0	717.7	741.2	762.7
CH ₅	487.0	491.6	503.0	495.7	499.1	488.6	467.8	445.5	432.2
N ₂ O	351.6	353.7	359.7	350.8	356.4	351.1	344.1	329.7	315.5
HFC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PFC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SF ₈	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
USA (covered)									
USA (uncovered)									

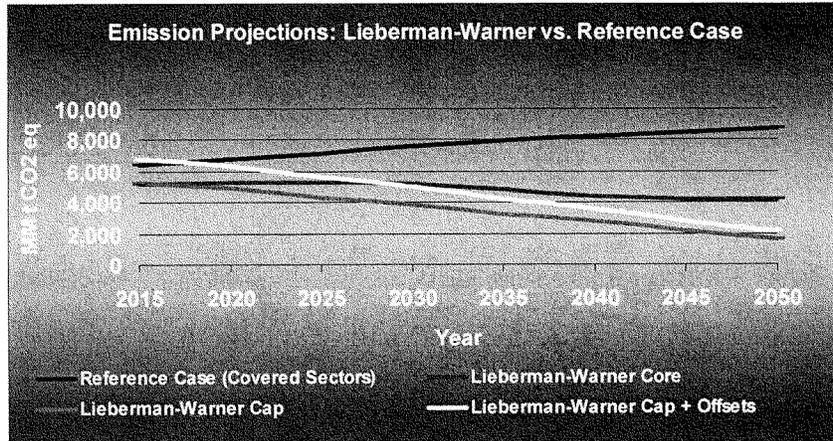


Figure A-1. Emission Projections: Lieberman-Warner vs Reference Case
Buying offsets from uncapped sources increases the amount that the covered sectors can emit.

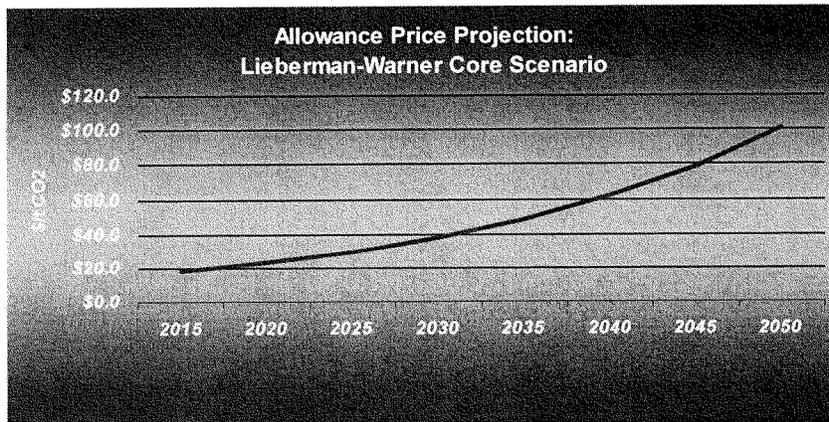


Figure A-2. Allowance Price: Warner-Lieberman

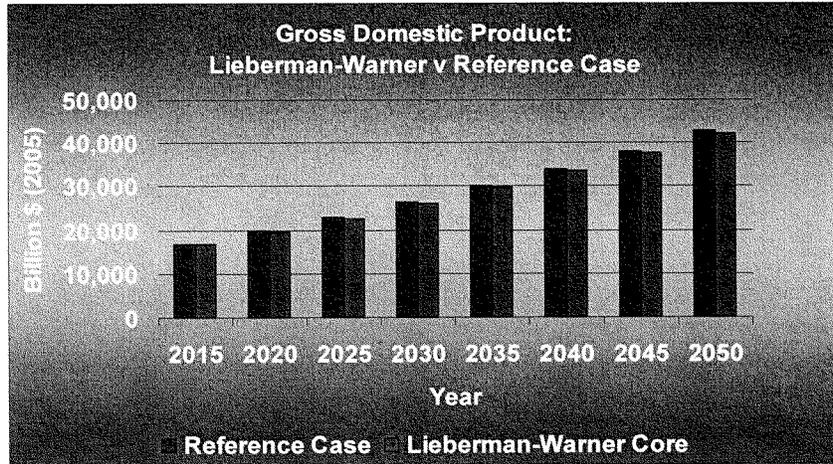


Figure A-3. GDP Effects: Lieberman-Warner

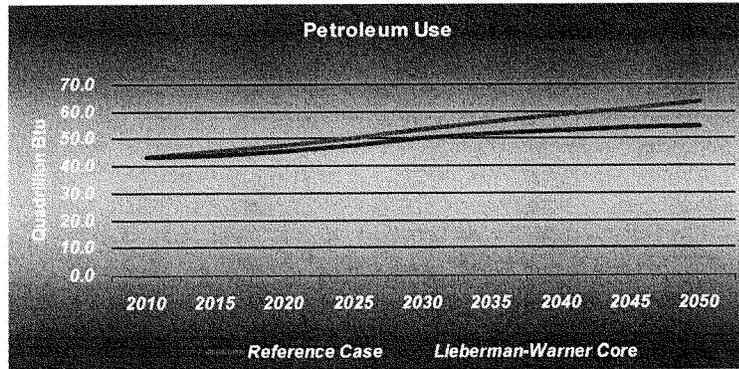
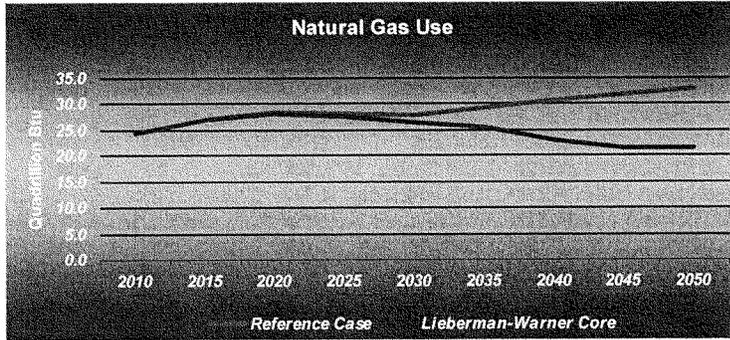
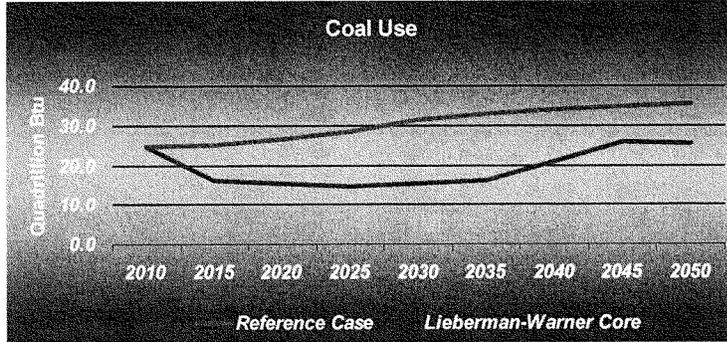


Figure A-4: Fossil Energy Use: Lieberman-Warner

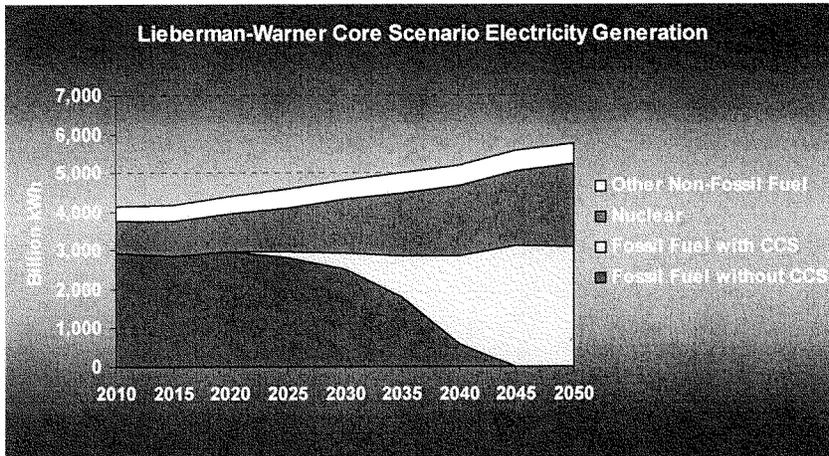
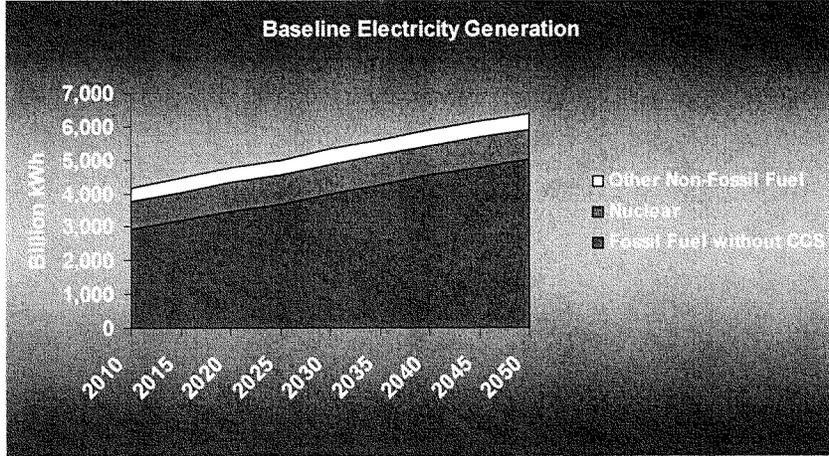


Figure A-5. Electricity Generation: Lieberman-Warner

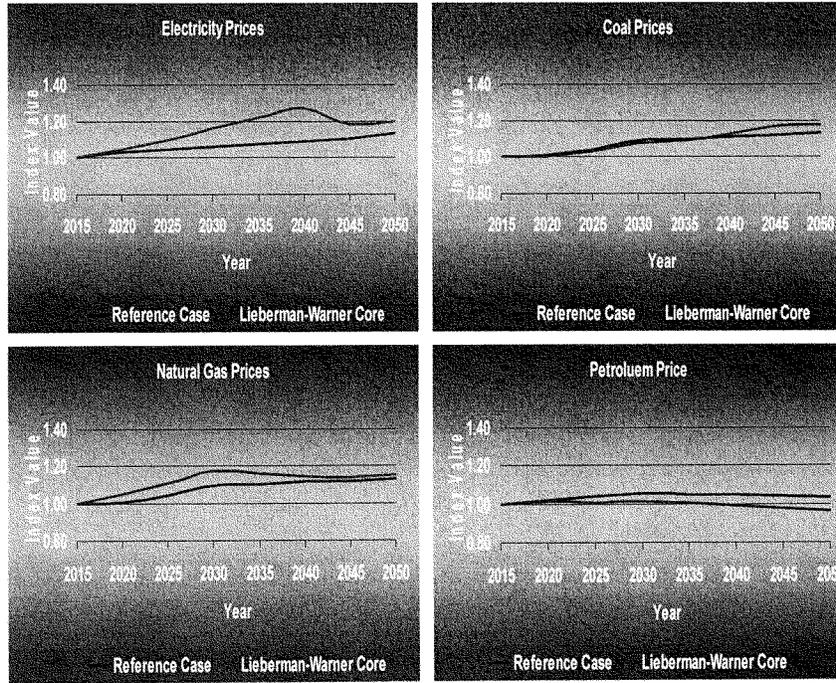


Figure A-6. Energy Price Indexes: Lieberman-Warner

Sensitivity Cases

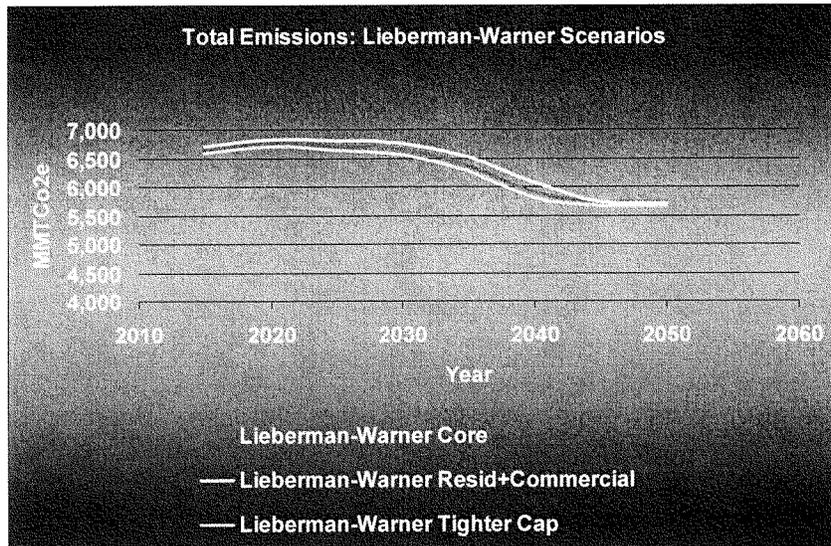


Figure A-7. Emissions: Lieberman-Warner Scenarios

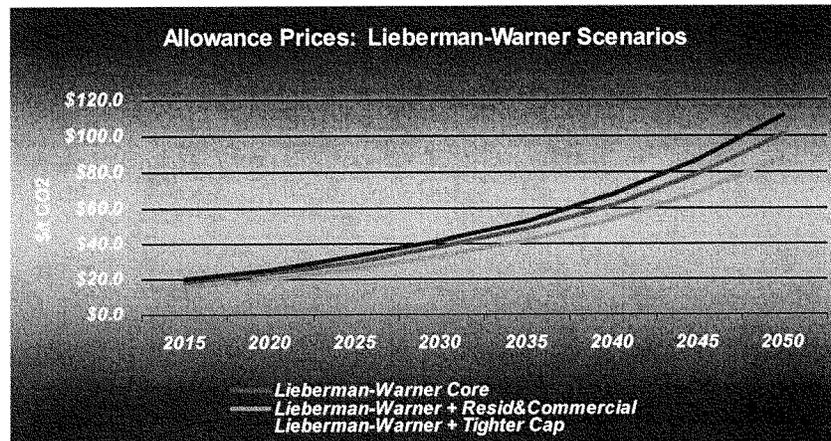


Figure A-8: Allowance Prices: Lieberman-Warner Sensitivity Cases

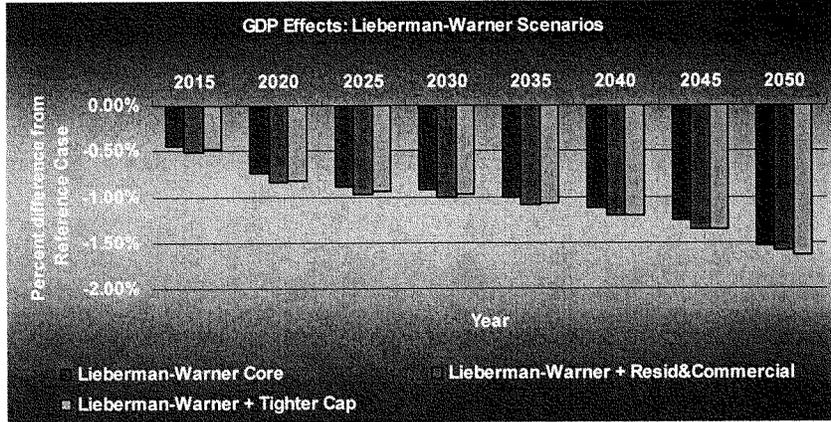


Figure A-9: GDP Effects: Lieberman-Warner Sensitivity Cases

Comparison to S.280

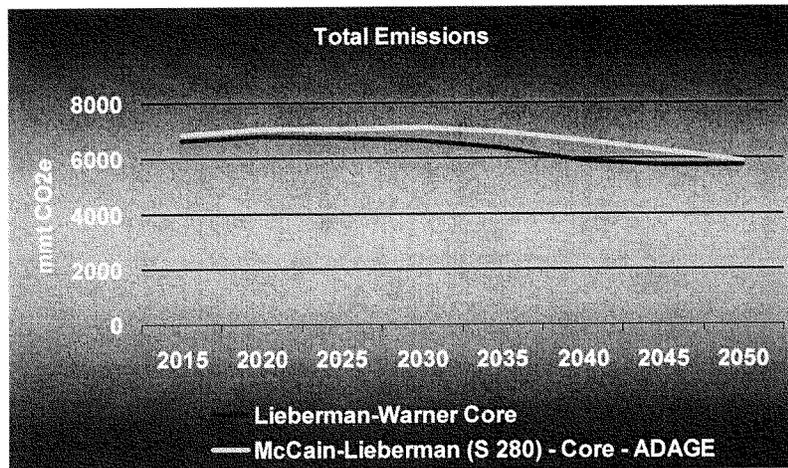


Figure A-10. Total Emissions: Lieberman-Warner vs S.280

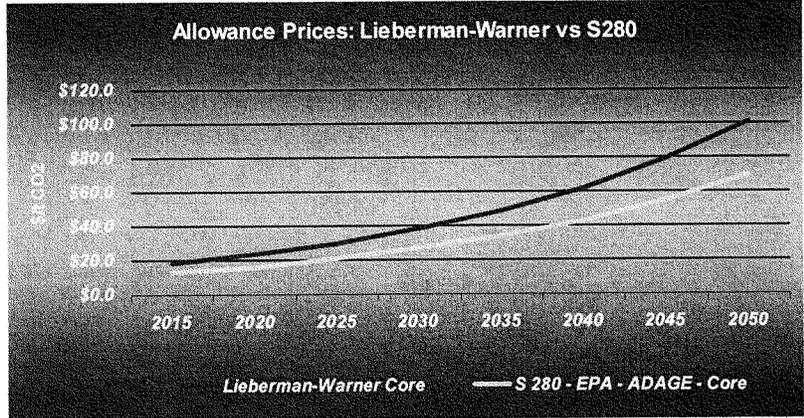


Figure A-11. Allowance Prices: Lieberman-Warner vs S.280

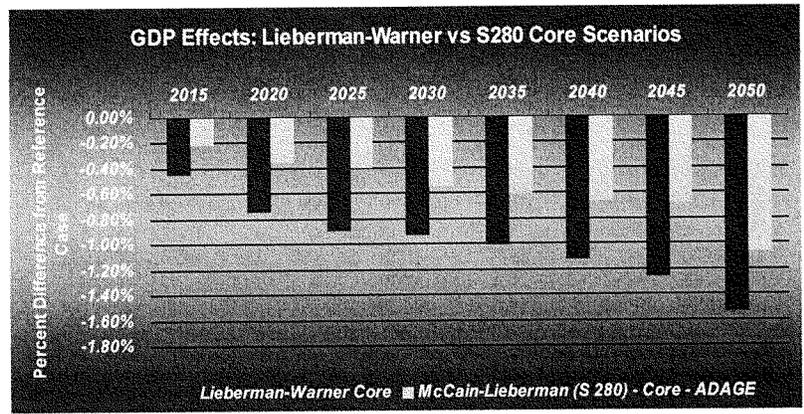


Figure A-12. GDP Effects: Lieberman-Warner vs S.280

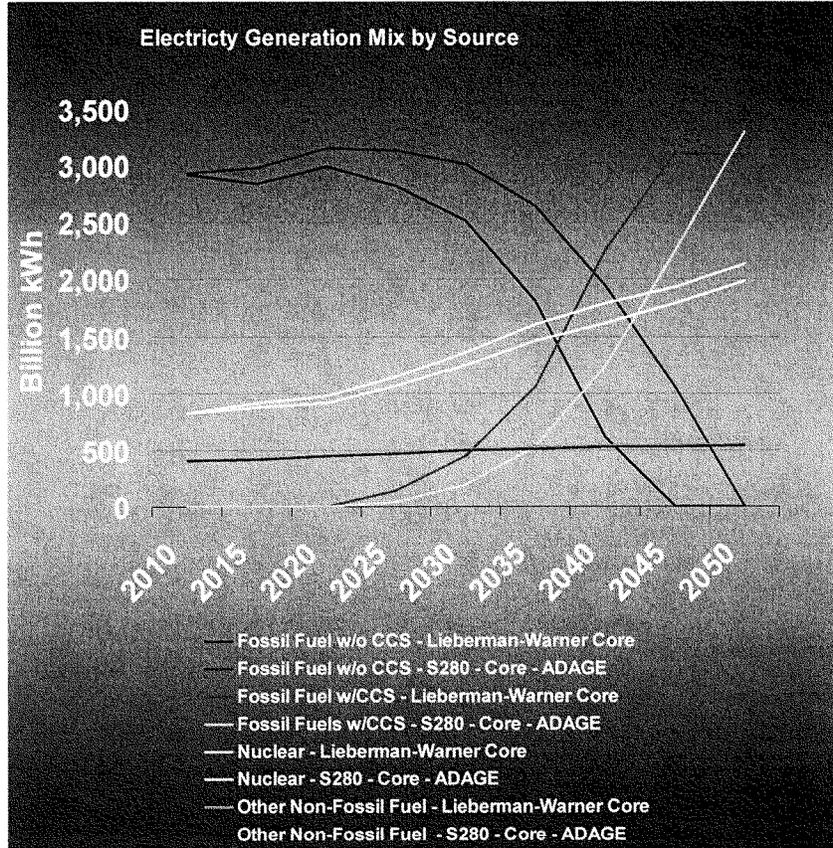


Figure A-13. Electricity Generation Mix over Time: Lieberman-Warner vs S.280

the Nicholas Institute

The Nicholas Institute for Environmental Policy Solutions at Duke University is a nonpartisan institute founded in 2005 to engage with decision makers in government, the private sector and the nonprofit community to develop innovative proposals that address critical environmental challenges. The Institute seeks to act as an "honest broker" in policy debates by fostering open, ongoing dialogue between stakeholders on all sides of the issues and by providing decision makers with timely and trustworthy policy-relevant analysis based on academic research. The Institute's staff leverages the broad expertise of Duke University as well as public and private partners nationwide.

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