LEGISLATIVE PROPOSALS TO REDUCE GREENHOUSE GAS EMISSIONS: AN OVERVIEW

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY AND AIR QUALITY

OF THE

COMMITTEE ON ENERGY AND COMMERCE

HOUSE OF REPRESENTATIVES

ONE HUNDRED TENTH CONGRESS

SECOND SESSION

JUNE 19, 2008

Serial No. 110–130

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energycommerce.house.gov

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U.S. GOVERNMENT PRINTING OFFICE

56–980 PDF WASHINGTON : 2008

For sale by the Superintendent of Documents, U.S. Government Printing Office
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WITNESSES

SUBMITTED MATERIAL

[1] Mr. Cicio did not present an oral statement at the hearing.

LEGISLATIVE PROPOSALS TO REDUCE GREENHOUSE GAS EMISSIONS: AN OVERVIEW

THURSDAY, JUNE 19, 2008

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY AND AIR QUALITY,
COMMITTEE ON ENERGY AND COMMERCE,
Washington, DC.

The subcommittee met, pursuant to call, at 9:40 a.m., in room 2123 of the Rayburn House Office Building, Hon. Rick Boucher (chairman) presiding.

Members present: Representatives Boucher, Butterfield, Melancon, Barrow, Waxman, Markey, Doyle, Harman, Allen, Inslee, Baldwin, Hooley, Matheson, Matsui, Dingell (ex officio), Upton, Hall, Shimkus, Blunt, Bono Mack, Walden, Rogers, Myrick, Sullivan, Burgess, Blackburn, and Barton (ex officio).

Staff present: Bruce Harris, Lorie Schmid, Laura Vaught, Alex Haurek, Chris Treanor, Rachel Bleshman, David McCarthy, Andrea Spring, Amanda Mertens Campbell, and Garrett Golding.

OPENING STATEMENT OF HON. RICK BOUCHER, A REPRESENTATIVE IN CONGRESS FROM THE COMMONWEALTH OF VIRGINIA

Mr. BOUCHER. The subcommittee will come to order.

We begin this morning by welcoming to the subcommittee a new member, both of this subcommittee and also of the full Committee on Energy and Commerce. I have known and had the privilege of working with the gentlelady from California, Doris Matsui, for a number of years, both prior and since her election to the House of Representatives, and I can say that she brings to the work of our subcommittee an experience that will enlighten our work and further our efforts, and I just want her to know how warmly we welcome her this morning and how much we look forward to working with her.

This morning, the subcommittee continues our climate change hearings, which are preparatory for the drafting and approval by the committee of a cap-and-trade program for greenhouse gas emissions, and we are planning additional hearings on that subject during the latter part of this summer.

Today's hearing focuses on a variety of cap-and-trade proposals that have been introduced in both Houses of Congress during the course of last year and this year. During the day, interested stakeholders will have an opportunity state their views on the various provisions of five currently pending measures, and we will benefit

from having their views as we draft our own cap-and-trade legislation in this committee.

Today we are examining H.R. 1590, the Safe Climate Act of 2007, introduced by Mr. Waxman; H.R. 6186, the Investing in Climate Action and Protection Act, introduced by Mr. Markey; S. 2191, America's Climate Security Act of 2008, introduced by Senators Lieberman and Warner; the Senate amendment 4825, introduced by Senator Boxer as a substitute during Floor consideration of the Lieberman-Warner measure; and S. 1766, the Low Carbon Economy Act of 2007, introduced by Senators Bingaman and Specter. Each of these proposals makes a valuable contribution in the effort to address the climate change challenge. While the provisions in each of the bills will be subject to ongoing debate, the authors are to be commended for their considerable efforts to assemble proposals that advance our understanding of the alternative meals through which greenhouse gases can be controlled through the market-based mechanisms of cap-and-trade.

Today's witnesses will inform the subcommittee of the components of cap-and-trade that are most important to them and the extent of which their core needs either are met or are not met by the pending bills. That overview will be tremendously instructive to the subcommittee as we prepare to draft our own cap-and-trade measures.

While all of the bills we are examining rely on cap-and-trade programs to control emissions, they vary greatly in their design and in their respective means of operation. They employ, for example, different methods for allocating allowances, contain contrasting timetables and targets for achieving emission reductions, vary with respect to cost containment opportunities including the use of domestic and international credits and offsets, have different definitions of covered entities and varying points of regulation, and proposed varying means of engaging developing nations. The views of our witnesses on these and other aspects of the pending bills will be welcome this morning.

Our shared goal is to pass into law a program which achieves the needed reductions in greenhouse gas emissions at the least possible cost to the public and with the least amount of economic disruption. By commenting on the pending bills, we hope that the witnesses will suggest to us ways that those goals can be achieved.

That concludes my opening statement.

Mr. BOUCHER. At this time I am pleased to recognize the ranking Republican member of our subcommittee, the gentleman from Michigan, Mr. Upton, for 5 minutes.

OPENING STATEMENT OF HON. FRED UPTON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MICHIGAN

Mr. UPTON. Well, thank you, Mr. Chairman. I too want to welcome Doris Matsui to our committee, and look forward to working with her on a number of issues as it impacts our great country.

I want to thank you and Chairman Dingell for holding this hearing, my friend, Mr. Boucher. However, the nature of the bills that we are examining today is disappointing. I agree that climate change needs to be addressed and I am a strong proponent of reducing greenhouse gas emissions. But I find it hard to believe that

a cap-and-trade scheme is the only way to address this global problem.

We are fortunate to be serving on a great committee with some of the brightest minds in the Congress. How it is that for an issue of paramount importance we can come up with only one approach: cap-and-trade? By design, this approach works by increasing energy costs and slowing down economic growth. Rather than making energy more expensive and sending American job overseas, we should be pursuing an approach that promotes and encourages clear energy and builds economic strength through exporting American technology and thus creates jobs rather than exporting those same jobs. Climate change policy must adhere to a set of commonsense principles. Legislation must, one, provide a tangible environmental benefit to the American people; two, advance technology and provide the opportunity for export; three, provide and protect American jobs; four, strengthen U.S. energy security; and five, require global participation. I am sure that every one of us is in agreement with many of these principles yet not one of the bills we are discussing today would meet the whole test.

We must take a sector-by-sector approach that cultivates innovation and technology and efficiency rather than arbitrary government mandates. Thoughtful choices need to be made on how we are going to meet our ever-increasing energy demand as we keep our economy moving. Arbitrary mandates are not sound. Both the United States and European Union reduced emissions between 2005 and 2006 but the United States' percent reductions were 4.3 times greater than the EU's and the EU, of course, has been using a cap-and-trade scheme; we haven't.

We have a wealth of resources and ingenuity to meet the challenge. By investing in clean coal, providing incentives for renewable power, giving tax credits to businesses to increase their energy efficiencies, helping our auto manufacturers develop more fuel-efficient vehicles, and creating a regulatory environment that spurs a renaissance in nuclear power, we can drastically reduce greenhouse gas emissions. No mandates, no lost jobs, no spike in costs, rather just the opposite: cleaner air, more jobs, and stable costs.

Last week, Mr. Chairman, you and I and Ranking Member Barton, other members from both sides of the aisle took a great step in the right direction by introducing legislation that will create a carbon capture and storage technology fund. The legislation will help reduce greenhouse gas emissions and promote existing and exciting new technologies that will not only keep energy costs down for consumers but also foster new jobs and build a stronger economy. With that approach, we will fortify our Nation's energy supply with American-made energy and protect the pocketbooks of our Nation's consumers, exporting American ingenuity and not the jobs.

The recent failure in the Senate highlights the many problems with cap-and-trade. Members of both parties have repeatedly raised objections and the Democratic leadership in the Senate in fact withdrew the bill because it failed to garner enough support from either party. In fact, my State's two Democratic Senators expressed serious concerns in a letter signed by other Members of the Senate to Majority Leader Reid and Chairwoman Boxer. In their correspondence, Senators Levin and Stabenow recognized that the

"cap-and-trade program developed in the Lieberman-Warner bill has the potential to raise over $7 trillion. Much of these funds will be indirectly paid for by consumers through increased energy prices," is what they wrote, concluding that they could not support final passage of the Boxer substitute. The only consensus achieved during the Senate debate was that cap-and-trade was not the right approach.

I commend my two Senators for recognizing that the cap-and-trade legislation would cost Michigan families about $7,000 a year by 2050 and increase national electricity rates by 44 percent by the year 2030. Some analysts see electric rates increasing 115 percent to pay for higher fuel costs, building new plants, and recovering global warming fees. At a time of economic slowdown, do we really need legislation that would cut GDP by some almost $3 trillion? At a time when our economy is squeezed by record gas prices, we are considering legislation that would increase gas prices another 144 percent by the year 2030. Under cap-and-trade, we will be unified in our longing for the good old days of $4 gasoline.

On top of the skyrocketing costs for consumer, cap-and-trade legislation will send American jobs in energy-intensive industries overseas. Take the steel industry, for example. Here in the United States, steel producers are the most efficient in the world. On average, American steel makers emit 1.2 tons of greenhouse gases per ton of steel made. Compare that to the Chinese steel emissions estimated to be in the neighborhood of 4 to 5 tons per ton of steel produced. We are not helping the environment by sending industries that operate cleanly and efficiently in the United States to a regulation-free China. China is the number one emitter in the world and their greenhouse gas growth every year equals the current output of Germany.

In closing, I would like to put the scale of the emissions reductions being called for by these bills in perspective. The proposals would mean that the United States cannot emit more in the year 2050 than we emitted in the year 1910. That is a daunting task, considering that in 1910 the United States had only 92 million people compared to some 420 million that we are likely to have by 2050; and in per capita income in current dollars, it is about $6,000. Michigan's working families are already struggling to get by. How in the world can we in good conscience pursue a policy that will not only have little environmental benefit but also puts the costs squarely on the backs of hardworking American families? Not to mention that the only nations in the world today that emit at the same level mandated in this bill are poor, developing countries such as Belize, Haiti and Somalia. Shouldn't our global warming solution actually lower temperatures? Can anyone here say today for sure with certainly what the global temperature reductions will be as a result of this legislation? In fact, a strong argument can be made for just the opposite, that these bills would in fact worsen the environment.

I yield back.

Mr. BOUCHER. Thank you very much, Mr. Upton.

The gentleman from Georgia, Mr. Barrow, is recognized for 3 minutes. Before I recognize Mr. Barrow, let me note that in accordance with the rules of the full committee and subcommittee, any

member who decides to waive an opening statement will have 3 minutes added to that member's time to question the first panel of witnesses.

The gentleman from Georgia.

OPENING STATEMENT OF HON. JOHN BARROW, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF GEORGIA

Mr. BARROW. I thank the Chair. It is ordinarily my custom to waive opening but this is too important an opportunity to get my two cents in on this.

First, I want to commend you, Mr. Chairman, and the chairman of the full committee, Mr. Dingell, for your leadership in this effort. We are reaching something of a milestone in the work of this committee on this subject. We have had up to 20 years in the course of this Congress on the subject of climate change. In the course of those 20 hearings, we have considered exhaustively the scientific evidence of our contribution to the problem and our responsibility to do something about it. We have surveyed every sector of the economy and every interest group we can in order to get their feedback and now we are getting down to brass tacks. Now we are starting to look at specific, concrete pieces of legislation to address this issue. While we do that, and I want to acknowledge, everybody understands the importance of this issue as it relates to the cars they may drive, the appliances they will have to buy, the electric bills they are going to have to pay, everybody can feel a connection to those things that have to do with their cost of living.

But I want to put in a word, just one word for the role of agriculture in this whole process. As the only Member of Congress who serves on both the Energy and Commerce Committee, on the one hand, and the House Ag Committee, on the other, I feel like I have not only a unique sensitivity to this issue but a unique responsibility to speak up for incorporating agriculture in this process. The EPA estimates that right now agriculture is involved in carbon sequestration activities and agriculture is responsible for sequestering something like 1 percent of the total amount of carbon emissions in our entire economy. The EPA also estimates that if they were properly engaged, if agriculture was properly included and motivated and incentivized and engaged in this process, they could sequester up to 20 percent of all carbon emissions in the entire United States economy. Any other sector of the economy that is putting out as much carbon and could make a 20-fold increase in the solution to the problem ought to get a lot of attention, and I want to make sure we don't lose sight of the role that agriculture can play. Whether agriculture is going to be allowed to play a role as a big part of the solution as opposed to just a part of the problem is going to depend on whether or not this committee incorporates them properly. I understand the challenges of measuring compliance and the role that agriculture can play but we need to engage them because there is just too much potential there for solving the problem for us to ignore the role of agriculture.

Finally, I want to make sure that folks understand the importance of us looking into the issue of a safety valve. I know there has been a lot of discussion about that. I think it is important that we make sure that the mandates don't get too far out in front of

the technology and so what I want to do is hear about the advantages and disadvantages of including a safety valve as a part of this committee's work and the legislation byproduct of the committee.

With that, Mr. Chairman, I want to thank you once again for your leadership and I yield back the balance of my time.

Mr. BOUCHER. Thank you very much, Mr. Barrow.

The gentleman from Texas, Mr. Hall, is recognized for 3 minutes.

OPENING STATEMENT OF HON. RALPH M. HALL, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Mr. HALL. Mr. Chairman, I thank you for that, and I am just thinking back here to when global warming and all those conversations started. I don't remember ever taking a position that there is just absolutely nothing to it, like some have, and I have always thought we needed to have an eye toward technology and an eye toward cleansing the methods of obtaining energy from the fossil fuels to nuclear to right on up to all of them, and Mr. Chairman, I respect you as chairman of this committee and I know you as one of the more reasonable members of this body, and I think Mr. Upton said one giant comparison of the population difference from the time it all started until today, and the gentleman from Georgia spoke of the cars you drive and the effect you have on that.

Let me caution you about one other thing that it seems most everybody has forgotten, and my speech will be about caution today. There is a cash register looming out there. It is larger for some people than it is for others. Russia does not recognize it. India will not look at the cash register. China ignores it completely except contributing to the damage to the earth with their coal thrust and every 5 or 6 days starting a new one, and there is just no way you can get around the American taxpayer who is going to find out sooner or later that you are probably going to raise taxes three or four times on everybody in here and everybody you know and maybe not know for 50 or 60 years whether it helped or not, and I have heard people say, and I think this is not a good statement but I have heard it said they are just as worried about global freezing as they are global warming. Now, I would say to you that, and I appreciate the careful approach to climate policy that you have outlined, Mr. Chairman.

I want to point out an example of what can happen if we don't take a careful approach. It relates to the treatment of natural gas in the Senate's Lieberman-Warner-Boxer bill, and despite all the long-time modeling done by the EPA and private firms, no one apparently thought to ask natural gas processors and producers how the gas market really works and whether the long-term models could capture near-term effects of the bill, and so the bill was drafted to require that natural gas processors and/or producers pay for emission allowances for all of the end-use customers who burn gas. Never mind that the processors and producers have no control over the end-use emissions. According to an analysis done by one of the leading energy consulting firms in the world, Wood Mackenzie, the approach could have put more than 30 percent of natural gas supply at risk. In closing, let me say that is because exploration and production companies, mainly independent, spending more than

they earn and all of their cash flow to find and produce gas and they have to reduce drilling investment to pay for consumer emissions allowances. This makes no sense, Mr. Chairman. That is why we need to be careful, and I would like to submit a news release from the American Exploration and Production Council and the Wood Mackenzie report for the hearing record and ask unanimous consent that they be included.

Thank you, Mr. Chairman. I yield back my time.

Mr. BOUCHER. Thank you, Mr. Hall. Without objection, that material will be included in the record.

Mr. HALL. I thank the chair.

[The information appears at the conclusion of the hearing.]

Mr. BOUCHER. The gentleman from Massachusetts, Mr. Markey, was here previously and announced his intention to waive an opening statement. The gentleman from Pennsylvania, Mr. Doyle, is recognized for 3 minutes.

OPENING STATEMENT OF HON. MIKE DOYLE, A REPRESENTATIVE IN CONGRESS FROM THE COMMONWEALTH OF PENNSYLVANIA

Mr. DOYLE. Thank you, Mr. Chairman. Mr. Chairman, I am happy that we are beginning our examination of the various climate change proposals which have been introduced in this Congress, and while each of these proposals offer constructive suggestions as to the path this subcommittee should follow as we draft our legislation, I do not believe any of these proposals in and of themselves provide the complete solution we need. Simply put, the time is now for Congress to address this problem. The time for scientific discovery is passed and today we have ample evidence that this problem is real and that there are actions we can take to address it. The President has acknowledged this reality by transmitting to Congress a plan to address the problem. The EPA is actively implementing their authority to unilaterally regulate greenhouse gases and our power industry is delaying new investment until they see the playing field Congress will create. We can no longer put our heads in the sand and pretend this is not a problem. We must act and we must act now.

As we move forward toward a achieving a substantial reduction in greenhouse gases though, it is important to recognize the reality on the ground and not to legislate mandatory reductions that are beyond our technical ability to achieve. Instead, we must ensure that the funds generated by this bill do not go to the general treasury but instead are reinvested to achieve our dual goal of achieving energy independence while combating the threat of global warming. As I have said before, there is no silver bullet that will solve this problem for us. We need a broad energy portfolio that increases renewables and new sources of energy while we continue to improve the resources we have today. Clean coal and nuclear, two energy sources which today power most of America, must continue to play a key role as we move into the carbon-constrained world. Simply put, we have many challenges ahead of us.

I have been working with Congressman Jay Inslee to address the very real concerns about international competition and job and emission leakage that may occur as a result of our final bill. Our

policy is narrowly tailored, affecting only those industries which are high carbon-intensive and face an internationally set price for their goods. This policy, which some of you may know as an output-based, or benchmark policy, will address the real-world challenges these industries face while encouraging them to do their part to reduce our Nation's greenhouse gas emissions. I look forward to hearing our panelists' thoughts on this proposal.

In conclusion, Mr. Chairman, I reiterate my offer to work with any member of this committee to construct what I believe will be landmark legislation to combat climate change. The time is now. The American people have demanded action and I am ready to answer that call with my colleagues.

I yield back the balance of my time.

Mr. BOUCHER. Thank you very much, Mr. Doyle.

The gentleman from Texas, Mr. Barton, the ranking member of the full committee, is recognized for 5 minutes.

OPENING STATEMENT OF HON. JOE BARTON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Mr. BARTON. Thank you, Mr. Chairman. As you know, I am a skeptic on this issue, but one thing you and I are in agreement on: if anything is going to be done, it should be done in this committee, it should start in this subcommittee, so we appreciate the hearing, we appreciate the number of witnesses, and we appreciate the attendance of the audience.

Also on behalf of the Republicans, we wish to welcome our newest member to the Committee, Congresswoman Matsui. We will soon have a subcommittee called the California Subcommittee. We are delighted to have another representative of the California delegation on our committee.

Mr. Chairman, we are at the crossroads with this hearing today and the debate over whether to constrain carbon dioxide by rationing energy. As we all know, at the beginning of this Congress our new Speaker, Speaker Pelosi, announced it was her objective to enact a carbon cap-and-trade bill in this Congress. Her intent was to establish a price signal on carbon, in other words, a strategy to make fossil fuel energy more expensive in America in order to repress or suppress the public demand for it. Let us go back and see where we were at the beginning of this Congress in terms of a carbon signal. The price of unleaded gasoline was selling on average nationally for $2.30. Today it is $4.07. I would say that is a pretty strong signal. Diesel fuel was $2.58 a gallon. Today it is $4.70. Natural gas was $6.60 a thousand cubic feet. It is expected to hit $12 this fall. Twelve dollar natural gas means home heating will come close to doubling. Gas-fired electricity prices will rise significantly and industries that rely heavily on natural gas including chemicals, fertilizers and others in manufacturing will continue their exodus to other countries. We only have two fertilizer manufacturers that are still doing business in the United States, for example. Home construction has stalled. Auto workers are being laid off by the thousands. Food prices are soaring. Airlines are canceling flights because they can't afford to pay for the aviation fuel. Small businesses throughout the United States are failing. I met with a farmer yesterday who told me it cost him over $1,200 to fill up his trac-

tor, $1,200. How much more of a price signal do we need on carbon? How much greater of a burden must we place on the American people?

And for what environmental benefit? EPA estimates that if the Lieberman-Warner bill would have passed the Senate and been enacted, that it would reduce greenhouse gas emissions by 2050 by 25 parts per million, 25 parts per million. At that rate, it wouldn't change the temperature one degree, not one degree with temperature change if Lieberman-Warner were to be enacted and be implemented in the 2050 time zone. It would not change global temperatures. It would transform the U.S. economy for the worse.

If in January 2007 Speaker Pelosi had called for a consumer price signal as high as those that we are suffering already today, she would have stood virtually alone in her strategy. Those price signals are hitting us. They are hurting our economy. We do need to do something about them. Enacting a cap-and-trade bill, in my opinion, is not the solution. The World Resource Institute says that Mr. Waxman's bill, H.R. 1590, Mr. Inslee's bill, H.R. 2809, and the Sanders-Boxer bill would reduce greenhouse gas emissions in the United States by 80 percent below 1990 levels by 2050. Where does that number come from? I don't know. I am told that it is also Senator Obama's proposal. I do know that if we reduce CO_2 by 80 percent below the 1990 level, it is going to take us back to an emission level that we last had in 1910, when there were about 40 million people in America and two-thirds of them lived on the farm and the method of transportation was foot power or animal power. In the State of Texas, the average per capita carbon emission today is 31 tons. In the great State of Vermont, it is zero. I don't quite understand that since each of us emit a third of a ton of CO_2 every year just breathing. But whatever it is and whatever part of our great nation, going back to 1910 emission levels, in my opinion, makes no sense. In Texas alone, the National Association of Manufacturers says that the Lieberman-Warner bill would cost the average household $8,000 a year.

Mr. Chairman, I could go on and on but I think you get the gist of what I am trying to say. I believe, as you believe, that we do need to look at this issue seriously. That is why I have endorsed and I am a cosponsor of your bill to begin a research program on how to best capture or convert CO_2. That is putting the horse before the cart. That is actually, let us develop the technology, let us see what the problem is, let us continue to do research on the science but let us don't take the U.S. economy off the cliff by enacting some of the bills that are before us today.

With that, Mr. Chairman, I again thank you for the hearing. I thank our witnesses. I look forward to hearing their testimony and I look forward to hearing our members ask some questions. I yield back.

Mr. BOUCHER. Thank you very much, Mr. Barton, for your thoughtful remarks and also for your coauthorship of our legislation to promote the research on carbon capture and storage.

The gentlelady from California, Ms. Harman, is recognized for 3 minutes.

OPENING STATEMENT OF HON. JANE HARMAN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Ms. HARMAN. Thank you, Mr. Chairman, and welcome to our witnesses and also welcome to my California sister, Doris Matsui. Mr. Barton has it partly right. There are lots of Californians on this committee and most of them, most of us are women. That is why, as I told Chairman Dingell recently, the Committee is doing so well, and P.S., California has the largest delegation in Congress, of the Democrats from California, a majority are female and both of our Senators happen to be female. That is why California is doing so well.

On that subject, as you and I discussed before the hearing, Mr. Chairman, one of our Senators, Barbara Boxer, is chairman of the Environment and Public Works Committee, as you know. She is the author of one of the bills before us. She did ask to testify this morning and I gather that there was an issue about the amount of time she could spend here and whether she would have time to take questions from members. I do appreciate your offer to telephone her and to arrange for her to testify at one of our hearings in the near future on this subject. I know we are having many hearings.

Mr. BOUCHER. Will the gentlelady yield?

Ms. HARMAN. I would be happy to yield to you.

Mr. BOUCHER. Yes, I will be happy to do that, and I would say for those who might be interested, that Senator Boxer was in fact invited to testify today under the same circumstances that all other members of Congress are invited to testify, and I think her time frame perhaps did not permit the potential for answering questions. But we will clarify with her the fact that she is welcome at future hearings and hope that she can join us.

Ms. HARMAN. Well, I appreciate that. Reclaiming my time. I want to commend her and the whole Senate for trying to take up this subject of cap-and-trade on the Senate floor last week. I think there are lessons to be learned from what happened there and I would like us to learn them. I do consider this to be the greatest legislative committee in the House. Most of the major environmental laws have originated here and I think we can do our work well on this subject, and I look forward to this committee authoring major cap-and-trade legislation in the near future.

Let me just make a few points. Number one, the looming likelihood of $5-a-gallon gas has generated the political will to change our energy habits. Now we need the political leadership. Number two, we are facing two interrelated problems, the dependence on oil as our primary fuel, and global climate change. Addressing both is an economic and a national security imperative. Number three, cap-and-trade is an essential part of the solution but not the only part. We need to be creative and look at a variety of short-, medium- and long-term measures that foster alternative fuels and technologies. This committee has done a very good job on the subject of efficiency. Mr. Upton and I are the light bulb authors. Efficient light bulbs is big part of the answer but so is a creative market-based system to put the right price on carbon and have a trading arrangement so that we reduce the greenhouse gases in our atmosphere.

I thank you for this hearing and yield back the balance of my time.

Mr. BOUCHER. Thank you very much, Ms. Harman.

The gentlelady from Tennessee, Ms. Blackburn, is recognized for 3 minutes.

OPENING STATEMENT OF HON. MARSHA BLACKBURN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TENNESSEE

Ms. BLACKBURN. Thank you, Mr. Chairman. I want to thank you for the hearing. I want to thank our witnesses for their preparation and for being here with us today and taking the time to come and testify on the prospects of a cap-and-trade system, and how they feel it would be administered.

I think that by this point it is no secret to anyone on this committee that I do have some very serious concerns about the carbon reduction schemes because I do fear that they would drastically affect this Nation's energy supply and that they could possibly significantly distort the marketplace. Worse yet, I think that what we are beginning to see in some reports of some studies that have taken place over the past decade, things in scientific journals that show that any recent global warming could or could not be caused by humans and could or could not be caused by the sun and other natural causes that really have no link to human activity, and I found it rather curious that we are seeing data collected by satellites and weather balloons that indicate that global temperatures have cooled by 0.7 degrees Celsius over the past 16 months. I think that should be instructive to us because this has offset the warming that took place over the past 100 years, but the IPCC models that have been presented to us time and again had predicted significant rising in temperatures and no cooling. So that is a little bit of a head scratcher there and I think deserves a revisit by this committee and those of us who are going to review this issue.

Now, Mr. Chairman, I know you are aware and some of the others, we made a trip, a fact-finding mission to look at and investigate some of these trading schemes, and what I came away from that trip with was a concern, a true concern that the trading system in the scheme was flawed and did have some problems and that you didn't always end up with your goal, which was to reduce CO_2 emissions, and now what we are seeing is if carbon sequestration and reduction of emissions is your goal, then it would be difficult to achieve that goal and have that outcome if it were only the U.S. participating in this and only Europe participating in this. It would require worldwide participation and participation by some of the countries that are currently the most significant global polluters, and what we also have found out that this type of scheme could result in a wealth transfer to those who can gain the market and will reduce economic investment to solve more pressing problems such as diseases, malnutrition and water sanitation. A cap-and-trade system or carbon tax system will likely lead to shuttering power plants that will only make Americans poorer and more reliant on foreign energy sources and could have a negligible effect on environmental improvement.

So I am looking forward to hearing from our witnesses today, Mr. Chairman. I thank you again for the time. I yield back.

Mr. BOUCHER. Thank you very much, Ms. Blackburn.

The Chairman of the full committee, the gentleman from Michigan, Mr. Dingell, is recognized for 5 minutes.

OPENING STATEMENT OF HON. JOHN D. DINGELL, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MICHIGAN

Mr. DINGELL. Mr. Chairman, I thank you for holding this hearing. I commend you for your leadership and the vigor with which you are addressing perhaps the most difficult, complex issue that I have faced on this committee during the time that I have had the honor to serve here.

Before I make my statement, I would like to observe that today is the first hearing that is being attended by our new member, Mrs. Matsui, and I would like to welcome her this morning. I also would like to observe that she is not the first Matsui to serve upon this committee. Her dear husband, my good friend, Bob, was a member of this committee in earlier days. He was the successor to my beloved friend, John Moss from California, and the two of them served this Congress and served their State and their districts with extraordinary dignity and capability. So welcome to you, Mrs. Matsui. We are honored that you are here with us.

I also want to thank our witnesses this morning, ladies and gentlemen at the witness table and others who will be appearing before us. Thank you. We need your wisdom and we have given you a very difficult task, that is, comparing and commenting on five key climate change legislative proposals, a total of more than 1,000 pages of legislative text which I anticipate as we go forward will grow. I also want to express the thanks of the committee for your willingness to prepare the thoughtful testimony on this difficult and complex issue which, I repeat, is probably the most complex and difficult that I have had to confront during my time on this committee.

Since this hearing was announced, we have been asked why we are holding a hearing that looks at five different lengthy and complicated legislative proposals. The answer is very simple. As we move forward with drafting the climate legislation that this committee will be presenting to the Congress, there is much that we can learn from these legislative proposals. We need to know how people feel about them, how they are going to impact upon the different industry groups, upon labor and upon every ordinary citizen and conservationist and person who does business or who has interest and concerns on these matters. The authors of the bills, including Mr. Waxman and Mr. Markey, have put a great deal of thought and effort into their bills. We need to build on these efforts to move the legislation forward to understand how we can pass the best legislation which will best serve the public interest of this country and of the world.

We also can see that we need to learn from the efforts of the other body. The Senate debate revealed a strong bipartisan support for addressing climate change with a cap-and-trade program. This is an important development. The Senate debate also showed, how-

ever, that the other body has far from a consensus on what to include in such a program. It also is apparent from that discussion that there is small evidence of a consensus in the country on these matters. Now, I mean no disrespect to the Senate or to anyone else when I say this because as I pointed out, this is an enormously complex issue. I have no delusions about the amount of effort that it is going to take to first of all come up with proper legislation, and second, to create a coalition that will pass a responsible climate change bill, but we must pass such legislation and this committee intends to devote its vigorous effort to achieving that great purpose.

Today's hearing is designed to give us a beginning of our overview of these key legislative proposals. We will need a large number of additional hearings to delve into the details of the legislation because legislation of this complexity and difficulty needs careful and thorough attention to achieve the purpose of passing good legislation.

I look forward to the testimonies of our witnesses today and I thank them and congratulate them for their appearance. I also want to know what issues are most important to them and I want to hear what the witnesses think about these bills and what they do right and what they do wrong and what they fail to address and what needs addressing and how our legislation can improve upon the proposals now before us. Given the number of witnesses appearing before us today, I conclude my statement here and I thank you, Mr. Chairman, for your extraordinary leadership in this particular matter, and I commend and thank my colleagues for their participation.

Thank you, Mr. Chairman.

Mr. BOUCHER. Thank you very much, Chairman Dingell.

The gentleman from Oregon, Mr. Walden, is recognized for 3 minutes.

OPENING STATEMENT OF HON. GREG WALDEN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF OREGON

Mr. WALDEN. Thank you, Mr. Chairman. I appreciate the hearing and look forward to hearing from the witnesses. I will admit up front, I have to step out for a meeting here in a few minutes but I do have the testimony and will be back.

This is an issue I think that we all care a lot about from various perspectives. Clearly, I think each of us wants to do the right thing for the environment. I mean, I have been fortunate enough to go invest in two hybrid vehicles but it still costs me 50 bucks or thereabouts to fill up my Prius here in Washington and certainly about that in Oregon to fill up my hybrid Escape. We have passed legislation here that has been helpful and under your jurisdiction. There have been provisions I have disagreed with and think we should revisit, like on biomass from forests not counting toward renewable fuel standards seems to be rather absurd. It either is biomass and is a renewable fuel or it is not. It shouldn't matter from which forest it comes.

What troubles me, though, today in America and in my district, people are having trouble filling up their tanks. I have an orchard in my hometown of Hood River known for its famous pear produc-

tion. Their fertilizer costs double year to year. You go talk to people about trying to fill up, as the chairman said, a tractor fuel tank, or I know we have a witness later that is going to talk about $1,400 to fill up a truck tank for diesel, and while we need to do the right thing for the environment, we don't need to kill our economy in the process. And I note there are lots of provisions in some of these bills to spend the magical money that comes from no consumer and yet we all know it is the consumer that is going to pay the bill here, and there are estimates as high as $6 trillion in costs to consumers, and I think we have to be cognizant of that. It is very disturbing to me, especially when some of the other major emitters in the world would be left out of any framework. They can continue to pollute and to create jobs and offshore our jobs to them where they will be more competitive, and that is not good for our country, especially with the economy we face.

I met with the CEO of one power company who told me their power generation costs under Warner-Lieberman would go up two-and-a-half times. So if you like what has happened at the gas pump, if you like what is happening with natural gas prices, you are going to love some of these bills if you are a consumer. And the biggest advocates for some of these bills are frankly the traders and the speculators around the world because they know there is a lot of money to be had, and what we have seen in the oil markets and all the hearings we have had on speculation in the oil markets has led me to believe that if we move down this path, we better darn well make sure the regulatory framework is there so that consumers don't get ripped off by the traders if indeed that could occur, and I think we have seen defaults overseas on some of the trading markets by some of the traders and we are talking America's future economy here as well.

So as we try to work to do the right thing for the environment, let us not forget the Wal-Mart moms and the diesel truck driving dads out there in America who need fuel now and don't need higher energy costs now, and there are lots of things we can invest in as a government, especially the research side, Mr. Chairman, like your bill, make sure we have the technologies in place for the future and I am all for that.

Thank you, Mr. Chairman.

Mr. BOUCHER. Thank you very much, Mr. Walden.

The gentleman from Maine, Mr. Allen, was previously in attendance and announced his intention to waive his opening statement. The gentlelady from California, Ms. Matsui, is recognized for 3 minutes.

OPENING STATEMENT OF HON. DORIS MATSUI, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Ms. MATSUI. Thank you, Mr. Chairman. I am so pleased to be here today and I want to thank everyone for their very warm welcome.

Mr. Chairman, the Energy and Commerce Committee has jurisdiction over so many issues that are important for my district, the city of Sacramento. Since coming to Congress, I have wanted to be a part of this committee and help craft legislation that affects so

many aspects of our country. I am truly looking forward to working with each and every one of you.

Mr. Chairman, I am encouraged that this committee is further examining climate change. Increased droughts, wildfires and Sacramento's risk of food are daily reminders to my constituents that this issue affects them personally. Because global warming is such a widespread problem, we must take care to craft responsible and intelligent solutions that put us on the right course from the beginning. This committee and subcommittee have been extremely active in the 110th Congress. I look forward to joining your efforts and continuing to promote sound policy that affects the health, safety and welfare of the American people.

Mr. Chairman, I thank you for your leadership and your commitment to these issues. I look forward to the testimony. I yield back the balance of my time.

Mr. BOUCHER. Thank you very much, Ms. Matsui.

The gentlelady from North Carolina, Ms. Myrick, is recognized for 3 minutes.

Ms. MYRICK. Well, thank you, Mr. Chairman. I want to welcome our witnesses as well and look forward to everyone's testimony. I too will leave for a little while. But actually, Mr. Walden said pretty much everything I was going to say, including support for your bill, so with that, I will just yield back.

Mr. BOUCHER. Thank you very much, Ms. Myrick.

The gentlelady from Wisconsin, Ms. Baldwin, is recognized for 3 minutes.

OPENING STATEMENT OF HON. TAMMY BALDWIN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF WISCONSIN

Ms. BALDWIN. Thank you, Mr. Chairman. I really appreciate your holding this hearing today because I really think it is important that we take the time to examine the legislative proposals that have been introduced thus far as these proposals will clearly serve as guideposts for legislation that this subcommittee will ultimately draft and consider over the months to come.

I commend Mr. Waxman and Mr. Markey as well as our Senate colleagues for their contributions and there is no doubt that despite the potentially contentious nature of some of the provisions, a lot of hard work has gone into ironing out the various proposals that we have before us today. As I have said many times, I believe that we have a responsibility to our planet and to future generations to address climate change with firm, bold, and decisive actions that reduce greenhouse gas emissions. We must set a roadmap for repairing the damage we have done to our environment.

In adopting a cap-and-trade plan, we also have a responsibility to the Nation, businesses, workers, and consumers to ensure that American industries remain competitive and the production of American products remains right here in America, and that prices and costs remain reasonable and affordable, and for that reason, it is crucial that we evaluate and understand the provisions in these bills and the effects that they will have on our planet, on our businesses, and on our constituents.

I am pleased that we will be hearing from such a wide variety of witnesses today who can provide very different perspectives on the language of the bills before us. I expect that much of the testimony today will be focused on concerns or criticisms with the legislation but I do hope that we will also hear about the sound provisions, those that industry and environmentalists and labor unions, religious leaders believe are necessary to reducing greenhouse gas emissions, creating green jobs, boosting our economy, and aiding communities and ecosystems vulnerable to harm from global warming. Certainly the process of designing a cap-and-trade bill will not be easy and there will be many difficult decisions yet to be made but one thing is clear: the costs of inaction are too great for us to fail to act. I hope this hearing will show us how we can rise to that challenge.

Thank you, Mr. Chairman. I yield back the balance of my time.

Mr. BOUCHER. Thank you very much, Ms. Baldwin.

The gentleman from Illinois, Mr. Shimkus, is recognized for 3 minutes.

OPENING STATEMENT OF HON. JOHN SHIMKUS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ILLINOIS

Mr. SHIMKUS. Thank you, Mr. Chairman. I do appreciate you having this hearing and I want to applaud your efforts so far in working in a bipartisan manner to, if we are going to move in this direction, to have a system designed that we can address the fossil fuel use and carbon capture and sequestration, which is critical. I am also optimistic that if you remain at the helm here along with Chairman Dingell, if we move in this direction, which I am not a fervent believer we should do so, but if we do, that we won't destroy our economy in the process, and that is my commitment to you. I really do believe this is one of the greatest opportunities for harm in the economy of this country that we have seen in a long time.

The Senate did a great job last week bringing up the climate bill when we had historical high energy prices, and that is the debate that we have been trying to have in this committee for the past year-and-a-half, and we have moved the environmental community to accept the principle that this will cost. Now, how much it will cost is up for debate. I think from my perspective, people have to understand that I represent southern Illinois. The Clean Air Act was a great benefit to clean air and emissions but it disproportionately harmed and destroyed the economy of southern Illinois. There will be winners and there will be losers, and if we don't identify that fact, then we are doing—we will be going down a path.

I am not embarrassed about the internal combustion engine in this country. It has provided jobs and the economy and a standard of living unrivaled in the world today, and I am not going to back down from the benefits. Why do you think the Chinese are building a coal-fired power plant every 2 weeks? They want to have the standard of living that we have. Why do you think they are not moving down to climate change? Because they want to have the standard that we are going to have, that we have today, and at $136 a barrel of crude oil today and $4.07 for a gallon of gas, the costs as Chairman Dingell pointed out earlier in this Congress, 50

cents additional gallon of gas. So that would be $4.57 for climate change for no environmental benefit because we know India and China are not going to go there. Chairman Boucher and I sat across from a Chinese official who said it is our turn to reap the benefits of fossil fuels in this world, and we are going to do it. We asked him twice.

So let us be careful, let us be diligent, first do no harm. I yield back.

Mr. BOUCHER. Thank you very much, Mr. Shimkus, and I appreciate those thoughtful remarks.

The gentleman from Washington State, Mr. Inslee, is recognized for 3 minutes.

OPENING STATEMENT OF HON. JAY INSLEE, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF WASHINGTON

Mr. INSLEE. Inaction here will damage the U.S. economy as the Midwest changes its climatic system and severe storms sweep and health problems arise due to global warming. Action will improve the U.S. economy when we become the clean energy supplier to the world. Pessimism will hurt us here. Optimism is the name of the game to rely on the innovative spirit of America to solve this problem.

I want to focus on the necessity of auctioning off the permits under this bill and I want to do it because of four reasons: it will help the U.S. economy. Could we put up chart number one?

[Chart shown.]

Mr. INSLEE. We have to radically increase our innovation, our pace of innovation towards clean energy in this country, and I want to show a chart here of the research and development budgets of the United States. On the left, far left, is energy, a pittance, a peppercorn, as they used to say in law school. In the middle is the graph for our health R&D, and on the right is our research budget for military expenditures. We have gone down significantly. We are hurting. You look at it, it is a pathetic research and development budget. We need to use the revenues from the auction proceeds to increase this budget dramatically to capture the clean energy technology so we can sell it to China and sell it to India and make green money in America. Next chart, please.

[Chart shown.]

Mr. INSLEE. We need to do what we have done in the past in this country when we had a major—could we go to the next chart up, please?

[Chart shown.]

Mr. INSLEE. This shows what we have done in the past with our research budgets when we have had major national challenges. On the left is what we did with our research budget in the Manhattan Project. Next is what we did in the R&D budget in the Apollo Project. The next is the rise in the defense budget in the last several decades. The second to the right is the War on Terror, and if we do an auction and use the proceeds for R&D and have a five or ten times increase in our research budget, we can develop the solutions it will take to have a clean energy decarbonized economy in the United States, perhaps with clean coal and other assortments.

The right shows a vision for America that is based on optimism and our ability to develop a clean energy technology and it is dependent upon the revenues from the auction of these permits. That is not the only reason to do that. The second reason is, we should not give away a public resource that belongs to the citizens of the United States worth billions of dollars based on largesse decisions by the U.S. Congress. The market should decide who gets those permits. The second reason why it makes sense, if you are a capitalist, you ought to favor auction. And third, what we learned in Europe is if you don't do an auction, you get massive windfall profits by utilities who take the value of these non-auction permits, pass the cost down to your consumers and increase utility bills.

So for four reasons, we have got to have auction, we have got to do it as soon as possible. I look forward to this. I think we ought to approach this with a little humility because if we don't get this right, the planet isn't going to be around the way we know it, so I hope we do.

Mr. BOUCHER. Thank you very much, Mr. Markey—I am sorry, Mr. Inslee.

Mr. MARKEY. I never looked so good.

Mr. BOUCHER. Well, I was actually thinking about Al Gore. You know, a slide show, if converted into a documentary, can take you a long way, and maybe this is the beginning of something big. Thank you, Mr. Inslee.

The gentleman from Texas, Mr. Burgess, is recognized for 3 minutes.

OPENING STATEMENT OF HON. MICHAEL C. BURGESS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Mr. BURGESS. Thank you, Mr. Chairman, and thank you for holding this hearing today.

I appreciate the legislative proposals that the Committee has under consideration and recognize that each is the product of good intentions. Some of them vary on scope, the targets and the baseline emissions and allocations of credits but the inherent property in each of the regimens before us today is, there will be a cost, there will be consequences and, of necessity, there will be restrictions. The point of any carbon control program is to assign carbon a monetary value and then make individuals decide if they are willing to pay the price for changed behavior. I can tell you that most of America and certainly the Americans in my district are not ready to pay the high cost of carbon compliance and their behavior has already changed. High transportation fuel costs have already forced American families to adjust their budgets and their lives due to their energy costs. With any of the proposals before us today, there will be additional costs and there will be additional restrictions.

Mr. Chairman, I might also point out that the law of unintended consequences not yet been repealed but what we have seen in the past 18 months is, it used to be the sins of the father were visited upon the son so it took a generation for these unintended consequence to come full circle. Now we are seeing them come full circle in a period of as little as four to six months' time. Witness what we did with the ethanol mandate in December and what has hap-

pened to food and other commodity prices in May and June and that of course was before we had a major earthquake in China, a cyclone in Burma, and Iowa was submerged.

Well, Mr. Chairman, there is a wide range of witnesses here today. The fact that it takes such a broad group of individuals to help explain these proposals is an indication as to the amount of work that you have undertaken, the size and the scope and the impact of this legislation. Unfortunately, carbon cap-and-trade legislation is a consumer compliance arrangement and will have a behavioral control mechanism. So maybe we should take a poll of the Nation and we can ask them, are you willing to pay still more for your energy? I will tell you from the letters and phone calls coming into my office and my district office right now, people may be optimistic because they are Americans and they live in the greatest country in the world but they are a little bit mad for that 3 to 4 minutes that it takes them to full up their tank and they do that two or three times a week. So I think I know the answer for my district, are you willing to pay more for energy, the answer is no, and they want this Congress to do something and reduce the cost of energy.

On the issue of selling the carbon on a new exchange or new commodities market, there is probably not a person in the country who doesn't wonder if there is some type of market manipulation going on right now in the oil futures market and wonders if there are not people out there who are betting against America and driving the cost up. Will there not be new opportunities for manipulation in a cap-and-trade scheme and a carbon-traded market?

Mr. Chairman, there is a great deal more than I know we need to go into today. I know we have got a long panel of witnesses. So I am going to yield back my time.

I do think it is a little bit odd that we don't have more representation from the natural gas industry here. When we think of climate change, my district in Texas in Tarrant and Denton counties is one of the richest areas, one of the most prolific areas for drilling currently and we are drilling down into the Barnett shale 8,000 feet below the ground, because we used to be a seabed that was rich with small sea creatures that are now responsible for the production of that natural gas. That is climate change on a grand scale and we are reaping the benefits of that climate change today in my district in Texas. But I do wish we could hear from someone from the natural gas industry because I do think they are going to play a crucial role in whatever the future holds for this country, and I will yield back my time.

Mr. BOUCHER. Thank you very much, Mr. Burgess, and let me assure the gentleman that we will be inviting representatives from the natural gas industry to testify at future climate change hearings.

The gentleman from Massachusetts, Mr. Markey, was here earlier and has now returned and I would ask if he would care to make an opening statement.

Mr. MARKEY. Thank you, Mr. Chairman, very much.

Mr. BOUCHER. The gentleman is recognized for 3 minutes.

OPENING STATEMENT OF HON. EDWARD J. MARKEY, A REPRESENTATIVE IN CONGRESS FROM THE COMMONWEALTH OF MASSACHUSETTS

Mr. MARKEY. And I want to thank you, Mr. Chairman, and Chairman Dingell for holding this hearing to consider proposed climate legislation including the Investment in Climate Action and Protection Act, or ICAP, which I introduced earlier this month.

The scientific debate on global warming is over. The chorus for action is deafening and the costs of delay grow by the day. We must act now to cap heat-trapping pollution and spark a clean energy revolution that will save the planet and return America to a position of economic and moral leadership. We can only do that by enacting legislation that satisfies four core principles. One, we must reduce greenhouse gas emissions quickly and deeply enough to avoid dangerous global warming at least 80 percent by 2050. Two, we must transition America to a clean energy economy by investing aggressively in efficiency and renewable energy technologies. Three, we must avoid windfalls for polluters and protect American consumers and workers using climate legislation as a vehicle to create jobs and grow our economy. And four, we must help defend vulnerable communities and ecosystems against those impacts of global warming that unfortunately can no longer be avoided.

I can only support legislation that satisfies these principles, which are set forth in a letter to the Speaker that Mr. Waxman, Mr. Inslee, and I have circulated with 80 other members including six on this subcommittee. The ICAP bill reflects these principles. It sets up a cap and a best system that is science-based, consumer-focused, market-fueled and technology-driven. It reduces covered emissions by 85 percent by 2050. It makes polluters pay by auctioning 100 percent of pollution allowances by 2020. ICAP returns over half of the proceeds directly to consumers through tax credits and rebates. The result: 80 percent of Americans would reduce benefits and two-third of U.S. households would be fully compensated for any cost increases from the bill. ICAP invests trillions of dollars in efficiency, clean energy technology, and in American farmers, workers and communities. Finally, it sets up a system of carrots and sticks to ensure that countries like China and India will take comparable action.

I look forward to working with Chairman Dingell, with you, Chairman Boucher, and other members of the committee to develop climate legislation that is effective and fair. ICAP provides a model and I will work to build support for this approach. I thank you and I yield back the balance of my time.

Mr. BOUCHER. Thank you very much, Mr. Markey.

The gentleman from North Carolina, Mr. Butterfield, is recognized for 3 minutes.

OPENING STATEMENT OF HON. G.K. BUTTERFIELD, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NORTH CAROLINA

Mr. BUTTERFIELD. I want to thank you, Mr. Chairman, for convening this most important hearing today. We have certainly been looking forward to it, and I want to thank you for your leadership

in this area. You told us a few months ago that you were serious about climate change and today is a demonstration of your willingness to tackle head-on this very important issue.

I also want to thank the eight witnesses who sit in front of us. Thank you very much for coming and giving us your testimony today. We are going to listen very carefully and review all of your written testimony as well.

But Mr. Chairman, I agree with my colleagues that the question with global climate change legislation is not whether Congress should act but rather how we move forward in a most responsible and expeditious manner. We all agree that this is a very, very fundamental issue that we must address. The world is watching and the American people are watching, and I agree that we cannot continue to ignore this issue. We are currently experiencing the disturbing effects of climate change. Most of us now agree with that, from the melting of the icecaps to the exacerbation of the hurricane season, and I am from North Carolina and certainly we understand that, all the way to the substantive evidence and suggesting that these problems will continue to grow if we don't act responsibly. And so, Mr. Chairman, it is my hope that we will soon put forward carefully constructed policy which addresses this issue in a direct but balanced way. We must work together, and I want to pledge my cooperation to my friends on the other side of the aisle that we will work together on this issue.

Among the numerous issues essential to the discussion of this matter mitigating the cost on low- and middle-income families. That is very important. When the cost of reform reaches the many low-income residents who I represent, we need to ensure that they are not swept away and swept up and away. We must take every opportunity to allay the costs and provide a safety net for people of modest means. As this discussion moves forward, it is important to remember that those who contribute the least to this problem should not be forced to shoulder the greater burden.

And so I thank you, Mr. Chairman, for your vision and for your leadership. At this time I am going to yield back the balance of my time.

Mr. BOUCHER. Thank you very much, Mr. Butterworth. The gentleman——

Mr. BUTTERFIELD. Butterfield.

Mr. BOUCHER. I am sorry, Mr. Butterfield.

Mr. BUTTERFIELD. Thank you, Mr. Barker.

Mr. BOUCHER. I am just going to recognize somebody else at this point. The gentleman from Michigan, Mr. Rogers, is recognized for 3 minutes.

OPENING STATEMENT OF HON. MIKE ROGERS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MICHIGAN

Mr. ROGERS. Thank you, Mr. Chairman. I am not sure how you follow that, but thank you.

Mr. Chairman, thank you for holding today's hearing. It is clear to me now that there are really two schools of thought on how we deal with our energy crisis. The first school of thought is one that is represented by most of today's witnesses is, quite frankly, my colleagues' school of thought on the other side of the aisle. They say

that high gas prices are a good thing because high gas prices will get people to use less. I give Barack Obama credit for having the guts to say he likes $4-a-gallon gasoline. At least it is an honest answer. It is an answer the American people can appreciate, and most of today's panelists are going to tell us the same version of the very same thing: high energy prices are a good thing, high energy prices will get us to consume less, high energy prices will get us to switch to other fuels. But I ask, at what cost?

We know that cap-and-trade is going to cost over $1 trillion in new taxes. We also know that every plan before us today will destroy jobs and raise the price of energy. The only questions are how many and how much. In my home State of Michigan, we struggled with high energy prices, high taxes, and bad policy. The high price of natural gas and President Bush's terrible decision to impose steel tariffs has done more to destroy manufacturing jobs in my State than anything else. That is a lesson that this committee should learn from. When you raise the cost of doing business at home and then you make it more expensive to import products, you destroy jobs and, quite frankly, you destroy lives.

We cannot continue down this road. We cannot ignore the pleas of working Americans and our middle class to lower gas prices now. We certainly cannot support a plan that will bring us $5 or $6-a-gallon gasoline and electric bills that are twice what they are today. I know that some people will say that high prices are important because they send the price signal to the market. I suppose that is true. But high energy prices send another signal as well. It is a signal to working Americans that Washington simply doesn't care about them, that if you are in the middle class, we may in fact ruin your opportunity to stay there.

It is offensive that we would seriously consider a plan to raise gas prices today. It is offensive to the mother who can no longer afford to attend her children's away sports games. It is offensive to the independent truckers who are selling their trucks and getting out of the business they love because their margins are gone today. It is offensive to the airline workers who again are on the precipice of bankruptcy.

Mr. Chairman, there is another way. We can be energy independent. We can be a whole lot cleaner as well. Right now in my home State, Michigan researchers are working 24 hours a day to produce lithium ion batteries. We can make and unleash the intellectual capital of this country in a better way versus big regulation, big mandates and big tax bills. It benefits no one when we charge the average American twice as much for their electric bill, twice as much for their gasoline, and to the end, we make Wall Street very, very rich and the average American much less better off.

I would urge us to pick innovation over regulation and taxes, Mr. Chairman, and I look forward to further discussion of this important debate.

Mr. BOUCHER. Thank you very much, Mr. Rogers.

The gentlelady from Oregon, Ms. Hooley, is recognized for 3 minutes.

OPENING STATEMENT OF HON. DARLENE HOOLEY, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF OREGON

Ms. HOOLEY. Thank you, Mr. Chair, for holding this important hearing and I thank all of our witnesses appearing before us today and providing that testimony.

We have a long day of testimony before us so I won't take very long in my opening remarks. Let me just say over many years in Congress, I have sat through dozens of hearings on climate change in multiple committees: Science Committee, Budget Committee, and this committee. And now comes the really hard work. We are going to address climate change but how? How much of our lives will change? How much will it cost? Who will be the winners? Do we have to have losers? And to me and the many people in Oregon that I have talked to about this, striking a balance is key. I met with Oregon's energy producers and major consumer groups, agriculture, forestry, environmental groups, and many kinds of businesses. Almost to a person, they encouraged me to work for legislation that would, number one, take meaningful steps to cut emissions, reduce current carbon levels in the atmosphere, and provide opportunities for American businesses to prosper. In addition, they said legislation should account for the economic results of addressing climate change for those businesses adversely affected. Legislation should also provide money for ecosystem adaptation. They urged me to get Congress to act now.

Last year I asked scientists from the Intergovernmental Panel on Climate Change if it was too late to reverse the effects of climate change. Dr. Richard Alley, a lead author of IPCC's assessment report, Climate Change 2007, stated that the loss of snow pack due to global warming will cause summer droughts in the West, which could adversely affect farmers and fisherman and the health of our salmon stocks. Could it be that we are already seeing that with the most recent salmon disasters?

Through the Bush Administration and prior Congresses, we have shown little concern with global climate change. States like Oregon and Illinois who are testifying here today have filled that void and led the way in many key areas by being aggressive and working to curb carbon emissions and setting standards for renewable energy production. As an Oregonian, I am proud of the strides we have made as a State to be a leader in this and other environmental matters. However, it is no substitute for gains we can make as a country if we establish policies that affect the country as a whole, and that is the task before us, and I look forward to your testimony.

Mr. BOUCHER. Thank you very much, Ms. Hooley.

The gentleman from Louisiana, Mr. Melancon——

Mr. WAXMAN. Mr. Chairman, may I just ask——

Mr. BOUCHER. Mr. Waxman?

Mr. WAXMAN. I would like to waive my opening statement and reserve that time for questions because I have to go over and chair another meeting. I just wanted to make that point.

Mr. BOUCHER. That is fine. The gentleman will have 3 minutes added to his time for questioning the first panel.

The gentleman from Louisiana, Mr. Melancon, is recognized for 3 minutes.

Mr. MELANCON. Thank you, Mr. Boucher. I am not going to take the 3 minutes. I would rather have it spent with discussions and input from the panel that is here, so I just waive the rest of my time. Thank you.

Mr. BOUCHER. The gentleman waives his opening statement and 3 minutes will be added to his questioning time.

We welcome now our first panel of witnesses, and we thank each of our guests for their patience this morning. The first witness will be Mr. Kraig Naasz, the President and Chief Executive Officer of the National Mining Association; Mr. Michael Goo, the Climate Legislative Director for the Natural Resources Defense Council; Mr. Alan Reuther, Legislative Director of the United Auto Workers, Ms. Lisa Jacobson, the Executive Director of the Business Council for Sustainable Energy; Mr. Thomas Kuhn, the President of the Edison Electric Institute; Ms. Mary Minette, Director of Environmental Education and Advocacy for the Evangelical Lutheran Church in America; Admiral Frank Bowman, the President and Chief Executive Officer of the Nuclear Energy Institute; and Mr. Ford West, the President of the Fertilizer Institute. We welcome each of you, and without objection, your prepared written statements will be made a part of the record. We would now welcome your oral summaries, and given the number of witnesses we have both on this panel and the next, we ask that your oral statements be kept to approximately 5 minutes.

Mr. Naasz, we will be happy to begin with you.

STATEMENT OF KRAIG R. NAASZ, PRESIDENT AND CHIEF EXECUTIVE OFFICER, NATIONAL MINING ASSOCIATION; ACCOMPANIED BY GLENN KELLY, VICE PRESIDENT, GOVERNMENT AFFAIRS, NATIONAL MINING ASSOCIATION

Mr. NAASZ. Thank you, Mr. Chairman. Chairman Boucher, Ranking Member Upton and members of the subcommittee, I appreciate this opportunity to testify this morning.

As you mentioned, my name is Kraig Naasz. I am President and CEO of the National Mining Association. NMA represents coal producers, mineral producers and mining equipment manufacturers with combined annual sales of $200 billion.

NMA is committed to playing a constructive role in the development of policies to address global climate change and to meet our Nation's growing demand for energy. We stand ready to assist you to achieve these important and inextricably linked objectives.

Coal is a prime source of energy in the United States and throughout the world and is likely to remain so as global energy demand continues to increase. Coal presently fuels 40 percent of the world's electricity generation. In the United States, 50 percent of our electricity is generated from coal and the Energy Information Administration projects that number will grow to 54 percent by 2030. EIA also estimates that the demand for electricity will increase by 30 percent over the next 2 decades to meet the needs of a growing population and expanding economy.

As such, meaningful efforts to address climate change in a sustainable manner will depend upon the development and deployment of advanced clean coal and carbon capture and storage technologies. To that end, NMA commends Chairman Boucher, Rep-

resentatives Barton, Upton, Doyle, Matheson, Whitfield, and Shimkus, among others, for introducing the Carbon Capture and Storage Early Deployment Act. This important legislation, while not the subject of today's hearing, will help to reduce greenhouse gas emissions by providing the funding needed to bring CCS technologies to commercial fruition. NMA looks forward to working with you, Mr. Chairman, in support of this important legislation's enactment.

In developing federal climate change legislation, it is essential that Congress gets it right. The consequences for getting it wrong are starkly described in the National Energy Technology Laboratory's recent analysis wherein NETL finds that dramatic shifts away from coal will lead to, and I quote, "Spectacular price increases for households and industry with serious and damaging implications for the reliability of electricity supply and the viability of the U.S. economy."

Furthermore, the National Electric Reliability Council has warned that many regions of our country face an imminent shortage of capacity to generate and transmit electricity.

The good news is that 27 coal-based generating units and plants representing more than 15,000 megawatts of electricity are currently being constructed throughout the United States. Given the demand forecast, even more facilities would likely be underwent were it not for the uncertainty regarding the form and timing of efforts to reduce greenhouse gas emissions.

With these considerations in mind, NMA supports the adoption of federal climate legislation that promotes America's continued economic and energy security. We believe such legislation should promote the continued use of our Nation's abundant coal resources as a critical part of a diverse and affordable supply of energy, that it should promote the accelerated development and deployment of advanced clean coal and CCS technologies, establish a uniform legal framework for long-term carbon storage, encourage energy efficiency, harmonize emission reduction expectations with the commercial deployment of cost-effective emissions control technology, ensure an economy-wide approach that supports economic growth and the global competitiveness of energy-intensive industries, and include appropriate participation by developed and developing countries.

Regrettably, the Boxer-Lieberman-Warner Climate Security Act failed to meet these objectives and the Senate was not provided with an opportunity to consider any substantive amendments. As such, NMA strongly opposed the Climate Security Act as crafted. In our view, neither the Safe Climate Act nor the Investing in Climate Action and Protection Act addresses the principles we view as necessary to sustain affordable and reliable energy for American families and businesses.

The Low Carbon Economy Act sponsored by Senators Bingaman and Specter represents a more workable framework that with appropriate modification could promote the development of technologies needed to achieve its proposed emissions reductions. However, significant modification would be required to address our industry's other major objectives. In our assessment, each of these legislative proposals falls well short of balancing our environmental

aspirations with our energy needs. However, I wish to underscore that NMA remains committed to working with you to develop legislation that addresses climate concerns while providing continued economic and energy security.

Mr. Chairman, this concludes my oral remarks. Again, I appreciate this opportunity to appear before you this morning and I look forward to answering your questions.

[The prepared statement of Mr. Naasz follows:]

Statement of
Kraig R. Naasz
President & CEO, National Mining Association

Before the
United States House of Representatives
Committee on Energy and Commerce
Subcommittee on Energy and Air Quality

"Legislative Proposals to Reduce Greenhouse Gas Emissions: An Overview"

Chairman Boucher, Ranking Member Upton and members of the subcommittee, thank you for the opportunity to testify on the important topic of legislative proposals to reduce greenhouse gas emissions.

My name is Kraig R. Naasz and I am president and CEO of the National Mining Association (NMA). NMA represents more than 325 companies involved in all aspects of mining, including coal, metal and industrial mineral producers, mineral processors, equipment manufacturers, state associations, bulk transporters, engineering firms, consultants, financial institutions and other companies that supply goods and services to America's coal and mineral producers.

NMA is committed to playing a constructive role in the development of policies to address global climate change and meet the growing global and domestic demand for energy. We stand ready to assist you and the members of this committee to achieve these important and inextricably linked objectives.

Coal is a prime source of energy in the United States and throughout the world, and is likely to remain so as global energy demand continues to

increase. Coal presently fuels 40 percent of world electricity generation. In the United States, 50 percent of our electricity is generated from coal, and the Energy Information Administration (EIA) projects that number will grow to 54 percent by 2030 to meet increasing demand for electricity for a growing population and expanding economy.

As such, meaningful efforts to address climate change in a sustainable manner will depend upon the development and deployment of advanced clean coal and carbon capture and storage (CCS) technologies. The national science academies of the G8+5 affirmed this policy imperative in a joint statement this month that concludes: "Technologies should be developed and deployed for carbon capture, storage and sequestration (CCS), particularly for emissions from coal, which will continue to be a primary energy source for the next 50 years for power and other industrial processes."

We commend Representatives Boucher, Barton, Upton, Doyle, Matheson, Hill, Whitfield and Shimkus, among others, for introducing "The Carbon Capture and Storage Early Deployment Act" that will help provide the funding needed to bring these technologies to fruition. NMA looks forward to working with the committee in support of this important legislation's enactment.

In developing federal climate legislation, it is essential that Congress get it right. The penalties for policy failure are starkly described in the National Energy Technology Laboratory's (NETL) April 28 analysis, wherein NETL finds that dramatic shifts away from coal as a baseload provider for U.S. electricity generation will lead to "spectacular price increases for households and industry. . .[with] serious and damaging implications for the reliability of electricity supply and the viability of the U.S. economy."

Furthermore, the National Electric Reliability Council (NERC) has warned that many regions in the United States face an imminent shortage of capacity to generate and transmit electricity. In its most recent 2007 report, NERC

found that "electric capacity margins continue to decline and actions are needed to avoid shortages." Capacity margins could decline below targeted margins as soon as 2009 in the Rocky Mountain states, California and Texas, as soon as 2010 in the Midwest and 2011 in New York State. Over the longer term, new capacity will be required to prevent actual shortages of electricity throughout the United States.

The good news is that 27 coal-based generating units and plants, representing 15,352 megawatts of electricity, are currently being constructed throughout the United States. Given the demand forecast, even more facilities would likely be underway were it not for the uncertainty regarding the form and timing of efforts to reduce greenhouse gas emissions.

With these considerations in mind, NMA supports the adoption of federal climate change legislation that promotes America's continued economic and energy security.

We believe such legislation should promote the continued use of our nation's abundant coal resources as a critical part of a diverse and affordable supply of energy to meet our nation's growing electricity needs as well as to provide industrial and transportation fuels through coal gasification and liquefaction technologies.

In addition, it should promote the accelerated development, demonstration and widespread commercial deployment of advance clean coal and CCS technologies. To do so, a dedicated source of funding should be established in addition to providing financial and other incentives necessary to achieve significant advances in such technologies. Sufficiently funded programs to collect and enhance the geologic, scientific and technical data necessary to characterize large underground storage basins suitable for CCS are also necessary. The establishment of a uniform legal framework for long-term

carbon storage, including site selection, permitting, monitoring and liability for storage sites, is also imperative.

Any policy efforts to address climate change should encourage energy efficiency and harmonize greenhouse gas emissions reduction expectations with the commercial availability and deployment of cost-effective emissions control technology.

Policy efforts must also ensure an economy-wide approach to climate change that includes all sources of greenhouse gas emissions and that promotes domestic economic growth and the global competitiveness of U.S. industry.

Finally, it is vital to promote international partnerships to address climate change as a global issue that requires global solutions, including appropriate participation by developed and developing economies.

Regrettably, the "Boxer-Lieberman-Warner Climate Security Act" (S. 3036) failed to meet these objectives. While NMA advocated several constructive modifications to the bill, the Senate was not provided with an opportunity to consider any substantive amendments. As such, NMA strongly opposed the Boxer-Lieberman-Warner Climate Security Act.

Neither the "Safe Climate Act of 2007" (H.R. 1590) nor the "Investing in Climate Action and Protection Act" (H.R. 6286) addresses the principles we view as necessary to sustain affordable and reliable energy for American families and businesses.

The "Low Carbon Economy Act" (S. 1766), sponsored by Sens. Jeff Bingaman (D-N.M.) and Arlen Specter (R-Pa.), represents a more workable framework that, with appropriate modification, could promote the development of technologies needed to achieve its proposed emissions reductions. However,

significant modification would be required to address our industry's other major objectives.

Having provided our assessment of these legislative offerings, I wish to underscore that NMA remains committed to working with you and your colleagues to develop legislation that addresses climate concerns while providing for continued economic and energy security.

Thank you again, Mr. Chairman, for the opportunity to appear before the subcommittee this morning. I look forward to answering your questions.

Mr. BOUCHER. Thank you very much, Mr. Naasz.
Mr. Goo, we will be happy to hear from you.

STATEMENT OF MICHAEL GOO, CLIMATE LEGISLATIVE DIRECTOR, NATURAL RESOURCES DEFENSE COUNCIL

Mr. GOO. Thank you, Chairman Boucher and Ranking Member Upton for the opportunity to testify and for holding this hearing on legislative proposals to reduce greenhouse gas emissions. My name is Michael Goo. I am the Climate Legislative Director for the Natural Resources Defense Council.

To begin my testimony, I will emphasize but not belabor the point that global warming is upon us now. As dramatic satellite photos show—see page 2 of my testimony—since 1979, the extent of summertime arctic ice has declined by 40 percent. Last night at 1:38 a.m., I received an e-mail, and I will emphasize that at NRDC, we do work 24 hours a day on global warming. The BlackBerry uses a little electricity but we try and make sure it is renewable energy. Anyway, the e-mail forwarded an article from the BBC from a colleague in California and it said that some researchers are predicting that the arctic ice could be gone in the summertime by 2013. Now, most of the bills before you begin to take action in 2012. That is just one year before the arctic ice would be gone, too late to save the arctic ice. We need action. We need it now.

You are going to hear a lot about costs today. The first point to remember about cost is that the cost of inaction is much larger than any possible cost of action. Lord Nicholas Stern in a study commissioned by the British government has estimated that the cost of inaction globally will be 5 to 11 percent of global GDP. Building on that work, researchers at Tufts University has recently analyzed the cost of inaction for the U.S. economy and found that doing nothing will cost the United States more than $3.8 trillion annually by 2100.

The second point is that these bills are not, contrary to the arguments of some, economy killers. Cost models analyzing the entire U.S. economy uniformly predict the GDP will increase with climate legislation in place. I repeat, GDP will increase, it will continue to rise with climate legislation just a little bit more slowly. EIA, the Energy Information Agency, for instance, predicts that between 2007 and 2030, 23 years, GDP will increase by 74.9 percent without the Lieberman-Warner bill, and by 73.5 to 74 percent with the Lieberman-Warner bill. That is a difference of just 1.6 percent over 23 years.

As the Congressional Research Service has explained, the GDP per capita impact of S. 2191 is within the noise of the reference cases. We need to recognize that with regard to our energy future, the die is not yet cast. cap-and-trade bills can dramatically affect that outcome in a positive fashion, especially if revenues are recycled to fund new technologies and mitigate impacts on consumers. Models that predict very high cost impacts for specific energy systems often ignore the vast untapped reserves we have for energy efficiency. They assume that low carbon technologies will not advance or will advance very slowly and they ignore the impacts of new policies like the recently enacted CAFE provisions. In short, they predict for at least the next decade a static energy picture

using mostly outdated energy technologies and ignoring the possibility of funding sources worth hundreds of billions of dollars. That need not be the future if this committee acts now.

An analysis by Michael J. Bradley Associates makes clear that reducing emissions to close to the level in the Lieberman-Warner bill can be done without massive switching to natural gas and another undesirable effects. The limits, a 20 percent reduction by 2025, can be met with just a 10 percent increase in energy efficiency, deployment of renewable energy at twice the current rate, and 6 gigawatts of carbon capture and sequestration per year between 2015 and 2025. That is not a moon shot. It is eminently doable.

Of all the committees in the Congress, this committee is uniquely suited to dealing with the problem of global warming. It has a deep reservoir of expertise and experience, both in the environmental area and in the energy field. And many of its members participated in the 1990 Clean Air Act amendments including Chairman Boucher, Congressman Dingell, and many other members of this committee. The bills now before you provide many excellent examples of ways in which global warming legislation can reduce emissions consistent with scientifically-based targets while helping to limit costs, create jobs, grow our economy, increase our energy independence, and spur new energy technologies for export to the world at large. But none of them are perfect.

We urge you to act now to draft legislation as soon as possible and to seek to report such legislation to the full Committee on Energy and Commerce and to the full House of Representatives. We cannot afford to wait any longer.

Thank you for the opportunity to testify.

[The prepared statement of Mr. Goo follows:]

Testimony of Michael Goo
Climate Legislative Director, Natural Resources Defense Council
Before The Subcommittee on Energy and Air Quality
Committee on Energy and Commerce
United States House of Representatives
Hearing On
Legislative Proposals to Reduce Greenhouse Gas Emissions: An Overview

June 19, 2008

Thank you for the opportunity to testify today regarding global warming legislation.

My name is Michael Goo. I am the Climate Legislative Director 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 online activists nationwide, served from offices in New York, Washington, Los Angeles and San Francisco, Chicago and Beijing.

Chairman Boucher and Ranking Member Upton, thank you for holding this hearing on legislative proposals to reduce greenhouse gas emissions. We look forward to working with the Energy and Air Quality Subcommittee and the full Energy and Commerce Committee, including Chairman Dingell and ranking member Barton, to enact comprehensive global warming legislation as soon as possible.

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. Recent 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.

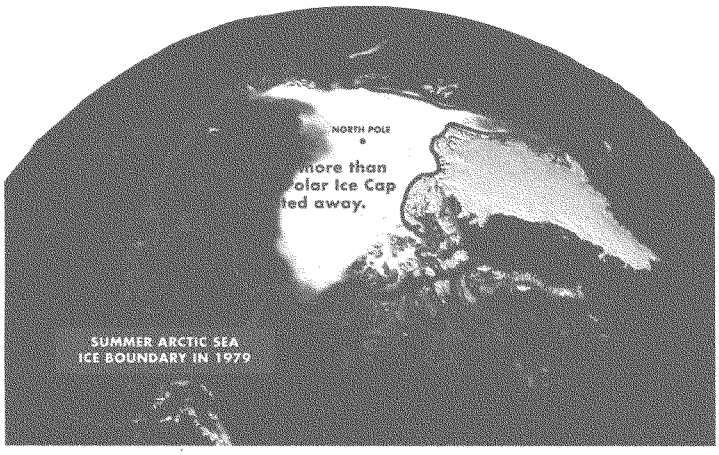

Figure 1: ARCTIC MELTDOWN - Arctic summer sea ice extent in 1979 and 2007. Source: NASA.

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 CO_2 and other global warming gases are kept from exceeding 450 ppm CO_2- 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 percent 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 percent 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 percent 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.

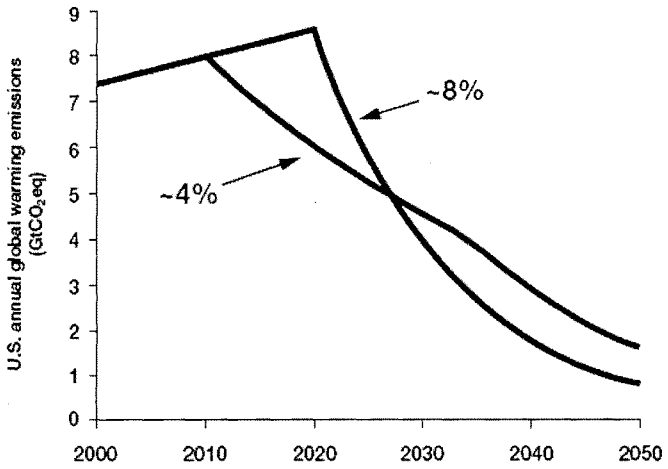

Figure 2: SLOW START... CRASH (OR BURN) FINISH
Source: Union of Concerned Scientists.

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 Carbon dioxide 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.

Costs of Inaction

The claim that climate protection is "too expensive" treats it like a discretionary expense – perhaps like a luxury car or exotic vacation that is beyond this year's budget. No harm is done by walking away from a high-end purchase that you can't quite afford.

But if we walk away from climate protection, we will be walking into danger. Unless we act now, the climate disruption will continue to worsen, with health, economic, and environmental costs far

greater than the price of protection. Scholars and economists have only begun a serious assessment of the costs of inaction but it is clear from their work that it is climate disruption, *not* climate protection programs, which will wreck the economy.

The Stern Review, sponsored by the British government and directed by Sir Nicholas Stern, formerly the chief economist at the World Bank, estimated that 5 percent of world economic output would be lost, given a narrowly defined estimate of economic damages. Add in an estimate for environmental damage and for the increased chance of an abrupt climate change catastrophe, and Stern's estimates of losses from climate disruption climb to 11 percent or more of world economic output.

A recent report released by researchers at Tufts University, commissioned by NRDC, builds on the Stern Review and presents two ways of estimating the costs of inaction to the United States, both leading to staggering bottom lines[1]. A comprehensive estimate, based on state-of-the-art computer modeling, finds that doing nothing on global warming will cost the United States economy more than 3.6 percent of GDP - or $3.8 trillion annually (in today's dollars) - by 2100.

In addition, a detailed, bottom-up analysis finds that just four categories of global warming impacts -- hurricane damage, real estate losses, increased energy costs and water costs -- will add up to a price tag of 1.8 percent of U.S. GDP, or almost $1.9 trillion annually (in today's dollars) by 2100.

Costs and damages for the four detailed categories cited in the report if global warming continues include:

- Hurricane damages: $422 billion
- Real estate losses: $360 billion
- Increased energy costs: $141 billion
- Water costs: $950 billion

The Global Warming Price Tag in Four Impact Areas, 2025 through 2100

	Cost in billions of 2006 dollars				
	2025	2050	2075	2100	U.S. Regions Most at Risk
Hurricane Damages	$10	$43	$142	$422	Atlantic & Gulf Coast states
Real Estate Losses	$34	$80	$173	$360	Atlantic & Gulf Coast states
Energy-Sector Costs	$28	$47	$82	$141	Southeast & Southwest
Water Costs	$200	$336	$565	$950	Western states
	$271	**$506**	**$961**	**$1,873**	

Figure 3: Cost of Inaction
Source: NRDC, available at http://www.nrdc.org/globalWarming/cost/contents.asp
Authors: Frank Ackerman and Elizabeth A. Stanton, *Tufts University*

[1] See Ackerman, Frank A., and Elizabeth A. Stanton, Climate Change and the U.S. Economy: The Costs of Inaction, March 2009 http://www.nrdc.org/globalwarming/cost/contents.asp.

Global warming is already melting sea ice and glaciers that will contribute significantly to sea level rise. Sea level is expected to rise 23 inches in 2050 and 45 inches by 2100, with grave impacts expected for the Southeastern U.S. By 2100, an estimated $360 billion per year will be spent on damaged or destroyed residential real estate in the United States as a result of the rising sea levels inundating low-lying coastal properties. The effects of climate change will also be felt in the form of more severe heat waves, hurricanes, droughts, fires, and other erratic weather events—and in their impact on our economy's bottom line.

Inaction on climate change also increases the chance of an abrupt, irreversible catastrophe, which would be much worse than the predictable costs of inaction discussed above. This point is emphasized in the Stern Review, and the economic analysis behind it is supported by recent research by Harvard University economist Martin Weitzman[2]. The collapse and complete melting of either the Greenland or West Antarctic ice sheets would cause sea levels to rise by 20 feet or more, causing devastation of coastal cities and regions where a large fraction of the American population lives. No one can say for certain at what temperature this will occur, but it becomes more likely as the world warms. We are taking a gamble, where the stakes are unbelievably high and the odds get worse the longer we stay on our current course.

In the future, global warming will cause drastic changes to the planet's climate, with average likely temperature increases of as much as 13 degrees Fahrenheit in most of the United States and 18 degrees Fahrenheit in Alaska over the next 100 years. This will change the nature of where Americans live. By 2100, New York City will feel like Las Vegas does today and San Francisco will have a climate comparable to that in New Orleans. In 2100, Boston will have average temperatures similar to those in Memphis, Tennessee today.

No sensible person bets his or her home on a spin of the roulette wheel. But inaction on climate change is betting the only home humanity has. Who knows, we might get lucky and win the bet; a few scientists still doubt that hurricanes are getting worse. But the consequences of a bad bet are enormous. Without arguing that Katrina was "caused" by global warming, the misery it caused the people of Louisiana and Mississippi and the continuing economic turmoil it produced are wake-up calls that show how much harm a disrupted climate can produce.

A catastrophe, such as 20 feet or more of sea level rise, is not certain to occur; we don't know enough today to say how quickly we may lock in these catastrophic events with current emission paths. But homeowners buy fire insurance, although they are not likely to have a fire next year; healthy young parents buy life insurance to protect their children, although they are not likely to die next year. The most catastrophic dangers from climate change are so immense that even if we believe

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[2] *See, e.g.*, "On Modeling and Interpreting the Economics of Catastrophic Climate Change," (November 2007), where Weitzman argues that conventional cost-benefit analyses of climate change are misleading because they ignore nontrivial risks of genuine disaster. "Standard conventional cost-benefit analysis (CBA) of climate change does not even come remotely close to grappling seriously with this kind of potential for disasters. When CBA is done correctly, by including reasonable probabilities of (and reasonable damages from) catastrophic climate change, the policy implications can be radically different from the conventional advice coming out of a standard economic analysis that (essentially) ignores this kind of potential for disasters."
http://www.economics.harvard.edu/faculty/Weitzman/papers/Modeling.pdf

the chance of catastrophe is small, it is irresponsible to ignore them. Taking action against climate change is life insurance for our home planet, needed to protect everyone's children.

Costs and Benefits of Action

The debate on global warming in Washington has turned decisively from "Is it a problem?" to "What are we going to do about it and how much is it going to cost?" In fact, we can't afford *not* to solve global warming. Economic analyses of the cost of reducing global warming pollution do not attempt to tally the benefits of preventing global warming. As the studies just discussed make clear, the costs of inaction are likely to swamp the costs of reducing emissions.

Even considering only the direct economic implications, it is clear that action to reduce global warming pollution presents opportunities as well as costs, as recognized by the business and environmental leaders that have formed the US Climate Action Partnership. We need only look to California as a prime example of how aggressive implementation of climate friendly energy efficiency measures has been accompanied by strong economic growth.

Due to these measures, California's per capita electricity consumption has been level over the last 30 years while that of the US as a whole has steadily increased. Per capita electricity consumption in California is now more than 40 percent lower than in the rest of the country. Meanwhile, from 1990 to 2005 the California economy grew by more than 50 percent in real terms, an average annual growth rate of 2.9 percent[3]. And from 2003-2006 California has had an average annual real growth rate of 4 percent, while nationally the growth rate was 3.1 percent per year[4].

The results of recent economic studies analyzing the costs of global warming cap and trade bills have shown that we can cut our global warming pollution substantially in a manner that is affordable for consumers and the US economy as a whole[5]. A number of agencies and organizations have made forecasts of the economic impacts of the Lieberman-Warner Climate Security Act (CSA), which was reported from the Environment and Public Works Committee on December 5, 2007 and considered on the floor of the Senate during the week of June 2, 2008.

The most important result from these studies of that particular bill is that, regardless of whether the study is a peer-reviewed academic or government analysis, or a non-peer reviewed industry-backed forecast, one prediction is the same: per capita household income (as measured by per capita gross domestic product, or GDP) will not decrease from today's levels. In fact, *all of the projections forecast robust economic growth and increasing household incomes*, despite the limits on global warming pollution contained in the CSA[6]. The most pessimistic GDP projection, from the Energy Information Administration (EIA), predicts GDP increasing by about 73.5 to 74.4 percent between

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[3] California Department of Finance, http://www.dof.ca.gov/html/FS_DATA/STAT-ABS/TABLES/d1.xls
[4] Bureau of Economic Analysis, U.S Department of Commerce http://www.bea.gov/national/xls/gdplev.xls.
[5] See NRDC Fact Sheet "Forecasts Of the Economic Effects of Climate Change Legislation: What Can We Conclude? Available at http://www.nrdc.org/legislation/factsheets/leg_08060201A.pdf
[6] See "Cutting Global Warming at Low Cost with the Lieberman-Warner Climate Security Act" http://www.nrdc.org/legislation/factsheets/leg_08051401A.pdf; and "New Department of Energy Study Shows Limit on Global Warming Pollution Compatible With Robust Economic Growth," http://www.nrdc.org/media/2008/080430.asp.

2007 and 2030. The business-as-usual projection (i.e. growth without climate policy) for this study is growth of 74.9 percent.[7]

Thus, macroeconomic cost analyses of the Lieberman-Warner bill suggest that climate change regulation can be enacted at little cost. Even the most pessimistic studies predict only modest decreases in GDP *growth* (as opposed to decreases in current GDP levels), and all the studies exclude the costs of inaction, which will likely greatly exceed these costs. Further, when provisions in recently enacted energy legislation (EISA) and proposed climate legislation are included in cost analyses, reductions in GDP growth are almost imperceptible.

All of the cost analyses predict continued economic growth, and ignore benefits, but it is still important to examine what drives the smaller versus larger estimates. Some of the ways in which the higher cost estimates differ from more realistic estimates include:

- **Higher cost forecasts do not model critical provisions in the Energy Independence and Security Act of 2007 (EISA) and in the Climate Security Act and make arguments that contradict more than 30 years of experience with environmental regulations.**

In contrast, the lowest cost estimates have the most extensive accounting for EISA and CSA provisions, and make assumptions that are consistent with the historical record. In reviewing the cost estimates predicted from regulating sulfur dioxide (SO_2) under the Clean Air Act, the Congressional Research Service (CRS) noted that *all* estimates (by government and industry alike) were significantly higher than the program's actual costs, and were "essentially the product of models' failure both to fully incorporate the flexibility that a cap-and-trade program provided participants and to employ sufficient imagination to explore the potential for technological breakthroughs and enhancements." In this regard, the high-end cost estimates for CO_2 regulation are *worse* than those made for SO_2: they fail to account for numerous provisions in EISA and CSA that augment technological innovation, a feature that did not accompany SO_2 regulation. More precisely,

- **High-cost studies assume low-carbon alternative energy sources will not advance,** such as carbon capture and sequestration (CCS), renewables, or energy efficiency, despite dramatic increases in research and development (R&D) spending, more stringent fuel economy standards (CAFE) for passenger cars and light trucks, higher efficiency standards for appliances and lighting, higher efficiency requirements for government buildings, requirements for reduced carbon content of fuels, increased funding for energy efficiency programs, and expanded rebates and incentives to consumers for purchasing low-carbon sources of energy and more efficient appliances.

To give just one illustration of the importance of these provisions, during its first 10 years of implementation, the Climate Security Act would invest $13 billion to help domestic vehicle

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[7] These figures are for 2007 to 2030, whereas the figures given in NRDC's Fact "Forecasts of the Economic Effects of Climate Change Legislation: What Can We Conclude?" are from 2011 to 2030.

manufacturers retool their facilities to build advanced technology vehicles[8]. In comparison, the Department of Energy currently spends between $200 and $400 million dollars per year on advanced vehicle and hydrogen fuel R&D.

With regard to employment, high cost studies forecast dire consequences. Again, unrealistic assumptions are needed to reach these results:

- **High-cost studies ignore the jobs that will be retained and created in producing and installing low-carbon technologies,** despite the provisions in EISA and CSA discussed above. Again, history serves as a guide: prior to SO_2 regulation, millions of lost jobs were forecasted by industry that never materialized.

High cost studies also predict dire consequences for household energy costs. To arrive at this result,

- **high-cost studies assume energy efficiency measures that are currently cost-competitive with fossil fuels will not be increasingly adopted.** This assumption is based on the premise that consumers, firms, and the government are currently using all available cost-effective energy efficiency measures, i.e., there is no waste in energy consumption patterns. But experts in energy efficiency find significant opportunities for energy efficiency improvements that are not now widely used due to various market barriers. A recent report by McKinsey & Company, supported by several major energy companies and others, found that almost 40 percent of the abatement required by 2030 could be achieved at "'negative' marginal cost." These costs are shown in Figure 4 below. All of the reduction strategies that are below the line represent strategies like energy efficiency that actually save money.

[8] For a more complete description of the technology provisions in the CSA see "The Climate Security Act is an Investment in America's Clean and Independent Energy Future," http://www.nrdc.org/legislation/factsheets/leg_08052701A.pdf.

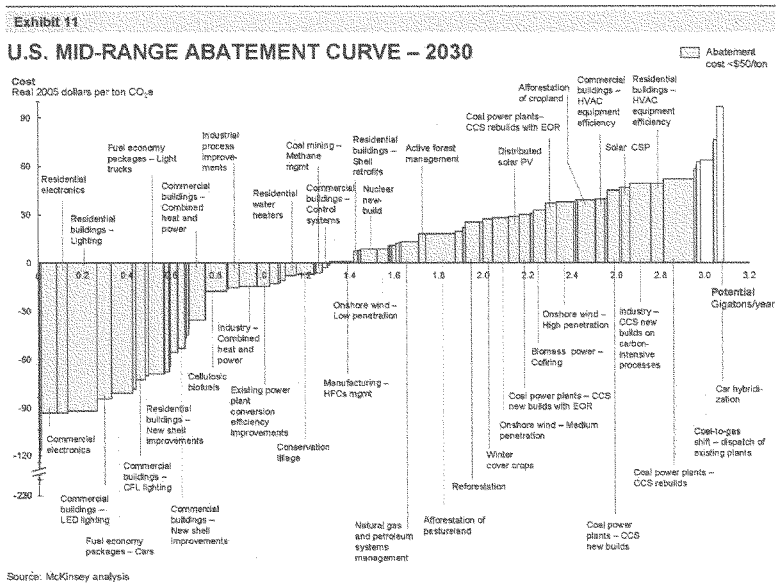

Figure 4: Abatement Opportunities
Source: McKinsey&Company, December 2007

Other problematic assumptions in cost studies with higher estimates include:

High-cost studies assume firms have very little flexibility in finding ways to reduce emissions. Compared to the SO_2 trading program, which proved highly flexible in meeting its reduction target *without* special provisions increasing firms' compliance options, proposed CO_2 regulation gives firms numerous ways to satisfy their requirements, such as international trading, offsets, and borrowing. Further, because so many more sectors are covered under CO_2 regulation than was the case for SO_2 regulation, the possibilities for creativity are likely to be substantially higher in a CO_2 trading program.

High-cost studies assume rising energy costs will put U.S. products at a competitive disadvantage relative to other countries' goods, causing U.S. firms to suffer losses, despite the fact that in the Lieberman-Warner bill there are **generous provisions in the bill** to offset higher costs in energy-intensive industries. **In addition, with the exception of a handful of industries, for more than 30 years economists have found no evidence of**

> **firms moving to developing countries for their weaker environmental regulations.** The explanation is simple: labor cost differences overwhelm any potential regulatory cost differences for nearly all firms. For example, labor accounts for roughly 70 percent of production costs in the United States, sometimes dwarfing wages in China by a factor of 20 to 1.

With the recent run up in oil and gasoline prices, there have been suggestions that global warming legislation will lead to increased household transportation fuel costs. NRDC's analysis suggests otherwise[9]. Under the Lieberman-Warner bill, household transportation fuel bills in 2020 and 2030 are likely to be lower than today's bills even as oil companies are required to purchase emission allowances. Total transportation fuel bills are what matters to household budgets, not the price per gallon of gasoline.

NRDC estimates that under the Lieberman-Warner bill, the average household will pay 7 percent to 16 percent less for transportation fuels in 2020 than they did in 2007, depending on the future price of oil[10]. As a result, the average household's total transportation fuel bill will be $230 to $530 lower in 2020 than it was in 2007. Total fuel costs drop due to more fuel efficient vehicles and (in the higher savings case) the decrease in oil prices forecast by the U.S. Energy Information Administration (EIA). For a sensitivity case, we estimated the savings if oil prices did not drop from 2007 average levels although the current AEO2008 predicts a drop. The average household still pays about 7 percent less in total transportation fuel bills in 2020, or a decrease of $230.

For 2030, we use EIA's world oil price forecasts and estimate that the average household will pay 18 percent to 25 percent less for transportation fuels under the CSA than they did in 2007, depending on the price of emission allowances. As a result, the average household's total transportation fuel bill will be $590 to $805 lower in 2030 than it was in 2007[11].

Even if base gasoline prices do not fall from 2007 levels (which AEO2008 forecasts), households will still see their fuel bills drop significantly. If base gasoline prices do not drop from 2007 levels, the reduction in gasoline consumption due to a more energy efficient vehicle fleet and greater use of electricity is more than sufficient to outweigh the increase in fuel costs due to addition of the carbon allowance on the base price.

To demonstrate this, we ran a sensitivity analysis of household bills assuming that the base gasoline price without the carbon allowance price addition stays at the 2007 average level of $2.77 per gallon. The average household still pays about 12 percent to 19 percent less in total fuel bills in 2030, or a decrease of $390 to $600[12].

Increases in household energy bills have also been a concern. However, even under the most extreme assumptions, EIA forecasts show that *relative to annual household income*, households will experience *relief* from today's home energy bills. The reason for this is that annual household

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[9] See NRDC Fact sheet: "Household Transportation Fuel Bills and the Climate Security Act" available at http://www.nrdc.org/legislation/factsheets/leg/_08061201A.pdf
[10] Id.
[11] Id.
[12] Id.

incomes are projected to increase by more than 70 percent by 2030, which is far greater than any increases in energy bills.

In EIA's core case, energy bills are actually expected to be *lower* than today's bills. And while it is true that under extreme assumptions they will be higher, under ***any*** set of assumptions *the percentage of a households' income devoted towards energy bills declines.* Figure 5 shows that under the core EIA policy case, the percentage of a households' income devoted toward home energy bills declines 34 percent by 2020 (from 3.1 percent today to 2 percent in 2020), and 45 percent by 2030 (from 3.1 percent today to 1.7 percent by 2030). ***But for even the most unlikely scenario, the burden is still reduced***: the percentage of a households' income spent on energy is 23 percent less in 2020 and 27 percent less in 2030.

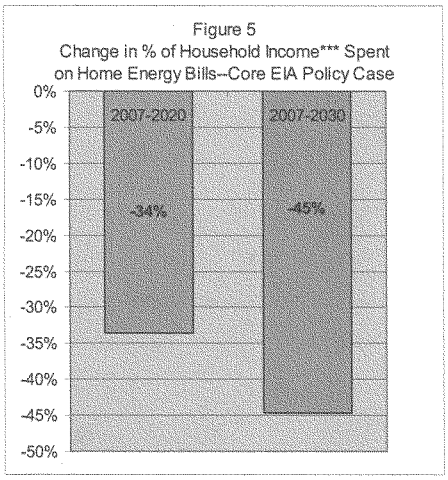

Figure 5: Annual household income was estimated by taking current average annual household income and growing it at the rate of GDP growth projected in EIA's Core CSA Case
Source: NRDC analysis using EIA data.

We should also note the assumptions required for the extreme case are unrealistic: 1) in contrast to proposed legislation, no international offsets are allowed to meet compliance standards; 2) Carbon capture and storage (CCS) technology is not available by 2030, despite generous proposed subsidies for its development and deployment; and 3) biomass power plant additions are limited to AEO2008 Reference Case level, despite significant proposed increases in subsidies for biofuel research and development. Because these assumptions are contrary to actual policies that would accompany emissions reduction requirements, NRDC finds the extreme case implausible.

The above projections are anything but the cataclysmic claims made by some opponents of climate legislation. But the picture might be even more positive, if one assumes an optimistic technological path.

An analysis of the proposed Lieberman-Warner legislation prepared for NRDC shows that the global warming pollution reduction targets established by the bill can be achieved without a significant increase in the country's total energy costs[13]. The overall economic impact is small because increased investment in new, more efficient appliances and equipment and low-carbon technologies is offset by savings from decreased expenditures on fuel and electricity. The analysis also shows that there are opportunities in the major transition to new technologies needed to achieve these reductions.

The analysis was performed using an improved and extended version of the US national MARKAL model (US-NM50), which was originally developed by the Environmental Protection Agency's Office of Research and Development. The reference point for the analysis is a business-as-usual (BAU) scenario calibrated to the Department of Energy's 2008 Annual Energy Outlook (AEO2008).

The effect of the Lieberman-Warner bill on energy investments and total energy system costs is illustrated with two different cases. Case A illustrates a future where substantial reductions in renewable energy costs occur as experience with these technologies accumulates, causing those resources to achieve a large market share after 2030. Case B illustrates a future with major continued investments in coal generation, with more substantial reliance on carbon capture and geologic sequestration (CCS).

The main findings of this analysis, presented by topic, include:

The Lieberman-Warner emission limits could be achieved with contributions to global warming pollution reductions from the following sources (Case A):

- Electric demand reduction - 19 percent
- Renewable energy - 24 percent
- Carbon sequestration - 8 percent
- Domestic offsets - 13 percent
- International credits - 18 percent
- Nuclear power - 0 percent

Emission reductions in both cases come mostly from the electric sector through a combination of efficiency improvements reducing electricity and direct fuel consumption, renewable energy use, CCS, and reduced energy service demands. In Case B, CCS contributes 19 percent of the reductions and other measures contribute somewhat less than in Case A. Direct emissions from major consuming sectors are roughly flat in both scenarios – with efficiency improvements offsetting economic growth.

Renewables will grow to between 50 percent and 60 percent of total electricity supply. In this model, renewables are a mix of biomass, geothermal, concentrating solar power, solar photovoltaics and wind technologies. The two main contributors to renewable electric output are large, remote wind farms and concentrating solar power.

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[13] See US Technology Choices, Costs and Opportunities under the Lieberman-Warner Climate Security Act: Assessing Compliance Pathways Pat DeLaquil, Gary Goldstein and Evelyn Wright International Resources Group Available at http://docs.nrdc.org/globalwarming/glo_08051401A.pdf

Achieving the Lieberman-Warner CO2 emission reductions targets results in about a 0.45 percent increase in the total discounted energy system cost in Case A relative to the BAU case over the 2000 to 2050 period. Achieving the Lieberman-Warner CO2 emission reductions targets results in about a 0.65 percent increase in the total discounted energy system cost in Case B relative to the BAU case over the 2000 to 2050 period. The impact is modest because increased investments in energy efficient end-use devices and renewable energy technologies are offset over the long-term by reduced expenditures on fuel and electricity.

One important and interesting finding is that oil imports drop to 35 percent of total oil supply in the middle years of the period under study due to both lower demand and the use of CCS for Enhanced Oil Recovery (EOR) that greatly expands domestic production from existing fields. Oil imports rise again between 2035 and 2050 as the EOR resource (estimated at 50 billion barrels) begins to deplete, although they remain under 60 percent of total oil supply, as compared to more than 80 percent by 2050 in the BAU case

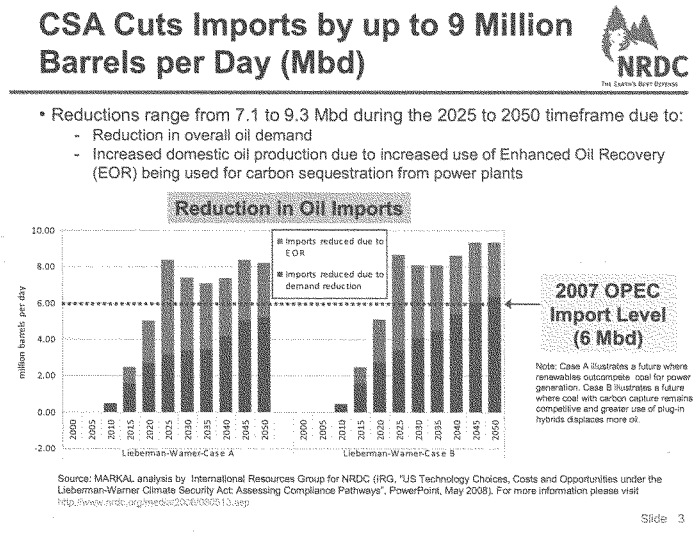

Figure 6: Reduction in Oil Imports
Source: MARKAL Analysis by International Resources Group for NRDC

Energy prices for coal and natural gas (not including allowance costs) are between 15 and 30 percent lower relative to the BAU case because of decreased demand. The marginal cost of generating electricity for summer days decreases relative to the BAU case due to the lower demand, while summer night costs increase as the use of plug-in hybrids grows.

The analysis also shows that use of domestic offsets and international credits within the limits in the Lieberman-Warner legislation would significantly reduce compliance costs, while expanded access to offsets would be of little additional benefit in terms of reducing costs.

This analysis demonstrates that the impact of strong global warming legislation on energy costs is relatively modest and manageable, particularly if some of the value of emission allowances is invested to spur deployment of increased energy efficiency, renewable energy and CCS technology.

Finally, refuting industry claims that major fuel switching would occur with enactment of climate protection legislation a recent report by M.J. Bradley & Associates shows that the emission reductions required by the Climate Security Act can be achieved in the electric power sector without fuel switching from coal to natural gas. The study outlines a realistic scenario where increased reliance on efficiency, renewable resources like wind, solar, and biomass, and carbon dioxide capture from coal power plants can achieve the near and mid-term reduction goals of the Climate Security Act without significant changes in reliance on coal, natural gas or nuclear energy to meet U.S. power needs. The analysis assumes:

- efficiency measures that reduce electricity demand by 10 percent below business-as-usual in 2025,
- renewable sources are deployed at approximately twice the current rates, and
- 65GW of coal with carbon capture and sequestration (CCS) is built by 2025, or about 6 GW a year from 2015-2025.[14]

A cap combined with focused incentives for these three activities would ensure that the Climate Security Act's emission reduction requirements can be met with no switching from coal to natural gas.

LEGISLATIVE PRINCIPLES

Before turning to specific provisions of particular bills, it may be instructive to discuss some basic legislative principles that NRDC believes should apply to all global warming legislation. These principles help provide a framework by which the members can gauge the merits of current and future legislative proposals.

On September 14, 2007, 16 major environmental organizations wrote to members of the U.S. Senate and annunciated principles for global warming legislation. For the environmental groups who signed this letter, these principles remain fundamental for any federal legislation and we urge this committee to consider them as it drafts legislation. As noted in the letter, these organizations will judge any climate legislation on how well it reflects these principles. The principles are as follows:

Preventing dangerous global warming is paramount.

Permits to emit carbon must be used for public benefit, not private windfalls.

Promoting a clean energy future is key.

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[14]M.J. Bradley & Associates, "Coal and Natural Gas Use in the Electric Power Sector under the Climate Security Act," June 2008. http://docs.nrdc.org/globalwarming/glo_08060401A.pdf

Ensuring a just transition is critical.

Assisting adaptation to an altered climate is an essential goal.

Managing costs must be done without breaking the cap

Energy policy reform is an essential companion of any cap.

For a fuller discussion of the content of these principles see Attachment A: Letter from 16 Environmental Groups to U.S. Senators, April 22, 2008.

On April 22, 2008, three members of the Committee on Energy and Commerce, Congressman Waxman, Congressman Markey and Congressman Inslee circulated a set of global warming legislative principles for signature in the House of Representatives. We understand the Waxman/Markey/Inslee principles have already garnered more than 80 signatures to date with continuing interest from additional members. NRDC and many other members of the environmental community endorse these principles and encourage members of the Subcommittee and full Committee, as well as other members of the House to sign on to these principles.

The first and most important principle is that global warming legislation must reduce emissions of greenhouse gases so as to avoid dangerous global warming. Scientists are telling us that we will need to reduce total us emissions 15-20 percent below 1990 levels by 2020 and 80 percent below 1990 levels by 2050. In case, even these numbers turn out to be insufficient to avoid catastrophic global warming, legislation must include a mechanism for periodic scientific review and adjustment of targets. Because global warming is a worldwide problem, in addition to leading through domestic action, the U.S. must continue to seek international commitments and actions to reduce emissions, so that the worldwide targets described by the Intergovernmental Panel on Climate change can be met.

The legislation must ensure that emissions limits are certain and enforceable. For this reason, as discussed more fully below, NRDC does not support the so called "safety valve" cost containment mechanism which allows the unlimited purchase of permits to emit greenhouse gases, once the market price for allowances reaches a set price. Such a mechanism allows the release of greenhouse gases in excess of the emissions cap, in exchange for payment of a set dollar figure. As various analyses of legislation that includes a safety valve have demonstrated, in cases in which the safety valve is invoked, emissions can actually increase, rather than decline under such an approach. Figure 6 below illustrates this point with regard to the Bingaman/Specter bill, as seen in the cross hatched area in green, which represents additional emissions allowed through the safety valve mechanism.

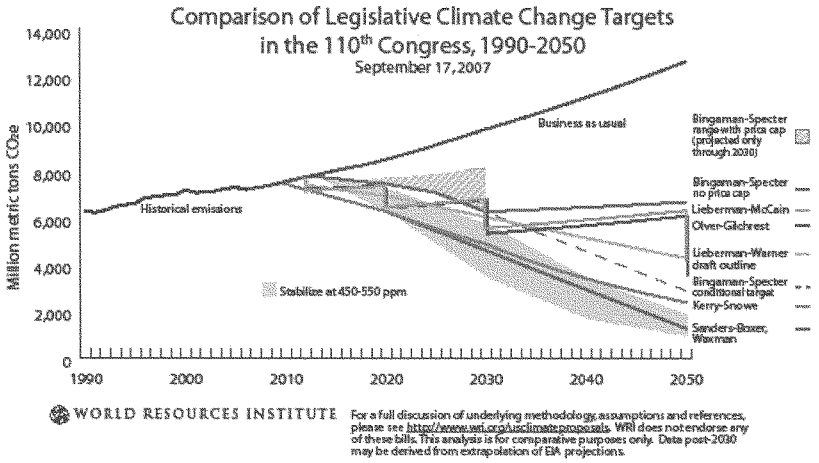


Figure 6: Comparison of Legislative Climate Change Targets
Source: World Resources Institute

As the chart shows, 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 some of the current 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 allowing firms to borrow a limited number of allowances with appropriate interest and payback guarantees.

A common feature of all of the bills being examined by the Subcommittee today is that they are implemented largely through a cap and trade system that achieve emission reductions through a market based allowance trading system. NRDC agrees that – combined with complementary policies--cap and trade is the most effective and efficient approach to curbing global warming pollution. 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 $50 and $300 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.

The Waxman/Markey/Inslee Principles make the same points. They indicate that acceptable legislation must:

- **"Use public assets for public benefit in a fair and transparent way.** Emissions allowances should be auctioned with the revenues going to benefit the public, and any free allocations should produce public benefits. If any allocations are given to polluters, they must be provided only to existing facilities for a brief transition period and the quantity must be limited to avoid windfall profits.

- **Return revenues to consumers.** Revenues from auctioned allowances should be returned to low- and moderate-income households at a level sufficient to offset higher energy costs.

- **Return revenues to workers and communities.** Workers and communities most affected by the transition to a clean energy economy should receive a portion of the revenues to ease the transition and build a trained workforce so that all can participate in the new energy economy.

- **Protect against global trade disadvantages to U.S. industry.** In addition to providing incentives for developing countries to reduce emissions, the legislation should provide for an effective response to any countries that refuse to contribute to the international effort. These elements will protect energy-intensive U.S. enterprises against competitive disadvantage.

- **Assist states, localities and tribes to respond and adapt to the effects of global warming.** A portion of auction revenues should be provided to states, localities, and tribes to respond to harm from global warming and adapt their infrastructure to its effects, such as more severe

wildfires, intensified droughts, increased water scarcity, sea level rise, floods, hurricanes, melting permafrost, and agricultural and public health impacts.

- **Assist developing countries to respond and adapt to the effects of global warming.** A portion of auction revenues should be provided to help the developing countries most vulnerable to harm from global warming and defuse the national security threats posed by the conflicts over water, famines, and mass migrations that could be triggered by global warming. Vulnerable countries include least developed countries, where millions of people are already living on the brink, and small island states, which face massive loss of land.

- **Assist wildlife and ecosystems threatened by global warming.** A portion of auction revenues should be provided to federal, state, and tribal natural resource protection agencies to manage wildlife and ecosystems to maximize the survival of wildlife populations, imperiled species, and ecosystems, using science-based adaptation strategies."

See Letter From Reps. Henry Waxman, Edward Markey and Jay Inslee, April 22, 2008. Attachment B.

As discussed more fully below in the context of the specifics of particular legislative vehicles, NRDC agrees with these principles as the basis for a sound and effective distribution of the revenues from a cap and trade program.

LEGISLATION

The Committee invite letter asks that I present the views of NRDC regarding five legislative vehicles under consideration this Congress:

H.R. 1590: the Safe Climate Act, (introduced by Representative Henry Waxman),

S. 1799, The Low Carbon Economy Act, (introduced by Senators Bingman and Specter

S. 2191, America's Climate Security Act of 2007 (as reported out of the Senate Committee on Environment and Public Works and introduced by Senators Lieberman and Warner)

S. 3036 (the Lieberman-Warner Climate Security Act of 2008 --Senator Boxer's Substitute)

H.R. 6186 (the Investing in Climate Action and Protection Act (Congressman Markey).

The massive size and scope of these bills make a full summary and comparison of them beyond the scope of this testimony. Several of the bills run to nearly 500 pages and the combined page total for all the bills reaches nearly 2000 pages. In addition, some of these bills have not yet had the same level of analysis, especially outside economic analysis, as some of the earlier bills such as the Bingaman/Specter and Lieberman/Warner bills. Nevertheless, because each of these bills makes important contributions to the legislative debate over climate change, I will highlight a few of the key provisions in each that merit close attention.

The Safe Climate Act, H.R. 1590 (introduced by Representative Henry Waxman)

The Safe Climate Act was the first bill in Congress to point to the need for a long term reduction target for 2050. That same approach was followed in the Sanders/Boxer bill, S. 309. Using a cap and trade system, the Safe Climate Act requires annual reductions of approximately 2 percent per year, reaching 1990 levels until 2020 and approximately 5 percent per year thereafter, ultimately resulting in a 80 percent reduction from 1990 levels by 2050. The Safe Climate Act reduction targets are based on 100 of U.S. emissions, unlike other bills which only guarantee reductions from a subset of covered sources. It would be implemented by EPA and DOE. Because of its stringent reduction path, the Safe Climate Act would be consistent with limiting global CO2 emission concentrations to 450 parts per million and thus meets the requirement for a scientifically based emissions reduction goal sufficient to avert dangerous global warming.

The Safe Climate Act was also the first bill to include the concept of a scientific review provision. The bill directs the National Academy of Sciences and the National Research Council to review, every five years, progress toward avoiding dangerous climate change. If the National Academies find that dangerous global warming is likely, they must identify the reductions needed and recommend additional national and international actions to achieve the reductions.

Under the Safe Climate Act, allowances are distributed according to a plan developed by the President, with an opportunity for Congress to ratify or modify the plan. Proceeds from auctioning allowances are deposited in the Climate Reinvestment Fund. Revenues in the fund are dedicated to maximizing the public benefit and promoting economic growth, including supporting technology research and development, compensating consumers for any energy cost increases, providing transition assistance for affected workers and regions, and protecting against harm from climate change, such as safeguarding water supplies, protecting against hurricanes, and mitigating harm to fish and wildlife habitat

In addition to the cap and trade program under the bill, a number of complementary policies are included:

> The bill directs EPA to set standards for reducing greenhouse gas emissions from motor vehicles that are at least as stringent as the current California standards. EPA must tighten these standards in 2014 and periodically thereafter.
>
> The bill directs the Department of Energy to establish national standards requiring an increasing proportion of electricity to be generated from renewable energy sources, reaching 20 percent of retail electricity sold in 2020.
>
> The bill directs the Department of Energy to establish national standards requiring utilities to obtain, each year, 1 percent of their energy supplies through energy efficiency improvements at customer facilities. These savings would accumulate each year through 2020.

More than 150 members of the House of Representatives have cosponsored the Safe Climate Act, which is the largest number of co sponsors on any global warming bill in Congress to date. NRDC supported the Safe Climate Act upon its introduction and continues to commend Congressman Waxman and the many other members of the House of Representatives for their groundbreaking leadership in pushing this important piece of legislation forward.

The Low Carbon Economy Act, S. 1799 (introduced by Senators Bingaman and Specter)

S 1799, the Low Carbon Economy Act, also creates a cap and trade system for reducing greenhouse gas emissions. The current version of the bill is based on previous efforts by Senator Bingaman and other senators, and builds off the work of the National Commission on Energy Policy. Many key concepts in other bills, such as the Lieberman-Warner Bill, the Boxer Substitute and the Markey bill first appeared as part of the Low Carbon Economy Act and its predecessor versions. These include concepts such as the bonus allowance provision for carbon capture and sequestration, the initial version of a carbon border adjustment provision, a detailed technology investment fund, a fund for energy intensive industries and the decision to flesh out a detailed and dedicated allocation system with substantial revenues going directly to states. Senator Bingaman and the National Commission on Energy Policy are to be commended for being among the first to bring forth such ideas.

The Low Carbon Economy Act would reduce U.S. emissions to 2006 levels by 2020 and would reduce U.S. emissions to 1990 levels by 2030. The bill also includes a "safety valve" provision, called the "Technology Accelerator Payment" or "TAP". This "Technology Accelerator Payment" (TAP) price starts at $12 per metric ton of CO2-equivalent in the first year of the program and rises steadily each year thereafter at 5 percent above the rate of inflation. The proceeds from the TAP are to be used for investment hastening the pace of technological development, in the event the safety valve price is reached and TAP payments are actually collected.

Although NRDC commends the bi-partisan leadership of Senators Bingaman and Specter, the reduction targets in the Low Carbon Economy Act are not in line with the scientific evidence and are not stringent enough to prevent dangerous global warming. In order to meet those requirements, U.S. emissions must be reduced by 15-20 percent below current levels by 2020. The Low Carbon Economy Act would, putting aside the safety valve, result in about a 4 percent reduction from 2005 levels by 2020 and a 20 percent reduction from 2005 levels in 2030. Thus, the needed cuts in emissions would come about a decade too late under the Bingaman-Specter bill.

Equally important, with the safety valve, emissions could actually increase. NRDC estimates that if the safety valve provision were invoked emissions could actually increase by 6 percent above 2005 levels by 2020 and by 11 percent above 2005 levels by 2030. Because of the weak reduction targets and the potential effect of the safety valve provision on emissions, NRDC and many other environmental groups do not support the Bingaman-Specter legislation.

America's Climate Security Act of 2007, S. 2191 (as reported out of the Senate Committee on Environment and Public Works and introduced by Senators Lieberman and Warner)

The Lieberman-Warner bill, America's Climate Security Act (S. 2191) as reported from the Environment and Public Works Committee represents a major step towards putting our country on an emissions pathway consistent with avoiding extremely dangerous global warming. This bill represents the most detailed and comprehensive attempt to date to combat global warming. On December 5, 2007, the Climate Security Act was approved by an 11-8 vote in the United States Senate Environment and Public Works Committee. This was the first comprehensive global warming bill ever to be reported from that Committee and consideration of its substitute version (discussed more fully below) was the subject of a historic debate and vote in the Senate on June 6, 2008. 48 Senators voted for cloture on the bill and another 6 who were absent indicated that they too, would

have voted for cloture. With that vote, it is accurate to conclude that a majority of the United Senate (54 members) supports moving forward to consider strong global warming legislation consistent with scientifically based limits. We urge the House to move as soon as possible to have a similar vote, both in this Committee and on the floor of the full House of Representatives.

The Climate Security Act, as reported, caps and cuts emissions of three sectors – electricity, transportation, and industry – that together account for about 84 percent of U.S. greenhouse gas emissions. It calls for about a 19 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 18-25 percent by 2020 and approximately 62-66 percent by 2050.

S. 2191 embraces the principle that pollution allowances should be used for public purposes and contains a detailed allocation system that eliminates free allocations to emitters in 2031. However, as reported, S. 2191 still 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.

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 emission reduction activities that are not covered by the emissions cap. The 15 percent limitation is essential to ensure the overall integrity of the emissions cap in the bill and to spur technology innovation. Analysis of S.2191 by the Energy Information Administration shows that allowing greater use of offsets would have only a small impact on compliance costs, but would delay needed investments in low-emission technologies, such as CCS. NRDC has and will consistently oppose efforts to allow unlimited use of offsets for compliance purposes.

The Lieberman/Warner legislation includes "cost containment" provisions that protect the integrity of the emissions cap and preserve incentives for technology innovation. 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 would not have the authority to change the cumulative emissions cap, thereby protecting the environment while minimizing cost volatility. NRDC supports this and other provisions of the bill that help to contain costs without compromising environmental performance.

The bill 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.

The bill also includes several incentive provisions to reward developers who incorporate carbon capture and geologic disposal systems for new coal plants, including an updated version of the bonus allowance provision for carbon capture and sequestration, transition assistance for electricity generation, funding for zero and low carbon technologies, and an advanced coal and sequestration technology fund. As the bill was reported from Committee, NRDC continued to conclude that the

bill contained excessive funding for coal based technologies that would be wasteful and result in windfall profits for emitters. As discussed more fully below, the bills sponsors substantially revised the technology funding provisions in the Boxer substitute version.

Finally, 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.

S. 3036 (the Lieberman-Warner Climate Security Act of 2008 --Senator Boxer's Substitute)

S. 3036 represents changes made to the Climate Security Act between the time the bill was reported from the Committee on Environment and Public Works in December of 2007 and consideration of the bill by the full Senate. The primary notable changes included incorporation of a new fund designed to help the bill conform to pay-as-you go budget rules, inclusion of a new cost containment mechanism, changes to natural gas coverage, substantial changes to the allocation provisions (including a reduction of the amount of funding for coal related emissions and technologies) and changes to the offset provisions.

S. 3036 represents changes made to the Climate Security Act between the time the bill was reported from the Committee on Environment and Public Works in December of 2007 and consideration of the bill by the full Senate. The primary notable changes included incorporation of a new fund designed to help the bill conform to pay-as-you go budget rules, inclusion of a new cost containment mechanism, changes to natural gas coverage, substantial changes to the allocation provisions (including a reduction of the amount of funding for low-carbon technologies) and changes to the offset provisions.

S. 3036 contained a new cost containment mechanism designed to help dampen volatility in the carbon market price. Under S. 3036 a new cost containment auction was created. A pool of allowances totaling 6 billion tons, borrowed from the years 2030 to 2050 provides the basis for an auction, with a price to be set between $22-30 dollars per ton as determined by the President. The initial price chosen escalates annually at 5 percent above the rate of inflation. In the first year 450 million tons may be auctioned and each year the total number of allowances available for auction declines by 1%. 70 percent of the revenues (if any) from the cost-containment auction are to be used to create additional reductions. This cost containment mechanism helps to limit allowance market volatility, but preserves the integrity of the emissions cap. Although NRDC does not endorse the specific trigger price and auction pool size in the Boxer substitute, NRDC believes the structure of this cost-containment mechanism provides an acceptable alternative to a classic safety valve that breaches the emission cap.

S. 3036 also adjusted the offset provisions in the Lieberman/ Warner bill that allow firms to comply with emission reductions from sources that are not covered by the cap. Under S. 3036, the firm-wide offsets limit contained in S. 2191 was converted to a percentage limit of total allowances. Offsets from domestic agriculture and forestry may total up to 15 percent of the cap under S. 3036. Another 15 percent may come from international actions, including 10 percent from national-level

programs to reduce tropical deforestation. Carry over provisions are included to allow unused tonnage to be used in future years. These changes help improve flexibility in the use of offsets without jeopardizing the overall cap integrity.

Unfortunately under S. 3036, a provision that would have required EPA to regulate emissions from unprocessed natural gas was altered to a study provision. Future versions of this legislation should be strengthened to increase the coverage of natural gas and hence increase the amount of overall reductions.

Finally S. 3036 adjusted the allowance allocation framework in significant fashion. Although these changes are too numerous to detail here, some of the more significant ones include an increase in the amount of allowances to carbon intensive manufacturers, accompanied by a matching decrease in the amount of transition assistance to electricity producers, reallocating 1/3 of the state general fund to assist state economies that rely heavily on coal and elimination of the fund for advanced coal and carbon sequestration, but creation of a new "kick start" program for carbon capture and sequestration. In general these changes represented improvements in the legislation as the portion of allowances going to energy efficiency and other public purposes was increased. In addition, because of the new deficit reduction fund created in order to comply with budget rules, the overall amount of the allowance pool for other purposes was significantly reduced. A chart summarizing the revised allocation scheme is included below:

Allowance Allocation Beneficiaries	Cumulative % Allowances, 2012-2050
Consumers, states, and tribes	49%
Free allocations to industry	9%
Low-carbon technology development and deployment	
■ Energy efficiency, renewable and zero emission sources (6 percent)	
■ Advanced coal with carbon capture and storage (2 percent)	
■ Advanced biofuels and vehicles (1.5 percent)	9.5%
Domestic agricultural and forestry activities	4.5%
Worker training for green jobs	3%
International mitigation and adaptation	6%
Domestic wildlife adaptation and ecosystem protection	4%
Pay-as-you-go budget offset and other program costs	15%

Figure 7: Allowance Allocation Beneficiaries
Source: NRDC, http://www.nrdc.org/legislation/factsheets/leg_07121101A.pdf

The Investing in Climate Action and Protection Act, H.R. 6186 (Congressman Markey).

H.R. 6186, the Investing in Climate Action and Protection Act (iCAP) builds off the basic structure of S. 2191 and S. 3036. The bill includes many of the same features as the Lieberman-Warner bill, as reported, and the Boxer substitute bill, but also calls for steeper emission cuts and returns significantly smaller amounts of the allowance revenue to emitters. Other features of the Lieberman-Warner Bill and the Boxer substitute are also adjusted under iCAP as discussed below.

H.R. 6186 covers approximately 86 percent of U.S emissions and uses the same definition of "covered" entities as S. 2191 and S. 3036, however the point of regulation for natural gas is the local gas distribution companies. The iCAP bill also covers emissions from geological sequestration sites, which represents a different approach to dealing with any potential leakage from geological sequestration sites than the Lieberman-Warner bill.

H.R. 6186 requires covered sectors to reduce by 85 percent by 2050 from current levels of greenhouse gas emissions. Covered sectors must reduce emissions by 20 percent from current levels by 2020. In addition mandatory performance standards are included in the bill for coal mines, landfills, wastewater treatment operations, and large animal feeding operations. Together with voluntary incentives for agricultural and forest sequestration, these additional measures are estimated by the bills sponsors to achieve an additional 7 percent reduction from source that are not covered entities. The iCAP also establishes mandatory performance standards for any new coal-fired power plant, requiring all plants on which construction begins after January 1, 2009, to achieve capture and geological sequestration of 85 percent of their CO2 emissions, by either 2016 or within 4 years of commencing operation. The bill also statutorily grants the California Wavier for greenhouse gas emission standards for motor vehicles, which EPA has denied.

The iCAP Act auctions 94 percent of allowances in 2012 and transitions to a 100 percent auction in 2020. The 6 percent of allowances that are not initially auctioned are distributed to U.S. industries that are energy-intensive and exposed to international trade competition (e.g., iron and steel, aluminum, cement, glass, and paper).

The iCAP Act allows banking, borrowing and trading of permits. Borrowed allowances must be repaid within five years with interest. Covered entities can meet up to
15 percent of their annual obligations with EPA-approved domestic offset credits and up to an additional 15 percent with EPA-approved international emission allowances or offset credits. However, domestic and international offset credits are subject to rigorous standards to ensure reductions in emissions or increases in sequestration are real, verifiable, additional, permanent, and enforceable. Only 4 categories of domestic offsets are allowed as follows:

- Reductions in (outside-the-cap) fugitive greenhouse gas emissions from oil and gas systems;
- Reductions in greenhouse gas emissions from livestock operations that are not covered by performance standards,
- Reductions in greenhouse gas emissions from abandoned coal mines; and
- Increases in biological carbon sequestration through afforestation and reforestation.

The iCAP Act directs the Federal Energy Regulatory Commission to oversee the carbon market to prevent fraud and market manipulation.

Among the most prominent features of the iCAP act is the creation of a fund for low and middle income households under which more than half of auction proceeds would be returned to low- and middle-income households through rebates and tax credits. The fund is designed to compensate all increased energy costs due to climate legislation for all households earning under $70,000 (66 percent of U.S. households), and will provide benefits to all households earning up to $110,000 (over 80 percent of U.S. households).

Under iCAP the remaining auction proceeds are invested in a number of programs aimed at further reducing the costs of reductions, spurring technology development and mitigating unavoidable impacts of climate change. Funds are included for:

- clean energy technology research, development, demonstration and deployment
- energy efficiency policies
- incentives to U.S. farmers and foresters

- carbon storage in agricultural soils and forests
- green jobs training and assistance
- reduction of deforestation and deployment of clean technologies in developing countries
- programs to increase resilience to domestic and foreign climate change impacts
- climate change education

The iCAP Act includes provisions to address international competition and engagement in fighting climate change. Under the iCAP Act, developing countries that take comparable action to reduce global warming pollution will have access to funding from the International Clean Technology Fund and will be allowed to sell "offset credits" into the U.S. market. Developing countries that carry out programs to reduce emissions from deforestation will be eligible for assistance from an International Forest Protection Fund. For countries failing to take comparable action by 2020, importers of energy-intensive primary goods (e.g., iron and steel, aluminum, cement, glass, and paper) from that country will have to purchase special reserve allowances to account for pollution generated in the production of such goods. Also, until 2020, U.S. manufacturers of competing primary goods will be given free allowances to prevent loss of jobs or "leakage" of emissions due to international competition.

The iCAP bill provides a strong basis for global warming legislation with emissions reductions that fall within the range of reductions science tells us are needed to avoid dangerous climate change. NRDC supports the decision to provide a very small amount of free allowances to emitters and to use a substantial amount of the proceeds from the auction for rebates and tax credits for low and middle income consumers. NRDC also supports the decision to limit offsets to 15%, subject such offsets to stringent criteria and to only allow domestic offsets from a well-defined set of sources. Similarly, NRDC supports the decision to use the set-aside approach, rather than an offset based approach for soil sequestration reductions from agriculture. NRDC believes the iCAP Act makes a very substantial contribution to further progress in the global warming debate and urges this committee to consider some or all of its provisions carefully as a basis for future action.

* * *

Chairman Boucher, allow me to once again thank you for holding this legislative hearing and for indicating your desire to consider moving forward on strong, bi- partisan global warming legislation this year. We have reached a key moment in history and you, along with Chairman Dingell, Ranking Members Barton and Upton, and the other distinguished members of the Committee, can be central in solving the greatest environmental problem that mankind has yet faced. The work that you and your staff are doing now will be critical in making progress toward enactment of strong, bipartisan global warming legislation. The bills now before you provide many excellent examples of ways in which global warming legislation can reduce emissions, consistent with scientifically based targets, while helping to limit costs, create jobs, grow our economy, increase our energy independence, and spur new energy technologies for export to the world at large. We urge you to act now to draft legislation as soon as possible and to seek to report such legislation to the full Committee on Energy and Commerce and to the full House of Representatives. We cannot afford to wait any longer. We look forward to further progress as your legislation moves through the Subcommittee and the full Committee, and we at NRDC stand ready to assist in any way possible.

Clean Water Action • Defenders of Wildlife • Earthjustice • Greenpeace
League of Conservation Voters
National Audubon Society • National Environmental Trust
National Tribal Environmental Council • National Wildlife Federation
Natural Resources Defense Council
Oceana • Physicians for Social Responsibility • The Sierra Club
Union of Concerned Scientists • U.S. Public Interest Research Group
The Wilderness Society

September 14, 2007

Dear Senator,

This fall, as the Congress completes its work on the energy bill and turns its attention toward enacting legislation to tackle global warming, there are some fundamental principles that we urge you to embrace. An approach that combines capping and cutting carbon emissions to science-based levels, market flexibility for cost-effective reductions, using carbon permits for public benefit, and reforming the energy sector is the key to meeting the challenge of global warming, improving our economy and enhancing fairness and justice. Our organizations will judge any climate legislation on how well it reflects these principles:

Preventing dangerous global warming is paramount. Science tells us we have little time left to take action. To prevent dangerous temperature increases and drastic climate impacts, it is essential to adopt mandatory and enforceable limits that start cutting global warming pollution by 2012, with mandated annual reductions in global warming emissions reaching at least 15 to 20 percent below current levels by 2020 and on the order of 80 percent by mid-century.

Permits to emit carbon must be used for public benefit, not private windfalls. Pollution allowances are a public trust. All allowances should be auctioned or otherwise used to benefit the public, not to generate windfall profits for polluting industries. Free allocations, if any, must be limited to a short transition period.

Promoting a clean energy future. Allowances should be used to accelerate deployment of clean technologies we have today and to develop the ones we need for tomorrow. Energy efficiency – more efficient vehicles, appliances, homes, and factories – is the fastest and cheapest way to cut emissions. Investing in efficiency and renewables creates new industries and good jobs here at home. We could be selling clean technology to the world instead of sending our dollars abroad for oil.

Ensuring a just transition. Allowances should be used to help finance a just transition, protecting low- and moderate-income citizens and creating new jobs and ensuring fair treatment for affected workers and their communities. We must also take care of communities that suffer the impacts of global warming we were too late to avoid.

Assisting adaptation to an altered climate. Allowances should be used to help facilitate adaptation of distressed and impoverished people, communities and regions at home and abroad. Allowances should also be used to help fish, wildlife and ecosystems adapt in the face of global warming's complex threats.

Managing costs without breaking the cap. Banking, limited borrowing, and other tools exist to help industry keep costs predictable and manageable. "Safety valves" and other devices that break the cap on emissions must not be allowed. Any offsets must be real, surplus, verifiable, permanent, and enforceable. Use of offsets must be limited in quantity to ensure the transformative investments in low-carbon technology needed to achieve the long-term emission reduction goals.

Energy policy reform is an essential companion of any cap. An economy-wide carbon cap, while essential, is not a sufficient strategy to combat global warming. Our national energy policies need to be restructured to encourage efficiency, innovation, competition and fairness. A comprehensive set of policies to fight global warming needs to include measures like the CAFE standards increase that has been included in the Senate energy bill and the renewable electricity standard included in its House counterpart.

We must act quickly. Carbon dioxide remains in the atmosphere for generations; the longer we wait, the more aggressive our actions will have to be. Delay will commit us either to making emission reductions on a much more costly crash basis later or to inflicting truly dangerous global warming impacts on our children and grandchildren.

Many existing technologies can be deployed now to achieve these goals, and the right policies will increase our national security, revitalize our industrial jobs base, and enhance our global competitiveness. These solutions will create jobs and improve our standard of living as we tackle this dangerous problem. We look forward to working with you to help design and enact global warming legislation that accelerates economic growth and creates new jobs while achieving the steady reductions in global warming pollution that are needed.

Sincerely,

Frances Beinecke, President
Natural Resources Defense Council

Larry Schweiger, President
National Wildlife Federation

Gene Karpinski, President
League of Conservation Voters

Margie Alt, Executive Director
U.S. Public Interest Research Group

Rodger Schlickeisen, President
Defenders of Wildlife

William H. Meadows, President
The Wilderness Society

Vawter Parker, Executive Director
Earthjustice

David Zwick, President
Clean Water Action

Carl Pope, Executive Director
Sierra Club

Kevin Knobloch, President
Union of Concerned Scientists

Philip E. Clapp, President
National Environmental Trust

John Flicker, President
National Audubon Society

Andrew Sharpless, Chief Executive Officer
Oceana

Jerry Pardilla, Executive Director
National Tribal Environmental Council

Michael McCally, MD, Executive Director
Physicians for Social Responsibility

John Passacantando, Executive Director
Greenpeace

Congress of the United States
Washington, DC 20515

April 22, 2008

Support Strong, Fair, Science-Based Legislation to Fight Global Warming

Dear Colleague:

Please join us in establishing principles for strong, fair, science-based legislation to fight global warming while creating jobs and building a clean energy economy. The attached letter to Speaker Pelosi salutes her leadership on this issue and recommends a set of principles to guide Congress as it produces a comprehensive global warming bill.

The American people, states and communities, environmental and public health advocates, multinational corporations, and small businesses all recognize that we need a comprehensive mandatory national program to reduce global warming pollution. This presents a great opportunity for America. We must have a clear vision of what we aim to accomplish, or we risk establishing a program that would be unfair, ineffective or have other unintended consequences. Now is the time to focus on what this legislation must achieve.

We believe there are four key goals for global warming legislation:

1. Reduce emissions to avoid dangerous global warming;
2. Transition America to a clean energy economy;
3. Recognize and minimize any economic impacts from global warming legislation; and
4. Aid communities and ecosystems vulnerable to harm from global warming.

The attached letter lays out these goals and identifies the key elements that are necessary for legislation to achieve these goals.

The principles include the following elements: strong science-based targets for near-term and long-term emissions reductions; auctioning emissions allowances rather than giving them to polluting industries; investing auction revenues in clean energy technologies; returning auction revenues to consumers, workers, and communities to offset any economic impacts; preserving state authorities; protecting against trade disadvantages to U.S. industry; and dedicating a portion of auction revenues to help address harm from the degree of global warming that is now unavoidable.

Please join us in supporting the development of strong, fair, and effective legislation to fight global warming. To sign on to the attached letter, please contact Melissa Bez (5-3976) (Rep. Waxman), Ana Unruh Cohen (5-4012) (Rep. Markey), or James Bradbury (5-6311) (Rep. Inslee).

Sincerely,

HENRY A. WAXMAN
Member of Congress

EDWARD J. MARKEY
Member of Congress

JAY INSLEE
Member of Congress

[Month] [Date], 2008

The Honorable Nancy Pelosi
Speaker
U.S. House of Representatives
Washington, DC 20515

Dear Madam Speaker,

We salute your leadership on one of the critical issues of our time: the effort to save the planet from calamitous global warming. You have listened to the scientists and recognized the scope and severity of the threat that global warming poses to our nation's security, economy, public health, and ecosystems. You have made enacting legislation to address global warming a top priority for Congress for the first time in our history. We stand ready to help develop this legislation and enact it into law.

As part of this effort, we have developed a set of principles to guide Congress as it produces legislation to establish an economy-wide mandatory program to address the threat of global warming. Acting in accordance with these principles is critical to achieving a fair and effective bill that will avoid the most dangerous global warming and assist those harmed by the warming that is unavoidable, while strengthening our economy.

The following are the principles we have developed to guide the creation of comprehensive global warming legislation.

Comprehensive legislation to address global warming must achieve four key goals:

1. Reduce emissions to avoid dangerous global warming;

2. Transition America to a clean energy economy;

3. Recognize and minimize any economic impacts from global warming legislation; and

4. Aid communities and ecosystems vulnerable to harm from global warming.

To meet each of these goals, climate change legislation must include the following key elements.

Reduce Emissions to Avoid Dangerous Global Warming

The United States must do its part to keep global temperatures from rising more than 3.6 degrees Fahrenheit (2 degrees Celsius) above pre-industrial levels. The scientific

community warns that above this level, dangerous and irreversible changes to the Earth's climate are predicted to occur. To meet this goal, the legislation must:

- **Cap and cut global warming emissions to science-based levels with short and long-term targets.** Total U.S. emissions must be capped by a date certain, decline every year, be reduced to 15% to 20% below current levels in 2020, and fall to 80% below 1990 levels by 2050.

- **Review and respond to advancing climate science.** The effects of global warming are happening much faster than scientists predicted several years ago, and there may be tipping points at which irreversible effects occur at lower levels of greenhouse gas concentrations than previously predicted. A mechanism for periodic scientific review is necessary, and EPA, and other agencies as appropriate, must adjust the regulatory response if the latest science indicates that more reductions are needed.

- **Make emissions targets certain and enforceable.** Our strong existing environmental laws depend on enforceable requirements, rigorous monitoring and reporting of emissions, public input and transparent implementation, and government and citizen enforcement. All of these elements must be included in comprehensive global warming legislation. Cost-containment measures must not break the cap on global warming pollution. Any offsets must be real, additional, verifiable, permanent, and enforceable. The percentage of required emissions reductions that may be met with offsets should be strictly limited, and should be increased only to the extent that there is greater certainty that the offsets will not compromise the program's environmental integrity.

- **Require the United States to engage with other nations to reduce emissions through commitments and incentives.** The United States must reengage in the international negotiations to establish binding emissions reductions goals under the United Nations Framework Convention on Climate Change. The legislation must encourage developing countries to reduce emissions by assisting such countries to avoid deforestation and to adopt clean energy technologies. This is a cost-effective way for the United States and other developed nations to achieve combined emissions reductions of at least 25% below 1990 levels by 2020, as called for by the Intergovernmental Panel on Climate Change.

Transition America to a Clean Energy Economy

Global warming legislation provides an opportunity to create new jobs, while transforming the way we live and work through renewable energy, green buildings, clean vehicles, and advanced technologies. To realize this opportunity, the legislation must:

- **Invest in the best clean energy and efficiency technologies.** A significant portion of revenues from auctioning emissions allowances should be invested in clean energy and efficiency measures, targeted to technologies and practices that

are cleaner, cheaper, safer, and faster than conventional technologies, as determined through the application of clear standards set by Congress.

- **Include and encourage complementary policies.** Complementary policies can lower program costs by producing lower-cost emissions reductions from economic sectors and activities that are less sensitive to a price signal. Smart growth measures, green building policies, and electricity sector efficiency policies are important types of complementary policies. The legislation should include federal complementary policies and encourage state and local complementary policies in areas better addressed by states and localities.

- **Preserve states' authorities to protect their citizens.** Federal global warming requirements must be a floor, not a ceiling, on states' ability to protect their citizens' health and state resources. Throughout our history, states have pioneered policies that the nation has subsequently adopted. Addressing global warming requires state and local efforts, as well as national ones.

Recognize and Minimize Any Economic Impacts from Global Warming Legislation

Reducing global warming pollution will likely have some manageable costs, which would be far lower than the costs of inaction. To minimize any economic impacts, the legislation must:

- **Use public assets for public benefit in a fair and transparent way.** Emissions allowances should be auctioned with the revenues going to benefit the public, and any free allocations should produce public benefits. If any allocations are given to polluters, they must be provided only to existing facilities for a brief transition period and the quantity must be limited to avoid windfall profits.

- **Return revenues to consumers.** Revenues from auctioned allowances should be returned to low- and moderate-income households at a level sufficient to offset higher energy costs.

- **Return revenues to workers and communities.** Workers and communities most affected by the transition to a clean energy economy should receive a portion of the revenues to ease the transition and build a trained workforce so that all can participate in the new energy economy.

- **Protect against global trade disadvantages to U.S. industry.** In addition to providing incentives for developing countries to reduce emissions, the legislation should provide for an effective response to any countries that refuse to contribute their fair share to the international effort. These elements will protect energy-intensive U.S. enterprises against competitive disadvantage.

Aid Communities and Ecosystems Vulnerable to Harm from Global Warming

Global warming is already harming communities and ecosystems throughout the world, and even with immediate action to reduce emissions and avoid dangerous effects, these impacts will worsen over the coming decades. To ameliorate these harms, the legislation must:

- **Assist states, localities, and tribes to respond and adapt to the effects of global warming.** A portion of auction revenues should be provided to states, localities, and tribes to respond to harm from global warming and adapt their infrastructure to its effects, such as more severe wildfires, intensified droughts, increased water scarcity, sea level rise, floods, hurricanes, melting permafrost, and agricultural and public health impacts.

- **Assist developing countries to respond and adapt to the effects of global warming.** A portion of auction revenues should be provided to help the developing countries most vulnerable to harm from global warming and defuse the threats to national security and global stability posed by conflicts over water and other natural resources, famines, and mass migrations that could be triggered by global warming. Vulnerable countries include least developed countries, where millions of people are already living on the brink, and small island states, which face massive loss of land.

- **Assist wildlife and ecosystems threatened by global warming.** A portion of auction revenues should be provided to federal, state, and tribal natural resource protection agencies to manage wildlife and ecosystems to maximize the survival of wildlife populations, imperiled species, and ecosystems, using science-based adaptation strategies.

These principles, if adopted as part of comprehensive climate change legislation, will meet the United States' obligations to curb greenhouse gas emissions and also will provide a pathway to the international cooperation that is necessary to solve the global warming problem.

We commend these principles to you and hope that you find them helpful as we move forward together to develop and adopt global warming legislation.

Sincerely,

Mr. BOUCHER. Thank you very much, Mr. Goo, and let me note, following your testimony, that Mr. Goo did serve as one of the counsels for this subcommittee for a number of years and provided highly valuable service, and we are delighted to have you return today in a different capacity and thank you for your remarks. Mr. Goo mentioned Sir Isaac Stern. He will be the lead witness at a hearing this subcommittee will conduct one week from today and so those who are interested in his report and some of the conclusions that it reaches are welcome to attend that session.

Mr. Reuther, we will be happy to hear from you.

STATEMENT OF ALAN REUTHER, LEGISLATIVE DIRECTOR, UNITED AUTO WORKERS

Mr. REUTHER. Thank you, Mr. Chairman. My name is Alan Reuther. I am the legislative director for the UAW. The UAW appreciates the opportunity to testify before this subcommittee on legislative proposals to reduce greenhouse gas emissions. We applaud the Boxer-Lieberman-Warner, the Markey, the Bingaman-Specter and the Waxman bills for all establishing an economy-wide cap-and-trade program to reduce greenhouse gas emissions from the major sources of emissions in the United States. We are also pleased that most of these bills cover the fossil fuels and transportation sectors on an upstream basis. This minimizes regulation, promotes economic efficiency and ensures that all sectors are required to participate in reducing greenhouse gas emissions.

The UAW opposes the provisions in the Waxman bill that would require EPA to regulate greenhouse gas emissions from light-duty vehicles. This would simply relax the pressure from the federal cap on other sectors without producing any additional reduction in greenhouse gas emissions beyond the level mandated by the federal cap. Thus, the only result of the EPA regulations would be to shift the burden of reducing greenhouse gas emissions from the relatively low cost electric power sector to the much higher cost auto sector. The UAW supports the safety valve cost containment provisions in the Bingaman-Specter bill. However, we also welcome the approach set forth in the Boxer-Lieberman-Warner bill, which would permit a pool of allowances to be borrowed from the future and auctioned to parties at set prices.

The UAW applauds the Boxer-Lieberman-Warner, the Bingaman-Specter and the Markey bills for including provisions designed to protect American businesses and workers from being placed at a competitive disadvantage by imposing carbon allowance requirements on certain imports from other nations that do not adopt comparable programs to reduce greenhouse gas emissions. However, these provisions need to be strengthened by making it clear that finished products such as automobiles and auto parts are covered under the international carbon allowance requirements.

The UAW would especially like to commend the Boxer-Lieberman-Warner and the Bingaman-Specter bills for using a portion of the revenues from the auction of carbon allowances to finance a program to encourage auto manufacturers and parts companies to retool facilities in the United States to produce advanced technology vehicles and their key components. This program can help to speed up the introduction of these vehicles, thereby reduc-

ing oil consumption and greenhouse gas emissions. At the same time, it can create tens of thousands of jobs for American workers.

The UAW strongly opposes the provisions in the Boxer-Lieberman-Warner, Markey and Waxman bills that would allow the EPA to retain residual authority under the Clean Air Act to regulate CO_2 emissions. This means that EPA could supersede key decisions that Congress will make in enacting a federal cap-and-trade program concerning the timetable for reductions in CO_2 emissions, the appropriate point of regulation and the distribution of economic burdens. We believe this would be inappropriate and untenable.

The UAW also strongly opposes the provisions in the Boxer-Lieberman-Warner and Markey bills that would supersede pending litigation over whether California and other States may regulate auto CO_2 tailpipe emissions. We believe the courts should be allowed to resolve whether these regulations are tantamount to regulating fuel economy and are preempted by the federal CAFE program.

In addition, the Boxer-Lieberman-Warner, Markey, and Waxman bills all fail to deal with the important issue of how State climate change measures will interface with the federal cap-and-trade program. Because of this critical deficiency, State climate change measures would result in zero additional reduction in greenhouse gas emissions beyond the level already mandated by the federal cap-and-trade programs established by these bills. Although State measures could reduce emissions from a particular sector, this would simply relax the pressure from the federal cap on other sectors without providing any net environmental benefit. To avoid this nonsensical result, the UAW submits that any entities regulated by State climate change measures must be allowed to purchase and retire allowances from the federal cap-and-trade program to satisfy the State standards to the extent they are more stringent than comparable federal standards. This would guarantee that State measures actually produce additional reductions in greenhouse gas emissions while also allowing this to be accomplished in the most economically efficient manner.

In conclusion, the UAW appreciates the opportunity to testify before this subcommittee. We look forward to working with the members of this subcommittee, the entire Congress and a new Administration to pass strong federal legislation that can achieve reductions in greenhouse gas emissions necessary to combat climate change while at the same time enhancing prospects for economic growth and the creation of jobs for American workers. Thank you.

[The prepared statement of Mr. Reuther follows:]

STATEMENT OF ALAN REUTHER

INTRODUCTION

Mr. Chairman, my name is Alan Reuther. I am the Legislative Director for the International Union, United Automobile, Aerospace & Agricultural Implement Workers of America (UAW). The UAW represents over one million active and retired workers across the country, many of whom work or receive retirement benefits from auto manufacturers and parts companies. The UAW appreciates the opportunity to testify before this Subcommittee on legislative proposals to reduce greenhouse gas emissions. We will focus on comments on the Climate Security Act of 2008 (S. 3036) sponsored by Senators Boxer, Lieberman, and Warner; the Investing In Climate Ac-

tion and Protection Act (H.R. 6186) sponsored by Representative Markey; the Safe Climate Act (H.R. 1590) sponsored by Representative Waxman; and the Low Carbon Economy Act (S. 1766) sponsored by Senators Bingaman and Specter.

The UAW shares the growing national concern about climate change. Scientific studies have confirmed that human use of fossil fuels is contributing to global warming. These studies underscore the major environmental challenges posed by global warming, including rising sea levels, changes in climate patterns, and threats to coastal areas. To avoid these dangers, we believe the growth in greenhouse gas emissions must be reduced and ultimately reversed.

To address the problem of global warming in a meaningful way, the UAW believes we need a broad, comprehensive policy that will require all sectors of the economy to come to the table to help reduce our nation's greenhouse gas emissions. This includes stationary sources, such as power plants and factories. It includes our fossil fuels, such as coal, oil, and natural gas. And it includes all mobile sources, such as planes, trains, buses, and ships, as well as light duty vehicles, which have already had their carbon emissions reduced through the reformed CAFE program that was enacted last year.

We believe each sector should be required to contribute to the reduction of greenhouse gases in a proportionate manner. No sector should enjoy a free ride or be exempted. No sector should be required to bear a disproportionate burden, or to shoulder costs that would have a devastating impact on its operations or employment.

To achieve these objectives, the UAW strongly supports the establishment of an economy-wide mandatory tradable-permits program that will slow the growth of, and eventually reduce greenhouse gas emissions in the United States. We believe this type of "cap-and-trade" program should mostly be done on an "up-stream" basis in order to minimize regulation and to ensure that all sectors of the economy participate in reducing greenhouse gas emissions. We also believe this program should include mechanisms to ensure that no sector is hit with unacceptable spikes in the price of carbon permits or burdens that would have a negative impact on economic growth and jobs. In addition, this program should include measures to ensure that our businesses and workers are not placed at an unfair competitive disadvantage with U.S. trading partners and developing countries. Finally, this program should carefully delineate the authority of the Environmental Protection Agency (EPA), as well as the authority of the states, and ensure that any state climate change measures are integrated with the federal program in a way that leads to further reductions in greenhouse gas emissions in an economically efficient manner.

STRUCTURE OF CAP-AND-TRADE PROGRAMS

The UAW applauds all of the legislative proposals for establishing economy-wide cap-and-trade programs to reduce greenhouse gas emissions. By covering the electric power, industrial, transportation and fossil fuels sectors, these bills effectively address the major sources of greenhouse gas emissions in the United States.

The UAW also applauds the Boxer-Lieberman-Warner, Markey and Bingaman-Specter bills for covering the fossil fuels and transportation sectors on an "up-stream" basis. This minimizes regulation, promotes economic efficiency, and also ensures that all sectors are required to participate in reducing greenhouse gas emissions. In contrast, we oppose the approach in the Waxman bill that simply leaves key decisions about the point of regulation and operation of the cap-and-trade program to the discretion of the Environmental Protection Agency (EPA). In our judgment, these critically important policy decisions should be made by Congress, not left to the discretion of a federal agency.

The UAW also opposes the provisions in the Waxman bill that would direct EPA to regulate greenhouse gas emissions from light duty vehicles. We believe it is wrong to focus exclusively on light duty vehicles, and exclude other parts of the transportation sector. Furthermore, because the Waxman bill establishes a cap-and-trade program covering the transportation sector, EPA regulations dealing with light duty vehicles would not produce any additional reduction in greenhouse gases beyond the level mandated by the federal cap. Although the EPA regulations would reduce greenhouse gas emissions from the auto sector, this would relax the pressure from the federal cap on other sectors, especially the electric power sector. In the end, there would not be any net environmental benefit. The only result of the EPA regulations would be to shift the burden of achieving greenhouse gas reductions from the relatively low cost electric power sector ($20–30 per ton) to the much higher cost auto sector ($90–100$ ton). See "Bringing Transportation into a Cap-and-Trade Regime." A. Denny Ellerman, Henry D. Jacoby, and Martin B. Zimmerman. MIT Joint Program on the Science and Policy of Global Change, Report No. 136,

pps. 7–11, June 2006. This directly contradicts the fundamental tenet underlying the establishment of an economy-wide cap-and-trade program.

We would note that various industries—such as airlines and steel—have already put forward amendments to exempt the coal or oil that they use from the requirements of the cap-and-trade programs. We oppose such "carve outs" for specific industries. To the extent any industries are exempted, this will only serve to increase the pressure on the rest of the industries and sectors that are still covered under the cap-and-trade programs. In the end, this could unravel the prospects of enacting any meaningful federal program to combat climate change, which in our judgment must be premised on an equitable distribution of the resulting economic burdens.

COST CONTAINMENT

The UAW believes it is essential that any cap-and-trade program include an effective mechanism for preventing price spikes and ensuring that no sector of the economy is forced to bear disproportionate costs or burdens that would have a negative impact on employment. In our judgment, the failure of the Markey and Waxman bills to include such provisions represents a serious deficiency.

The UAW supports the "safety value" contained in the Bingaman-Specter bill. However, we also welcome the approach set forth in the Boxer-Lieberman-Warner bill, which would permit a pool of allowances to be borrowed from the future and auctioned to parties at set prices. In our judgment this could provide a workable mechanism for containing costs. However, we believe more work needs to be done to ensure that any pool of allowances is sufficiently large and is made available at acceptable prices.

INTERNATIONAL COMPETITION

The UAW applauds the Boxer-Lieberman-Warner, Bingaman-Specter, and Markey bills for including provisions designed to ensure that American businesses and workers are not placed at a competitive disadvantage with our trading partners and developing nations. In particular, we welcome the provisions that would impose carbon allowance requirements on certain imports from other nations that do not adopt comparable programs to reduce greenhouse gas emissions.

However, in our judgment these provisions still need to be strengthened in a number of respects. Most importantly, we are concerned that finished products, such as automobiles and auto parts, may not be covered under the international carbon allowance requirements. This would pose a major threat to the jobs of American workers, especially as China and India continue to ramp up their auto industries for export to the United States. Failing to extend the international carbon allowance requirements to finished products made from energy-intense materials will drive the production of these products off-shore. It also will undermine the protection of U.S. suppliers of energy-intense materials by removing the international allowance requirements from these materials once they are formed into finished products.

The UAW regrets that the Waxman bill does not appear to include any provisions to deal with the critically important issue of international competition.

INVESTING IN NEW TECHNOLOGIES AND JOBS

The UAW is pleased that all of the proposals would reinvest revenues raised from the auctioning of carbon allowances to spur research and development of advanced, low carbon technologies, and to promote the deployment of these technologies throughout our nation. This can be critically important in ensuring that our economy continues to grow and that we create the jobs of the future in this country.

The UAW would especially like to commend the Boxer-Lieberman-Warner and Bingaman-Specter bills for including robust provisions that would use a portion of the revenues from the auction of carbon allowances to finance a program to encourage auto manufacturers and parts companies to retool facilities in the United States to produce advanced technology vehicles (hybrids, plug-in hybrids, clean diesels) and their key components. This type of program can help to speed up the introduction of these advanced technology vehicles, thereby reducing oil consumption and greenhouse gas emissions. At the same time, it will provide a significant incentive for auto and parts manufacturers to retool facilities in this country to produce these vehicles of the future and their key components. This can create tens of thousands of jobs for American workers.

RESIDUAL EPA AUTHORITY TO REGULATE CO_2 EMISSIONS

Even though the Boxer-Lieberman-Warner, Markey, and Waxman bills establish an economy-wide cap-and-trade program to reduce greenhouse gases, they would also allow the EPA to retain residual authority under the Clean Air Act to regulate CO_2 emissions. This effectively means that EPA would be free to disregard key decisions that Congress will make in considering these bills concerning the timetable for reductions in CO_2 emissions, the appropriate point of regulation, and the distribution of economic burdens. Instead, EPA would be free to regulate CO_2 emissions from the electric power, industrial, transportation and fuels sectors in ways that differ fundamentally from these bills. The UAW submits that it is inappropriate and untenable to allow a federal agency to supersede decisions by Congress in this manner.

In the absence of any federal cap-and-trade program, the UAW understands the importance of EPA's existing authority to regulate CO_2 emissions. But if Congress is going to take the difficult step of enacting a comprehensive federal cap-and-trade program to combat climate change, we do not believe it makes any sense to allow EPA to proceed in ways that differ from this program.

STATE AUTHORITY

The Boxer-Lieberman-Warner, Markey, and Waxman bills all preserve existing state authority to regulate greenhouse gases. However, the Boxer-Lieberman-Warner and Markey bills also supersede pending litigation over the scope of that authority, and make it clear that California and other states may regulate auto CO_2 tailpipe emissions. The UAW strongly opposes these provisions as unnecessary and overreaching. We believe the courts should be allowed to resolve the contentious issue of whether the states may regulate auto CO_2 tailpipe emissions, or whether this is tantamount to regulating fuel economy and is preempted by the CAFE program. Attached to this testimony is an addendum setting forth the reasons why we believe the California auto CO_2 tailpipe emissions standard is both pre-empted and seriously flawed.

In addition, the Boxer-Lieberman-Warner, Markey and Waxman bills all fail to deal with the important issue of how state climate change measures—whatever their scope—will interface with the federal cap-and-trade program. Because of this critical omission, the unfortunate reality is that state climate change measures would result in ZERO additional reduction in greenhouse gas emissions beyond the level already mandated by the federal cap-and-trade programs established by these bills. Although state measures could reduce emissions from a particular sector, this would simply relax the pressure from the federal cap on other sectors, without providing any net environmental benefit. See "Bringing Transportation into a Cap-and-Trade Regime." A. Denny Ellerman, Henry D. Jacoby and Martin B. Zimmerman. MIT Joint Program on the Science and Policy of Global Change, Report No. 136, pps. 7–11, June 2006.

The UAW submits that this is a nonsensical result. If the states are going to be allowed to implement climate change measures that impose significant economic burdens on particular industries, a mechanism should be established to ensure that these state measures can interface with the federal cap-and-trade program in an appropriate manner, and thereby provide additional reductions in greenhouse gas emissions.

The UAW believes this can easily be accomplished by allowing entities regulated by state climate change measures to purchase and retire allowances from the federal program to satisfy the state standards (to the extent they are more stringent than comparable federal standards). This would guarantee that the state measures actually provide an environmental benefit through additional reductions in greenhouse gas emissions, while also allowing this to be accomplished in the most economically efficient manner in keeping with the fundamental premise of the federal cap-and-trade program.

CONCLUSION

The UAW appreciates the opportunity to testify before this Subcommittee on various legislative proposals for reducing greenhouse gas emissions. These proposals have many positive features, and therefore represent an important first step in the effort by Congress to deal effectively with the threat posed by global warming. At the same time, there are still many serious problems and issues that need to be resolved. The UAW looks forward to working with the Members of this Subcommittee, the entire Congress, and a new administration to pass strong federal legislation establishing an economy-wide cap-and-trade program to reduce greenhouse gas emis-

sions. If this is done correctly, it can achieve the reductions necessary to combat climate change, while at the same time enhancing prospects for economic growth and the creation of jobs for American workers.

ADDENDUM

STATE AUTO CO_2 TAILPIPE EMISSIONS STANDARDS

For a number of reasons, the UAW strongly opposes the provisions in the Boxer-Lieberman-Warner and Markey bills that would supersede pending litigation concerning the scope of state authority to regulate greenhouse gas emissions, and make it clear that California and other states may regulate auto CO_2 tailpipe emissions

First, these provisions would directly interfere with the ongoing litigation in the federal courts over whether the state CO_2 tailpipe emissions regulations are preempted. In our judgment, the courts should be allowed to determine whether current law forbids the states from making such regulations. Although several lower federal courts have issued decisions on this issue, so far there has not been a definitive ruling by a Court of Appeals or the Supreme Court. Specifically, in Massachusetts v. EPA the Supreme Court did not consider the issue of whether state regulations regulating CO_2 tailpipe emissions from automobiles are preempted by the Energy Policy and Conservation Act (EPCA).

When higher federal courts do consider this issue, the UAW believes they will conclude that state CO_2 tailpipe emissions regulations are indeed preempted. EPCA expressly preempts state standards that are "related to" the federal corporate average fuel economy standards (CAFE). 29 U.S.C. 32919 Congress made this judgment when it established the CAFE program because it wanted to avoid the negative economic consequences on the auto industry of a multitude of different state standards.

As a scientific matter, there is no dispute that reducing CO_2 tailpipe emissions from automobiles is directly and overwhelmingly related to their fuel economy. The only way to significantly reduce CO_2 tailpipe emissions is to substantially increase fuel economy through the adoption of engine, transmission and other vehicle technologies that increase fuel economy. There is a direct and indisputable correlation between the CO_2 tailpipe emissions and fuel economy. As a result, statements by the California Air Resources Board (CARB) and the leading congressional advocates of the California CO_2 tailpipe emissions standard all refer to the fuel economy (mpg) target achieved by that standard.

Second, it is important to recognize that the California CO_2 tailpipe emissions standard directly conflicts with the new reformed CAFE program enacted by Congress in the Energy Independence and Security Act of 2007 (EISA). Specifically, the California standard:

- Is not based on an attribute-based system like the reformed CAFE program. Instead, it applies the same rigid formula to all manufacturers, regardless of their product mix. This undercuts the effectiveness of the standard, since companies producing towards the smaller end of the passenger car and light truck markets will not have to make as great an effort to reduce the CO_2 emissions and to increase the fuel economy of their fleets. In effect, it significantly discriminates against full line manufacturers.
- Does not maintain separate standards for passenger cars and light trucks. As a result, it discriminates against and penalizes companies whose product mix is more oriented towards the light truck market.
- Exempts auto manufacturers whose production is below a certain threshold. This also undercuts the effort to reduce CO_2 emissions and improve fuel economy. And it gives a major competitive advance to newer entrants into the auto market.

Third, granting a waiver to California will not simply result in two standards for vehicles, a federal standard and a more stringent California standard adopted by many states. Instead, in order to comply with the CO_2 tailpipe emissions standards adopted by California and other states, auto manufacturers would have to make sure that the vehicles they sell in each state satisfy this stringent standard. Because of product mix differences in different states, it would be virtually impossible for the auto manufacturers to satisfy this compliance burden. Even though a manufacturer is selling the same type of vehicles with the same technologies in each state, as a result of product mix differences the manufacturer might be in compliance in one state, but flunk the same standard in another state.

Fourth, the reduction in greenhouse gas emissions and improvement in fuel economy which proponents of the California standard hope to achieve will be significantly offset by increased CO_2 tailpipe emissions and decreased fuel economy in states that have not adopted this standard. The new federal CAFE standard established by Congress in EISA simply requires the auto manufacturers to comply with

stiffer fuel economy targets for their entire nationwide fleets of passenger cars and light trucks. To the extent that California and other states impose more stringent fuel economy/CO_2 standards on the vehicles sold by manufacturers in those states, this simply relaxes the fuel economy target that the manufacturers will have to meet in the rest of the country to remain in compliance with the new CAFE standard. In effect, the manufacturers will be able to increase the number of larger, less fuel efficient passenger cars and light trucks that they sell in the states that have not adopted the California CO_2 tailpipe emissions standard.

Fifth, allowing states to proceed with CO_2 tailpipe emissions standards would raise the prospect of states seeking to combat global warming through measures that place the economic burden on the economies of other states. In our judgment, this type of "economic warfare" raises troubling constitutional issues.

SUMMARY

The UAW applauds all of the legislative proposals on climate change for establishing economy-wide cap-and-trade programs to reduce greenhouse gas emissions. We also commend the Boxer-Lieberman-Warner, Markey and Bingaman-Specter bills for covering the fossil fuels and transportation sectors on an "upstream" basis, which will minimize regulation and ensure that all sectors are required to participate in reducing greenhouse gas emissions.

The UAW supports the provisions in the Bingaman-Specter bill that would establish a "safety value" to contain costs. But we also welcome the provisions in the Boxer-Lieberman-Warner bill that seek to achieve the same objective by creating a pool of allowances that could be borrowed from the future and auctioned at set prices.

The UAW applauds the Boxer-Lieberman-Warner, Bingaman-Specter, and Markey bills for including provisions to ensure that American businesses and workers are not placed at a competitive disadvantage with our trading partners, by imposing carbon allowance requirements on imports from other nations that do not adopt comparable programs to reduce greenhouse gas emissions. However, we believe these provisions need to be strengthened to make it clear that certain finished products, such as automobiles and auto parts, are covered by these protections.

The UAW commends the Boxer-Lieberman-Warner and Bingaman-Specter bills for including robust provisions that would use a portion of the revenues from the auction of the carbon allowances to finance a program to encourage auto manufacturers and parts companies to retool facilities in the United States to produce advanced technology vehicles and their key components. This would help to reduce greenhouse gas emissions, while creating tens of thousands of jobs for American workers.

The UAW strongly opposes the provisions in the Boxer-Lieberman-Warner, Markey and Waxman bills that would allow the EPA to retain residual authority under the Clean Air Act to regulate CO_2 emissions. This would effectively allow EPA to disregard key decisions that Congress will make concerning the timetable for reductions in CO_2 emissions, the appropriate point of regulation, and the distribution of economic burdens.

The UAW also strongly opposes the provisions in the Boxer-Lieberman-Warner and Markey bills that would supersede pending litigation over whether the California auto CO_2 tailpipe emission standard is tantamount to regulating fuel economy and is preempted by the CAFE program. This contentious issue should be left for the courts to resolve.

In addition, the Boxer-Lieberman-Warner, Markey and Waxman bills all fail to deal with the important issue of how state climate change measures will interface with the federal cap-and-trade program. Because of this omission, state climate change measures would result in ZERO additional reduction in greenhouse gas emissions beyond the level already mandated by the federal cap-and-trade programs established by these bills. Although state measures can reduce emissions from a particular sector, this would simply relax the pressure from the federal cap on other sectors, without providing any net environmental benefit.

The UAW believes this fundamental defect in the three bills can easily be solved by allowing entities regulated by state climate change measures to purchase and retire allowances from the federal program to satisfy the state standards (to the extent they are more stringent than comparable federal standards). This would guarantee that the state measures actually provide an environmental benefit through additional reductions in greenhouse gas emissions, while also allowing this to be accomplished in the most economically efficient manner.

Mr. BOUCHER. Thank you very much, Mr. Reuther.
Ms. Jacobson.

STATEMENT OF LISA JACOBSON, EXECUTIVE DIRECTOR, BUSINESS COUNSEL FOR SUSTAINABLE ENERGY

Ms. JACOBSON. Thank you, Mr. Chairman and members of the subcommittee for the opportunity to share views of clean energy businesses in the United States. Our industries are actively investing capital and creating jobs that help our Nation reduce greenhouse gas emissions. They include advanced batteries, biomass, biogas, fuel cells, geothermal, hydropower including new waterpower resources such as ocean, tidal and in-stream hydrokinetic, natural gas, solar, wind, and supply-side and demand-side energy efficiency. I have provided more detailed perspectives on the five legislative proposals in my written testimony so I will use my time this morning to describe why existing clean energy technologies need to be the centerpiece of any federal response to climate change and provide recommendations on how specific elements are needed in the legislation to stimulate these investments.

The Council's members are businesses and we support federal action to address climate change. We therefore commend the bill's sponsors and committee members for their leadership in the development of national climate change legislation and we appreciate the thoughtful work that this committee has also put into the issue to date. As businesses, we support market-based approaches such as cap-and-trade. We think that offers a chance to effectively and cost-effectively reduce emissions and stimulate investment that we will need for our future energy sources.

The Council feels strongly that we do not need to wait to begin to reduce greenhouse gas emissions. We have technologies that are readily available today and many of them are cost-effective to reduce greenhouse gas emissions. According to a March 2008 report by McKinsey and Company, the Nation can reduce greenhouse gas emissions in 2030 by 3 to 4-and-a-half gigatons. That is up to 28 percent below 2005 levels by using existing tested approaches and high-potential emerging technologies. McKinsey estimates that the total needed investments to achieve this is 1.5 percent of the investments the U.S. economy is expected to make over this period. Deploying existing clean energy technology as soon as possible will ease this transition to a future carbon-constrained economy. Starting early pays clear dividends. This is even more urgent in the period leading up to 2020 as the United States faces electric demand growth and regulatory uncertainty on climate change policy is stalling some domestic sector investments. Existing technologies can help smooth out this transition.

Further, deployment of existing technologies creates high-paying U.S. jobs and increases our economic prosperity. Every State can benefit and these jobs are not easily outsourced. Therefore, existing clean energy technology deployment represents the vital first phase of a U.S. climate change program.

In order for clean energy technologies to be able to play their role in reducing emissions, a federal climate change program must do several things. First, it must send clear, predictable signals to the market to invest in these sectors over the short, medium, and long

term. Businesses need to know where to invest their capital. Second, it must ensure that financial mechanisms such as allocation policy and auction proceeds are directed at near-term emission reduction. These provisions also send signals to the market and can drive significant market growth in existing clean tech sectors. Third, it must address regulatory and market barriers in the power sector, providing incentives and policy direction that shifts our Nation to less emitting energy generation, distribution, and use. The Council has released a package of energy policies and incentives under the Clean Energy Deployment Path to Climate Solutions Act that can be adopted by Congress immediately. This will deploy existing technology and start us down the path to reduce emissions. Fourth, it should include a robust offset program as a vehicle to deploy technology in sectors that are not under a cap and to lower the cost of compliance. However, integrity in this offset program is critical. Finally, we support credit for early action to recognize businesses and other entities that take steps now to reduce emissions. This will also deploy technology.

As with other major economy-wide proposals, the details will be critical. We need to ensure that there is clarity in the markets and we start forward with the first phase of a U.S. climate change program ensuring that existing clean energy technology is deployed.

Thank you very much for your time and your consideration.

[The prepared statement of Ms. Jacobson follows:]

Testimony of the Business Council for Sustainable Energy
Before the House Committee on Energy and Commerce
Subcommittee on Energy and Air Quality

Legislative Proposals to Reduce Greenhouse Gas Emissions: An Overview
June 19, 2008

Mr. Chairman and Members of the Subcommittee:

My name is Lisa Jacobson, Executive Director of the Business Council for Sustainable Energy. I appreciate the opportunity to testify before the Subcommittee today to provide the Council's views on several of the leading climate change bills under consideration by Congress and how they address the issues of critical importance to our members.

The Council is an industry coalition that includes businesses and trade associations representing currently available technology options for reducing greenhouse gas emissions that contribute to global climate change. They include: advanced batteries, biomass, biogas, fuel cells, geothermal, hydropower (including new waterpower resources such as ocean, tidal and instream hydrokinetic), natural gas, solar, wind, and supply-side and demand-side energy efficiency.

The organization was formed in 1992 by executives in the renewable energy, natural gas and energy efficiency industries and has since advised policymakers at state, regional, federal and international levels on the design of market-based environmental programs, including cap-and-trade models and other relevant policies.

The Council has provided extensive comments on major design elements of a federal, economy-wide cap-and-trade program. Our members assess the provisions of various bills in a holistic manner – with a benchmark focused on immediate and long-lasting clean energy deployment signals. Whether pending bills will drive existing technology deployment between now and 2020 depends on the

allowance value directed to existing clean energy technologies, and whether the legislation includes complementary energy polices to increase clean energy investment, deployment and certainty.

It is important to note that as a diverse business coalition, not all Council members endorse or take positions on the entire set of recommendations provided below.

Cost-effective opportunities exist today to help achieve the nearly 80 percent reduction in greenhouse gas emissions called for in pending climate change proposals.[1] An integrated federal energy and climate policy approach will produce immediate benefits and pave the way for a secure energy future.

In addition to the emission reduction benefits, deployment of existing clean energy technologies will:

- Foster U.S. economic growth and create new high-quality jobs
- Enhance energy security and independence
- Provide affordable, available clean energy choices for consumers
- Lower the cost of compliance with federal greenhouse gas emissions reduction programs
- Increase the ability of the U.S. to meet mid-term and long-term emission reduction objectives for greenhouse gas emissions and other criteria pollutants
- Strengthen the electricity industry infrastructure and reliability

Initial Steps

To tackle the challenge of global climate change, all technologies at our disposal will be required over a long time horizon. However, between now and 2020, existing clean energy technologies such as renewable energy, energy efficiency and cleaner fuels such as natural gas are the viable, readily available solutions. While assumed, new and/or additional technologies for achieving greenhouse gas emission reductions may be fully deployed and cost effective by the 2020 to 2030 time-period, there is a very real possibility that they may not. However, deploying existing clean energy technology, such as renewable energy and supply-side and demand-side energy efficiency as soon as possible will reduce greenhouse gas emissions and help mitigate consumer impacts.

Indeed, to some degree these technologies provide a critical option during the transition to a greenhouse gas constrained economy -- beyond their benefits for emissions reductions. The fact that Congress and the U.S. Environmental Protection Agency are now seriously addressing our greenhouse gas policies will make the financing of some energy infrastructure more difficult due to the uncertainty of the market rules in coming years. Future options for other low emitting technologies are either not yet commercially viable, or would be difficult to permit and develop within the near-term. Yet the U.S. Energy Information Administration projects continued domestic electric demand growth over that period. The technologies represented by the Council can step into that gap and ensure that we continue to meet the energy needs of the country during this transition. But today such technology deployment faces market barriers that Congress needs to address immediately if it is to fulfill this potential.

By implementing policies that drive immediate clean energy investments, our nation increases its flexibility and likelihood to achieve our long-term climate change mitigation goals at affordable costs to consumers and businesses. ***For all of these reasons, deployment of existing clean energy technologies is the essential, first phase solution for the U.S. to reduce greenhouse gas emissions.***

Existing Clean Energy Technology Deployment is the Vital First Phase of US Climate Change Strategy

Through the greater use of renewable energy resources, clean energy fuels and increased supply-side and demand-side energy efficiency investments, real and measurable greenhouse gas reductions can be realized, contributing to:

1. lower overall economic costs for businesses and consumers;
2. a healthier, more sustainable environment; and,
3. stimulation of U.S. employment and economic growth in the clean technology sector.

Understanding the time it may take for Congress to adopt a federal climate change bill coupled with the urgency to act, Congress has the opportunity to pass a package of policies, such as those being put forward under the Council's Clean Energy Technology Deployment Path to Climate Solutions Act (CETDP). Adoption of the Clean Energy Path proposal will speed the deployment of a broad range of existing clean energy technologies and begin to make real and measurable greenhouse gas reductions. Moving forward with a strong clean energy deployment strategy can be

done now, while Congress deliberates the design of a federal climate change program. This will provide a down payment on greenhouse gas reduction and start the nation down a clean energy path.

Business Council for Sustainable Energy's Views on Federal Climate Change Legislation

In reviewing the five federal climate change bills under consideration by the House Energy and Commerce Subcommittee Energy and Air Quality, it is important to acknowledge the leadership of the bill sponsors and the valuable contributions their proposals are making in the development of historic, federal climate change legislation. Second, it is noteworthy that all five legislative proposals adopt or contemplate the establishment of an economy-wide cap-and-trade program. The Council supports market-based cap-and-trade models as a means to ensure lower cost compliance with emission targets for covered entities, businesses and consumers. Cap-and-trade models also offer environmental integrity through the imposition of an emissions cap with the incentives under the trading provisions for over compliance and technology innovation. As with other large-scale economy-wide policies, the design of the market will be critical to how effectively and efficiently any given proposal will achieve its objectives. In the Council's testimony, we will outline some of the key provisions in the five bills that will be effective drivers for existing clean energy technology deployment.

A federal climate change program should send predictable medium- and long-term signals to capital markets -- providing certainty about the emissions reductions to be achieved and directing new

investments in low- and zero-carbon resources technologies. A national climate change program should:

- Incorporate a mandatory, economy-wide and market-based approach
- Establish near-term and long-term targets to signal the marketplace and drive capital investments in existing technology and innovation
- Establish linkages with domestic and international greenhouse gas emissions reduction programs and markets
- Expand alternative energy resources from clean energy and energy efficiency technologies
- Recognize and reward improvements in both supply-and demand-side energy efficiency
- Include policies in addition to market programs to drive new technology
- Drive energy efficiency improvements in new and existing buildings

The Council believes that Congressional direction would speed the transition to a clean energy path that increasingly utilizes existing technologies. This will be especially important in the early phase of program implementation when other emission reduction options are not yet available.

To advance the clean energy path, a comprehensive approach to the design of market-based climate change legislation is required. The Council strongly believes that the design must include the following:

1. Allowance value, in the form of allowance allocations and/or auction proceeds, directed to reduce program costs and to clean energy and energy efficiency investments;

2. The adoption of a package of complementary energy policies to enable rapid market expansion. This should include multi-year extensions of clean energy investment tax credits (ITC) and production tax credits (PTC), clean renewable energy bonds (CREBs) as well as a national Renewable Electricity Standard and a national Energy Efficiency Resource Standard; and expansion of the transmission grid
3. A robust, high-quality carbon offset program to drive new technology investments in uncapped sectors and contain costs; and
4. Recognition and credit for early action taken by businesses and other entities to reduce emissions.

The analysis below covers how several of the leading bills currently under consideration by Congress address these issues.

1) Allowance Value as a Driver for Existing Clean Energy Technology Deployment

The Council recommends that allowance value through free allowance distribution, set-aside pools and auction proceeds be directed at deployment and investment in existing clean energy technologies.

Free, Transition Allocation Pools to Generators

The Council firmly maintains that any free allowances be distributed to covered entities in the power sector based on the efficiency of their total power generation (both electrical power and heat),

through output-based approaches. An output-based approach focuses on carbon-energy efficiency and promotes clean generation – including renewable energy – since distribution is based on the amount of power generated, not on the amount of fuel used or a facility's historic emissions. The Council recommends a fuel-neutral (rather than fuel-weighted), updating, output-based allocation that rewards greater efficiency and encourages investment in new generating technologies.

Output-based allocation approaches send needed signals to the marketplace that reward, recognize and drive investment in clean, efficient energy technologies and provide further incentives for renewable energy generation. In looking at the various bills under discussion at this hearing, we would like to highlight the precedents for output-based allocation in the Lieberman – Warner America's Climate Security Act of 2007 (S. 2191) and the Boxer Substitute (S. 3036). While both bills grant covered entities emission allowances based on their historic emission levels, S. 2191 includes a New Entrant Set-Aside provision that employs an output-based allocation for fossil generators. The Council recommended changes to the allocation provisions as well as expansion of the New Entrant Set-Aside to renewable energy generators. S. 3036, the Boxer Substitute, removed the New Entrant Set-Aside, but did provide an output-based allocation approach under the Load Distribution Company allocation, by distributing emissions allowances based on sales.

Set-Aside Allocation Pools

Another mechanism to direct allowance allocations to new, clean energy generation is through set-aside allowances pools. S. 3036 provides an important set-aside to renewable energy generators by distributing 4 percent of the free, unallocated emission allowances to renewable energy programs

and generators between the years 2012-2030; renewable energy receives 1 percent of free allowances from 2031-2050 (Title VIII, Subtitle D). It is estimated that this set-aside will provide $150 billion through 2050 to owners or operators of facilities that deploy renewable energy technologies.

The Council strongly supports the direct allocation of allowances to renewable energy and believes that this is an improvement over S. 2191, specifically. Of note, the Council seeks opportunities to improve the distribution mechanism under this provision to make it more predictable and more effective at driving investment.

On energy efficiency, many of the bills provide opportunities to invest in energy efficiency through their set-aside allowance pools. For example, S. 2191, S. 1766 and S. 3036 provide free allocations to states that are able to use the allowances to support investments in energy efficiency, among other options. It is important that energy efficiency (as well as other existing technology options) be eligible for allowance value under multiple areas of the bill, given their important role in helping to meet emission reduction targets. Additionally, it is critical that provisions aimed at increasing investments in energy efficiency be front-loaded and clearly defined.

For example, S. 3036 made important strides to address these challenges. Specifically, the Boxer Substitute added a specific title on energy efficiency (Title VIII) as well as authorizing existing and new energy efficiency programs. The Council also appreciates the inclusion of specific programs aimed at increasing energy efficiency in key sectors and with key constituencies through the efficient building programs and the Super-Efficient Equipment and Appliance Deployment

(SEAD) programs (Title I, Subtitle B and Title VIII). It is estimated that the SEAD program and the energy efficiency building program would receive $51 billion respectively through 2050.

Finally, federal climate change bills should consider the inclusion of a set-aside for new entrants. This provides the opportunity to encourage new, lower-emitting resources to come on line. As stated above, S. 2191 includes a New Entrant Set-Aside and the Bingaman – Specter Low Carbon Economy Act (S. 1766) also includes a set-aside for new entrants.

Auctions and Use of Auction Proceeds

All but one of the legislative proposals under discussion at this hearing include specific provisions that establish an auction as a vehicle to distribute emissions allowances under a cap-and-trade program. The Council does not have specific recommendations on the scale and phase-in of auction programs, but our members recommend a hybrid allocation approach with a phase-in period, as several of the bills include (S. 1766, S. 2191, S. 3036). This will minimize possible dramatic economic impacts that a large-scale auction might have on affected sources in the initial phases of the program. Further, should an auction be pursued, the Council strongly recommends the targeted use of auction revenue to existing clean energy technology investment and deployment.

The Council has worked actively with Congress to front-load, expand and better define auction proceeds directed to existing clean energy technologies. Further, the Council calls for, at minimum, equal treatment of existing clean energy technologies in the proposed distribution of auction proceeds as a percentage carve out on par with the other auction revenue priorities.

Under the current legislative proposals, existing clean energy technologies are eligible for auction proceeds under several different program areas. Under H.R. 6186, the Investing in Climate Action and Protection Act, existing clean energy technologies are significant recipients of auction proceeds. 12.5 percent of auction funds, estimated at $963 billion over the life of the program (or $24 to $25 billion annually), are directed to support a Low-Carbon Technology Fund. In addition, 12.5 percent of auction proceeds are directed to support a National Energy Efficiency Fund.

The Low-Carbon Technology Fund would support research, development and deployment of technology, with 80 percent allocated for renewable energy and energy efficiency (35 percent for renewable energy and energy efficiency research, development, and demonstration; 40 percent for renewable energy deployment incentives; and 5 percent for distributed renewable energy technologies). Of note, included in the Low-Carbon Technology Fund are two new programs to deploy renewable energy via production payments through a reverse auction and rebates for the purchase and installation of distributed generation technologies such as solar panels.

The National Energy Efficiency Fund supports incentive payments to states based on the level of energy savings achieved each year through consumer efficiency programs, and awards grants to states that adopt and implement building efficiency and recycling policies. This fund also supports weatherization programs and efficient transit initiatives.

S. 2191 and S. 3036 both include a low- and zero-carbon energy deployment program that enables generators and manufacturers to receive auction revenue to support investment. A challenge with

the approach taken in these bills is that it is not certain how much of these resources would go to existing technology, as they would be in competition with other technology investments.

On renewable energy, S. 2191 originally included an auction proceed pool specifically for renewable energy, entitled the Sustainable Energy Program. This provision was valuable as it dedicated a significant fund for renewable energy investments supported by auction funds – in addition to the low- and zero-carbon programs. However, this provision was not included in the Boxer Substitute, S. 3036.

In summary, the Council urges that any free allocation pools – including set-asides – be distributed based on efficiency, using output-based metrics when appropriate. This will ensure that the market is signaled to invest in supply-side efficiency, and low-and zero emissions energy sources. Further, existing clean energy technologies should be primary recipients of allowance value through auction proceeds. Auction revenues provide essential funding to achieve near-term emission reductions through clean energy technology investments.

2) Integrating Energy and Climate Change Policy and the Inclusion of Complementary Energy Policies in Climate Change Legislation

As stated above, it is essential that Congress include an aggressive clean energy technology deployment strategy as soon as possible to drive near-term greenhouse gas emission reductions as the costs of inaction will be significantly higher. The cap-and-trade approach provides vital signals to the economy that integrate the cost of greenhouse gas emissions over a long time-period.

However, the direct price signals established by the cap-and-trade program alone will not deploy needed energy efficiency and clean generation investments as quickly as needed and on the scale that is needed. Further, significant regulatory and market barriers exist that will require policy changes that the market design of a cap-and-trade program will not address.

The Council has developed a comprehensive Clean Energy Technology Deployment Path to Climate Solutions Act (CETDP). The CETDP authorizes the creation, expansion and extension of a balanced set of federal policies that will deploy proven and commercially available clean energy technologies to achieve climate change mitigation goals. The CETDP can be integrated into a national, economy-wide greenhouse gas emissions reduction strategy, move as a stand-alone package or as individual bills – the critical point is that the nation cannot afford to delay.

Critical Elements of the Clean Energy Deployment Path Proposal

- Renewable Electricity Standard (RES)
- Energy Efficiency Resource Standard (EERS)
- Tax and/or comparable clean energy technology incentives to more widely deploy existing clean energy technologies and projects (PTC, ITC, CREBs)
- Expand the transmission grid
- Energy efficiency savings programs in the form of codes, standards and incentives to promote carbon-efficient buildings and appliances and combined heat and power (CHP)
- Research and development for deployment of emerging technologies

These elements should result in a balanced and integrated program providing accurate, cost-based price signals to promote wise use of energy and reduce energy use at peak times; avoid programs

that would encourage inefficient use or production of energy; and encourage additional generation with the right size, location and operation times to have real, positive impacts on the grid and on customer cost.

Implementation of these policies should be carefully designed to recognize and reward accomplishments of individual states, consumers and entities within those states, including reducing greenhouse gas emissions, increasing renewable energy generation and enhancing efficient use of energy – through programs, equipment and installation, and through building and appliance codes.

The urgent need to adopt polices that deploy existing clean energy technologies is reflected in most of the federal climate change bills under consideration by the Subcommittee. H.R. 1590, the Safe Climate Act of 2007 offers the most comprehensive set of policy provisions, such as the inclusion of a Renewable Electricity Standard whereby renewable energy would reach 20 percent of the US generation mix by 2020. It also includes a strong energy efficiency resource standard.

Several bills have important building sector policies, including national targets for building codes (H.R. 6186, S. 2191 and S. 3036) that the Council wholeheartedly supports. In addition, these bills include needed incentives for states to implement and enforce code changes. H.R. 6186 in particular includes large-scale funding to implement building code change through its National Energy Efficiency Fund.

3) Offsets as a Technology Deployment and Cost Containment Instrument

The Council has supported the use of offsets as a means to generate lower-cost reductions and drive technology innovation. In contrast to alternative cost containment measures, the use of offsets does not dilute the price signals created by the cap-and-trade program, but does help to lower the cost of compliance and achieve emission reductions that are consistent with the objectives of the program. This is especially important in the near-term, prior to availability of advanced technologies.

Under a compliance offset program, covered entities are permitted to help meet their obligation to reduce greenhouse gas emissions by purchasing offset allowances generated from projects or activities that fall outside the scope of an emissions cap. This flexibility provides covered entities with cost-effective emission reductions and can help promote technological deployment and innovation. The availability of lower-cost emissions reductions lessens the economic impact of the program on consumers and businesses, while generating immediate environmental benefits. For this reason, offset programs have been included in existing climate change programs inside and outside the U.S., and should be valued as an important design feature of federal climate change legislation.

As with other aspects of market-based initiatives to address climate change, the details and structure of a federal offset program will play a critical role in determining successful implementation, as well as achieving desired greenhouse gas emission reductions.

The Council released a paper in September 2007 that detailed recommendations for the development of a federal offset program.[ii] In that paper, the Council emphasized the importance of a high

integrity offset program that credited real, additional, permanent, independently verifiable, measurable and transparent offsets. Ensuring the environmental integrity of offsets is fundamental to meeting desired emissions reductions levels. Verifiable and surplus offsets must be the standard for program integrity. In addition, independent, third-party monitoring and verification requirements must be in place to ensure that greenhouse gas emissions reductions are delivered.

In reviewing the five bills under consideration, the Council is pleased that all proposals establish or contemplate an offset program as part of a national climate change program.

Most of the bills have specific quantitative limitations on the amount of domestic offsets and international offsets (allowances and/or project-based credits) that a covered entity can use to meet its emission reduction obligation. S. 1766 does not include a domestic limitation in the proposal, and allows international offsets subject to a recommendation by the President up to a limit of 10 percent. S. 2191, S. 3036 and H.R. 6186 limit both domestic offsets to 15 percent of an entities compliance obligation and international offsets to 15 percent of an entities compliance obligation.

In all these legislative proposals, the Council seeks to encourage more workable offset provisions, such as the inclusion of a multi-year crediting period, and removal of financial additionality tests. Furthermore, since offset projects can take years to design and develop, covered entities and consumers will benefit if the federal government can begin establishing the rules, oversight and accounting mechanisms of an offset program as soon as possible – even independently of the passage of climate change legislation.

The Council also maintains that verified, high-quality international offset allowances and project-based credits should be eligible for recognition within a U.S. cap-and-trade program, regardless of the location where they are generated. We are pleased that several of the climate bills under consideration by the Subcommittee allow covered entities to meet part of their emission obligation through international offsets (S. 1766, S. 3036). This is especially important for cost containment, as recent analysis of S. 2191 performed by the U.S. Energy Information Administration showed the exclusion of international offsets caused the price of U.S. allowances to more than double in the early years of the program and increase by almost 40 percent in later years.[iii]

Of note, the Council was pleased that the Boxer Substitute (S. 3036) permits up to 5 percent of international offsets to be generated by project-based activities, opening the opportunity for international credits, such as those recognized under the Clean Development Mechanism (CDM) of the Kyoto Protocol, to be eligible under the US program. This is an improvement over the provisions in S. 2191.

The Council would like to call your attention to an amendment to the Boxer Substitute that was offered by Senator Stabenow and co-sponsored by Senators Warner and Lieberman that would have modified the offsets framework. While the Council did not support all elements of the amendment, it was a useful start and deserves consideration as this chamber considers the design of an offset program.

4) Credit for Early Action to Recognize Existing Clean Energy Technology Investments

The Council appreciates the inclusion of a credit for early action program within several of the legislative proposals under review by the Subcommittee. Recognition for early action is provided in

specific set-aside pools for entities as well as states. The Council believes early investments in greenhouse gas reductions should be recognized within a federal greenhouse gas program. Rewarding emission reductions that occur in advance of the enactment of the program has the potential to generate economic and environmental benefits, as well as hasten clean-energy technology deployment. High-quality mandatory programs at the state level, such as those in Oregon, Washington and Massachusetts, which have affected new power generation facilities in those states over the past decade or more, should be recognized in any future federal legislation.

Likewise, a federal climate change program should recognize early actions that have been made or will be made under California's landmark greenhouse gas program (AB 32), as well as those that fall under the Regional Greenhouse Gas Initiative. Companies making voluntary early reductions want assurances that they will not be penalized later for reducing greenhouse gas emissions in advance of a national, mandatory program.

To ensure transparency, the Council recommends that federal legislative proposals include specific criteria to guide the Administrator of the federal greenhouse gas program on eligibility for early action allowances.

On behalf of the members of the Business Council for Sustainable Energy, thank you for the opportunity to share our views on several leading climate change legislative proposals. We appreciate the Subcommittee's leadership in development of landmark federal climate change legislation and offer our coalition as a resource.

APPENDIX A

Growth of Clean Tech Sectors and U.S. Job Creation

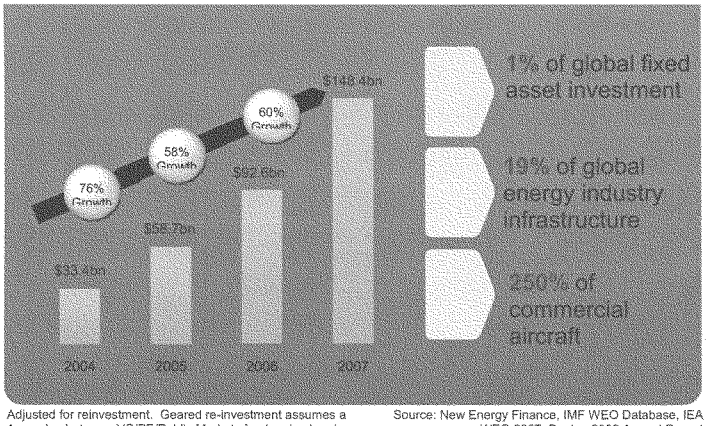
The clean energy sectors are growing rapidly as the public demands more efficient and lower-emissions energy generation, distribution and use. A recent report by *New Energy Finance*, found that clean energy investment grew by nearly 60 percent in 2005 and 2006 (See Table 1.).

In the U.S., rapid growth in these sectors is resulting in millions of new, high paying clean technology jobs – vital to the nation's economic competitiveness and prosperity.[iv, v] Adoption of a federal climate change program that relies on existing clean energy technologies to reduce emissions could lead to millions of new jobs in these sectors.[vi] The aforementioned Department of Energy report on 20 percent wind energy projected that expanded deployment of wind energy would support nearly 500,000 jobs, including over 150,000 directly in manufacturing, construction and operations and would represent an investment in the U.S. economy of $1 trillion.[vii]

This is consistent with public views on the economic benefits of higher utilization of clean energy technologies. A 2007 poll conducted for the Center for American Progress showed that 79% of respondents "believe that shifting to new, alternative energy production will help America's economy and create jobs, not cost American jobs." Only 17% disagreed.[viii]

Table I.

Total Global New Investment in Clean Energy, 2004 – 2007



Adjusted for reinvestment. Geared re-investment assumes a 1 year lag between VC/PE/Public Markets funds raised and re-investment in projects.

Source: New Energy Finance, IMF WEO Database, IEA WEO 2007, Boeing 2006 Annual Report

APPENDIX B

Increased Use of Existing Clean Energy Technologies Can Lower Consumer and Business Energy Costs

Deploying existing clean energy technology, such as renewable energy and supply-side and demand-side energy efficiency as soon as possible will help mitigate consumer impacts. As an example, when Congress considered a Renewable Electricity Standard in 2007,[ix] there were claims that retail electricity prices might increase dramatically. At that time, the Union of Concerned Scientists completed a report, entitled "Cashing in on Clean Energy", which identified effects on consumer electricity prices and found that, in all 50 states, electricity rates were likely to fall, often significantly.[x] The report concluded that deployment of clean energy technology under that legislation would yield **$13 billion to $18.1 billion in savings in lower electricity and natural gas bills by 2020** (growing to $27.7 billion to $31.8 billion by 2030). This would result from a diverse supply of energy decreasing demand on finite natural gas resources and lowering the prices for those resources.

Another study, conducted by the American Council for an Energy Efficient Economy (ACEEE) found that a Renewable Electricity Standard of 15% renewable energy by 2015 when coupled with a cap-and-trade policy similar to the Lieberman - Warner Climate Security Act (S. 2191 and S. 3036) resulted in a **reduction of 1.5% in retail electricity rates by 2025.**[xi]

The Department of Energy report entitled, *20 Percent Wind Energy by 2030* found that expanding deployment of wind energy "potentially reduces demand for fossil fuels, in turn reducing fuel prices and stabilizing electricity rates." DOE estimated the 20 percent wind scenario would avoid more than 80GW of new coal capacity and reduce demand for natural gas across all industries by 11 percent.[xii]

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[i] According to the McKinsey & Company report, *"Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost" 2007.* The U.S. could reduce greenhouse gas emissions in 2030 by 3.0 to 4.5 gigatons of CO2e using existing technologies.

[ii] Please see the Council's website for a copy of its paper on federal offset recommendations, http://www.bcse.org/files/BCSE%20Offset%20Principles%20Final.doc_0.pdf?phpMyAdmin=c3410f726d1c4bc885e0c67b3e06c97f

[iii] http://www.cia.doe.gov/oiaf/servicerpt/s2191/index.html

[iv] *Economic and Jobs Impacts of the Renewable Energy and Energy Efficiency Industries: U.S. and Ohio,* Roger H. Bezdek of Management Information Services Inc. for American Solar Energy Society, July 2007
http://www.ases.org/jobs_report.pdf

[v] Karen Ehrhardt-Martinez and John A "Skip" Laitner, *The Size of the U.S. Energy Efficiency Market: Generating a More Complete Picture*, American Council for an Energy Efficient Economy, May 2008 http://www.aceee.org/pubs/e083.htm

[vi] *New Energy for America*, Apollo Jobs Report, January 2004,
http://www.apolloalliance.org/downloads/resources_ApolloReport_022404_122748.pdf, 7

[vii] *20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply*, U.S. Department of Energy, May 2008. Available online at http://www1.eere.energy.gov/windandhydro/pdfs/41869.pdf

[viii] John Podesta, Daniel J. Weiss, and Laura Nichols, "Americans Feel New Urgency on Energy Independence and Global Warming," (Washington: Center for American Progress, 2007), available at
http://www.americanprogress.org/pressroom/releases/2007/04/environmental_poll.html

[ix] A renewable electricity standard was considered as part of the Energy Independence and Security Act of 2007. That provision would have required utilities to obtain 11% of their power from renewable energy resources by 2020 and achieve a further 4% reduction from improvements in energy efficiency.

[x] *Cashing in on Clean Energy: A National Renewable Energy Standard Will Benefit the Economy and the Environment*, Union of Concerned Scientists, October 2007 Update, http://www.uesusa.org/assets/documents/clean_energy/Cashing-In-National-15.pdf

[xi] *Assessment of the Renewable Electricity Standard and Expanded Clean Energy Scenarios*, American Council for an Economic Efficient Economy, December, 2007, http://aceee.org/pubs/e079PPT.pdf

[xii] *20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply*, U.S. Department of Energy, May 2008. Available online at http://www1.eere.energy.gov/windandhydro/pdfs/41869.pdf

Summary of Testimony
Lisa Jacobson, Executive Director of the Business Council for Sustainable Energy
House Committee on Energy and Commerce, Subcommittee on Energy and Air Quality
Legislative Proposals to Reduce Greenhouse Gas Emissions: An Overview -- June 19, 2008

The Council is an industry coalition that includes businesses and trade associations representing currently available technology options for reducing greenhouse gas emissions. They include: advanced batteries, biomass, biogas, fuel cells, geothermal, hydropower (including new waterpower resources such as ocean, tidal and instream hydrokinetic), natural gas, solar, wind, and supply-side and demand-side energy efficiency. Deploying existing clean energy technology as soon as possible will reduce greenhouse gas emissions and help mitigate consumer impacts – especially prior to 2020. This is even more urgent as regulatory uncertainty is stalling some energy sector investments and the U.S. faces electric demand growth over the next several decades. Existing technologies can fill this gap during the transition. ***Existing clean energy technology deployment represents the first phase solution for the U.S. to reduce greenhouse gas emissions.***

Whether pending legislative proposals will drive existing technology deployment between now and 2020 depends on two key elements: 1) how allowance value is directed to existing clean energy technologies, and 2) whether the legislation includes complementary energy polices to increase investment and to accelerate deployment.

Understanding that it will take time for Congress to adopt a federal climate change bill, coupled with the urgency to start reducing emissions right away, Congress should pass a package of policies, such as those put forward under the Council's Clean Energy Technology Deployment Path to Climate Solutions Act (CETDP). Critical elements of the proposal include a Renewable Electricity Standard (RES); a Energy Efficiency Resource Standard (EERS); tax and/or comparable incentives (PTC, ITC, CREBs); expansion of the transmission grid; energy efficiency savings programs in the form of codes, standards and incentives to promote efficient buildings and appliances and combined heat and power (CHP); and research and development for deployment of emerging technologies.

Allowance Value as a Driver for Existing Clean Energy Technology Deployment
The Council firmly maintains that any free allowances be distributed to covered entities in the power sector based on the efficiency of their total power generation (both electrical power and heat), through output-based approaches. Precedents for output-based allocation are included in America's Climate Security Act of 2007 sponsored by Senators Lieberman and Warner (S. 2191) and the Boxer Substitute (S. 3036) to that bill.

- S. 3036 provides an important 4 percent renewable energy set-aside that is estimated to provide $150 billion through 2050 to owners or operators of facilities that deploy renewable energy technologies.

- It is critical that provisions aimed at increasing investments in energy efficiency be front-loaded and clearly defined. S. 3036 made important strides in this area.

- As auctions are pursued, the Council strongly recommends directing auction revenue to existing clean energy technology investment and deployment. Under H.R. 6186, the Investing in Climate Action and Protection Act, existing clean energy technologies are significant recipients of auction proceeds.

Integrating Energy and Climate Change Policy
H.R. 1590, the Safe Climate Act of 2007, offers a comprehensive set of policy provisions, such as the inclusion of a RES and an EERS. Several bills have important building sector polices, including national targets for building codes (H.R. 6186, S. 2191 and S. 3036). In addition, these bills include needed incentives for states to implement and enforce code changes. H.R. 6186 includes large-scale funding to implement building code changes.

Offsets as a Technology Deployment and Cost Containment Instrument
The Council supports the use of high integrity offsets as a means to generate lower cost reductions and drive technology deployment and innovation. We seek workable offset provisions, such as the inclusion of a multi-year crediting period, and the removal of financial additionality tests. Of note, the Council was pleased that the Boxer Substitute (S. 3036) permits up to 5 percent of international offsets to be generated by project-based activities.

Mr. BOUCHER. Thank you very much, Ms. Jacobson.
Mr. Kuhn.

STATEMENT OF THOMAS R. KUHN, PRESIDENT, EDISON ELECTRIC INSTITUTE

Mr. KUHN. Thank you, Chairman Boucher and members of the Committee. My name is Tom Kuhn, president of Edison Electric Institute, and I would first like to commend the Committee for their thorough and very inclusive work that they have done on this particular issue. I think that the white papers and the many, many hearings you have are designed to address the difficulty and complexity of this issue.

The electric industry has been a leader in reductions of greenhouse gas emissions since 1994. We established a program to do that and we are responsible for about two-thirds of the overall emissions reductions that have been reported to the Federal Government at this point in time. More than a year ago, our board of directors did take a unanimous position that indicated we would support legislation to achieve greater reductions in greenhouse gas emissions and to establish a price of carbon, either by a tax or a cap-and-trade.

I would first like to mention the magnitude of that challenge though. With population economic growth, the Energy Information Administration estimates that by the year 2030, electricity growth will grow by 30 percent and that is after factoring in the very significant provisions that you passed in the Energy Policy Act of 2007 for energy efficiency. Electricity is the lifeblood of the economy so our main job to supply electricity and to make sure it is reliable and there when people need it.

In order to do this job to reduce greenhouse gas emissions where you are going to have to increase the electricity supply and at the same time reduce emissions, we are going to need the full suite of technologies to accomplish this issue, and I would like to talk a little bit about—turn to a slide that we have that was done by the Electric Power Research Institute that talks about again the challenges of this task.

[Slide shown.]

The EPRI put up a—did a thorough, exhaustive study and we have complemented it by a tremendous amount of work by our CEO team over the past year and a half to look at all the technologies that we would need to deal with the global climate issue, and I might emphasize that this work talks about the technological feasibility of these technologies so that we are really pushing the envelope on them and would need significant public policy support in order to accomplish it.

First, we start out with energy efficiency, which we call the fifth fuel, and I think we have done a great deal over the past decades, several decades on energy efficiency but we do believe we can do a great deal more and we can do it with the help of major new technologies such as advanced meters and information systems and new technologies in the building efficiency and appliance efficiency that can enable us to achieve a lot more. The Congress is talking about policies that would reduce the depreciation for advanced meters. That would help very much. Incidentally, on that target, I

might point out that electricity growth for the past 10 years has been over 2 percent. The Energy Information Administration talks about it declining to somewhere in the neighborhood of 1 percent and EPRI is talking about the possibility of going to .7 percent. So again, that talks about the magnitude that we are looking to to achieve in the area of energy efficiency.

In the area of renewables, the industry has been strongly supportive of additional renewables. In fact, wind is one of the fastest growing fuels that we see. But once again, we estimate here, the Energy Information Administration talks about a doubling of renewables between now and the year 2030. EPRI is pushing for a quadrupling of those renewables. Right now renewables produce about 2 percent of our overall electric generation so if we do that, we will get a lot more and it will be very necessary but it still would not produce a significant percentage of the overall generation. In order to get more renewables, we are going to need transmission policies that will allow us to get the transmission to where the renewables are needed, and we certainly also need tax support that would entail extension of the production tax credits and the investment tax credits for renewables.

Nuclear generation—every CEO of electric utilities around the world who are members of our organization will indicate that if you are going to make the goals that you want to make with global climate change, you will need additional nuclear power plants. We now have about 118 gigawatts of nuclear energy in this country. The Energy Information Administration talks about many additional nuclear power plants that would be brought on board by the year 2030. We are talking about the possibility of bringing 64 gigawatts of new nuclear plants on by that period of time, and that again is a huge challenge but one that will be necessary.

New clean coal technologies and carbon capture and storage—again, if you see that chart, you see the big bar that is going to be necessary for us to bring on carbon capture and storage and new clean coal technologies that will enable us to remove the carbon from—or capture and sequester and remove the carbon from coal power plants. This is a huge task and one that we need to advance with a great deal of funding for these new technologies in the near term.

Finally, plug-in hybrid electric vehicles. We think the PHEVs can provide a great deal not only in the energy and security side but on the environmental side as these vehicles come in and reduce our dependence on oil and also allow us to reduce greenhouse gas emissions in a major way.

All of these things are ambitious targets, and if we have overly ambitious targets, particularly in the near term, it will entail us moving toward more use of natural gas and that would further drive up natural gas prices and would certainly hurt our ability to make the long-term goals. We believe that need every one of these technologies. There is no silver bullet. You can't pick out energy efficiency and renewables and said that will do it all. You can't pick out nuclear and say that will do it all. We need everything in order to get it done.

We do have four additional major principles that I would just like to say, first——

Mr. BOUCHER. Mr. Kuhn, your time is about 2 minutes over at this point and——

Mr. KUHN. Cost containment mechanisms are going to be very important, like a safety valve. Offsets will be very important to reduce the cost. We need all nations to participate and we certainly need to harmonize the federal and state policies in order for us to do this thing with an overall national policy.

I very much appreciate the opportunity to testify, Mr. Chairman.

[The prepared statement of Mr. Kuhn follows:]

Written Testimony[1]
of
Thomas R. Kuhn
President
Edison Electric Institute

Before the United States House of Representatives
Committee on Energy and Commerce
Subcommittee on Energy and Air Quality

"Legislative Proposals to Reduce Greenhouse Gas Emissions: An Overview"

June 19, 2008

My name is Thomas R. Kuhn, and I am President of the Edison Electric Institute (EEI). EEI is the trade association of U.S. shareholder-owned electric companies and has international affiliate and industry associate members worldwide. Our U.S. members serve 95 percent of the ultimate customers in the shareholder-owned segment of the industry and represent about 70 percent of the U.S. electric power industry.

I. Introduction

The electric utility industry is committed to working with Congress to achieve greenhouse gas (GHG) legislation that will result in significant emissions reductions across the economy between now and 2050. Under any scenario, these reductions will be expensive, but the wisest way to accomplish them in the power sector is through the development and deployment of a full portfolio of climate technologies and measures over the long term. These include: energy efficiency for both supply and demand; renewable energy; advanced coal technologies integrated with carbon capture and storage; new nuclear power plants; and plug-in hybrid electric vehicles.

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[1] This testimony represents the views of the Edison Electric Institute (EEI). EEI has a diverse membership with a wide range of views, and this testimony does not reflect all of our companies' various views.

Likewise, the need for explicit cost-containment measures, such as a safety valve or price collar, within the context of an economy-wide cap-and-trade program to reduce GHG emissions in the U.S. would be important, especially during the initial years of the program, during which zero- and low-emitting advanced climate technologies are developed, become commercially available and are deployed, and as financial tools and strategies for managing price volatility and risk become widely available and are accepted.

GHG emissions reductions in the power sector must be made against the backdrop of population and economic growth: The Energy Information Administration (EIA) projects net electric demand to increase 30 percent by 2030, even after taking into account energy-efficiency improvements due to market-driven efficiency and stricter building codes and appliance and other efficiency standards mandated by the Energy Independence and Security Act of 2007 (EISA). The technological transformation of America's power sector will occur in the face of tremendous capital investment needs in order to meet the electricity needs of a growing population and economy. Even with substantial energy-efficiency measures, new and replacement power plant capacity is projected to total 150,000 megawatts (MW) and cost $560 billion by 2030.[2] Transmission and distribution investment needs are projected to total $900 billion by 2030.[3]

The most efficient way to reduce GHGs is through an economy-wide approach, with no exceptions. If there were exemptions and the power sector were the only covered sector or one of a few covered sectors, the odds of achieving environmental success would decline and the costs of regulation would be even higher. Electric generation is responsible for 34 percent of GHGs in the U.S., but transportation is responsible for 28 percent, industry for 19

[2] The Brattle Group, "Transforming America's Power Industry: The Investment Challenge" 4, Edison Foundation Conference (preliminary results) (Apr. 21, 2008) (hereinafter referred to as "Brattle Group Presentation").
[3] *Id.* at 5.

percent, agriculture for 8 percent, commercial for 6 percent, and residential for 5 percent.[4] The least economically intrusive and most environmentally effective and equitable regulatory system will be comprehensive: It will involve the participation of all major emitting nations, all sources and sinks, all GHGs and all sectors of the economy. "[A] domestic regulatory system, like an international system, should move as rapidly as feasible towards including all sources and sinks under a cap."[5]

Furthermore, several studies show that GHG emissions reductions are available from other sectors of the economy—buildings, transportation, forestry and agriculture/waste—at lower costs than from the power sector.

We offer the following comments on pathways to achieve GHG reductions in comparison to the bills under consideration by the Subcommittee. **Our comments reflect the Global Climate Change Principles agreed upon by EEI's CEOs in February 2007, which focus on market-based mechanisms and provide the benchmark against which our industry evaluates federal legislation or action.** These Principles are attached in Appendix A.

II. The Technology Pathway For Long-Term Targets For The Power Sector

A. Summary

For the electric utility industry, the optimal path to achieve long-term targets will rely on development and deployment of a full suite of climate technologies and measures to assist in the transition to a low-carbon future. These include: improved end-use energy efficiency, increasingly efficient generation of power; renewables; advanced coal technologies (ACT)

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[4] Environmental Protection Agency (EPA), Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005 at 2-22 - 2-23 (Apr. 15, 2007).

[5] M. Wara & D. Victor, "A Realistic Policy on International Carbon Offsets" 15, Stanford University Program on Energy and Sustainable Development, Working Paper #74 (Apr. 2008) (hereinafter referred to as "Stanford University Paper").

integrated with carbon capture and storage (CCS); new nuclear power plants; and plug-in hybrid electric vehicles (PHEVs).

In the near term, the power sector will engage in stepped-up energy-efficiency practices and enhanced renewable energy activities to help meet targets.[6] In the longer term, even with very aggressive assumptions about the potential for renewable energy and energy-efficiency deployment, the electric utility industry will need to depend on fossil fuel and nuclear generation to serve baseload demand. Short-term targets beyond what can be accomplished with efficiency and renewables that kick in before advanced technologies such as ACT with CCS and new nuclear plants are commercially available and deployed on a widespread basis would result in fuel switching from coal to natural gas, with negative impacts on gas supply and prices. In addition, this devotion of resources necessary to comply with short-term targets would frustrate our long-term national goals by diverting resources away from developing and deploying the technologies needed to meet long-term targets.

Thus, a two-pronged approach is needed for the electric utility industry. A primary focus should be on developing and commercially deploying climate technologies and practices, while relying on enhanced energy efficiency and increased renewables to the maximum extent feasible in the near term. In the near term, the goal would be to slow and eventually to stabilize the growth of GHG emissions. With new nuclear power plants being completed and ACT with CCS starting to become commercially available after 2020, more ambitious reduction targets could be achievable starting in the 2025 time frame. Even more aggressive reductions could be undertaken beginning in 2030 and beyond, on to 2050, assuming the U.S. is engaging in aggressive and widespread commercial deployment of the full suite of climate technologies. This would result in a nearly de-carbonized electricity supply. **Underlying this assumption are**

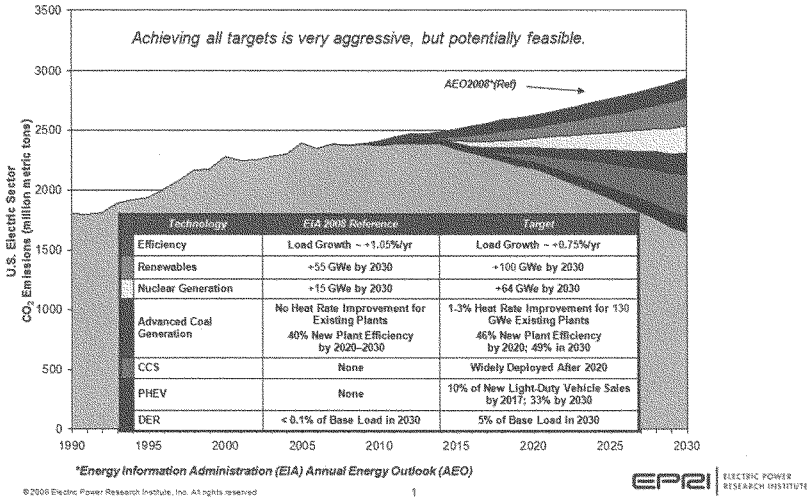
[6] The extent to which individual utilities will be able to reduce GHGs as a result of these practices and activities will be affected by load growth, regional variability and regulatory structure.

greatly increased funding of technologies by both the government and private sector, including financial and tax incentives, and removal of regulatory, economic and siting barriers. For example, if issues relating to loan guarantees for nuclear power plants are not resolved, or if ACT and CCS are not funded soon and do not develop in an integrated and cost-effective manner, generation choices would become greatly constricted, and some might be infeasible. If targets and timetables are not aligned with the nearer-term capabilities of expanded energy-efficiency and enhanced renewables, and the longer-term, widespread commercial deployment of new nuclear plants and advanced coal and CCS technologies, the costs of compliance would become astronomical and consumers would be compelled to curtail their use of electricity dramatically, with resulting consequences to the economy and the standard of living.

As the so-called "PRISM" work by the Electric Power Research Institute (EPRI) demonstrates,[7] a full technology pathway for the power sector is a far wiser path to follow than a limited technology approach. See Figure 1 below.

[7] EPRI, The Power to Reduce CO_2 Emissions – The Full Portfolio, Report 1015461 (Aug. 2007), available at: http://mydocs.epri.com/docs/public/DiscussionPaper2007.pdf. The PRISM in Figure 1 has been updated to reflect EIA's Annual Energy Outlook 2008, Report DOE/EIA-0383 (revised early release) (March 2008).

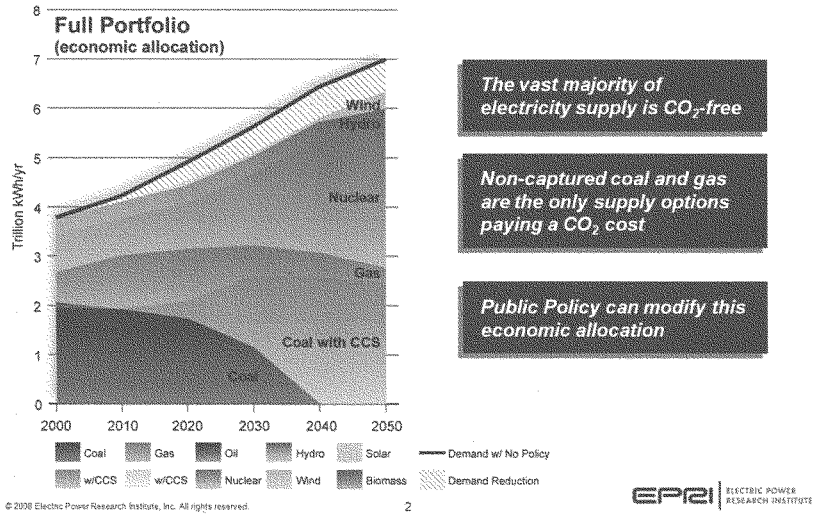
Figure 1: 2008 Prism...Technical Potential for CO_2 Reductions



Relating to Figure 1, note that the U.S.'s current capacity of renewable energy is 39 gigawatts (GW) and of nuclear energy is 118 GW.

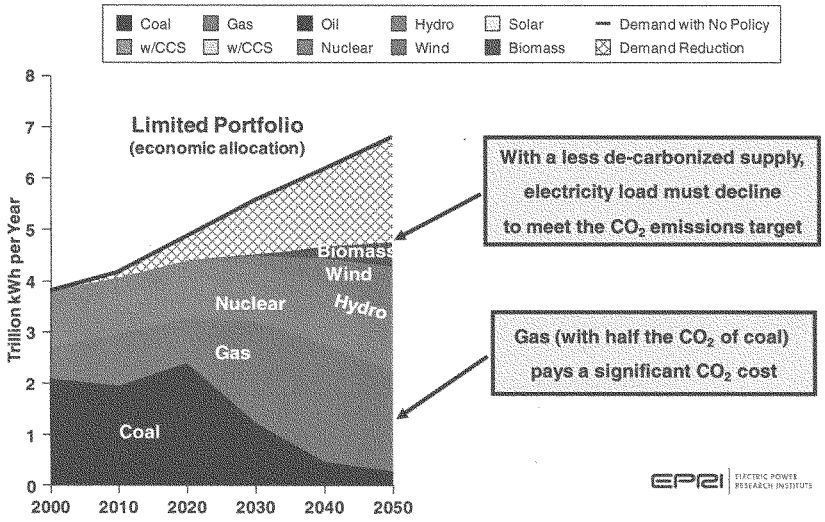
Each of the wedges in the PRISM represents very aggressive implementation of technical potential for a particular technology or measure—end-use efficiency, renewables, nuclear, ACT, CCS, PHEVs and distributed energy resources—and therefore assumes efficient resolution of economic, financial, regulatory and siting constraints. In this sense, the PRISM should be viewed as a roadmap or goal for the development of an optimal mix of supply- and demand-side resources. The **full portfolio** approach depicted in Figure 2 below—which meets the comparable level of emissions reductions as in the PRISM using an economic model—relies heavily on a renaissance of nuclear energy after 2020 and large deployment of ACT with CCS after 2020-2025. Under this economic allocation, the vast majority of electricity supply by 2050 is carbon free. However, changes in public attitudes and policies could modify this economic allocation.

Figure 2: U.S. Electric Generation – Full Portfolio



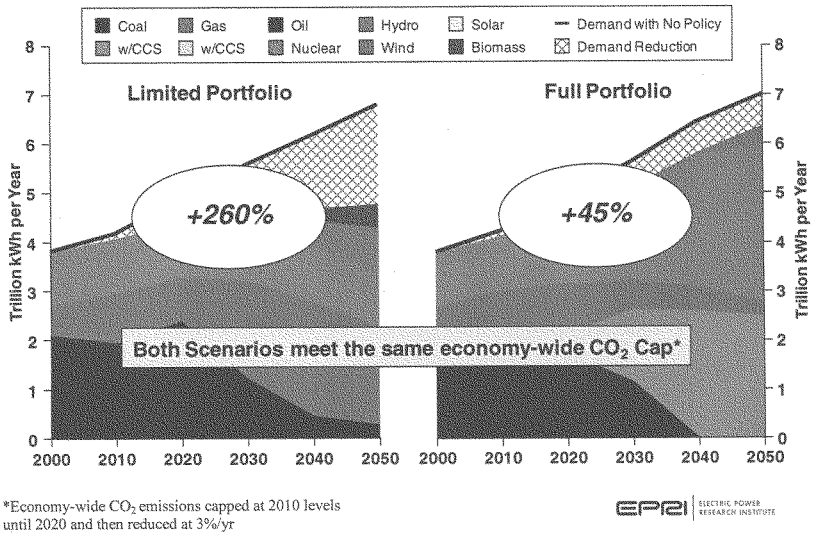
On the other hand, the **limited portfolio** approach depicted in Figure 3 below does not reflect either new nuclear energy or CCS by 2050. Consequently, electricity demand must decline in order to meet the GHG emissions target, and natural gas—which has a little more than half the carbon dioxide (CO_2) content of coal—carries a significant carbon cost.

Figure 3: U.S. Electric Generation – Limited Portfolio



As illustrated in Figure 4 below, both the full portfolio and limited portfolio approaches meet the same economy-wide carbon cap, yet the difference in increase in real electricity prices—45 percent compared to 260 percent—is vast.

Figure 4: Increase in Real Electricity Prices...2000 to 2050



*Economy-wide CO_2 emissions capped at 2010 levels until 2020 and then reduced at 3%/yr

EPRI ELECTRIC POWER RESEARCH INSTITUTE

The lessons of the EPRI analysis are threefold:

1) Under any scenario, the costs of compliance with GHG mandates will be high.

2) The wiser path to compliance for the power sector relies on development and deployment of a full portfolio of climate technologies and measures over the longer term.

3) Short-term targets should not lead the power sector off the long-term technology path.

An expanded discussion of the technology pathway is detailed in Appendix B.

B. Severe Economic Dislocations Must Be Avoided, and Cost-Containment Mechanisms Could Help.

In addition to alignment of targets and timetables with the commercial deployment of advanced climate technologies, the provisions in the bills under consideration by the Subcommittee that need the most change are cost-containment mechanisms. Such mechanisms generally fall into three categories: economic safeguard—safety valve or allowance

price collar; offsets; and allowances. A fuller discussion of economic safeguards and offsets follows.

1. Comparison of economic safeguards

A reasonably priced safety valve, or allowance price ceiling, would prevent the severe economic disruptions that would otherwise occur under most of the bills under consideration by the Subcommittee, particularly in the near term (2010-2030). Variations on a safety valve[8] could include a price collar (or band), or a price floor in addition to a price ceiling, within the context of managing the overall GHG budget. A safety valve also would provide price certainty and some protection to the economy from price spikes and would facilitate investment in advanced technologies. Furthermore, a safety valve would help to prevent price volatility and market manipulation, unfortunate hallmarks of the California energy crisis of 2000-2001, the European Union (E.U.) CO_2 price experience under Phase I of its emissions trading scheme (ETS),[9] and various natural gas markets.

A strong justification for a safety valve was articulated in a June 12, 2003, letter from R. Glenn Hubbard (Council of Economic Advisors (CEA) chairman under President Bush) and Joseph Stiglitz (CEA chairman under President Clinton) to Sens. McCain (R-AZ) and Lieberman (I-CT):

> Our support for the safety valve stems from the underlying science and economics surrounding the problem of global climate change, and is something that virtually all economists—even the two with as politically diverse views as ourselves—can agree.
> . . . .
> First, unexpected events can easily make the cost of a cap-and-trade program that includes carbon dioxide quite high, even with a modest cap.
> . . . .

[8] This is called a "technology accelerator payment" in S. 1766.

[9] The high volatility of Phase I of the ETS, where the price of a CO_2 allowance ranged from under $1 to more than $30, illustrates the case for a safety valve. In addition, given the strong correlation of CO_2 allowances to natural gas prices in the E.U. experience, the hard constraints of a tough emissions cap can be expected to have additive impacts on both natural gas and electricity prices in the U.S.

> Second and equally important, the benefits from reduced greenhouse gas emissions have little to do with emission levels in a particular year.
>
> . . . .
>
> Finally, few approaches can protect the economy from the unexpected outcome of higher energy demand and inadequate technology as effectively as a safety valve.[10]
>
> . . . .
>
> To summarize, the climate change problem is a marathon, not a sprint, and there is little environmental justification for heroic efforts to meet a short-term target.

Labor unions have been very supportive of the safety valve concept. In writing to the Senate about S. 2191 on June 2, 2008, the president of the International Brotherhood of Electrical Workers wrote, "I am also distressed about the lack of a meaningful 'safety valve' regarding the cost of CO2 allowances." See also AFL-CIO congressional testimony of November 13, 2007.

There is an economic safeguard in S. 1766. By way of contrast, there are no safety-valve mechanisms in either H.R. 1590 or H.R. 6186. And while there are types of cost-containment mechanisms in S. 2191 and S.A. 4825, they are not practical. They do not cap allowance prices, and they rely heavily on borrowing.

While the most direct and efficient means of containing the costs of an economy-wide cap-and-trade program is to impose an upper limit on the price of an emissions allowance, *i.e.*, establish a safety valve price, some policy-makers and other stakeholders are concerned that a simple safety valve may not adequately incentivize investment in zero- and low-emissions GHG climate technologies. An alternative approach is to establish an allowance price pathway, with a ceiling and floor price, that increases over time. This allowance price pathway should be incorporated into a broader system that manages the overall GHG budget associated with a national cap-and-trade program over a multi-year period. This concept, known as a price collar, can help to establish a predictable price pathway, limit allowance price volatility, and thus

[10] The discussion in the letter (omitted here) discounts alternatives to a safety valve such as offsets, a "circuit breaker," and banking and borrowing.

manage the overall cost of the program to the economy, those facing a compliance obligation and, ultimately, energy consumers.

The price collar would function by creating a trigger price to address high allowance prices, which would provide access to an allowance reserve in order to help increase quantities of allowances in the near term, placing downward pressure on allowance prices. At the same time, an allowance floor price would be created, which would be used as a minimum price in the allowance reserve. This floor price would help ensure a minimum level of investment is made in needed zero- and low-emission climate technologies. The price "band" between the floor and ceiling price could be narrow in the early years to provide more predictability and limit volatility, with the gap and overall price levels increasing over time.

In sum, most EEI members support a reasonably priced safety valve or price collar, especially as a transition mechanism from 2010 to 2030 until advanced technologies such as new nuclear plants and ACT and CCS are developed and commercially deployed on a widespread basis.

2. The importance of offsets as a cost-containment mechanism

Everyone is aware that GHGs are well-mixed in the atmosphere, are carried long distances and are a global phenomenon – hence, we talk about global climate change and global warming. There are no local effects or "hotspots" caused by GHGs.

So if an electric utility in the U.S. reduces, avoids or sequesters GHGs outside of its service territory or outside of the country, that offset or off-system action is just as effective in addressing climate change as a reduction within its own system. After all, a ton of GHGs is a ton of GHGs, no matter where it is reduced, avoided or stored.

While an economic safeguard is far and away the best cost-containment mechanism,[11] offsets comprise a critical tool in holding down the compliance costs of a GHG regulatory

[11] See n. 10, *supra*; Stanford University Paper, *supra* n. 5, at 5, 8, 18, 24.

regime. There is an important "niche role for offsets both as a tool for cost control within cap-and-trade systems and as one of a portfolio of tools for engaging developing nations in the problem of climate change."[12] This is particularly true for electric utilities. For utilities, some of the lowest-cost opportunities for reducing, avoiding or sequestering GHGs may be located outside of service territories, out of state or overseas. "Where" flexibility—the ability to mitigate GHGs anywhere in the world due to the ubiquitous nature of GHGs, which are well mixed in the atmosphere globally—is critical for lowering the costs of compliance.

A number of studies have demonstrated that domestically there is significant potential to reduce, avoid or sequester GHG emissions through offsets in unregulated sectors. This may include methane capture and destruction from coal mines, landfills and livestock; agricultural offsets of methane and nitrous oxide emissions; and afforestation, reforestation and forestry management.[13] The domestic potential from these activities is quite large.

Similarly, there is broad scope for international offsets, particularly in avoiding tropical and other deforestation, which accounts for 20-25 percent of global GHG emissions. The technical, economic and environmental potential of harnessing these offsets as well as other large sources of emissions through technologies such as ACT with CCS and nuclear energy is undeniably huge.[14] U.S. policy could play a very important role by counting these offsets, not restricting them, and even providing developmental support.

In addition to geographic flexibility, it is important that offsets not be arbitrarily limited in nature (or project type), scope or quantity. "We. . .counsel against many of the popular 'solutions' to problems with offsets such as imposing caps on their use."[15] **Legitimate concerns**

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[12] Stanford University Paper, *supra* n. 5, at 9.
[13] See, *e.g.*, *id.* at 15.
[14] See, *e.g.*, *id.* at 20, 22.
[15] *Id.* at 5; see also *id.* at 20.

with offsets may be addressed by monitoring, measurement, appropriate third-party verification and regulatory oversight.

Accordingly, we recommend that the bills under consideration by the Subcommittee be modified in the following ways:

- **In the case of H.R. 1590, by allowing the full and robust use of both domestic and international offsets.**
- **In the case of some of the other bills, by lifting numerical limitations on the use of both domestic and international offsets.**
- **In the case of the other bills, by not unduly restricting the qualifying criteria for offsets, but instead making them subject to monitoring, measurement, appropriate third-party verification and regulatory oversight.**

An EPA study of S. 2191 offers a good example of the severe negative economic impact that limited offsets can have. "If international credits are not allowed and domestic offsets are still limited to 15%, then allowance prices increase by 34% compared to the bill as written." [16]

III. Funding Needs For Increased Climate Technology Research, Development And Demonstration

As explained in Appendix B, the combined government and private sector research, development and demonstration (RD&D) funding needs for ACT and CCS are $800 million to $1 billion annually for the next 25 years. For the power sector overall, total government and private sector funding needs for climate technology RD&D are estimated to be about $1.4 billion **above current levels** annually to 2030.[17] (That number would of course be much higher economy-wide.) Current spending on power sector climate technology RD&D is estimated at

[16] "EPA Analysis of the Lieberman-Warner Climate Security Act of 2008" 6 (March 14, 2008).
[17] EPRI, *supra* n. 7, at 3-14 – 3-15. EPRI estimates that such climate technology RD&D investment could lower the costs of emissions reductions by as much as $1 trillion in the long run. *Id.* at 5-1.

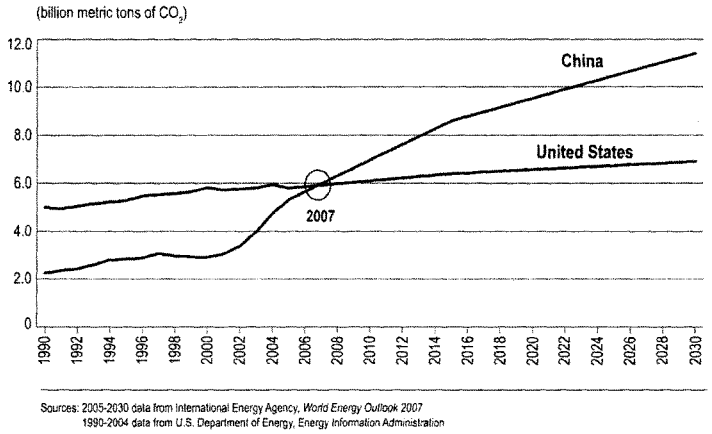
about $730-870 million for DOE in FY 2008.[18] For overall government spending on climate technology RD&D, the FY 2007 figure was about $2.1 billion. As acknowledged in Appendix B, the bills under consideration by the Subcommittee make progress in remedying those funding shortfalls, but clearly much more funding and support is needed in the near term from both the government and the private sector. This includes greater tax and financial incentives for zero- and low-emissions climate technology RD&D and deployment (including substantial loan guarantees for new nuclear energy and other technologies), as well as significant relief from onerous regulatory and siting barriers to new generation and transmission.

IV. International Competitiveness And Participation

Unless all major emitters of GHGs, including key developing countries, commit to reducing emissions, efforts by the U.S. to reduce its GHG emissions will be offset by rising overall global emissions from other countries. The International Energy Agency (IEA) predicts that global energy-related CO_2 emissions will increase 57 percent between 2005 and 2030, with developing countries accounting for more than 75 percent of this projected increase. In addition, as Figure 5 below illustrates, IEA data projected that China surpassed the U.S. in 2007 as the leading global emitter of CO_2 emissions.

[18] The breakdown is as follows: $240 million for solar, wind and geothermal technologies; $135 million for Nuclear Power 2010; $140 million for electricity delivery and reliability (which are arguably not climate-related); $235 million for ACT; and $120 million for CCS.

Figure 5: China Surpasses U.S. in Carbon Dioxide Emissions



The Netherlands Environmental Assessment Agency recently called the IEA projection "a robust conclusion."[19]

Furthermore, an EPA analysis of three Senate bills addressing CO_2 reductions concluded that each of the bills would have virtually no impact on global CO_2 concentrations if the U.S. were to act alone.[20] In the EPA analysis, global CO_2 concentrations would rise to 718 parts per million (ppm) in 2095, but the three bills studied would reduce global CO_2 concentration levels by only 23-25 ppm by 2095—or about 3.5 percent. The Lieberman-Warner bill could only have slightly more impact.

[19] "China Increases Lead as Biggest Carbon Dioxide Emitter," New York Times (June 13, 2008).
[20] EPA, "EPA Analysis of Bingaman-Specter Request on Global CO_2 Concentrations" (Oct. 1, 2007). The three bills analyzed were: S. 1766, Bingaman-Specter's Low Carbon Economy Act; S. 280, Lieberman-McCain's Climate Stewardship and Innovate Act; and S. 485, Kerry-Snowe's Global Warming Reduction Act.

Ensuring that developing countries take actions to reduce their GHG emissions is vital for helping U.S. industry remain competitive in the global marketplace, as acknowledged in a recent paper prepared by this Committee.[21]

Most of the bills under consideration by the Subcommittee do include provisions designed to address competitiveness concerns, requiring importers to submit allowances to cover the GHG emissions produced in making certain GHG-intensive products in countries that have not taken comparable action to the U.S. Imports from countries that have taken comparable action would not face this requirement. **It is important that the effective date of any such provision closely follow enactment of the enabling legislation.**

Additional policies to encourage developing countries to reduce their GHG emissions as part of an effective climate change policy could include:

- Providing for the full and robust use of offsets from overseas activities to encourage actions in developing countries.
- Utilizing the resources and expertise of the World Bank, Overseas Private Investment Corporation, Export-Import Bank, and other multilateral and regional development banks to help "buy down" the difference in cost between conventional and advanced technologies to help engage developing countries in GHG-reduction activities.
- Fully funding international agreements—such as the Asia-Pacific Partnership on Clean Development and Climate (APP)—that address climate change issues through research and technology transfer. The APP involves governments working with the private sector to expand investment and trade in cleaner energy technologies. Australia, Canada, China, India, Japan, Korea and the U.S. are participating countries.

Another idea recently proposed by the Carnegie Endowment for International Peace[22] would be for the U.S. and China to set individual, national goals and then work together to achieve them through domestically enforceable measures and international agreements to prevent

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[21] U.S. House of Representatives, Committee on Energy and Commerce, "Climate Change Legislation Design White Paper: Competitiveness Concerns/Engaging Developing Countries" (Jan. 2008).

[22] W. Chandler, *Breaking the Suicide Pact: U.S.-China Cooperation on Climate Change*, Carnegie Endowment for International Peace, Policy Brief 57 (March 2008).

either nation from taking advantage of steps taken by the other. Three priority areas for cooperation would be: development of best practices technologies, innovation in new technologies, and agreements to prevent the two countries from taking advantage. The proposal also calls for making climate cooperation integral to trade policy, such as jointly setting product standards to limit the energy used in manufacturing exports. If successful, the approach could be exported to other countries.

Finally, another recent proposal from Stanford University[23] recommends that the U.S. 1) in collaboration with other developed countries, invest in a "Climate Fund" to finance critical changes in developing country policies to lead to near-term reductions, and 2) actively pursue a series of infrastructure deals with key developing countries to shift their longer-term development trajectories consistent with large GHG emissions reductions as well as their own interests.

V. Avoiding Multiple Federal Regulation Of GHGs And Harmonizing Federal And State Climate Policies

Several important regulatory and policy issues are only briefly or indirectly addressed—if at all—in the bills under consideration by the Subcommittee. Among the most important of these are the need to avoid multiple regulation of GHGs by federal statutory authorities and the need to harmonize federal and state climate law and policies.

With respect to the first issue, numerous authorities from the White House to the Congress—including the chairman of this Committee—to academia have called for a single comprehensive federal climate law, rather than a regulatory regime consisting of multiple, overlapping or conflicting statutes. One of the worst outcomes would be comprehensive climate legislation that leaves intact piecemeal regulation of GHGs under the Clean Air Act (CAA),

[23] Stanford University Paper, *supra* n. 5, at 6, 18-19, 21-23.

Clean Water Act, Endangered Species Act (ESA), National Environmental Policy Act (NEPA) and other federal statutes. Backdoor regulation of GHGs is already being attempted in CAA permitting cases, a NEPA petition is pending at the Council on Environmental Quality, and the Department of the Interior's ESA polar bear listing has already spawned litigation. Avoidance of this "glorious mess" should be a paramount objective of the Congress.

With respect to the second issue, numerous authorities from the Congress—we note this Committee's white paper on "Appropriate Roles for Different Levels of Government"—to labor to industry have called for the harmonization of federal and state climate laws and policies. States may well have appropriate roles in land-use programs and urban transit, renewable portfolio standards, and energy-efficiency standards and building codes. However, assuming cap-and-trade is the approach that Congress embarks on, there should be only one national cap-and-trade program. The prospect of federal, regional and state cap-and-trade programs, with multiple costs imposed on consumers through various allowance allocation and auction schemes, is an undesirable one from a policy standpoint.

Attachments

Appendix A

EEI Global Climate Change Principles
2-8-07

BACKGROUND

EEI's member companies clearly recognize the growing concerns regarding the threat of climate change. Since 1994—when EEI joined the U.S. Department of Energy in the Climate Challenge—the electric utility industry has led all other industrial sectors in reducing greenhouse gas emissions. Through various programs now under way—including Power Partners[SM], the Asia-Pacific Partnership and individual company efforts—that commitment continues.

Today, EEI's members recognize a growing imperative to make even deeper reductions in greenhouse gas emissions. No matter what the ultimate path is, success in that mission—while maintaining the reliable and reasonably priced electricity supply so vital to our economic well-being and national security—will require an aggressive and sustained commitment by the industry and policymakers to the development and deployment of a full suite of technology options, including:

- An intensified national commitment to energy efficiency, including advanced efficiency technologies and new regulatory and business models;
- Accelerated development and cost-effective deployment of demand-side management technologies and renewable energy resources;
- Advanced clean coal technologies (e.g. advanced pulverized coal, fluidized bed and IGCC technologies);
- Carbon capture and storage for all types of fossil-based generation;
- Increased nuclear capacity and advanced nuclear designs; and,
- Plug-in electric hybrid vehicles.

Although some of these options are currently available—albeit at a higher cost than conventional generation sources—many are not. All have different time horizons, but all are critical to our dual goals of addressing greenhouse gas emissions and maintaining a reliable, affordable electricity supply in a carbon-constrained world. Moreover, because of the global nature of the problem, solutions will require the participation of the entire world economy, including China and India.

PUBLIC POLICY PRINCIPLES

EEI will continue to emphasize the importance of:

- A reliable, stable and reasonably-priced electric supply to maintain the competitiveness of the U.S. economy;
- A fuel-diverse generation portfolio to assure system reliability, energy security and price stability;
- Public policies and initiatives to accelerate the development of viable and cost effective energy efficiency programs and technologies; zero- or low-emissions generation technologies; and carbon capture and storage technologies;
- International partnerships to address climate change as a global issue that requires global solutions, including appropriate participation by developing nations, such as China and India; and,
- Solutions compatible with a market economy that deliver timely and reasonably priced greenhouse gas reductions.

EEI supports federal action or legislation to reduce greenhouse gas emissions that:

- Involves all sectors of the economy, and all sources of GHG;
- Assures stable, long-term public/private funding to support the development and deployment of needed technology solutions;
- Assures compliance timelines consistent with the expected development and deployment timelines of needed technologies;
- Employs market mechanisms to secure cost-effective GHG reductions, and provides a reasonable transition and an effective economic safety valve;
- Establishes a long-term price signal for carbon that is moderate, does not harm the economic competitiveness of U.S. industry and stimulates future investments in zero- or low-carbon technologies and processes;
- Addresses regulatory or economic barriers to the use of carbon capture and storage and increased nuclear, wind or other zero- or low-GHG technologies;
- Minimizes economic disruptions or disproportionate impacts;
- Recognizes early actions/investments made to mitigate greenhouse gas emissions;
- Provides for the robust use of a broad range of domestic and international GHG offsets;
- Provides certainty and a consistent national policy; and,
- Recognizes the international dimensions of the challenge and facilitates technology transfer.

Appendix B

Expanded Discussion of the Full Technology Pathway

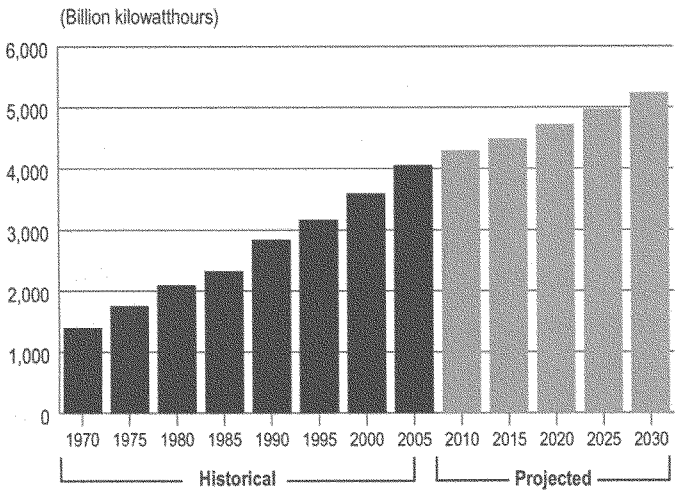
I. Electric Demand Is Projected To Grow 30 Percent By 2030.

EIA projects net electric demand to increase 30 percent by 2030, due primarily to economic and population growth.[24] See Figure 6 below. This projection already takes into account autonomous energy-efficiency improvements due to market-driven efficiency (5 percent) and stricter building codes and appliance and other efficiency standards (18 percent)[25] mandated by EISA.

[24] EIA, Annual Energy Outlook 2008 (early release).

[25] EPRI, "Energy Efficiency: How Much Can We Count On?," Edison Foundation Conference, Keeping the Lights On: Our National Challenge at 12 (Apr. 21, 2008) (hereinafter referred to as "EPRI Energy Efficiency Study").

Figure 6: Demand for Electricity Is Projected to Increase at Least 30% by 2030



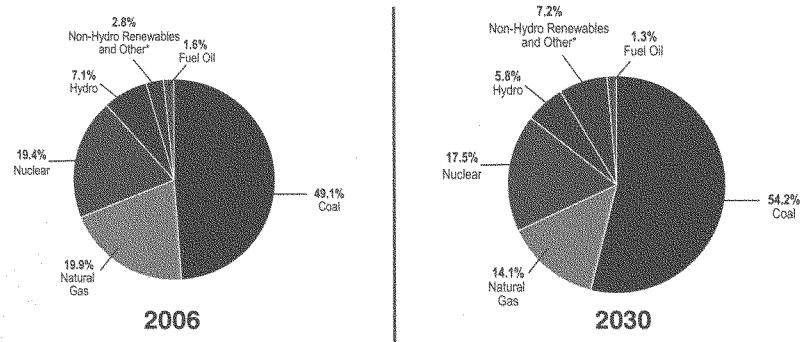
*Electricity demand projections based on expected growth between 2006 and 2030.

Source: U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2006* and *Annual Energy Outlook 2008* (early release).

Before the power sector can tackle the kinds of short- and mid-term targets proposed in most of the bills under consideration by the Subcommittee,[26] one must consider the national backdrop against which such reductions would have to occur. Accordingly, Figure 7 below presents the national electric generation fuel mix in 2006 compared to EIA's 2030 projections. **Note that the generation resource "pie" in 2030 is projected to be 30 percent larger in 2030 than it was in 2006.**

[26] The targets and timetables in H.R. 1590 and H.R. 6186 are even more stringent than the Lieberman-Warner bill, which would require GHG emissions reductions of 7 percent below 2006 levels by 2012, 39 percent below 2006 levels by 2030 and 72 percent below 2006 by 2050. See EIA, "Energy Market and Economic Impacts of S. 2191, the Lieberman-Security Climate Security Act of 2007" v (Apr. 2008). The targets and timetables in S. 1766 are ameliorated by the technology accelerator payment until about 2020 and then are as tough as other bills by 2030.

Figure 7: Current National Fuel Mix Compared to EIA's 2030 Projections



Looking ahead, EIA's early release Annual Energy Outlook 2008 projects that coal-fired power plants will continue to supply most of the nation's electricity through 2030.[27] In 2006, coal-fired plants accounted for nearly half of generation and natural gas-fired plants for about 20 percent. In 2030, the generation shares for coal and natural gas are projected to be 54.2 percent and 14.1 percent, respectively.

Under its reference forecast, by 2030 EIA also projects nuclear and renewable capacity (including conventional hydroelectric) to increase as 17 GW of new nuclear plants and 47 GW of new renewables are built, stimulated by federal loan guarantees and tax incentives and rising fossil fuel prices. Although nuclear generation is expected to increase modestly, with

[27] Ninety percent of U.S. coal is used for electric generation. In 2007, 5 percent of U.S. coal was exported. "An Export in Solid Supply," New York Times (March 19, 2008). That figure is expected to reach 7-8 percent in 2008. *Id.* Without the participation all major emitting nations in binding GHG commitments, such exports would increase with the imposition of stringent near-term targets and timetables, thus resulting in the movement of GHG emissions off-shore via leakage.

improvements in plant performance and expansion of existing facilities, EIA projects that the nuclear share of total generation will fall from 19.4 percent in 2006 to 17.5 percent in 2030. The generation increase in renewable capacity (including conventional hydroelectric) reflects an increase in non-hydro renewables from 2.8 percent of total generation to 7.2 percent.

EIA forecasts that relative fuel costs, particularly for natural gas and coal, will affect both the utilization of existing capacity and technology choices for new plants. Changes in energy and environmental policies could also affect the Annual Energy Outlook 2008 projections for capacity additions.

II. Enhanced Energy-Efficiency[28] Efforts Can Help To Reduce Electric Demand Growth In the Near Term.

Energy efficiency is a critical tool for addressing GHG emissions because it represents one of the major activities that can be undertaken immediately to reduce the need for electricity. It can be a low-cost option. Examples of energy-efficient technologies include: geothermal heat pumps, heat pump water heaters, variable-speed drive motors, and compact fluorescent and light-emitting diode (LED) lighting. In addition, energy efficiency affects CO_2 emissions not only through direct load reduction but also through deferring the need for new generation, buying time for cleaner and more efficient generation to come on-line.[29] As fuel and construction costs increase for new baseload generation, higher electricity prices will play an increasing role in capturing and motivating efficiency improvements. However, the challenge for increasing the role of energy efficiency is not solely a technological one, but also one that requires addressing market, behavioral and regulatory barriers.

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[28] This section addresses demand-side energy efficiency, or customer-focused and end-use energy efficiency. Supply-side energy efficiency is addressed in section IV below.

[29] EPRI, *supra* n. 7.

Achieving energy efficiency involves many consumers taking action rather than just industry. It will require policy-makers to address market imperfections by aligning incentives for companies and customers. For electric utility companies and state and federal regulatory commissions, it means changing business models from a supply orientation to considering both supply and demand. It also means that serious consideration must be given to demand response options, real-time pricing, development of the "smart grid," and regulatory mechanisms that encourage and reward the pursuit of customer-based energy efficiency (*e.g.*, decoupling and rate incentive mechanisms). This is because regulatory policies often blunt price signals and do not reward investment in demand-based activities.[30]

There is also a diverse range of opinion regarding what role energy efficiency will play going forward. Note that the average annual growth rate in electricity over the last decade was 1.8 percent annually, even with substantial energy-efficiency improvements. In its revised PRISM analysis,[31] EPRI assumes a 0.75 percent average annual growth rate in electric demand, while others claim that the country's electricity needs over the next 20 years can be met solely through increased efficiency and renewable energy. Regarding the latter claim, **EPRI's revised PRISM indicates the reduction in consumption through energy efficiency (beyond the considerable autonomous energy-efficiency improvements cited earlier) is 7-11 percent by**

[30] A primary concern of electric utilities is that traditional regulatory frameworks do not compensate efficiency efforts in a manner that effectively treats those investments the same way as investments in generation, transmission and distribution. Various business models are being implemented or proposed that: 1) allow timely cost recovery, 2) compensate for lost sales and 3) provide shareholder incentives for pursuing efficiency.

[31] EPRI, "Electricity Technologies in a Carbon-Constrained World," Air and Waste Management Association (Apr. 3, 2008).

2030[32]—significant, but even in combination with renewables far short of the 30 percent increase in net electric demand projected by EIA (see section I above and p. 29 *infra*).[33]

A key for all business models is sustainability—the revenue mechanism and value proposition must be durable over time. Customers need incentives to make energy efficiency a long-term goal, regulators need to see cost savings and customer benefits to ensure that the public interest is being protected, and utilities need regulators' support to ensure the certainty of their investments and planning. Short-term fluctuations in customer needs, technological innovation, regulatory factors and competitor actions must not undermine the model.[34] Some of these issues were addressed in the EISA, which requires states to consider ways to align utility incentives with energy efficiency. However, if this alignment of utility incentives with energy efficiency either does not occur or takes longer than expected, it will not be possible to realize the total potential benefits. Thus, regulatory reform and the creation of business models—while primarily a state-based activity—should be considered in conjunction with any federal plan for addressing GHGs.

Technology will also have to be developed and deployed to ensure that the existing grid infrastructure continues to work reliably and safely, while facilitating a transition to an intelligent or smart grid. Smart grid is a broad term for an ever-widening portfolio of utility applications that enhance and automate the monitoring and control of electric distribution networks for added reliability, efficiency and cost-effective operations.[35] The smart grid provides utilities the ability

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[32] EPRI Energy Efficiency Study, *supra* n. 25, at 14. **Thus, cutting demand growth by a quarter via energy efficiency by 2030 would still leave the electricity growth rate at 22.5 percent.** *Id.*

[33] Some EEI member companies may be able to achieve greater energy-efficiency improvements than posited by the EPRI PRISM. Other member companies may have difficulty achieving such efficiency gains due to load growth, regional differences or regulatory structure.

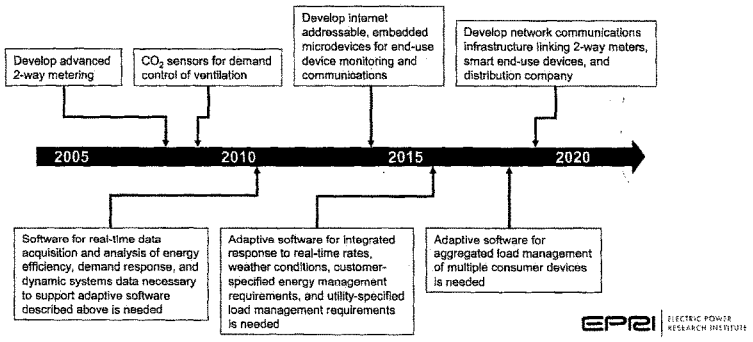
[34] NERA Economic Consulting, "Making a Business of Energy Efficiency: Sustainable Business Models for Utilities," Washington, D.C. (2007).

[35] Functionally, a smart grid should: enhance active participation (or two-way communications) by customers; accommodate all generation and storage options; enable new products, services

to make energy efficiency more automatic for customers, perhaps as a "default" service. This should make a huge difference for market penetration of demand-side management and end-use energy-efficiency technologies and practices.

The costs of building a major portion of the smart grid, advanced meter infrastructure, have been estimated at $19-27 billion.[36] **Tax incentives for a smart grid would be very helpful, such as 5-year depreciation for smart meters and 15-year depreciation for distribution assets.** In addition to major funding, full development and deployment of the smart grid will take time. Figure 8 below illustrates the timeline for development and deployment of the smart grid. In parallel, implementing demand response will facilitate the transition to a smart grid. Nonetheless, many valuable energy-efficiency programs can be launched today without it.

Figure 8: Timeline – Efficiency and Demand Response



Energy-efficiency abatement opportunities are widely spread across the economy, with power generation only accounting for approximately one-third of the total potential. Many GHG

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and markets; provide power quality for the digital economy; optimize asset utilization and operational efficiency; anticipate and respond to system disturbances; and operate resiliently under attack and natural disasters.

[36] Brattle Group Presentation, *supra* n. 2, at 22.

emissions reductions are available from other sectors of the economy—buildings, transportation, forestry and agriculture/waste—at lower costs than from the power sector.

III. Robust Investment In Renewable Energy Can Help To Meet Some Of Our Electricity Needs In The Near Term.

Increasing the deployment of renewable energy is another critical tool for addressing GHG emissions. However, while the share of renewable energy in the nation's electricity mix has increased—wind power has become the second largest source of new power capacity in the U.S. behind natural gas—many economic, regulatory and regional challenges remain that will affect the growth of renewable sources of energy.

There is also a diverse range of opinion regarding what role renewable energy will play going forward. In its revised PRISM analysis, EPRI assumes an additional 100 GW of renewables will be built by 2030—which would be two and a half times the current renewables capacity— while others, as noted earlier, claim that the country's energy needs over the next 20 years can be met solely through increased efficiency and renewable energy. Again, regarding the latter claim, **EPRI's revised PRISM assumption for renewables is 9.1 percent of total EIA projected electric generation capacity by 2030[37]—significant, but even in combination with energy efficiency far short of the 30 percent increase in net electric demand projected by EIA** (see section I above and p. 27 *supra*).

With the exception of wind energy in some parts of the country, renewable energy is currently not cost competitive with other forms of generating electricity. Moreover, except for biomass energy, renewable energy is dominated primarily by its initial capital costs. As a result, renewables generation development to date has mainly been driven by policy decisions and associated incentives—in the form of state renewable portfolio standards, the federal production

[37] This is in addition to the significant increase in non-hydro renewables cited earlier.

tax credit (PTC), the solar investment tax credit (ITC) and other financial incentives. **The extensions of the PTC and ITC, along with the removal of the ITC's utility exclusion, are vitally important to facilitating the increased deployment of renewable energy.**

Provisions in EISA will also help, but will need to be fully funded during the annual appropriations cycle in order to be effective. While outside the scope of comprehensive climate legislation, such congressional action will be a key part of advancing all zero- and low-emissions resources.

Greater deployment of renewable resources for electricity generation will depend on: the intermittent nature of wind and solar, and the associated lack of electricity storage that can overcome the need for backup fossil fuel generation; the regional variations in resource availability[38]; the high costs of some renewable technologies; and the inadequacy of the current transmission and interconnection systems to accommodate the desired growth in renewables generation. Ultimately, increasing the deployment of renewable energy technologies will hinge on addressing multiple technical, economic and regulatory challenges, mainly relating to battery storage, high capital costs, and important transmission siting, building and integration constraints.

Driven by the PTC, the wind industry has succeeded in reducing its production costs by a remarkable amount. Although wind technology has advanced, the cost improvements have been partially offset by increases in production costs, which have risen steadily since 2001 due to a sustained escalation in materials costs and devaluation of the dollar relative to the euro. In addition, even with improvements, unsubsidized wind electricity production costs are still high due to lower capacity factors, driven by intermittency and added costs for firm backup fossil generation. In some instances wind is cost competitive with traditional fuels. However, other

[38] Two states—California and Washington—accounted for almost 40 percent of all renewable generation in the U.S. in 2006 because of their hydroelectric, wind and geothermal resources. Texas led all states in wind generation.

renewable technologies are currently too costly to achieve a significant degree of market penetration.

Another major challenge is siting transmission to support renewable energy development. Because renewable energy resources are often located in sensitive or scenic environments, such as mountain ranges or coastal waters, siting these facilities is difficult.[39] Transmission siting usually faces local opposition and complex, multi-jurisdictional (*i.e.*, state and federal agencies') approval requirements. Moreover, wind resources are intermittent and are often located far from major urban load centers. To gain significant increases in renewable resources, the power sector is seeking major investment in, and extension of, the grid and ideally extra-high voltage transmission in order to maximize renewables' access to certain markets.

Hydroelectric power generates no GHGs. To the extent that existing hydropower can be maintained or expanded through advances in technology, it could continue to be an important part of a carbon-free energy portfolio. However, meaningful growth of this technology is highly unlikely given the aversion to, and difficulty in siting, large-scale dams.

Key breakthroughs could be very significant in allowing renewables to play a bigger role in the long run. Some examples include: continued improvement and cost declines in battery storage for wind and solar,[40] including compressed air storage for wind; other advancements in solar, including molten salt storage, to continue to bring costs down; biotechnology developments in biofuels, with the prospect of growing a significant amount of net-zero carbon emissions fuel supply on small amounts of land; and developments in hydrokinetic (wave and tidal) energy. None of these is available now, and all require significant RD&D to become part of the long-term solution. Given the nature of the obstacles faced, increased RD&D and

[39] S. Vajjhala, "Siting Renewable Energy Facilities: A Spatial Analysis of Promises and Pitfalls," Resources for the Future Discussion Paper (July 2006).
[40] Wind turbine improvements that lessen noise and limit bird and bat mortality are also desirable.

regulatory and policy regimes conducive to increased renewable deployment will be critical in facilitating the market penetration of renewables generation at a large scale by reducing their costs and by facilitating their integration into the grid and delivery to customers.

In sum, even with very aggressive assumptions on the technical potential of renewable energy and energy efficiency deployment, the electric utility industry will need to depend on fossil fuel and nuclear forms of generation, particularly to serve baseload demand in the near term.

IV. De-carbonizing Baseload Electric Generation Will Depend On Widespread Commercial Deployment Of ACT With CCS And Substantial Builds Of New Nuclear Plants.

The primary sources of baseload generation in the U.S. are coal, nuclear energy, natural gas and hydroelectric power. As indicated in section I above, they will continue to be the primary sources of baseload generation to at least 2030. Natural gas is a premium fuel that, given supply and price constraints, is considered by some observers to be better suited for intermediate and peaking generation, but it can be, and often is, used for baseload generation in many parts of the country.[41] However, it also has a little more than half of the carbon content of coal (on an energy equivalent basis), and thus has significant CO_2 consequences.

The electric utility industry is beginning the process of building new nuclear power plants and is working on the development and deployment of ACT integrated with CCS. With respect to new nuclear plants, there are nine applications at the Nuclear Regulatory Commission, each representing (on average) a 1,400-MW power plant. Projections are for 3-5 new plants to be

[41] Outside of the power sector, natural gas is used as a feedstock in the chemical, petrochemical and fertilizer industries and for other industrial and commercial purposes, and is the primary source of home heating fuel for much of the country.

ready for commercial operation in the 2016-2018 timeframe.[42] Assuming continued support for nuclear energy from federal and state governments, NEI projects that 45 new nuclear power plants could be in commercial operation by 2030, representing about 60 GW of additional capacity.[43] Similarly, EPRI's revised PRISM projects 64 GW of new nuclear plants technically possible by 2030. To put these estimates into perspective, NEI estimated (based on 2006 data) that the U.S. would need about 51 GW of new nuclear capacity by 2030 just to maintain nuclear energy at its 20 percent share of national electricity supply.[44] However, federal support for nuclear energy must be enhanced, and additional loan and financial guarantees (beyond those authorized by the Energy Policy Act of 2005) must be provided. Disposal of used nuclear fuel must also be addressed. With government support in these key areas, nuclear energy could make a greater contribution to reducing GHGs in the near term.

With respect to ACT,[45] there are only two IGCC plants in the U.S.—with only a few more elsewhere in the world—and both are under 300 MW. As Figure 9 below shows, additional IGCC plants and other advanced combustion systems (such as ultra-supercritical pulverized coal (PC) and circulating fluidized bed) will be commercially available in the 2010-2025 timeframe. Widespread commercial deployment depends on bridging the cost differential

[42] See, *e.g.*, Nuclear Energy Institute (NEI), "Status and Outlook for New Nuclear Power Plants in the United States" 1,5 (July 2007) (hereinafter referred to as "NEI Paper"); Electric Power Daily (Feb. 22 & Apr. 8, 2008).

[43] NEI Paper, *supra* n. 42, at 6.

[44] *Id.*

[45] Proponents of immediate and strict GHG targets and timetables for the electric utility industry point to title IV (Acid Deposition Control) of the Clean Air Act (CAA), added by the CAA Amendments of 1990 to regulate sulfur dioxide (SO_2) and nitrogen oxides (NO_x) emissions under cap-and-trade programs, as a legislative model for cost-effective emissions reductions. However, unlike the SO_2 and NO_x programs, which had SO_2 scrubbers, low-NO_x burners, selective catalytic reduction (SCR) and non-SCR technologies (as well as low-sulfur coal) available, there is currently no CO_2 scrubber. As many organizations—such as EPRI, the Massachusetts Institute of Technology (MIT) and the Coal Utilization Research Council (CURC)—and policy-makers have recognized, CCS, which must operate in an integrated fashion with ACT, will not likely be commercially available on a widely deployable basis until around 2025.

between ACT and conventional PC systems. The revised EPRI PRISM projects 130 GW of existing plant upgrades technically possible by 2030, with each constituent an improvement in heat rate of between 1-3 percent compared to the efficiency of the existing unit. As indicated above, such technical potential may be limited by real-world constraints—particularly, new source review (NSR) regulations under the CAA. Amending or reforming the NSR program could yield substantial near-term reductions in GHGs from power plants and other large stationary sources. For example, were it not for the disincentives created by NSR, one estimate of the benefits from retrofitting all existing coal-fired power plants with technologies to increase boiler or steam efficiency shows a potential overall efficiency increase of roughly 8 percent, with a corresponding potential CO_2 emissions reduction of 200 million tons annually.

Figure 9: Comparison of Clean Coal and CCS Technology Development Estimates

Note: CCS *commercial deployment* would follow 5-10 years after the RD&D timeline below (2025-2035). Any delays in either technology development or funding will significantly affect the estimated timeline for availability.

Roadmap Authors -Primary Source	RD&D Timeline Clean Coal Technology w/o CCS		RD&D Timeline Clean Coal Technology w/ CCS*		Total Funding Required/Timeframe
	IGCC	Adv. Comb.	IGCC	Adv. Comb.	
CURC-EPRI - Roadmap	2010-2025	2010-2025	2017-2025	2020-2025	$17 B over 18 years
EPRI - Reducing CO_2 Emissions from Coal-Based Power Generation	2012-2020		2017-2022	2020-2022	$17 B over 25 years
MIT - Future of Coal					$8-8.5 B over 10 years plus $5 B over 10 years
EEI Projections	**2012-2025**	**2010-2025**	**2020-2025**	**2020-2025**	**$20 B over 25 years**

* Includes stand-alone CO_2 capture and storage demonstrations as well as integrated demonstration.

The chart in Figure 9 above is a compilation of information and projections from EPRI, MIT and CURC. It also shows that CCS technologies are not expected to be commercially

available until 2020-2025. (EPRI estimates that 2025 is likely for commercial availability at today's pace, with 2020 possible with more aggressive funding and more demonstration projects.) The Note in the chart indicates that widespread commercial deployment of CCS would follow 5-10 years after the research, development and demonstration (RD&D) timeline, or 2025-2035, and adds, "**Any delays in either technology development or funding will significantly affect the estimated timeline for availability**" (emphasis in original).

As indicated in EEI's September 21, 2007, written statement to the House Select Committee on Energy Independence and Global Warming—from which the chart above was excerpted—, "**[i]t is important to note that this framework should be considered as a whole rather than as a set of discrete tasks**" (emphasis in original) (p. 7). The EEI statement further notes, "Significant challenges are associated with the individual goals related to efficiency, reliability, CO_2 capture and storage, as well as with **integrating** CO_2 capture processes with gasification- and combustion-based power plant processes" (emphasis added) (*id.*). No utility has successfully captured, compressed, transported and stored CO_2 from a coal-fired power plant to date, and the combined storage from all existing pilot and demonstration facilities worldwide would equal the amount of CO_2 emitted from one 250-MW PC plant annually. Moreover, there are considerable non-technical issues that will need to be addressed, including: federal and state regulatory frameworks; siting and permitting; rights-of-way or eminent domain for pipeline transport; property rights (including mineral rights and water rights); risk issues, insurance, and long-term ownership and control post-closure for storage facilities; and public acceptance.

The 2025 timeframe for the commercial availability of ACT integrated with CCS has been noted by several policy-makers.[46] Labor officials such as AFL-CIO Industrial Union Council executive director Robert Bauch have also noted the timing issue:

> We're worried about the ability to move carbon capture and sequestration. It's a riddle the world has to solve. It could become the source of many new jobs, but we're worried about the **timing.**"[47]

In addition, note the large amount of additional government and private sector funding—about **$800 million to $1 billion annually for the next 25 years**—that will be necessary for RD&D of ACT and CCS.[48]

In sum, RD&D of ACT and CCS, coupled with widespread commercial deployment of new nuclear plants and ACT and CCS, would buy time for the development of the next generation of electric generation and transportation technologies. Such RD&D and deployment also would be far preferable to massive fuel switching from coal to natural gas in a carbon-constrained environment in the near term (a topic addressed in section VI below), and would be consistent with long-term goals. The importance of developing these technologies is also critical from an international perspective, given the heavy dependence of many large developing countries, such as China and India, on coal as their primary source of electricity.

V. Plug-In Hybrid Electric Vehicles And Electrification Of Transportation Can Reduce GHG Emissions.

Transport emissions are the second largest source of U.S. GHG emissions, so it is important that ways be found to reduce their contribution. One promising technology is the

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[46] See, *e.g.*, "No Deep Emission Cuts by Utilities Till 2025," Energy Daily (March 12, 2008); "Key House Democrat Ties Major CO2 Cuts For Coal To Storage Availability," Clean Air Report (March 20, 2008).

[47] "Green Around the Collar," Congressional Quarterly Weekly (March 30, 2008) (emphasis added).

[48] This $800 million-$1 billion annual figure does not include the costs of widespread commercialization of technologies, which is expected to be borne by the private sector.

development of PHEVs. In 2007 EPRI and the Natural Resources Defense Council (NRDC) released a comprehensive analysis of the potential GHG reductions in the U.S. from wide-scale introduction of PHEVs.[49] The research measures the impact of increasing numbers of PHEVs between 2010 and 2050, including potentially large fleets that would use electricity from the grid as their primary fuel source. Among the study's findings were:

- Widespread adoption of PHEVs can reduce GHG emissions from vehicles by more than 450 million tons annually in 2050.
- There is an abundant supply of electricity for transportation; a 60-percent U.S. market share for PHEVs would use 7-8 percent of grid-supplied electricity in 2050.
- PHEVs can improve nationwide air quality and reduce petroleum consumption by 3-4 million barrels per day in 2050.

In its PRISM analysis, EPRI assumes that PHEVs can comprise 10 percent of new light-duty vehicle sales by 2017 and 33 percent by 2030.

EISA contained a number of provisions to support PHEV development, including: funding PHEV manufacturing, battery research, PHEV conversion, electricity storage research, PHEV demonstration and near-term deployment and market assessment programs, and studies of integration with electric infrastructure and smart grid as well as how to maximize off-peak electricity use for PHEV charging and on-peak use of PHEV-stored electricity by the grid. PHEVs also qualify for various benefits given to other renewable transportation fuels. Full appropriations for EISA's PHEV provisions, including tax credits, will be necessary for continued orderly development of this technology.

Additional GHG emissions benefits can be realized through electrification of the transportation infrastructure. This can be implemented through electrification of truck stops,

[49] EPRI and NRDC, Environmental Assessment of Plug-In Hybrid Electric Vehicles, Palo Alto, CA (July 2007).

ports and airports, thereby avoiding the GHGs that would otherwise be emitted from idling trucks, ships and planes.

In sum, it is important that any climate legislation include provisions speeding up commercialization of PHEVs—including battery research and vehicle demonstration, deployment and commercialization—and providing for electrification of transport.

VI. Massive Fuel Switching From Coal To Natural Gas Would Have Serious Effects On The Economy.

In the electric utility sector, the principal concerns with strict and immediate GHG targets in the near term are the costs and economic distortions that would result from massive fuel switching from coal to natural gas. This would cause large price increases and supply constraints in the power sector,[50] as well as high prices and constrained supply in residential heating and feedstock industries such as chemical, petrochemical and fertilizer manufacturers. Many of these industries would likely either shut down or move overseas. Other industrial and commercial firms that rely on natural gas for fuel also would be substantially affected. Liquefied natural gas (LNG) imports are projected to increase, but they are more than offset by the combination of greater natural gas exports to Mexico and declining imports from Canada.[51] Moreover, LNG imports face siting challenges and geopolitical instability in developing countries that control supply.[52] On fuel switching generally, see Government Accountability Office, "Implications of Switching from Coal to Natural Gas" 5-6, 11-19 (May 1, 2008).

There ordinarily is considerable volatility in natural gas prices and markets, and massive fuel switching from coal to natural gas would exacerbate both prices and volatility. As an

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[50] Gas supply contracts in the power sector are typically set for long periods of time.

[51] G. Caruso, EIA "Annual Energy Outlook 2008," D.C. Chapter of American Association of Blacks in Energy (Apr. 28, 2008).

[52] Major weather events, such as a hurricane, could also produce high swings in electricity and natural gas prices as well as the price of CO_2 allowances.

example of the impact of major fuel switching from coal to natural gas, the additional natural gas price increases (beyond the reference case) under S. 2191 have been noted in several economic studies as follows:

- Nicholas Institute: 18 percent by 2020, 21 percent by 2030.
- MIT: 39 percent by 2020, 64 percent by 2030.

In addition to the economic dislocations outlined above, there are two other principal effects of massive fuel switching from coal to natural gas. The first is **destruction of electricity demand**—which, we submit, would 1) compel consumers to use less electricity and 2) be harmful to a healthy and growing economy. The second is the **diversion of investment capital from advanced climate technologies**—such as nuclear power plants and ACT and CCS—to building natural gas plants in order to reduce GHGs and meet rising baseload demand in the near term. Thus, at precisely the time that the power sector should be devoting critical investment to the development and commercial deployment of new nuclear plants and ACT and CCS (2010-2030), it could be channeling investment capital to natural gas in order to comply with stringent climate change legislation.

CLIMATE LEGISLATION COMPARISON (6-17-08)

	Absolute cap-and-trade **Markey** **H.R. 6186**	Absolute cap-and-trade **Waxman** **H.R. 1590**	Absolute cap-and-trade **Lieberman-Warner** **(S. 2191)**	Absolute cap-and-trade **Boxer Substitute** **to S. 3036**	Absolute cap-and-trade **Bingaman-Specter** **S. 1766**
Targets – Type	Mandatory; Absolute Reductions	Mandatory; Absolute Reductions	Mandatory; Absolute reductions	Mandatory; Absolute reductions	Mandatory; Absolute reductions
Targets – Power Sector Reductions	TBD; 85% capture requirement for plants constructed after 1/1/2009	TBD	TBD	TBD	TBD
Targets – Baseline/Timeframe	2005 levels by 2012 20% ↓ 2005 by 2020 85% ↓ 2005 by 2050	2009 levels by 2010 1990 levels by 2020 80% ↓ 1990 levels by 2050	2005 levels by 2012; 15% below by 2020 70% below by 2050	7 % ↓ 2006 levels by 2012[1] 39 % ↓ 2006 levels by 2030 72 % ↓ 2006 levels by 2050	2006 levels by 2020 1990 levels by 2030 60% below by 2050
Scope – Covered GHGs	CO_2, methane, N_2O, SF_6, PFCs, HFCs and NF_3 (others as determined by Administrator)	CO_2, methane, N_2O, SF_6, PFCs, HFCs (others as determined by Administrator)	CO_2, methane, N_2O, SF_6, PFCs, HFCs	CO_2, methane, N_2O, SF_6, PFCs, HFCs	CO_2, methane, N_2O, SF_6, PFCs, HFCs
Scope – Reporting Program	Mandatory; Develop new program	Mandatory; Develop new program	Mandatory; Develop new program	Mandatory; Develop new program	Mandatory; President's discretion
Scope – Covered Sectors	Power and large industrials; oil, coal and gas; CCS sites	As determined by Admin. to cover largest sources and most cost-effective opportunities to reduce	Power, industrial (petrol., HFC, PFC, SF_6 prod.), commercial	Power, industrial (petrol., HFC, PFC, SF_6 production), commercial	Power, energy-intense industry (oil, gas, coal, steel, aluminum. etc.)
Scope – Flexibility	Bank/borrow; 94% auction in 2012 →100% in 2020. Non-auctioned allowances for transitional assistance	Banking; Auction near 100% - potential for free allocation at President's discretion to uncapped sources	Bank/borrow; Allocation; Auction (26.5%→100%); Early action CR (5 yrs.)	Bank/borrow; Auction (24.5%→58.75 in 2032); Early action CR (5 yrs.)	Banking; Allocation; auction (24%→100%); Safety valve (TAP); Early action (1% limit)
Scope – Offsets/Off-system	Yes; 15% domestic; 15% international	Not addressed.	Yes; domestic projects (15% limit)	Yes; domestic & international projects (15-30%)	Limited by type; international (10% limit); sequestration
Scope – Agency to Administer	EPA and Office of Carbon Market Oversight w/ FERC	EPA; 5-year review of caps by National Academy of Sciences	EPA and Climate Change Credit Corp (CCCC)	EPA and various boards	President
Technology – RD&D	12.5% of auction proceeds for various funds; 4% for international clean tech fund	"Innovative" technologies for avoiding, reducing or sequestering	Coal; CCS; transport; Auction and allowance $ for CCCC	CCS; transport; Auction proceeds for various funds; Bonus allowances for CCS	Coal; CCS; transport; nuclear; Energy & International Technology Deployment Funds
Technology – Renewable Energy	Production payments through reverse auction and rebates for distributed generation	Bill sets 20% RPS by 2020	Auction and allowance $ for CCCC; Biomass	Auction proceeds for funds; Bonus allowances for renewable technologies.	Energy & Intl Technology Deployment Funds
Technology – Energy Efficiency	12.5% of auction proceeds for various energy efficiency programs	Bill mandates end-use energy efficiency improvements at "retail" facilities up to 1% of sales	Auction and allowance $ for CCCC; Incentives for energy efficiency technologies	Auction proceeds for funds; Incentives for energy efficiency technology	Energy Technology Deployment Fund, state auction $
Financial Issues – Costs & Recovery	TBD	TBD	$3 trillion in 2050 (US economy)	$1.28 trillion in 2050 (U.S. economy)	$12/t$CO_2$e TAP (increase 5%/yr.+ inflation)

[1] Reduction values based on EIA, "Energy Market and Economic Impacts of S. 2191, the Lieberman-Warner Climate Security Act of 20907" v (Apr. 2008).

Mr. BOUCHER. Thank you very much, Mr. Kuhn.
Admiral Bowman.

STATEMENT OF ADMIRAL FRANK L. BOWMAN, U.S. NAVY (RETIRED), PRESIDENT AND CHIEF EXECUTIVE OFFICER, NUCLEAR ENERGY INSTITUTE

Admiral BOWMAN. Thank you, Mr. Chairman, Ranking Member Upton and Ranking Member Barton. Thank you very much to the committee for allowing me this opportunity to represent the nuclear energy industry at this hearing to discuss these legislative proposals. I am retired Admiral Skip Bowman, president and chief executive officer of the Nuclear Energy Institute.

NEI has taken no specific position on the various legislative proposals currently before Congress. Nonetheless, NEI is deeply engaged in and committed to the debate over climate policy. A year ago the NEI executive committee endorsed a set of principles establishing the nuclear industry's policy on climate change. Those principles included support for federal action or legislation to reduce greenhouse gas emissions. NEI and I personally believe that federal action through legislation cannot wait for completion of the technologies needed to mitigate carbon emissions and that federal action must be implemented now but must place immediate emphasis on approaches and technologies that can be deployed in the early years.

Let me address two issues that should be recognized and reflected in any legislative initiative to control carbon. First, we see a growing consensus that any credible program to reduce greenhouse gas emissions in the United States and worldwide will require a portfolio of technologies similar to what Mr. Kuhn just said, technologies and approaches and that nuclear energy is an indispensable part of that portfolio. This conclusion that nuclear power is an essential component of any carbon reduction initiative is unambiguous, it is beyond question and is supported by an impressive body of mainstream research and analysis. I just counted eight of these recent reports including a report from the National Academies of Sciences of 13 countries just last week, including the United States and indeed all of the G8 countries.

Second, we believe it is imperative to address the major investment challenge facing the electric power sector as it seeks to develop and deploy the low-carbon and zero-carbon technologies necessary to reduce greenhouse gas emissions. Federal climate legislation must obviously include targets and timetables for carbon reduction but legislation must also help industry be provided with the technology and the means to achieve those targets and timetables. In our view, that will require an aggressive program of financing support; more aggressive and ambitious than anything in place today.

Analyses of the various legislative proposals the subcommittee is considering today, including the modeling conducted by the Environmental Protection Agency and the Energy Information Administration, all show that nuclear plant construction must accelerate in a carbon-constrained world. In NEI's analysis of the Lieberman-Warner bill, the model forecasts more new nuclear capacity than could realistically be built, and in those modeling runs where nu-

clear energy expansion is constrained, carbon emissions and carbon prices are higher, electric sector consumption of natural gas soars, electricity and gas prices are higher, and GDP losses are much greater. Let me assure you that the U.S. nuclear industry hears this call to action and is moving forward as quickly as we can to license, finance and build new nuclear plants in the United States. Seventeen companies or groups of companies are preparing license applications for as many as 31 new reactors, nine applications for construction and operating license are currently under review by the Nuclear Regulatory Commission for a total of 15 new plants.

But for new nuclear plant construction, one of the most significant financing challenges is the cost of these projects relative to the size, market value, and financing capability of the companies that will build them. New nuclear power plants are expected to cost as least $6 to $7 billion in today's money. U.S. electric power companies simply do not have the size, the financing capability, or the financial strength to finance these projects on balance sheets on their own. These first projects must have financing support, either loan guarantees from the Federal Government or assurance of investment recovery from State governments, or both. We should not confuse those loan guarantees with subsidies. They are not. Every penny of the cost is borne by the industry. The modest loan guarantee program authorized by the 2005 Energy Policy Act was a small step in the right direction but it does not represent a sufficient response to the urgent need to rebuild our critical electric infrastructure. Limits imposed by appropriations report language have resulted in loan guarantee volumes that will not begin to cover the project cost. Time limits imposed by that report language have introduced uncertainty into the process. We believe the United States will need something similar to the clean energy bank concept now under consideration by a number of members of Congress. Creation of this financing entity should be an integral part of any climate change legislation.

Mr. Chairman, I appreciate the opportunity to testify and look forward to questions.

[The prepared statement of Admiral Bowman follows:]

STATEMENT OF FRANK L. BOWMAN

On behalf of the nuclear energy industry, the Nuclear Energy Institute (NEI) appreciates the opportunity to discuss legislative proposals to reduce greenhouse gas emissions.

NEI is responsible for defining and implementing nuclear industry policy on generic regulatory, financial, technical and legislative issues. NEI members include all companies licensed to operate commercial nuclear power plants in the United States, and hundreds of other companies and organizations that provide equipment, fuel and services to the nuclear energy industry.

NEI has taken no position on the specific legislative proposals currently before Congress. We leave to others the complex policy issues of how best to structure a program to reduce carbon emissions. Nonetheless, NEI is deeply engaged in, and committed to, the debate over climate policy. A year ago, the NEI Executive Committee endorsed a set of principles establishing nuclear industry policy on climate change. Those principles included support for federal action or legislation to reduce greenhouse gas emissions.

In this statement let me address two issues that should, we believe, be recognized and reflected in any legislative initiative to control carbon emissions.

First, we see a growing consensus that any credible program to reduce greenhouse gas emissions in the U.S. and worldwide will require a portfolio of technologies and

approaches, and that nuclear energy is an indispensable part of that portfolio. This conclusion is supported by an impressive body of mainstream research and analysis.

And second, we believe it is imperative to address the major investment challenge facing the electric power sector as it seeks to develop and deploy the low-carbon and zero-carbon technologies necessary to reduce greenhouse gas emissions. Federal legislation must obviously include targets and timetables for carbon reduction, but legislation must also help provide industry the technology and the means to achieve those targets and timetables. In our view, that will require an aggressive program of financing support-more aggressive and ambitious than anything in place today.

The growing body of mainstream research and analysis shows that nuclear power is an important part of the portfolio required to reduce carbon emissions. The most recent came from the Organization for Economic Cooperation and Development (OECD)'s International Energy Agency (IEA) last week. The IEA's 2008 Energy Technologies Perspective asserts that "A global revolution is needed in ways that energy is supplied and used. Far greater energy efficiency is a core requirement. Renewables, nuclear power, and CO_2 capture and storage must be deployed on a massive scale."

Last week's IEA report amplifies the findings in its World Energy Outlook, the pre-eminent global energy forecast, which was published earlier this year. In the 2008 edition of that forecast, the IEA analyzed what must be done to stabilize the concentration of CO_2 in the atmosphere at 450 parts per million (ppm)—the level judged necessary by the Intergovernmental Panel on Climate Change to avoid irreversible damage. In that scenario, world nuclear generating capacity more than doubles—from 368 gigawatts today to 833 gigawatts in 2030. Even with this ambitious growth, the additional nuclear capacity does not shoulder the entire carbon reduction load: end-use energy efficiency, improved efficiency of coal-fired power plants, and major gains in CO_2 capture and storage are also necessary.

This conclusion—that nuclear power is an essential component of any carbon reduction initiative—is unambiguous and beyond question. It is shared by leaders and governments around the world, including Yvo de Boer, Executive Secretary of the United Nations Framework Convention on Climate Change. Mr. de Boer said last July that he had never seen a credible scenario for reducing carbon emissions that did not include nuclear energy.

In addition to policy leaders, the world's scientific community agrees that nuclear energy must play a significant role in meeting the dual challenges of electricity production and greenhouse gas reduction. The most recent assessment report from the Intergovernmental Panel on Climate Change identifies nuclear energy as one of the "key mitigation technologies."

Closer to home, analyses of the various legislative proposals that have come before Congress, including the modeling conducted by the Environmental Protection Agency and the Energy Information Administration, all show that nuclear plant construction must accelerate in a carbon-constrained world. In EIA's analysis of the Lieberman-Warner legislation, the model forecasts more new nuclear capacity than could realistically be built during the forecast period. And in those modeling runs where nuclear energy expansion is constrained, carbon emissions and carbon prices are higher, electric sector consumption of natural gas soars, electricity and gas prices are higher, and GDP losses are greater.

Given that additional nuclear power is essential, what then must we do to ensure development and deployment of nuclear energy and the other clean energy technologies necessary to address the climate challenge?

We must start by facing the facts. The United States is increasingly dependent on older, less efficient, more costly generating capacity. We have roughly one million megawatts of electric generating capacity today, and almost one-half of that is more than 30 years old. Almost 20 percent is more than 40 years old. Continuing to operate that older, less efficient, generating capacity, continuing to defer capital investment in newer, cleaner, more efficient generating technologies, is frustrating our ability to achieve cleaner air and reduce carbon emissions, and will continue to do so.

Consensus estimates show that the electric sector must invest at least $1 trillion between now and 2020 for new generating capacity, new transmission and distribution, efficiency programs, and environmental controls. That is more than the book value of the entire existing electric power supply and delivery system, and it does not include the cost of carbon controls. Addressing this investment challenge—and we must address this problem—will require innovative approaches to financing.

Meeting these investment needs will require a partnership between the private sector and the public sector. The times demand innovative approaches, combining all the financing capabilities and tools available to the private sector, the Federal Government and State governments.

In terms of new nuclear plant construction, one of the most significant financing challenges is the cost of these projects relative to the size, market value and financing capability of the companies that will build them.

New nuclear power plants are expected to cost at least $6 to 7 billion. U.S. electric power companies do not have the size, financing capability or financial strength to finance new nuclear power projects on balance sheet, on their own-particularly at a time when they are investing heavily in other generating capacity, transmission and distribution infrastructure, and environmental controls. These first projects must have financing support-—either loan guarantees from the Federal Government or assurance of investment recovery from State governments, or both.

The states are doing their part. Throughout the South and Southeast, state governments have enacted legislation or implemented new regulations to encourage new nuclear plant construction. Comparable Federal Government commitment is essential.

The modest loan guarantee program authorized by the 2005 Energy Policy Act was a small step in the right direction, but it does not represent a sufficient response to the urgent need to rebuild our critical electric power infrastructure. We believe the United States will need something similar to the Clean Energy Bank concept now under consideration by a number of members of Congress—a government corporation, modeled on the Export-Import Bank and the Overseas Private Investment Corporation, to provide loan guarantees and other forms of financing support to ensure that capital flows to clean technology deployment in the electric sector. Creation of such a financing entity should be an integral component of any climate change legislation.

Such a concept serves at least two national imperatives.

First, it addresses the challenge mentioned earlier—the disparity between the size of these projects relative to the size of the companies that will build them. In the absence of a concept like a Clean Energy Bank, new nuclear plants and other clean energy projects will certainly be built, but in smaller numbers over a longer period of time.

Second, federal loan guarantees provide a substantial consumer benefit. A loan guarantee allows more leverage in a project's capital structure, which reduces the cost of capital, in turn reducing the cost of electricity from the project. Electricity consumers—residential, commercial and industrial—are already struggling with increases in oil, natural gas and electricity prices. The high cost of energy and fuel price volatility has already compromised the competitive position of American industry. We know that the next generation of clean energy technologies will be more costly than the capital stock in place today. In this environment, we see a compelling case for federal financing support that would reduce consumer costs.

If it is structured like the loan guarantee program authorized by Title XVII of the 2005 Energy Policy Act, in which project sponsors are expected to pay the cost of the loan guarantee, such a program would be revenue-neutral and would not represent a subsidy.

The public benefits associated with a robust energy loan guarantee program—lower cost electricity, deployment of clean energy technologies at the scale necessary to reduce carbon emissions-are significant. That is why the U.S. government routinely uses loan guarantee programs to support activities that serve the public good and the national interest—including shipbuilding, steelmaking, student loans, rural electrification, affordable housing, construction of critical transportation infrastructure, and for many other purposes.

Achieving significant expansion of nuclear power in the United States will require stable and sustained federal and state government policies relating to nuclear energy. The new nuclear power projects now in the early stages of development will not enter service until the 2016–2020. Like all other advanced energy technologies, continued progress requires sustained policy and political support.

In closing let me assure you that the U.S. nuclear industry is moving forward as quickly as we are able to license, finance and build new nuclear plants in the United States. Seventeen companies or groups of companies are preparing license applications for as many as 31 new reactors. Nine applications for construction and operating licenses are currently under review by the Nuclear Regulatory Commission for a total of 15 new plants.

We expect four to eight new U.S. nuclear plants in operation by 2016 or so. Assuming those first plants are meeting their construction schedules and cost estimates, the rate of construction would accelerate thereafter. With the necessary investment stimulus and financing support, we could see approximately 20,000 MW of new nuclear capacity (that would be about 15 plants) on line in the 2020 to 2022 time frame, and 65,000 to 70,000 megawatts (or 45 to 50 plants) by 2030.

These plants will produce clean, safe, reliable electricity, around the clock, at a stable price, immune to price volatility in the oil and natural gas markets.

But construction of these new nuclear plants will have other benefits too. At the peak of construction, a nuclear plant will employ 2300 skilled workers and, on completion, approximately 700 workers to operate and maintain the plant. New nuclear plant construction will also lead to new investment in the supply chain—in new manufacturing facilities to produce pumps, valves, pipe, electrical cable, and other equipment and components. That will create more jobs, new opportunities and higher economic growth, and allow the United States to reclaim economic opportunity that has moved overseas over the last several decades.

Mr. BOUCHER. Thank you, Admiral Bowman.

We have a series of four votes pending on the Floor of the House, and experience tells us that completing that work will take approximately 45 minutes, and so we have two additional witnesses to testify on this panel followed by questions from members here and then an entire second panel of witnesses following that. With apologies to our witnesses and with the hope that you can be patient for a bit longer, we are going to recess the subcommittee and reconvene here at about 12:15. So with that said, the subcommittee stands in recess.

[Recess.]

Mr. BOUCHER. The subcommittee will come to order, and with the apologies of the Chair for our delay, I want to thank everyone here for their patience. We had concluded Admiral Bowman's testimony at the time of the recess of the subcommittee, and Ms. Minette is next, so we will be very pleased to receive your oral summary.

STATEMENT OF MARY MINETTE, DIRECTOR FOR ENVIRONMENTAL EDUCATION AND ADVOCACY, EVANGELICAL LUTHERAN CHURCH IN AMERICA

Ms. MINETTE. Thank you, Mr. Chairman, and thank you to the Subcommittee. I am here today representing the Evangelical Lutheran Church in America, which is the spiritual home to about 4.9 million Lutherans around the country, and also the National Council of Churches, which represents 35 Christian denominations including my own.

As members of the NCC, we may not agree on how to take communion on Sunday but we all agree that climate change is one of the most pressing issues facing God's creation. As Christians who are called to protect God's planet and God's people, we are obligated to speak and to act in response to this moral crisis. Christ taught us to seek justice, to care for our neighbor and to provide special care and consideration for the least of these, those living in poverty. Our response to climate change must reflect this call to justice, particularly for those living in poverty around the world who are least responsible for climate change and most likely to suffer greatly from its impacts if we do not act now. God's first command to us in the book of Genesis was to tell and tend what God had made. The language there is about stewardship, caring for resources that are not your own and recognizing that humans are part of a network of creation.

In early 2006, the NCC and our interfaith partners developed a set of principles based on justice and stewardship that we have used as a lens to evaluate each of the legislative proposals that

have been introduced in the 110th Congress and that this committee is considering today. We have identified three main policy priorities which must be included in legislation in order to protect God's creation and God's people.

First, as a matter of stewardship, we must acknowledge the recommendations of the scientific community and work to ensure that the average global temperature does not increase by more than 2 degrees Celsius. Recent reports indicate that to meet this goal, we must reduce our emissions by 15 to 20 percent by 2020 and at least 80 percent by 2050. Next, we know that inaction on climate change will harm those living in poverty the most but we also must ensure as a matter of justice that low-income consumers are not pushed further into poverty by the burden of higher energy costs due to climate legislation. Finally, justice requires that we acknowledge our role as a nation in contributing to climate change and calls for international adaptation assistance for vulnerable developing nations who are least responsible for climate change yet are already suffering from its effects. Adaptation assistance would allow these countries to develop plans to prevent the most serious devastation while also providing financial support for disaster relief.

America's Climate Security Act, the legislation sponsored by Senators Lieberman and Warner, calls for 15 percent emissions reduction by 2020 and 65 percent by 2050, which falls short of our long-term goals. The bill would provide financial assistance to low-income consumers but would not provide enough funding in the bill's early years to offset rising costs for people in poverty and only 30 percent of the bill's consumer assistance funds are set aside for low-income consumers. The legislation also includes international adaptation assistance for developing nations. The faith community worked closely with Senator Warner on this program and we applaud his leadership and the leadership of Senator Boxer, who worked to expand funding for adaptation assistance in the substitute bill.

The Low Carbon Economy Act, sponsored by Senators Bingaman and Specter, fails to meet the criteria established by our faith principles. With relatively low emissions reduction, minimal assistance to low-income consumers and no funding for international adaptation assistance, the faith community has concerns about the impacts of this legislation on God's creation and God's people.

House legislation includes the Safe Climate Act, introduced by Congressman Waxman, long a leader on the issue of climate change. The bill calls for strong emissions reductions that meet our faith principles. However, it does not specifically address domestic energy assistance or international adaptation assistance. Congressman Markey introduced the Investing in Climate Action and Protection Act, ICAP, in June, which requires the United States to reduce its greenhouse gas emissions to 85 percent below 2005 levels by 2050, meeting the standards set in our faith principles. In addition, it provides for a tax refund and energy rebates that will help 80 percent of Americans with energy costs including low-income Americans. The legislation also provides adaptation assistance to developing nations of about $180 billion over the life of the bill.

I also would like to briefly mention a bill that we were not asked to consider, which is the Climate Matters bill, which was intro-

duced just this week by Congressman Doggett, which we feel also meets our call for stewardship and justice, calling for strong emissions reductions, financial assistance to low-income and middle-income families suffering from rising energy costs, and international adaptation assistance.

All of these bills are important. They may take different approaches and we may have different perspectives on their ultimate effectiveness but each of them represents real leadership on the part of their sponsors and cosponsors. The legislators who have introduced these bills are those who see our change in climate, and from their different political perspectives want to do something about it to protect our common future and the future of this plant. I urge the members of the subcommittee to join them in working for stewardship of God's good creation and justice for people in poverty. The urgency of this issue cannot be overstated and our obligation cannot be ignored.

Thank you very much for your time.

[The prepared statement of Ms. Minette follows:]

Statement for the Subcommittee on Energy and Air Quality
Mary Minette
Evangelical Lutheran Church in America and the
National Council of Churches of Christ in the USA
June 19, 2008

Climate change is one of the most important moral issues of our time because of the severe implications it has for the future of God's people and for all of God's creation. Already we are seeing impacts at both a local and global level—from melting ice sheets to increased storm events. The impacts of these global changes will continue to affect God's community both at home and abroad.

The Evangelical Lutheran Church in America (ELCA), in conjunction with the National Council of Churches of Christ in the USA (NCC) and its 35 member denominations such as the Episcopal Church, the Presbyterian Church USA, and the United Methodist Church, has been working to address climate change for over a decade. Many of the NCC's member communions have taken action to reduce their own carbon emissions and have passed resolutions and developed social policies calling for action from the federal government to prevent catastrophic climate change. These policies and resolutions, combined with many examples of congregant and congregational action, provide ample evidence of the overwhelming concern for global warming within the Christian community. (See Appendix I-III for denominational statements)

Our Faithful Call:
As Christians, we are called to be good stewards of God's creation. In Genesis, humans are called to care for God's good creation (Gen 2:15; 1:31) and to enable the fruitfulness with which God has blessed creation (Gen 1:11, 22) to continue. God made a protective covenant with all life (Gen 9:9-17). As Christians, we remember our responsibility to "provide for the redemption of the land" (Lev 25:24) for we know that the Earth is the Lord's (Ps 24:1). As Christians, we also look forward to the day when God will fulfill the promise to reconcile what God made- bringing a new heaven *a new earth* out of the present state of our planet. (Revelation 21) Our current actions are having devastating ecological consequences; we are not being good stewards of that which God has put into our hands and under our feet (Ps 8; Gen 9:2-3).

As people who take the Scriptures seriously, we also care about social justice and we have a duty to protect vulnerable communities around the world. Christ calls us to protect the vulnerable and minister to those in need (Matthew 25:40-45). The Bible proclaims an unmistakable priority for those living in poverty, and calls for justice for the oppressed and the marginalized. (Leviticus 26:34-35). Especially when we as a nation are contributing more than our fair share to the global warming problem, it is our responsibility to respond faithfully to the demands of God's justice. International agencies, scientific panels, and the evidence of our own work around the world tell us that the effects of global warming are already harming and will continue to have the

greatest impact on those living in poverty. This includes those living in developing countries as well as those in our own communities.

What Science Indicates

Numerous studies, such as the recent reports of the Intergovernmental Panel on Climate Change (IPCC), highlight how global warming impacts are already being felt around the globe. Oceans are progressively acidifying, which is negatively impacting coral reefs and fish populations. At least 20 percent of the world's species are at increased risk of extinction with a predicted 1.5-2.5 degree Celsius increase in global temperatures over the next century. Sea level rise caused by melting Arctic ice is expected to flood coastal communities, causing severe infrastructure damage that will affect millions of individuals.

Decreasing snow pack in the United States and around the globe will lead to decreased availability of fresh water. Rising sea levels and an increased number of extreme weather events will threaten communities not only globally but also across the United States. Increased incidence of drought will lead to shortages of food not only in countries already experiencing hunger, but also in places where hunger has become less common.

According to the IPCC, global climate change is already affecting communities and people around the world. In 2005, more than 20 million people were negatively affected by changes in agricultural production due to various changes in the climate including increased floods and droughts. As the climate grows warmer, food insecurity will increase in places where food is already scarce, like many countries in Africa, and will also rise in parts of the world that have seen progress in the fight against hunger like Latin America. An additional 90 million people who already live in poverty could be at risk of hunger and malnutrition in this century. One to two billion people will face water scarcity this century and by 2020 approximately 250 million will face water scarcity in Africa. Millions of individuals around the world will be at greater risk of contracting diseases such as malaria, dengue fever, and West Nile virus because of climactic changes and increasing ranges for the insects that carry these disease vectors. Each of these impacts will fall most heavily on those living in poverty and other vulnerable populations who are dependent on their natural environment for their day-to-day survival.

The scientific community, in addition to providing us with a better understanding of climate change, has also provided us with the knowledge to solve this global crisis. In order to prevent catastrophic climate change that will occur if global temperatures continue to increase, we must reduce our greenhouse gas emissions, particularly carbon dioxide, by at least 80 percent by the year 2050. To protect God's creation—both human and nonhuman— now and in the future, we must act now.

Our Response

God's planet and people are already suffering from climate change and it is our duty and call to serve justice and be good stewards of God's creation by acting now to reduce

carbon emissions and provide assistance to those who will be impacted by global warming and climate mitigation.

Since the early 1990s, the ELCA and our partners in the NCC have been working to educate its members about the impacts individuals and society are having on God's Earth. Many individuals of faith, communities, and congregations have been actively changing their lifestyles to reduce their carbon footprint, switching their church buildings to renewable sources of power and calling on their elected officials to take a leadership role on climate change. Prayerful reflection on the consequences of global warming makes it clear that immediate action is required to stop climate change. Our concern is rooted in our Christian call for stewardship and justice. The impacts of global warming highlight how we have failed to be good stewards of God's creation and are failing to provide justice for the most vulnerable among us.

The faith community is also calling on the federal government to take action. We believe we must make economy-wide reductions as well as changes in our personal lifestyles in order to curb greenhouse gas emissions In addition we must work to conserve the energy we use, make our systems more efficient, and take advantage of renewable sources of energy such as wind and solar power. Congress must implement measures that will prevent the catastrophic impacts that have been predicted if we continue with business as usual. Our actions at both a national, local, and individual level must ensure that we create a bountiful future for our children and grandchildren.

One area of particular concern is the impacts of climate change on low income people and communities of color in the United States who be disproportionately impacted by the effects of climate change. The African American community, in particular, will be adversely affected by both the impacts of climate change and climate change mitigation. African Americans, because they are more likely to live in poverty are more likely to suffer from extreme heat events. Because of predictions of higher energy costs with climate mitigation, African American households, which spend a higher fraction of their income on energy purchases than any other segment of the U.S. population because they are more than twice as likely to live in poverty, will be severely impacted. The burden of both climate change and climate change mitigation will fall most heavily on communities of color and those living in poverty, thus, climate legislation must include mechanisms to reduce the burden on these populations.

It is clear that the U.S. must act now in order to prevent the impacts of climate change from damaging communities and cultures in the U.S. and across the globe. As we have gained a better understanding of the present and future impacts of climate change it has become clear that we cannot address poverty without addressing global warming and we cannot address global warming without addressing poverty.

Faith Principles on Global Warming and Policy Priorities:
In early 2006, the ELCA in conjunction with the NCC and its member denominations developed "Faith Principles on Global Warming" to serve as an educational tool, but

more importantly to provide a lens to examine climate change legislation. These Faith Principles (attached as Appendix IV to this testimony) include four overarching themes: justice, stewardship, sustainability and sufficiency. We believe that each of these principles is critical to the development of public policy that not only prevents catastrophic climate change but also protects the voiceless and the vulnerable.

The "Faith Principles" emphasize justice, reflecting our primary concern for those living in poverty around the world who are least likely to have contributed to global warming and will be most affected by climate change and climate legislation.

Stewardship of creation is also an important priority for people of faith and legislation must demonstrate care for all of God's creation, both human and non-human. Our call to stewardship dictates that we follow the recommendations of leading scientists in order to protect all of God's creation from present and future harm. The Intergovernmental Panel on Climate Change has stated that we must reduce emissions by as much as eighty percent by 2050 with short term goals of up to twenty five percent by 2020 and we will continue to evaluate all legislation for adherence to this critical goal.

The principle of sustainability calls for policies that provide an acceptable quality of life for present generations without compromising that of future generations. In addressing global warming, we must make investments in clean, renewable energy that ensure a good quality of life for humanity while ensuring that the health and well-being of creation and the quality of life for future generations are not compromised by our actions.

Finally, the principle of sufficiency recognizes that we cannot achieve significant reductions in global warming emissions unless we make changes in our lifestyles, and particularly in our energy consumption, through adopting conservation measures and embracing energy saving innovations in our homes, our communities, our businesses and our places of worship as well as in the halls of government and in our transportation systems.

In addition to the principles we have identified three policy elements that must be included in climate legislation in order to protect all of God's creation and God's people:

1. **Climate legislation must heed the most up to date recommendations of the scientific community with regard to greenhouse gas emission reductions.** Currently this means legislation must ensure that we do not increase the Earth's temperature by more than two degrees Celsius and reduce global warming emissions by approximately 15-20 percent by 2020 and by 80 percent by 2050.

2. **Legislation must protect those living in poverty in the U.S. from the impacts of climate change and climate legislation.** Those living in poverty in the U.S. will be the least able to prepare for and adapt to the changes taking place in our climate and our economy. Legislation must hold those living in poverty harmless and ensure that they do not bear the burden of any increases in energy costs. In addition, it must ensure that it is not pushing people into poverty and provides for

those whose jobs are impacted by climate legislation.

3. **Legislation must provide adaptation assistance for those living in poverty abroad.** Those living in the most vulnerable developing nations around the world bear little responsibility for global warming and are already feeling the burden of climate change, with little ability to adapt to these impacts. Through adaptation assistance, the U.S. can prevent the destruction of vulnerable communities around the world and help with climate relief.

Climate Legislation

In recent years various versions of climate legislation have been introduced, each providing a unique look at climate change and the path to solving this moral crisis. Four particular bills have been introduced in the 110th Congress, each of which, when examined through the lens of our Faith Principles, has strengths and weaknesses.

Senate Legislation

The Senate has already addressed climate legislation in the 110th Congress and in preparation for the debate worked with three different bills. The first bill introduced by Senators Lieberman and Warner provided the basis for discussion, with policy elements taken from legislation developed by Senators Bingaman and Specter.

I. America's Climate Security Act (S.2191)

Introduced by Senators Lieberman and Warner with the support of Senator Boxer, America's Climate Security Act provides a step forward for climate policy.

1. Emissions Reductions

The bill calls for emissions reductions of 15 percent by 2020 and 65 percent by 2050 which would provide strong short term reductions and would put the United States on the right path for strong long term reductions. However the bill fails to require sufficient long term greenhouse gas reductions as outlined by the international scientific community and called for by the faith community.

2. Domestic Energy Rebate

In addition, S. 2191 provides financial assistance to low income consumers through established energy programs such as the Low Income Home Energy Assistance Program (LIHEAP) and financial assistance to low income utility customers. The funding provided to the energy programs creates two problems; these programs do not reach the vast majority of low income Americans and the funding provided in this bill is not enough to expand the programs in an effective manner.

3. International Adaptation Assistance

Senator Warner worked closely with the faith community in developing the international adaptation assistance language included in S. 2191. The language as developed by the Senator provides assistance to developing countries through USAID that would work to both prevent climate impacts and provide financial relief to those communities and countries devastated by climate change.

However, the funding provided in S. 2191 was inadequate to meet the needs of developing nations around the world, with only five percent of the auction revenue provided for this provision.

II Boxer-Lieberman-Warner Climate Security Act (S. 3036)

This substitute bill introduced by Senator Boxer together with Senators Lieberman and Warner made some crucial changes and would have provided greater financial support for those living in poverty around the world.

1. Emissions Reductions
The greenhouse gas emissions reductions outlined in S. 3036 were the same as those outlined in America's Climate Security Act (S. 2191). (see notes above for ELCA/NCC commentary)

2. Domestic Energy Rebate
S. 3036 provided greater support for those living in poverty than the initial bill (S. 2191). Two primary sections of this legislation provided financial resources to be used to assist U.S. consumers.

First, money was provided ($800 billion from 2012-2050) to fund tax breaks for consumers to help them offset the cost of increased energy prices that would result from climate change legislation. Though conceptually appropriate, the yearly financial assistance would not be enough to provide for those in the greatest need, nor is there a guarantee that financial assistance would be provided for those living in poverty. The money generated in the early years of the legislation, the time when consumers would be the hardest hit, is far too low to adequately provide for those in need.

The second area where assistance was provided to the consumer was through funds provided to local distribution companies (LDCs). LDCs were required to use these funds to help consumers offset their increased electricity cost while also investing in energy efficiency technology for consumers. Though S. 3036 would provide twelve percent of the carbon allowance value to these companies, they would be required to provide only three percent to assist low income individuals and households, which is again too little to help those in need.

3. International Adaptation Assistance
The international adaptation assistance fund in S. 3036 made substantial improvements to S. 2191. First and foremost, more financial assistance was

provided for eligible countries. Approximately $324 billion was allocated to this fund over the life of the bill (2012-2050). In addition, small but important language changes were made to the legislation, most importantly the inclusion of "most vulnerable developing nations" as those nations eligible for financial assistance through this fund. Each of these made significant positive changes to the legislation.

III. Low Carbon Economy Act of 2007 (S. 1766)

Introduced by Senators Bingaman and Specter, S. 1766 (as noted below) does not meet many of the requirements laid out by the Faith Principles.

1. Emissions Reductions
The emissions reductions resulting from this legislation would reduce greenhouse gas emissions to 2006 levels by 2020 and to 1990 levels by 2030. These reductions are not strong enough to meet the recommendations outlined by the scientific community, which require, at a minimum, emissions reductions that are 20 percent below 2006 levels by 2020.

2. Domestic Energy Rebate
This legislation provides assistance for those living in poverty through various programs. These programs include support for the Low Income Home Energy Assistance Program, weatherization programs, and rural energy assistance. Though these programs would assist low income households, they do not have the ability to reach the majority of those who may be impacted by climate change legislation.

3. International Adaptation Assistance
This legislation does not include financial assistance for international adaptation in the most vulnerable developing nations.

House Legislation

I. Safe Climate Act – (H.R. 1590)

The Safe Climate Act introduced by Congressman Waxman currently has 152 cosponsors. However, this bill does not provide specific funding to aid those living in poverty around the world in adapting to climate change. It also does not provide specific assistance for low-income Americans in dealing with rising costs of energy and other impacts of climate change and climate change legislation.

1. Emissions Reductions
This legislation calls on the Environmental Protection Agency to address climate change mandating the U.S. to reduce its emissions by 20 percent by 2020 and then by 80 percent by 2050. We are supportive of the emissions reductions that would

be required under this legislation as it meets the call for stewardship for all of God's creation in our Faith Principles.

2. Domestic Climate Rebate
This legislation simply requires that the Environmental Protection Agency (EPA) address the issue of climate change. It does not address consumer protection through energy rebates leaving the EPA to design this element.

3. International Adaptation Assistance
Again, the Safe Climate Act does not call for international adaptation assistance. The structure of the bill simply requires the EPA to ensure that the United States' emissions reductions are appropriate for preventing catastrophic climate change.

II. Investing in Climate Action and Protection Act (ICap) (H.R. 6186)

Introduced in June by Congressman Markey, ICap also works through the EPA but establishes a larger and more comprehensive program for addressing climate change than H.R. 1590

1. Emission Reductions
The bill calls for strong emissions reductions requiring the U.S. to reduce its greenhouse gas emissions to eighty five percent below 2005 levels by 2050. This, as noted before, meets the standards set forth in the Faith Principles document.

2. Domestic Energy Rebates
ICap includes tax refunds and rebates for middle and low income households to offset any increase in electricity/energy costs associated with climate change legislation. In total, more than half of the revenue generated by the auction goes back to U.S. consumers to help them maintain their purchasing power.

This bill provides rebates through an electronic transfer benefits card to the lowest income Americans, many of whom do not earn enough income to file taxes. According to studies by the Congressional Budget Office and the Center on Budget and Policy Priorities, the 7 percent allocated for rebates to low income individuals and families is enough to help those in the bottom quintile of our economy.

In addition, the bill provides tax refunds for 80 percent of the American public. These refunds are designed to hold consumers harmless by offsetting the increases in costs experienced under climate legislation.

3. International Adaptation Assistance
This legislation provides support for those in the most vulnerable developing nations, noting that climate change is a threat multiplier and may lead to increased migration, floods, droughts, and community impacts. In the early years this legislation provides 2 percent of the auction proceeds for this purpose increasing

to 2.5 percent after 2020. This funding would provide $4 billion a year from 2012-2019 and $5 billion a year from 2020 until 2050 to help developing and impoverished nations mitigate climate change impacts.

III. Climate MATTERS

Introduced on June 17th by Congressman Doggett, this bill would also provide a strong base for climate legislation.

1. Emission Reductions
This legislation calls for emissions reductions that are 80 percent below 1990 levels by 2050, reductions that are in line with both scientific recommendations as well as the Faith Principles.

2. Domestic Energy Rebates
Similar to the legislation introduced by Congressman Markey, This bill provides funding for rebates to low income consumers that effectively identifies those with the greatest need and uses effective tools such as the electronic benefits transfer card to get these benefits to consumers in an efficient and timely manner.

Financial assistance is provided in the form of rebates and tax relief to the consumer. While the rebate program has the ability to cover the poorest of the poor in the U.S. (similar to the Markey bill) the tax relief would not be as extensive as the tax relief provided in the Markey legislation, covering up to the second quintile of the U.S. economy (approximately). With the inclusion of the rebate and tax relief program, this legislation sets a high standard and protects those living in poverty and and on the edge of poverty in the U.S..

3. International Adaptation assistance
Funding for international adaptation assistance is included in this bill and requires funding to be distributed through the U.S. Agency for International Development program for the most vulnerable developing nations. The legislation is not specific about how distribution will occur but leaves these decisions to the administrator of USAID. The faith community feels this is a crucial part of any climate legislation and would like to see more specificity in the language.

Appendix I

Evangelical Lutheran Church in America (ELCA)

Caring for Creation: Vision, Hope, and Justice

This social statement was adopted by a more than two-thirds majority vote as a social statement of the Evangelical Lutheran Church in America by the third Churchwide Assembly on August 28, 1993, at Kansas City, Missouri.

Prologue

Christian concern for the environment is shaped by the Word of God spoken in creation, the Love of God hanging on a cross, the Breath of God daily renewing the face of the earth.

We of the Evangelical Lutheran Church in America are deeply concerned about the environment, locally and globally, as members of this church and as members of society. Even as we join the political, economic, and scientific discussion, we know care for the earth to be a profoundly spiritual matter.

As Lutheran Christians, we confess that both our witness to God's goodness in creation and our acceptance of caregiving responsibility have often been weak and uncertain. This statement:

- offers a vision of God's intention for creation and for humanity as creation's caregivers;
- acknowledges humanity's separation from God and from the rest of creation as the central cause of the environmental crisis;
- recognizes the severity of the crisis; and
- expresses hope and heeds the call to justice and commitment.

This statement summons us, in particular, to a faithful return to the biblical vision.

I. The Church's Vision of Creation

A. God, Earth and All Creatures
We see the despoiling of the environment as nothing less than the degradation of God's gracious gift of creation.

Scripture witnesses to God as creator of the earth and all that dwells therein (Pss 24:1). The creeds, which guide our reading of Scripture, proclaim God the Father of Jesus Christ as "maker of heaven and earth," Jesus Christ as the one "through [whom] all things were made," and the Holy Spirit as "the Lord, the giver of life" (Nicene Creed).

God blesses the world and sees it as "good," even before humankind comes on the scene. All creation, not just humankind, is viewed as "very good" in God's eyes (Gen 1:31). God continues to bless the world: "When you send forth your spirit, they are created; and you renew the face of the ground" (Pss 104:30). By faith we understand God to be deeply, mysteriously, and unceasingly involved in what happens in all creation. God showers care upon sparrows and lilies (Mat 6:26-30), and brings "rain on a land where no one lives, on the desert, which is empty of human life" (Job 38:26).

Central to our vision of God's profound involvement with the world is the Incarnation. In Christ, the Word is made flesh, with saving significance for an entire creation that longs for fulfillment (Rom 8:18-25). The Word still comes to us in the waters of baptism, and in, with, and under the bread and wine, fruits of the earth and the work of human hands. God consistently meets us where we live, through earthy matter.

B. Our Place in Creation

Humanity is intimately related to the rest of creation. We, like other creatures, are formed from the earth (Gen 2:7, 9, 19). Scripture speaks of humanity's kinship with other creatures (Job 38-39; Pss 104). God cares faithfully for us, and together we join in singing the "hymn of all creation" (*Lutheran Book of Worship*, page 61; Pss 148). We look forward to a redemption that includes all creation (Eph 1:10).

Humans, in service to God, have special roles on behalf of the whole of creation. Made in the image of God, we are called to care for the earth as God cares for the earth. God's command to have dominion and subdue the earth is not a license to dominate and exploit. Human dominion (Gen 1:28; Pss 8), a special responsibility, should reflect God's way of ruling as a shepherd king who takes the form of a servant (Phil 2:7), wearing a crown of thorns.

According to Gen 2:15, our role within creation is to serve and to keep God's garden, the earth. "To serve," often translated "to till," invites us again to envision ourselves as servants, while "to keep" invites us to take care of the earth as God keeps and cares for us (Num 6:24-26).

We are called to name the animals (Gen 2:19-20). As God names Israel and all creation (Pss 147:4; Isa 40:26, 43:1) and as the shepherd calls by name each sheep (John 10:3), naming unites us in a caring relationship. Further, we are to live within the covenant God makes with every living thing (Gen 9:12-17; Hos 2:18), and even with the day and night (Jer 33:20). We are to love the earth as God loves us.

We are called to live according to God's wisdom in creation (Prov 8), which brings together God's truth and goodness. Wisdom, God's way of governing creation, is discerned in every culture and era in various ways. In our time, science and technology can help us to discover how to live according to God's creative wisdom.

Such caring, serving, keeping, loving, and living by wisdom sum up what is meant by acting as God's stewards of the earth. God's gift of responsibility for the earth dignifies

humanity without debasing the rest of creation. We depend upon God, who places us in a web of life with one another and with all creation.

II. The Urgency

A. Sin and Captivity
Not content to be made in the image of God (Gen 3:5; Ezek 28:1-10), we have rebelled and disrupted creation. As did the people of ancient Israel, we experience nature as an instrument of God's judgment (cf., Deut 11:13-17; Jer 4:23-28). A disrupted nature is a judgment on our unfaithfulness as stewards.

Alienated from God and from creation, and driven to make a name for ourselves (Gen 11:4), we become captives to demonic powers and unjust institutions (Gal 4:9; Eph 6:12; Rev 13:1-4). In our captivity, we treat the earth as a boundless warehouse and allow the powerful to exploit its bounties to their own ends (Amos 5:6-15). Our sin and captivity lie at the roots of the current crisis.

B. The Current Crisis
The earth is a planet of beauty and abundance; the earth system is wonderfully intricate and incredibly complex. But today living creatures, and the air, soil, and water that support them, face unprecedented threats. Many threats are global; most stem directly from human activity. Our current practices may so alter the living world that it will be unable to sustain life in the manner we know.

Twin problems--excessive consumption by industrialized nations, and relentless growth of human population worldwide--jeopardize efforts to achieve a sustainable future. These problems spring from and intensify social injustices. Global population growth, for example, relates to the lack of access by women to family planning and health care, quality education, fulfilling employment, and equal rights.

Processes of environmental degradation feed on one another. Decisions affecting an immediate locale often affect the entire planet. The resulting damages to environmental systems are frightening:

- depletion of non-renewable resources, especially oil;
- loss of the variety of life through rapid destruction of habitats;
- erosion of topsoil through unsustainable agriculture and forestry practices;
- pollution of air by toxic emissions from industries and vehicles, and pollution of water by wastes;
- increasing volumes of wastes; and
- prevalence of acid rain, which damages forests, lakes, and streams.

Even more widespread and serious, according to the preponderance of evidence from scientists worldwide, are:

- the depletion of the protective ozone layer, resulting from the use of volatile compounds containing chlorine and bromine; and
- dangerous global warming, caused by the buildup of greenhouse gases, especially carbon dioxide.

The idea of the earth as a boundless warehouse has proven both false and dangerous. Damage to the environment eventually will affect most people through increased conflict over scarce resources, decline in food security, and greater vulnerability to disease.

Indeed, our church already ministers with and to people:

- who know firsthand the effects of environmental deterioration because they work for polluting industries or live near incinerators or waste dumps;
- who make choices between preserving the environment and damaging it further in order to live wastefully or merely to survive; and
- who can no longer make their living from forests, seas, or soils that are either depleted or protected by law.

In our ministry, we learn about the extent of the environmental crisis, its complexities, and the suffering it entails. Meeting the needs of today's generations for food, clothing, and shelter requires a sound environment. Action to counter degradation, especially within this decade, is essential to the future of our children and our children's children. Time is very short.

III. The Hope

A. The Gift of Hope

Sin and captivity, manifest in threats to the environment, are not the last word. God addresses our predicament with gifts of "forgiveness of sins, life, and salvation" (Luther, *Small Catechism*). By the cross and resurrection of Jesus Christ, God frees us from our sin and captivity, and empowers us to be loving servants to creation.

Although we remain sinners, we are freed from our old captivity to sin. We are now driven to God's promise of blessings yet to come. Only by God's promise are we no longer captives of demonic powers or unjust institutions. We are captives of hope (Zech 9:11-12). Captured by hope, we proclaim that God has made peace with all things through the blood of the cross (Col 1:15-20), and that the Spirit of God, "the giver of life," renews the face of the earth.

Captured by hope, we dream dreams and look forward to a new creation. God does not just heal this creation wounded by human sin. God will one day consummate all things in "new heavens and a new earth, where righteousness is at home" (2Pet 3:13). Creation--now in captivity to disruption and death--will know the freedom it awaits.

B. Hope in Action

We testify to the hope that inspires and encourages us. We announce this hope to every

people, and witness to the renewing work of the Spirit of God. We are to be a herald here and now to the new creation yet to come, a living model.

Our tradition offers many glimpses of hope triumphant over despair. In ancient Israel, as Jerusalem was under siege and people were on the verge of exile, Jeremiah purchased a plot of land (Jer 32). When Martin Luther was asked what he would do if the world were to end tomorrow, he reportedly answered, "I would plant an apple tree today." When we face today's crisis, we do not despair. We act.

IV. THE CALL TO JUSTICE

Caring, serving, keeping, loving, and living by wisdom--these translate into justice in political, economic, social, and environmental relationships. Justice in these relationships means honoring the integrity of creation, and striving for fairness within the human family.

It is in hope of God's promised fulfillment that we hear the call to justice; it is in hope that we take action. When we act interdependently and in solidarity with creation, we do justice. We serve and keep the earth, trusting its bounty can be sufficient for all, and sustainable.

A. Justice Through Participation

We live within the covenant God makes with all living things, and are in relationship with them. *The principle of participation means they are entitled to be heard and to have their interests considered when decisions are made.*

Creation must be given voice, present generations and those to come. We must listen to the people who fish the sea, harvest the forest, till the soil, and mine the earth, as well as to those who advance the conservation, protection, and preservation of the environment.

We recognize numerous obstacles to participation. People often lack the political or economic power to participate fully. They are bombarded with manipulated information, and are prey to the pressures of special interests. The interests of the rest of creation are inadequately represented in human decisions.

We pray, therefore, that our church may be a place where differing groups can be brought together, tough issues considered, and a common good pursued.

B. Justice Through Solidarity

Creation depends on the Creator, and is interdependent within itself. *The principle of solidarity means that we stand together as God's creation.*

We are called to acknowledge this interdependence with other creatures and to act locally and globally on behalf of all creation. Furthermore, solidarity also asks us to stand with the victims of fire, floods, earthquakes, storms, and other natural disasters.

We recognize, however, the many ways we have broken ranks with creation. The land and its inhabitants are often disenfranchised by the rich and powerful. The degradation of the environment occurs where people have little or no voice in decisions -- because of racial, gender, or economic discrimination. This degradation aggravates their situation and swells the numbers of those trapped in urban or rural poverty.

We pray, therefore, for the humility and wisdom to stand with and for creation, and the fortitude to support advocates whose efforts are made at personal risk.

C. Justice Through Sufficiency

The earth and its fullness belong to the Lord. No person or group has absolute claim to the earth or its products. *The principle of sufficiency means meeting the basic needs of all humanity and all creation.*

In a world of finite resources, for all to have enough means that those with more than enough will have to change their patterns of acquisition and consumption. Sufficiency charges us to work with each other and the environment to meet needs without causing undue burdens elsewhere.

Sufficiency also urges us to care for arable land so that sufficient food and fiber continue to be available to meet human needs. We affirm, therefore, the many stewards of the land who have been and are conserving the good earth that the Lord has given us.

We recognize many forces that run counter to sufficiency. We often seek personal fulfillment in acquisition. We anchor our political and economic structures in greed and unequal distribution of goods and services. Predictably, many are left without resources for a decent and dignified life.

We pray, therefore, for the strength to change our personal and public lives, to the end that there may be enough.

D. Justice Through Sustainability

The sabbath and jubilee laws of the Hebrew tradition remind us that we may not press creation relentlessly in an effort to maximize productivity (Exod 20:8-11; Lev 25). *The principle of sustainability means providing an acceptable quality of life for present generations without compromising that of future generations.*

Protection of species and their habitats, preservation of clean land and water, reduction of wastes, care of the land--these are priorities. But production of basic goods and services, equitable distribution, accessible markets, stabilization of population, quality education, full employment--these are priorities as well.

We recognize the obstacles to sustainability. Neither economic growth that ignores environmental cost nor conservation of nature that ignores human cost is sustainable. Both will result in injustice and, eventually, environmental degradation. We know that a

healthy economy can exist only within a healthy environment, but that it is difficult to promote both in our decisions.

The principle of sustainability summons our church, in its global work with poor people, to pursue sustainable development strategies. It summons our church to support U.S. farmers who are turning to sustainable methods, and to encourage industries to produce sustainably. It summons each of us, in every aspect of our lives, to behave in ways that are consistent with the long-term sustainability of our planet.

We pray, therefore, for the creativity and dedication to live more gently with the earth.

V. COMMITMENTS OF THIS CHURCH

We of the Evangelical Lutheran Church in America answer the call to justice and commit ourselves to its principles--participation, solidarity, sufficiency, and sustainability. In applying the principles to specific situations, we face decisions made difficult by human limitation and sin. We act, not because we are certain of the outcome but because we are confident of our salvation in Christ.

Human behavior may change through economic incentive, guilt about the past, or fear about the future. But as people of biblical faith, who live together in trust and hope, our primary motivation is the call to be God's caregivers and to do justice.

We celebrate the vision of hope and justice for creation, and dedicate ourselves anew. We will act out of the conviction that, as the Holy Spirit renews our minds and hearts, we also must reform our habits and social structures.

A. As Individual Christians

As members of this church, we commit ourselves to personal life styles that contribute to the health of the environment. Many organizations provide materials to guide us in examining possibilities and making changes appropriate to our circumstances.

We challenge ourselves, particularly the economically secure, to tithe environmentally. Tithers would reduce their burden on the earth's bounty by producing ten percent less in waste, consuming ten percent less in non-renewable resources, and contributing the savings to earthcare efforts. Environmental tithing also entails giving time to learn about environmental problems and to work with others toward solutions.

B. As a Worshipping and Learning Community

1. The Congregation as a Creation Awareness Center Each congregation should see itself as a center for exploring scriptural and theological foundations for caring for creation.

Awareness can be furthered by many already in our midst, for example: Native people, who often have a special understanding of human intimacy with the earth; scientists, engineers, and technicians, who help us to live by the wisdom of God in creation; experts

in conservation and protection of the environment; and those who tend the land and sea. We also will learn from people suffering the severe impact of environmental degradation.

2. ***Creation Emphases in the Church Year*** Congregations have various opportunities during the year to focus on creation. Among these are Thanksgiving, harvest festivals, and blessings of fields, waters, and plants and animals. Many congregations observe Earth Day or Soil and Water Stewardship Week. As a church body, we designate the Second Sunday after Pentecost as Stewardship of Creation Sunday, with appropriate readings (as a development of the traditional Rogationtide).

3. ***Education and Communication*** This church will encourage those who develop liturgical, preaching, and educational materials that celebrate God's creation. Expanded curricula, for use in the many contexts of Christian education, will draw upon existing materials. We will promote reporting on the environment by church publications, and encourage coverage of this church's environmental concerns in public media.

4. ***Programs Throughout this Church*** This church commends the environmental education taking place through synodical and regional efforts; camps and outdoor ministries; colleges, seminaries, and continuing education events; and the churchwide Hunger Program. We especially commend this church's Department for Environmental Stewardship in the Division for Church in Society, for its network of caregivers, its advice to church members and institutions on innovative caregiving, and its materials for use in environmental auditing.

C. As a Committed Community

As congregations and other expressions of this church, we will seek to incorporate the principles of sufficiency and sustainability in our life. We will advocate the enviromental tithe, and we will take other measures that work to limit consumption and reduce wastes. We will, in our budgeting and investment of church funds, demonstrate our care for creation. We will undertake environmental audits and follow through with checkups to ensure our continued commitment.

D. As a Community of Moral Deliberation

As congregations and other expressions of this church, we will model the principle of participation. We will welcome the interaction of differing views and experiences in our discussion of environmental issues such as:

- nuclear and toxic waste dumps;
- logging in ancient growth forests;
- personal habits in food consumption;
- farming practices;
- treatment of animals in livestock production, laboratory research, and hunting;
- land-use planning; and
- global food, development, and population questions.

We will examine how environmental damage is influenced by racism, sexism, and classism, and how the environmental crisis in turn exacerbates racial, gender, and class discrimination. We will include in our deliberation people who feel and suffer with issues, whose economic security is at stake, or who have expertise in the natural and social sciences.

We will play a role in bringing together parties in conflict, not only members of this church but also members of society at large. This church's widespread presence and credibility provide us a unique opportunity to mediate, to resolve conflict, and to move toward consensus.

E. As an Advocate
The principles of participation, solidarity, sufficiency, and sustainability will shape our advocacy--in neighborhoods and regions, nationally and internationally. Our advocacy will continue in partnership, ecumenically and with others who share our concern for the environment.

Advocacy on behalf of creation is most compelling when done by informed individuals or local groups. We will encourage their communication with governments and private entities, attendance at public hearings, selective buying and investing, and voting.

We will support those designated by this church to advocate at state, national, and international levels. We will stand with those among us whose personal struggles for justice put them in lonely and vulnerable positions.

1. *Private Sector* This church will engage in dialogue with corporations on how to promote justice for creation. We will converse with business leadership regarding the health of workers, consumers, and the environment. We will invite the insights and concerns of business leadership regarding responsible environmental actions. We will urge businesses to implement comprehensive environmental principles.

Government can use both regulations and market incentives to seek sustainability. We will foster genuine cooperation between the private and public sector in developing them.

2. *Public Sector* This church will favor proposals and actions that address environmental issues in a manner consistent with the principles of participation, solidarity, sufficiency, and sustainability.

These proposals and actions will address: excessive consumption and human population pressures; international development, trade, and debt; ozone depletion; and climate change. They will seek: to protect species and their habitats; to protect and assure proper use of marine species; and to protect portions of the planet that are held in common, including the oceans and the atmosphere.

This church will support proposals and actions to protect and restore, in the United States and Caribbean, the quality of:

- natural and human habitats, including seas, wetlands, forests, wilderness, and urban areas;
- air, with special concern for inhabitants of urban areas;
- water, especially drinking water, groundwater, polluted runoff, and industrial and municipal waste; and
- soil, with special attention to land use, toxic waste disposal, wind and water erosion, and preservation of farmland amid urban development.

This church will seek public policies that allow people to participate fully in decisions affecting their own health and livelihood. We will be in solidarity with people who directly face environmental hazards from toxic materials, whether in industry, agriculture, or the home. We will insist on an equitable sharing of the costs of maintaining a healthy environment.

This church will advance international acceptance of the principles of participation, solidarity, sufficiency, and sustainability, and encourage the United Nations in its caregiving role. We will collaborate with partners in the global church community, and learn from them in our commitment to care for God's creation.

Claiming the Promise

Given the power of sin and evil in this world, as well as the complexity of environmental problems, we know we can find no "quick fix"--whether technological, economic, or spiritual. A sustainable environment requires a sustained effort from everyone.

The prospect of doing too little too late leads many people to despair. But as people of faith, captives of hope, and vehicles of God's promise, we face the crisis.

We claim the promise of "a new heaven and a new earth" (Rev 21:1), and join in the offertory prayer (*Lutheran Book of Worship*, page 109): "Blessed are you, O Lord our God, maker of all things. Through your goodness you have blessed us with these gifts. With them we offer ourselves to your service and dedicate our lives to the care and redemption of all that you have made, for the sake of him who gave himself for us, Jesus Christ our Lord. Amen."

Appendix II

Proposed Resolution for the 2006 General Assembly
Resolution on Global Warming
Approved by the Justice and Advocacy Commission, the NCC Governing Board, and the NCC and Church World Service General Assembly

TITLE: Resolution on Global Warming

POLICY BASE: Christian Concern and Responsibility for Economic Life in a Rapidly Changing Technological Society, adopted by the General Board of the National Council of Churches USA Governing Board, February 24, 1966

The Ethical Implications of Energy Production and Use, adopted by the National Council of Churches USA Governing Board, May 11, 1979

RATIONALE: Prominent scientists and major, respected scientific bodies are in agreement that the Earth is warming because of human-induced carbon emissions. Global warming threatens the very fabric of God's creation and will hit those who are least able to adapt—both human and nonhuman—the hardest. Because the Christian community is called to justice, to be good "neighbors" with our brothers and sisters across the globe, and to steward God's creation, addressing global warming is a moral imperative and a Christian call.

RESOLUTION: The National Council of Churches has stated:

> The rapidly expanding dimensions of (human) "dominion" over the earth and its physical resources call for new and deeper commitment to the Christian doctrine of stewardship . . . Natural resources, human techniques and institutions all together constitute an interlocking and interacting system of amazing complexity, precision and balance.[1]
>
> An ecologically just society will be guided by the values of sustainability, fairness, and participation. Sustainability refers to the earth's limited capacity to provide resources and to absorb the pollution resulting from their use. Sustainability requires that biological and social systems which nurture and support life not be depleted or poisoned. Fairness refers to . . . an equitable distribution of the total benefits and costs.[2]

Whereas the impacts of global warming, as currently predicted and understood by leading scientists and scientific bodies around the world including the National

Aeronautics and Space Administration, the National Academy of Sciences, and the Intergovernmental Panel on Climate Change, will dramatically and negatively alter God's gracious gift of creation and

Whereas the predicted impacts of global warming will have a disproportionate impact on those living in poverty and hunger, the elderly and infants, and those least responsible for the emissions of green house gases.

BE IT THEREFORE RESOLVED THAT THE NATIONAL COUNCIL OF CHURCHES IN CHRIST:

1) Expresses its deep concern for the pending environmental, economic, and social tragedies threatened by global warming to creation, human communities, and traditional sacred spaces

2) Urges the Federal Government to respond to global warming with greater urgency and leadership and gives support for mandatory measures that reduce the absolute amount of greenhouse gas emissions, and in particular emissions of carbon dioxide, to levels recommended by nationally and internationally recognized and respected scientific bodies.

3) Urges the Federal, State and Local Governments to support and invest in energy conservation and efficiency, sustainable and renewable, and affordable and sustainable transportation

4) Calls for business and industry to respond to global warming with increased investment in conservation and more efficient and sustainable energy technologies that are accessible, sustainable, and democratic.

5) Stands firmly with all of God's children by urging that adaptive measures and financial support be forthcoming from government and industry to aid those directly impacted by global warming and in particular those least able to relocate, reconstruct, or cope with the current and pending impacts of climate change

6) Calls on all Christians, people of faith and people of good will the world over to lead by example and seek active means whereby they may, individually and in community, quickly reduce their emissions of green house gas emissions and speak out for engagement by their elected officials on matters of global warming.

Appendix III

Orthodox Perspectives on Creation
Report of the WCC Inter-Orthodox Consultation, Sofia, Bulgaria, October 1987 (Extracts)
Creation and Holy Trinity
1. We believe that the created world itself is a 'mystery' originating in the sovereign will of God accomplished by the action (*energia*) of the Holy Trinity. We confess in the Nicene Constantinopolitan creed (325/381) that the Father is the "Creator of heaven and earth and of all things visible and invisible", the Son "He through whom all things were made", and the Holy Spirit, the "Creator of life" (*zoopion*). Thus, the three persons created together the world, which is the fruit of the common action of the Holy Trinity issuing out of the one essence.
2. As St. Basil the Great said, "We should understand in the creation the original cause of the Father as a founding cause, the cause of the Son as a creative, and the cause of the Spirit as an implementing one." Thus the Father is the "Creator of all things", the Son is the one "through whom all things were made", and the Holy Spirit is the one "in whom are all things". Everything that he (God the Creator) had made ... was very good" (Gen. 1:31), because "first He conceived, and His conception was a work carried out by His Word, and perfectly by His Spirit.
3. Thus, the action of the Holy Spirit, rooted in the Father, is presented as the 'economy' of the Son and the Spirit: the former bringing God's desire into existence and the latter perfecting it in goodness and beauty; the one calling the creation and leading it to the Father, and the other helping the creation to respond to His call and communicating perfection to it. Thus, the creation is the result of the communion (*koinonia*), close relationship and cooperation of the Holy Trinity. The community of three Persons participates actively in the execution of the whole of God's plan. Creation "out of nothing"
4. "In the beginning" the Holy Trinity created the world (heaven and earth) "out of nothing" (*ex nihilo*) and not out of preexistent matter. The world is a production of God's free will, goodness, wisdom, love and omnipotence. God did not create the world in order to satisfy some need of His. Rather he created it without compulsion and without force in order that it might enjoy His blessings and share in His goodness. God then brought all things into being out of nothing, creating both the visible and the invisible.
5. "Out of nothing" (*ex nihilo*) finds its first expression in the Bible. "Beholding the heavens and the earth, and seeing all that is there, you will understand that God has created it all from nothing" (2 Macc. 7:28). Thus, the creation springs into being or passes into being out of non-being. As St. Gregory of Nyssa affirms, "It begins to be, and the very substance of the creation owes its beginning to change". This transition from non-existence is a change brought about by God's creative Word "who has established the world so that it shall not be moved" (Ps.93:1).
Creation of the cosmos- integrity of the world
6. God is the Creator of the world. The world as cosmos, i.e. a created order with its own integrity, is a positive reality. It is the good work of the good God (Gen. 1), made by God for the blessed existence of humanity. The Cappadocian Fathers teach that God first creates the world and beautifies it like a palace, and then leads humanity into it. The genesis of the cosmos, being in becoming, is a mystery (mysterion) for the human mind, a genesis produced by the Word of God. As such, the world is a revelation of God (Rom. 1:19-20). Thus, when its intelligent inhabitants see it as cosmos, they come to learn about the Divine wisdom and the Divine energies. The cosmos is a coherent whole, a created synthesis, because all its elements are united and interrelated in time and space. A serious study of the mystery of creation, through faith, prayer, meditation and science, will make a positive contribution to the recognition of the integrity of creation. The daily office of the Church (vespers) begins with a psalm which exalts the beauty of this mystery (Ps. 103), while the Fathers of the Church often comment on the various biblical passages which describe the integrity of the creation.
Value of the creation

7. The value of the creation is seen not only in the fact that it is intrinsically good, but also in the fact that it is appointed by God to be the home for living beings. The value of the natural creation is revealed in the fact that it was made for God (something which is beautifully expressed in Orthodox iconography), i.e. to be the context for God's Incarnation and humankind's deification, and as such, the beginning of the actualization of the Kingdom of God. We may say that the cosmos provides the stage upon which humankind moves from creation to deification. Ultimately, however, the whole of the creation is destined to become a transfigured world, since the salvation of humankind necessarily involves the salvation of its natural home, the cosmos.

Human being as a microcosm

8. The fact that Adam and Eve were created by God last of all the other created beings and in a different way - not just by the utterance of a Divine Word but by the direct involvement and action of God - indicates not only the outstanding position of the human in the whole of the creation, but also its special relation to God. According to the Church Fathers, Genesis 1:26 ff, "...Let us make man ...(*poiesomen anthropon*) shows that the creation of the human being was the result of a Trinitarian act. Particularly significant in this connection is the statement that "man was made according to the image and the likeness of God". The reference to "the image of God" is to be understood in terms of Jesus Christ, since he is explicitly identified with it (2 Cor.4:4; Col. 1:15; Heb. 1:3 ff). Thus for mankind to be in the image of God means to be in, or assimilated to, Christ. This is a matter of grace and act and not a matter of nature, because only Christ is by nature God's image as God's eternal and natural offspring, his only begotten Son. The "likeness of God" is often connected with the grace of the Spirit who assimilates us to Christ.

9. In the created world only the human being combines material and spiritual elements. Human existence is thus differentiated from non-human creation in a qualitative way. In light of this fact, the Church Fathers often speak of the human being as a "little world", a "microcosm" of the whole of the creation. Using this notion, the Church Fathers teach that the human body contains in it all levels of existence of the natural world which preceded it in order of the creation, and considered the physical elements which make up the human body as in no way different from those which constitute the physical world. This means that the natural world is fully integrated with the human being and the whole of the creation.

10. At the same time, the Fathers' use of the notion of microcosm means that humanity, created in God's image and likeness, transcends the material world because it participates in God spiritually and consciously, unlike the rest of the creation. Humankind then stands on the boundary (*methorion*) between the material and the spiritual worlds as a connecting link. It is directly related to the earthly aspect of created existence as well as to the untreated existence of the Creator. As such, on the one hand, it directly influences our thinking about the integrity of creation, and on the other hand it gives to human nature a dynamic spiritual dimension.

11. St. Gregory the Theologian says that we are fully involved with the material creation by virtue of our physical existence, and that the material created reality is deeply involved with us. If we move to the direction of deification, our human nature, progressing towards God, will somehow carry the created material world with it. If, however, we move to the opposite direction, the created world will suffer with us as well (cf. Rom. 8:19-22). This means that we are called to exercise dominion over all creatures on earth (cf. Gen. 1:28), i.e. to be stewards (*oikonomoi*) of God's material world, caring for it, maintaining it in its integrity and perfecting it by opening it up to God through our own deification.

The Incarnation as the renewal of the creation

12. God's will, wisdom and love for the creation in general and for humankind in particular are revealed in the Incarnation in an inexpressible way. The Son of God, as the one through whom the process of creation was fulfilled, came down from heaven into the world and became fully man, i.e. assumed human nature in its integrity and led it to the fulfillment of its God-given destiny, deification. The Orthodox Church teaches that the Virgin Mother of God, the Theotokos, is the model of the renewal of humankind and the creation in Christ. In her receiving of the Son

of God, the whole humankind and the whole of the creation participate. In the Incarnate God the Father "made known. His will ... as a plan for the fullness of time, to unite all things in Him (Christ), things in heaven and things on earth" (Eph. 1:10). In other words, Jesus Christ, the Son of God became man, restored and renewed humanity and the whole of the creation, uniting both of them with the Creator in and through Himself. One of the Trinity, thus, became Incarnate, became man, revealing his Lordship over the whole of the creation, and showing humanity a Lordship in stewardship and service.

II. Disintegrated creation

The human fall and the disintegration of creation

13. Before their fall the first human beings experienced the creation as one harmonious whole. It was like a beautiful garden (*paradeisos*, Gen. 2:8) which they tended with care and love. The human fall, however, which was essentially a sinful exercising of human freedom, introduced forces of disintegration into the body of creation. Humanity experienced a two-fold alienation. On the one hand, it was estranged from the Creator, since Adam and Eve tended to hide themselves away from the sight of God (cf. Gen. 3:8) as their communion with the source of life and light was broken. On the other hand, humanity lost its capacity to enter into a proper relation with nature and with the body of the creation. Enmity between the natural world and human beings replaced the relationship of harmony and care. Domination and exploitation of the creation for selfish ends by greedy human beings became the order of history. Thus, manifold forms of disintegration set in which converged in the fact of death and corruption. Fear of death instilled anxiety, acquisitiveness, greed, hatred and despair in human beings. Modern forms of economic exploitation, racial oppression, social inequalities, war, genocide, etc. are all consequences of the fear of death and collective signs of death.

The environmental crisis (...)

18. Environmental issues like air and water pollution, depletion of non-renewable resources, destruction of the ozone layer, increasing nuclear radiation, deforestation and desertification of vast areas, etc. threaten the life itself on this planet. The gifts of science and technology are being misused by human beings to the extent of abusing nature and turning today's life on earth into a hell, not only for the many millions of existing people but also for the generations to come. The voice of those who call for a just development, equal distribution of resources and ecological lifestyles is being systematically suppressed. Advances in bio-technology and genetic engineering need to be seen in the light of the Holy Spirit because without adequate knowledge of the transcendent (divine) vocation and spiritual nature of humanity, these new techniques run the risk of initiating biological disruption leading to a disastrous mutations that are extremely dangerous for the true life on earth. While human creativity and freedom can be armed as supreme gifts of God, it should also be emphasized that they should be rooted in divine wisdom and in human spiritual maturity. A reintegrated environment (...)

37. The environmental crisis is a sin and a judgment upon humanity. We need to find ways, as churches, to support sound programs which seek to preserve from pollution air, water and land. To speak of the reintegration of creation today is first to speak words of repentance and to make commitments toward the formation of a new way of living for the whole of humanity. The contemporary world must repent for the abuses which we have imposed upon the natural world, seeing it in the same kind of relationship to us as we see the unity of our human nature in both body and soul. We must begin to undo the pollution we have caused, which brings death and destruction to the mineral, vegetable and animal dimensions of the world environment. We must work and lobby in every way possible to us in our different situations to encourage the scientific community to dedicate the good potentials of science and technology to the restoration of the earth's integrity. For ourselves, this means a recommitment to the simple life which is content with necessities and - with the Church Fathers – sees unnecessary luxuriousness as the deprivation of necessities owed to the poor. In all of its aspects, concern for the reintegration of the creation calls Christians to a new affirmation of self-discipline, a renewal of the spirit of

asceticism appropriate to Christians, regardless of their status, position or condition. In short, we must see the created world as our own home, and every person in it as our brother and sister whom Christ loves.

Conclusions

(...) 45. We confess that God is the creator of all that exists, beautifully and wonderfully made, a fitting manifestation of His glory (cf. Ps. 103). But we stand today before a wounded creation which suffers under distorted conditions which are the result of the sin of humanity. In our selfishness and greed we have used our otherwise good technological abilities to exploit God's creation, to destroy the balance of nature and to deform what God originally made to be in wholesome communion with us and with Him. Creation is no longer integrated with humanity nor is it in harmony with God. In fact, it stands in danger of conflagration, in the face of nuclear war.

46. The creation needs to be reintegrated, but this can happen only as it is brought once again into communion with the Lord, so that it may find its fullness of purpose and its transfiguration. Humanity can no longer ignore its responsibility to protect it and preserve it. In order to do this, however, humanity must learn to treat the creation as a sacred offering to God, an oblation, a vehicle of grace, an incarnation of our most noble aspirations and prayers.

47. Just as bread and wine are liked up as an offering for the sanctification of the world and all people in the

Eucharist, a sacramental approach to the creation is needed for its reintegration.

49. The Lord God created His universe and all that is in it as an integrated whole. Today, we have brought about disintegration in what God intended to be integrated. We call upon individuals, nations and churches to give effect to a vision of the rightful harmony between the human dimension and the mineral, plant and animal dimensions of the creation. In spirit and in body, we are called to offer the whole of God's creation back to Him as a sacrament and as an offering cleansed, purified, restored for His sanctification of it.

50. O God, "the things that are Yours, we offer them to You according to all things and for all things. Amen." May this be our prayer for the "integrity of God's creation."

Source: The Orthodoxy and Ecology Resource Book is produced by SYNDESMOS, The World Fellowship of Orthodox Youth.

Editor: Alexander Belopopsky and Dimitri Oikonomou

Appendix IV

FAITH PRINCIPLES ON GLOBAL WARMING

Justice: Strive for justice and acknowledge that global warming's societal impact already falls, and will continue to fall, most heavily on the people around the world who are least able to mitigate the impacts—poor and vulnerable populations in the U.S. and in developing countries. As a leading industrialized nation that has disproportionately contributed to greenhouse gas emissions, it is incumbent upon us to rectify this injustice. To reach our goal of justice, we require that legislation:

- Include mechanisms that mitigate the impacts of global warming particularly for vulnerable populations in the U.S. and abroad.
- Prevent further harm to human health and all of God's creation by utilizing clean energy sources when addressing global warming and carbon pollution.
- Focus on a fair and equitable distribution of total benefits and costs among people, communities, and nations, and in particular rectify the disproportionate impact that low-income communities have and will experience as the climate continues to change.
- Enable our brothers and sisters now living in poverty to have both economic independence and stability and to eliminate the devastating impacts that global warming has and will continue to have on those people in the U.S. and around the world living in poverty.
- Take action now to avoid placing the burden of carbon reduction unduly on our children's children.
- Endorse policies that place a high priority on allowing all people to live in God's abundance and with dignity by ensuring that basic human needs and worker justice are not adversely impacted by the effects of global warming or future efforts to address global warming.

Stewardship: Heed the call to be faithful stewards and caretakers of God's creation by limiting the future impacts of global warming on God's Earth. Already, global warming has damaged the precious balance of God's creation, including increasing the number of threatened species, causing long-term drought, and melting Arctic ice. To reach our goal of stewardship, we require that legislation:

- Follow recognized scientific guidelines and recommendations in order to protect all of God's creation and prevent catastrophic damage to God's Earth and God's people. Following their recommendations, legislation must include comprehensive, mandatory, and aggressive emission reductions that aim to limit the increase in Earth's temperature to 2 degrees Celsius or less. Legislation should focus on the short term goal of reducing U.S. carbon emissions to reach a 15-20 percent reduction in carbon by 2020 with a long term vision to achieve carbon emissions that are 80 percent below 2000 levels by the year 2050.
- Avoid catastrophic global warming, which would devastate God's creation, put more pressure on disaster and relief responses, and endanger the future of the planet. Although global warming impacts are already being felt, we must ensure that God's people and planet are protected from the catastrophic effects that may occur if we fail to significantly curb our carbon emissions.

- Call on major emitters to take responsibility for their actions and work to significantly reduce their carbon emissions.

Sustainability: Ensure that efforts to curb global warming prevent further environmental and societal tragedies. As people of faith we are guided by the value of sustainability. Sustainability requires that we enable biological and social systems that nurture and support life not be depleted or poisoned. To reach our goal of sustainability, we require that legislation:

- Maintain God's good creation by preventing policies that place the burden of our lifestyles on one aspect of creation and encouraging policies that sustain and restore vibrant eco-systems with economic justice so that communities of life can flourish for generations to come.
- Respond to global warming in a way that reflects the interdependence of all of God's creation.
- Support energy sources that are renewable, clean, and avoid destruction of God's creation.

Sufficiency: In a world of finite resources, for all to have enough requires that those among us who have more than enough will need to address our patterns of acquisition and consumption. We can not achieve significant reductions in global warming emissions unless we make changes in our lifestyles and particularly in our energy consumption. To support the goal of sufficiency, legislation must:

- Encourage energy conservation in our homes, our communities, and our places of worship.
- Encourage energy conservation in national transportation and distribution systems and commercial enterprises.
- Encourage the federal government to lead through research and example in the practice and implementation of energy conservation.

Endorsed by:
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Church of the Brethren/Washington Office
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Union of Reform Judaism
Unitarian Universalist Association of Congregations

Summary of Evangelical Lutheran Church in America Testimony
Prepared for Subcommittee on Energy and Air Quality
Energy and Commerce Committee
June 19, 2008

I. Faith Principles on Global Warming

The following principles have been developed by the ELCA in conjunction with the National Council of Churches to serve as an educational tool, but more importantly to provide a lens to examine climate change legislation.

a. Justice
b. Stewardship
c. Sustainability
d. Sufficiency

II. Climate Change Policy Priorities

The following policy priorities have emerged within the broader faith community as key components of climate policy in order to ensure that legislation protects all of God's creation and God's people.

a. **Climate legislation must heed the most up to date recommendations of the scientific community with regard to greenhouse gas emission reductions.** Currently this means legislation must ensure that we do not increase the Earth's temperature by more than two degrees Celsius and reduce global warming emissions by approximately 15-20 percent by 2020 and by 80 percent by 2050.
b. **Legislation must protect those living in poverty in the U.S. from the impacts of climate change and climate legislation.** Those living in poverty in the U.S. will be the least able to prepare for and adapt to the changes taking place in our climate and our economy. Legislation must hold those living in poverty harmless and ensure that they do not bear the burden of any increases in energy costs. In addition, it must ensure that it is not pushing people into poverty and provides for those whose jobs are impacted by climate legislation.
c. **Legislation must provide adaptation assistance for those living in poverty abroad.** Those living in the most vulnerable developing nations around the world bear little responsibility for global warming and are already feeling the burden of climate change, with little ability to adapt to these impacts. Through adaptation assistance, the U.S. can prevent the destruction of vulnerable communities around the world and help with climate relief.

Mr. BOUCHER. Thank you very much, Ms. Minette.
Mr. West.

STATEMENT OF FORD WEST, PRESIDENT, THE FERTILIZER INSTITUTE

Mr. WEST. Chairman Boucher, Ranking Member Upton, thank you and members of the committee.

The fertilizer industry encompasses the production and distribution of the three basic nutrients required for plant growth: nitrogen, phosphate, and potash. These are commodities that are traded as commodities in the worldwide market. Natural gas is the feedstock or the raw material to produce nitrogen fertilizer. We take nitrogen from the air, combine it with hydrogen from natural gas and produce ammonia, which is the basic building block for all nitrogen fertilizer. There is no economic substitute for producing nitrogen fertilizer other than the use of natural gas, and that makes nitrogen fertilizer uniquely sensitive to the price of natural gas and to public policy that affects the supply and demand and use of natural gas. Phosphate and potash are minerals. We mine those. Certainly climate change will have a direct and indirect effect on those businesses, but today I want to focus my comments on nitrogen production, and it is the most vulnerable fertilizer of the impact of cap-and-trade systems. Nitrogen fertilizer is essential to the United States and world food production. The majority of nitrogen products produced are sold for crop production and fertilizer nutrients, they produce the food and the feed that nourishes the world. Forty to 60 percent of the world's food production is tied to the use of fertilizer.

Another critical use of nitrogen products is to scrub nitric oxide emissions from coal-burning facilities, diesel engines and natural gas-fired turbines. In 2007, nitrogen products, ammonia and urea, were used in this manner to remove 650,000 tons of NO_x from the U.S. skies with no byproducts.

Soaring natural gas prices have exacted a heavy toll on America's nitrogen fertilizer producers and farmer customers they supply. Since 1999, the U.S. nitrogen industry has closed 26 nitrogen fertilizer production facilities due primarily to high natural gas prices, and I think this is one of the unintended consequences of the Clean Air Act we passed in 1990 when we declared that natural gas is the environmental fuel of choice, and the utilities began using natural gas to burn to produce electricity. Currently, there are only 30 nitrogen plants operating in the United States and over half of the nitrogen we use in the United States is imported and it is imported from countries with weaker environmental standards, no climate change policies, and the majority of these countries are those from whom we are striving for energy independence. The result is, the United States is increasingly becoming dependent on foreign sources for nitrogen from places that charge very low or no cost for the natural gas. Examples of these are the Middle East, China, Russia, Venezuela. Last year we imported over 300,000 tons of nitrogen from Libya, 477,000 tons from Egypt, 1.8 million tons from the Middle East, and over 3 million tons from the former Soviet Union, and if this trend continues and if we have public policy

that drives natural gas prices higher, then America's food security and by our extension our natural security will be jeopardized.

Within the climate change debate, the fertilizer industry has some grave concerns that the remaining nitrogen production facilities will be severely impacted during any transition period that we have as utilities continue to fuel switch to natural gas for generating electricity. Fuel switching has already caused the price of natural gas to go very high and it is causing—and if it continues and we are above $12 today, it will cause additional U.S. production to move offshore. In climate change, we are trying to do this at a time we are having kind of what is called the world food crisis of 2008. The world demand for food is an all-time high. It is causing an all-time high in fertilizer prices, and any decline in our domestic production for fertilizer will even cause higher production cost for farmers. The fertilizer industry commissioned a study on the impact of high energy costs resulting from climate change from higher energy costs. Using the Lieberman-Warner bill, the Doane Advisory Services measured the production costs increases for eight commodities. Doane economists found that the Lieberman-Warner legislation would add somewhere between $6 to $12 billion to the total production costs leading to significant decline in farm income, and these estimates may be low because we used the energy price forests from the Department of Energy and they have been roundly criticized as being too low. Mr. Barrow brought up about agriculture. Certainly agriculture has to be part of this solution on climate change.

The record demand for food in this world food crisis that we are in has resulted in record demand for fertilizer. The surge in world demand has meant that U.S. farmers and farmers around the world are paying the highest prices they have ever paid for fertilizer. With food demand levels predicted to stay high and fertilizer prices predicted to stay high, Congress must really tread cautiously and consider all the ramifications and unintended consequences of such sweeping policy as climate change, especially if it forces the utilities to use more natural gas to produce electricity. Any climate change policy must take into account essential industries such as fertilizer, which we believe is a strategic commodity to our national security, and it is frightening to imagine what the uncertainties would be like if we have to import all our fertilizer to meet our food production goals. Currently at the natural gas prices we have today, 90 percent of the cost of production of a ton of ammonia is tied to natural gas. We produced 11 million tons of ammonia last year using 33 million BTUs per ton and every dollar increase in natural gas costs our industry $400 in increased production costs, and that figure far exceeds any other American industry. Complicating the climate change, we are limiting where we can look for supply of gas. That is a complicating factor here as we look at climate change.

I just want to end by sending that critical to our food production is to maintain our current domestic production of fertilizer, nitrogen phosphate and potash, and I will be glad to answer any questions.

[The prepared statement of Mr. West follows:]

The Fertilizer Institute

Nourish, Replenish, Grow

Testimony of Ford West

President, The Fertilizer Institute

Subcommittee on Energy and Air Quality

Committee on Energy and Commerce

Thursday, June 19, 2008

Good morning Chairman Boucher, Ranking Member Upton, and members of the Committee. I am Ford West, President of the Fertilizer Institute. The Fertilizer Institute is the leading voice for the nation's fertilizer industry and we are pleased and appreciative to be here today to provide our industry's perspective on climate change legislation.

The fertilizer industry encompasses the production of nitrogen, phosphate, and potash. Natural gas is the feedstock, or raw material for producing nitrogen fertilizer. Currently, there is no substitute for producing nitrogen fertilizer other than natural gas. This makes the nitrogen fertilizer industry uniquely sensitive to the price of natural gas. Phosphate and potash are minerals mined from the earth and this process also requires a great deal of energy.

Today as we discuss climate change legislation, I will focus my comments on our nitrogen production as it is most vulnerable to the impacts of a cap and trade system, however, phosphate and potash production will also be directly and indirectly affected.

Nitrogen fertilizer is essential to U.S. food production. A majority of the nitrogen products produced are sold for crop production, where, as fertilizer nutrients, they produce the food and feed that nourish the world. Fertilizers are also used on crops that produce the fibers that clothe the world. Another critical use of nitrogen products is to scrub harmful nitrous oxide emissions from coal-burning facilities, diesel engines, and natural gas fired turbines. In 2007 nitrogen products were used in this manner to remove 650,000 tons of NOx from the U.S. skies with no byproducts.

However, soaring natural gas prices are exacting a heavy toll on America's nitrogen fertilizer producers and the farmer customers they supply. Since 1999, the U.S. nitrogen industry has closed 26 nitrogen fertilizer production facilities, due primarily to high natural gas prices. Currently, only 30 nitrogen plants are operating in the U.S. and over half of the U.S. farmer's nitrogen fertilizer is imported. More than 50 percent of this imported fertilizer is from countries with weaker environmental standards, no climate change policies, and the majority of these countries are those from whom we are striving for energy independence.

The result is that U.S. farmers are becoming increasingly dependent on foreign sources for their fertilizers from places that charge very low or no cost for the natural gas used in nitrogen fertilizer production. Examples of these countries are the Middle East, China, Russia, and Venezuela. Last year, U.S. farmer's imported 314 thousand tons of nitrogen products from Libya, 477 thousand tons from Egypt, 1.8 million tons from the Middle East, and over 3 million tons from countries of the former Soviet Union. If these trends continue, America's food security, and by extension, our national security will be

jeopardized if action is not taken to address the impacts of our country's current natural gas crisis.

Within the climate change debate the fertilizer industry has grave concerns that our remaining domestic production will be severely impacted during any "transition period" where utilities will fuel switch to natural gas for generating electricity. Projected fuel switching will cause the price of gas to skyrocket even further causing additional U.S. production to shut in or move offshore. Moreover, with world demand for food at all time highs, any decline in our domestic production of fertilizer will further exacerbate the high production costs for farmers.

This year, The Fertilizer Institute commissioned a study of the impacts of high energy costs resulting from climate change legislation on American farmers. Using the Lieberman Warner bill, the Doane Advisory Service measured the production cost increases for eight commodities. Doane economists found that the Lieberman Warner legislation would add $6 - $12 billion to total crop production costs leading to a significant decline in farm income. These estimates are conservative since they are based on energy price forecasts from the Energy Information Administration of the Department of Energy, which have been roundly criticized for being too low.

The current record demand for food and fuel has resulted in record demand for fertilizer. This surge in world demand has meant that U.S. farmers and farmers around the world are paying the highest prices for their fertilizer inputs in history. With food demand levels predicted to stay high, Congress must tread cautiously and consider all ramifications and unintended consequences of such sweeping policies as climate change. Any climate change policy must take into account essential industries, such as fertilizer,

that could be severely challenged if this policy does not address our unique situation. It is frightening to imagine the uncertainties that could result if U.S. policy made us completely reliant upon foreign sources of fertilizer for our food production.

As natural gas prices have dramatically increased since early 2000, the U.S. nitrogen fertilizer industry has seen its natural gas costs account for over 90 percent of its total cost of production. This figure far exceeds that of any other American industry. Complicating the climate change debate, Congress has limited the ability to drill for natural gas in the Outer Continental Shelf and on federal lands where there are known supplies of natural gas. Increases in the U.S. supply of natural gas will put downward pressure on the market price and help keep the remaining nitrogen plants in the United States running. It is critical to our food production stability to maintain the current domestic production of all fertilizer: nitrogen, phosphate and potash.

I would like to thank you for the opportunity to present the fertilizer industry's concerns related to climate change legislation. I appreciate your interest in our industry's need and I am happy to answer questions at the appropriate time.

Mr. BOUCHER. Thank you very much, Mr. West, and I want to express appreciation to all of the members of this panel for their thoughtful testimony here this morning and this afternoon.

I am going to begin my questions with the first witness, although the first witness has been replaced by a stand-in, and we want to welcome to the panel Mr. Glenn Kelly, who is vice president for government affairs of the National Mining Association. Mr. Naasz, I think is not feeling particularly well today and had to leave for that purpose. Mr. Kelly, we thank you for standing in in his stead.

In Kraig's testimony, he stressed the need for a uniform legal framework in order to govern the storage of carbon dioxide on a permanent basis. You have reviewed the five bills that we are hearing today. Do you see in any of those five bills the kinds of regulatory certainty contained in a legal framework that would encourage the carbon capture and storage projects to move forward?

Mr. KELLY. The simple answer, Mr. Chairman, is no, not in any of the five legislative proposals that we have examined for the purpose of this hearing. In fact, during consideration in the Senate of the Lieberman-Warner legislation, we offered, or attempted to secure an amendment to that legislation that would put in place ultimately the legal and liability framework that we foresee as necessary for the treatment of——

Mr. BOUCHER. Do you have—has your industry worked with others to develop a proposal for what that framework ought to be?

Mr. KELLY. We have. We have specific legislative text that we showed to a number of Senators.

Mr. BOUCHER. So you have developed that. Let me ask you this question. The European Union at the present time is formulating regulatory framework for carbon capture and storage. Have you made reference to that at all or looked at it for comparative purposes as you developed your position?

Mr. KELLY. I don't believe we have.

Mr. BOUCHER. Thank you very much.

Mr. Goo, let me turn to you. I notice in the testimony of NRDC that you addressed the presence of various forms of safety valves in the five bills that we have under consideration here, and as I interpret your testimony, you have strong objection to a kind of an unlimited safety valve that would release potentially an infinite number of additional emission allowances into the market upon the triggering of a certain price level but you have a somewhat greater level of comfort with more circumscribed kinds of safety valve provisions. Could you describe for us what kind of provision you would be more comfortable with if we had a strategic reserve of allowances, for example, that had a quantified number so that that number of allowances would be the maximum that could be released? I guess it might be possible for the financial market to price that better than a potentially unlimited release. Is that the kind of approach that you think would make sense and could you elaborate on that?

Mr. GOO. Thank you, Mr. Chairman. Absolutely, we do oppose the classic safety valve because that allows emissions to be released into the atmosphere for a said cost. We also don't necessarily think that a price trigger is necessary. We think that banking, borrowing, offsets and other means of cost containment

should be looked at first but in the end, NRDC's concern is integrity of the emissions cap. In the Senate proposal, the substitute amendment proposed by Senator Boxer, there is a proposal worked on by the Nicholas Institute and the National Commission on Energy Policy and many other interest groups that NRDC was able to support. This takes a reserve of allowances from the years 2030 to 2050. It would be approximately one year's worth of allowances, or 6 million tons. It would allow release of those allowances in years prior at a set price between $22 and $30 per ton with the price set by the President, and an amount of 450 million tons per year or a little less than 10 percent. We think that that is a cost containment solution that would limit volatility in the market while nevertheless maintaining the integrity of the emissions cap, and we think it is something that the Congress should look at.

Mr. BOUCHER. Thank you, a very thorough answer.

Mr. Kuhn and Mr. West, let me conclude my questions with you. Both of you have made reference to the potential economic disruption that could occur if coal-fired electric utilities are required because of the early schedule for greenhouse gas emissions reductions to surrender using coal and to fall to some other fuel. Mr. West made the point, and I think he is right, that if they are required to default to another fuel, it is very likely to be natural gas, which is the next least expensive fuel, and both of you have pointed to economic disruption that could occur in the event that that occurs. So my question to both of you is this: do you believe that it is possible from the effective date of a cap-and-trade program until the time when carbon capture and sequestration technologies are available, affordable, and reliable that the utilities could be required to take reductions, and if so, how would they be able to achieve those reductions consistently with their continued ability to use coal?

Mr. KUHN. Mr. Chairman, this is a very, very critical question, and I think it relates to the importance of moving carbon capture and storage technology demonstration projections, which is incorporated in your legislation, but I think that it is going to be extremely important to align the dates and timetables that you have in the bill with the ability to bring on carbon capture and storage and nuclear plants so that we don't have this massive switching to natural gas. We have already seen tremendously high prices for natural gas, questions about supply and availability. I think Mr. Goo mentioned that he expects carbon capture and storage projects to be able to come in place by 2015 and at 6 gigawatts a year. I don't see that substantiated by any other analysis. MIT, the Coal Utilization Resource Council, et cetera, all talk about the availability of carbon capture and storage sometime in the 2020 to 2025 range, and that is when they are available. The deployment would follow that maybe 5, 10 years afterwards. We both are in total agreement that we need to move this as fast as possible. If we can make it happen faster, God bless us, but we need to be realistic when we set these targets and timetables.

Mr. BOUCHER. Well, my time is expired. Let me just ask a leading question, which I try to refrain from doing, but not getting the answer I was seeking initially, would you agree that between the effective date of the law and the time when carbon capture and storage technologies become available and are ready to use, that

the coal-fired utilities and other emitters in the economy could be required to take reductions that could be achieved by installing efficiency, by purchasing offsets and credits, either domestically or internationally or by other kinds of cost containment means?

Mr. KUHN. I fully agree with that. I think that——

Mr. BOUCHER. And your organization would not oppose an approach that requires that reduction to be taken early on as long as they are achievable through those kinds of mechanisms?

Mr. KUHN. Early reductions are going to come from energy efficiency and renewables. The mid-term reductions will come from nuclear plants and coal plants with carbon capture and storage.

Mr. BOUCHER. All right. Thank you, Mr. Kuhn.

Mr. Upton.

Mr. UPTON. Thank you all. I know that the entire country is of course very concerned about the high gas prices that we are experiencing and I don't know how many of you might have seen USA Today's front-page story earlier this week, headlined "Utilities Raising Price of Power." Here is a shocker: electricity bills are heading up, way up. It goes on to say that the price of coal which fires half of the U.S. power plants has doubled since last year, largely because of surging energy use in countries such as China and India. Natural gas prices are up nearly 50 percent on high U.S. demand. Cost to build a power plant has also gone up more than doubling since the year 2000, and South Carolina Electric and Gas wants to boost rates some 37 percent by 2019 to cover its share of two nuclear reactors covering $10 billion and goes on to talk about other increases as well, and I just would say particularly, Mr. Kuhn, independent of the need to reduce emissions, how much investment is going to be needed over the next 30 years to maintain the current electricity infrastructure and keep up with the demand to ensure the reliability of the grid? What are your estimates?

Mr. KUHN. Our estimates and those of others are in excess of $1 trillion. We are very concerned also about increasing prices for fuel that are causing electricity prices to increase and this emphasizes even more the need for bringing on new technologies and additional technologies that can give us the fuel diversity we need and the supply to help keep those prices down.

Mr. UPTON. Mr. Kelly, what impact will the cancellation, as have seen over the last year, the cancellation of dozens of coal-fired plants have on electricity rates and the reliability of the grid?

Mr. KELLY. From the coal production point of view, we have concerns that increasing pressure at the local level that has led to cancellation of a number of these plants is going to potentially force generators to look for an alternative fuel source, namely principally natural gas, which would result in higher demands for gas and ultimately higher prices. We believe that given the fact we have got a 240-year-plus supply of affordable domestic coal, that we ought to be using that as a resource in conjunction with all the other sources. We are going to need—given the pace of the growing demand for electricity in this country, we are going to need all sources of energy and that is nuclear, renewables, gas, and coal.

Mr. UPTON. I want to spend a little time on nuclear. Admiral Bowman, the proponents of cap-and-trade often rely heavily on the

assumptions of new nuclear power plants to keep the costs of the program down and achieve the emission reductions. What is your realistic estimate of how many new nuclear plants we might be able to bring online by the year 2030, and then again maybe by 2050?

Admiral BOWMAN. Mr. Upton, we are doing this slowly intentionally so that we do it correctly this time around. Let me start in a little bit shorter term. By 2016, 2017, we believe we will have four to eight new nuclear plants online.

Mr. UPTON. Some of us would like it to be 48.

Admiral BOWMAN. I am one of them. But we are going slowly. We are doing it cautiously. We are doing it so that it comes out right. Based on the experience at that first wave of four to eight plants experiences as they are going along in the regulatory process and the construction process, we believe we could see as many as 20 plants online by 2020, and then our target for 2030 certainly depends on so many factors that it would be difficult for me to say but I believe achievable that 68 gigawatts that Tom Kuhn talked about earlier from the Electric Power Research Institute, 64 gigawatts is achievable. That means we are talking on the order of 30 to 50 new plants by 2030.

Mr. UPTON. So it is my understanding that of course we use about 20 percent of our power today is generated from nuclear. To maintain 20 percent by the year 2030, we have to have 52 new plants on line is the estimate that I have seen. Is that correct?

Admiral BOWMAN. Our number says more around 30,000 megawatts, which would be closer to 25 to 30 plants, just to maintain the 20 percent portfolio share.

Mr. UPTON. Now, in my remaining time, Mr. Goo, as you know, nuclear power is responsible for about 70 percent of our Nation's zero-emission power. What role do you see for the NRDC as it relates to nuclear power?

Mr. GOO. Nuclear power will continue to be part of the mix of our energy supply for the foreseeable future, and under a carbon-constrained world, nuclear power will undoubtedly receive a benefit because of the fact, as you mentioned, that it is essentially a lower or zero-carbon source of energy. We have traditionally had a history of opposing nuclear power because of safety, waste and numerous other reasons. However, as far as a carbon cap system is concerned, we believe that nuclear power need not receive any further subsidies and that it should compete in the marketplace on its own.

Mr. UPTON. My time is expired but I would just like to put into the record a letter from the National Petrochemical and Refineries, if I might.

Mr. BOUCHER. Without objection.

[The information appears at the conclusion of the hearing.]

Mr. BOUCHER. The gentleman from Pennsylvania, Mr. Doyle, is recognized for 5 minutes.

Mr. DOYLE. Thank you, Mr. Chairman.

Mr. Goo, welcome back to the Committee. Good to have you here. As you know, I share your organization's goals of establishing a national policy to reduce greenhouse gases and like you, I believe we can do it without deindustrializing the American economy. But one of the particular areas that I do haves some concerns with is the

issue of international competition and job leakage and emission leakage that may occur as a result of this policy we are looking at. As you know, Congressman Inslee and I have proposed a new approach known as output-based or benchmark approach to addressing some of these very real concerns, and we believe that this approach, which essentially pays for the increased costs these industries will face as a result of these policies will not only help us address the competition and leakage issues but will also help us bring industries like steel and cement and other carbon-intensive industries forward in a new carbon-constrained world. I would just like you to share your thoughts on that proposal and how you see that as being advantaged or disadvantaged compared to other proposals that are before the committee.

Mr. GOO. Well, thank you, Congressman Doyle. I appreciate your interest in the issue and I appreciate your work with Congressman Inslee. It is a formidable duo, the two of you working on something together. So there are proposals in the existing bills to deal with the international competitiveness issue. They have made a substantial advance in that regard in terms of border tax adjustments and those kinds of things. But those provisions as they were considered in the Senate, I think people felt that they did need further work, that they didn't necessarily meet the goals. There are trade issues associated with them under the World Trade Organization rules and those kinds of things. Your proposal, which we have not had a chance to examine in detail, adds further progress to that, to consideration of that issue. We look forward to working with you on it. I think it is, looking across the industries you correctly identified that are vulnerable to competition because of their energy impacts and looking at their output and how that relates to the output of similar industries in other countries, it looks like the right way to go.

Mr. DOYLE. Thank you very much.

Mr. Kelly, as Mr. Naasz had said in his statement, I am one of the cosponsors with Chairman Boucher for the Carbon Capture and Storage Early Deployment Act, because I believe coal is going to continue to play a strong role in providing energy to our country, and I think it is important, as the chairman does, that we move down this path to carbon sequestration as quickly as possible. But I also think it is critical that we don't duplicate efforts as we create this new fund and we look at the role of the National Energy Technology Lab and their role in carbon capture and CCS and this new bill that the chairman is moving forward. I wonder if you could comment on two things. What do you see as the critical components in a successful CCS program? What do we need to do to take these estimates from 2020 to 2025 and accelerate them? You know, what isn't being done or what needs to be done to accelerate the deployment of carbon capture technology? And then secondly, what role do you think the NETL should play in concert with this proposal that is being advanced by Chairman Boucher so that there isn't a duplication of efforts?

Mr. KELLY. Thank you, Congressman, and thank you again for your support of the legislation. The mining association believes it is absolutely critical that we move forward as quickly as possible on trying to fund accelerated development of carbon capture and

storage technology. With regard to the first question about what would constitute the components of a successful program and what can be done to accelerate it, our analysis that we have looked at indicates one of the reasons why I think Tom Kuhn indicated the time frame for expected delivery and availability and commercial deployment of carbon capture and storage is at the 2020 to 2025 and maybe slightly beyond range is, in the process of developing the technologies which have never been tested on the scale that will be required to achieve the emission reductions that we are all contemplating, it would require, first, sufficient demonstration, that we know that the carbon in some shape or form can be captured but the long-term requirement to demonstrate that once it is stored and capped in a facility, whether it is underground or where that might be, in order to gain public confidence, it is going to require some time to be able to demonstrate that it is safe and secure and that we understand exactly what is happening in the geologic formation and so forth. That is several years. So the key is to do a number of these demonstration projects in different formations, using different techniques to see which ones are most successful and which ones can be brought on to scale commercial deployment in the future. So we think that is absolutely critical.

In terms of what can be done to accelerate the type of reductions, the Coal Utilization Research Council has promoted something they call the near-term plan, and that is very much focused on energy efficiencies, but it also would help support the development of the type of basic research that would be necessary for CCS technologies. And then lastly, Congressman, with regard to the question on NETL, the system, the way your legislation would operate, applicants would be able to seek support from the fund in order to conduct the research and conduct demonstrations and develop the technology, and I think NETL would be a key partner in that process if not an outright recipient of that type of support. So we very much see them as a key partner and very much involved in the process looking further down the road.

Mr. DOYLE. Thank you.

Mr. Chairman, I see my time is up. I would just like to say, Mr. Kuhn, I think that the full portfolio approach is right on the money. I enjoyed a lot of remarks in your testimony and wish I had more time to speak to you about it, but I see my time is up.

Mr. BOUCHER. Thank you very much, Mr. Doyle.

We are honored to have as a member of the subcommittee the Minority Whip of the House, the gentleman from Missouri, Mr. Blunt, and I am pleased to recognize him for 5 minutes.

Mr. BLUNT. Thank you, Chairman Boucher, and thank you for holding this hearing. I have an opening statement that I will just insert into the record.

[The prepared statement of Mr. Blunt follows:]

STATEMENT OF HON. ROY BLUNT

This hearing focuses on five bills, each of which establishes a cap-and-trade program intended to achieve substantial decreases in greenhouse gas emissions.

The environmental community and some members here have urged the U.S. to reduce its greenhouse gas emissions (GHG) to at least 60–80% below 2005 levels by 2050.

The EPA, MIT, CRA International and others have analyzed the economic impact of several of these bills. All of these models show substantially higher electricity, gasoline, diesel and natural gas prices, along with a corresponding decline in economic activity.

I would like to put that in perspective:

In 2006 the U.S. emitted 5.8 billion metric tons of carbon dioxide, or just under 20 tons per capita. An 80% reduction in these emissions from 1990 levels means that the U.S. cannot emit more than about one billion metric tons of CO_2 in 2050.

Were man-made carbon dioxide emissions in this country ever that low? The answer is probably yes—from historical energy data it is possible to estimate that the U.S. last emitted one billion metric tons around 1910. But in 1910, the U.S. had 92 million people, and per capita income, in current dollars, was about $6,000.

By the year 2050, the Census Bureau projects that our population will be around 420 million. This means per capita emissions will have to fall to about 2.5 tons in order to meet the goal of 80% reduction.

The only nations in the world today that emit at this low of a level are poor developing nations, such as Belize, Jordan, Haiti and Somalia.

Even France and Switzerland, compact nations that generate almost all of their electricity from non-fossil fuel sources (nuclear for France, hydro for Switzerland) emit about 6.5 metric tons of CO_2 per capita.

EPA estimates that in 2006, approximately 34% of greenhouse gas emissions were from electric power plants, 28% from the transportation sector, 19% from industry and the remaining 19% from the residential, agriculture and commercial sectors.

So to put the enormity of the reduction goal into an understandable context, if 100% of GHG emissions were eliminated from the electric and transportation sectors, it would still leave the United States approximately 18% short of the 80% goal, even assuming no increases in the years ahead.

Right now our cars and trucks consume about 180 billion gallons of motor fuel. To meet the 2050 target, we shall have to limit consumption of gasoline to about 31 billion gallons, unless a genuine carbon-neutral liquid fuel can be produced. To show how unrealistic this is, if the entire nation drove nothing but Toyota Priuses in 2050, we'd still overshoot the transportation emissions target by 40%.

Such a goal envisions a massive overhaul of our infrastructure and economy, an overhaul perhaps larger and certainly more difficult and costly than the electrification of our economy in the early part of the last century. The cost of such an overhaul, should it even be technically feasible, easily with be in the many trillions of dollars.

Even if the United States were to reduce its GHG emissions substantially, this alone would make a negligible contribution to global GHG concentrations.

Unilateral action by any one country will simply serve to transfer jobs, economic activity and GHG emissions to other countries that do not have similar emissions reduction requirements.

Unless China and India, two of the fastest growing GHG emitters, and other developing countries are brought into a regulatory regime, global GHG concentrations will not decline materially regardless of what the United States does.

Any action on Climate Change must achieve meaningful environmental benefits, and should rely on technological advancements and consumer choices rather than government mandates and more layers of bureaucracy.

A technology-based approach will reduce emissions, keep jobs in America, and strengthen America's energy security by encouraging clean, affordable, and reliable supplies of American energy for consumers.

Climate change is a global problem and it requires a global solution. Therefore, any U.S. action must also require comparable action by developing countries, such as China, whose carbon emissions have already exceeded those in the U.S. Without joint international action, jobs and emissions will simply shift overseas, to countries that require few, if any, environmental protections, harming the global environment as well as the U.S. economy.

Finally, the American public deserves transparency in the process. We must fully engage the American people and keep them informed about potential choices and the impacts that those choices will have on their daily lives.

I believe the bills that we are focusing on here today, if enacted, will be detrimental to the U.S. economy driving up the costs of electricity, gasoline, diesel and natural gas prices at a time when American consumers are already paying too much.

Mr. Chairman, we need meaningful, practical emissions reductions that result in a cleaner, healthier environment, not those that merely tax consumers and shift emissions overseas.

Thank you Mr. Chairman.

REPUBLICAN CLIMATE CHANGE PRINCIPLES

Any action to reduce greenhouse gas emissions should: 1) provides tangible environmental benefits to the American people; 2) advances technology and provides the opportunity to export; 3) protect U.S. jobs; 4) strengthen U.S. energy security; and 5) require global participation.

PROVIDE TANGIBLE ENVIRONMENTAL BENEFITS:

• We need meaningful, practical emissions reductions that result in a cleaner, healthier environment, not those that merely shift emissions overseas to other countries.

ADVANCE AND INVEST IN TECHNOLOGY:

• We should promote technologies that reduce emissions, increase America's energy security, and keep prices for consumers affordable;
• Need advancement of alternative forms of energy such as clean coal technologies to increase the use of America's vast supply of coal, to reduce emissions, and to keep America's coal-dependent communities strong;
• We need expansion of emissions-free nuclear power, including policies that encourage construction of new nuclear power plants and timely completion of the long term nuclear waste storage site;
• We need to promote increases in energy efficiency by removing bureaucratic barriers that prevent businesses from using innovative technologies that produce cleaner energy.

PROTECTING JOBS HERE IN THE UNITED STATES:

• I believe Americans should know the costs they will bear to reduce greenhouse gas emissions and the environmental benefits those reductions will provide;
• Our actions need to promote economic growth and expansion keeping and increasing jobs in the United States.

STRENGTHENING U.S. ENERGY SECURITY:

• We need to reduce America's dependence on energy from unfriendly and unstable foreign governments by producing more American Energy;
• I support a diverse U.S. energy portfolio.

REQUIRING GLOBAL PARTICIPATION AND PROMOTING INTERNATIONAL COOPERATION:

• We need policies that create a level playing field for American workers in the global market place.
• China, India, and similar countries must agree to meaningful emissions reductions before Congress imposes carbon mandates on American workers.

Mr. BLUNT. And thanks for putting this panel together, a broad diversity of views, some of which I didn't get to hear earlier but I have been listening and looking through the comments that have been made already. I have just a few questions here.

Mr. West, clearly we are in what I think you described and others are describing as this world food crisis, which seems more of a crisis because of the world food opportunities we have gotten used to for so long, but in that regard, we are now very dependent on places like Russia and Libya and Egypt. What is the difference in that kind of dependency and the dependency we used to have on places like North Carolina and Louisiana and other places to get our fertilizer and what happens if that trend continues?

Mr. WEST. Well, I think currently world food demand has driven the price of fertilizer off the charts. Farmers are paying the highest prices they ever paid for fertilizer, and the difference is, our distribution system is much longer now. Farmers have traditionally been used to setting their planting date, going to their fertilizer

dealer and saying I am planting tomorrow, get the fertilizer there. Today that is not true. The farmers have to start planning much longer now than they ever have, and because the logistics of bringing urea fertilizer from Qatar is 45 days on the seas, 20 days coming up the river. So it is a lot longer logistic system. And I think in this tight supply, every ton of fertilizer that is produced in the world today is being bid on by three or four countries, India, China, Brazil, and that fertilizer doesn't necessarily have to come to the United States, and that is the difference.

Mr. BLUNT. In that regard, the increase in price of fertilizer, is it being driven—give me some percentage of how much it is being driven by cost of natural gas and other energy and how much it is being driven by demand.

Mr. WEST. Today it is being driven by demand, and that is why we are able to continue to produce nitrogen fertilizer in this country at $12 gas. Now, if you look since 1999, I said we closed all these plants. We closed 13 plants when natural gas averaged $4. By the time it got to $7, we had shut down 25 plants. It is world demand for food that is driving fertilizer prices around the world that has allowed us to keep producing nitrogen fertilizer today in the United States.

Mr. BLUNT. And 10 or 15 years ago, who was the biggest nitrogen exporter in the world? What country?

Mr. WEST. Russia has always played a big role in nitrogen export and when they—when the fall of the Soviet Union, the world fertilizer use fell 17 percent, and Russia has never really caught up with their use of fertilizer. They still import 50 percent of their food, and their production of fertilizer is to the world market and they have always been a major player.

Mr. BLUNT. So this is another case where the world market is truly driving the price.

Mr. WEST. Yes, sir.

Mr. BLUNT. And food generally probably relates to another day but for purposes of this committee, I think that, you know, ethanol is one of the easiest things to blame for cost of food as opposed to energy, competition for food, bad weather conditions, lots of things have kind of come all at once that created this crisis.

Admiral Bowman, Mr. Barton and Mr. Upton both have legislation on spent fuel, and I wonder if you have looked at that and if your group or you personally have taken a position on that bill.

Admiral BOWMAN. Mr. Blunt, the nuclear industry recognizes that the disposal of used nuclear fuel is and never has been a technical issue. It has always been a political issue. We really have two means available today that are perfectly satisfactory from a safety and security point of view. One is to do exactly what we have been forced to do that, and that is, hold it on site where it was produced. The second is to continue down the path required by U.S. law to license and open and operate Yucca Mountain. Those two means both would satisfactorily address the method of disposal of——

Mr. BLUNT. What about spent fuel recycling?

Admiral BOWMAN. That is used fuel. However, we think that there is a better way, and it is that, sir. It is rather than bury in a way up to 90 percent of the energy content of the rods, rather to look into an advanced reprocessing system that does not con-

tribute to proliferation risk, proliferation concerns in this country, and we the nuclear industry very much support that way of doing business, that is, an interim storage method at one or two sites, three sites centralized, followed by a robust research and development approach to develop an advanced reprocessing capability that does not produce pure plutonium as a byproduct and then determine what type of end product is left and achieve the proper disposal of that end product at that time. It doesn't have to happen today. We don't have to determine the disposal of that end product today because we don't know what it is until we complete this R&D.

Mr. BLUNT. Is it safe to assume, looking at what other countries have done, that that end product becomes a much smaller issue to deal with in terms of size and storage and all than the non-recycled product we have now? Would that be right?

Admiral BOWMAN. To a certain extent, it is correct, sir. The other countries that are reprocessing today are using the method that the United States developed specifically for the production of nuclear weapons. It is called plutonium-uranium extraction, PUREX. The downside of that process is that it does produce a pure stream of plutonium as a byproduct. I think the United States will not and should not go back to that method of reprocessing. I think that there is a method to reprocess that would combine that plutonium with the other long-lived radioactive elements and then fission that entire group to really reduce the volume requirements of a repository. Today in France, for instance, the reprocessing technique reduces the volume required for high-level waste disposal by about 60 percent, 66 percent, but it doesn't reduce the repository requirements because the repository requirements are based on the heat load of the product. So we need to go the next step in this country. If we are going to reprocess, we need to do it smarter than what is being done in the world today.

Mr. BLUNT. Now, essentially in France—I see I am about to run out and I am not a good enough attender at this committee to assume I should have much more time than anybody else has, I am absolutely confident of that. The technology they are using in France, for instance, was largely developed by us as military technology and then converted. Is that what I heard you say?

Admiral BOWMAN. Yes, sir, not just largely, completely developed by the United States for the specific——

Mr. BLUNT. A number of staffers from this committee visited some French nuclear sites within the last few months and were reminded over and over again that every bit of technology that was making that system work, at least the people in France that were making the system work, over and over again reminded them that that technology was developed by us, not by them, and they are the ones using it and using it to great advantage in a great renewable source.

Thank you, Chairman. I yield back.

Mr. BOUCHER. Thank you very much, Mr. Blunt, and I would say for your benefit that we will be looking at a range of nuclear issues including the potential for reprocessing as part of our subcommittee's work in a future month.

The gentlelady from Wisconsin, Ms. Baldwin, is recognized for 5 minutes.

Ms. BALDWIN. Thank you, Mr. Chairman.

As the months go by and given the Senate debate last week, it is becoming ever more likely that we will not be passing into law a comprehensive cap-and-trade bill this year. And given those political facts, I have spent a lot of time considering what steps Congress could take this session to get a head start, if you will. For instance, most of the bills that we are looking at today have greenhouse gas registry provisions, and one of the things that we learned from the phase I implementation of the European cap-and-trade system was the importance of having high-quality data about emissions on hand in order to assure that appropriate distribution of allocations occurred, and essentially that means having sectors and/or facilities report their greenhouse gas emissions. As you may all know, a tiny provision in the 2008 consolidated appropriations bill requires the EPA to establish a registry so that we can begin gathering greenhouse gas emissions data and so that we don't make the same missteps that the European Union did in implementing phase I and phase II of their cap-and-trade program.

I want to actually ask a few questions to explore the adequacy of the current registry provisions and about potential modifications we could make at this juncture. I wanted to start with Mr. Goo and Mr. Kuhn. Are you both familiar with the EPA's efforts and have you been invited at all to participate in their process of establishing a registry, and if so, could you elaborate on some of the suggestions that you have made to design a registry and recognizing of course that we already are doing emissions registry in the electrical sector. Mr. Goo first.

Mr. GOO. Thank you for the question. We actually—as you know, EPA is now working on a registry because of the appropriations language and we have been talking to them about it. There is a registry provision in the Lieberman-Warner bill. It is title I of the Lieberman-Warner bill, and we support that as well. So I guess if you are going to work on a registry provision, which we encourage you to do, we would like to work with you on that to make sure that what is happening at EPA fits in with what you are doing. So registry is extremely important, that we get good information form all the sectors now in advance of a cap-and-trade system so that the system will work well. As you have noted, the European system didn't work well because of that precise issue. So again, it is an important issue and we look forward to working with you on it.

Ms. BALDWIN. Mr. Kuhn?

Mr. KUHN. Congresswoman, thank you for the question. We strongly support a registry. As I mentioned in my testimony, we have been reporting for 14 years now and we believe that the registry has to be complete. It has to be—the emissions reductions obviously have to be verifiable. We do think that there should be credit for early actions. That was mentioned by somebody else this morning. I think that those companies and organizations that are out doing reductions on a company basis, on an industry basis are to be commended for their early actions.

Ms. BALDWIN. Thank you.

I have three related questions to the registry, and I would also invite other panelists if you have a comment, I would welcome all comments on this, but I will start again with Mr. Goo. These are the three questions. A, do you believe that EPA is currently operating under enough guidance to establish the registry? Secondly, greenhouse gas registries in the bills that we are examining today differ based on whether they cover—whether they look at covered facility or entity. For example, the Boxer substitute, I think, follows the facility approach and the Markey bill looks at effective entities and I would like to hear your thoughts on which direction we should go. And then lastly, it is my understanding that EPA in their rulemaking is operating under authority in the Clean Air Act to set up the greenhouse gas registry and it is my understanding that the registry designed in the Markey bill also establishes its framework within the Clean Air Act. But I wonder if you have any thoughts about whether the Clean Air Act provides the appropriate authority or whether it might be more appropriate to set up a registry under the Emergency Planning and Community Right to Know Act because as we know, the Community Right to Know Act already contains a registry, the Toxic Release Inventory, that requires public disclosure of toxic releases and I just wondered if you had comments on those three questions starting with Mr. Goo.

Mr. GOO. Thank you. The first question, do I think EPA has adequate guidance, EPA has a long history of dealing with these issues so they tend to know what they are doing but the guidance that was provided by Congress in the appropriations act is really fairly sparse so it certainly would not hurt to direct them with more specificity and a more comprehensive system. I think that makes sense.

The next question is whether or not EPA should use a covered facility or a covered entity definition. I think that the finer grain definition that we have, the easier it is going to be to know what we are doing. I actually am not prepared now to address the differences between the Markey bill versus the Boxer and how those different definitions work, especially under the Clean Air Act, but we will take a look at that and get back to you.

The final question, Emergency Planning and Community Right to Know, obviously it is very important that the public have transparency. That is the basis of the Emergency Planning and Community Right to Know Act. It is also important that under the Clean Air Act, there is already an existing system for enforcement as Mr. Kuhn has noted, that the power industry has been reporting under the Clean Air Act for a number of years. I think we probably need to look to see which of those two statutes or maybe a combination of those two statutes would work.

Mr. KUHN. I think Mr. Goo said it all. I really think we would look forward to working closely with you on those specific questions but I think the general drift of what he said was correct.

Mr. WEST. I would just say from a fertilizer perspective, EPA is pretty knowledgeable about our emissions because they have studied our industry for years, and we don't have any problems with the registry and working with the registry.

Mr. BOUCHER. Thank you, Ms. Baldwin.

At this time, we are pleased to recognize the gentleman from Oregon, Mr. Walden, for 5 minutes.

Mr. WALDEN. Thank you very much, Mr. Chairman.

Mr. Kelly, I want to go to you first because we are talking a lot about creating a system that would rely upon carbon sequestration, compression and storage. Is there technology in place, in operation today that does all three of those things?

Mr. KELLY. Currently, not on the scale that we are talking about for electric generation. There is currently, what I understand, and I am certainly no expert on, in enhanced oil recovery, limited amounts of carbon dioxide are used to facilitate that process. However, again, I am not qualified to really——

Mr. WALDEN. Mr. Kuhn, can I go to you maybe from the electric institute? Talk to me about that. Is there proven technology today, commercially available, to sequester, compress and then store carbon from power generation?

Mr. KUHN. Maybe the key here to your question is proven. Once again, on the capture side, we have a number of technologies that are being worked on right now.

Mr. WALDEN. Commercially available?

Mr. KUHN. I think they are more in the demonstration side, and there is no CO_2 capture technology that is right of the shelf right now.

Mr. WALDEN. And when you capture, then don't you also have to compress before you can store?

Mr. KUHN. Well, that is the other—the situation is, you need a major addition to the pipeline capacity. You would need to replicate a lot of pipelines in this country to get the gas to where you want to store it and then there is the sequestration question.

Mr. WALDEN. So you would have to build all new, a bunch of new pipelines across the country. Is that correct?

Mr. KUHN. Yes.

Mr. WALDEN. And then when you go to store it, isn't carbon a pollutant now? Isn't it described as a pollutant under the Clean Air Act?

Mr. KUHN. Under the Supreme Court finding.

Mr. WALDEN. Right. And is it legal to put a pollutant in the ground?

Mr. KUHN. I think the legality is that you would have licensing questions, you would have public acceptance questions, you would have liability questions and those are, I think as we look at the, again, what we call the technical issues and the non-technical issues, the non-technical issues are every bit as challenging as the technical issues.

Mr. WALDEN. And I think the technical issues about having the technology in place to do what is called for under this legislation, we aren't quite there yet. But we need to—I understand, but we need to invest and get there and make sure it is also commercially available and affordable. Now, in February of 2007, you talked about principles for carbon signals in the market. Gasoline is now double what it was then. Natural gas is now double what it was then. There are some estimates that electricity costs are going to be up 29 percent this year because of increased cost of coal. How high a price signal in addition to the current market do you think is necessary to reduce carbon demand?

Mr. KUHN. Well, I think a price signal that would be based on a carbon cap-and-trade system or a tax or whatever would be carbon specific as opposed to the——

Mr. WALDEN. So how high does that need to be? Our chairman had a sort of draft proposal out there of an additional 50-cent-a-gallon tax, carbon tax, and he has since withdrawn that. Is that what you think it would take? How big a signal?

Mr. KUHN. We think several things are very important. Number one, the price initially should be moderate and——

Mr. WALDEN. What does that mean?

Mr. KUHN. To make sure that it does not harm the economy. I think that is a question of——

Mr. WALDEN. So in addition to the current market price, you still think there needs to be additional cost?

Mr. KUHN. Well, I think that if you are going to establish a cap-and-trade system, there certainly would be an additional cost on there. I think it is important to have a safety valve to make sure that the price does not go——

Mr. WALDEN. And I hate to cut you off. I have got a minute and 13.

Mr. West, I represent 70,000 square miles of the most beautiful patch of the country possible, I may get argument from my colleagues, and a lot of that is agriculture, and you probably heard me in my opening comments say, I have got fruit growers that are paying double for fertilizer. What is $12 natural gas going to do to those folks, and are we going to see your industry continue to go offshore, and how do we compete?

Mr. WEST. Well——

Mr. WALDEN. And what kind of price signal do you need, do you think is needed for the fertilizer industry and what effect does that have on feeding people, which by the way, is a humanitarian issue.

Mr. WEST. The current price of fertilizer is tied to world food demand. That is what driving the fertilizer price.

Mr. WALDEN. It is not tied to natural gas prices, sir?

Mr. WEST. The world food demand is allowing us to continue produce at $12 natural gas in the United States. As I said before, we shut down plants when gas was $4, had 25 shut down when gas was $7. We are producing fertilizer today at $12 because the world demand for food, which has driven up the world demand for fertilizer, and that is why today's price of fertilizer is at record levels and, as you know, commodity prices are also at record levels. We went to $22. The reason it did that was because the demand for food brought on by weather conditions in Australia and places like that.

Mr. WALDEN. Well, I just raise these issues because I continue to—when I look at the cost of what it costs to fill up the tank in the tractor or the pickup or the whatever and the effect that is having all the way to the grocery store, and I sit in these hearings and hear this isn't enough, we have got to have additional cap-and-trade system that could equal $6 trillion, this is going to do enormous damage to the Wal-Mart mom and the diesel truck driving dad.

Mr. WEST. If the price of natural gas continues because of the demand generated by the utilities going to natural gas——

Mr. WALDEN. Right, away from coal.

Mr. WEST [continuing]. Then we will close our facilities, have to go into the world market and purchase 8 million tons or 11 million tons of ammonia. That will drive the world price of fertilizer even higher.

Mr. WALDEN. My time is expired, Mr. Chairman. Thank you for your courtesy.

Mr. BOUCHER. Thank you very much, Mr. Walden.

The gentleman from Washington State, Mr. Inslee, is recognized for 5 minutes.

Mr. INSLEE. Thank you.

Just kind of in response to some concerns people have brought up today about cost, I just want to note, we are all sort of suffering under the tyranny of the status quo and everybody is thinking that we are locked in to the technologies we have today and it is very frustrating to me, having spend the last couple years getting to know the people who are developing the new visions. I had lunch with a guy the other day who has a company called Sapphire Energy. It is a California-Washington company. They just raised $50 million venture capital. They have a technology to use algae to produce not biofuel but gasoline with the same ATSM characteristics of gasoline, which would be a net-zero CO_2 emitting net technology today. I went to talk to Google the other day, who has made a multimillion-dollar investment in a company called Altarock that has enhanced geothermal, which where you don't depend where springs are. You punch a hole down 3 kilometers and you bring up water at 300 degrees Kelvin and you produce steam, and according to the DOE, there is enough energy to produce half the electricity in the United States. We had a solar thermal company sign a contract the other day with Ford in California for 400,000 homes, and it is frustrating to me that we don't think of these things that are just around the corner of commercialization that the cap-and-trade system is pivotal to their commercialization, both by creating a fund that I talked about earlier for R&D and for driving demand for these products. I just want to note that. If anybody wants to make a comment on what I said, feel free. Mr. Kuhn?

Mr. KUHN. Congressman, in my testimony, I extensively talked about our support for just the kinds of technologies you are talking about. We definitely need to push energy efficiency to the maximum extent possible, and the good news, as you indicated, is there are many technologies. I mentioned the advanced meters and information system, the plug-in hybrid vehicles and things of that nature that can contribute greatly, and I think that we need to have the public policies that will help support and make them happen. Additionally, on the renewable side of the equation, we have many things happening there as well and we need to have the public policies that will support that but I would say, the conclusion that they can do it all I think is wrong.

Mr. INSLEE. No, no, I want to make sure you understand. I am not suggesting they can do it. I totally believe in a portfolio approach, a smorgasbord, spreading our risk. Any portfolio diversifies. I believe we should be doing research on any single CO_2-emitting technology possible that is available to us. But I want to ask you this question. In dividing up the research dollars and what we

do, this is a bill we are not considering but it has been proposed. We have sort of a wires charge to finance clean coal sequestration technology research, and I support research on clean coal sequestration. I think it is worthy of research to see if there a way we can sequester CO_2 and make that a commercially viable technology. I think it is a little bit of a long shot but I think it is worthy of that. But I think it is critical that we don't allow that to swallow the research budget with all the other technologies that we have. How would you suggest, Mr. Kuhn, and I will ask the others, how do we divide up the R&D pie or the loan guarantee pie amongst all of these potential technologies, between solar thermal, advanced biofuels, enhanced geothermal, transmission grid improvements, nuclear, clean coal. How should we make sense of this to divide that up? Does anybody have any general ideas in that regard? I am presuming everybody agrees that everyone should be involved, every technology, but do you have any other suggestions?

Mr. KUHN. I just might say, you have to look at each technology specifically and see what is most needed. The carbon capture and storage issue is a demonstration issue and needs a great deal of funds to help move those demonstrations. In the House Appropriations Committee, I think the other day there was a doubling of the funds in there for energy efficiency and renewables, and certainly I think that is a good thing, but in addition, on the renewable side, you need some of those production tax credits and investment tax credits as well so on the nuclear side, it is mostly about loan guarantees so there are different approaches that are needed for each of the technologies and you have to approach it that way.

Mr. INSLEE. Right. Let me ask one quick question. I hope all of you will share your thoughts, but what Mr. Doyle and I are working on, a way to reduce the impact of this on energy-intensive industries that might be exposed to international competition. I will look forward to your thoughts about that. Also, Ms. Baldwin was talking about this early registration bill that I am very interested in. I have actually introduced a bill last year about this. I would appreciate any of your thoughts about that, how to do that. Does anyone think it is a bad idea to pass a registration and data-gathering bill this year? Would anybody be opposed to doing that this year so we can get out of the gate at least gathering data?

Mr. GOO. Congressman, let me just address a few things that you have mentioned. First of all, a registry bill this year would be great but a full cap-and-trade bill would be even better so we can get that done as soon as possible. That is really the primary goal. We do have registry efforts already in place, and as I explained to Congresswoman Baldwin, it is important to do more in that area and we would support work there. But I couldn't agree with you more about the transforming effect of the allowance revenue on our economy and the need to not look at our economy and particularly our energy economy as a static picture. That doesn't have to be the case. And what you need is, you need a push from below, the money from below you also need to pull, that is the price signal from above. CBO has made that quite clear, that you can't get these technologies into the marketplace if you don't have the push and the pull.

Now, with regard to how the money should be divided up, there are really sort of two main needs. One is the technology need and the other is the need to mitigate the impacts on the lowest income producers and wage earners in our society. So that is the first thing. But when we get to the technology pie, we should look at things like performance-based standards for giving the money. We should look at things like reverse auctions for giving the money. Those are the—I see your time is up.

Mr. INSLEE. Thank you.

Mr. BOUCHER. Thank you very much, Mr. Inslee. Thank you, Mr. Goo.

The gentleman from Illinois, Mr. Shimkus, is recognized for 5 minutes.

Mr. SHIMKUS. Thank you, Mr. Chairman. I know Ms. Bono Mack wants to do a unanimous consent to submit some questions for the record because I imagine you might be ending this with votes with his panel. Is that true?

Mr. BOUCHER. If it is at all possible to do so. Ms. Bono Mack, would you like to make a unanimous consent request?

Ms. BONO MACK. I am sorry, yes, please, if we could just submit questions for the record.

Mr. BOUCHER. Without objection, the record will remain open for a period of 2 weeks in order for questions to be submitted and responses to be received from the witnesses.

Ms. BONO MACK. I thank the chair.

Mr. BOUCHER. Mr. Shimkus.

Mr. SHIMKUS. Thank you, Mr. Chairman. I just want to register a complaint, Mr. Chairman. You are playing the Lutheran card on me, and that is unfair. I would note that the Evangelical Lutheran Church in America is a little more moderate than my brand but we want to welcome you here, and come in and see me and we can talk about really the harm that is going to be done to the people you are hoping to address. That is where a lot of this debate is coming from.

Who can tell me what the number one issue on the public mind is today? Anyone want to guess? National polls are pretty clear, no surprise to anybody. Mr. Kuhn?

Mr. KUHN. High energy prices probably.

Mr. SHIMKUS. High energy prices. It should be no surprise to anybody. In January of 2007, crude oil price was about $58 a barrel. Today it is $134 a barrel. Gasoline prices have gone from—it is up $1.75 actually in just one year. Now, I would like to ask everybody in traditional Chairman Dingell yes or no, will movement on a climate bill increase the cost of gasoline? Mr. Kelly, yes or no?

Mr. KELLY. It depends.

Mr. SHIMKUS. Be brave. What do you mean, it depends?

Mr. KELLY. I think the expectation is yes.

Mr. SHIMKUS. Mr. Goo?

Mr. GOO. As a percentage of household income, your energy prices will be lower.

Mr. SHIMKUS. The question is, will the gallon of gasoline be more expensive under a climate change regime?

Mr. GOO. Perhaps slightly.

Mr. SHIMKUS. That is about the best as I am going to get so I will take it. Thank you.

Mr. REUTHER. Yes.

Mr. SHIMKUS. Thank you.

Ms. Jacobson?

Ms. JACOBSON. Certainly it is possible but the key is the policies in place that will help mitigate that for consumers.

Mr. SHIMKUS. Certainly it is possible? We are the politicians here. You are the expert.

Ms. JACOBSON. Well, not on fuels, on the power sector, but——

Mr. SHIMKUS. Well, we are going to get to that. Just prepare for question number two.

Mr. Kuhn?

Mr. KUHN. Yes.

Mr. SHIMKUS. Admiral Bowman?

Admiral BOWMAN. Yes, sir. Let me quickly add, if the impetus draws us to plug-in hybrids fed from nuclear power plants, I think we can make it neutral.

Mr. SHIMKUS. And actually we are very excited about that opportunity. We are going to talk about plug-in hybrids a little bit if I have time but I don't think I have a lot of time.

Ms. Minette?

Ms. MINETTE. I am no expert but I would say probably yes.

Mr. SHIMKUS. That is a good guess.

Mr. West?

Mr. WEST. Yes.

Mr. SHIMKUS. Great. Now, let us go to electricity. Any climate bill present will increase the cost of electricity. Mr. Kelly?

Mr. KELLY. All five bills that we studied for this hearing would lead to price increases.

Mr. SHIMKUS. Do you have a percentage?

Mr. KELLY. We have got analysis that we have done from CRA International, which I would be happy to supply, that would show the projected price increases for the Lieberman-Warner legislation.

Mr. SHIMKUS. What is the increase?

Mr. KELLY. By 2030——

Mr. SHIMKUS. If Kraig was there, he could give it to me.

Mr. KELLY. That is quite possible. I will have to get back to you on that, sir.

Mr. SHIMKUS. All right. Thank you.

Mr. Goo? But it is going to increase.

Mr. GOO. If revenues are recycled as in the Markey bill, the cost impacts to the lowest wage earners in the American public can be mitigated entirely.

Mr. SHIMKUS. OK, but that is not in line with the GAO report. Is that correct?

Mr. GOO. That is again——

Mr. SHIMKUS. My time is running. Mr. Reuther?

Mr. REUTHER. Yes.

Mr. SHIMKUS. Ms. Jacobson, my expert.

Ms. JACOBSON. Many of the studies confirm that there will be some increases, but if you do more efficiency like ACEE reports shows——

Mr. SHIMKUS. The answer is yes, there——

Ms. JACOBSON. Well, there are a variety of studies on this so I think we don't quite know yet because we don't know what the legislation is going to look like.

Mr. SHIMKUS. Mr. Kuhn?

Mr. KUHN. If this is another issue which is high on the minds of the American people, we need to solve, the answer is yes, it certainly will have a cost.

Mr. SHIMKUS. Admiral Bowman?

Admiral BOWMAN. The answer is yes but less so if nuclear is a part of the program.

Mr. SHIMKUS. Ms. Minette?

Ms. MINETTE. Again, I am not an expert but what I have read is in the short term, yes, in the long term, perhaps not as much.

Mr. SHIMKUS. And I think most people worry about immediate cost escalations to get kids to school. Mr. West?

Mr. WEST. Yes.

Mr. SHIMKUS. Of course, I appreciate your testimony because I represent rural America and fertilizers.

Let me just say, Mr. Chairman, that everyone at this panel concurred that climate change legislation will increase gas prices and electricity prices.

Mr. BOUCHER. Thank you very much, Mr. Shimkus. I think that point was made.

We have another series of recorded votes on the Floor of the House and 6 minutes, 42 seconds in which to respond to those. Mr. Waxman, if you want to attempt your questions, I will be happy to stay here with you.

Mr. WAXMAN. I will try to make it less than the time allotted to me.

Mr. BOUCHER. You have a total of 8 minutes.

Mr. WAXMAN. Let me just see if I can do it in 3.

Mr. BOUCHER. That will be fine.

Mr. WAXMAN. As this committee and the Congress develop legislation to tackle global warming, it is essential we get the fundamentals right. We are confronting a looming crisis with very little time to avoid catastrophe. Unless we adopt a real and comprehensive response based on what the science says is necessary, our efforts will be in vain. That is the foundation for my legislation, the Safe Climate Act, and I am pleased that 152 of my colleagues have joined me on this bill to date. I have also worked with two members of this committee, Mr. Markey and Mr. Inslee, to develop a set of broad principles for global warming legislation, which complement and supplement the Safe Climate Act. Over 80 of our colleagues have joined with us on those principles, and we expect to expand that support.

We believe there are four key goals for global warming legislation. One, reduce emissions to avoid dangerous global warming; two, transition America to a clean energy economy; three, recognize and minimize any economic impacts from global warming legislation; and four, aid communities and ecosystems vulnerable to harm from global warming. I would like to ask if any of the witnesses disagree with these goals and presumably you would support those goals, unless you disagree. Yes?

Mr. KUHN. Mr. Waxman, certainly it is easy to support those goals. I think that with respect to the economic impacts, we strongly believe that any legislation needs a safety valve and——

Mr. WAXMAN. Well, my goal was recognize and minimize any economic impacts.

Mr. KUHN. I certainly agree with that goal. I am just talking about things that might help us get there.

Mr. WAXMAN. Now, I would like to know if this panel agrees that climate legislation must reduce emissions to the degree science tells us is necessary. Does anybody disagree with that idea?

Mr. KUHN. Consistent with the availability of technology to get us there, and certainly we agree with your long-term goals.

Mr. WAXMAN. I would like to be informed whether you agree, this panel, that the Intergovernmental Panel on Climate Change is the preeminent scientific body on this matter and we should look to it to understand what emissions reductions are necessary. Anybody disagree with that?

And I would be interested to know if you agree that to protect our environment, economy, energy security and national security, we need to transition America to a clean energy economy. Anybody disagree with that? Thank you for your lack of agreement, or at least lack of disagreement.

I have been working on legislation to address global warming since 1992. There is now a widespread call for congressional action although, as today's testimony shows, not everyone is on the same page yet. That is why this committee must exercise leadership. We must have clear vision for our Nation's energy future and we must make that vision a reality. It won't be easy but I know it can be done, and it must be done soon, and I look forward to working with the chairman and members of this committee, the interests represented here today and many others to adopt strong global warming legislation that meets the principles I have outlined today before it is too late. Thank you, Mr. Chairman.

Mr. BOUCHER. Thank you very much, Mr. Waxman.

We do have some other members who want to propose questions, Mr. Barton is here, for example, and so I am going to ask this panel to remain, if you don't mind doing so. If it is not possible for you, we understand. We have a series of four votes pending, and that will take approximately 45 minutes. So pending the conclusion of those votes, the subcommittee stands in recess.

Mr. BARTON. Mr. Chairman, my questions will be very easy so I hope they will stay.

Mr. BOUCHER. Well, potentially they will be enticed by that assurance to remain here.

Mr. BARTON. They won't be mean.

[Recess.]

Mr. BOUCHER. The subcommittee will reconvene. Well, my apologies to the veterans of panel number one, and thank you for your tremendous patience.

The gentleman from Texas, Mr. Barton, the ranking member of the full committee, is recognized for his questions.

Mr. BARTON. Well, thank you, Mr. Chairman. The person I wanted to ask the first question to is just now sitting down, so as soon as Mr. Kuhn gets seated. If we will have the media capability, I

would like for Mr. Kuhn to put his chart back up that talked about 2008 prism of solutions, something like that. It showed the amount of emissions, CO_2 emissions by year from 1990 up to 2050 and various scenarios, how various bills and policies would impact that. No, not that one. It is more of a graph. It shows by year and then strategies, technologies to ameliorate. It had a heading, 2008, and I think prism something. No, that is not either. That is it.

[Chart shown.]

Mr. BARTON. You can't see that very well from here but I studied it when it was up. The vertical graph is tons of U.S. emissions and the horizontal graph is timeline, and Mr. Kuhn, in 1990 that chart I think shows total U.S. emissions were about 1,800 gigatons. Is that correct?

Mr. KUHN. That is correct.

Mr. BARTON. OK. Right answer. Now, most of the proposals that we are looking at today for reductions, and put aside for a second whether I think we need to reduce or not. I am still skeptical that CO_2 is a pollutant, but let us assume that we do need to reduce emissions. Most of the bills today require emissions order of magnitude in the 80 percent range. What is an 80 percent reduction from 1,800?

Mr. KUHN. Congressman, an 80 percent reduction from 1,800, I am not sure I have got the math there——

Mr. BARTON. About 4.6?

Mr. KUHN. Right.

Mr. BARTON. We would reduce the number of tons down to actually 360 gigatons for the entire U.S. economy.

Mr. KUHN. Congressman, this chart only goes through 2030. It is not taking us out to 2050, but——

Mr. BARTON. OK. I am going to get to my point. The point I am trying to get at it is, at 360 gigatons for the whole U.S. economy in 2050, we are probably going to have around 400 million Americans, that is either 1 ton per American or maybe 10. I don't have a slide rule with me. But as I said earlier, in Texas right now, per capita tons of CO_2 emissions is 31 tons. I don't think we have a concept of what 80 percent off of 1,800 is but it is a very small number and I do know that just me talking up here in Congress, respiring in and out, inhaling, is a third of a ton a year. What kind of economy do we have if we go from the baseline of 1,800 gigatons in the U.S. economy to 360 gigatons?

Mr. KUHN. Well, Congressman, I warned in my testimony about picking out targets and timetables that didn't mesh with our ability to get the technologies available. Again, I think it is very easy to pick out a target and timetable. It is a whole other question if you want to ask how we are going to do this, and I think the how we are going to do this question really needs to be considered before you pick out the target and timetable, and I think in many cases, that is not being done. If you extrapolate that chart out to 2050, again, I think what we would be saying is if you had the full suite of technologies in play at that point in time, including nuclear, which is a zero carbon, carbon capture and storage on coal plants, at least on new coal plants, and have been putting them on from the 2030 time frame on, and that you have renewables and that you have energy efficiency and you have plug-in hybrid vehicles,

you would essentially be in a much lower carbon fuel supply situation. But I think when some people arbitrarily will pick out numbers and just say, well, let us go 10 percent higher, let us go 10 percent higher than that, it does become more of a wishful thinking than a real——

Mr. BARTON. Well, my point is that we throw these numbers around and the public and members just take them on faith, but an 80 percent reduction from a 1990 baseline is a huge reduction.

Now, I want to ask Mr. Goo a question. He used to work around here and he is now doing a good job at the National Resources Defense Council. He was a bright fellow when he worked for Chairman Dingell before so I am assuming he is still a bright fellow. Do you know—and if you don't, it is OK, because I don't—how many tons does the average car emit out of the tailpipe? I was going to ask this to Mr. Reuther but he is not here. How much does the average vehicle emit in tons of CO_2 each year if you drive it the average number of miles, which I think is around 18,000 miles?

Mr. GOO. I don't want to give you the impression I am not that bright but I actually——

Mr. BARTON. Well, no, I don't——

Mr. GOO [continuing]. Know the answer off the top of my head.

Mr. BARTON. I thought you might actually know. That is the only reason I asked you.

Mr. GOO. Yes, I apologize.

Mr. BARTON. Well, I want to say, and again, I could be wrong, and I have been many times, as Mr. Boucher would tell you, but I think it is around 3 tons. If it around 3 tons, and we add a third of a ton just by breathing, we have almost used up the 80 percent number reduction in breathing and driving, and we are not talking about heating or cooling or cooking or anything like that. My last question——

Mr. GOO. Congressman, could I just——

Mr. BARTON. Yes, sir.

Mr. GOO. We were not actually going to be covering human emissions. We are not going to be trying to reduce emissions from humans, so——

Mr. BARTON. I know, but you have a cap.

Mr. GOO. The cap doesn't apply to human emissions.

Mr. BARTON. It applies to total emissions?

Mr. GOO. It doesn't apply to human emissions. It would apply to emissions from so-called covered sources, so——

Mr. BARTON. I know, but the whole point of the cap is to reduce the total number of emissions. Isn't that correct?

Mr. GOO. That is correct, but from covered sources, not from humans.

Mr. BARTON. I understand that. I am not saying you are going to tell us we have to breathe every other minute or something. I am not saying that. Only every person can breathe on alternate days, I am not saying that. But if you have a cap and you are reducing total emissions and we are part of the emissions, even though we are not covered, you have to reduce more emissions from what is covered. I mean, that is just—that is a fact.

Mr. GOO. No, the cap doesn't cover those emissions.

Mr. BARTON. So——

Mr. GOO. They are outside the cap.

Mr. BARTON. OK. We are going to pass a law that——

Mr. GOO. Allows us to breathe.

Mr. UPTON. Mr. Goo, I think what he is trying to ask is, if Texas chili is going to be still allowed or not.

Mr. GOO. Texas chili and Dr. Pepper will still be allowed.

Mr. BARTON. Well, my time is expired and I need to yield back to the very gracious chairman. I understand that two-thirds of CO_2 is noncontrollable, it is not covered, to use Mr. Goo's term, but if you set that number up there is a total emissions, that is not man-made emissions, it is total. If you set the total, you reduce it, you have to reduce that which is covered.

Mr. GOO. None of the bills that this committee is considering now would cap those emissions.

Mr. BARTON. I understand that.

Mr. GOO. The 80 percent reduction would only apply to basically industrial sources and other sources.

Mr. BARTON. Oh, you are saying the 80 percent number doesn't apply to the total?

Mr. GOO. Yes, that is right. It doesn't apply to the total. It doesn't apply from trees. It doesn't apply from soil. It doesn't apply from people.

Mr. BARTON. It only applies to that which is controllable?

Mr. GOO. That is right.

Mr. BARTON. All right. That even reinforces my point. If that is the case, Mr. Goo, tell me what the temperature change if we met that goal in the year——

Mr. GOO. The temperature change that we need to avoid is a 2-degree Celsius temperature change.

Mr. BARTON. No, I asked what the temperature change effect would be.

Mr. GOO. The temperature change effect with action from other countries, comparable action——

Mr. BARTON. No, that is not what I asked. If we meet the goal in these bills, what is the temperature impact worldwide? And the answer is zero.

Mr. GOO. It is slightly above zero but it is not sufficient to avoid catastrophic global warming.

Mr. BARTON. It is zero, or close to zero.

Mr. Chairman, I yield back.

Mr. BOUCHER. As much as I am enjoying this exchange——

Mr. BARTON. I understand.

Mr. BOUCHER. Let me say the gentleman's time is expired and——

Mr. BARTON. It did.

Mr. BOUCHER [continuing]. I thank him for his questions.

The gentleman from Massachusetts, Mr. Markey, is recognized for 5 minutes.

Mr. MARKEY. Thank you, Mr. Chairman, very much.

Mr. Shimkus asked earlier whether climate legislation would raise gasoline and electricity prices. I am convinced that my legislation, the ICAP legislation, cap and invest, will unleash a technological revolution and actually put money back in consumers' pockets because of the lower priced goods that will ultimately save

them energy. But let us be clear about these bills and how they work. ICAP, for example, in my bill, there is a 100 percent auction of pollution allowances and it returns over half of the proceeds to low- and middle-income consumers through tax credits and rebates. Eighty percent of Americans under my approach would receive benefits and two-thirds of all households would be fully compensated for any additional costs resulting from the bill, increased gasoline or electricity prices. Mr. Shimkus's district, for example, over 96 percent of his constituents would receive benefits and over 70 percent would be held completely harmless under my ICAP legislation. So I would like to ask quickly each one of the people on the panel, do you believe, yes or no, that that kind of mechanism, some kind of mechanism like that is an essential element in climate legislation, that we take care of consumers? Mr. Kelly?

Mr. KELLY. We would advocate that climate legislation should address the——

Mr. MARKEY. Yes or no, please.

Mr. KELLY [continuing]. Issues at hand, so it would have to address the question of emissions.

Mr. MARKEY. Right, but should there be rebates, yes or no, rebates and tax breaks for the consumers who are affected in these groups that I was just mentioning?

Mr. KELLY. We don't have policy on that but I suspect the answer would be no.

Mr. MARKEY. Would be no. OK. Thank you.

Mr. Goo?

Mr. GOO. Emphatically yes.

Mr. MARKEY. Thank you.

Ms. Jacobson?

Ms. JACOBSON. Yes, of course, and if I may, I would like to also acknowledge the large energy efficiency and renewable energy investments your legislation has, which also will help mitigate price impacts.

Mr. MARKEY. Thank you.

Mr. Kuhn?

Mr. KUHN. We think there should be allowances that would go to customers through their local distribution companies as an alternative way that you would do that and would be based on a formula but also I think you have to worry about the economic competitiveness. So you are worried about the industries and things of that nature and the impacts of the prices that they might incur.

Mr. MARKEY. But you would support rebates to consumers. Thank you.

Admiral Bowman?

Admiral BOWMAN. I have two yesses, yes for the consumers but also a part of that should be delivered to generating the required technologies and the low-carbon ability to generate electricity.

Mr. MARKEY. Thank you.

Ms. Minette?

Ms. MINETTE. Absolutely, and we very much like the approach——

Mr. MARKEY. Absolutely yes?

Ms. MINETTE. Absolutely yes.

Mr. MARKEY. OK. Good. Thank you.

Mr. West?

Mr. WEST. Who am I to disagree with the Lutheran Church? Of course.

Mr. MARKEY. Beautiful. Now, we have heard a lot of doom and gloom today about why we can't act now to save the planet. We don't have the technology, it will ruin the economy. Those are the very same arguments that were used by the technology community, the telecommunications community, that wanted to hold onto the black rotary dial phone for 80 more years, and when we broke up, all those monopolies, when we passed the 1996 Telecommunications Act, who would have thought we would all be carrying around BlackBerries and iPods and broadband service just 10 years later? A revolution unimaginable really to those that really wanted to hold onto the black rotary dial phone. I think the same kind of revolution is about to occur: lowering the costs, improving our lives.

Mr. Goo, could you tell us how you think these new technologies are going to meet these challenges?

Mr. GOO. Absolutely. I completely agree with your comments about the state of computer technology just 30 years ago, and most of the models that we see predict a very static energy situation. We think that the billions and billions of dollars that will be created under a cap-and-trade system can be used to incentivize these technologies and encourage their development and we are going to see a low-carbon future under which we are more energy independent and we have more business opportunities and more jobs, green jobs, good green jobs in America.

Mr. MARKEY. And one final question to you and Ms. Minette. Ms. Minette, your testimony highlights the importance of auctioning pollution allowances rather than giving them away free to polluters. Isn't it true that giving allowances for free to polluters will not in most cases reduce costs to American consumers and instead result in windfall profits for the polluters themselves?

Ms. MINETTE. That is our position, yes.

Mr. MARKEY. Mr. Goo?

Mr. GOO. Yes, it is absolutely the case. It is interesting, if you give somebody $1, they don't give it back to you unless you give them something worth something. If you give pollution allowances to these companies, they will keep them and they will charge more for the electricity, and interestingly enough, they will actually charge you for that carbon allowance that they receive for free.

Mr. KUHN. Mr. Markey, I——

Mr. MARKEY. If the chairman would allow? Yes, Mr. Kuhn?

Mr. KUHN. I would totally disagree with that, and I think if we are not talking about giving them to the companies, we are talking about giving them to the consumers, and rather than putting the money back in the government and having it given to a whole lot of different interests, we are trying to decide what the difference is between low-income and middle-income. We are talking about exactly the way that this was impacted to the consumers, in other words, if the utility industry is responsible for 34 percent of the emissions, those allowances can go back. We are regulated industries and I guarantee, the regulators are going to make sure this money gets back to the consumers.

Mr. MARKEY. We just have to avoid the fiasco that unfolded in Europe. Otherwise we are just going to engage in repetition syndrome and we have to take note of what did happen there. Thank you, Mr. Kuhn.

Thank you, Mr. Chairman.

Mr. BOUCHER. Thank you very much, Mr. Markey

The gentleman from Texas, Mr. Burgess, is recognized for 5 minutes.

Mr. BURGESS. Mr. Kuhn, if you wouldn't mind just expanding on that a little bit, I am not sure you had enough time to adequately answer the question or weigh in on your observation of the answers that were given previously. In a regulated environment, how would that money actually devolve then to the consumer?

Mr. KUHN. Well, number one, we are talking about cost containment mechanisms because I think we have all agreed that this is going to be—any kind of legislation will impact the consumer, electricity consumers, and we are just talking about the electricity segment here, but under that situation, this is why we feel very strongly that there needs to be a safety valve, particularly to prevent the volatility of a market that is occurring in Europe right now and economic harm to the economy, so I think the safety valve is a major cost containment mechanism that needs to be put in place. We think that ample use of offsets need to be put in place because that is where you will probably get the most cost-effective emissions reductions from offsets, at least in the early years. And thirdly, on the allowance side of the question, we don't have an agreed-upon position in our industry in terms of how the allowances should be allocated from the standpoint of customers that may be most effective because they are receiving their power from coal or whether or not customers that might be affected by they are already receiving electricity from clean power sources but we do know that all those allowances we believe should go back to the local distribution companies and should be—and with the work of the regulators would ensure that they go back to the customers. I think it has been misinterpreted. In Germany, for example—and it is not all the EU but in Germany in particular, there was a situation where allowances went to the companies and did not get to the customers because they have a different regulatory situation. So it is——

Mr. BURGESS. How would that work in a State where deregulation of the electrical utility has occurred?

Mr. KUHN. I think that in restructured States, particularly——

Mr. BURGESS. Texas, for example.

Mr. KUHN. Texas, for example. In Texas, for example, if the allowances went to the LDC, they would be sure to get back to the customers, and again, you could have a formula based on an input formula and an output formula and figure out how that should be divided, but make sure that it goes back to the LDC and that ensures it going back to the customers.

Mr. BURGESS. I think in your testimony you talked about advances in technology, things like net metering that would make a difference in the future. Is that correct?

Mr. KUHN. That is correct.

Mr. BURGESS. Now, in Texas, we do have net metering but I have encountered constituents who have attempted to do their own thing with either solar panels, windmills, and have encountered having to purchase a rather large liability policy in order to have the electric meter flow both ways. Is that in fact common for the consumer to have to buy a liability policy when they want to engage in net metering?

Mr. KUHN. Well, I think the issue about specifically how net metering might be done in different States, their regulation is done on a State level and so it certainly differs from place to place.

Mr. BURGESS. It seems to me if we want to foster that, which sounds like a good idea when you brought it up in your testimony, I do agree with you that advances in technology will make the distribution and use of electricity much more efficient in the future, but there must be some way we can allow either by capping liability or by some method so that these rather large liability policies won't be stock and trade in the future.

Admiral Bowman, can I ask you, what are some of the obstacles right now to getting America back on its feet as far as the evolution of nuclear power? It just seems like it takes so long and it is so expensive and we did do some things in 2005 and the reason we put the time limits on there was because we didn't want people sitting on the sidelines until you know what froze over. I forgot it is going the other way but nevertheless, that was the reason for putting those timelines on there. What are the major obstacles to getting nuclear power up and going?

Admiral BOWMAN. The major obstacle is the one that I addressed in both my written and oral testimony, and it is the financing of this. These plants are expensive. I would dare say that on a megawatt-hour basis, they are not any more expensive than any of the new power plants that we are going to see coming down the line. We have done a great deal of work on granularity of exactly how much it is going to cost to build a new nuclear plant.

Mr. BURGESS. Are advances in technology helping bring that price down or are they actually contributing to the cost increase?

Admiral BOWMAN. The advances in technology are not so revolutionary that we don't understand them. They are more evolutionary off existing systems that we have today but in each case, we have a different way to ensure a little bit more safety in this new generation of power plants but the single thing that is an impediment today is the loan guarantee program and financing these large, high-cost nuclear plants on a relatively small market capitalization business so that if you put it on the balance sheet of a $7 billion business. If you put a $7 billion project on a $7 billion business, Wall Street will have a field day with lowering the debt rating.

Mr. BURGESS. Is there any difficulty in getting the actual reactors and materials that are needed to build the plant?

Admiral BOWMAN. That has not become a problem. We are certainly aware of the bottlenecks in the infrastructure because we haven't built in a long time. We are aware that the rest of the world is going in this direction. Those people who are in that first wave that I discussed earlier, those four to eight plants that might be online by 2016, are already buying long lead time components. In some cases, those long lead time components have been deliv-

ered. If they aren't delivered, the companies are in the queue. So that is not causing the difficulty.

Mr. BOUCHER. Thank you very much, Mr. Burgess, Admiral Bowman.

The gentleman from Utah, Mr. Matheson, is recognized for 5 minutes.

Mr. MATHESON. Well, I thank the chairman and I thank the panel. It has been a long day, and assuming no one walks in the door, I think I am the cleanup batter today.

I want to talk a little bit in the context of cost containment about how allowances can help mitigate that issue, and it seems to me that the ability to bank credits and to have some flexibility in how allowances are used assists in that effort as a tool to help with cost containment or cost mitigation. Does anyone on the panel have a problem with legislation that permits the banking of allowances?

Mr. KUHN. Congressman, we feel strongly that you need something stronger than just the banking and borrowing. Number one, if you do borrow, you are going to be borrowing from future allowances, which most likely are going to be much more expensive in the future and I think that is going to cause problems, at least in the beginning years when you are putting in place the largest trading system that has ever been established in the world, a multitrillion-dollar trading system. We all know the challenges we have had with a lot of trading systems. You can go back to the Enron situation or mortgage-backed securities or whatever. There has been a lot of volatility in a lot of trading systems. There has been a lot of manipulation. And we think that you need a strong safety valve or collar that would ensure that the economy doesn't get harmed, that the price does not go over a particular level, or perhaps maybe even a collar that doesn't go below a certain level so that it might not incent new technologies because banking and borrowing, at least in the beginning years, is not going to be enough.

Mr. MATHESON. Well, I was going to split it into two questions. You already anticipated the second one. Because the first was about banking allowances, which I think in terms of environmental effect, I am assuming you get it either way. So I didn't anticipate anyone would have a problem necessarily with the banking. But now I want to ask about the borrowing and I want to see if that is something that people support or not support, and I would mention two things. One, in response to what you said, Mr. Kuhn, I am assuming if the market develops, you are going to have a forward price. That is the whole point of markets and futures. If some cap-and-trade legislation is put in place and it sets caps over the years that the marketplace is going to price those allowances out over time. It won't do it perfectly in the start-up, I understand that, but I do think that there will be a differential in price that will reflect those more expensive in future years, so if you want to borrow against them, I would think the borrowing would reflect that premium. And secondly, I know at least one of the legislative proposals that has been put out has an interest rate, if you will, a 1.1 percent cost if you borrow for the future. So I want to ask the people on the panel how they feel about borrowing allowances in general and if the interest rate associated with borrowing, if the 1.1 is reasonable or if that is a reasonable approach to have an interest

rate. I just want to see if people on the panel have any comments on that structure.

Mr. GOO. We strongly support borrowing. We think it is a way to have some cost containment without breaking the emissions cap. We also support the interest rate. The 10 percent interest rate that was in the Lieberman-Warner bill is something we support. If we borrow, there are some consequences from too much borrowing because the climate is warming. We just can't borrow willy-nilly and we don't want to put ourselves in a situation we can't pay back. But we support borrowing.

Mr. MATHESON. So would you say there should be some overall boundaries set on how much could be borrowed?

Mr. GOO. We support—in the Lieberman-Warner bill, there is a 15 percent limit on borrowing. We support that.

Mr. MATHESON. Anybody else have any comments on borrowing or banking?

Mr. KELLY. Congressman, I would be happy to. We did some analysis on this that was included in analysis of Lieberman-Warner impact that CRI conducted for us and they found that all the incentives were actually for banking as opposed to borrowing. We would be happy to supply this to you and your office.

Mr. MATHESON. I appreciate that. One other thing I will just mention real quick. I just recently was told about a proposal that the notion of writing a provision in the legislation that would allow allowances to be turned in, instead of being turned in every quarter or every year, it would be over a 2-year period and allow a little more flexibility for people in terms of a compliance period. Has anyone on the panel thought about that and have any opinion on having a 2-year compliance period instead of a 1-year compliance period for allowances?

Mr. GOO. We think that is an interesting idea and that it may help ease some of the volatility in the market. It is sort of like having businesses can choose their own tax year so if you are having a hard year or you have a growth in a particular year, then all the allowances don't come due at December of the year causing an interest in prices, so we think it is an interesting concept.

Mr. MATHESON. Thanks, Mr. Chairman.

Mr. BOUCHER. Thank you very much, Mr. Matheson, and our thanks to all of the panel members. We appreciate your patience and the long time that you have spent with us today. The information we have gained from you is tremendously valuable and has well justified your long-term presence here. So with our thanks, this panel is excused and we welcome now our second panel of witnesses: Dr. John Felmy, the Chief Economist for the American Petroleum Institute; Mr. Robert Baugh, the Executive Director of the AFL-CIO Industrial Union Council and Chair of the AFL-CIO Energy Task Force; Mr. Joseph Hart, Vice President of the American Trucking Association; Ms. Emily Figdor, the Director for the Federal Global Warming Program of Environment America; Mr. Jason Grumet, the Executive Director of the National Commission on Energy Policy; and Mr. Douglas Scott, the Director of the Illinois Environmental Protection Agency.

Without objection, the prepared written statement of each of our witnesses will be made a part of the record. We would welcome

your oral summaries and ask that they be kept to approximately 5 minutes.

Dr. Felmy, we will be happy to begin with you.

STATEMENT OF JOHN FELMY, CHIEF ECONOMIST, AMERICAN PETROLEUM INSTITUTE

Mr. FELMY. Thank you, Mr. Chairman and Ranking Member Upton. My name is John Felmy. I am the chief economist of API, the national trade association of the U.S. oil and natural gas industry. API represents nearly 400 companies involved in all aspects of the oil and natural gas industry including exploration and production, refining, marketing and transportation as well as the service companies that support our industry.

API believes it is important to address global climate change. We are committed to working with Members of Congress on policies that are environmentally effective, economically sustainable, and fair. Good policies can help contain costs and enhance our competitiveness while tackling the hard issue of managing greenhouse gas emissions.

We all have a role to play in addressing climate change, and the U.S. oil and natural gas industry has been trying to do its part. Companies have invested in alternative fuels and refinery efficiency improvements, which reduce emissions. Through API, they have developed tools for tracking emissions, which are needed to measure our progress, and these companies have 4 decades of experience capturing and storing CO_2 to enhance domestic oil production and reduce our reliance on imports. Virtually 100 percent of the natural gas produced by API members is with companies participating in EPA's Natural Gas STAR program.

Between 200 and 2006, the U.S. oil and natural gas industry invested $42 billion in carbon mitigation technologies. This is 45 percent of the total for all U.S. companies and the Federal Government combined. Nearly $3.5 billion of that was in non-hydrocarbon technologies including wind, biomass, solar, and geothermal.

We believe climate legislation should meet some basic criteria for a robust, cost-efficient national policy for long-term reductions in greenhouse gases. These criteria including balancing reasonable cost burdens, encouraging low-carbon technologies, providing a uniform national policy, and finding the most cost-effective way to reduce emissions without choosing winners and losers. The Lieberman-Warner bill fails to meet these criteria. For example, it would have imposed disproportionate costs on the supply of natural gas, gasoline, diesel, aviation fuel, and other petroleum products such as heating oil. This unbalanced cost burden is the consequence of providing only 3 percent of the needed emissions allowances for fuels and natural gas sectors.

These costs could have contributed to increases in consumer prices according to analysis by the U.S. Energy Information Administration and the Congressional Budget Office. Our own supply-side study estimated that the legislation could have seriously affected supplies of both natural gas and fuels.

Clean-burning natural gas has low levels of greenhouse gas emissions. According to a Natural Gas Council study, climate legislation is likely to increase the demand for natural gas. A sound climate

policy should enable more supply of natural gas, not less. However, a study by ICF International commissioned by API and included with my testimony estimates the Lieberman-Warner bill would have reduced natural gas supplies by 12 percent. The estimated fall in natural gas supplies is because of the added costs of production and gas processing. A Wood Mackenzie study estimates even greater supply reductions. Our ICF study also estimates that the legislation would shift refinery capacity overseas by 3 million barrels a day, or 17 percent of U.S. capacity. The estimated shift in refinery capacity would have also meant lost jobs and the export of emissions overseas.

From our review of the Lieberman-Warner bill, we have identified additional shortcomings. It fails to establish a uniform national policy that coordinates with other legislation, Federal and State, to reduce redundancy and inefficiency. It fails to safeguard against potentially triggering overlapping federal regulations for greenhouse gases under the Clean Air Act, NEPA and the Endangered Species Act. The bill locks in an inflexible 40-year schedule of allowance allocations that fails to allow for midcourse corrections, and it does not provide a sufficiently transparent signal of cost which weakens the impact on consumer behavior.

In conclusion, managing greenhouse gas emissions will require new energy technologies and sensible policies. A sound approach involves investment, equitable cost, consistent national policies, transparent signals for consumers and development of all sources of energy including coal, nuclear, oil, natural gas, and new alternatives. We hope to work with you and your colleagues to help develop sound policy.

That concludes my remarks, which have focused on the analysis of the Lieberman-Warner legislation. API is still examining the other bills you are considering today. I would like to submit for the record the executive summary of our ICF study, which is the first to focus on supply-side impacts of the legislation. I would also like to submit an analysis we commissioned of the financial investments into climate mitigation technologies. I would be happy to answer your questions. Thank you.

[The prepared statement of Mr. Felmy follows:]

STATEMENT OF JOHN FELMY

I am John Felmy, chief economist of API, the national trade association of the U.S. oil and natural gas industry. API represents nearly 400 companies involved in all aspects of the oil and natural gas industry, including exploration and production, refining, marketing, and transportation, as well as the service companies that support our industry.

API believes it is important to address global climate change and manage greenhouse gas emissions. We are committed to working with Members of Congress on policies that are environmentally effective, economically sustainable, and fair. Good policies can help contain costs and enhance our competitiveness while tackling the hard issue of greenhouse gas emissions.

We all have a role to play addressing the climate change challenge, and the U.S. oil and natural gas industry has been trying to do its part. Companies have invested in alternative fuels and refinery efficiency improvements, which has reduced emissions. Working with EPA and others, they've reduced natural gas flaring and virtually 100% of the natural gas produced by API members is from companies participating in EPA's Natural Gas STAR program. Through API, they've developed a suite of tools for estimating and tracking emissions, without which any progress will be hard to measure. And, for many years now, they've been building experience cap-

turing and storing CO_2, boosting domestic oil production in the process and reducing our reliance on imports.

Between 2000 and 2006, the U.S. oil and natural gas industry invested $42 billion in carbon mitigation technologies, more than either than the Federal Government or all other businesses and industries combined. Nearly $3.5 billion of that was in non-hydrocarbon technologies, including wind, biomass, solar and geothermal.

One climate change proposal that was considered by the Senate earlier this month fell short of meeting what we believe are the essential criteria for a robust, cost-efficient national policy for long-term reductions in greenhouse gases. These criteria include balancing reasonable cost burdens; encouraging low-carbon technologies; providing a uniform national policy; and finding the most cost-effective ways to reduce emissions without choosing winners and losers.

For example, the Lieberman-Warner bill would have imposed disproportionate costs on the supply of natural gas, gasoline, diesel, aviation fuel, and other petroleum products such as heating oil. This is the consequence of providing only three percent of the needed emission allowances for the fuels and natural gas sectors while granting some other sources of emissions as much as 300 percent of their needed allowances.

These costs would have helped raise consumer prices, according to analyses by the U.S. Energy Information Administration and the Congressional Budget Office. And they would have seriously affected natural gas supplies and fuel production. A study by ICF International commissioned by API estimates the legislation would have reduced natural gas supplies by 12 percent and driven overseas some three million barrels per day or 17 percent of our refinery capacity. The shift in refinery capacity would also have meant lost jobs. A Wood Mackenzie study estimates greater reductions in natural gas supplies.

The projected fall in natural gas supplies is troubling. Natural gas is relatively clean-burning. It produces barely half the greenhouse gas emissions of coal. A rational climate change policy should encourage more use of natural gas, not less. Indeed, the legislation, while at the same time it could reduce supplies, would also have spurred demand for natural gas, according to a recent Natural Gas Council study.

The shifting of refinery capacity overseas also would have meant exporting rather than controlling some emissions.

From our review of the Lieberman-Warner bill, we've identified additional shortcomings:

It fails to establish a uniform national policy that coordinates with other legislation, Federal and State, to reduce redundancy and inefficiency. For example, it fails to safeguard against potentially triggering overlapping federal regulations for greenhouse gases under the Clean Air Act, NEPA, and the Endangered Species Act.

It locks into an inflexible 40-year schedule of allowance allocations that fail to allow for mid-course corrections.

And, it does not provide a sufficiently transparent signal of all the costs, which weakens the impact on consumer behavior.

In short, a sound approach to managing greenhouse gas emissions that involves investment, equitable costs, consistent policies, and understandable signals still remains to be advanced. We hope to work with all of you and your colleagues to help make that happen.

That concludes my remarks. I'd like to submit for the record two studies API commissioned on supply-side impacts of legislation and a report on investments into climate mitigation technologies. I would be happy to answer your questions.

Executive Summary - Overview

Addendum to Impact Assessment of Mandatory GHG Control Legislation on the Refining and Upstream Segments of the U.S. Petroleum Industry

Lieberman/Warner Climate Security Act of 2007, S.2191

April 2008

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EXECUTIVE SUMMARY

OVERVIEW

This study estimates the impacts of the Lieberman/Warner *Climate Security Act of 2007*[1] on U.S. oil and gas operations and the potential impacts on U.S. energy supplies. Extending the analysis in the preceding report, *Impact Assessment of Mandatory GHG Control Legislation on the Refining and Upstream Segments of the U.S. Petroleum Industry*, this study used detailed models of the U.S. oil and natural gas production, natural gas processing, and the U.S. and global refining sectors to estimate impacts on new oil and gas drilling, the potential shutdown of existing wells, increased costs on natural gas processing plants, investment in refining capacity in the global refining market, and refinery throughput. The results presented herein raise questions about the broader implications of the impact of the Lieberman/Warner bill on U.S. energy supplies.

This report does not take into account how the cost of consumer emission allowances to natural gas processors under the Lieberman-Warner bill could affect natural gas supply. To the extent that any of the consumer allowance costs are borne by natural gas producers and/or processors, the adverse impact on U.S. natural gas supplies would be greater than estimated in this report. Additionally, this study estimates the cost to producers due to the Lieberman/Warner bill but it does not attempt to estimate how these costs and other costs imposed by the bill might impact overall energy markets including supply, demand and market prices.

Requirements for the Oil and Gas Sector:
The Lieberman/Warner bill as passed by the Senate Environment and Public Works Committee[2] would require:

- Exploration and production activities to obtain allowances for facility greenhouse gas emissions (GHG). Under a rulemaking required by the bill, E&P activities also may to be required to obtain allowances for "consumer emissions" (emissions from consumer use of natural gas) for any gas not sent to a natural gas processing plant;
- Natural gas processing plants to obtain allowances for facility GHG emissions and emissions from consumer use of natural gas and NGLs delivered to the market;
- Refineries to obtain allowances for facility GHG emissions and emissions from consumer use of petroleum products. Similarly, importers of refined petroleum products have the same obligations.

Key Assumptions & Caveats

- GHG Emission Allowance Costs:
  - The assumed costs of GHG emission allowances are comparable to or below estimated allowance costs found in recent studies of the Lieberman/Warner bill.
  - The potential impacts of the low carbon fuels standard in the Lieberman/Warner bill were not evaluated.

- Baseline & Mitigation Technologies:

[1] *Lieberman/Warner Climate Security Act of 2007*, S. 2191
[2] The wording in the bill requires some interpretation and coverage of emissions related to natural gas will depend on a required EPA rulemaking to be completed within two years of the bill becoming law. While not addressed in this analysis, importers of finished petroleum products and natural gas would be responsible for any facility emissions as well as consumer emissions from the use of those products.

- Based on experience under the EPA Natural Gas STAR program, improved technologies are expected to result in lower methane emissions per well in coming years. For example, methane emissions per onshore natural gas well are expected to decline by 27% between 2012 and 2020 in the base case. The potential for additional methane emission reductions under Lieberman/Warner has been estimated using the large database created through the Gas STAR program.
- The refining base case incorporates recent fuel quality requirements such as the introduction of Ultra Low-Sulfur Diesel fuels. Additionally, the base case assumes that by 2012 and 2020, a series of Sulfur Dioxide (SOx) Emission Control Areas (SECAs) will be established requiring significant reductions in the sulfur content of marine bunker fuels. Despite these increasingly stringent fuel specification requirements, expected investments in the base case results in CO_2 emissions per unit of refinery throughput that are estimated to be 4% lower in 2020 than in 2012. Lacking a data base comparable to that of the Gas STAR program, robust estimates of refinery mitigation potential and cost could not be developed.

- Allowances for Facility Emissions and Consumer Emissions:
  - The estimated cost of allowances for facility emissions are assumed to be fully absorbed by the facility and lead to the estimated impacts. The cost of allowances for emissions from consumer use of fuels delivered to the market is estimated and reported but not integrated into facility operating cost estimates or the overall operation of energy markets.
  - It is critical to note that the estimated required allowances for consumer emissions are many times that for facility emissions – more than 20 times (about $39 billion) for natural gas processing plants and roughly 9 times (about $90 billion) for refineries in 2012. A fully-integrated assessment of the Lieberman/Warner bill requires a detailed full-market assessment of:
    - potential impacts of allowance costs on domestic energy supplies – covering facility allowances as well as consumer allowance costs;
    - potential impacts of allowance costs on energy consumers and demand-side responses;
    - the integration of these supply- and demand-side initial impacts and subsequent market responses within the broader functioning of the complex US economy.
  - Thus far, no major analysis of the impact of climate bills on the overall US economy has investigated in-depth the potential supply-side impacts on US oil and gas supplies. The ICF study is the first study to do so. While the analysis is "static" and does not attempt to evaluate potential impacts on consumers, overall energy demand, market prices for fuels, or the overall economy, it provides a basis for beginning to integrate oil & gas energy supply considerations into a broader analysis of climate bills.

Impacts on the Nation's Energy Supplies

- **Reduction in Natural Gas Supplies**
  - The cost of GHG emission allowances is estimated to raise the cost of drilling new wells somewhat but result in a substantial increase in the cost of operating wells. Even though methane emissions from the E&P sector are small relative to the nation's overall GHG emissions (about 1%), the impact on investment in new wells would be substantial because the estimated cost of allowances is high relative to the cost of operating gas wells.
    - Compared to an estimated average gas well operating cost of around $25,000/year, the increased operating costs associated with Lieberman/Warner

are estimated at about $12,500 in 2012 and $25,600 in 2020, or roughly 50% and 100% increases in operating costs.
    - Additionally, obtaining allowances for natural gas processor facility emissions is estimated to increase the cost of operations by an estimated $0.13 per Mcf processed in 2012, $0.18 per Mcf processed in 2020, and $0.27 per Mcf processed in 2030.
    - Higher costs would reduce the incentive to drill for natural gas and it is estimated that natural gas drilling would decline, relative to the base case and depending on assumptions about potential additional mitigation efforts, by about 18% to 22% over 2012-2020 and about 31% to 40% over 2021-2030.
  - Taking into account the estimated allowances costs incurred for upstream facility emissions but not any allowance costs associated with consumer emissions from the use of natural gas, overall US natural gas production is estimated to be reduced from base case projections about 3-4% in 2012, about 5% to over 6% in 2020, and 7% to over 12% in 2030 depending on mitigation assumptions. Over the entire 2012-2030 period, lost natural gas production is estimated at 20.4 TCF to 30.8 TCF which is roughly equal to one to one and one/half years worth of production. This assumes that drilling reductions occur mostly on marginal fields – those with the lowest expected new production. The lower impact estimate reflects additional methane emission mitigation efforts beyond the 27% reduction in emissions per well already incorporated in the base case. U.S. oil production also is estimated to be adversely impacted but by smaller amounts.
  - These estimated production impacts were estimated based on the impact of allowance costs from facility emissions only and do not consider the potential impacts of the much larger consumer emissions or any broader market supply & demand impacts that are likely to occur under the economy-wide implementation of Lieberman/Warner.

- **Increased Dependence on Imported Refined Petroleum Products**
  - Because U.S. refineries would be required to obtain allowances for facility emissions while most foreign refineries would not, U.S. refineries would become increasingly disadvantaged as estimated allowance costs increased. Investment in U.S. refinery facilities is estimated to drop over $3 billion/year in 2012 from the base case and about $11.5 billion/year in 2020. As refinery throughput moved overseas, U.S. jobs would be lost but global refinery GHG emissions are estimated as unchanged.
  - U.S. refinery throughput is estimated to decline by about 3 million barrels a day off a base case level of about 18.5 million barrel/day in 2020. Total U.S. imports of crude oil plus refined petroleum products are estimated to shift from about 15% refined petroleum products in the 2020 base case to about 29% under Lieberman/Warner.

- **Increase Cost of Producing Energy for the Nation**
  - The estimated reductions in output under Lieberman/Warner are driven by the allowance costs requirement for facility emissions. Additionally, covered facilities also must obtain allowances for emissions from consumer use of natural gas and petroleum products. The estimated cost of allowances for consumer emissions vastly outweigh the estimated cost of allowances for facility emissions as summarized in the table below.
  - For natural gas, the estimated costs of allowances for facility and consumer emissions are equivalent to about $2.28 per MCF of natural gas in 2012, and about $3.14 per MCF in 2020.
  - For refining, the estimated costs of allowances for facility and consumer emissions are equivalent to about 43 cents per gallon of petroleum product in 2012 and about 61 cents per gallon in 2020.

ES-1: Summary of Estimated Allowance Costs under Lieberman/Warner

	Units	2012 L/W	2020 L/W
Allowance Cost	**2006$/tCO2e**	**$41.21**	**$57.31**
Exploration, Production & Processing			
Exploration & Production:			
GHG Emissions After Mitigation	Million tCO2e	121	121
Direct emission allowance cost	**Million 2006$**	**$4,986**	**$6,935**
Natural Gas Processing:			
Gas production in cases with mitigation	Bcf per year	21,302	21,997
Natural gas processing throughput	Bcf per year	18,213	19,797
GHG emissions per unit of gas processed	tCO2e/MMcf/day	629	685
Facility direct emissions after mitigation	Million tCO2e	45.0	39.3
Facility direct emissions allowance cost	**Million 2006$**	**$1,855**	**$2,195**
Consumer emissions after mitigation *	Million tCO2e	961.4	1045.0
Allowance cost of consumer emissions	**Million 2006$**	**$39,620**	**$59,891**
Total cost of direct and consumer allowances	**Million 2006$**	**$41,476**	**$62,086**
Direct plus consumer allowance cost per Mcf	**2006$ per Mcf**	**$2.28**	**$3.14**
* Consumer GHG emissions shown are only those resulting from gas processing operations. This excludes produced gas that does not require processing, imported gas from Canada, and imported LNG.			
Refining			
Refinery throughput	Million Bbls/day	15.79	15.54
Refinery throughput	Million Gal/yr	242,060	238,230
Non-feedstock products assuming they are 95% of total	Million Gal/yr	229,960	226,320
Refinery direct CO2 emissions	Million tCO2e	251.72	237.18
Total allowance cost for direct emissions	**Million 2006$**	**$10,373**	**$13,593**
Direct emission allowance cost	Cents/gal. throughput	**4.51**	**6.01**
Consumer emissions from petroleum products **	Million tCO2e	2,189	2,154
Cost of allowances for consumer emissions	**Million 2006$**	**$90,209**	**$123,446**
Consumer emission allowance cost	Cents/gal. throughput	39.2	54.6
Total refinery allowance cost	**Million 2006$**	**$100,582**	**$137,039**
Allowance cost per gallon (refinery plus consumer emissions)	**Cents/gal**	**43.7**	**60.6**
** Allowance requirements for imported finished petroleum products are not included in this table.			

Key Investments in Greenhouse Gas Mitigation Technologies by Energy Firms, Other Industry and the Federal Government

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May 2008

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Executive Summary

Climate change has garnered the ever increasing attention of scientists, government officials, the media and public over the last decade. As climate policy in the U.S. continues to develop, it is important to understand how current and emerging greenhouse gas (GHG) mitigation technologies are being employed today by major stakeholders to reduce GHG emissions.

This report documents the investments made in GHG mitigation technologies in North America during the period 2000 to 2006.[2] Investments are reported for the private sector and the Federal government and by technology/energy category. The data were compiled from a review of over 300 company annual reports, federal budget documents, and other public sources.[3] It should be noted that most of the investments have benefits in addition to any ability to reduce greenhouse gas emissions, and were made for multiple reasons including to increase and/or diversify energy supplies, or to improve efficiency.

Greenhouse gas emissions can be reduced by a variety of measures, such as improving energy efficiency and developing alternative energy sources, like wind and solar power. Another way to reduce atmospheric emissions is to capture the CO_2 that is released from, say, fossil fuel-fired power plants and store it underground, referred to as carbon capture and storage (CCS). This is the focus of significant attention, as power generation accounts for about one-third of CO_2 emissions from fossil fuel use. As well, oil and gas companies are reducing natural gas flaring and fugitive emissions to curb releases of methane, a potent greenhouse gas, while at the same time adding to energy supplies through various substitute fuels. The GHG mitigating technologies examined in this report were placed into four categories: fuel substitution, nonhydrocarbon, end-use and enabling technologies as laid out in the organizational chart preceding the Executive Summary.

The Challenge of Emission Reduction in The Face of Rising Energy Demand

There has been recent progress in mitigation of U.S. GHG emissions although significant challenges remain going forward. The Energy Information Administration (EIA) released in November 2007 its estimates of GHG emissions for 2006, and they indicated a decline of 1.5% from 2005 levels—the first annual decline since 2001 and the third annual decline since 1990. In addition, since 2002, it is estimated that U.S. greenhouse gas intensity (GHG emissions per real dollar of GDP) has fallen by an average of 2.5% per year, resulting in a total reduction in intensity of roughly 12% for the five years ending in 2006[4]. Despite this progress, total U.S. CO_2-equivalent emissions from primary fuel[5] use across all economic sectors in 2030 are projected by the EIA to be 16% higher than the 2006 level[6] indicating a

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[2] No claim is made to have captured 100% of investments in each technology or for each GHG, but the authors believe that further refinements to the database would change the relative distributions only at the margin.

[3] See bibliography for a list of data sources used in this study. Not all company reports reviewed provided data for the analysis undertaken in this report.

[4] http://www.eia.doe.gov/oiaf/1605/ggrpt/index.html

[5] Principally petroleum, natural gas and coal.

[6] U.S. Energy Information Administration, *Annual Energy Outlook 2008* available at EIA-Annual Energy Outlook 2008 (Revised Early Release) , March 2008. Includes the projected impacts of the Energy Independence and Security Act of 2007.

need for continued economically viable investments in GHG mitigation technologies going forward.[7]

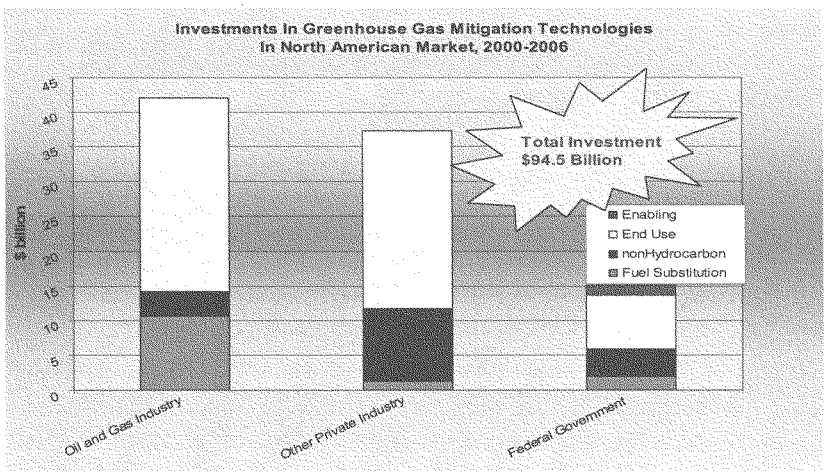
Arguably more important with respect to GHG emissions, the International Energy Agency (IEA) projects more than a 50% rise in global energy consumption between 2005 and 2030, a roughly 1.8% annual increase led by developing countries, many of which are expected to significantly increase energy consumption due to rising per capita incomes and population growth. Fossil fuels are estimated to account for roughly 84% of the increase in projected global primary energy demand out to 2030 from a 2005 base.[8]

These projections of energy demand highlight the importance of continued economically viable investments leading to more efficient, and lower-GHG emitting technologies, as well as the development of efficient technology transfer programs to developing countries.

Investments In Greenhouse Gas Emission Mitigation Technologies

Total North American investments in GHG mitigating technologies are estimated to have totaled $94.5 billion dollars between 2000 and 2006.[9] These investments were made by the oil and gas industry, other private sector industries and the Federal government, and span a variety of areas or categories. For each sector, figure ES-1 summarizes these investments by technology category.

Figure ES-1



[7] On a per capita basis, EIA projects a 4.5 percent decline in U.S. CO2-equivalent emissions from primary fuel use over the 2006 to 2030 period.

[8] International Energy Agency, *World Energy Outlook 2007*.

[9] "North American market" is used herein to include Canada and the U.S.

Oil and Gas Industry Investment in GHG Emission Mitigation

It is estimated that oil and gas companies invested $42.1 billion from 2000 through 2006 on GHG emission mitigation technologies in the North American market. (***Figure ES-1***) This expenditure represents 45% of the estimated total of $94.5 billion invested by U.S. companies and the Federal government over this time period.

The largest share of oil and gas industry investments falls into the end-use technology category. The industry is estimated to have invested $27.8 billion (or 66% of the $42.1 billion sector total) for advanced end-use technologies, mostly for efficiency improvements through combined heat and power (cogeneration) and for advanced technology for vehicles. Significantly, this $28 billion investment in end-use technologies represents 46% of the estimated total amount of $61 billion invested by all U.S. companies and the Federal government in this technology class as shown in figure ES-2. The second largest investment share made by the oil and gas industry, about 25% or $10.5 billion, was to develop substitute (and less carbon intensive) fuels, e.g., LNG, and to reduce methane fugitive emissions and flaring. This $10.5 billion investment in fuel substitution technology represents 76% of the estimated $13.8 billion invested in total in this technology class. ***(Figure ES-2)***

Publicly announced nonhydrocarbon investment by the oil and gas industry in the North American market is estimated at $3.4 billion over the 2000 – 2006 period, or 8% of its industry total. Significantly, this represents 19% of the total industry and Federal government investments of approximately $18 billion in this technology class. ***(Figure ES-2)*** The oil and gas industry's top investments are in wind and biomass; expenditures were also made in solar, geothermal, and landfill digester gas. The oil and gas industry also made investments in the enabling technology category principally for research into carbon capture and storage, and for the development of second generation biofuels.

Other Private Industry and Federal Government Investments

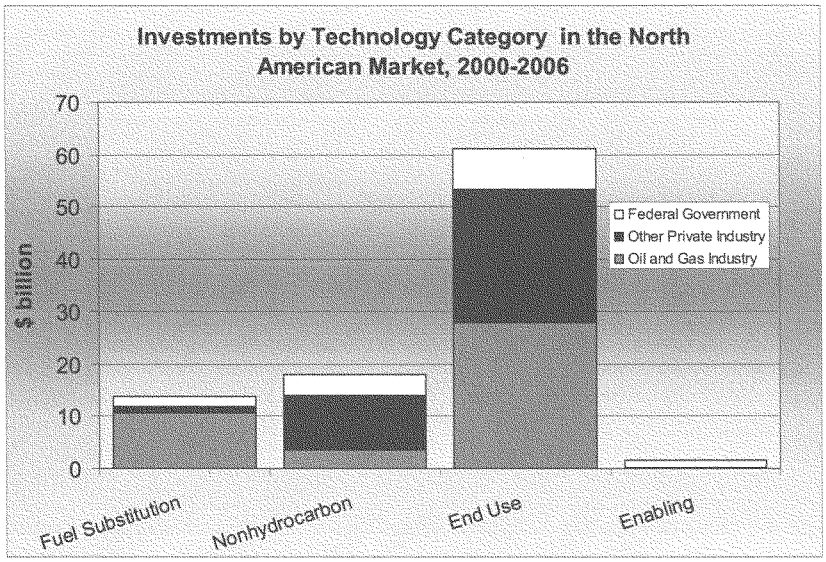
In addition to the oil and gas industry, other significant technology investments were made by the motor-vehicle industry, agricultural industry, electric utilities, and the renewable-fuels industry. These other private industries are estimated to have invested $37.3 billion (or 39% of the $94.5 billion total) from 2000 to 2006. Of the $37.3 billion sector total, $25.5 billion (68%) is associated with end-use technologies, and $10.4 billion (28%) with non-hydrocarbons as seen in figure ES-1. End-use technologies include advanced technology vehicles, efficiency improvements and combined heat and power. Non-hydrocarbons include industrial gas replacements (e.g. for SF_6), and renewables such as wind, and ethanol. By technology class, other private industries' investment share was 42% of the end-use category and 58% of the nonhydrocarbon investment as seen in figure ES-2.

Likewise, the Federal government is estimated to have invested $15 billion (16% of the $94.5 billion total) from 2000 to 2006 through the Climate Change Technology Program. Fifty-two percent of the Federal government investment is estimated to be in end-use technology, including more energy efficient lighting, combined heat and power and similar efficiency improvements as seen in figure ES-1. Twenty-six percent of the Federal government investment is in the nonhydrocarbon class (including ethanol and biodiesel), 13% in the fuel substitution class (such as landfill gas), and 9% fell into the enabling technology class (such as carbon capture and storage).

While the level of investment is less than that of the private sector, early-stage development investments, particularly at the basic research stage, can leverage billions of dollars of later private investment. Federal investments are more evenly spread amongst the technology categories than for the industry sectors.

Federal tax transfers in the form of credits and similar techniques and international assistance were not included. A significant re-emphasis occurred in Federal expenditures related to greenhouse gas mitigating technologies, with an increase of $180 million in fiscal year (FY) 2007, compared to fiscal year 2006, largely due to an increased Federal focus on cellulosic ethanol, solid state lighting and hydrogen storage. That focus is expected to further increase by $200 million between FY 2007 and 2008.

Figure ES-2

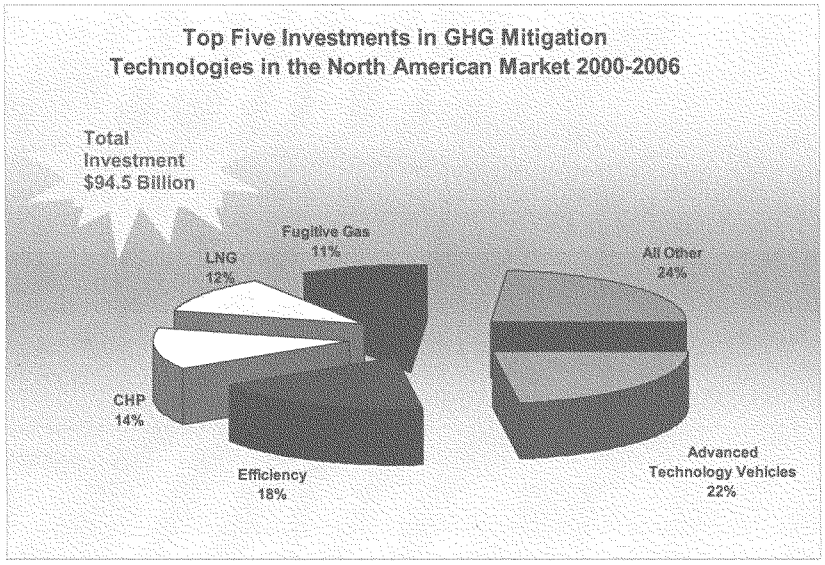


Five Leading Technology Investments

The five leading emission mitigation technologies for private and public sector investment (***Figure ES-3***), as measured by expenditure share, are: advanced technology vehicles 22% ($21 billion); efficiency 18% ($17 billion); combined heat and power 14% ($13 billion); liquefied natural gas 12% ($11 billion)[10], and fugitive gas emission reductions 11% ($10 billion). These top five technologies commanded 76% of the estimated total investments, or $72 billion over the 2000 – 2006 period in the North American market. All other technologies combined comprised 24% of the estimated total investments.[11]

[10] Includes investments in North American LNG regasification facilities only and does not cover investments outside of North America in liquefaction facilities or ships.
[11] Percentages may not add to 100% due to rounding.

Figure ES-3



The investments included in this analysis mitigate greenhouse gas emissions in a variety of ways.

- Improving efficiency lowers energy use thereby decreasing GHG emissions.
- CHP – also called cogeneration or combined heat and power – saves energy through the simultaneous production of both electricity and thermal energy (steam, hot water, or hot air). According to the *EPA*[12], CHP improves energy efficiency by as much as 55%.
- LNG – liquefied natural gas – increases the availability of natural gas. The combustion of natural gas emits almost 45 percent less carbon dioxide than coal.
- Reduced fugitive gas emissions – covering mainly methane emissions from oil and gas production, and emissions associated with pipeline transmission and local distribution to customers. These reductions not only reduce methane emissions into the atmosphere but also increase the supply of lower-carbon natural gas.
- Nuclear energy provides electricity with no greenhouse gas emissions during the generation process.

All major forecasts of U.S. and global energy supply, including outlooks developed for the United States by the Energy Information Administration (U.S. Department of Energy) and for the world by the International Energy Agency (Organization for Economic Co-Operation and Development), continue to place carbon-based fuels in the forefront for supplying the world's energy needs at least over the next several decades. Emerging technologies, such as carbon capture and storage, to mitigate emissions from future fossil

[12] http://www.epa.gov/CHP/basic/efficiency.html

fuel use, combined with increased use of commercially viable nonhydrocarbon and GHG mitigating end-use technologies, will be crucial to addressing the climate issue going forward.

Note that this report does not attempt to document or assess so-called "disruptive" energy technologies that have the potential for significantly altering energy production, distribution and use in the U.S. and worldwide. Disruptive technologies include nanotechnology and advanced materials that have the potential to be used for superconducting "smart grids" to vastly improve electricity transmission; for reducing weight while maintaining or increasing vehicle safety; or for reducing friction and improving energy efficiency for both air and ground modes of transportation.[13]

[13] This report also does not include investments made by individual consumers (e.g. for more efficient appliances or hybrid and flexible fuel vehicles), tax shift and tax policies by the government intended to encourage specific technologies, nor monies paid in various legal settlements. Finally, many of the project investments were made by partnerships and/or joint ventures. While all reasonable efforts were made to allocate those project expenditures to the entities involved, this was not always possible. In those instances, project level expenditures were assigned to the lead sponsor and the corresponding sector.

Mr. BOUCHER. Thank you, Dr. Felmy. Those documents may be submitted as a part of your prepared statement and will appear in the record.

Mr. Baugh.

STATEMENT OF ROBERT C. BAUGH, EXECUTIVE DIRECTOR OF AFL-CIO INDUSTRIAL UNION COUNCIL AND CHAIR OF AFL-CIO ENERGY TASK FORCE

Mr. BAUGH. Thank you, Chairman Boucher. I would like to say on behalf of the 9 million members of the AFL-CIO, thank you for the opportunity to testify here today. We have been engaged in this process over the last 18 months with our energy task force working with the business community, the environmental community, community organizations and Members of the House and the Senate to work our way through and understand this and come to some conclusions, and we have. We found your white papers quite helpful that you issued from this committee.

The AFL-CIO believes it is time for our Nation to take bold steps to meet the 21st century challenges related to climate change. We believe it is real. We believe something needs to be done and we support a new environmental economic development policy, both policies come together, it is not one or the other, with a balanced approach that ensures diverse, abundant, affordable energy supplies and creates good jobs for American workers that improves the environment. We do support a cap-and-trade program that is transparent and economy-wide, and note that the legislations under consideration do do that. We also believe they have to have timetables and standards that are sensitive to development and deployment of new technology and we think there is a problem there, and I will talk more about that in a second.

We also believe there should be an economic development policy from cap-and-trade that has principles to it, one that domestic investment of the auction proceeds, we need to be sure of that, that do create jobs here, the capturing of cutting-edge technologies and the discouraging of the offshoring of the manufacturing and production of this work. I think the idea is—that is why it is economic development—to reinvest these dollars in our economy. And these investments need to be supported by an international component that provides both incentives and a border mechanism enforced through trade regime to encourage the rest of the world to engage in similar activities around climate change, and there must be adequate resources to address the needs of displaced workers and the communities that may be affected by this as well as low- and moderate-income relief from the cost of any such programs.

We support a robust investment portfolio that includes carbon capture and sequestration technology, advanced technology vehicles, renewable energy and biomass, the electrical grid modernization, relief for low- and moderate-income workers, worker training and more, and the Senate bill certainly reflects that investment portfolio and we recognize that the Markey bill has similar investment portfolio pieces into it. It is not as spelled out as much in the Waxman legislation.

I want to make one statement. There is an immediate need that has been said by the previous panels for the investments in CCS technology, and I want to applaud this committee and the chairman and the members of this committee who have supported the carbon capture and storage early deployment act. This has to happen now. We can't wait 2, 3, 4 years for the implementation of auction monies to come down the road, a very important step forward, and we applaud your actions on this. We are fully supportive of that.

In the short term, there is a wide variety of actions that can be taken to capture the difference between the technology gap that exists here and the standards and timelines that are being proposed, and this includes the modernization of the grid, the retrofit of buildings, what we do about mass transit and home weatherization are all things that are technologies that are there that we can move on and make a difference to cut the demand. It is not going to solve the complete gap between the technology and the timeline.

We supported caps and timetables in the Bingaman-Specter bill. There they come in shorter than the other ones that we were looking at in the other three pieces of legislation which are more stringent. I think those bills fail to recognize the technology gap that has been addressed here by other people, especially in the 2020 time frame. That is where the big push is, and our concern is that that time frame and that standard and timeline will actually push the issue of fuel switching that has been discussed earlier on the panels this morning.

We also support a very limited market approach with price control mechanisms. We did support the safety valve that has been talked about in the Bingaman-Specter bill. We have also looked with interest upon the emergency off ramp, as it was called, in the Lieberman-Warner legislation that was proposed that used borrowing and other mechanisms to address the idea that this is a cost control mechanism.

We very much recommend a regulated and restricted trading system. We remain deeply, deeply troubled with a simple market-only approach that is open to speculation and windfall profits by individuals and entities such as hedge funds that are never going to use these carbon credits. We believe it should be restricted that the people actually have to buy them and use them.

In addition, we are very concerned about the use of offsets. We should approach this cautiously. The international allowances need to be approached again with caution. We need to be sure that they can be verifiable and that they are actually permanent, and in fact, I met with two EU commissioners on their energy commission recently and discussed this issue, and in their phase II reform, they limited offsets to 15 percent. Their concern was that if they made them too readily available, their domestic industries would not make the investments in their own industries to make the changes that need to be made, a very interesting approach that I didn't really realize what they had done until I had the chance to sit down and go through this with them. We want viable, competitive domestic industries. We want them to make those investments.

We believe Congress needs to be better informed about the impact of cap-and-trade and the performance on energy-intensive in-

dustries. We have worked with the National Commission on Energy Policy. They are completing four studies of four major industries, steel, aluminum, chemical, part of the chemical industry, and paper, to really better understand the impact of a cap-and-trade program on these. Frankly, we have been operating with too little information about these impacts. We really look forward to these reports, which should be available in the next couple of weeks, is my understanding.

We do support the inclusion of the international language that was in the Boxer-Lieberman-Warner package and the Bingaman-Specter bill has been raised in the other legislation and we think it is an important step forward to addressing the part. We think there is additional steps that could be needed around that. We are very open to discussion on this but we think the international component is important in terms of sending the right signals that the whole world has go to do their part in this, and we shouldn't move forward without that.

We believe Congress also needs to take action to address the conflict between a State and Federal cap-and-trade programs, Alan Reuther mentioned in his testimony this morning. We fully concur that that is something that needs to be addressed.

We have learned a lot as a committee, as a trade union over the last 18 months. We do believe there will be some price impacts to this. We believe they can be addressed. We also view this with optimism as we learned the rest of the world did when we participated in the negotiations in Bali that within crisis, there is opportunity, and we tried to take that point of view, and that is why we so strongly the investment portfolio that offers a view of how we invest in new technologies, in renewable energies, in our existing technologies to re-engineer them so that we do have clean coal. There is another way to do this and we do believe it is possible. Our only hurdle in this is the standards and timelines, the technology gap and the steps we take both to mitigate that and to move ahead for the future.

Thank you.

[The prepared statement of Mr. Baugh follows:]

STATEMENT OF ROBERT C. BAUGH

Chairman Boucher, on behalf of the 9 million members of the AFL-CIO, I want to thank you and the members of the Subcommittee on Energy and Air Quality of the House Energy and Commerce Committee for the opportunity to testify this afternoon on this important subject. Our comments will focus on the Federation's climate change initiatives in relation to the Climate Security Act of 2008 (S. 3036). Sponsored by Senators Boxer, Lieberman, and Warner; the Investing In Climate Action and Protection Act (H.R. 6186) sponsored by Representative Markey; the Safe Climate Act (H.R. 1590) sponsored by Representative Waxman; and the Low Carbon Economy Act (S. 1766) sponsored by Senators Bingaman and Specter.

The AFL-CIO believes it is time for our Nation to take bold steps to meet the 21st Century challenges related to climate change. Scientific evidence has confirmed that human use of fossil fuels is undisputedly contributing to global warming, causing rising sea levels, changes in climate patterns and threats to coastal areas. Unrestrained growth in greenhouse gas emissions poses critical economic and environmental issues. This challenge is an opportunity to enact an energy policy that will result in a cleaner planet, greater energy efficiency, and the revitalization of our manufacturing base.

The world is looking to the United States for leadership because we are the most energy-intensive nation in the world and one of its leading emitters of greenhouse

gas. Our Nation can lead a new technological revolution in the way energy is generated and used that can be of benefit to the world as a whole and serve as a foundation for the revival of the middle class in the United States. But to accomplish this, we need a strategic approach centered on domestic investment in new technologies and good jobs. And we need to lead in fostering a shared international response to this issue.

POLICY AND PRINCIPLES

Over the past 18 months, our interaction with Congress and many other businesses, industry, environmental and international labor organizations, has helped evolve and sharpen the thinking of the AFL-CIO Energy Task Force.

The February 2007 report by the AFL-CIO Energy Task Force recognized that "reliable and affordable electrical energy, is the lifeblood of the manufacturing, transportation, construction and service industries;" .and that we must "maintain diversity in the electric utility industry, by retaining all current generating options, including fossil fuels, nuclear, hydro and renewables, to ensure a stable, reliable and low-cost supply of electricity for the United States."

That report was also driven by our belief that a strong and diverse manufacturing base is in the national interest. This sector is in a deep and ongoing crisis. Since 1998, some 3.9 million manufacturing jobs were lost and 35,000 manufacturing facilities closed while the nation amassed trillion of dollars in trade deficits. The offshoring of skilled work, R&D, design, engineering and more continues to erode our innovative and technical capacities. Solving the climate change crisis is an opportunity to address the manufacturing crisis.

The AFL-CIO supports a new industrial policy, and an environmental economic development policy, which places manufacturing and trade at the center of a green economy program. New investment in a sustainable energy infrastructure must be structured to create good jobs and ensure stable energy prices. These must be supported by effective trade policies. Without these key elements, there is a serious risk of driving good jobs offshore into nations without emission regimes and far less carbon efficient production.

A set of environmental economic development principles has helped guide the Federation's efforts:

1) Our Nation should embrace a balanced approach that ensures diverse, abundant, affordable energy supplies, creates good jobs for America's workers, and improves the environment.

2) Our Nation should adopt an economy-wide cap-and-trade program that is transparent and requires all sectors to come to the table to reduce their carbon emissions. It should have timetables and standards that allow for the development and deployment of new technology and should help finance the new technologies that can provide clean energy at prices close to conventional sources.

3) Energy incentives and investments by the Federal Government must be based on a set of economic development principles that clean the environment and create jobs but will not encourage offshoring of manufacturing jobs.

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

5) The international component of any climate change cap-and-trade program must provide both incentives and a border mechanism enforced through a trade regime, to ensure that major developing nations, such as China and India, participate.

6) There must be adequate resources to both address the transition needs of workers and communities adversely affected by legislation, as well as, financial assistance to assist low- and moderate-income families.

The AFL-CIO is here today to reinforce these principles with the Energy and Air Quality Subcommittee, just as we have in every discussion held with staff and Members of Congress.

INVESTING FOR THE FUTURE: GREENING THE ECONOMY

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

The Markey and Waxman bills and Boxer-Lieberman-Warner and Bingaman-Specter legislation all provided for an investment portfolio based on auction proceeds. The Waxman bill does not provide the level of detail that appears in the other bills. The AFL-CIO was most deeply engaged in the Senate stakeholder process that developed a robust portfolio in both bills. This included carbon capture and sequestration technology (CCS), advanced technology vehicles, renewable energy and biomass, electric grid modernization, relief for low- and moderate-income families, worker and community transition, worker training, and more. These investments were bolstered by domestic investment requirements and international provisions regarding the participation of developing nations, including a border mechanism.

While the climate change bills all invest in CCS technology, those investments may be years away. There is an immediate need for investment in CCS technology. The AFL-CIO applauds the introduction of the Carbon Capture and Storage Early Deployment Act by Chairman Boucher. This legislation will create a non-governmental fund and entity to accelerate the deployment of carbon capture and storage technologies. This is an investment that needs to be made now so that the technology is available as soon as possible to meet the carbon emission standards of the future.

In the short term, there are a wide variety of options for emissions reduction that can help bridge some of the gap between the coal technology of today and the carbon capture and sequestration technology of the future. There is also an enormous potential for energy savings and good jobs in making our economy more energy-efficient. The modernization of the 160,000 miles of high transmission lines that make up the electrical grid and the retrofitting public, industrial and commercial buildings and home weatherization also increase energy efficiency and create jobs. The expansion and increased usage of mass transit and passenger rail offers similar opportunities for the economy and the environment.

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

The Bingaman-Specter, Boxer-Lieberman-Warner and Markey legislation all identified worker and community transition and worker training as critical investments. The Boxer-Lieberman-Warner identified major areas of worker investment, one of which corresponds with previous House legislation on green jobs. The worker and community transition is modeled after the best elements of TAA legislation and previous displaced worker legislation over the past 25 years. In addition to strong training, education, and counseling benefits it provides for wage replacement, health care, retirement bridges, and other forms of economic and social assistance. It also recognizes the burdens that may fall on communities heavily dependent upon an affected industry and offers community planning and other forms of economic development assistance. The green jobs training program is modeled after House legislation that encourages collaborative community and labor-management initiatives.

CAP AND TRADE, TIMELINES AND COST CONTAINMENT

A cap and trade system begins with the actual cap and an emission standards timeline The AFL-CIO supported the standards and timeline within the Bingaman-Specter bill. These were reasonable and recognized the linkage between standards and technical capability for mass deployment of new CCS technology. The caps and timetables established in the Boxer-Lieberman-Warner, Markey, and Waxman bills are more stringent. These fail to take into account the actual state of technology development and deployment necessary to achieve their proposed standards.

The AFL-CIO believes that any approach for addressing greenhouse gas emissions must be done upstream on an economy-wide level, with contributions from each sector in proportion to the greenhouse gas emissions of that sector. Also, any auction of carbon permits should be reasonable in scope and must assure that no sector is disproportionately burdened. The Boxer-Lieberman-Warner, Bingaman-Specter, and Markey bills do take an upstream approach with the burden being shared across sectors.

The AFL-CIO supports a limited market approach to cap and trade, with regulatory mechanisms that act as a price control to prevent any serious long-term damage to the economy. The Bingaman-Specter legislation contained a safety valve and

the Boxer-Lieberman-Warner legislation offered an alternative approach to controlling price spikes through a borrowing from the future mechanism with set pricing. The Waxman and Markey bills fail to provide similar protections.

Carbon pricing has a direct relationship to fuel switching (from coal to natural gas) and that has serious consequences for the economy. The goal should be to encourage the adoption of new technologies like carbon capture and storage and discourage fuel switching. The AFL-CIO worked with the NCEP and members of the environmental community to identify the price triggers for fuel switching and ways to avoid this scenario. The Boxer-Lieberman-Warner bill did take this concern into account.

Fuel switching is directly related to our ongoing concern over the cost containment measures, and any legislation's timetable and standards for emission reductions in the 2020 period. While the Boxer-Lieberman-Warner bill offers one form of cost control it does not solve the problem of the 2020 standards in theirs and the Waxman and Markey bills. The stringent timelines will act as a trigger for massive fuel switching. It is in the 2020-2030 period that CCS technology should become available for mass deployment. But, the early aggressive targets will have already triggered the investment decisions for compliance. We urge that there be greater flexibility in the standards and timetable.

MARKET FUNCTIONALITY

The Stern Commission cited climate change as the greatest market failure in history. Today, open and unregulated markets have left the Nation in a housing crisis, soaring food costs, world capital markets in turmoil, and still dealing with the fallout of Enron. Even as this testimony is being delivered Congress is looking into the role speculation and futures contracts are playing in oil, grain and commodities markets. Thus, we remain deeply troubled with a simple market-only approach that is open to speculation and windfall profits by individuals and entities that have nothing to do with carbon emissions.

The open and "unlimited trading" initially proposed in legislation means that anyone, can buy allowances from a limited and declining pool. With well over 10,000 firms needing allowances, we reject the notion that letting additional speculators (those not needing to use carbon emission credit) into the market to create more liquidity is neither necessary nor desired. However, letting these speculators in will create windfall profits and drive prices higher leaving consumers and industry to pay the price.

In addition, the ability of purchasers to bank these allowances in perpetuity creates additional risks. While some would argue that unlimited banking might help business decision making, it also may lend itself to uncompetitive behavior in search of windfall profits or market advantage.

Open access and unlimited banking leaves the system open to predatory and speculative trading practices, the hoarding of allowances and windfall profits that will fuel volatile pricing in the market. This will have a direct and detrimental pricing impact on the public, utilities sector, and energy-intensive industries.

The AFL-CIO believes that the goal of any climate change legislation with a cap and trade program is to move industries and consumers to change behavior and lower carbon emissions. The Federation recommends a regulated and restricted approach to the trading of allowances. We believe that:

- Market participation (as purchasers not sellers) should be limited to firms that intend to use the allowances. With an accurate carbon footprint and a declining pool of allowances, available prices will rise but not be artificially inflated by speculators.
- The banking of allowances should be limited and regulated to avoid non-competitive and speculative behavior. There needs to be a limit on the amount of allowances any particular firm can bank related to its actual needs. In addition, there should be a "time certain" by which a firm must use the allowances or revert back to the auction pool. A firm would always be able to reenter the market and bank a limited amount for a limited duration. These steps will help create a more certain, less speculative, trading environment.
- The allowances and market will be created for buyers and sellers who need to use them. Purchasing and retirement of allowances should be limited to entities regulated by state performance or efficiency standards in any sectors covered under the federal cap-and-trade program seeking to meet state standards more stringent than any comparable Federal standards, by purchasing and retiring Federal allowances.

OFFSETS AND INTERNATIONAL ALLOWANCES

The use of offsets and international allowances as tools for cost containment needs to be approached with caution so that the outcomes sought for the long run, a clean-

er planet and viable competitive domestic industries, are achieved. It is in our interest to assure that domestic industry makes the needed investments in transformational technology. Our concern is that these investments will be deferred with the easy availability of less expensive offsets and allowances. This would be a formula for business closure in future years.

In recent meetings with EU officials and European traders, the AFL-CIO has learned that the EU had the same concerns in mind with their recently implemented phase II reform. Under their system, offsets are limited on average to 15% because they fear that too many easily obtained offsets will undermine efforts to assure that domestic investments for mitigation are made. They want viable competitive clean industries in their countries. The EU does not have domestic offsets only international offsets. To date their experience with international offsets has been problematical and filled with concerns over the validity of these offsets.

The AFL-CIO remains concerned about the ability to monitor the legitimacy of domestic and foreign offsets. The Boxer-Lieberman-Warner legislation recognized these concerns and took steps to assure their legitimacy. However, this bears further examination. Project based international offsets may interfere with the adoption of a systematic carbon emission regime in the Nation selling the offsets. Additionally, offsets must be both verifiable and there must be enforcement mechanisms in place to assure that investments into allowable offsets actually result in the reductions of green house gasses.

The idea should be to use these tools to help a firm balance that transition, but not to avoid making needed industry investments. The need for flexibility in the use of offsets and international allowances should be tempered with requirements that the purchasers must also be making progress with domestic investments to improve carbon emission performance. This needs to be made explicit in the legislation.

ENERGY INTENSIVE INDUSTRIES

There is far too little known about the impact of a cap-and-trade program on energy intensive industries such as steel, aluminum, paper, chemicals, airlines and others. The AFL-CIO has raised this issue consistently through the stakeholder process on the Senate bills. The Federation encouraged a set of economic impact studies that the National Commission on Energy Policy has commissioned for the steel, aluminum, paper, and chemical industries. These will be finished within the next few weeks. The Boxer-Lieberman-Warner legislation recognized this concern by making additional free allocations of allowances available for these sectors. The NCEP studies will be a valuable source of data to help inform future decision-making.

There needs to be additional analysis of the economic impact on other sectors such as the aviation industry. The Airline Pilots Association points out the acute situation of this sector and its price sensitivity. Record fuel prices have wreaked havoc on the airline sector with four air carriers having ceased operations and more than 9,000 airline employees having lost their jobs this year and thousands more facing furlough this fall. The industry like others has a record of accomplishments in reducing GHG and conserving fuel, but fuel costs, industry consolidation, and a weakening economy will continue to threaten our national aviation system for the foreseeable future. Congress needs to be better informed on the impact of cap and trade and performance of energy intensive industries so that these factors can be taken into consideration when crafting legislation.

INTERNATIONAL ASPECTS: THE NEED FOR A GLOBAL SOLUTION

The inclusion of an international section in the Boxer-Lieberman-Warner, Bingaman-Specter, and Markey bills to assure that our industries and workers are not put at a competitive disadvantage with our trading partners is an important step forward. The Waxman bill does not address this concern. It has been a critical issue for our support of any legislation. The AFL-CIO believes that having a dynamic and healthy industrial base is in the best interest of the Nation and we must do our best to cut our carbon emissions. However, this cannot be a go it alone proposition.

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

In 2007 China passed the United States in carbon emissions. They have a new "1950's technology" coal plant coming online every week with 500 plants being planned. They are dirty but cheap to build. Unabated, by 2030 China's emission will grow 139 percent and make up 26 percent of the world's total. They and other major

developing nations must be part of the solution or everything we the EU and other nations do to cut carbon emissions will be for naught.

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

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

While we applaud the inclusion of international language in the Senate and Markey bills there is more that can be done to strengthen them. For example, the coverage should include more finished products. The AFL-CIO stands ready to work with Congress to address the critical issue of international competitiveness.

Federal and State Issues

Many states have enacted or are considering measures to reduce greenhouse gas emissions. This includes state or regional cap-and-trade programs, performance or efficiency standards relating to autos, utilities, fuels and other sectors covered under the cap in the federal legislation, as well as, initiatives in areas outside of the cap (e.g. building codes, conservation, transportation planning).

The Boxer-Lieberman-Warner, Markey and Waxman bills all preserve existing state authority to regulate greenhouse gases. However, the Boxer-Lieberman-Warner and Markey bills also supersede pending litigation over the scope of that authority, and make it clear that California and other states may regulate auto CO_2 tailpipe emissions. In addition, the Boxer-Lieberman-Warner, Markey and Waxman bills all fail to deal with the important issue of how state climate change measures—whatever their scope—will interface with the federal cap-and-trade program

In exchange for the establishment of the federal cap-and-trade program, the states should be pre-empted from having state or regional cap-and-trade programs affecting the sectors covered under Federal legislation. This would prohibit state programs that cap emissions from the electric power, transportation or industrial sectors, or require the purchase, sale or retirement of allowances in these sectors. This is necessary to prevent regulated entities from having to submit duplicative allowances for the same ton of carbon, and to establish a level national playing field for an economy-wide emissions trading program.

The Federal cap-and-trade program should be the exclusive Federal authority for dealing with greenhouse gas emissions from those sectors covered under the cap. This is necessary to prevent EPA from issuing regulations that impact these sectors and have the effect of overriding the decisions made by Congress in the cap-and-trade program concerning the stringency of the federal cap, the point of regulation, and the distribution of economic burdens. EPA should retain any existing authority it may now have under the Clean Air Act to regulate in sectors that are outside the cap.

Conclusion

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

The Federation looks forward to working with Congress to achieve these goals.

Summary

The AFL-CIO believes it is time for our Nation to take bold steps to meet the 21st century challenges related to climate change. We support a new environmental economic development policy with a balanced approach that ensures diverse, abundant, affordable energy supplies, creates good jobs for America's workers and improves the environment. We support a cap and trade program that is transparent, economy-

wide with timetables and standards sensitive to development and deployment of new technology.

Investments from cap-and-trade should be based on a set of economic development principles: domestic investment of auction proceeds, job creation, capturing cutting-edge technologies and discouraging offshoring. These investments need to be supported by an international component that provides both incentives and a border mechanism enforced through a trade regime. And, there must be adequate resources for displaced workers and their communities and for low and moderate-income families.

The AFL-CIO supports a robust investment portfolio that includes: carbon capture and sequestration technology (CCS), advanced technology vehicles, renewable energy and biomass, electric grid modernization, relief for low- and moderate-income families, worker, and community transition, worker training and more. There is an immediate need for investment in CCS technology. We applaud the Carbon Capture and Storage Early Deployment Act by Chairman Boucher. In the short term, there are a wide variety of options for emissions reduction that can help bridge the technology gap: modernization of the electrical grid, building retrofits, home weatherization, improved mass transit, and the renewable energy and biofuels initiatives already underway.

The Federation supported the caps and timetables in Bingaman-Specter. The other bills are more stringent and fail to recognize the technology gap that exists especially in the 2020 timeframe. This can trigger fuel switching. Also, we support a limited market approach with price control mechanisms, i.e., the safety valve in Bingaman-Specter. The Boxer-Lieberman-Warner legislation offered an alternative approach.

The Federation recommends a regulated and restricted trading system. We remain deeply troubled with a simple market-only approach that is open to speculation and windfall profits by individuals and entities like hedge funds. In addition, the use of offsets and international allowances needs to be approached with caution so that the outcomes sought for the long run, a cleaner planet, and viable competitive domestic industries, are achieved

Congress needs to be better informed on the impact of cap and trade and performance of energy intensive industries. The inclusion of international language in the Boxer-Lieberman-Warner, Bingaman-Specter, and Markey is an important step forward in addressing part of that concern but additional steps are needed. Congress also needs to take action to address the conflict between State and Federal cap and trade programs.

The AFL-CIO believes climate change is both a crisis and an opportunity for our nation. The Federation looks forward to working with Congress on this landmark legislation.

Mr. BOUCHER. Thank you very much, Mr. Baugh.

Ms. Figdor.

STATEMENT OF EMILY FIGDOR, DIRECTOR, FEDERAL GLOBAL WARMING PROGRAM, ENVIRONMENT AMERICA

Ms. FIGDOR. Thank you for the opportunity to share my views regarding these legislative proposals. My name is Emily Figdor and I am the director of the Federal Global Warming Program at Environment America. Environment America is the new home of U.S. PIRG's environmental work. We are a federation of State-based, citizen-funded environmental advocacy organizations.

My testimony today outlines three principles for strong, effective and fair global warming legislation and provides an overview of how well five major House and Senate bills fulfill those principles.

Twenty years ago this summer, NASA scientist James Hansen appeared before Congress for the first time to warn the American people of the dangers posed by global warming. Today thousands of families in the Midwest are struggling to recover from devastating floods. The extreme rainstorms that caused those floods have become more common over the last 60 years and scientists predict they will become even more common in a warming world.

These events remind us that inaction has consequences. It is vital, therefore, that we listen to what scientists are telling us today. They say that the United States and the world must begin reducing global warming pollution now and achieve steep reductions soon if we hope to avoid the most catastrophic impacts of global warming.

While achieving these reductions is a challenge of historic scale, the United States has the energy efficiency and renewable energy technologies to reduce emissions. A 2006 Environment America analysis found that the United States could reduce its emissions by nearly 20 percent by 2020 by taking just five technologically feasible steps to improve energy efficiency and use more renewable energy, and these solutions would also make America more energy independent, reinvigorate our economy and create good, new jobs here at home.

To get us there, Congress must pass global warming legislation that fulfills three principles. First, the legislation must be strong enough to get the job done, meaning that it must be able to deliver the domestic emission reductions that science tells us are necessary to prevent the worst effects of global warming. That means reducing total U.S. global warming emissions by at least 15 to 20 percent by 2020 and by at least 80 percent by 2050. Second, the legislation must accelerate the transition to clean energy economy. Capping global warming pollution while subsidizing polluters is like gunning the engine of a car while riding the brake. By contrast, smart climate policies that pair a carbon cap with investments in clean energy technology and infrastructure can shift America's energy transition into high gear. Finally, the legislation must maximize the benefits of our investments in clean technologies and minimize societal costs.

Any response to global warming will have an impact on American families. All Americans will benefit from a cleaner and more efficient economy that is less dependent on foreign oil. But some families may also experience increased burdens. It is important therefore that any climate policy is designed to maximize the benefits American families will reap in terms of cleaner air, improved energy efficiency and greater energy independence and minimize the costly experience in terms of higher energy bills. Studies including one released just yesterday by CBO show that auctioning emission allowances and returning some or all of the auction revenue to the American people reduces the societal cost of the cap-and-trade program. By auctioning allowances, we can assure that precious dollars are not siphoned away to unjustly pad the profits of Big Oil and other fossil fuel industries. At the same time, we can redirect those dollars towards the achievement of two very important goals: helping Americans make the transition to a clean energy economy and making that transition easier by returning some of the money to Americans who face the greatest burden from energy costs.

Turning to the legislation before us today, Congressman Waxman's Safe Climate Act and Congressman Markey's ICAP bill meet these three principles for strong, effective and fair climate legislation. Unfortunately, the Senate bills do not. First and foremost, the Senate bills would not achieve the degree of emission reductions

demanded by the science. Two of the bills have weak emission reduction targets and all three include mechanisms that undermine the ability of the legislation to achieve their targets. These mechanisms include a price cap, a cost containment auction and large-scale offset programs. These mechanisms are designed to contain costs. However, there are other ways to contain costs in cap-and-trade programs that will enhance rather than jeopardize the environmental integrity of the legislation. An analysis conducted for the Regional Greenhouse Gas Initiative shows that increasing investments in energy efficiency can significantly reduce allowance price as well as overall increases in energy prices that result from the cap-and-trade program. Legislation that incorporates improved energy efficiency standards, the removal of non-market barriers to energy efficiency improvements and vigorous financial support for energy efficiency would reduce compliance costs while preserving the program's environmental integrity.

Thank you for the opportunity to present these views today. I look forward to working with the subcommittee and the full committee to craft strong, effective and fair global warming legislation.

[The prepared statement of Ms. Figdor follows:]

Testimony of Emily Figdor, MPH
Federal Global Warming Program Director
Environment America

Before the Subcommittee on Energy and Air Quality
Of the Energy and Commerce Committee
U.S. House of Representatives
June 19, 2008

Introduction

Thank you for the opportunity to share my views regarding the various global warming legislative proposals currently pending before the Congress. My name is Emily Figdor, and I am the director of the Federal Global Warming Program at Environment America. Environment America is the new home of U.S. PIRG's environmental work. We are a federation of state-based, citizen-funded environmental advocacy organizations.

Twenty years ago this summer, NASA scientist James Hansen appeared before Congress to warn the American people of the dangers posed by global warming. Today, thousands of families in the Midwest are struggling to recover from devastating floods. The extreme rainstorms that caused those floods have become more common over the last 60 years,[i] and scientists predict they will become even more common in a warming world.[ii]

The juxtaposition of those two events reminds us that inaction has consequences. It is vital, therefore, that we listen to what scientists, including James Hansen, are telling us today. They say that the United States and the world must begin reducing global warming pollution now, and achieve steep reductions soon, if we hope to avoid the most catastrophic impacts of global warming.

Achieving those emission reductions will be an historic challenge. But America has what it takes to rise to that challenge. We have the resources, the ingenuity, and the creativity to lead the world in the effort to combat global warming – while at the same time making America more energy independent, reinvigorating our economy, and creating good new jobs here at home.

To get there, however, we need a roadmap. The global warming legislation that Congress ultimately adopts must be that roadmap, showing how America can achieve the deep reductions in global warming pollution that will be needed to prevent catastrophic impacts from global warming.

My testimony today outlines three basic principles for strong, effective, and fair federal global warming legislation and provides an overview of how well five major House and Senate bills fulfill those principles.

The three principles are as follows:

First, the legislation must be strong enough to get the job done, meaning that it must incorporate domestic emission reductions consistent with those the science tells us are necessary to prevent the worst impacts of global warming. This is especially important in the near term because the longer we delay the more difficult and costly reductions will be in the future.

Second, the legislation must accelerate the transition to a clean energy economy. Capping global warming pollution while subsidizing polluters is like gunning the engine of the car while riding the brake. By contrast, smart climate policies that pair a carbon cap with investments in clean energy technology and infrastructure can shift America's energy transition into high gear.

Finally, the legislation must maximize the benefits of our investments in clean technologies and minimize societal costs.

These three principles are consistent with a more detailed statement of principles circulated to the House by three members of this subcommittee, Representatives Waxman, Markey, and Inslee, in April 2008. The Waxman-Markey-Inslee principles have garnered more than 80 signatures to date from other members and interest from additional members, as well as the support of Environment America and the broader environmental community. We commend the Congressmen for this important contribution.

Principle 1: Action Must Be Sufficient to Prevent Dangerous Global Warming
The United States has already committed, as a signatory to the 1992 United Nations Framework Convention on Climate Change, to the goal of "[s]tabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."[iii] Many scientists and policymakers have identified a 2° C rise in global average temperature over pre-industrial levels (which is equivalent to 3.6° F or about 2° F over today's levels) as a rough threshold between damaging and catastrophic global warming.[iv]

According to the Intergovernmental Panel on Climate Change (IPCC), to have a reasonable chance of keeping global temperatures from rising by more than 2°C, the atmospheric concentration of global warming pollutants (in carbon dioxide equivalent) must not rise higher than 450 parts per million (ppm).[v] Leading climate scientists, such as James Hansen, believe that even this level of pollution may be too much. They argue for a target of returning concentrations of global warming pollutants to 350 ppm.[vi] Given that the concentration of global warming pollutants is already 375 ppm and rising every year, the need for strong action is immediate.[vii]

To stabilize carbon dioxide levels between 445 and 490 ppm (carbon dioxide equivalent), global emissions must peak no later than 2015 and decline by 50 to 85 percent below 2000 levels by 2050.[viii] The United States must:

- stabilize total U.S. emissions at or below today's levels immediately;

- reduce total U.S. emissions by at least 15 to 20 percent below today's levels by 2020; and
- reduce total U.S. emissions by at least 80 percent by 2050.[ix]

Of course, the United States cannot solve global warming on its own. But let's be clear: these emission reduction targets – 15 to 20 percent by 2020 and 80 percent by 2050 – presume similarly strong action by other developed countries and action by developing nations such as China and India. In other words, these emission reductions represent the level of cuts that must be made right here at home.

We also need to help kick-start emission reductions in other countries through mechanisms such as international forest protection. But none of these efforts minimize the need for immediate and ultimately deep cuts in domestic global warming emissions.

Principle 2: Action Must Accelerate the Transition to a Clean Energy Economy
America is on the cusp of a clean energy revolution – a revolution that will transform our economy from one dependent on dirty, dangerous, and unstable sources of energy to one that is clean and energy efficient.

This clean energy revolution is happening all across America. Texas has added 4,000 megawatts of wind power to its grid in the last decade alone. New Jersey has doubled the amount of solar power on its rooftops in just the last two years. More than 4,000 megawatts of solar thermal power are scheduled to be built in the deserts of the American southwest over the next several years. And states like Vermont are using energy efficiency to meet an ever-growing share of their electricity needs – indeed, last year, Vermont used energy efficiency to completely offset the growth of electricity demand in the state and did so at a quarter of the cost of buying power.[x]

Yesterday, Environment America released *Global Warming Solutions that Work*, a report detailing more than 20 examples of cutting-edge policies and practices that communities, states, and countries are using to reduce global warming pollution. Innovative and common sense practices like these, and many more like them, are being replicated across the country.

But much more needs to be done. America has enormous potential to save energy through improved efficiency and to tap the vast resources of the sun and wind to power our economy. For example, a 2006 Environment America report found that by achieving five technologically feasible targets for energy efficiency and renewable energy development (along with keeping emissions of non-carbon dioxide global warming pollutants constant), the United States could reduce its total global warming emissions by 19 percent below 2004 levels by 2020 (see Table 1).[xi]

Table 1. Global Warming Emission Impacts in 2020 of Selected Energy Targets (Relative to 2004 Emissions)[xii]

Strategy	Savings $MMTCO_2E$
Stabilize Vehicle Travel	0*
40 MPG Fuel Economy and Heavy-Duty Truck Fuel Economy Standards	383
10% of Transportation Fuel from Renewables	61
10% Reduction in Energy Consumption	400
20% of Electricity from New Renewables	511
Total Savings	**1355**
2004 U.S. Global Warming Emissions	7122
Reduction Relative to 2004	**19%**

* Avoids increase in emissions resulting from projected increases in vehicle travel between now and 2020.

The long-term goal of achieving an 80 percent reduction in total U.S. global warming emissions also is feasible, given an aggressive push to improve energy efficiency and expand the production of renewable energy in the United States.[xiii]

The only thing we need to fuel this clean energy revolution is a clear and consistent signal from the federal government. Adoption of a strong cap on global warming pollution will unleash the creativity of American scientists and entrepreneurs to develop new technologies to reduce emissions. At the same time, however, the architecture of a carbon cap must accelerate, rather than hinder, the transition to a clean energy economy.

By investing the revenues from auctioning emission allowances under a cap-and-trade program in energy efficiency programs and research, development, and deployment of renewable energy and energy efficiency technologies, we can accelerate our transition to a new energy future. On the other hand, distributing allowances to polluting industries will hinder that transition and make it more difficult and more costly for America to achieve the required levels of emission reductions.

We also need additional policies to accelerate the transition to a clean energy economy. Those policies include:

- Strong energy efficiency standards for vehicles and appliances.

- Strong building energy codes designed to improve the efficiency of homes and businesses. The federal government also should encourage the construction of green buildings and zero-energy buildings that go "beyond code" and should adopt measures to encourage or require the use of small-scale renewable energy technologies like solar water heaters, geothermal heat pumps, or solar panels on new residential and commercial buildings.

- Renewable electricity standards that will ensure that America gets at least 25 percent of its electricity from renewable sources by 2025.

- Energy efficiency resource standards for electric and gas utilities that require that energy efficiency improvements play an important role in meeting future energy needs.

- Transportation and land-use policies that provide Americans with viable alternatives to driving by encouraging the development of compact, walkable neighborhoods where automobile use is an option, not a requirement.

- Policies to reduce global warming pollution and promote sustainable practices in other parts of the economy, including policies to encourage recycling, efficient use of water, sustainable agriculture, more energy efficient industrial practices, and to reduce emissions of global warming pollutants other than carbon dioxide.

Principle 3: Action Must Maximize Benefits and Minimize Costs
Any response to global warming will have an impact on American families. All Americans will benefit from a cleaner and more efficient economy that is less dependent on foreign oil. But some families may also experience increased burdens.

It is important, therefore, that any climate policy is designed to maximize the benefits American families will reap in terms of cleaner air, improved energy efficiency, and greater energy independence, and minimize the costs they experience in terms of higher energy bills.

To use our resources most effectively, any emission trading program used to comply with a global warming emission cap must auction, rather than give away, emission allowances, and use the proceeds of that auction to accelerate the transition to a clean energy economy and reduce the cost of the program to consumers.

Economic research shows that auctioning allowances (along with "recycling" some or all of the revenue from the auction back to the public) is a less expensive way to achieve emission reductions through cap-and-trade than a free distribution system. For example:

- A study by Resources for the Future estimated that an auction and revenue recycling approach was roughly half as expensive to society as an allocation system based on "grandfathering" of existing emitters. Total savings under the auction approach increase as emission-reduction targets become more stringent.[xiv]

- These results are supported by evidence from other economic modeling efforts suggesting that allowance auctions, combined with recycling of auction revenues, can allow for emission reductions at lower overall cost and possibly promote more innovation and better investments in technology.[xv]

The conclusion that auctioning allowances is less costly to society than giving them away seems to defy common sense. After all, consumers will mainly see the impact of a cap-and-trade system in higher prices for energy and some products. If polluters are given

allowances for free, one might think that they would not need to pass the cost of compliance down to consumers, thus saving consumers money.

However, economic research and practical experience show that giving away allowances to polluters represents the worst of both worlds. Consumers pay more for energy or products as the cost of those products comes to reflect the cost of global warming pollution – just as they would under a system in which allowances are auctioned. But instead of the government gaining revenues from allowance auctions, which could then be used in a variety of ways to reduce the cost of the program, *polluters* could benefit by receiving unjustified "windfall" profits – even if they take no action at all to reduce their global warming emissions.

Windfall profits are a real and significant concern. In the United Kingdom, for example, power producers have netted an estimated £1 billion (about $1.9 billion) in windfall profits through participation in the European Union's Emission Trading Scheme.[xvi]

By auctioning allowances, we can ensure that precious dollars are not siphoned away to unjustly pad the profits of Big Oil and other fossil fuel industries. At the same time, we can redirect those dollars toward the achievement of two important goals: helping Americans make the transition to a clean energy economy, and making that transition easier by returning some of the money to those who face the greatest burden from energy costs, particularly low-income consumers.

Overview of the Bills
The five bills that are the subject of today's hearing include the following:

- Safe Climate Act (H.R. 1590, introduced by Representative Waxman);
- Investing in Climate Action and Protection Act (H.R. 6186, introduced by Representative Markey);
- Climate Security Act (S. 2191, as reported out of the Senate Environment & Public Works Committee, introduced by Senators Lieberman and Warner);
- Boxer-Lieberman-Warner substitute to the Climate Security Act (S. 3036); and
- Low Carbon Economy Act (S. 1766, introduced by Senators Bingaman and Specter).

I will turn first to the House bills and then to the Senate bills.

Safe Climate Act and Investing in Climate Action and Protection Act
The Safe Climate Act and Investing in Climate Action and Protection Act (iCAP) meet the three principles for strong, effective, and fair climate legislation.

Of the five bills, the Safe Climate Act, which was the first of these bills to be introduced in the Congress, has the strongest science-based framework. It is the only bill that covers all U.S. global warming emissions. It sets emission-reduction targets and then establishes different regulatory programs to achieve those reductions. An analysis by the World Resources Institute indicates that the cumulative emission reductions required by the bill are consistent with the goal of stabilizing the atmospheric concentration of global warming pollutants near 450 ppm.[xvii]

Importantly, both the Safe Climate Act and the iCAP bill include mechanisms for periodically reviewing developments in the science and promptly adjusting the program if the latest science shows that we are not on track to avoid dangerous global warming.

The Safe Climate Act would accelerate the transition to a clean energy economy by establishing an energy efficiency resource standard, renewable electricity standard, and global warming emissions standards for vehicles. And it envisions auctioning, rather than giving away, emission allowances, and using the auction proceeds to maximize the public benefits and minimize the effect of any energy cost increases to consumers, though the bill does not set forth a detailed plan for achieving these important objectives.

The iCAP bill provides the most detailed road map for transitioning America to a clean energy economy, while protecting American consumers.

The bill auctions 94 percent of the emission allowances at the start of the program and 100 percent by 2020. It dedicates a substantial portion of the auction revenue to energy efficiency, while also establishing energy efficiency standards, which will reduce the costs of the policy. It invests in the research, development, and deployment of renewable energy technologies and in the low-carbon infrastructure and human resources that will be needed to successfully fight global warming, such as through green jobs training programs.

In addition, the iCAP bill returns more than half of the proceeds of the auction to low- and middle-income households to help compensate for any increase in energy costs as a result of the legislation. This will compensate all increased energy costs due to the policy for households earning under $70,000 (66 percent of U.S. households) and will provide benefits to all households earning up to $110,000 (more than 80 percent of U.S. households).

Climate Security Act, Boxer-Lieberman-Warner Substitute, and Low Carbon Economy Act

We commend Senators Boxer, Lieberman, Warner, Bingaman, and Specter for their dogged work to advance global warming legislation. The Lieberman-Warner Climate Security Act and the Boxer-Lieberman-Warner substitute include many provisions that attempt to address the principles I have outlined. The bills have much stronger emission-reduction targets than any bill ever voted on by the Senate, and, for the first time, a bill considering auctioning a substantial portion of the pollution allowances was put before the Senate for a vote. However, these bills do not adequately fulfill the three principles.

Given the primacy of the need to assure real emission reductions consistent with what science says is necessary, I will focus my testimony on this fatal shortcoming in these bills.

Of the three bills, the Lieberman-Warner Climate Security Act has the strongest emission-reduction targets (see Table 2); in particular, the bill has an ambitious 2020 target to reduce total U.S. emissions by 21 percent below 2005 levels by 2020. Unfortunately, the bill aims to reduce total U.S. emissions by just 65 percent by 2050, not the 80 percent demanded by the science. The Bingaman-Specter Low Carbon Economy Act has the weakest emission-reduction targets of the three bills. The pollution caps and incentives in the bill would reduce total U.S. emissions by an estimated 3 percent below 2005 levels by 2020 and by 22 percent by 2050.[xviii]

Table 2. Comparison of Emission-Reduction Targets in the Five Global Warming Bills (from 2005 baseline)[xix]

	Percent of Total U.S. Emissions Covered	Emission-Reduction Target for Covered Sources, 2020	Emission-Reduction Target for Covered Sources, 2050	Estimated Reduction in Total U.S. Emissions, 2020*	Estimated Reduction in Total U.S. Emissions, 2050*
Safe Climate Act (H.R.1590)	100%	1990 levels	80% below 1990 levels	14%	83%
Investing in Climate Action and Protection Act (H.R. 6186)	cap-auction-and-invest program covers 87%, additional coverage from other regulatory programs	20%	85%	21%	75%
Climate Security Act (S. 2191), as passed by the Senate Environment & Public Works Committee	87%	19%	71%	21%	65%
Boxer-Lieberman-Warner Substitute to Climate Security Act (S. 3036)	82%	19%	71%	14%**	60%**
Low Carbon Economy Act (S. 1766)	87%	2006 levels	1990 levels	3%**	22%**

* These estimates reflect the emission-reduction targets in the bills, growth in uncovered emissions, and potential additional emission reductions that could occur from incentives and complementary policies in the legislation. The estimates assume that offsets will be real, permanent, and additional.

** These estimates do not include the potential impact of the cost containment auction in the Boxer-Lieberman-Warner substitute or the price cap in the Low Carbon Economy Act.

In addition to the problems with these emission-reduction targets, all three bills include mechanisms that threaten to undermine the ability of the legislation to achieve even these targets. The mechanisms include a price cap, or so-called "safety valve," in the Bingaman-Specter Low Carbon Economy Act, a cost containment auction in the Boxer-Lieberman-Warner substitute, and large-scale offsets programs in all three bills.

These three mechanisms are designed to contain costs. However, there are other ways to contain costs in cap-and-trade programs that will enhance – rather than jeopardize – the environmental integrity of the legislation. An analysis conducted for the Regional Greenhouse Gas Initiative (a regional, power sector cap-and-trade program that includes 10 northeastern states) shows that increasing investments in energy efficiency can significantly reduce allowance prices as well as overall increases in energy prices that result from the cap-and-trade program.[xx] A wise U.S. climate policy would provide a policy framework that incorporates improved energy efficiency standards for equipment, the removal of non-market barriers to energy efficiency improvements, and vigorous financial support for energy efficiency (financed from revenues from allowance auctions), which would reduce the cost of compliance with the program while preserving its environmental integrity. The Markey iCAP bill takes this approach.

- Price cap

The Bingaman-Specter Low Carbon Economy Act includes a price cap, which would allow emitters to pay a set price for emission allowances if the price set by the market exceeds a certain level. Price caps erode the environmental integrity of the program by allowing emissions to exceed the limits in the bill. In addition, the economic risks posed by global warming are significant and severe. Price caps do nothing to reduce the overall economic costs of addressing global warming but merely shift the costs from today to future years, since increased emissions now will require steeper emission cuts in the future.

- Cost containment auction

The Boxer-Lieberman-Warner substitute borrows 6 billion tons of emission allowances from the future (2030-2050) and allows companies to buy them at a set price in the early years of the program. The availability of these additional allowances in the early years of the program significantly jeopardizes the ability of the bill to deliver the near-term reductions in emissions demanded by the science. Considering the impact of this provision as well as the offsets program in the bill, Joseph Romm, a former senior official at the Department of Energy and a fellow at the Center for American Progress, commented that "the most likely outcome of this bill is that U.S. energy-related CO2 emissions in 2025 would be about the same as they are now, and possibly higher."[xxi]

- Large-scale offset programs

All three of these bills include large-scale domestic and international offsets programs. Offsets allow emitters covered by a carbon cap to comply by paying for emission reductions at facilities or for activities not covered by the program. Offsets are problematic because they provide less-certain reductions in emissions, thus eroding the environmental integrity of the program, and because they reduce the potential for the American people to receive the "co-benefits" of domestic emission reductions, such as cleaner air and improved energy security.

There is a fundamental difference between offsets and emission allowances. Allowances represent units of pollution emitted – they can be accurately measured and tracked. Offsets represent units of pollution *not emitted*. To determine whether an emission

reduction achieved through an offset is equivalent to an allowance, one must know not only how much pollution was emitted from the source receiving the offset, but how much pollution *would have been emitted* had the offset not been issued. This is difficult, if not impossible, to know with certainty.

A recent report by Stanford University on international experience with offsets concluded that "any [domestic or international] offset market of sufficient scale to provide substantial cost-control for a cap-and-trade program will involve **substantial issuance of credits that do not represent real emissions reductions**" (emphasis added).[xxii]

The widespread use of offsets, particularly international offsets, reduces the amount of emission reductions that occur domestically. To the extent that many of the nation's largest emitters of carbon dioxide are also among its largest emitters of health-threatening air pollution and most profligate consumers of fossil fuels, allowing offsets reduces the potential for climate policy to drive simultaneous improvements in air quality and energy security. Indeed, international offsets result in American consumers paying for capital improvements in other nations' industrial and energy systems.

While the Markey iCAP bill includes an offsets program, it incorporates rigorous limitations and standards to maintain the environmental integrity of the bill.

Conclusion

Global warming poses a profound threat to our future. The science is clear that we must begin reducing global warming pollution now, and achieve steep reductions soon, if we hope to prevent catastrophic effects of global warming. In the United States, we must cut domestic emissions by at least 15 to 20 percent by 2020 and by 80 percent by 2050.

Achieving those emission reductions will be an historic challenge. However, in responding to this challenge, there is also opportunity – if we act quickly and sensibly – including reduced dependence on fossil fuels, cleaner air and healthier communities, and new jobs. Congress should develop legislation that embodies the principles I discussed today to accomplish these goals.

Thank you for the opportunity to present these views. I look forward to working with the subcommittee and full committee to help craft strong, effective, and fair global warming legislation.

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[xix] Personal communication with John Larsen of the World Resources Institute, 17 June 2008; and Environmental Protection Agency, *U.S. Inventory of Greenhouse Gas Emissions and Sinks, 1990-2006*, April 2008.
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Mr. BOUCHER. Thank you very much, Ms. Figdor.
Mr. Grumet.

STATEMENT OF JASON S. GRUMET, EXECUTIVE DIRECTOR, NATIONAL COMMISSION ON ENERGY POLICY

Mr. GRUMET. Thank you very much, Chairman Boucher, Ranking Member Upton and Mr. Barton. On behalf of the National Commission of Energy Policy, I appreciate the opportunity to be here with you today and I appreciate the three of you sticking with us. It is a testament to your commitment to this tough discussion.

Mr. Chairman, in 2001, the National Commission on Energy Policy brought together a group of 20 diverse leaders, diverse both in expertise, in ideology and political history. We brought together an aggressively bipartisan group of leaders from the energy industry, from organized labor, leaders in the environmental advocacy, consumer advocacy communities and officials from the past three Administrations, and our goal was simple. It was to develop a set of principled, detailed, and pragmatic compromises across the energy policy debate. On climate change, as you can imagine, we had some spirited, at times contentious discussions but I was pleased that in December of 2004 we were able to release a set of recommendations which were unanimous. Our group concluded that the problem was real and that there was an imperative to act. We also concluded that it was possible, in fact, to develop a well-designed program that had a mandatory economy-wide cap on greenhouse gas emissions that would achieve our environmental imperatives while at the same time accelerating necessary technology and protecting the economy. We elaborated those recommendations in a report in 2004 and updated recommendations in 2007, and we have appreciated the interest of this committee in our work to date.

Mr. Chairman, the differing views reflected here today are evidence of the work that we have yet to do. At the same time, the work of this committee, the bills before this testimony and the testimony that I think we have all heard is a sign of some optimism because it reveals that there is a growing center of gravity around a number of key themes. I believe that we see that the discussion is moving towards support for an economy-wide cap that is upstream in the energy food chain and that targets investments to clean technologies and towards consumer protection. I also believe it is clear that we are going to have to have a program that limits costs and links the actions of the United States to what happens in the rest of the world.

I want to commend Chairman Dingell and his staff and staff of the committee for the white papers on costs, on international competitiveness and on the Federal-State relationship because we on the Energy Commission believe that these in fact are the three key issues that are going to have to be resolved in order to build the kind of bipartisan consensus that we need for action, and I guess I would like to just follow the lead of the committee and try to telegraph where we see some of the kernels of optimism for the kinds of principal compromise that we think are both possible and necessary.

Mr. Chairman, first on cost, while acknowledging the problem, there are some who still would argue that we should solve this

problem at no cost. There are others who argue that the imperative is so great that we should do whatever is necessary regardless of cost. I think our commission believes, and it is, I think, a rather obvious conclusion, that of course there has to be a middle ground, a middle ground that allows the market to work, that creates real incentives for the economy to innovate but that provides predictable and transparent costs at the outset of a program. Within our organization and our commission, we found very sincere and intelligent people reach incredibly distinct and different positions on the expected costs of climate action based on a number of reasonable and different assumptions. We found after a year of having "my modeler is smarter than your modeler" discussions, there was a better way forward and it was a way that allowed people to have their disagreements and still in fact advance a mandatory program. It was to have an agreement that didn't at the end of the day require one side to say trust me to the other side. We think that a safety valve is the most transparent and obvious way to do that. We have worked with folks in the Senate to find other mechanisms that we think can provide the same kind of predictable and transparent cost containment and we believe that it is going to have to be part of the ultimate solution.

On the important issue of international competitiveness, the entry points in this discussion, I think, are well known. They are a decade old. It is the Kyoto fight. It is the on one hand, America, go fix it, and on the other hand, let us wait to be led by others. Again, of course, this is not where the solution lies. The Energy Commission recognizes that this is global warming and not American warming. We recognize that we cannot afford to design a program that is going to export jobs and import carbon. We have to link what we do here in the United States to what happens or doesn't happen in the rest of the world.

At the same time, the story of our country is not waiting to be led by others to solve problems that we believe are real. We believe this problem is real and we believe the U.S. is going to have to take real action. The solution, we believe, is a combination of positive incentives for technology investment, both here and overseas, and countervailing trade measures that will ensure that if other major nations, major emitters and trade partners, do not take in fact real action, that there will be consequences. We are, I think, appreciate of the work that our friends in organized labor have done along these lines and think that this provides a pathway for future discussion.

Finally, on the question of the great federal republic in which we live, the relationship between Federal Government and States in solving this problem again, the outlines of the debates are simple. Some would argue that Federal action has to provide a complete and total preemption of all State activities, otherwise chaos would reign. Others say that because of States' rights, States should be able to do whatever in fact they want and have what would ultimately be duplicative regulation. Of course, the answer is somewhere in the middle. We believe that there has to be and is a path forward that would acknowledge the leadership that States have taken to date that provides both tolerance and incentives for States to take on complimentary efforts that achieve energy efficiency and

address what they have unique ability to do, but ensure that State efforts do not create a muddle of currencies. We have to have a consistency across the program that allows for a single national currency for the market to function if we are going to protect the environment and protect the economy.

So let me just close with one more point of optimism and that is to recognize that this committee has quite a history of both full-throated and active debate but also tackling incredibly complicated issues like the Clean Air Act and bringing forth a compromise that not only has the substantive integrity but the political pragmatism to move the legislation. It is that kind of leadership that we are going to have to rely on here. The National Commission on Energy Policy, our parent organization, the Bipartisan Policy Center, is eager to continue to work with you as a resource along the way.

Thank you for your time.

[The prepared statement of Mr. Grumet follows:]

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Testimony before the Subcommittee on Energy and Air Quality
Of the House Committee on Energy and Commerce

June 19, 2008

Good morning Chairman Boucher and Members of the Subcommittee. I speak to you today on behalf of the National Commission on Energy Policy. The Commission is a project of the Bipartisan Policy Center, a new organization dedicated to advancing bipartisan solutions to some of our nation's most urgent challenges.

Certainly energy and climate change are among the foremost of these challenges and I commend this Subcommittee, the Committee on Energy and Commerce, and especially Chairmen Dingell and Boucher, for the thoughtful consideration they are giving these issues and for the good work the Committee has already been done in developing white papers and holding hearings.

Before discussing the various legislative proposals that are the subject of today's hearing, I'd like to say a little more about the National Commission on Energy Policy and the Bipartisan Policy Center (BPC). The Commission was launched in 2002. It brings together a politically and professionally diverse group of 21 nationally recognized energy experts. In 2004, the Commission released its first report, calling for a comprehensive, bipartisan strategy to meet our nation's energy challenges. Since then we have continued to meet, undertake new analyses, and help inform the national debate over these critical issues. We issued a subsequent report, with updated recommendations, in April 2007 and continue to work closely with members of Congress on both sides of the aisle to develop effective climate and energy policies.

The Energy Commission's success forging a principled bipartisan compromise inspired the founding of the Bipartisan Policy Center. Launched in 2007, the BPC has projects underway that address a broad suite of issues in addition to energy, including national security, agriculture, health care, and transportation. The BPC's mission is to develop and promote solutions that can attract the public support and political momentum to achieve real progress. Real progress is just what we need on climate change. Real progress will require a long-term transformation of our energy systems. We need to get started on that transformation, not only because the climate risks we incur by continued delay are unacceptable, but because the energy status quo isn't working very well. Congress passed major energy legislation in 2005 and 2007 and we've made progress in some important areas—notably boosting automobile fuel economy, energy efficiency standards, and renewable energy technologies. Still, to most experts and certainly to most American citizens our energy future seems far from secure.

All the bills the Subcommittee is considering today, by requiring significant greenhouse gas reductions and providing incentives for new technologies, seek to make a decisive course correction in our current energy trajectory. Their specifics certainly vary. H.R. 1590 and H.R. 6186, the Waxman and Markey bills respectively, set the most ambitious emission reduction targets (on the order of 80 percent below current levels by mid-century). S.1766, S. 2191, and S. 3036—the Bingaman/Specter, Lieberman/Warner, and Boxer bills, respectively call for reductions on the order of 60–70 percent below current emissions levels by 2050.

Given the difficulty of charting public policy on *any* issue over a four-decade timeframe, I would argue that one probably should not make too much of these differences in long term targets. Rather the more important questions are: How do these bills address the myriad and sometimes competing concerns that inevitably arise when contemplating mandatory limits on greenhouse gas emissions? How well do various program designs balance the different interests of consumers, businesses, investors, and the environment? How effective will they be in accelerating the development and deployment of a next generation of energy technologies? And perhaps most important of all: what is the combination of trade-offs that will make it possible for a bill to garner the

bipartisan support needed to become law and get a greenhouse-gas reduction program started.

As a starting point, it's useful to look over where we've been and how far we've come in grappling with the climate issue. Certainly our collective sense of urgency has grown, spurred in part by mounting evidence on the scientific front. New stakeholders have joined the call for action including labor unions, evangelical Christians, sportsmen, Latino and African American organizations, farmers, national security experts and a wide variety of energy producers, manufacturers and business groups.

The depth and seriousness of the proposals we are discussing today is itself testimony to how far this debate has progressed. Especially promising, from the standpoint of passing legislation, are the multiple points of commonality in all of these bills. First, all propose to implement reductions via a market-based, cap-and-trade regime. Even the Waxman bill (H.R. 1590), which sets broad targets but leaves most implementation details to EPA, points to a presumption that cap and trade would be the approach used. There is convergence on a number of other key points as well. For example, each of these bills (with the exception, in some cases, of H.R. 1590[1]) includes provisions for:

- an economy-wide program that primarily regulates "upstream" emissions sources (e.g., petroleum producers/importers; natural gas pipelines/distributors; large coal users/industrial facilities)
- containing program costs via mechanisms like banking, borrowing, and offsets (i.e., emissions credits for reductions achieved outside the cap and in other countries)
- auctioning a far larger share of allowances than has been typical in past cap-and-trade programs (like the U.S. Acid Rain Program) and using some of the proceeds to address impacts on consumers, including low-income households
- increasing public investment in the development and deployment of new, climate-friendly energy technologies

[1] H.R. 1590 is simply silent on a number of these issues.

- encouraging major trading partners to commit to similar emission reductions and other mechanisms to address the competitiveness concerns of U.S. industry

In sum, these bills contain the broad outline of a legislative compromise. But as usual, the devil is in the details. The remainder of my testimony focuses on four specific areas that are especially contentious—and especially important in terms of advancing viable legislation. These issues – that the Committee has identified in its thoughtful white papers – include cost containment, allowance allocation and revenue recycling, international issues (including both the treatment of offsets and competitiveness concerns), and state/federal roles.

Cost containment: Cost has always been a central issue in the debate over whether and how to limit greenhouse gas emissions. If everyone agreed that achieving reductions was cheap, we'd have a program in place by now. Instead, cost debates usually bog down in fruitless disagreements over who is making the right assumptions about technology, fuel prices, and other factors. Different assumptions can produce wildly different estimates of economic impact. Finally, even if long-term costs prove, on average, no higher than expected, there is a concern that greenhouse gas allowance markets could suffer from short-term liquidity problems and excessive volatility—producing potentially harmful price spikes. All of these cost-related concerns will be even more acute in the current environment of high and rising energy prices. That is why the Commission believes it is essential to include an explicit cost-containment mechanism as part of a cap-and-trade program. Ideally, that mechanism should be both transparent and predictable.

The Commission has recommended one option that meets those criteria: a safety valve—essentially, a cap on the price of emissions allowances—that has the effect of assuring that the per-ton cost of emissions reductions required under the program cannot rise above a known level. The safety valve or price cap would increase at a known rate over time so as to deliver steadily stronger incentives for mitigation over time while simultaneously providing planning certainty for industries, such as electric utilities, that must make large capital investments in energy technology. We have argued that such a

safety valve should be phased out when the need for environmental certainty outweighs the need for cost certainty and significant progress has occurred at the international level.

We are aware that some find the safety valve approach unacceptable because it risks foregoing emission reductions if costs prove higher than expected (that is, it allows for the possibility that actual emissions will exceed the cap). We are also aware that other measures included in the bills we are discussing today are part of the overall answer to cost concerns. Many of these mechanisms—examples include banking and borrowing; emission offsets; and a more recent idea, first introduced in the Lieberman-Warner bill, that involves creating a Federal Reserve-like entity to oversee carbon markets—can help to ensure that the market for allowances is sufficiently liquid and does not suffer from excessive price volatility. None of these options, however, provide the certainty or predictability of a safety valve. And as such, they may not be "enough" to decisively answer concerns about the potential economic impact of carbon regulation on consumers and households. Given the importance of these concerns, the Commission—while still supportive of a safety valve—believes that other cost-containment options and compromises should be explored.

Allowance allocation and revenue recycling: Closely related to the issue of cost is concern about the impact of higher energy prices on consumers, especially low-income households, and businesses. Revenue recycling—that is, taking some of the revenues raised by auctioning emission allowances and returning those revenues to consumers via the tax code, direct rebates, assistance programs, or other mechanisms—provides a means of addressing consumer and low-income concerns without reducing the effectiveness of the cap-and-trade program in terms of creating market signals for emissions reductions.

Moreover, economic modeling indicates that auctioning allowances and recycling the revenues is generally more "efficient"—in the sense that it reduces the net cost to society of implementing the program—than giving allowances away. Depending on how revenues are recycled (the economics literature tends to favor using auction revenues to reduce taxes on income and investment), this approach can generate economic benefits that offset some of the costs incurred to reduce emissions.

As I have already noted, all of the major proposals under discussion today provide for a much larger auction than has been typical of past cap-and-trade programs and use the resulting revenues to address a number of other important policy objectives. The Markey bill (H.R. 6186) directs over half of auction proceeds to low- and middle-income households via a combination of rebates and tax credits. The Senate bills (S. 1766, S. 2191, and S. 3036) allocate a share of allowances (9–11 percent) directly to states for redistribution as the states see fit.[2] All of the bills also allocate some share of allowances (or auction revenues) to other programs or for other purposes, including technology development, adaptation assistance, energy-intensive industries, and agricultural and forest carbon sequestration.

Exactly who gets what share of the allocation pie is likely to remain very contentious, as the stakes are high—the potential allowance value created by an economy-wide program is on the order of tens of billions of dollars per year. The recent Senate debate suggests the need for a closer focus on the fiscal implications of greenhouse-gas emissions reduction programs. Given the importance of these issues and the magnitude of the potential revenue streams involved, the Commission believes that would be entirely appropriate. Our general view is that arguments for auctioning some portion of the allowances and for emphasizing the positive gains achievable through thoughtful revenue recycling are stronger than ever, in the current economic and political context. The Commission has long recommended that allocation decisions should be guided by equity considerations, should seek to maximize benefits to society as a whole, and should protect low-income households. These remain, in our view, the right priorities.

International participation, offsets, and U.S. competitiveness: Clearly, domestic efforts to limit greenhouse gas emissions will not occur in a vacuum. Action by other nations is not only desirable but ultimately essential—not only because the problem of climate change will inevitably require a global response, but because concern about adverse

[2] In addition, S. 1766 directs auction revenues from a 4 percent share of allowances specifically to low-income assistance programs.

impacts on U.S. competitiveness will continue to arise as long as our major trading partners (including especially major developing countries like China and India) are not undertaking similar action to reduce carbon emissions. The Senate bills provide for countervailing trade measures if major trading partners fail to act within some reasonable timeframe. Defining those measures with greater specificity such that they both address the legitimate concerns of energy-intensive U.S. industries and do not run afoul of international trade rules and agreements will be a challenge. Current legislative proposals also provide positive inducements for participation by other nations (such as funding for technology transfer and forestry projects overseas). The Commission strongly believes that a balance of carrots and sticks is the most effective approach to engage our major trading partners.

Emissions offsets present another aspect of program design with important international dimensions. By allowing American companies to take advantage of low-cost emission reductions or carbon sequestration opportunities in other countries, offsets can enhance regulatory flexibility and significantly reduce program costs at home, while delivering other important non-climate benefits (such as forest and biodiversity protection and sustainable development) in poor countries. An offsets program must be carefully designed, however, and implemented with appropriate guidelines and verification requirements. Over-reliance on offsets—especially with inadequate safeguards to ensure that claimed emissions reductions are real, permanent, additional, and verifiable—could undermine program goals and political support, especially if substantial U.S. funds are leaving the country to support emission-reduction efforts abroad rather than at home.

State/federal roles: A number of states and regions have moved ahead of the federal government to adopt their own greenhouse gas reduction goals and regulatory requirements. Some states are concerned that a federal program could undermine their ability to pursue more ambitious targets. The best response to this concern, in the Commission's view, is to encourage state actions that are consistent with a national program but that avoid creating overlapping cap-and-trade programs with different currencies. Federal policy should provide incentives designed to recognize states leadership while also promoting continued progress in areas where states have primary

jurisdiction or have traditionally played a key role, including building codes, appliance and equipment efficiency standards, electric and natural gas utility regulation, and local clean energy development.

In sum, I come before the Subcommittee today with a message of good news and bad news. The good news is that the bills before you show that we have come a long way toward finding common ground on than environmentally and economically sound policy for tackling our nation's contribution to global warming. The bad news is that many difficult questions remain. My testimony has attempted to identify four of the issues that will be especially important in advancing the legislative debate. These issues are difficult, but we cannot allow them to paralyze us. To the extent the Commission can provide more information or help explore options for resolving some of these questions, we would welcome the opportunity to be of assistance.

In closing, I would like to address the argument that, with energy prices at record highs, this is precisely the wrong time to be doing something about climate change. The Commission disagrees. If anything our current predicament illustrates precisely the danger of drifting along with the status quo. In the long run, the policies we need to address global warming are also the policies we need to regain control of our energy destiny. And with thoughtful program designs we can be confident that benefits will be realized and the price impacts will be manageable and distributed in a manner that protects our most vulnerable citizens.

Thank you for this opportunity to testify.

NATIONAL COMMISSION ON ENERGY POLICY

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Summary of Testimony of Jason S. Grumet
Executive Director, National Commission on Energy Policy
President, Bipartisan Policy Center
Before the House Energy & Commerce Subcommittee on Energy and Air Quality
June 19, 2008

The climate policy debate in the United States has evolved considerably over the last several years. Legislation now before Congress points to an emerging consensus on a number of key points. Significantly, all the bills under consideration today agree on (1) the need for substantial long-term emissions reductions and (2) the desirability of relying on a market-based, cap-and-trade approach to achieve these reductions.

Much hard work still needs to be done, however, to reach agreement on important program details. Four design issues – which the Committee has addressed in thoughtful white papers - have emerged as critical to developing a successful program:

1. Cost containment. The program will need to include mechanisms to protect consumers and the economy in the event that program costs prove significantly higher or more volatile than expected. Ideally, such a mechanism should be transparent and predictable,
2. Allowance allocation and revenue recycling. Current proposals call for auctioning a large share of allowances and using the revenues to support a variety of public policy objectives. Allocation decisions should be guided by equity considerations, should seek to maximize benefits to society as a whole, and should protect low-income households.
3. International participation and U.S. competitiveness. The long-term success of any U.S. climate policy requires that we engage our major trading partners and address competitiveness concerns. This is best accomplished through an approach that combines positive inducements with negative consequences in the event of continued non-participation.
4. State/federal roles. Having multiple cap-and-trade programs with different requirements and currencies in different parts of the country is unlikely to make environmental or economic sense. States have a critical role, however, in advancing complementary policies in areas like efficiency, renewables, and utility regulation.

The policies we need to address climate change are also the policies we need to regain control of our energy future. And with thoughtful program design we can ensure that the benefits will be realized and the costs will be manageable and distributed in a way that protects our most vulnerable citizens.

The National Commission on Energy Policy is focused on helping to resolve these critical issues and stands ready to assist the Committee as it continues to address this important challenge.

Mr. BOUCHER. Thank you very much, Mr. Grumet.
Mr. Scott.

STATEMENT OF DOUGLAS SCOTT, DIRECTOR, ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

Mr. SCOTT. Thank you very much, Chairman Boucher, Ranking Member Upton, Ranking Member Barton, Congressman Burgess. My name is Doug Scott. I am director of the Illinois Environmental Protection Agency. On behalf of Governor Blagojevich, I appreciate the opportunity to speak to you today, and let me also add my thanks for the work that this committee has done and will continue to do, not just today but the white papers have been very good about teeing up a lot of the issues that all of us are facing, so we appreciate that.

I have had the opportunity in my position to work on this issue from a number of different perspectives. First, in Illinois, we studied the issue. I chaired a taskforce that made 24 separate recommendations to the governor as to how we could reduce greenhouse gas emissions in Illinois back to 1990 levels by the year 2020. I have served as vice chairman of the Climate Registry, which is 39 States, nine Canadian provinces, six Mexican states and three Native American tribes which have gotten together working on developing and have developed a voluntary protocol for greenhouse gas registry and now we are working on coordinating that with States that have mandatory reporting jurisdictions as well. I chair the Air Committee for the Environmental Council of the States, which has passed a resolution on this very issue about the States' role in federal climate legislation. Illinois is part of the Midwestern Governors' Association Greenhouse Gas Accord. Six Midwestern States and the province of Manitoba are working to develop right now a Midwestern cap-and-trade program similar to the initiatives going on with the Western Climate Initiative and the Regional Greenhouse Gas Initiative, and finally, Illinois was one of 18 signatories to the Governors' Declaration on Climate Change, which was presented 2 months ago at Yale University, and that document sets forth some guiding principles to help develop a State and federal partnership on climate change.

I set all those initiatives out just as a way of trying to demonstrate all of the commitments that States are making towards addressing this issue and have been making for some time, but rather than all of those things being at odds with each other, there actually are some fairly unifying principles through all of those different organizations.

First is the assertion that there needs to be a meaningful greenhouse gas emission reduction plan, and for it be effective, States will have to play a major partnership role with the Federal Government, an that role also needs to be carefully and robustly delineated in whatever legislation comes from Washington. There is the practical necessity of having States implement pieces of the program, whether that is permitting or monitoring as we do in so many other major environmental policies, and the reality that States and localities are uniquely situated to best implement portions of plans. Things like renewable portfolio standards, land use and building codes come to mind. But in addition, there is also the

realization, and we have heard it expressed already today, that federal cap-and-trade legislation by itself may not go far enough to reach the levels of reductions that are ultimately needed. States will be in the position to implement complementary programs to help provide further reductions.

But beyond that, States have been working on this issue, some of them for years, and have already developed programs that are working to provide significant reductions. In addition, the debate on the Senate floor 2 weeks ago highlighted issues and we have heard a lot of them here today as well that have already been studied in a lot of the States. Many of us have researched what reduction strategies mean to us, to our economies, to our employment outlook, and all of this information we believe can help inform and shape the federal debate. For example, in Illinois, modeling done in conjunction with our climate change advisory group demonstrated that implementing a comprehensive set of reduction strategies could actually provide economic gains as compared to a business-as-usual strategy.

And second, because there has been and continues to be so much effort by the States and regions, national policy should reward that early action and provide incentives to promote future State innovation and action. As a manner of achieving this goal, funding that results from revenues raised through a cap-and-trade system should in part be directed towards specifically targeted objectives that result in greenhouse gas reductions, be they implemented through the States or through the Federal Government.

Third, funding for new and innovative technologies is critical. In Illinois, we have had the experience of dealing with FutureGen, a project that we worked very hard to advance, only to have the funding pulled by DOE after a location in Illinois was selected for construction. We obviously continue to be strong supporters of that project and we are supportive of funding being targeted to help bring new technologies to commercial application. For instance, we have permitted an IGCC plan in Illinois that is capable of carbon capture and sequestration but to have commercial viability, there are other incentives that are going to be necessary, and I appreciate the work, Chairman Boucher, that you have done in recognizing that and introducing your legislation along with many cosponsors to provide a mechanism to fund innovative technologies.

Fourth, we believe a federal program should utilize the work of the Climate Registry in developing a national greenhouse gas registry, and finally, legislation should acknowledge the ability of the States to go beyond federal requirements, a framework that has served us well in numerous major initiatives including the Clean Air Act and the Clean Water Act. We believe that this can be accomplished without interfering with federal cap-and-trade programs and other important federal greenhouse gas strategies. For example, States are not interested, I don't believe, in having different currencies for greenhouse gases nor are they interested in charging businesses twice for the same ton of greenhouse gas.

I thank you for allowing me to share these thoughts. We have a tremendous opportunity to work together and do something historic here, and I look forward to the opportunity to work with you. Thank you again.

[The prepared statement of Mr. Scott follows:]

Testimony to The Committee on Energy and Commerce
Subcommittee on Energy and Air Quality

June 19, 2008

Mister Chairman, members of the subcommittee:

Good morning. My name is Doug Scott, and I am the Director of the Illinois Environmental Protection Agency. On behalf of Governor Rod Blagojevich, I appreciate the opportunity to speak for a few minutes concerning the role of the states in federal climate change legislation.

I have had the ability to work on the issues concerning climate change in a number of ways. First, as environmental commissioner in a state that has studied the issue through a task force that made recommendations to the Governor that collectively, are designed to reduce greenhouse gas emissions in Illinois to 1990 levels by the year 2020.

In addition, I have served as vice-chairmen of The Climate Registry, an organization of 39 states, nine Canadian provinces, six Mexican states and three Native American tribes which has established a uniform protocol for the voluntary registering of greenhouse gas emissions, and is establishing a framework for jurisdictions requiring mandatory reporting.

I chair the Air Committee for the Environmental Council of the States, which has passed a resolution on the states' role in federal climate change legislation.

And Illinois is part of the Midwestern Governors' Association Midwestern Greenhouse Gas Accord, in which six Midwestern states and the Canadian province of Manitoba are working to develop a Midwest cap-and-trade program, an initiative similar to that being developed in the Western states, and in the Regional Greenhouse Gas Initiative, comprised of Northeastern states.

Finally, Illinois was one of eighteen signatories to the Governors' Declaration on Climate Change that was presented two months ago at Yale University. This document sets forth some guiding principles to help develop a state-federal partnership on climate change.

I set out all of these initiatives as a means of demonstrating that the commitment of states to make a meaningful difference on greenhouse gas emissions is strong. And, instead of these efforts being in conflict with one another, they represent some unified themes.

Rather than getting into the details on particular bills, I would like to utilize the time allotted me to set forth some of the core principles that all of these efforts share.

First is the assertion that there needs to be a meaningful national greenhouse gas emission reduction plan, and for it to be effective, states will have to play a major partnership role with the federal government, and that role needs to be carefully and robustly delineated in the legislation. There is the practical necessity of having states implement pieces of the program, as has been the case with other major national environmental policies, and the reality that states and localities are uniquely situated to best implement portions of any plan. But in addition, there is also the realization that the federal cap-and-trade legislation that is being contemplated by itself may not go far enough to reach the levels of reductions that are ultimately to be needed. States will be in the position to implement complimentary programs to provide further reductions.

But beyond that, the states have been working on this issue, some of them for years, and have already developed programs that are working, and which can provide significant reductions. In addition, the debate on the Senate floor two weeks ago highlighted issues that have already been studied in the states. Many of us have researched what reduction strategies mean to us, to our economies, to our employment outlook, and all of this information can help to inform and shape the federal debate. For example, in Illinois modeling done in conjunction with our Climate Change Advisory Group demonstrated that implementing a comprehensive set of reduction strategies could provide economic gains as compared to a business as usual strategy.

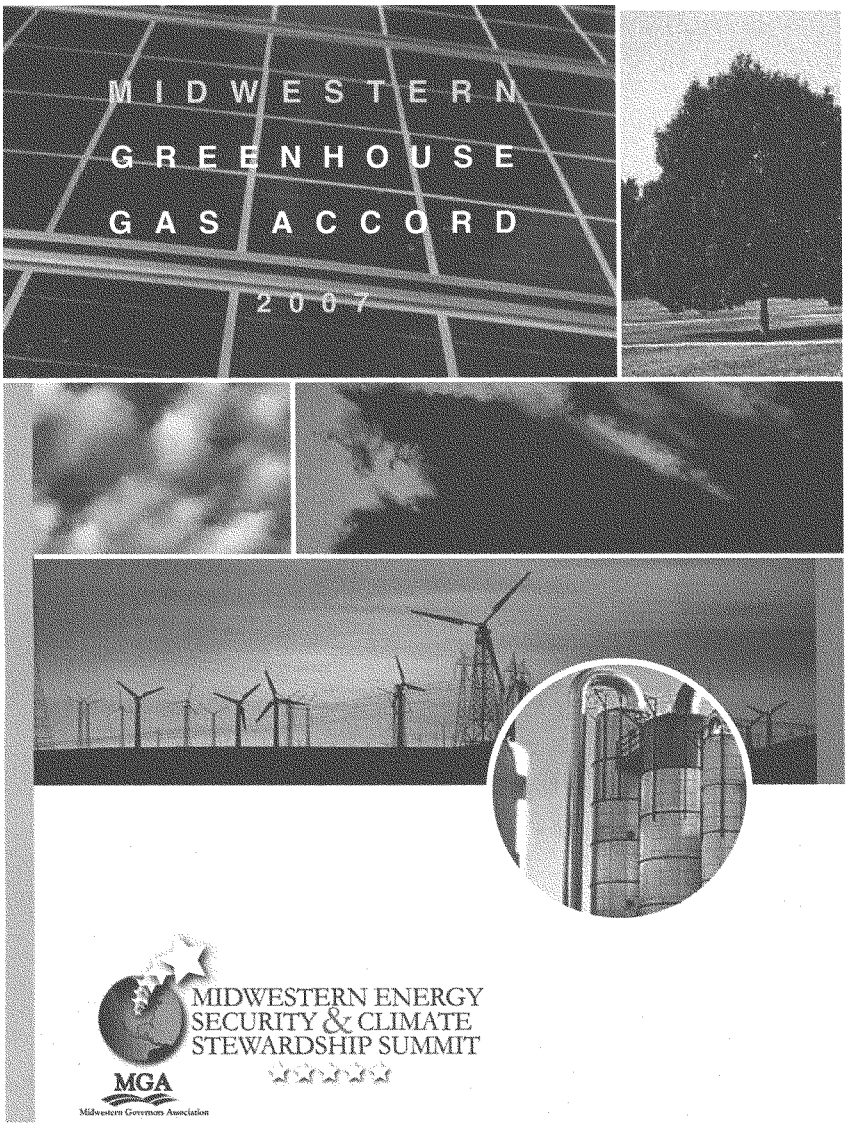
Second, because there has been and continues to be so much effort by the states and regions, such as the Midwestern Governors Association (MWGA), Western Climate Initiative (WCI) and Regional Greenhouse Gas Initiative (RGGI), a national policy should reward that early action, and provide incentives to promote future state and local innovation and action. As the Governors' declaration from Yale explains, "There are a variety of ways these actions can be further strengthened, and more of them developed and implemented, with federal support." As a manner of achieving this goal, funding that results from revenues raised through a cap-and-trade system should in part be directed toward specifically targeted objectives that result in greenhouse gas reductions, be they implemented through the states or the federal government.

Third, funding for new and innovative technologies is critical. In Illinois, we have had the experience of dealing with FutureGen, a project that we have worked very hard to advance, only to have the funding pulled by the DOE after a location in Illinois was selected for construction. We obviously continue to be strong supporters of that project, and we are supporters of funding being targeted to help bring new technologies to commercial application. For instance, we have permitted an IGCC plant that is capable of carbon capture and sequestration, but to have commercial viability, other incentives will be necessary. I know that Chairman Boucher recognizes this need and last week introduced legislation to provide a funding mechanism for innovative technologies.

Fourth, a federal program should utilize the work of The Climate Registry in developing a greenhouse gas registry. A great deal of time and effort has gone into this registry, with a large stakeholder process. The members not only represent the vast majority of this country, but there are over 240 businesses and other entities that have already signed on as founding reporters, signaling that the work which has been done has been done well.

Finally, the legislation should acknowledge the ability of the states to go beyond federal requirements, a framework that has served us well in numerous major initiatives, including the Clean Air Act and the Clean Water Act. We believe this can be accomplished without interfering with federal cap and trade programs and other important federal greenhouse gas strategies. For example, states are not interested in having different currencies for greenhouse gases, nor are they interested in charging businesses twice for the same ton of greenhouse gas.

I thank you for allowing me to share these thoughts. We have a tremendous opportunity to build on the work of the states, and develop a federal greenhouse gas reduction program that sets out a substantial partnership role for the states; that acknowledges, supports and provides incentives for the work already done by the states; that provides funding for new and innovative technologies; that recognizes the work already done to establish a common currency by which to register greenhouse gases; and that does not undermine the states' traditional role of implementing environmental programs, while recognizing differences between states and regions. I look forward to the opportunity to work with you in this historic effort.


MIDWESTERN
GREENHOUSE
GAS ACCORD
2007
MIDWESTERN ENERGY
SECURITY & CLIMATE
STEWARDSHIP SUMMIT
MGA
Midwestern Governors Association

MIDWESTERN GREENHOUSE GAS REDUCTION ACCORD

WHEREAS, the effects of climate change present growing economic, social and environmental risks in the Midwest and the world; and

WHEREAS, we know enough to act on climate change, and there is sufficient scientific certainty that we must begin to take action now; and

WHEREAS, government has the obligation to establish a policy framework for reducing emissions of the six recognized greenhouse gases (GHG) while maintaining reliability and enhancing the cost-competitiveness of the Midwest's energy supply; and

WHEREAS, regional cooperation will help the Midwest respond to and prosper in a carbon-constrained world and maximize the region's comparative energy advantages, including:

1. national leadership by individual Midwestern states and provinces in the delivery of effective energy efficiency programs; and

2. world-class renewable energy resources that support rapidly growing wind energy, corn ethanol and biodiesel industries, as well as the potential for robust cellulosic biomass and solar industries; and

3. extensive and secure coal reserves, combined with extensive geologic reservoirs for storing carbon dioxide (CO_2); and

4. pioneering experience with the capture of CO_2 for use in enhanced oil and gas recovery (EOR) to extend production from the region's oil and gas fields, including the world's largest CO_2 storage project that presently captures 3 million tons of CO_2 annually from coal in North Dakota and transports it by pipeline to Saskatchewan for EOR; and

5. national leadership by the Midwest's agricultural and forestry communities to implement both methane mitigation and terrestrial carbon sequestration programs and practices; and

WHEREAS, addressing climate change will create new economic opportunities and produce economic growth and jobs by maximizing the region's low-carbon energy production and by providing opportunities for the Midwest's manufacturing and service sectors to supply low-carbon technologies and know-how to the region and the world; and

WHEREAS, meeting governments' obligations on climate change will require a range of strategies, including incentives, flexible market-based approaches and legal requirements; and

WHEREAS, a multi-jurisdictional GHG registry (The Climate Registry) is under development and is expected to be operational in early 2008 and will be available for entities participating in this program; and

WHEREAS, the Chicago Climate Exchange, sulfur dioxide trading markets and other established market-based systems in the U.S.; the Montreal Protocol for protecting the ozone layer; and the European Union's Emission Trading Scheme for GHG emissions allowances all provide working examples of emissions reduction mechanisms; and

WHEREAS, the Midwest can draw on the most effective aspects of other jurisdictions' experiences in crafting a coordinated, regional approach to the climate challenge that takes advantage of the Midwest's strengths and is environmentally effective, fair and cost efficient; and

WHEREAS, the U.S. federal government has not met the challenge to date of crafting a comprehensive national response to climate change, while governors representing U.S. states and national governments around the world have made commitments to reduce GHG emissions; and

WHEREAS, some Midwestern governments have established significant CO_2 reduction targets, either by executive order or statute, and formed climate task forces to advise on policies and strategies for meeting such targets; and

WHEREAS, we recognize the benefits of regional collaboration in developing climate change policies and approaches to GHG reductions that provide for consistency across jurisdictions;

NOW, THEREFORE, BE IT:

RESOLVED, that we, the undersigned, jointly enter into this accord to establish a Midwestern Greenhouse Gas Reduction Program (hereafter Program) to reduce GHG emissions in our states, and we jointly endeavor to:

1. establish GHG reduction targets and timeframes consistent with those of MGA member states and provinces; and

2. develop a market-based and multi-sector cap-and-trade mechanism to help achieve GHG reduction targets; and

3. join The Climate Registry to enable tracking, management and crediting for entities that reduce GHG emissions; and

4. develop and implement other associated mechanisms and policies as needed to achieve the GHG reduction targets, such as a low-carbon fuel standard and regional incentives and funding mechanisms; and be it

RESOLVED, that the above described cap-and-trade system be developed to:

1. enable linkage to other jurisdictions' systems to create economies of scale, increase market efficiencies, diversity and liquidity, while reducing costs; and

2. maximize economic and employment benefits, while minimizing any transitional job losses; and

3. reduce the shifting of generation and emissions to non-participating states; and

4. credit past and present actions to reduce GHG emissions; and

5. address potential interaction or integration with a future federal program; and be it

RESOLVED, MGA member and other states, Canadian provinces, tribal governments and First Nations, and other jurisdictions may participate in the program, or they may choose to observe; and be it

RESOLVED, that we agree to establish a Work Group structure and process, through the Midwestern Governors Association, involving representatives of public, private and nongovernmental institutions to make recommendations to governors and other participating jurisdictional leaders regarding implementation; and be it

RESOLVED, that we shall:

1. direct our staff and appropriate state agency representatives to develop a work plan and establish a work group to move forward with the Program, within two months of the effective date of this accord; and

2. establish targets for GHG emission reductions and timeframes consistent with states' targets, and adopt policies, implementation mechanisms and any work products deemed necessary, within eight months of the effective date of this accord; and

3. complete development of proposed cap-and-trade agreement and a model rule, within 12 months of the effective date of this accord; and

4. complete the undertakings set forth herein, within 30 months of the effective date of this accord.

DONE, this 15th day of November, 2007, in Milwaukee, Wisconsin.

PARTICIPATING STATES AND PROVINCE: Illinois, Iowa, Kansas, Manitoba, Michigan, Minnesota, Wisconsin

OBSERVING STATES: Indiana, Ohio, South Dakota

YALE UNIVERSITY

2008 Conference of Governors
on Climate Change

Governors' Declaration on Climate Change

Yale University, April 18, 2008

Standing in the shadows of President Theodore Roosevelt, and Gifford Pinchot, the founder of the Yale School of Forestry and first Chief of the US Forest Service, we - Republican and Democratic Governors alike – are gathered to challenge ourselves, our congressional leaders and the Presidential candidates to learn the lessons these men have taught us and fully embrace the conservation challenge of our time: the threat of climate change.

In 1908, Roosevelt and Pinchot stared down those who looked at the nation's natural resources and saw only the riches they could accumulate from the water, lumber, coal and gold. They did what had to be done to make them see the forests for the trees and as a result, future generations have been blessed with a National Park System that is second to none, and over 193 million acres of nationally protected forestlands. Together, they transformed what was then perceived as an isolated conservation elite into a more lasting and effective national movement – one that connected people and nature, and conservation with economic prosperity. And they did so by calling on states to work together – to unite - to strengthen federal policy.

At that time, 100 years ago, President Roosevelt convened a historic Conference of Governors to establish a conservation partnership between the states and the federal government. Always the pragmatist, Roosevelt said, "My concern is not the academic discussion of either the principles of State rights or the principle of National sovereignty, but it's what will best conserve the needs of the people as a whole." What was true in 1908 remains true in 2008.

We recognize that we are facing a new threat to our natural resources and our way of life, and we are prepared to act with similar courage and determination to meet the needs of the public we serve. We are proud that our state and local governments have been in front – taking action to reduce the emission of greenhouse gases that is contributing to the changing climate - and we will continue these efforts, but we cannot do it alone. All levels of government must work together – in cooperation and without regard for party affiliation – if we are to succeed in meeting the challenge before us. We applaud and encourage the enactment of strong and effective federal climate policy, and look forward to the integration of these efforts with those being made at a local, state, and regional level.

Today, we recommit ourselves to the effort to stop global warming and we call on Congressional leaders and the Presidential candidates to work with us – in partnership – to establish a comprehensive national climate policy. Such a policy must be founded on three principles:

- A federal-state partnership is the only way we can get the job done. Success in tackling climate change in the United States will require the full engagement of leadership states in climate governance processes and organizations, as well as support for state innovation and the development of green energy technologies.

- State-based climate action plans and programs have paved the way for cost-effective reductions of greenhouse gases and they deserve continued support. The comprehensive portfolio of measures taken at the state level across all sectors are real and they work. There are a variety of ways these actions can be further strengthened, and more of them developed and implemented, with federal support.

- Rewarding and encouraging meaningful and mandatory federal and state climate action is the key to success. Incentives for states to provide leadership on climate action are critical. Incentives drive change and they can come from existing federal energy, transportation, and agriculture programs as well as from auction revenue derived from a federal cap and trade system.

These principles underscore our firm belief in the importance of fashioning a role for both states and the federal government in the design and implementation of a comprehensive national climate policy. This is not a case of advocating local, state or regional interests versus federal interests, but rather of promoting an approach and a partnership that will ultimately strengthen this nation's approach to the climate challenges we face.

To build this partnership we will coordinate our efforts and actively solicit the support of all Governors and members of Congress who are also serious about the need to take action now to reduce emissions of greenhouse gases - at all levels of government. In addition, we will reach out to major Presidential candidates as a means of shaping the first 100 days of the next Administration. We have no time to lose.

Together, we are committing to walking in the footsteps of President Roosevelt and Gifford Pinchot by embracing the conservation challenge of our lifetime – the threat of climate change. We hope that many others will join in this journey.

Governor Schwarzenegger
California

Governor Rell
Connecticut

Governor Sebelius
Kansas

Governor Corzine
New Jersey

Additional signatories:

Governor Janet Napolitano, *Arizona*
Governor Bill Ritter, *Colorado*
Governor Ruth Ann Minner, *Delaware*
Governor Charlie Crist, *Florida*
Governor Rod Blagojevich, *Illinois*
Governor John Baldacci, *Maine*
Governor Martin O'Malley, *Maryland*
Governor Deval Patrick, *Massachusetts*
Governor Jennifer Granholm, *Michigan*
Governor Bill Richardson, *New Mexico*
Governor David A. Paterson, *New York*
Governor Ted Kulongoski, *Oregon*
Governor Tim Kaine, *Virginia*
Governor Christine Gregoire, *Washington*

Resolution Number 08-8
Approved April 15, 2008
New Orleans, LA

As certified by
R. Steven Brown
Executive Director

ON THE NEED FOR STATE INVOLVEMENT IN FEDERAL CLIMATE ACTION

WHEREAS, global climate change and greenhouse gas (GHG) emissions are issues of tremendous importance to the United States and the world; and,

WHEREAS, many states and localities are developing carbon management plans, emissions reduction policies and multi-state cap-and-trade programs; and,

WHEREAS, well over 40 of the 50 states have some level of action underway related to climate change, and 20 states have developed and are developing statewide multi-sector GHG emissions reduction policies; and,

WHEREAS, 39 U.S. states and the District of Columbia, six Mexican states, seven Canadian provinces and three Native American tribes have formed The Climate Registry to act as a policy neutral registry for GHG emissions programs; and,

WHEREAS, there are regional partnerships among states to initiate programs in three regions of the U.S.: in the Northeast/Mid-Atlantic, the Regional Greenhouse Gas Initiative; in the Midwest, the Midwest Governors Greenhouse Gas Accord; and in the West, the Western Climate Initiative; and,

WHEREAS, states serve as the "laboratories of innovation" for new technologies and strategies upon which GHG emissions reductions can be based; and,

WHEREAS, the U.S. Supreme Court has found that EPA has the authority to regulate GHG emissions as air pollutants; and,

WHEREAS, there are climate change bills now being considered by Congress; and,

WHEREAS, the role of states in the regulation and implementation of GHG emissions reductions should be recognized and clearly stated in any federal legislation or regulations; and,

WHEREAS, states' role in GHG emissions program implementation will require funding to the states.

NOW, THEREFORE, BE IT RESOLVED THAT:

ECOS urges Congress and the Executive Branch to work closely with the states to develop a strong national climate plan.

ECOS supports states' rights to set standards above and beyond any federal requirements for GHG emissions reductions in any sector.

ECOS supports adequate funding for states' roles in implementing GHG emissions reduction legislation or regulations.

ECOS supports directing a substantial portion of any revenues generated by a federal GHG emissions program to the states for energy efficiency or other GHG emissions reduction initiatives.

Mr. BOUCHER. Thank you, Mr. Scott.
Mr. Mullett.

STATEMENT OF RANDAL MULLETT, VICE PRESIDENT, GOVERNMENT AFFAIRS, CON-WAY, INC.

Mr. MULLETT. Thank you, Mr. Chairman. My name is Randal Mullett. I am a vice president with Con-way. It is a $4.7 billion trucking and logistics company. We employ 30,000 people at nearly 500 locations across the United States. We operate 11,000 tractors, 40,000 trailers, and we run about a billion miles every year on the Nation's highways and roads. Today I am also representing the American Trucking Association, where I serve as vice chair of their environmental and energy policy committee.

While cap-and-trade continues to be the primary mechanism being discussed to promote carbon reductions, it is much more effective when applied to stationary sources rather than extremely diversified mobile sources such as trucking. We appreciate that the committee has taken the time to examine and address the uniqueness of the transportation industry in its white paper, Scope of a cap-and-trade System.

As you know, commercial trucks are used for goods movement, not pleasure. There are very few discretionary miles. We are very concerned about the effect that any cap-and-trade system will have on our ability to deliver the Nation's freight. There are no commercially viable hybrid line-haul trucks and truck fuel economy has remained stagnant for some time, leaving us few options. ATA will be working closely with the U.S. DOT and the National Academy of Sciences in the evaluation of fuel economy and fuel efficiency standards as directed under the Energy Information Security Act of 2007.

The trucking industry is concerned about what a cap-and-trade system will do to the price of fuel. At today's diesel prices, it costs over $1,400 to refuel a typical truck. Over 1,000 trucking companies failed and over 10,000 independent operators, drivers and employees lost their jobs in the first quarter of this year alone, and there is a direct correlation between these failures and the price of fuel. Significant fuel cost increases resulting from cap-and-trade will only exacerbate this problem.

The trucking industry also supports safeguards that ensure carbon regulations do not inadvertently disrupt fuel supplies for the commercial transportation sector. As you know, we cannot choose the fuel we use to transport goods and we cannot decouple economic growth from the growth of freight transportation. If not anticipated and safeguards not included in legislative proposals, a cap-and-trade on mobile sources could disrupt the amount of diesel fuel available to motor carriers. This may happen if the current mix of mid-level distillates that includes diesel fuel, jet fuel, home heating oil, and kerosene is changed or it lags behind demand or it is diverted to other uses. We fear that a cap-and-trade may also have the effect of reducing domestic refining capacity and shifting it to regions outside the country, further increasing costs, and putting the supply of on-road diesel at risk.

The trucking industry supports federal preemption of State, local and regional climate change laws to avert a regulatory patchwork

which would hamper the efficient delivery of the Nation's goods. In the absence of federal guidance, other governmental entities are taking independent action. If federal preemption is not enabled, ATA would ask that the Congress exempt entities involved in the interstate transport of goods.

The trucking industry is keenly aware of the need to find real solutions to reduce carbon emissions. We have recently unveiled a bold sustainability program that will have an immediate impact on the environment, reducing fuel consumption by 86 billion gallons and reducing the carbon footprint of all vehicles by nearly a billion tons over the next 10 years without restricting the deliver of the Nation's goods or placing undue economic hardship and regulatory burden on the trucking industry.

ATA's recommendations set out real solutions, though low-tech, for our industry that are achievable today to significantly reduce greenhouse gas emissions. The six key recommendations set out in the ATA program are: enact a national 65-mile-an-hour speed limit and govern new truck speeds to 68 miles per hour, decrease idling, reduce highway congestion through highway infrastructure improvements, increase fuel efficiency through participation in EPA's SmartWay programs, promote the use of more productive truck combinations, and support a national fuel economy standard for medium- and heavy-duty trucks.

In closing, ATA requests that Congress consider funding research and development in the areas of new engine technologies, truck aerodynamics, low-carbon fuels, tires, batteries, hybrids, and other energy-saving technologies that are specific to the operation of line-haul trucks. Technology advancements have been stalled for many years and an infusion of funding incentives is critical to developing the next generation of more efficient and lower- carbon-emitting trucks. We as an industry look forward to working with you to help reduce our carbon footprint. Thank you.

[The prepared statement of Mr. Mullett follows:]

Before the
U.S. House of Representatives
Committee on Energy and Commerce
Subcommittee on Energy and Air Quality

Statement of Randal Mullett
on behalf of the
American Trucking Associations, Inc. (ATA)

Legislative Proposals to Reduce Greenhouse Gas Emissions: An Overview
June 19, 2008

Mr. Chairman and Members of the Subcommittee:

My name is Randal Mullett. I am the Vice President Government Relations and Public Affairs for Con-way, Inc. Con-way is a $4.7 billion freight transportation and logistics services company headquartered in San Mateo, California. The headquarters of our largest subsidiary, Con-way Freight, is located in Ann Arbor, Michigan. Named FORTUNE magazine's *Most Admired Company* in transportation and logistics for 2007, Con-way delivers industry-leading services through its primary operating companies of Con-way Freight, CFI and Con-way Truckload, and Menlo Worldwide Logistics. These operating units provide high-performance, day-definite less-than-truckload (LTL), full truckload and intermodal freight transportation; logistics, warehousing and supply chain management services; and trailer manufacturing. All three of our major components are EPA SmartWay[sm] participants, the designation awarded by the agency for exceptional performance in greenhouse gas reduction and environmental stewardship efforts. Con-way employs nearly 30,000 people operating from more than 500 locations across North America and 150 more locations in 17 countries across five continents. Con-way operates 11,000 tractors and 40,000 trailers in its North American trucking operations, traveling close to one billion miles annually. Con-way consumes approximately 170 million gallons of diesel fuel annually.

Today, I appear before you representing not just my company, but also the American Trucking Associations (ATA) headquartered in Arlington, Virginia. I am proud to serve as the Vice Chair of ATA's Environmental & Energy Policy Committee, Vice Chair of the National Cooperative Freight Research Program Technical Oversight Committee, Vice Chair of the Transportation Research Board's Trucking Industry Committee, and as a member of ATA's Sustainability Task Force. ATA is the national trade association of the trucking industry. Through its affiliated state trucking associations, affiliated conferences and other organizations, ATA represents more than 37,000 trucking companies throughout the United States.

The trucking industry has been following the on-going climate change debate with special interest. While a cap-and-trade program continues to be the primary mechanism being discussed to promote carbon reductions, such an approach is more effectively applied to stationary sources and not extremely diversified mobile sources such as trucking. My testimony today will not focus on the specific details contained in any one legislative proposal, but rather on the unique nature of the trucking industry and concerns we have regarding cap-and-trade impacts on our ability to deliver the nation's freight.

Overview of the Trucking Industry

With more than 750,000 interstate motor carriers in the United States, the trucking industry is the driving force behind the nation's economy. Trucks haul nearly every consumer good at some point in the supply chain. Few Americans realize that trucks deliver nearly 70 percent of all freight tonnage or that 80 percent of the nation's communities receive their goods exclusively by truck. Even fewer are aware of the significant employment, personal income, and tax revenue generated by the motor carrier industry.

Nearly nine million people employed in the trucking industry move approximately 11 billion tons of freight annually across the nation. Trucking generates approximately $646 billion in revenue and represents roughly five percent of our nation's Gross Domestic Product. One out of every 13 people working in the private sector in our country is employed in a trucking-related jobs ranging across the manufacturing, retail, public utility, construction, service, transportation, mining, and agricultural sectors. Of those employed in private-sector trucking-related jobs, 3.5 million are commercial drivers.

The trucking industry is composed of both large national enterprises as well as a host of small businesses, all of whom operate in extremely competitive business environments with narrow profit margins. According to the U.S. Department of Transportation, 96 percent of motor carriers have 20 or fewer trucks and are characterized as being small businesses.

Trucking Industry Concerns Over Cap-and-Trade Legislation

A. Increased Fuel Costs

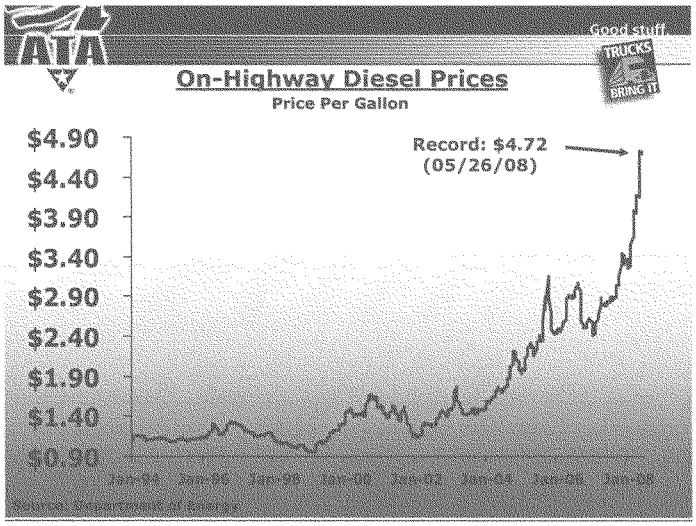
The trucking industry is concerned over what cap-and-trade legislation will do to the price of fuel we consume. We are extremely sensitive to rapidly shifting operating costs given our thin operating margins of between 2-4 percent. These margins continue to be chipped away given the numerous and unprecedented costs being imposed upon the industry. For instance, new diesel engine emission standards imposed by the U.S. Environmental Protection Agency (EPA) in 2002 drove up engine costs on average of between $3,000 to $5,000 while decreasing fuel economy between 6-8 percent. Additional EPA diesel engine emission standards in 2007 drove up the cost of engines between $8,000 to $10,000 and, by many accounts, decreased fuel economy between

2-4%. Diesel engine emission standards set to take effect in 2010 will substantially increase engine costs yet again while fuel economy impacts still remain unknown at this time.

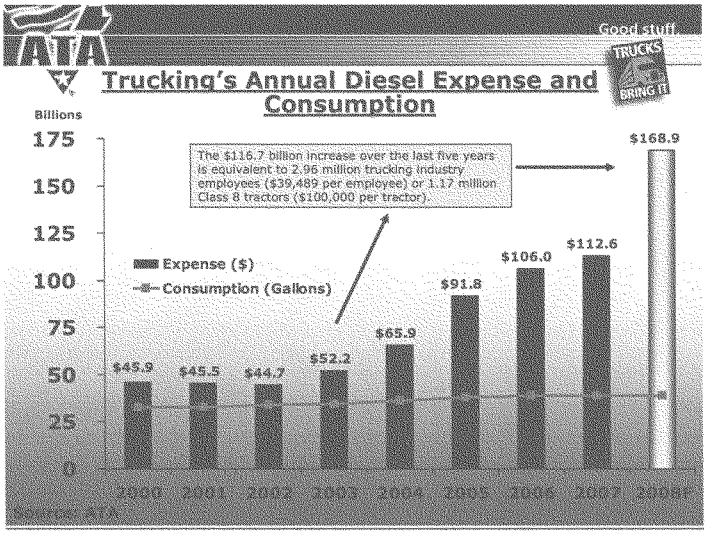
Not only have equipment costs increased due to federal requirements, but state regulatory mandates have substantially increased the financial burdens being placed upon our industry. Beyond equipment costs, we have experienced record increases in insurance premiums and, most critically, historical expenditures for fuel in the absence of any climate change legislation being passed. I wish to further expand upon the critical role diesel fuel plays in our industry.

The fuel of choice for the nation's long-haul trucks is diesel fuel. Diesel fuel provides greater fuel economy and the higher energy content necessary to transport widely diversified loads under extreme operating conditions. Burning diesel fuel is the main source of carbon emissions from our industry equating to 22.2 pounds of CO_2 per gallon of fuel. We use a tremendous amount of diesel fuel every year to keep our economy moving and our industry is deeply concerned over what a cap-and-trade program may do to further exacerbate fuel costs and our current fuel emergency.

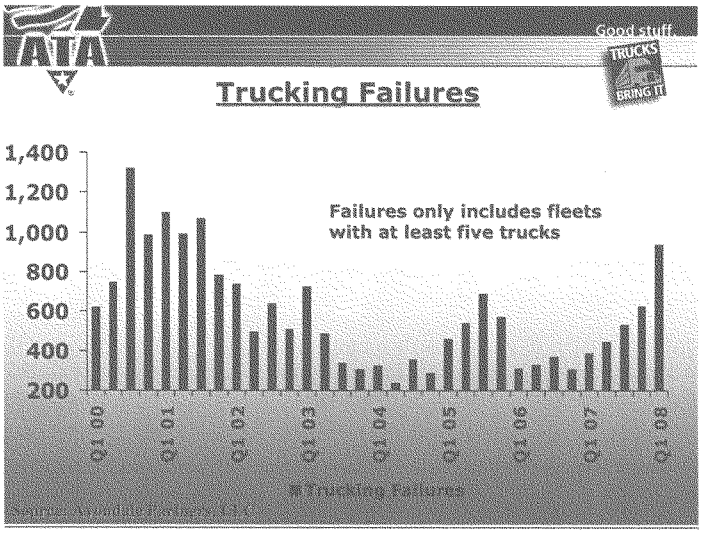
In 2006 alone trucking consumed over 39 billion gallons of diesel fuel. This means that a one-cent increase in the average price of diesel costs the trucking industry an additional $391 million in fuel expenses. The average national price of diesel fuel this week is now over $4.69 per gallon, which is $1.89 more than just one year ago.



The trucking industry is on pace to spend an incredible $168.9 billion on fuel this year. This is $56 billion more than we spent in 2007, and more than double the amount we spent just four years ago.



Today it costs over $1,400 to refuel a truck. As a result of this dramatic increase in the price of diesel, which has coincided with a downturn in the economy and a softening of the demand for freight transportation services, many trucking companies are struggling to survive. In the first quarter of 2008, 1000 trucking companies with at least five trucks failed and 10,400 independent operators, drivers and employees have lost their jobs. This was the largest number of trucking related failures since the third quarter of 2001. It is very likely that a large number of companies that operate fewer than 5 trucks also have turned in their keys during the first quarter of this year.



This hardship surprises few in the industry. For most truckers, fuel has now surpassed labor as their largest operating expense. Over the past five years, total industry consumption of diesel fuel has gone up 15 percent, while the price of diesel has nearly tripled during the same time period.

Trucking is a highly competitive industry with very low profit margins. This explains why many trucking companies are reporting that higher fuel prices have greatly suppressed profits, if they are making a profit at all. Our industry can not absorb rapid increases in fuel costs. That is why the trucking industry is extremely sensitive to how climate change legislation may further escalate fuel prices. Provisions to release more allowances to help mitigate fuel price spikes will not provide timely relief to our industry. ATA urges Congress to carefully evaluate other approaches to evaluate and address fuel price impacts that result from climate change legislation.

B. Fuel Availability

The trucking industry supports measures to ensure carbon regulation does not adversely impact fuel supplies for the commercial transportation sector. Given that a 42-gallon barrel of crude oil produces 7.8 gallons of diesel and 2.7 gallons of other distillates (including home heating oil), our industry is concerned over possible diversions of on-road diesel fuel to home heating oil use due to demand or price differential considerations. Such a shift in fuel use would be devastating to an industry that is already beset with record high fuel costs in the absence of climate change legislation.

C. Need for Federal Preemption

The trucking industry supports federal preemption of local, state, and regional climate change laws to avert a widely-diverse regulatory patchwork which would impede the delivery of the nation's goods given the interstate nature of trucking. This patchwork will create widely varied economic and administrative regulations that will serve as barriers to an efficient transportation system. In the absence of federal climate change guidance, governmental entities are taking matters into their own hands either independently or in collaboration with other vested stakeholders.

Long-haul truck drivers will not be able to afford delivering goods across state lines unless Congress proceeds to preempt regional, state, and local climate change efforts already enacted. If 100 percent federal preemption is not secured by Congress, ATA in the alternative asks for a blanket exemption applicable to business activities involving the interstate transport of goods,

D. Cap-and-Trade is not Well-Suited to Mobile Source Applications

The trucking industry opposes carbon emission caps being placed on the trucking sector as unworkable and impracticable given the interstate and diverse nature of our business operations. There are more than 750,000 interstate motor carriers operating in the United States ranging from single truck operators to fleets with thousands of trucks.

Keep in mind that as the nation's population continues to grow, so does the corresponding demand for more consumer goods. The demand for more products will in turn require more trucks to deliver such goods which will result in more vehicle miles traveled and greater diesel fuel consumption. The table below clearly shows these relationships.

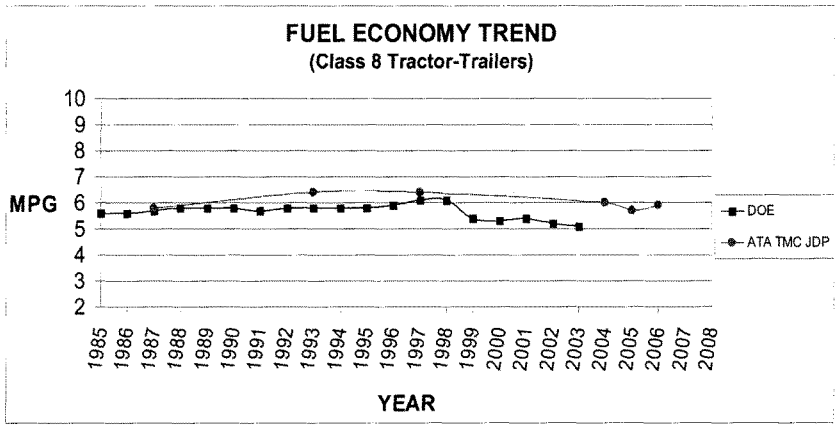
TRUCK POPULATION, FUEL USE, VMT & POPULATION

Year	Class 8 Trucks (Millions)	Diesel Fuel Consumed (Billions of Gallons)	VMT (Billions)	U.S. Population (Millions)
2000	2.60	32.5	119.7	282.3
2001	2.61	32.5	115.7	285.0
2002	2.63	33.9	114.5	287.7
2003	2.64	34.6	113.9	290.3
2004	2.72	36.4	117.8	293.0
2005	2.86	38.1	130.5	295.7
2006	3.01	39.1	139.3	298.4
% Increase Over 2000	+16%	+20%	+16%	+6%
2018	3.64	---	178.8	330.7
% Increase Over 2000	+40%	---	+49%	+17%

Source: American Trucking Associations

Approaches to dramatically reduce carbon emissions from line-haul trucks will curtail the delivery of vital consumer goods across the nation such as food, medicine, and clothing. Constraining the country's freight delivery system will do nothing short of shutting down life as we know it.

Keep in mind that fuel economy of line-haul trucks has not recognized any appreciable change over the last quarter century averaging between 6.0 and 6.5 miles per gallon. Heavy-duty trucks are far different from passenger cars. There are no hybrid line-haul trucks, truck fuel economy continues to remain stagnant, and truck movement is undertaken to conduct business operations – not pleasure. The table below depicts fuel economy trends in our industry.



Sources: American Trucking Associations (ATA)
ATA Technology & Maintenance Council (TMC)
JD Powers & Associates (JDP)
U.S. Department of Energy (DOE)

In short, trucking is unlike any other industry, mobile source or otherwise. As such, a one-size-fits-all climate change approach does not dovetail nicely with our business practices.

E. Trucking Should be Excluded from any Registry Program

Due to the unique nature of the trucking industry, a sectoral climate change approach would be more applicable to trucking operations and carbon reduction. Given current reporting burdens already placed on our industry, and given ample trucking information data already available from existing reporting and recordkeeping requirements, ATA sees no need to include the trucking sector in any climate change registry program. Imposing such additional reporting burdens on an industry that is 96 percent small business is both unnecessary and impractical.

Recommendations to Reduce Greenhouse Gases from Trucking

Trucking is not an industry that chooses to remain on the sideline awaiting new mandates. This is especially true with climate change legislation. That is why ATA undertook a full analysis of our industry and its operations and began its efforts to develop its greenhouse gas reduction plan beginning in 2006 before serious climate debates in Congress even began. The ATA effort took into account the unique nature of the trucking industry and identifies opportunities to reduce its carbon footprint without restricting the delivery of the nation's goods.

The fruits of our industry's efforts culminated in May of this year when ATA formally unveiled its sustainability plan entitled *Strategies for Reducing the Trucking Industry's Carbon Footprint* at a press event held here in Washington, DC. At that event, we committed to a bold sustainability program that will have an immediate impact on the environment, reducing fuel consumption by 86 billion gallons and thus reducing the carbon footprint of all vehicles by nearly a billion tons over the next ten years. Our new plan can achieve real results with far less cost and disruption to our industry sector than under a cap-and-trade scenario. In addition, our plan will extend the significant progress industry has already made over the past 24 years in reducing its carbon footprint and overall impact on the environment. To view ATA's plan, go to http://www.trucksdeliver.org/pdfs/Campaign_Executive_Summary.pdf.

The recommendations set out real solutions for our industry that are achievable today to reduce greenhouse gases. The six key recommendations set out in the report are as follows:

A. Enact a National 65 mph Speed Limit and Govern New Truck Speeds to 68 mph

The typical heavy-duty diesel truck travels between 5 and 7 miles on a gallon of diesel, depending upon load, route, equipment and drivers' skill. Speed has a direct correlation to fuel consumption. In fact, for each mile per hour that a truck travels in excess of 65 mph, its fuel economy decreases by 1/10 of a mile per gallon. Thus, a truck traveling at 65 mph that is capable of achieving 6 miles per gallon, will achieve only 5 miles per gallon when traveling at 75 mph. For this reason, ATA recommends that Congress establish a national speed limit of 65 mph for all vehicles. Of course, to achieve the maximum benefit of this policy, the federal government will need to partner with states to ensure strict enforcement of the 65 mph speed limit.

ATA also has petitioned the Administration to require that all new trucks be equipped with factory-installed devices that electronically limit the truck's maximum speed to 68 mph. In addition to the fuel conservation benefit from ensuring that trucks do not exceed this speed, we are confident that this measure will further reduce the number of truck-related fatalities that occur on our nation's roadways.

B. Decrease Idling

Truck drivers idle their trucks out of necessity. The Department of Transportation's Federal Motor Carrier Safety Administration *Hours-of-Service* regulations require mandatory rest periods. As the driver rests in the truck's sleeper compartment, he/she will often need to cool or heat the cab to rest comfortably. In extremely cold weather, truck drivers also will idle their engines to prevent the engine block from freezing. Argonne National Laboratory estimates that the average long-haul truck idles for 1,830 hours per year. With hundreds of thousands of these trucks on the road, idling has a significant impact on fuel consumption and the environment. The U.S. Environmental Protection Agency (EPA) estimates that idling trucks consume approximately 1.1 billion gallons of diesel fuel annually.

Many options are currently available to reduce engine idling. Auxiliary power units (APUs) are among the most popular choices in anti-idling equipment providing climate control (heating and cooling), engine preheating, battery charging, and power for household accessories without use of the truck's main engine. APUs have been proven by the Federal Highway Administration to save up to one gallon of fuel per hour of idling and to substantially reduce emissions and greenhouse gases.

More than 30 states, counties, or cities have adopted regulations limiting the amount of time a commercial vehicle can idle. While reducing main engine idling is a laudable goal, three major barriers stand in the way of trucking companies purchasing such equipment for their daily use: (1) the failure to grant exceptions for the additional weight associated with anti-idling equipment; (2) the imposition of a federal excise tax on the purchase of such devices; and (3) the actual cost of the devices themselves.

Since idling reduction equipment can add weight to a truck, many fleets do not want to reduce their cargo capacity to compensate for the installation of idle reduction equipment on a truck. To address this concern, Congress authorized a 400-pound weight exemption for trucks equipped with idle reduction equipment under Section 756 of the *Energy Policy Act of 2005*. While Congress' intent was to mandate this exemption, the Federal Highway Administration (FHWA) has determined that states "may" adopt the exemption on a voluntary basis. FHWA's interpretation of the weight exemption gives states the option of whether to allow the exemption or not. To date, seven states have passed legislation recognizing the 400-pound weight tolerance and a handful of states are exercising enforcement discretion. ATA asks Congress to clarify the 400-pound weight exemption as being applicable to idling reduction equipment nationwide.

A recent IRS interpretation applies the Federal Excise Tax (FET) to the purchase of idle reduction equipment, which has increased the cost of this equipment and consequently reduced consumer demand for these proven anti-idling solutions. The 12 percent tax acts as a disincentive to truckers looking to reduce main engine idling. FET makes the acquisition of idle reduction equipment such as APUs financially less attractive and beyond the reach of potential buyers. The tax alone for a large fleet looking to buy 1,000 APUs at a typical retail price of $9,000 is over $1 million. Taxing devices that offer truckers a solution to reduce fuel consumption and diesel emissions clearly sends the wrong message to the nation. By taxing APUs, we are doing a great disservice to both our economy and the environment. To address these disincentives, ATA asks congress to amend Section 4051 of Internal Revenue Code to make idling reduction equipment purchases exempt from FET. This action will increase demand for the introduction of idling reduction equipment, thereby ensuring greater anti-idling compliance, higher fuel savings, and a cleaner environment.

While a variety of proven technologies exist to reduce main engine idling, most trucking companies just cannot afford purchasing devices that can cost up to $10,000 per unit. ATA is therefore seeking financial incentives from Congress in the way of tax credits or grants to expedite the introduction of idling reduction equipment across the nation.

C. Reduce Highway Congestion through Highway Infrastructure Improvements

Americans waste a tremendous amount of fuel sitting in traffic. According to the most recent report on congestion from the Texas Transportation Institute, in 2005, drivers in metropolitan areas wasted 4.2 billion hours sitting in traffic. These congestion delays consumed 2.9 billion gallons of fuel. ATA estimates that if congestion in these areas was ended, 32.2 million tons of carbon would be eliminated and, over a 10-year period, nearly 32 billion gallons of fuel would be saved, reducing carbon emissions by 314 million tons.

ATA recommends that Congress invest in a new congestion reduction program to eliminate major traffic bottlenecks identified in all 437 urban areas across the country, with a specific focus on those that have the greatest impact on truck traffic. Congestion relief offers one of the most viable strategies for reducing carbon emissions. ATA recommends a 20-year plan for addressing congestion. During the first five years, the focus would be on fixing critical highway bottlenecks. During the next five to 15 years, traffic flow in critical freight corridors would be improved through highway capacity expansion. Beyond that, the focus would be on creating truck-only corridors which would enable carriers to run more productive vehicles. These improvements are possible only with dedicated revenue generated by an increased federal fuel tax.

D. Increase Fuel Efficiency through EPA's SmartWay^{sm} Program

In February 2004, the freight industry and EPA jointly unveiled the SmartWay^{sm} Transport Partnership, a collaborative voluntary greenhouse gas reduction program designed to increase the energy efficiency and energy security of our country while significantly reducing air pollution in the process. The program's mantra is "fuel not burned equates to emissions not had." The program, patterned after the highly-successful Energy Star program developed by EPA and DOE, creates strong market-based incentives that challenge companies shipping products and freight operations to improve their environmental performance and improve their fuel efficiencies. To become a partner a fleet must commit to reduce fuel consumption through the use of EPA-verified equipment, additives, or programs. By 2012, the SmartWay^{sm} program aims to save between 3.3 and 6.6 billion gallons of diesel fuel per year and reduce trucking's annual carbon emissions by 48 million tons. SmartWay^{sm} is one voluntary greenhouse gas program that not only works, but exceeds expectations.

The trucking industry has fully embraced SmartWay^{sm} and relies upon the innovativeness of this cutting edge program. However, while the program is growing by leaps and bounds, future funding remains uncertain. While ATA and other freight and shipping sectors continue to work towards ensuring a separate line item in future EPA appropriations for SmartWay^{sm}, we are troubled with the FY08 funding cuts to the program. More specifically, total monies allocated to the program this year dropped from roughly $3 million in FY07 to $2 million in FY08. Funding cuts to grants, contracting, marketing, technology development, and other program expenses have severely undermined the mission of the program. It is our hope that EPA will redirect an additional $1 million from the Climate Protection Program under the FY08 budget to ensure the continued growth and success of this remarkable program. Given that the

Energy Star program's annual operating budget is $50 million, we also ask that Congress provide a line item appropriation to ensure that SmartWay[sm] is adequately funded in the future.

E. Promote the Use of More Productive Truck Combinations

By reducing the number of trucks needed to move the nation's freight, the trucking industry can lower our fuel consumption which would produce significant environmental benefits. More productive equipment - where it is consistent with highway and bridge design and maintenance of safety standards - is an additional tool that should be available to states. ATA estimates that allowing nationwide operation of higher productivity vehicles by increasing single tractor trailer maximum gross vehicle weights to 97,000 pounds and use of heavier double 33-foot trailers would save more than 20.5 billion gallons of diesel fuel and reduce carbon emissions by over 227 million tons over a 10-year period.

A recent study by the American Transportation Research Institute found that use of these vehicles could reduce fuel usage by up to 39%, with similar reductions in criteria and greenhouse gas emissions. The reduction in truck vehicle miles traveled on highways such as the New York Thruway, Massachusetts Turnpike, Florida Turnpike, and on roads throughout the Western United States, has lowered the amount of fuel burned in these states. These examples of responsible governance could be replicated by other states if given the necessary flexibility under federal law.

F. Support National Fuel Economy Standards for Medium- and Heavy-Duty Trucks

ATA supports increasing fuel economy standards for commercial medium- and heavy-duty trucks that are technologically and economically feasible, do not compromise truck performance, and provide manufacturers sufficient stability and lead time for production. Given that fuel economy in the industry has remained flat over the last quarter century and fuel now is the largest operating expense for many fleets, it is more critical than ever to ensure small and large fleets alike are able to continue to deliver the nation's goods. ATA will be working closely with the U.S. Department of Transportation and the National Academy of Sciences as they work to evaluate fuel economy, fuel efficiency, and the establish associated standards for medium- and heavy-duty trucks as directed under the Energy Information and Security Act of 2007.

Beyond the six aforementioned recommendations and in closing, ATA requests Congress to consider funding research and development in the areas of new engine technologies, aerodynamics, low-carbon fuels, fuel additives, lubricity, tires, batteries, hybrids, anti-idling equipment, insulation, and rolling resistance specific to operations of line-haul trucks. Technology advancements have been stalled for many years and an infusion of funding and will is critical to realize the next generation of more efficient and lower carbon-emitting trucks.

ATA and Con-way appreciate this opportunity to offer our insight into measures to control greenhouse gas emissions in this country.

Mr. BOUCHER. Thank you very much, Mr. Mullett, and the committee's thanks to all of the witnesses for their testimony this afternoon.

Mr. Baugh, let me begin with you, and thank you first of all for the endorsements you provided a few moments ago for the special fund that Mr. Upton and I and several other members, Mr. Barton, are proposing in order to accelerate the arrival of carbon capture and sequestration technologies. We appreciate very much that strong statement of support and your assistance with that. It will be most welcome.

I want to question you for a moment about the statements you made during your testimony about that critical early schedule for taking greenhouse gas reductions and the time frame in question is the time between the effective date of the legislation and the time when carbon capture and sequestration technologies become available. During that time frame, if the schedule for required reductions is too rapid and too severe, coal-fired electric utilities would have no way to meet that schedule through regular cost containment mechanisms. They could not meet it by installing efficiency or by purchasing credits or offsets, borrowing from the future or other similar kinds of means. If they were forced because of a very rapid required schedule for reductions to stop using coal, they would naturally default to the next cheapest fuel, which is natural gas, and in your testimony you talk about economic dislocation that would occur rather broadly across the country should that fuel switch occur, and my question to you is whether or not you have done any estimates of job losses that might come in the manufacturing sector or perhaps other sectors of the economy where you have an opportunity to represent the workers that might happen if that schedule in the early years is too severe and dramatic fuel switching from coal to natural gas takes place.

Mr. BAUGH. Mr. Chairman, no, we have not. We have worked, as I said, with the National Commission on Energy Policy and urged them, and they have done so to look at the impact of this on energy-intensive industries, of how cap-and-trade impacts that. I think the point is that we are concerned about the fuel switching. I mean, we believe CCS is a viable technology and we really need to move it and we need to speed up the timeline as much as possible but everything I hear from the science and the industry and looking at it says that chart we saw earlier really reflects that it won't—2020, 2025 is when you can get to the era of mass deployment and it just doesn't match up with these. We don't want to trigger the fuel switching. That has other cost consequences in and of itself. We have not done any estimates, and I am not making claims about the displacement of workers or industries relating to it but that is not an answer in terms of where we need to go to solve this problem.

Mr. BOUCHER. I noticed that from your testimony that you are working, I think, with Mr. Grumet on a series of economic studies. What do those studies target? Are they targeting what happens in the absence of proper border adjustments? Are they targeting the effect on jobs in the United States of various cap-and-trade scenarios? What are the questions you are asking in your studies?

Mr. BAUGH. I don't want to speak for Mr. Grumet. They are really his studies.

Mr. BOUCHER. Oh, all right.

Mr. BAUGH. But I know what we were trying to get when we began to ask, we said we really—there has been so much talk about the impacts of this legislation and we really looked around and found very little information in terms of how it affects these energy-intensive industries, and there is more than four but we looked at four big ones. The four that happen to be mentioned in the international trade component of the language as it turns out is energy-intensive industries. We really wanted to understand various scenarios of cap-and-trade and how it may impact those. What is the job impact, will it lead it displacement, will these industries remain competitive, some fundamental questions.

Mr. BOUCHER. All right. Mr. Grumet, do you know when those studies might be forthcoming and can you tell us if you intend to make any recommendations for the Congress based on them?

Mr. GRUMET. I appreciate Bob's confidence that they will be ready in a couple of weeks. I hope he is correct, and of course, we would be eager to share those with you. These studies are not explicitly focused on making policy recommendations. I think Bob laid out—the question is right, and that is, I think we all recognize that sound carbon policy has to make sure that we are not in fact, as we said, exporting jobs and importing carbon, and so the first question is, well, what would the impacts actually be on internationally competitive energy-intensive industries? I think there is a lot of anxiety about that but there wasn't a lot of data about it, and so we are working together to really try to drill down some of these key industries and understand what is in fact the actual magnitude of those competitive impacts, and then the second desire is to figure out, well, what could you do about them because I think in almost all of the legislation, there is a shared sense that these are serious issues that have to be attended to and there are opportunities by targeting allowances to those industries to ameliorate those cost impacts, so the desire is to figure out how much that is and how to move those resources.

Mr. BOUCHER. Thank you, Mr. Grumet.

Dr. Felmy, if I may, I would like to question you for a moment about your statement, I think in your prepared written testimony, about the number of allowances as a percent of the total assigned in one of the Senate bills, and I presume it was Lieberman-Warner that you were analyzing, to the petroleum sector and potentially also to the natural gas sector, and I think the number that you used was 3 percent of the nationwide total being targeted towards you. Do you know if that 3 percent represented allowances that were assigned to you based on your stationary source emissions, that would be refinery emissions, or were these allowances both for your stationary sources and also for the fuel that contains the carbon which is then sold downstream? Is it one of those or both of those?

Mr. FELMY. Mr. Chairman, it was both of them.

Mr. BOUCHER. And so what do you think an appropriate level of allocation would be given the emissions that today emanate from

refineries and also are contained in the carbon that would be sold downstream?

Mr. FELMY. Well, I think that the answer to that I can't give you but what I would propose is that as we go forward on this, that we develop an equitable amount of allowances. Of course, we as one industry cannot call the tune for everyone and so as the process goes forward, we would propose that it would be equitable across all industries, just in terms of equity across all areas and so on should also be considered.

Mr. BOUCHER. Do you happen to know what percent of the total CO_2 emissions arises from refinery operations?

Mr. FELMY. I believe it is roughly about 200 million tons from refinery operations. Total industry emissions are roughly about 2 billion tons out of the total of roughly 6 billion tons for the total economy.

Mr. BOUCHER. OK. So do the math for me. Is 3 percent compensatory to you for that or not?

Mr. FELMY. In terms of the refinery operations, 200 divided by 6,000 gets you roughly on the order of about 3 percent for just the refinery operations.

Mr. BOUCHER. So it sounds like that 3 percent was really targeted for your stationary source emissions?

Mr. FELMY. That is entirely possible. I am not sure how it is developed, Mr. Chairman.

Mr. BOUCHER. All right. My time is expired. Thank you very much.

Mr. Upton from Michigan.

Mr. UPTON. Thank you, Mr. Chairman. I appreciate everyone's testimony.

Mr. Mullett, I just want to say a couple things at the start, and that is, I sat down with some of my truckers this last week and I am very concerned about them but also the people that work for them because they are losing their jobs and particularly in rural areas. It is really tough. I have got a number of counties and often you will see an independent operator, maybe it is just him or her and that truck is just parked along the side. I was one that supported an increase in CAFE, and that was a pretty tough vote coming from Michigan, but at the same time, I said I don't want it to be an unfunded mandate, that we need to help the industry. In fact, I hope that we might have a hearing later on this year, maybe this fall, when things perhaps shut down a little bit on the House floor in terms of how the industry is going to meet those targets as they struggle to do that. It is one of the ideas that Mr. Boucher has, Boucher and myself and Mr. Barton and Shimkus and others with the Carbon Capture, Storage Early Deployment Act. We are going to try to help the industry get there in terms of offering an actual fund where we can capture this carbon and really help and I want to see that happen with the auto industry. I have Eaton in my district, and they are doing a terrific job at develop some hybrid technology, and when I went out there last summer, we brought the secretary of EPA and the administrator, or the administrator rather of EPA, and literally we found that the technology that they have now can save the average UPS truck 1,000 gallons that they don't have to use just on the idling technology and other things and

I would like to think that whether it be this committee or Ways and Means, we can help with legislation to promote that, to help the industry, and I would just urge you to talk to your colleagues at ATA to see what we can do. We think it is a bipartisan bill to try and push those incentives so you don't have those unfunded mandates as we struggle with these prices that clearly are not going to be going down. I just was struck by that in your testimony about all the truckers, literally 10,000 operations that are out of work just this year because of the increase.

Mr. Felmy, how does the environmental regulations on domestic refineries compare to refineries overseas or not in this country? I have been to a couple refineries in Texas and other places. We have one close to my district. It is in Peter Visclosky's district in Whiting, Indiana. There is another one in Toledo, Ohio, close to Michigan. How do those refineries in terms of the regulations overseas compare to the United States?

Mr. FELMY. Well, there are two aspects of that. First of all is the environmental regulations of the facilities themselves in terms of emissions, and I have no personal experience with one refinery versus over abroad but at least from suggestions that we have very rigorous environmental regulations, we have continually reduced emissions from our refineries, and then the second aspect is in terms of the fuels coming out of the facilities, and our fuels are very clean compared to the rest of the world, very low-sulfur gasoline, ultra low-sulfur diesel, which we are at 15 parts per million, for example, and Europe is 50. You know, and so the investments that we made for the last 10 years for the refinery system alone are about $55 billion for reduced emissions.

Mr. UPTON. But are we doing a much better job in terms of fewer emissions, having cleaner emissions than——

Mr. FELMY. I really can't——

Mr. UPTON. I think Aruba has the largest refinery. Is that right, largest operating refinery in the world? Is it not in Aruba?

Mr. FELMY. That is entirely possible. It is very large. I can't give you a definitive answer in terms of the specific emissions rates and so on to be able to give you a quantitative comparison.

Mr. UPTON. Well, because in your testimony you state that the cap-and-trade bills would send perhaps as much as 17 percent of our refinery capacity overseas, so I have to believe that that will have an impact, be transferring that carbon emission from here to someplace else and they won't have the same technology that we impose on ourselves and in fact you would increase then at the end of the day the emissions by having a cap-and-trade system.

Mr. FELMY. There is no question that could certainly happen. If you do export industry to areas with less environmental restrictions, that could be an outcome, and as you see from the study we had done by ICF, you see the reduction in refinery capacity in the United States.

Mr. UPTON. My time is quickly winding down. I wanted to ask just a simple question of both Mr. Grumet and Ms. Figdor. Something that I care a lot about is the expansion of nuclear energy and I just to know where your organizations or your thoughts are as it relates to that.

Mr. GRUMET. I am not sure I would call that a simple question, sir, but I will give you a quick answer if I can. Nuclear energy——

Mr. UPTON. Yes is good. Yes is all——

Mr. GRUMET. Nuclear energy needs to be part of the mix going forward. It is 70 percent of our non-carbon energy. The Commission believes that there are some real challenges and that we have to have real effort to specifically address the issues associated with waste and proliferation and we think that we have to have as an aggressive effort there as we do with other non-carbon forms of energy.

Mr. UPTON. Ms. Figdor?

Ms. FIGDOR. We think there are many problems with nuclear power but one of them is the timing. It would take many years to get new nuclear power plants up and running when we need to make deep and real reductions in emissions now and so we need to invest in the technologies and reap the benefits from the technologies that are already available like energy efficiency and clean renewable energy.

Mr. UPTON. I yield back.

Mr. BOUCHER. Thank you very much, Mr. Upton.

Mr. Matheson, if you are ready, we will recognize you for 5 minutes.

Mr. MATHESON. Well, thank you, Mr. Chairman. I am sorry, I had a series of meetings where I had to step out for a few minutes. I hope you haven't covered it too much already but I just wanted to raise the issue of international participation for a moment. I wanted to know, I have been focused on this issue because I am having trouble getting my arms around it, how we are going to make progress on this issue, and I am concerned about WTO issues. I am concerned about just practical issues, and I am wondering if any of you have comments to offer regarding the four legislative proposals that have been put out there in terms of if they have realistic starting points in terms of addressing international participation in this issue. So I don't direct that to anyone in particular but does anyone have comments on that?

Mr. BAUGH. Mr. Chairman, I will take the question on since we are the ones that have been pushing hard for it. We believe it really is a starting point, and we supported the international legislation that appeared in the Bingaman-Specter bill. We worked through the changes of that that then appeared in the Boxer-Lieberman-Warner bill. The attorneys we worked with are the top environmental attorneys and trade attorneys in the country, and they assured us that it is WTO compliant. Now, we absolutely know that no matter what we do, there is going to be a WTO test of it, but from our point of view, we think these steps we have been taking are WTO compliant. There are additional suggestions that have come in that were being proposed in the Senate. They weren't taken in the bill but I am certainly it is going to be discussed in the House, and we are willing to look at that. We are actually willing to look at that and other means. I know Mr. Inslee has talked about an input-output solution that I have not really had the chance to examine—we haven't had the chance to look at. We believe in redundancy but we strongly support international steps around that. We believe that it is compliant, and sort of the proof

in the pudding is, what we have proposed, the EU has actually threatened to implement on two occasions in the last year. The discussion is very live in Europe about it. They have a cap-and-trade program and they have had it in place 3 years, and basically the first rule for the WTO is that you have to be doing it to yourself before you can apply it to somebody else, and the proposal we put together mirrors that. It says OK, we have a cap-and-trade, we are asking other developed countries and others to participate. It is not going to be exactly the same but they have to have something comparable to do that, and if not, if they choose not to, then there would be a cost to that, and so it is exactly as the EU has talked about, employing that in the European Union it would actually apply to us because we don't have a comparable system at this point. But I think that is something we have to do and we have to talk about these issues together. We can't ignore them. It is very, very important.

Mr. MATHESON. Does anybody else have any comment?

Mr. GRUMET. Mr. Matheson, just to add to that a little bit, I think that going back now almost 20 years to the Rio Summit in 1990, this notion of differentiated commitments was on the table and it was the idea that the developed world, the United States, was going to have to lead to the solution but we couldn't be chumps, right? In other words, we can't solve this problem without in fact a meaningful, equitable and efficient global program, and the framework that I think now is gathering appropriate momentum is recognition that we are going to have to take a first step, a real step in this country. It is going to have to be measured. We are going to have to have certain constraints to make sure that we protect our economy as we move forward and there is going to be an inflection point, 7 years, 10 years out. In other words, the idea that Congress can legislate a trajectory for 4 years without a course correction, we don't think is particularly realistic. We need to set a long-term goal but we have to acknowledge that we are going to take a first step, we are going to have to make sure that there are real incentives and both positive and negative incentives for other countries to join with us, and at a certain point several years in the future, we are going to have a gut check, not just as a country but as a world, are we going to solve this problem or not, and at that point that would be the point where we would believe that the kind of cost containment measures and others would be I think traded in for the kind of ultimate ecological endpoint but that is going to be contingent upon a president determining that all of our major trading partners are making in fact commensurate efforts to solve the problem.

My last point I guess would be that it is the developing countries that are going to suffer the impacts of climate change, frankly, much more severely than we in the developed world. Our ability to adapt is much greater than that in China and other places. The leaders of those countries recognize that they have a real challenge here.

Mr. MATHESON. Do you think the concept of a look-back or a gut check, as you called it, provision should be put in, not just for international participation but across the board on all aspects of climate change legislation?

Mr. GRUMET. I am not sure of—my view of what encompasses all aspects, I guess I am not certain——

Mr. MATHESON. Just whatever it is in the bill, should there be a requirement, a reauthorization, to see how things are going? I mean——

Mr. GRUMET. I think whether it is mandated or not, that will be the reality. Congress is going to have to be revisiting this decision and I think in a number of different bills there is an explicit requirement for the president to make a determination. On the basis of that determination then a series of actions flow from it. I think that is the appropriate way to proceed.

Mr. MATHESON. Thanks, Mr. Chairman. I will yield back.

Mr. BOUCHER. Thank you, Mr. Matheson, a perfectly riveting set of questions.

The gentleman from Texas, Mr. Barton, for 5 minutes.

Mr. BARTON. Thank you. Mr. Chairman, looking around the room, seeing the membership present, I am tempted to ask consent to suspend the rules, ask the bills before us to be considered as read, considered en bloc, move the previous question and call for a 3-minute vote. I think we could dispose of this issue in a very timely fashion. But knowing that is not in the spirit of this hearing, I am not going to do that. I do want to ask some questions.

Mr. Baugh, you talked not directly but briefly in response to an answer to a question about the European cap-and-trade program. Are emissions going up or down in Europe because of that cap-and-trade program?

Mr. BAUGH. The cap-and-trade program didn't work, and I can tell you why. They did a footprint three times too large, they had too many emissions so that when it started off, the prices stayed low——

Mr. BARTON. All I need is the answer, which you gave me honestly.

Mr. BAUGH. It didn't work. They have done a phase II reform they just implemented that is looking much more like what we are doing here and will have a footprint that is correct and will have a different outcome than the first time.

Mr. BARTON. And so far it hasn't worked. I will give you a chance to—do you think these changes that they are going to implement will make it work?

Mr. BAUGH. I think yes, I already believe it is having an impact to make it work differently. We have actually cautioned them not to make the mistake the United States is making in looking at this with an open, unrestricted market approach. We have serious concerns about that when this Congress is actually investigating the use of derivatives in futures markets and the impact they are having on oil and commodities and food, and we are setting up, as somebody noted, the largest trading system around. We think it should be a much more focused market.

Mr. BARTON. If I had 10 minutes, I would let you answer that a little more fully but I have got just 3 more minutes.

Mr. Grumet, is that correct?

Mr. GRUMET. I know you are talking to me, but it is Grumet.

Mr. BARTON. Grumet. I am sorry. I am not trying to be facetious. I want to get your name right. Mr. Grumet, you talked about that

we need to take the first step regardless of what the developing world does. Have you ever directly negotiated with the Chinese?

Mr. GRUMET. Well, actually, I was in China and I bought some good stuff at a dirt market so, yes, I have.

Mr. BARTON. Well, that is a great answer to that question. Let me rephrase it. Have you ever tried to directly negotiate with them on emission reductions?

Mr. GRUMET. Sir, I have never had the pleasure of representing the U.S. government in any of those discussions.

Mr. BARTON. Well, I have. Now, this is a dated story, and their view may have changed. I am not going to say it is still their current view but I think it is. When we went to Kyoto under the leadership of Chairman Dingell as the congressional observer delegation, we met directly with the Chinese, and Chairman Dingell asked the question, and this is 12 years ago or whenever the Kyoto Accord was signed or at least implemented, but China's position was that they couldn't sign on to Kyoto because they were developing. Chairman Dingell said well, do you think you will be able to do it in maybe 20 years? No, we don't think so. Well, what about 50 years? No, we don't think so. Well, what about 100 years? Well, we don't think so. Well, will you ever sign on to it? Well, we don't think so.

Now, China is putting in play a 500-megawatt coal-fired power plant every other week, and they are either now exceeding U.S. emissions of greenhouse gases or will next year. I don't think it is conceivable in the real world that they are ever going to sign on anything except take our technology if we develop it for free. I think they will accept our plants if we adopt some rigidity of regulation that causes the remaining industry in this country to shut down. They will take our power plants. They will take our steel plants. They will take our chemical plants. They will take anything that we ship over and they will produce those goods and then ship the goods back to us but they are not going to because we adopt something. If they were going to do that, they would have already begun to do it because of what Europe is trying to do. You know, Europe's economy collectively is as large as the United States economy, not individually by nation but collectively, so I just respectfully disagree that us taking a unilateral first step is going to be met by a reciprocal action on the part of countries like the Chinese.

My last question, Mr. Chairman, because I want to go to the gentleman that represents the trucking industry. Repeat for us how many trucking companies have already gone out of business this year.

Mr. MULLETT. I believe the figures that I gave were over 1,000 and over 10,000 employees and owner-operators. That was the first quarter. In the second quarter, there were some pretty significant bankruptcies as well.

Mr. BARTON. Now, if we were to adopt—the position right now I think of these bills before us, if we adopt some sort of a cap-and-trade regime, it does affect mobile sources. There is no current technology that I am aware of that cost-effectively reduces emissions of mobile sources. How many more trucking companies would go out of business just generically if we adopt one of these bills? Do you have any estimate of that?

Mr. MULLETT. I do not but I can assure you that there is a direct causal relationship between the price of fuel and these failures, and there is also a causal relationship between these failures and the strength of the overall U.S. economy.

Mr. BARTON. Mr. Chairman, my time is expired. I appreciate your graciousness and I yield back.

Mr. BOUCHER. Thank you very much, Mr. Barton.

The gentleman from Washington State, Mr. Inslee, is recognized for 5 minutes.

Mr. INSLEE. Thank you.

Mr. Grumet, I don't know if you were here to hear some comments I made about R&D needs for the United States, and I would just like to ask your thoughts on what the scope of that effort ought to be, how we should define that, and I would also like your thoughts on how, assuming we do create a pool of revenues associated with a cap-and-trade auction, how should that be managed and invested? To what degree should Congress be making decisions about allocations between solar thermal and clean coal and algae-based fuels? Should there be some new structure formed independent of Congress that we haven't seen before to do that? Some people have suggested some sort of public-private partnership arrangements. I would appreciate your thoughts on those subjects.

Mr. GRUMET. Thank you for the question and thank you for your leadership on this set of issues. Let me just agree with the original premise of your presentation which I did see, and that is that based on the heroic scale of the challenges we face from both environmental implications and energy security implications, the public investment in research and development is actually quite anemic. We are investing one-third in real dollars today of what we were investing 30 years ago, and so fundamentally, we do need as a country to be devoting more resources to these challenges. I think it is important also to separate between the challenges of kind of pure R&D and the challenges of deployment. Our commission proposed that we needed to triple the resources going into direct R&D. We think that the current structures at DOE with the national labs and universities, especially in the public-private partnerships, work quite well there.

Where we think there really has been a tremendous lack of investment and focus is on the deployment, the acceleration of these new technologies. There is a wonderfully dramatic term, the valley of death in the R&D world, one of the neatest things we get to say in energy geekery, and this is the idea where new, neat ideas basically go to die or go overseas to get commercialized, and fundamentally, that is a place where we believe government needs to be playing a more significant role. I think that the efforts of this committee and this Congress in the last couple of energy bills has been a step in the right direction. The focus on loan guarantees is a significant and important way to take the risk capital out of those decisions and advance that discussion. I think there has been a sense that we need to do more of that. I believe that there is also an important challenge to think about these kinds of mechanisms because while there might be a general consensus that we need to plus up the resources, I do believe that there has to be much great-

er transparency and accountability in terms of how we do that, and let me close with one or two thoughts on mechanism.

One is that it is very tough for the good people at the Department of Energy to venture risks because if you are going to have an R&D portfolio that is going to be creative, you are going to have tremendous successes and you are going to have significant failures, and we have a culture which enjoys those successes but really doesn't enjoy or like to tolerate those failures and so we create a culture of caution in our decision making which does not match the challenges that we face. So the idea of bringing together the kind of private sector venture capital ideal which recognizes that if you have one giant win and three medium losses, you are a rock star, we need to bring that culture into this discussion and so I think the idea of public-private partnerships, greater reliance on these credos is a real opportunity going forward.

I guess the one last point I would make, and this goes back to something Mr. Barton was saying, is on the international collaboration. We need to be careful to make sure that we don't wind up importing CCS technology, importing renewable technology, importing smart metering technology from China and India because I certainly agree that while we are going to have a real challenge in getting those countries to take commitments, they are investing in these kinds of technologies.

Mr. INSLEE. And may I add, not just the technology but the products as well, so that is another issue. Thank you. I appreciate that.

Mr. GRUMET. And my last thought is that having a dedicated revenue stream makes this a lot easier but I want to commend Chairman Boucher for the focus on moving quickly on CCS. I think also Mr. Upton pointed out the important opportunity to invest tax credits in retooling domestic vehicle facilities and I think we do not have time to wait.

Mr. INSLEE. And we hope those brilliant ideas will be applied in other technologies in addition to CCS, and the whole smorgasbord that we want to talk about.

Mr. Scott, could you give us some advice on a Federal register? Many of us believe, some of us believe, at least, that we should move a bill this year that really moves forward with a registry and data collection, even prefatory to a cap-and-trade system. Could you give us any thoughts on how to structure that, anything we should avoid?

Mr. SCOTT. Well, I think first of all, I would hardly recommend going and using the work that has already been done by this coalition of the States that has worked with private industry, a large stakeholder process that worked on a protocol for that. So rather than reinvent the wheel, I would suggest using that work that has already happened and engaging and trying to work with both mandatory and with voluntary protocols, which is what the Climate Registry has done. So there are many, many, very detailed, very technical issues, as you know, with that that we have worked through over the course of the last year. We have got over 240 voluntary reporters who have come on board now with the Climate Registry this quickly, so we think the work we have done has been done very well and would hardly hold that out to you as a good place to start.

Mr. INSLEE. Well, we will plagiarize as much as we can.

Mr. Baugh, talking to a blue and green forum about the green collar job possibilities of these new developing industries, do you have any message you want me to deliver from Washington, D.C., to them?

Mr. BAUGH. Yes, I think that green jobs are not just jobs in renewable energy. Green jobs are any job that go to cut the carbon emissions, and if that is doing advanced automotive technology, if that is doing CCS technology, that is what green jobs are all about and it is not just all new jobs, it is about changing the way certain jobs work. You may be producing new things, you may acquire new skills to produce those things. It is a combination of some new job opportunities, changing job opportunities, getting our manufacturers to produce some of those 40,000 parts that go into a wind turbine that they are not producing today and the huge opportunities that are coming at us. So I think it is about seizing the moment, directing our investments towards this job creation opportunity, making sure this legislation is economic development and legislation and requires the money be spent domestically so that we actually generate these new energies. And I want to remind everybody in this room, we were here in 1980. We were here in 1980. We led the world in photovoltaics, wind turbine technology, battery technology, geothermal technology, and all of this developed with government investment and money and we blew it when we walked away from it in the 1980s because the Germans, the Spanish, the Brazilians with the biofuels, the Netherlands all took our technologies that sat on a shelf that was developed in this country and ran with it and invested in it as nations as an industrial policy and today, Congressman, we are shipping barges of parts from the Netherlands to the wind turbine development that is going on in Hood River. I want that stuff made back in those aluminum plants that are closed along with Columbia Gorge.

Mr. INSLEE. We are going to work with you and Mr. Doyle with this output-based rebate program to try to make sure we have domestic production. Thank you. I thank the whole panel.

Mr. BOUCHER. Thank you, Mr. Inslee.

The gentleman from Oregon, Mr. Walden.

Mr. WALDEN. Thank you very much, Mr. Chairman.

Mr. Baugh, I couldn't agree more that I would like to see those aluminum plants reopen too. Unfortunately, pressures in the region were such and worldwide economy that they couldn't sustain, and Enron, although I would hasten to say I think Northwest Aluminum was down before Enron, plus they had the power contrast with BPA that escaped that so I don't think that was exactly—Enron was a huge problem and a huge issue and a huge scam and this committee investigated all that, so—but I fully concur, although there are probably members of this committee that would disagree with both of us on this notion of keeping manufacturing in this country. And there were emissions associated with those plants and all of that.

I want to go to Dr. Felmy from API. You made a comment that if some of these cap-and-trade proposals were in place—I want to make sure I get this right—17 percent of domestic refinery capacity could be shoved overseas. Is that what you indicated?

Mr. FELMY. That is the result of the ICF International study of the Lieberman-Warner proposal.

Mr. WALDEN. Seventeen percent. How many barrels——

Mr. FELMY. Three million barrels a day.

Mr. WALDEN. How many?

Mr. FELMY. Three million barrels a day.

Mr. WALDEN. And what is the U.S. consumption of gasoline per day?

Mr. FELMY. U.S. consumption of gasoline is—well, total oil consumption is 20.6.

Mr. WALDEN. In the United States?

Mr. FELMY. In the United States, million barrels a day. Gasoline is roughly around 9, 9.2 million barrels a day.

Mr. WALDEN. So is the equivalent then 3 million barrels of gasoline a day, or oil?

Mr. FELMY. No, the typical yields from a barrel are about 50 percent gasoline, 24 percent heating oil and diesel, 10 percent——

Mr. WALDEN. So the long and short of it though, we drive 17 percent overseas and then we get to pay somebody else to bring it back?

Mr. FELMY. Short of a demand reduction, that is what would happen.

Mr. WALDEN. And I am all for some level of demand reduction but not the kind we are seeing out there in America today, which is people are going broke and our economy is going upside down with this type of demand reduction. We send $160 million a day to Hugo Chavez. Isn't it true that 95 percent of the world's oil supply is controlled by governments and government-owned entities?

Mr. FELMY. Well, the numbers are a little more complex than that. If you look, roughly 77 percent are government oil companies. Then you have a collection of other entities such as Russian companies that you have to decide what you want to call them. Ultimately it comes down to in terms of the integrated oil companies, roughly only about 6 percent——

Mr. WALDEN. And we have heard about the Brazilian model that they have become pretty much energy independent, in part because they have developed sugar-based ethanol, which has had an effect on forests, I think, as they expand, but didn't they also develop their offshore resource?

Mr. FELMY. Absolutely. If you look, I believe the numbers are in 1980, Brazil produced about 244,000 barrels a day of oil, and now they are over 2 million, and when they announced energy independence, the president did it on an oil platform.

Mr. WALDEN. And that was because of what? How much is ethanol and how much is crude oil?

Mr. FELMY. Well, roughly ethanol, I believe, the consumption in Brazil is about 260,000 barrels a day and so oil production is in excess of 2 million barrels a day.

Mr. WALDEN. So 9, 10 times, something like that?

Mr. FELMY. That is correct.

Mr. WALDEN. What would happen in this country and what would happen to the market, the oil market globally, if we were to pass legislation opening up either ANWR or the OCS? Would it have a positive effect for consumers?

Mr. FELMY. Well, as an economist, we believe firmly that increasing supplies helps consumers, and so being able to produce more oil, of course, will take some time.

Mr. WALDEN. Absolutely. I understand that.

Mr. FELMY. But it also will telegraph to the world that the country is serious about supply and demand situation so that would help in terms of what the market assessment would be perhaps further out in the futures market, for example.

Mr. WALDEN. I want to switch topics for just a minute and ask our panelists the same question. That is, I have had a real passion for dealing with forest health and some panelists today have referenced that in their testimony about the role of forests. We certainly see the decline of forests in the industrializing world and we see the destruction of the forests here due to fire, a record 9 million acres last year alone. Half the Forest Service budget is consumed fighting fire. That has to be enormous emissions into the atmosphere. The Forest Service for at least 10 or 20 years has done research on climate change and has come to the conclusion, and don't hold me to this but I think they said it would take 10,000 years for the trees to migrate to the point north where the temperature will get in 100 years, which means that you are going to have increased disease, infestation of bugs, drought and forest fire. Now, some of the very organizations that support climate change legislation also oppose active management of our Federal forests and I just wonder from you all, do you share that view that we just leave the Federal forests the way they are today or do you support changing Federal law to actually actively manage them to cope with what we see coming with higher temperatures, disease, bug infestation, overstocking? Dr. Felmy, do you have any comment on that?

Mr. FELMY. I don't have a position on that.

Mr. WALDEN. Mr. Baugh, are you going to make any more woodies, you know? You might need——

Mr. BAUGH. Since I once served on the Oregon Board of Forestry, forest management is important. I can't answer the bigger question you are asking here but I do know you address it in terms of the pine beetle infestations, which we used to deal with in eastern Oregon, where there were choices to be made. Do you just let them stand once they have been infested or do you go and cut them down and replant, and that is the kind of forestry management that does make some sense.

Mr. WALDEN. And I concur with you.

Ms. Figdor?

Ms. FIGDOR. I am not sure of your question with regard to forestry management and a climate policy.

Mr. WALDEN. Sure.

Ms. FIGDOR. If so, I think there is a role for carbon sequestration, biological sequestration in forests, but we need to be careful in making sure that we can accurately quantify those.

Mr. WALDEN. As we work on that though, do you support active management of the forest to reduce them where they are overstocked and deal with the disease and bug infestations so we can reduce the opportunity for catastrophic fire?

Ms. FIGDOR. We support protecting our national forests and ensuring that they remain the wild places that——

Mr. WALDEN. So you don't support active management?

Ms. FIGDOR. We do not.

Mr. WALDEN. OK.

Mr. BOUCHER. Mr. Walden, our time is about expired here. You are about 2 minutes over. We will give Mr. Grumet an opportunity to make a response.

Mr. WALDEN. Thank you, Mr. Chairman.

Mr. GRUMET. I don't want to belabor this but I think that adaptation has to be an active part of the climate debate and forests have to be part of adaptation.

Mr. WALDEN. Perfect. Thank you.

Thank you, Mr. Chairman. I apologize.

Mr. BOUCHER. That ended on a pleasant note from your vantage point, I think.

Mr. Burgess is recognized for 5 minutes.

Mr. BURGESS. Thank you, Mr. Chairman. Let me just note for the record that within my congressional district, we do have solar research development at Entech. We have a large windmill blade manufacturer in Gainesville, Texas, probably one of the largest in the country, and I would just encourage anyone who is following the course of these hearings, don't buy those cheap Brazilian blades that cost so much money to bring to this country and always break in that fierce Texas wind. Get your blades from Gainesville, Texas.

But while I am concerned about those two industries in my district, I have a lot more truckers in my district than I have people who work at solar research and development and even the good people who work at MFG up in Gainesville, so I am very concerned, Mr. Mullett, about the problems and the numbers that you have shared with us today. They seem pretty stark. Is there one thing that you have in mind—and I apologize, I was in and out while the testimony was being given but is there one thing that you have in mind that might be of some immediate help to the truckers in your industry that are so put upon right now?

Mr. MULLETT. Well, I think that there are a couple of different things. Number one, the six items that we referenced in our sustainability initiative which, while low tech and mostly policy decisions, can be quickly implemented at little cost and will have real meaningful effect quickly for the use of fuel. The second thing I think we can do from an industry point of view is send a pretty strong signal to the rest of the world that we are serious about maintaining our own energy supplies, whether this has to do with drilling, investigating the futures markets, something that sends a signal back to the rest of the world and speculators that we are not going to tolerate these increases in price that are not a direct result of supply-demand constraints.

Mr. BURGESS. And I actually could not agree with you more on that. In fact, 2 or 3 weeks ago, we had a vote on the House Floor to stop filing the Strategic Petroleum Reserve, and I realize that it is a proverbial drop in the bucket, but at least for the first time on the floor of the House of Representatives in a bipartisan fashion, we said supply matters, and I think if we are willing to admit that supply matters, even in that very little bit that we did, some of the

other things you referenced will be extremely important. There was a move afoot right toward the end of the spring for perhaps a roll-back on the federal excise tax on gasoline, but my understanding is that the federal excise tax on diesel is actually a bigger hit than the 18.34 cents on a gallon of gasoline, diesel federal excise taxes being about 6 cents higher than that. So what about a proposal to roll back the federal excise tax on diesel, offsetting that, if you will, with ceasing the tax break for ethanol and giving the break to the truckers while your industry is in so much peril? I realize at 68-mile-per-hour governor may be a great idea going forward but you need some help today.

Mr. MULLETT. I would be irresponsible if I said any immediate relief for a lot of our industry would not be helpful. That having been said, we would not want to take money out of the highway trust fund that is in so much jeopardy right now because we are actually fearful that further degradation of the road systems, increased congestion and things like that may more than offset any savings that we would get out of that.

Mr. BURGESS. But now if you offset that money that would not going to the highway trust fund from diesel excise tax, if you offset that by, my opinion, the appropriate tax going on the ethanol to the federal highway trust fund, perhaps we could strike a balance there. I will just leave that there for your thoughts. There is a bill out there, 5986, expertly crafted, and leave it for your consideration.

But Mr. Grumet, let me just ask you, in Mr. Mullett's testimony, he references cap-and-trade as not well suited to mobile source applications. So in your world with your National Commission on Energy Policy, how do you reconcile that?

Mr. GRUMET. Well, Mr. Burgess, I think that I entirely agree that in the early years, the dominant reaction to a cap-and-trade bill is going to come out of the energy production sector, particularly the coal sector. A penny-a-gallon gasoline translated or diesel is about $1 a ton of CO_2. So if we have a carbon price in the $15 or $20 range, which is what I am imagining the ultimate outcome would be, that would pass through across to 15 cents or so to the American consumer. I don't think any of us believe, based on what we have seen over the last 2 years, that that in and of itself is going to dramatically change the operation or choices we make on the motor vehicle transportation side. So our commission believes that while we should have an economy-wide program, there are more effective and direct ways to address the energy security challenges that we face because we are relying on petroleum for 97 percent of all of our transportation so we supported the reform and strengthening of vehicle fuel economy standards that Congress acted on. We are actively looking into the low-carbon fuel standard, and I think there is a real active discussion about whether in fact you should focus those kinds of direct measures on the transportation sector or whether it is better served to have it all lumped together under one national cap.

Mr. BURGESS. It seems like they are directly focused on the transportation sector right now. I mean, you talked about a price signal for carbon. I think we are there. Now, we did hear testimony on this committee right after Hurricane Katrina that gasoline

would have to get up to $6 a gallon before you would actually influence consumption.

Mr. GRUMET. We are seeing——

Mr. BURGESS. We are seeing it in my district at $3.85.

Mr. GRUMET. And significant pain, and I think the question is, are we going to ride along as the victims of that or are we going to kind of seize that choice going forward. In the past the problem has been the volatility of prices.

Mr. BURGESS. Let me ask you this. On the pricing, do you agree with our friend at the end that supply does matter?

Mr. GRUMET. Absolutely. The Commission believes that we can neither drill nor conserve our way out of this problem. We have to do both.

Mr. BURGESS. And I am happy to hear you say that because when we had a lot of the debate on the Energy Policy Act of 2005 in this committee, a lot of it was, there was a lot of criticism directed at the Energy Subcommittee because we refused to just simply go in a direction of conservation and alternatives. I come from a couple of counties back home where there is probably more active drilling into the Barnett shale than anywhere else in the world right now, and although we are all happy to sell our natural gas at $12 or $14 per million cubic feet, I do recognize the pain that it is causing the country and look forward to the day when those prices are in fact reduced, and I think the "drill now, drill here, pay less" philosophy certainly in my part of the world, that makes a lot of sense.

Mr. Chairman, you have been very generous with time and I will yield back.

Mr. BOUCHER. Thank you, Mr. Burgess. Thank you very much.

Well, this has been a very long day and I want to express the Committee's appreciation to this panel you're your endurance and for the excellent testimony that you provided to us. There may be some additional questions coming to you in written form from some of the panel members. If so, your rapid response to those would be much appreciated. The record shall remain open for 2 weeks for that purpose.

So with the committee's thanks, this panel is excused and the hearing is adjourned.

[Whereupon, at 4:35 p.m., the subcommittee was adjourned.]

[Material submitted for inclusion in the record follows:]

Testimony of Paul N. Cicio
President
Industrial Energy Consumers of America
House Subcommittee on Energy and Air Quality
June 19, 2008
Legislative Proposals to Reduce Greenhouse Gas Emissions: An Overview

Summary of Major Points

1. The bills do not differentiate the industrial sector from others and they should.
   - Products and technology are essential to reducing significant quantities of green house gases. Our products consume energy in their production but they save more energy in their life-cycle when used by customers and are indispensable for economic growth. The only unanswered question is whether they will be manufactured here or imported.
   - Industrial sector emissions are at 1990 levels versus all other sectors are at +31 percent.
   - Because we have already reduced emissions, the cost of future reductions is more expensive.
   - Only the industrial sector faces international competition and potential loss of jobs.

2. The bills do not address natural gas supply (the default low carbon fuel) and its implications on price, nor do they address the impact of natural gas supply on electricity prices, which will have a greater short term negative impact on the manufacturing sector GHG emissions than climate policy. Unless the Congress takes decisive action to increase domestic production of natural gas and bring down the price, manufacturing will accelerate its movement offshore.

3. The bills do not set emission reduction targets with timetables that match the availability of cost effective commercial technology such as carbon capture and sequestration and nuclear capacity for the power sector to reduce their emissions. As a result, massive coal to natural gas fuel switching will occur and will drive up the price of natural gas and electricity nationwide.

4. The bills do not protect energy intensive manufacturing competitiveness by providing full allowances that cover the increased costs of energy and emissions. They also do not address the needs of manufacturing companies who are our suppliers or customers but not large energy intensive companies.

5. The bills do not recognize the reality of the international market place in which we compete. Forcing energy intensive manufacturers in foreign countries to reduce their GHG emissions in exchange for access to US markets is not effective. A global agreement must set a transparent protocol.

6. The bills do not determine the real cost of each climate bill because EIA under-estimates the natural gas price assumptions used in the climate change modeling. EIA under estimated the cost of S.2191 by over $1 trillion.

7. The bills do not provide assistance to help manufacturers reduce GHG emissions and develop the next generation process technology. Major energy intensive manufacturing processes are near their stoichiometric limits.

8. The bills do not consider potentially more cost-effective policy alternatives to cap and trade.

9. The bills do not recognize the enormous financial risks that trading carbon and market manipulation presents globally. Carbon offsets could easily become the next sub-prime crisis. Today, carbon in Europe is being traded as an energy-basket commodity, not reflecting the under-lying cost of carbon abatement as it is theorized to achieve.

Testimony of Paul N. Cicio

President

Industrial Energy Consumers of America

House Subcommittee on Energy and Air Quality

June 19, 2008

Legislative Proposals to Reduce Greenhouse Gas Emissions: An Overview

Chairman Boucher, Ranking Member Upton and Committee Members, we are grateful for the opportunity to testify before you on the important issue of climate change policy, a topic that could determine the competitiveness of the manufacturing sector in the US.

The Industrial Energy Consumers of America (IECA) is a non-profit non-partisan cross-industry trade association whose membership is exclusively energy intensive manufacturing companies. IECA membership represents a diverse set of industries including: chemicals, plastics, fertilizer, cement, paper, steel, glass, rubber, food processing, aluminum, brick, insulation, industrial gases, pharmaceutical, construction products, automotive products, and brewing.

The industrial sector represents about 20 percent of the total US emissions. Because of international competition, continuous energy efficiency and demand destruction due to higher natural gas prices, greenhouse gas emissions are at 1990 levels. All other sector emissions have increased an average of 31 percent.

High natural gas prices have significantly contributed to the loss of 3.3 million manufacturing jobs (19 percent) since 2000. Climate policy, if not implemented with our competitiveness in mind, will drive more good jobs offshore.

Unfortunately, all climate legislation introduced to date does not address or does not sufficiently address several critically important issues for the manufacturing sector.

1. They do not recognize and embrace manufacturing industries as a strategic enabler of vital products and technology that are essential to reducing significant quantities of GHG. They fail to directly or indirectly appreciate the enormous life cycle benefits of our products in the market place. While the industrial sector products consume energy in their production, they save more energy in their life-cycle when used by customers. These same products are indispensable for economic growth. It is impossible for our country to meet the climate challenge without using more, not less, of these products.

Legislation to date significantly increases our costs, which increases the costs of the GHG reduction solution and discourages its use as an option. Higher costs raise the question of whether these products will be produced here or imported.

For example, the chemicals, plastics, aluminum, light weight steel and cost effective fiber glass insulation that save energy when used in homes, commercial buildings, appliances, cars, trucks and air planes are industrial products. These products are also

used extensively by the renewable energy industry to build wind turbines and solar panels.

2. They do not address natural gas supply concerns. Natural gas is the default low carbon fuel in the short term. The resulting higher demand will increase natural gas and electricity prices and will have a greater short term negative impact on the manufacturing sector than climate policy.

Unless the Congress takes decisive action to increase domestic production of natural gas and bring down the price, manufacturing could accelerate its movement offshore. Domestic production of natural gas from 2000 to 2007 is flat despite record well completions. We strongly encourage Presidential and Congressional action to remove outer continental shelf moratoriums and speed up construction of the Alaska Natural Gas Pipeline.

3. They do not set emission reduction targets with timetables that match the availability of cost effective commercial technology such as carbon capture and sequestration and nuclear capacity for the power sector to reduce their emissions. As a result, massive coal to natural gas fuel switching will occur and drive up the price of natural gas and electricity nationwide. This could pit the purchases of natural gas by electric utilities against the demand of the homeowner, farmer and manufacturer. This is not good policy and we urge special attention to this problem.

The April 28, 2008 report by the National Energy Technology Laboratory entitled "Natural Gas and Electricity Costs and Impacts on Industry" agrees with our conclusions. The report says, "Should climate change legislation pass, the dash to gas will be exacerbated, doubling natural gas consumption for power generation, increasing dependence on foreign energy sources, and sending natural gas and power prices skyward across the country."

Fuel switching from coal to natural gas is exactly what happened in Europe with the EU ETS as reported by Garth Edwards, Shell Oil, Trading Manager, Environmental Products, London, England. Mr. Edwards 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)."

Demand for power generation has consistently grown since 2000 but is accelerating due to a combination of factors including the threat of climate mandates and opposition to coal fired power plants. Natural gas consumption by the power sector has grown by 35 percent since 2000 while total US demand rose by only 9.8 percent. Demand has fallen by all other sectors as a result of higher prices.

Further heightening our concern is the reality that, according to the Energy Information Administration, 73 percent of all new electrical generating capacity built in 2006 was based on natural gas. EIA's 2007 estimate jumps to 78 percent and the 2008 forecast is more of the same. A single 500 MW rankine cycle power plant will consume the equivalent natural gas volume used to fuel 842,308 homes each year.

Lastly, according to the EIA there is about 230,000 MW of existing natural gas fired power generation capacity in the US. Today, only a small amount of this capacity is used, mostly for peaking power. If this generation capacity were to be incentivized to turn-on because of climate legislation it could consume about 5.4 trillion cubic feet of natural gas, about 25 percent of today's US demand. The point is that any incremental increase in demand for natural gas by the power sector will significantly increase the price of natural gas and electricity, especially when we do not have a comparable increase in supply.

4. They do not protect energy intensive manufacturing competitiveness by providing full allowances that cover the increased costs of energy and emissions. They also do not address the needs of manufacturing companies who are our suppliers or customers but not large energy intensive companies. Higher costs reduce our ability to compete for domestic and international markets against foreign producers who do not have these higher costs. Unless full allowances are provided under a cap and trade program, companies will move offshore.

5. They do not recognize the reality of the international marketplace in which we compete. Forcing energy intensive manufacturing in foreign countries to reduce their GHG emissions in exchange for access to US markets is not effective. A global agreement must set a transparent protocol.

6. They do not determine the real cost of each climate bill because the EIA under-estimates the natural gas price assumptions used in the climate change modeling. For example, on April 30, 2008 the Energy Information Administration completed an economic evaluation of S.2191 America's Climate Security Act. Comparing EIA's natural gas price assumptions used in the study to the New York Mercantile Exchange closing forward prices of May 30, 2008 indicates they have under-estimated the cost of S.2191 by over one trillion dollars.

Year	$/mmBtu NYMEX (1)	$/mmBtu EIA (2)2008	$/mmBtu Difference	Tcf Consumption (3)	Additional Cost ($billion)
2008	11.96	7.23	4.73	23.79	$112.5
2009	11.11	7.31	3.80	23.92	$90.9
2010	10.25	6.85	3.40	23.82	$81.0
2011	9.97	6.48	3.49	23.84	$83.2
2012	10.00	6.18	3.82	23.75	$90.6
2013	10.14	5.99	4.15	23.57	$97.8
2014	10.28	5.83	4.45	23.60	$105.4
2015	10.45	5.70	4.75	23.69	$111.6
2016	10.62	5.55	5.07	23.51	$116.6
2017	10.77	5.52	5.25	23.02	$119.0
2018	10.94	5.56	5.38	22.65	$120.3
2019	11.12	5.61	5.51	22.38	$123.4
2020	11.34	5.52	5.82	22.42	$130.5
					$1,383.0
					Total

(1) NYMEX prices as of May 30, 2008
(2) EIA – Core Case
(3) TCF (trillion cubic feet)

7. They do not provide assistance to help manufacturers reduce their ghg emissions and develop the next generation process technology. Major energy intensive manufacturing processes are near their stoichiometric limits. Higher energy and compliance costs means there is less capital available to do energy efficiency projects and invest in R&D to develop new and more energy efficient manufacturing processes.

8. They do not consider potentially more cost-effective policy alternatives to cap and trade. We believe that there are more cost effective policy alternatives that should be explored. Each sector of the economy is different and will respond better to policy options and achieve greater reductions when they are specifically designed for cost effective reductions for that sector.

9. They do not recognize the enormous financial risks that trading carbon and market manipulation presents globally. Carbon offsets could easily become the next sub-prime crisis. Today, carbon in Europe is being traded as an energy-basket commodity, not reflecting the under-lying cost of carbon abatement as it is theorized to achieve. Carbon trading can easily get caught up in the excessive speculation that has gripped energy commodities and drive up the price of carbon.

10. They do not establish one federal regulatory system that preempts state programs. It will be very costly for companies to have regulatory requirements in potentially 50 states. Nothing in these bills prevents the possibility of having to comply

with 50 different regulatory programs, which means compliance costs will be very high and retail consumers will eventually pay for all costs.

STATEMENT OF HON. TOM ALLEN

Chairman Boucher, thank you for holding this hearing on this important topic. Thank you also to all of the witnesses here before us today. I look forward to your testimony.

Climate change is perhaps the most important environmental issues facing our planet today. As a leading emitter of greenhouse gases, the United States must act to reduce emissions that are causing significant changes in our climate.

I am proud that Maine is a leader in combating climate change. My state has joined the Regional Greenhouse Gas Initiative, enacted tough new emission standards for automobiles, and is aggressively working to develop new sources of renewable energy. However, climate change remains a global problem, and that requires national and international efforts. While Maine is doing the best it can, Maine's actions are no substitute for effective leadership in Washington.

All around, we are seeing the continued impacts of climate change: migration patterns are shifting, the ice caps are continuing to melt, and weather patterns are becoming more erratic.

The time to act is now and we need comprehensive climate change legislation with clear goals and objectives. I believe that for climate change legislation to be successful it must reduce emissions, facilitate a smooth transition to clean and renewable energies, minimize economic impacts and assist communities impacted by global climate change.

I believe to successfully and efficiently curb carbon emissions we need to cap emissions to ensure an 80 percent decrease below 1990 levels by 2050. Additionally, successful climate change legislation also needs to engage other nations to develop binding international standards. This is a global problem that calls for global solutions.

While capping current emissions is key to slowing the impact of climate change, it is only part of the solution. We need to develop long term solutions to facilitate the transition from a fossil fuel, carbon intensive economy to an economy of renewable energies and green technologies. Climate change legislation can make this transition possible by reinvesting revenues from allowance auctions into developing clean energy technologies. Our options are not limited to capping carbon emissions rather we can and should encourage complementary policies including smart growth measures, green building policies and efficient electricity policies.

Whatever legislation we enact, it must not hinder the States ability to go above and beyond federal standards. States around the country, Maine being one of them, have taken far greater steps than our current Administration to curb carbon emissions. Any federal legislation must set a baseline not a ceiling on states' ability to continue to fight climate change.

There will be costs associated with climate change legislation. That is undeniable. What is crucial is how we choose to manage these costs and minimize impacts on consumers. Revenues from auction allowances should be allocated to the public to assist low and moderate income households offset possible higher energy costs. Auction revenues should be used to invest in research and development into new green technologies.

This is also a great economic opportunity. I firmly believe that in the long run, climate change legislation has the potential to stimulate economic growth. The middle class jobs of the twenty first century will be in the field of energy technology, and that industry's job growth will be driven by policies enacted by Congress to combat climate change.

Finally, we cannot neglect communities that are already facing impacts from warming and will continue to do so as the fight over climate legislation drags on. New legislation should provide financial assistance to help state and local governments respond and adapt to impacts from sea level rise, intensified droughts, water scarcity and additional public health impacts.

Mr. Chairman, cleaner air and a comprehensive strategy to combat global climate change go hand-in-hand with energy independence and in my opinion must be part of this Subcommittee's long-term strategy. I look forward to working with you to achieve this goal.

STATEMENT OF HON. MARY BONO MACK

Mr. Chairman, thank you for this time to provide a few brief comments regarding today's hearing on various climate change policy proposals.

Let me first say that I recognize the breadth of this issue and the daunting task ahead of this Committee in moving forward with eventual legislation. Given other proposals being introduced and further refined, I am confident that the proper venue for this legislation to be debated and considered is this Committee. We've got an excellent cross-section of the country represented and have been deeply enmeshed in some of the most intense and difficult energy debates of the past decade; it is my hope that this Committee can continue to be the foundation by which any policies relating to climate change will be pursued and enacted.

I know other Members, much like me, have been hearing from residents in their districts regarding the price of energy over the last few months. Almost exclusively it's what I'm hearing about when I'm at home on the weekends or in my office here in DC when constituents call. What we're having a hearing on today is definitely related to the future prices our residents will see for years to come. That's one reason why the debate must be extensive, as the passion and focus of our constituents is reflected in how the public is affected by rising prices.

Most of these climate change proposals about which we'll learn more today have within them a fundamental common theme, that is, they will likely raise the price of energy in our country. This doesn't only apply to individual consumers, but to various other sectors of our economy, from electric utilities to the transportation industry.

Representing southern California puts my district at a unique place in this debate, much as the issues or concerns with various approaches affect regions of the country differently. As an example, Mr. Chairman, it's going to get to around 115 degrees in parts of my district today. The need for air conditioning is clear, and I don't see demand decreasing anytime soon. It's really a matter of life or death for many older residents as well, much like the winter months affect energy needs in the northern portions of our country in the winter.

But this same area of southern California also has great potential already being realized in renewable energy sources; wind, solar, and geothermal energy development is likely to rapidly increase, I'd like to think in part thanks to some of the provisions we debated with the EPAct legislation a few years ago. Residents come to visit, retire, and raise families in this area, and they're also often initially attracted by the beautiful environment that surrounds them. I've been committed on their behalf to protecting that unique economic and human health resource ever since I came to Congress.

Because of this, as you may know Mr. Chairman, I am open to examining a system by which we can achieve carbon dioxide emissions reductions. The complexities of any solution are going to involve more insight, analysis, and technological projections than nearly any other concept we've tackled on this Committee. It's a complex undertaking, but one that we began last year and I think on which we continue to take a reasonable approach.

We know that the consequences of our actions will affect our entire domestic economy, and yet we've also got to keep a mind toward how the benefits of any policy can be utilized by others. For our efforts to have any real effect, the international community must also engage on substantive reforms.

I know much of our focus today will be on various "cap and trade" approaches, and I look forward to hearing the effects they will have on our environment as well as our global economy. The facts are pretty clear in our local economy, as I'm hearing about the high price of gasoline and diesel fuel and its effect already on the residents of California's 45th District. These families are already seeing how increased energy prices are forcing them to change the way that they conduct their lives. The local industries, including housing construction are also seeing a severe downturn, not to mention the fact that Riverside County had the largest number of foreclosed homes in the State. Our area's foreclosure rate was the fifth-highest in the entire country last month. It is with this in mind that we must be careful about imposing new mandates.

In the end, hearing the concerns expressed by my constituents lately, from small independent truck drivers to school teachers on the effects high energy prices have on their lives, my focus remains with a few important factors: the costs to our society, both individual and industrial, the benefits to our global environment, and focusing on solutions that are based in technologies we can deploy effectively and efficiently, from carbon capture to incredible new renewable and alternative energy options.

Thank you Mr. Chairman and I look forward to hearing from our numerous panelists today. I yield back the balance of my time.

AXPC American Exploration & Production Council

News Release

Date: Thursday, May 29, 2008
Contact: Bill Whitsitt, AXPC President
(202) 742-4300

Senate Climate Bill Puts Natural Gas Supply at Risk
Consumers could see significant near-term price increases

Washington, DC, May 29, 2008 – The American Exploration & Production Council (AXPC) announced today that a new Wood Mackenzie study shows climate policy legislation to be considered by the Senate as early as next week could force a reduction in natural gas supplies and a significant price increase for consumers.

International energy research and consulting firm Wood Mackenzie, one of the foremost experts on North American energy, has provided this independent estimate of the potential risks to the economic development of US natural gas resources. These impacts could result from pending legislation that would require natural gas processors to purchase "cap and trade" program emission allowances for ultimate end-users of natural gas.

Wood Mackenzie found that as much as 32% of expected natural gas supply in the year 2012, rising to more than 45% in 2017 could be put at risk if natural gas exploration and production companies are forced to bear the emission allowance costs of those ultimately burning the gas. Even if 50% of the costs are somehow passed to consumers, expected supplies would be reduced by 5% to 14%, at a time when most studies find that the need for natural gas supplies will be growing. The Wood Mackenzie analysis warns of "...sharply higher prices in response to any threat to US natural gas supplies."

The analysis by Wood Mackenzie (available at www.axpc.us) was contracted by the American Exploration and Production Council (AXPC) which represents 25 of the largest independent US exploration and production companies that are high-tech leaders in finding and developing natural gas supplies throughout North America.

"This finding, stunning as it is, reflects the reality of a very sophisticated and reliable natural gas market that could be severely disrupted by wrong policy choices," said David Trice, Chairman of AXPC and the Chairman and CEO of Newfield Exploration Company. "Member companies invest all their cash flow and multiples of their profits to grow reserves of our cleanest fossil fuel and to increase production. These efforts are paying off. It is inconceivable that policymakers would enact climate legislation that could have anything even approaching the potential effects cited by Wood Mackenzie."

The Wood Mackenzie report built on data from previous third party research that projected costs associated with natural gas processors buying emission allowances for the gas they eventually put into the market for end-users. However, processors are often the producers. In addition, existing third-party processing agreements probably do not contemplate processors' cap and trade program consumer allowance payments. And since producer natural gas sales contracts are generally based on market indexes and similar consumer-driven price determinations as opposed to being tied to producer costs, it is likely that a significant share of government-imposed consumer emission allowance costs assessed on processors would actually be paid by exploration and production companies in the near term as funds are diverted, contracts are renegotiated, and the market adjusts to this new commodity burden. Previous analyses using long-term market balancing models to analyze pending Senate climate legislation do not capture the potential effects of these factors on supply availability, as does the Wood Mackenzie proprietary North American modeling and analysis.

The full Wood Mackenzie report is available at www.axpc.us.

The American Exploration & Production Council represents 25 of the largest US independent exploration and production companies, high-tech leaders in finding and developing natural gas supplies throughout North America.

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Wood Mackenzie

May 29, 2008

Impact Assessment of Consumer Emission Allowance Costs under the Lieberman/Warner *Climate Security Act of 2007* on US Natural Gas Production

Summary

If consumer emission allowance costs under the Lieberman/Warner *Climate Security Act of 2007*, and pending substitute legislation, are born by US natural gas producers, US natural gas production will be reduced.

Introduction

The American Exploration and Production Council (AXPC), has requested that Wood Mackenzie provide an independent and objective estimate of the potential risks to the economic development of US natural gas production, from 2012 – 2017, resulting from added costs associated with the Lieberman/Warner Climate Security Act of 2007 ("Lieberman/Warner"), as well as pending substitute legislation. These costs result from the requirement under Lieberman/Warner that natural gas processors and/or producers purchase allowances for consumer emissions. Wood Mackenzie has been asked to provide estimates of potential US natural gas production changes associated with the upstream sector's absorbing 100% and 50% of the allowance cost of consumer emissions that might result from this legislation.

Wood Mackenzie is an international energy research and consulting firm, based in Edinburgh, Scotland, providing commercial analysis and strategic advice to the world's leading energy companies. Wood Mackenzie has developed a unique formulation of knowledge, experience and understanding of a broad range of markets and companies. More than 80 companies from all sectors of the energy business subscribe to Wood Mackenzie's North American Gas Insight service. As such, Wood Mackenzie's views, including any US natural gas production changes that might result from cost and/or policy shifts, are independent of any single sector of the energy business.

Estimates of total annual allowance costs of consumer emissions resulting from Lieberman/Warner are based on those contained on page ES20 of the ICF International report submitted to the American Petroleum Institute, dated April of 2008, titled "Addendum to Impact Assessment of Mandatory GHG Control Legislation on the Refining and Upstream Segments of the U.S. Petroleum Industry, Lieberman/Warner Climate Security Act of 2007, S. 2191." As such, these cost estimates were not developed by Wood Mackenzie, and Wood Mackenzie makes no representation regarding the validity of these estimates. These estimated costs from the ICF report range from $39.620 billion in 2012, to $59.891 billion in 2020.

Summary of Findings

Costs of this magnitude, if born by US natural gas producers, would place a substantial portion of US production at risk.

- If 100% of the consumer emission costs are born by producers, approximately 32% to 46% of expected US production during the years 2012 – 2017 becomes uneconomic to develop, and many higher-cost prospects would not be drilled. These percentages correspond to

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approximately 18.1 to 25.9 billions of cubic feet per day (Bcfd), out of a US natural gas production base expected to range from 56.0 to 56.7 Bcfd during that period.

- If half of the consumer emission costs are born by producers, approximately 5 – 14% of US production becomes uneconomic to develop, corresponding to approximately 3.1 to 7.6 Bcfd of production placed at risk for lack of development.
- The costs addressed in this study are in addition to the direct emission allowance costs associated with exploration and production activity and processing facilities, as addressed in the ICF study for the API. According to ICF, those costs range from $6.8 billion in 2012 to $9.1 billion in 2020. If producers were to bear all of these costs in total, production at risk would be greater than found in this report.

In Wood Mackenzie's view, increased reliance upon natural gas for power generation in the US will drive sharply higher prices in response to any threat to US natural gas supplies. These higher prices would allow an adequate return once again for the development of at least a part of this production placed at risk. However, the speed of this market response, and the amount of production lost as a result, is uncertain. This uncertainty alone is likely to affect for a time producer capital budgets, and the supply of a fuel on which the US will increasingly rely.

Methodology

Wood Mackenzie utilizes the GPCM model as the engine for analyzing the effects of shifts in supply and demand in North America on prices, pipeline flows and basis. GPCM is a linear-programming model that reconciles supply, demand, price and flows throughout the North American gas marketplace and infrastructure set. Wood Mackenzie has invested 3+ years in enhancing the accuracy and detail within this model for various pipeline systems and storage facilities. In addition, WM uses its own analysis to populate the supply and demand data within this model, as well as the supply and demand elasticity assumptions. As such, supply curves are contained within Wood Mackenzie's version of the GPCM model, and are consistent with Wood Mackenzie's own upstream analytic teams' views of costs of production in given producing areas within the US.

In this assignment Wood Mackenzie has:

1) Reduced prices at supply nodes in the GPCM model by the per MMBtu costs consistent with the ICF/API report, by amounts representing 100% and 50% of consumer emission allowance cost absorption by producers. The original prices at each supply node are as contained in Wood Mackenzie's most recent available Base Case GPCM model run. As such, no effect on consumer prices, or demand response, is considered in this production change estimate.

2) Calculated the reduction in economic production volumes at each major supply basin resulting from each price reduction. These individual supply reductions are according to the development cost supply curves currently contained in Wood Mackenzie's GPCM model, as consistent with Wood Mackenzie's upstream teams' analysis of development costs for natural gas reserves in various producing basins the US.

3) Aggregated all estimated supply reductions for each basin into a US total.

Each of these steps is described in more detail in the remainder of this report.

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Step 1A: Development of the Consumer Emission Allowance Costs per Mcf

To develop an estimate of consumer emission allowance costs per thousand cubic feet (Mcf) of production, Wood Mackenzie divided the total annual cost figure from the ICF/API report by the expected US annual production volume in Wood Mackenzie's Base Case. These results are illustrated in Table 1 below:

Table 1: Production Outlook by Basin, and Consumer Emission Allowance Costs per Mcf

Production (MMCFD)	2012	2013	2014	2015	2016	2017
Eastern US	2,900	2,989	3,074	3,159	3,263	3,349
Gulf Coast	14,437	14,189	14,020	13,861	13,995	14,001
Gulf of Mexico	3,367	3,199	3,049	2,912	2,831	2,753
Deepwater	3,480	3,379	3,454	3,722	3,734	3,617
Barnett Shale	4,357	4,333	4,236	4,157	4,106	3,948
Mid-Continent	8,101	8,188	8,269	8,386	8,512	8,476
Permian Basin	3,585	3,547	3,492	3,425	3,421	3,413
Rocky Mountains	12,107	12,218	12,314	12,445	12,587	12,694
San Juan Basin	3,508	3,374	3,275	3,153	3,061	2,964
West Coast	651	632	614	595	584	572
Total	56,722	56,275	56,018	56,034	56,311	55,994
Annual Prod. (TCF)	20.70	20.54	20.45	20.45	20.55	20.44

ICF Cost	2012	2013	2014	2015	2016	2017	2020
Carbon Price	41.21	42.94	44.67	46.40	48.58	50.76	57.31
Consumer Allowances	39,620						59,891
Spread	39,620	41,669	43,749	45,860	48,565	51,319	59,891

Allowance Cost per MCF						
2006$	1.91	2.03	2.14	2.24	2.36	2.51
2008$	2.01	2.13	2.25	2.36	2.48	2.64

The ICF/API report provided an estimate of annual costs for the years 2012 and 2020. Wood Mackenzie interpolated between the two years, and divided the costs, in billions of dollars ($2006) by the total US production volume. For example, for 2012, $39.62 billion was divided by 20.70 trillions of cubic feet (Tcf) to obtain a cost figure of $1.91 per thousand cubic feet (Mcf). This was escalated forward by 2 years at 2.5% annually to obtain the $2008 cost figure of $2.01 per Mcf. Wood Mackenzie's estimates of development costs by production area within each major basin are in 2008 dollars. An assumption implicit within this estimate is that consumer emission allowance costs are applied uniformly to all natural gas. Depending upon how the legislation may be interpreted, differing impurities contents and efficiencies of transporting and using natural gas could result in differing charges; however, such differences are difficult to quantify and should not vary significantly from a broader US average.

More importantly, Wood Mackenzie's supply outlook is relatively stable over the 2012 – 2017 time period, as US production plateaus. Growth in and increasing reliance upon more expensive, unconventional resource plays no longer offsets declines in existing production over this

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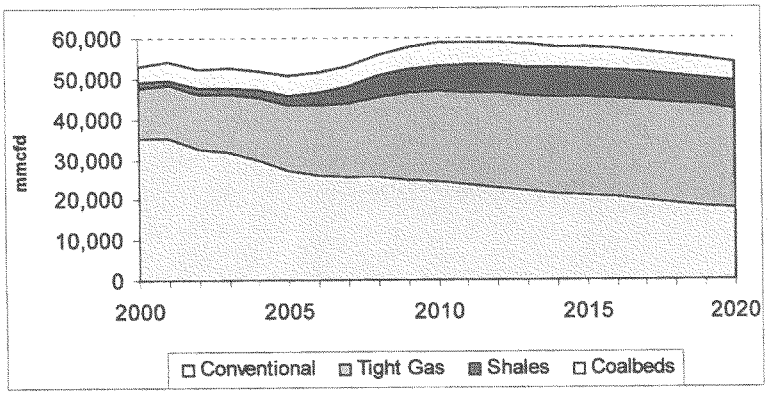
time period. The increased reliance upon unconventional production, from formations such as tight gas reservoirs, shales, and coal beds is illustrated in Figure 1 below:

Figure 1: US Natural Gas Production: Growing Reliance upon Unconventional Resource Plays



In Figure 1 above, the percentage of total US production represented by on average higher cost, unconventional resource plays grows from nearly 55% today (2008), to 61% in 2012, and to 65% by 2017. Although greater experience with unconventional production techniques can slow the increase in development costs associated with these types of plays, Wood Mackenzie's development cost outlook is stable or slightly rising over this period due to greater reliance upon historically unconventional production resources.

Step 1B: Natural Gas Prices Available to Producers

Wood Mackenzie's price outlook at the Henry Hub and the average price available to producers within each basin at the model supply nodes, analogous to the wellhead, are listed in Table 2 below.

Table 2: The Price Outlook Assumption - $2008 per Mcf

Price ($/MCF)	2012	2013	2014	2015	2016	2017
Henry Hub	6.94	6.99	7.04	7.07	7.39	7.72
Avg. Producer						
Eastern US	6.99	7.02	7.20	7.27	7.50	7.68
Gulf Coast	6.28	6.23	6.32	6.37	6.73	6.98
Gulf of Mexico	6.62	6.55	6.60	6.62	7.01	7.25
Fort Worth	6.00	5.99	6.00	6.00	5.98	6.00
Mid-Continent	6.26	6.24	6.31	6.32	6.66	6.89
Permian Basin	6.00	6.17	6.26	6.30	6.60	6.88
Rocky Mountains	6.07	5.77	5.97	5.95	6.22	6.33
San Juan Basin	6.18	6.11	6.20	6.23	6.66	6.84
West Coast	6.37	6.29	6.34	6.34	6.74	6.94

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These prices are consistent with Wood Mackenzie's analysis of supply/demand fundamentals for natural gas in the US, world oil prices, and import/export balances. Oil prices within this period are expected to fall within an approximate $70 - $75 price range per barrel for West Texas Intermediate (WTI) crude oil. Natural gas prices rise over this time frame as US production plateaus (see Table 1 above), demand pressure continues to build especially in power generation markets, and the US requires increasing volumes of natural gas imports from other world markets, which themselves often price with tighter links between natural gas and oil prices.

Again, these prices are not assumed in this analysis to change as the result of any emissions allowance costs imposed on US natural gas producers.

Step 2: Development Cost Curves – The Cost of Developing Natural Gas Production in US Producing Basins

Wood Mackenzie's research and consulting practice includes teams of upstream analysts which provide independent production outlooks for major producing basins while maintaining constant contact with US producers. These teams focus on providing analytic products covering the US Gulf of Mexico, the Mid-Continent, the Gulf Coast, Permian, San Juan and the Rockies producing areas. Direct coverage of the eastern US is also under development. Because this analytic coverage includes the Arkoma Basin, the Rockies, and the Fort Worth Basin, Wood Mackenzie's direct coverage includes between 90% and 95% of all US production expected during the 2012 – 2017 time period.

Development costs, those costs required to initiate an economic production stream at an attractive rate of return, once reserves are found, include such costs as drilling costs, service costs, labor, and materials, as well as equity return. These are analyzed directly by these teams within Wood Mackenzie for a variety of individual production "plays" within each larger basin area. Analytic detail varies, from development costs of proven, probable, and yet-to-find resources by field in the Deep Water Gulf of Mexico, to individual estimates of 93 separate plays in the Gulf Coast region. A high-cost stack of production economic at each dollar increment from $7 - $12 is also provided for each basin.

The development cost curves provided in the graphics below are, in Wood Mackenzie's view, on balance conservative (lower than many producers would face in reality), in that they include no aspect of finding costs, which producers might expect even in some established plays. Such finding costs include acquisition of seismic data that may exist, and land and acreage mineral rights. In addition, the development costs included are computed allowing only a 10% rate of return, lower than many producers' hurdle rates (often 15% or more) for investing in new projects. Partly offsetting this conservatism, development costs for certain production plays are developed at the processing plant or major marketing hub, whereas the pricing within the model provided in part 1B above is at the wellhead. However, on balance cost conservatism likely is greater than any mismatch in location between the pricing data and development costs provided. As such, these curves are likely lower, and the effect on production somewhat more limited, in the results provided below than they otherwise might be.

Development costs in individual areas are highly proprietary to Wood Mackenzie's clients. However, Wood Mackenzie is pleased to provide the curves below for the most significant production areas for six separate regions for the years 2012 and 2017 (twelve separate graphics).

Each of the curves below illustrates the original modeled basin price and production volume (in *red*), as well as the shift in price and economic volume associated with imposing 50% of the allowance costs of consumer emissions (in *blue*), and the further shift in price available to producers and economic volume associated with producers' bearing 100% of the allowance costs of consumer emissions, as developed in the ICF/API report (in *purple*).

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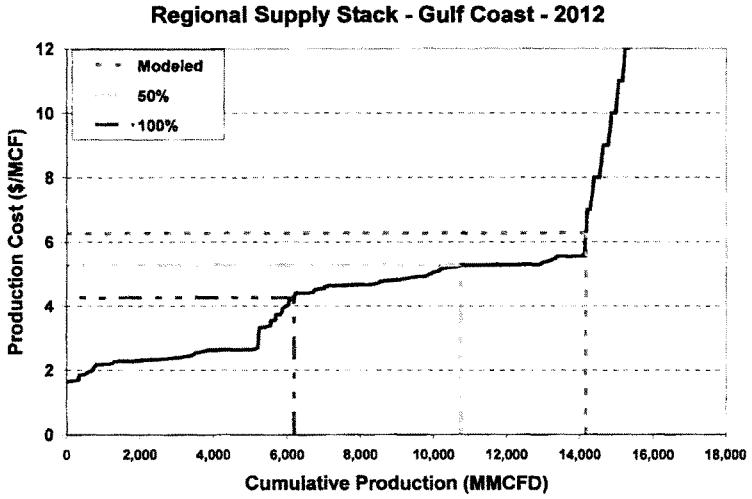
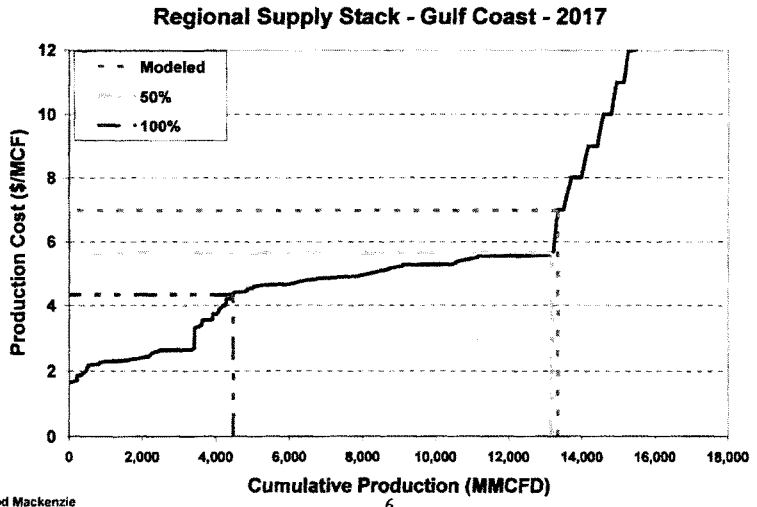
Figures 2-13: Development Cost Curves in Six Separate Regions, 2012 and 2017

Figures 2 and 3: The Gulf Coast Region





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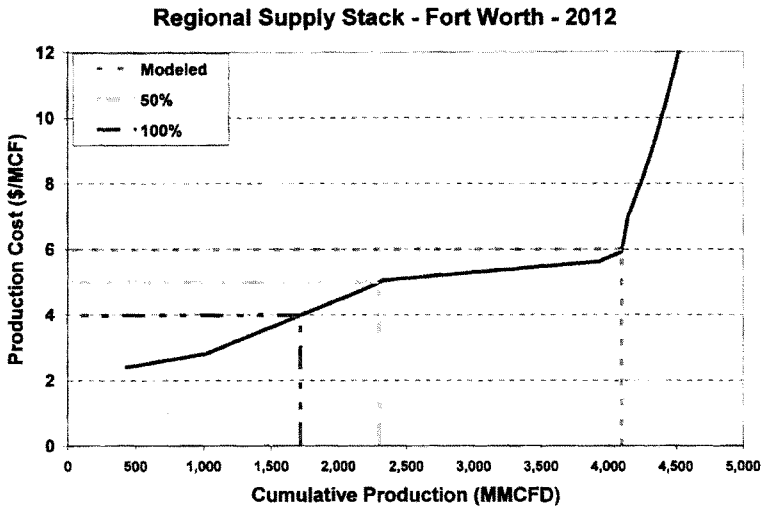
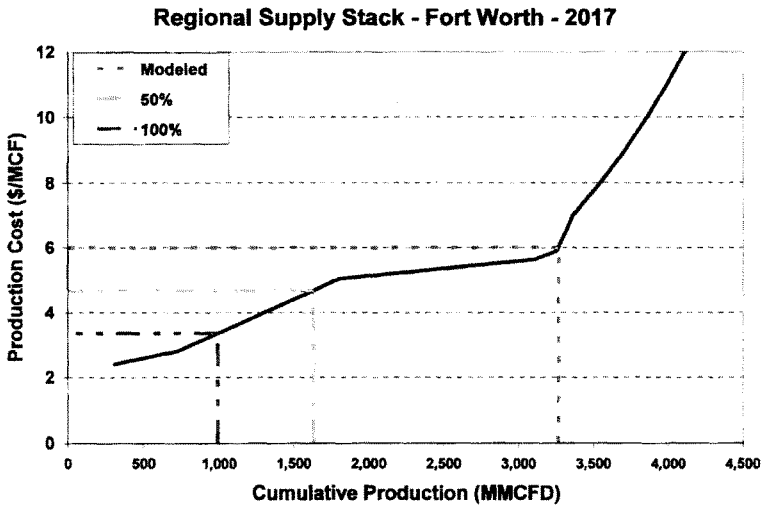
Figures 4 and 5: The Fort Worth Basin





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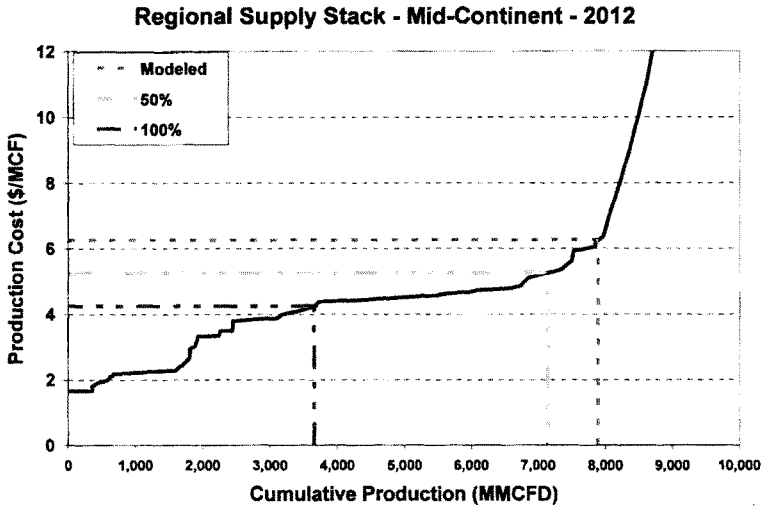
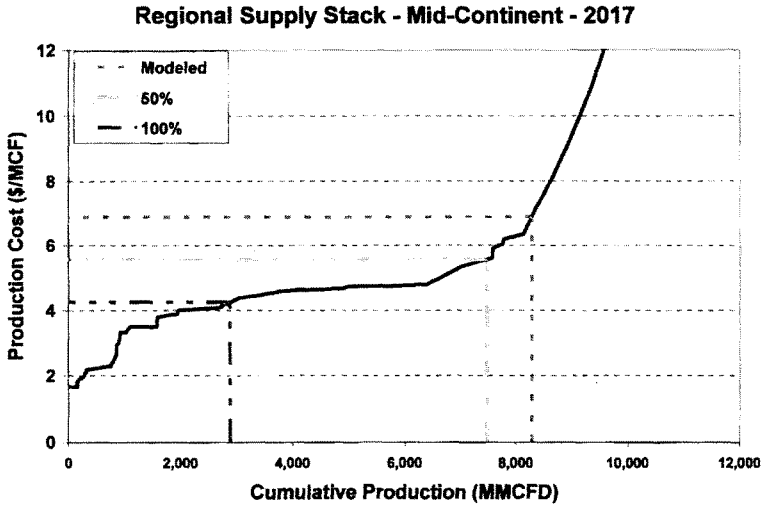
Figures 6 and 7: The Mid-Continent





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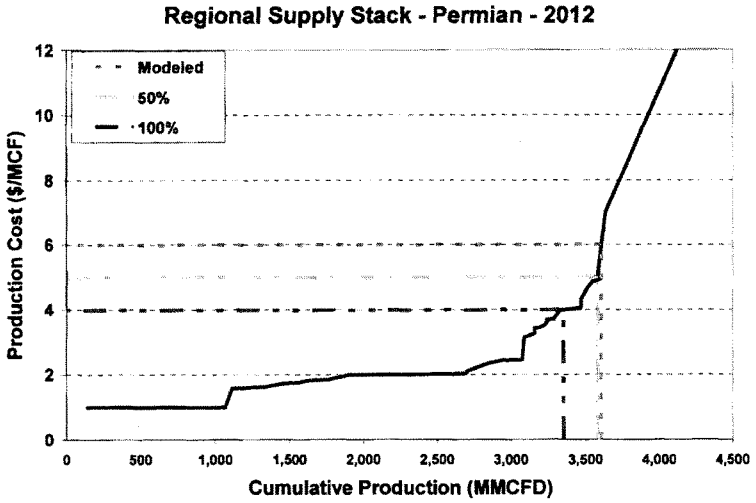
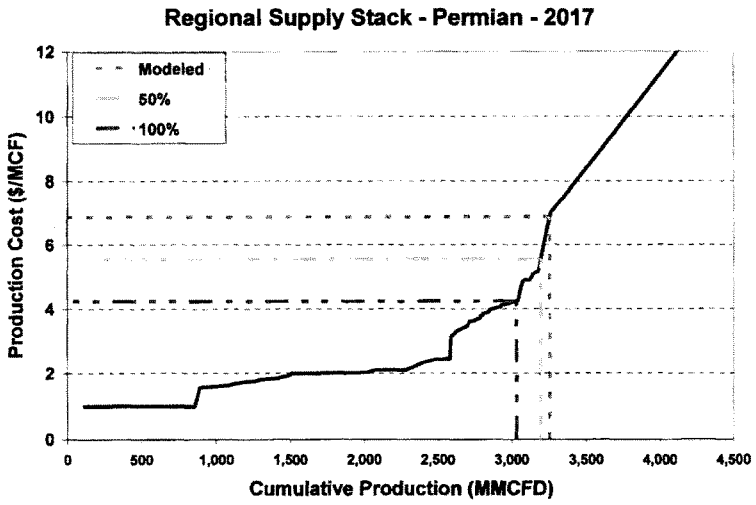
Figures 8 and 9: The Permian Basin





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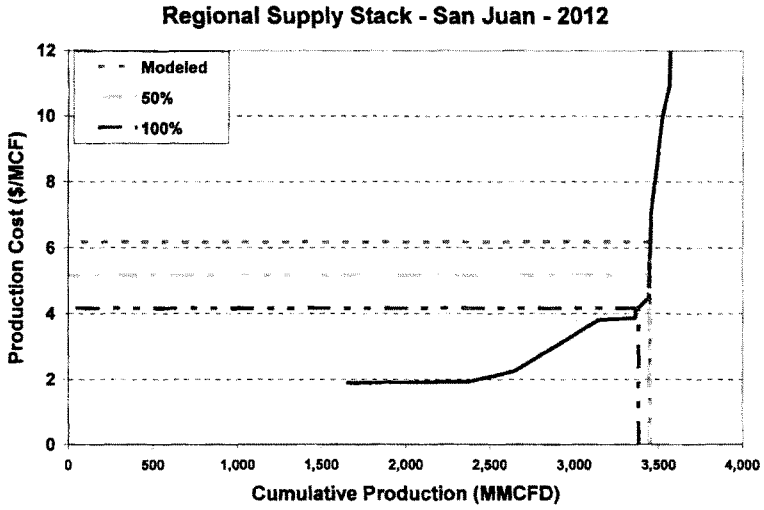
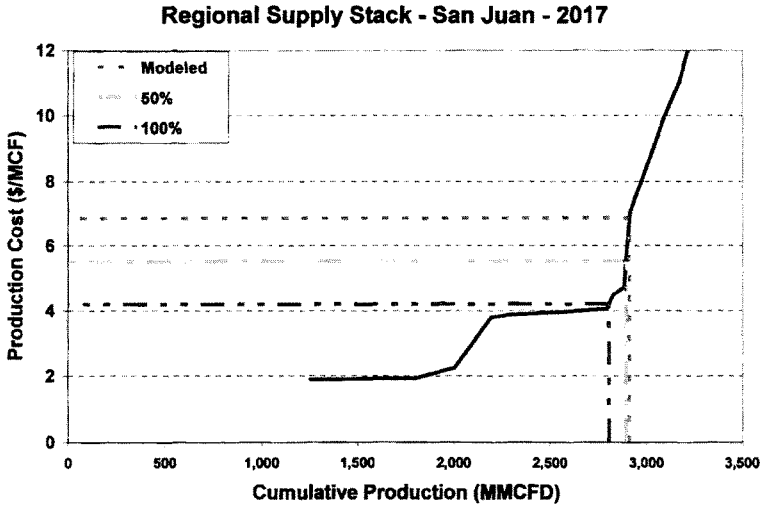
Figures 10 and 11: The San Juan





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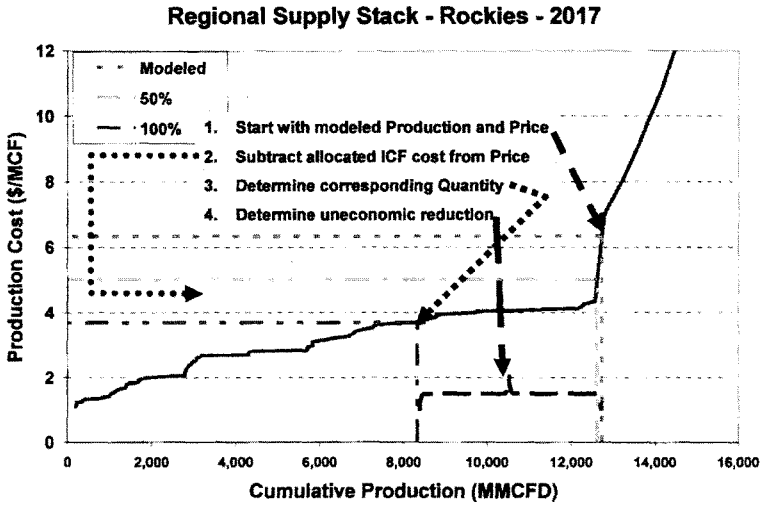
In general, the supply curves move up over time; however, the expected price does as well. Especially important to note is that in some regions, including the Rockies above, prices are above costs in most producing areas, so that even after allocating 50% of the allowance costs of consumer emissions to producers, economic production volumes do not decline proportionately to a 100% allocation. Costs in individual plays do not necessarily increase in a linear manner. In addition, the pattern of sharp increase in costs at high production levels was developed based on historic experience with supply responses to extreme prices, within each region.

Major potential producing areas in the Gulf Coast, Mid-Continent, and Fort Worth basins become uneconomic to develop as costs are imposed upon producers. Production in the Rockies would also be hit, whereas production in some of the older producing areas, including the Permian and San Juan basins, is, in relative terms, less affected.

A simplified illustration of the use of these curves to determine the change in economic producing volumes is provided for the Rockies in the year 2017 in Figure 14 below.

Figure 14: Determining a Reduction in Economic Production Volumes as Prices Available to Producers are Reduced



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Step 3: Aggregation of All Reductions in Economic Production Volumes

Adding the volumes that become uneconomic to produce as 50% and 100% of the allowance costs of consumer emissions are born by producers results in the reductions shown in Table 3 below.

Table 3: Absolute and Percent Production Volumes which become Uneconomic to Develop as 50% and 100% of the Allowance Costs of Consumer Emissions are Born by US Natural Gas Producers

	2012	2013	2014	2015	2016	2017
Modeled Production (MMCFD)	56,722	56,275	56,018	56,034	56,311	55,994
Expected Uneconomic Volume (MMCFD)						
50% Case	6,100	7,094	7,224	7,637	5,220	3,054
100% Case	18,130	21,910	22,691	25,930	24,802	25,303
Expected Uneconomic Volume (%)						
50% Case	10.8%	12.6%	12.9%	13.6%	9.3%	5.5%
100% Case	32.0%	38.9%	40.5%	46.3%	44.0%	45.2%

Tables 4 and 5 below provide numeric results for each major producing area, for the 50% and the 100% cases respectively. .

Table 4: Basin Results – 50% of Costs Born by Producers – Avg MMcfd

	2012			2017		
	Modeled Production	Remaining Economic Production	Uneconomic Volume	Modeled Production	Remaining Economic Production	Uneconomic Volume
Eastern US	2,900	2,898	(2)	3,349	3,239	(110)
Gulf Coast	14,437	11,025	(3,413)	14,001	13,844	(157)
Gulf of Mexico	6,847	6,786	(61)	6,370	6,216	(154)
Fort Worth	4,357	2,559	(1,797)	3,948	2,315	(1,633)
Mid-Continent	8,101	7,346	(755)	8,476	7,672	(804)
Permian	3,585	3,563	(22)	3,413	3,352	(61)
Rockies	12,107	12,064	(43)	12,694	12,580	(114)
San Juan	3,508	3,503	(5)	2,964	2,947	(18)
West Coast	651	649	(2)	572	567	(4)
Total	56,493	50,393	(6,100)	55,786	52,732	(3,054)

Table 5: Basin Results – 100% of Costs Born by Producers – Avg MMcfd

	2012			2017		
	Modeled Production	Remaining Economic Production	Uneconomic Volume	Modeled Production	Remaining Economic Production	Uneconomic Volume
Eastern US	2,900	2,896	(4)	3,349	3,234	(115)
Gulf Coast	14,437	6,463	(7,975)	14,001	5,128	(8,873)
Gulf of Mexico	6,847	5,252	(1,594)	6,370	2,466	(3,904)
Fort Worth	4,357	1,978	(2,379)	3,948	1,674	(2,273)
Mid-Continent	8,101	3,863	(4,238)	8,476	3,078	(5,398)
Permian	3,585	3,331	(254)	3,413	3,188	(226)
Rockies	12,107	10,493	(1,613)	12,694	8,295	(4,399)
San Juan	3,508	3,439	(69)	2,964	2,857	(107)
West Coast	651	647	(4)	572	563	(9)
Total	56,493	38,363	(18,130)	55,786	30,483	(25,303)

The supply elasticity is highest at these expected price levels in the Gulf Coast, with its multiple unconventional plays; the Mid-Continent; the Fort Worth; and the Rockies basins.

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May 16, 2008

The Honorable John Dingell
Chairman,
House Committee on Energy and Commerce
2125 Rayburn House Office Building
Washington, D.C. 20515

The Honorable Rick Boucher
Chairman,
Subcommittee on Energy & Air Quality
2125 Rayburn House Office Building
Washington, D.C. 20515

Dear Chairman Dingell and Chairman Boucher:

NPRA appreciates the opportunity to provide the following comments regarding the Committee's Climate Change White Papers. We commend the Energy & Commerce Committee for using this process to discuss the myriad issues raised by the implementation of any kind of greenhouse gas legislation. These papers as well as responses from interested parties are useful in outlining a number of concerns as well as solutions in addressing these issues.

It is imperative that Congress, the Administration, and all stakeholders work in a determined, but nevertheless cooperative effort to develop policies that achieve the desired balance of fuel supply and demand that affords necessary environmental improvements. At the same time, these policies must ensure continued economic growth and security. These goals are not and cannot be deemed mutually exclusive. NPRA therefore pledges to do our part in developing and communicating a fuller understanding of all factors surrounding these issues.

An honest discussion by this Committee and with the American people about the monumental economic tradeoffs and consequences inherent in any comprehensive climate change legislation will produce a better policy. NPRA applauds the Committee for consistently focusing the discussion in all three White Papers on the impacts that any legislation in this area will have on future household energy costs and potential job losses – two extremely volatile variables which will have to be ultimately absorbed by the American consumer. Various domestic industrial sectors can, will, and should make numerous valid arguments about the impact of legislation on their bottom lines. At the end of the day, however, the merits of any legislation adopted must pass final muster by the American consumer – can the objectives of any comprehensive measure on climate change actually be achieved without causing massive economic hardship to be disproportionately visited upon this country and, if so, are they worth it?

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Climate change is a global issue requiring a global approach. Without the involvement of the international community, particularly major economies, any climate change policy adopted unilaterally by the United States will be ineffective. Reducing CO2 emissions in the United States alone under any of the current legislative proposals, while emissions in developing countries like China and India are skyrocketing, will not accomplish anything to solve what is perceived to be a global problem. Instead, we will simply put the brakes on our economy, and transfer American jobs and wealth overseas, where the increased industrial activity in countries with less stringent environmental regulations will very likely lead to increased pollution and greater global concentrations of CO2 emissions.

Since climate change is a global issue requiring a global approach, results will be maximized through a predominant federal effort. Such an outcome requires that existing state and regional greenhouse gas regulations be preempted by federal legislation. This is necessary to avoid an inefficient and ineffective patchwork of conflicting federal, state and regional regulations.

Any cap-and-trade approach must ensure a fair allocation of allowances. In implementing the allocation process, the government should not be in the business of choosing winners and losers. NPRA believes a broad, national approach should ideally be based on an energy efficiency initiative that affects everyone. Such a framework would expand the audience and the participants of any GHG regulatory program and would not single out any specific or select group of industrial sectors. Each specific sector's carbon footprint should be taken into account when allocations are determined. Additionally, since it is foreseeable that refiners could face potentially competing regulations under both a Renewable Fuels Standard and a cap-and-trade program, any proposal should provide certainty regarding how both RFS credits and imported gasoline will be treated in terms of allocations. It is imperative that Congress recognize existing federal motor fuels policy and work to avoid duplicative, costly and potentially competing and conflicting new regulations while addressing fuels in climate legislation.

Natural gas supply must be expanded for any U.S. climate change policy to be economically viable. It is important to recognize that any restriction on carbon emissions will likely lead to an increased demand for natural gas through fuel switching, particularly a cap-and-trade approach with stringent early reduction targets. American industry has already been hurt by the high prices brought about by a tight natural gas supply – particularly industries for which natural gas is an important feedstock. The chemical industry is a prime example: of the 120 major new chemical plants currently being built worldwide, only one of them is being built in the United States, while 50 are being built in China. Further tightening of the natural gas supply will only serve to worsen the situation and send more American jobs overseas.

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NPRA is providing the following specific comments regarding the three papers that have been released:

A Realistic Climate Policy Ensures Global Participation and National Uniformity

We agree with the statement from the Committee's second White Paper that "in the absence of significant developing country commitments, unilateral action by the U.S. could harm the competitiveness of our industries in world markets and result in the loss of American jobs."[1] Not only should any legislation contain meaningful mechanisms for international participation, but the time frame for implementing such mechanisms is critical to American competitiveness. The bill currently moving through the Senate does not institute any of its international control frameworks until several years after a U.S. program starts. Such a situation could create significant migration of energy-intensive American industries in that time period.

Even if there is significant participation from other developed countries, the Committee's second white paper correctly acknowledges action is needed in developing countries as well. EPA's analysis of S. 280 (McCain-Lieberman) and S. 1766 (Bingaman-Specter) show that without significant international participation, enactment of either bill would result is almost no global GHG reduction.[2] Significant international participation is particularly important given future demand projections. The Committee's second White Paper acknowledges this reality in quoting the International Energy Association's 2007 World Energy Outlook, which states that by 2030, developing countries "contribute 74 percent of the increase in global primary energy use" and that "China and India alone account for 45 percent of the increase."[3] The second White Paper also notes that China will soon overtake the U.S. as the world's largest emitter.

As previously mentioned, America is already seeing new chemical sector jobs springing up overseas instead of here at home. In addition to the chemical sector, failure to ensure imported gasoline and distillate fuels are treated equitably from a GHG regulatory standpoint – and ensuring foreign countries cannot offset U.S. regulations through subsidizing their own industries – is critical to preventing a greater American reliance on imported petroleum products. NPRA believes any cap-and-trade legislation that is not accompanied by significant international participation will dramatically hamper American competitiveness without achieving any GHG reductions.

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[1] House Energy & Commerce Committee, "Climate Change Legislation Design White Paper: Competitiveness Concerns/Engaging Developing Countries," January 2008, p. 6.

[2] U.S. Environmental Protection Agency, "EPA Analysis of The Climate Stewardship & Innovation Act of 2007: S. 280 in the 110th Congress," July 16, 2007, p. 58; "EPA Analysis of the Low Carbon Economy Act of 2007: S. 1766 in the 110th Congress," January 15, 2008, p. 107.

[3] Energy & Commerce Committee, "Competitiveness Concerns," p. 4.

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The third White Paper states, "If a patchwork of State or local programs that imposes a burden on interstate commerce causing inefficient or wasteful resource allocation, that factor would weigh in favor of the Federal government having the exclusive or primary role for that portion of a comprehensive climate change program."[4] NPRA agrees that state and regional GHG regulations should be preempted by federal legislation. It is necessary to avoid an inefficient patchwork of conflicting Federal, state and regional regulations. Without explicit Congressional preemption, the result could be a proliferation of state GHG regulations with the potential for considerable interference with the implementation of federal provisions. As an example, the Energy Policy Act of 2005 included a federal Renewable Fuel Standard without explicit state preemption and state legislatures in Louisiana, Missouri, and Washington in 2006 and Oregon in 2007 passed ethanol and/or biodiesel mandates. This could result in negative impacts on fuel supplies and considerable interference with federal RFS provisions (e.g., credit trading, banking credits, identifying liable or obligated parties).

Furthermore, not preempting state programs effectively allows a State to place a greenhouse gas obligation on products that are produced in another state. As the third white paper notes, such a scenario would "just shift the location of, rather than decrease national emissions because the sources subject to the more stringent program will need fewer allowances (thus freeing up allowances for sources in other States)."[5] This would apply to wide array of products including some that are energy-intensive such as aluminum, cement, gasoline, steel and paper products. Such a scenario would clearly impose a burden on interstate commerce, resulting in an inefficient resource allocation. This situation would also apply to sources that operate in the United States and choose to shift their operations to portions of the world that do not require reductions in greenhouse gas emissions.

Finally, NPRA agrees with the third White Paper's concluding statement that "motor vehicle greenhouse gas standards should be set by the Federal government not by state governments: greenhouse gases are global (not local) pollutants, multiple programs would be an undue burden on interstate commerce and would waste societal and government resources without reducing national emissions, and the competing interests of different States should be resolved at the Federal level."[6]

Sharing the Burden: Ensuring a Fair Allocation of Allowances

NPRA believes a fair and equitable allocation of allowances must be a critical component of any cap-and-trade bill. In fact, the Committee's First White Paper essentially acknowledges this

[4] House Energy & Commerce Committee, "Climate Change Legislation Design White Paper: Appropriate Roles for Different Levels of Government," February, 2008, p. 22.
[5] Ibid, p. 11.
[6] Ibid, p. 25.

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point in its discussion of the industrial sector, stating, "the mechanisms for distributing allowances and addressing developing countries' obligations regarding their emissions could play critical roles in how a U.S. climate program affects the industrial sector."[7]

Unfortunately, at this point in the legislative session, the measure that has advanced the furthest in the process, S 2191 (the Lieberman-Warner Climate Security Act of 2007, or CSA) fails to achieve that principle. NPRA hopes the Committee will not follow that same inequitable path. In the CSA, the minimal allocation for petroleum fuels production places a compliance burden on the refining sector that greatly exceeds that of other industry sectors as both the product made and the refinery making it are regulated under the legislation. The transportation sector represents approximately 30 percent of the nation's total greenhouse gas emissions according to EPA's accounting of U.S. Greenhouse Gasses and Sinks (2005).[8] However, CSA allocates only 2 percent of its total greenhouse gas allocations to the refining industry in 2012. In addition, the refining industry is specifically excluded from receiving any additional allowance allocations from other sector categories. By comparison, the electric power industry generates more than 33 percent of the nation's greenhouse gases, yet is provided with an allocation close to 30 percent in 2012.

Given the scope of this inequitable distribution of allowances, this control paradigm is likely to have a significant upward impact on the cost of producing fuel and, in turn, our nation's domestic supply of gasoline, jet fuel, home heating oil and other petroleum-based products. The cost impacts are amplified because refiners have little control over the demand for fuels in the marketplace or vehicle efficiency technologies. In other words, the existing Senate structure essentially makes the refining industry pay disproportionately more for factors they can't control in relation to the treatment of other sectors covered in the legislation. The European Commission's proposed post-Kyoto cap-and-trade program seems to recognize these concerns. Reports indicate the Commission is considering initially providing 80 percent of the allocations necessary for the refining industry to produce petroleum-based fuels throughout the European Union. The vast difference in the allocation of allowances could result in a significant increase in motor fuels being imported in the United States. The bottom line here is clear: allocations must be fair and the Government must not be in the business of creating artificial winners and losers.

[7] House Energy & Commerce Committee, "Climate Change Legislation Design White Paper: Scope of a Cap-and-Trade Program," October, 2007, p. 14.
[8] U.S. Environmental Protection Agency, "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006," Table ES-7, p. ES-15.

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Do No Harm: Prevent Conflicting, Duplicative & Costly Fuels Regulation

A key principle to follow in developing policy recommendations is "do no harm." Well-intentioned legislation, especially involving energy and environmental policies, can and has had tremendous unintended negative consequences. The Committee does well in exercising caution by considering all potential impacts of new policy changes prior to imposing them on the refining sector which already faces significant operational challenges.

Along these lines, Congress must recognize existing federal motor fuels policy and work to prevent duplicative, costly and potentially competing new regulations while addressing fuels in climate legislation. We are concerned about some seemingly contradictory statements in the first White Paper on this topic. The paper states any climate program should cover "all emissions from all sectors" and that these should be counted "once and only once."[9] It also states, "all sectors should contribute their fair share."[10] On the other hand, it states refiners should be a focal point of regulation and that "for the transportation sector in the cap-and-trade program, a comprehensive climate change program will also regulate motor vehicle manufacturers through efficiency or other performance standards…such as a low carbon fuel program…." Finally, in discussing CAFÉ, the paper says fuel efficiency regulations for passenger vehicles are "the only current program that essentially puts a soft cap on greenhouse gas emissions from any sector."[11]

These statements suggest that the Committee is sensitive to the implications of the recently enacted renewable fuels mandate requiring refiners to operate in *a de facto* cap-and-trade system. The Energy Independence and Security Act (EISA, PL 110-140), adopted last December, dramatically expands the amount of ethanol that must be blended into the fuel supply. Refiners are responsible for turning in credits to show compliance with the volumetric standard in this program. Credits can be bought and sold on the market, very similar to other cap-and-trade programs. The renewable fuels required under EISA must also meet specific greenhouse gas (GHG) targets and the EPA is required to conduct lifecycle GHG analysis for specific fuels.

Concurrent with the establishment of this *de facto* GHG cap-and-trade program for certain mandated renewable fuels, Congress also inexplicably exempted or "grandfathered" ethanol produced from production facilities either in existence or under construction at the time of EISA's enactment from the GHG requirements. Many of these plants are coal fired plants. USEPA estimates that this "grandfathering" will have the effect of making 13-14 billion gallons of ethanol exempt from any GHG reduction requirement. Several recent studies have now quantified the GHG impacts of first generation biofuels and concur that they create an exponentially larger carbon footprint than conventional gasoline. As a result, it now appears that

[9] Energy & Commerce, "Scope of a Cap-and-Trade Program," p. 2.
[10] Ibid, p.3.
[11] Ibid, p. 13, 14.

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there will be in excess of 15 billion gallons of ethanol produced at some point over the next decade that ***must*** be blended into our nation's fuel supply and that will dramatically ***increase*** GHG emissions. These studies will be discussed further in the next section.

In addition, the ability of the motor vehicle fleet to handle significantly larger volumes of ethanol is already a challenge for the automobile industry. Currently, the only vehicles that can operate on fuel blended with more than 10 percent ethanol (known as "E-10") are so-called flex fuel vehicles (FFVs). The Alliance for Automobile Manufacturers, on their website, "www.discoveralternatives.org" notes there are currently 11 million alternative fuel vehicles on American roads out of the 240 million plus vehicles Americans are driving today. The National Ethanol Vehicle Coalition estimates that about 6 million of these vehicles are FFVs. In addition, over the next several years, automakers have indicated that while they intend to produce more FFVs, they will still be producing gasoline-only vehicles at a ratio of about seven or eight-to-one in relation to FFV output. The new ethanol mandate will most likely require fuel blends in excess of E-10, possibly as early as 2010. However, in addition to existing legacy fleets (e.g. cars that have been purchased up to this point in time that run only on gasoline and won't be retired for several years), there will be a new class of vehicles that may be unable to operate on mandated fuel blends. This is particularly important fact in light of the reality that engine and fuel pump makers will not provide warranties for equipment if blends greater than E-10 are used with those products. With the scope of the ethanol mandate and CAFE increases in EISA, the automobile industry already faces significant challenges in making vehicles capable of meeting these requirements. Failing to address the impacts of EISA while crafting climate change legislation could generate new mandatory fuel specifications likely to create further challenges for the auto industry.

NPRA requests that the Committee take into account the contribution to lowering the carbon intensity of transportation fuels as a result of EISA's low-carbon fuel standard as well as the inconsistent policies on GHG control inherent in EISA's Title II when crafting new climate change legislation. Failure to effectively recognize and address the effects and requirements of EISA into new climate legislation would only introduce further uncertainty and costs into our national fuel system alignment via new legislation These two dynamics, in turn, perpetuate and exacerbate supply/demand variables.

Transportation Fuels Should Include "All Emissions From All Sectors" – Including Biofuels

In addition to doing no harm, NPRA believes climate policies should demonstrate equity in how they seek to impact different economic sectors as well as defusing conflicts and contradictions with long-standing environmental goals. In its First White Paper, the Committee stated Congress

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should truly cover "all emissions from all sectors."[12] As the Committee notes therein, failure to do so will create "leakage," or the shifting of emissions to non-covered sources. To prevent leakage in the transportation sector, if one fuel is covered, all fuels should be covered – *including biofuels.* Failure to cover these sources will lead to a proliferation of certain biofuels that many scientists believe create significantly more GHG emissions on a lifecycle basis than the petroleum fuels they displace. Congress must ensure all biofuels are covered in any new climate legislation based on a lifecycle analysis of their GHG emissions. This becomes even more urgent if recent media reports are borne out that US EPA believes up to 14 billion gallons of corn-based ethanol, currently "grandfathered" from any GHG-lowering constraints via transition rules provided in EISA 2007, are foisted onto the transportation fuels market.

In discussing the growth rate of carbon emissions in developing countries, the Second White Paper notes "land use changes were responsible for more than 60 percent of Brazil's 2000 emissions...."[13] Brazil is also one of the world's biggest ethanol producers and has been criticized for clear cutting land to plant sugar cane for ethanol. A recent Time magazine article noted, "Brazil ranks fourth in the world in carbon emissions, and most of its emissions come from deforestation."[14] This example highlights the potential for "leakage" – as discussed in the first paper - if biofuels are not covered in climate legislation.

Ethanol and biodiesel are hydrocarbons – they are not carbon-free. Biofuels are often perceived as carbon-neutral because the carbon released when combusted is recycled as the biomass feedstock is grown. However, many scientists are concerned that the greenhouse gas emissions resulting from biofuel production and associated agricultural practices could effectively negate or even reverse any reduction in emissions that could be achieved by significantly expanding the use of ethanol as a transportation fuel. Biofuels are not a silver bullet for reducing greenhouse gas emissions and their impacts to the overall GHG emissions should not be ignored.

There is growing consensus in the scientific community that first-generation biofuels do more harm than good in terms of GHG emissions. Nobel Prize winner Paul Crutzen concluded that increased biofuels production is accompanied with a dramatic increase of nitrous oxide (N2O) emissions, which have nearly 300 times greater warming potential than CO2.[15] This would offset all greenhouse gas emissions reductions from the displaced petroleum fuels and actually

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[12] Ibid, p.2.
[13] Energy & Commerce, "Competitiveness Concerns," p. 3.
[14] Grunwald, Michael, "*The Clean Energy Scam,*" Time Magazine, Thursday, March 27, 2008, p. 40.
[15] P. J. Crutzen, A. R. Mosier, K. A. Smith, and W. Winiwarter, "N2O Release from Agro-Biofuel Production Negates Global Warming Reduction by Replacing Fossil Fuels," Atmospheric Chemistry and Physics Discussions, August 1, 2007.

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result in a net increase in total greenhouse gas emissions. The European Union recently passed a law that may essentially ban certain biofuels due to environmental impacts.[16]

A large increase in the production of biofuels could lead to further deforestation and release of soil carbon. Clearing land to grow crops as a feedstock for biofuels can increase greenhouse gas emissions. Carbon in the soil and plants is released when land use is changed and can be higher than the reduction in carbon releases obtained by replacing fossil fuel combustion with biofuel combustion. It would take many years for the increased GHG emissions from land use change to be offset by the decreased GHG emissions from the replacement of fossil fuel with biofuel combustion – a biofuel carbon debt. This biofuel carbon debt is substantial and is projected to take decades or centuries from which to recover.

Several analyses outline the deleterious land-use impacts from biofuels production. The following are excerpts from two studies published in 2008:

> Ethanol from corn produced on newly converted U.S. central grasslands results in a biofuel carbon debt repayment time of ~93 years. . . . At least for current or developing biofuel technologies, any strategy to reduce GHG emissions that causes land conversion from native ecosystems to cropland is likely to be counterproductive. . . . Our results demonstrate that the net effect of biofuel production via clearing of carbon rich habitats is to increase CO2 emissions for decades or centuries relative to the emissions caused by fossil fuel use.[17]

> To produce biofuels, farmers can directly plow up more forest or grassland, which releases to the atmosphere much of the carbon previously stored in plants and soils through decomposition or fire. The loss of maturing forests and grasslands also foregoes ongoing carbon sequestration as plants grow each year, and this foregone sequestration is the equivalent of additional emissions. Alternatively, farmers can divert existing crops or croplands into biofuels, which causes similar emissions indirectly. . . . As land generates more ethanol over years, the reduced emissions from its use will eventually offset the carbon debt from land-use change, which mostly occurs quickly and is limited in our analysis to emissions within 30 years. We calculated that GHG savings from corn ethanol would equalize and therefore "pay back" carbon emissions from land-use change in 167 years, meaning GHGs increase until the end of that period. Over a 30-year period, counting land-use change, GHG emissions from corn ethanol nearly double those from gasoline for each km driven. . . . As part of our sensitivity analysis, we found that, even

[16] John W. Miller, "EU is Planning Measures to Protect Biofuels Industry," January 23, 2008, P.A11.
[17] "Land Clearing and the Biofuel Carbon Debt;" Joseph Fargione, *et al.*; *Science* 319, 1235 (2008); DOI: 10.1126/science.1152747.

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> if corn ethanol caused no emissions except those from land-use change, overall GHGs would still increase over a 30-year period.[18]

In addition, a recent University of California, Berkeley memo to the California Air Resource Board affirms these earlier studies. This memo states that estimates of greenhouse gas emissions from direct land use changes are very large and are much larger than the emissions associated with the fuel itself because there are large amounts of carbon stored in ecosystems of all sorts.[19] The biofuel carbon debt summarized in these studies refutes the perception that biofuels are part of the solution to quickly reduce greenhouse gas emissions. Failure to cover "all emissions from all sectors" by excluding biofuels from a cap and trade bill will only lead to further proliferation of their use in American motor fuels. This "leakage" will likely result in GHG increases that could significantly outweigh GHG emissions reductions from the displacement of petroleum fuels.

Ensure Adequate Supplies of Low Carbon Emitting Sources

Any climate control legislation implementing a cap-and-trade regime will cause the use of natural gas to soar - especially in the near-term - as it is the only immediately available source of low carbon emitting energy. Enhanced national nuclear capabilities or widely commercially available carbon capture and sequestration programs are likely decades away at best. Thus, fuel switching must be an expected consequence of any climate change legislation.

The First and Second White Papers discussed the need for any greenhouse gas program to be designed so that our domestic industry retains some measure of competitiveness in the global marketplace and "with attention to retention of manufacturing and other industrial jobs in the United States."[20] Yet, Congress continues down the disconnected path of creating greater demand for natural gas usage while simultaneously restricting access to the production of this fuel from onshore and offshore sources.

A quick read of the CSA expected to be shortly before the Senate suggests the bill could result in increased demand for 5 to 15 trillion cubic feet of additional natural gas, an increase ranging from 20 to 60 percent from existing annual domestic usage. A shrinking natural gas supply will have serious adverse consequences for many manufacturing sectors, especially petrochemicals, which rely upon natural gas as a feedstock. Without adequate supplies of affordable natural gas, these sectors will find it difficult to compete internationally, placing a large bloc of industrial and

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[18] "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change;" Timothy Searchinger, *et al. Science* 319, 1238 (2008); DOI: 10.1126/science.1151861.

[19] Memo from Alex Farrell and Michael O'Hare (U. of California Berkeley professors) to the California Air Resources Board, "Greenhouse gas (GHG) emissions from indirect land use change (LUC)," January 12, 2008.

[20] Energy & Commerce, "Scope of a Cap-and-Trade Program," p. 14.

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manufacturing jobs at risk. In fact, this "demand destruction" within the manufacturing sector, particularly among the petrochemical industry, has been ongoing for several years. Sending these businesses overseas not only hurt American workers in our industry, but will create a situation where it is cheaper to import finished products Americans rely on every day than make them domestically.

Such products include:

Kevlar for bullet proof vests
Computer casings
Prescription drugs and over-the-counter medicines
Protective coatings for computer chips
Automobile bumpers
Automobile seat cushions
Airbags
Seatbelts
Automobile interior paneling
Artificial knees and joints
Paints
Packaging
Electronics
Safety equipment

Simply stated, Congress must reconcile the variables of increased natural gas usage caused by climate change legislation in the short-term with those of demand destruction and the need for enhanced production of natural gas from domestic sources. Failing to do so essentially causes the American manufacturing sector to unilaterally disarm itself in the global marketplace.

Modifying Existing Command and Control Regulations where Appropriate

Cap-and-trade programs - where the Government sets reduction requirements while limiting regulation of the plant or sector specific means by which to achieve those reductions - are structured significantly differently than more traditional command-and-control regimes in which the Government sets specific requirements for facilities, processes or sectors. NPRA believes that the magnitude of a cap-and-trade program for greenhouse gases warrants the streamlining of existing command-and-control regulations.

The Committee's First White Paper observes that: "Another benefit of a cap-and-trade program is that it provides economic incentives for industry to find the lowest cost method of achieving

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the desired emissions reductions, encouraging and rewarding innovation that might not otherwise occur under more traditional regulatory or government research programs."[21] This statement inherently recognizes the fact that cap-and-trade regulation is fundamentally different than traditional command-and-control programs. To provide covered parties with enough flexibility to meet the extreme challenges posed through cap-and-trade programs regulating GHGs, Congress must streamline and better align existing and outdated command-and-control regulations. Many advocates of cap-and-trade feel such a program yields co-benefits in reducing other pollutants. If the Committee believes that these co-benefits can be achieved, then streamlining programs like New Source Review would allow refiners and others to make efficiency upgrades critical for a GHG cap-and-trade program in a timelier manner. One way to partially accomplish this sound policy objective would be for Congress to ensure that actions taken by companies to reduce their GHG emissions for compliance with new climate legislation *do not trigger* other Clean Air Act regulatory programs.

Prevent Other Conflicting Environmental Policies

Environmental policies over the past few decades have created industrial processes which, in turn, have led to the production of cleaner fuels. These same processes are, however, sometimes much more energy intensive in producing these cleaner fuels. Additionally, methods for achieving some climate goals may actually conflict with other air quality regulations. For example:

- Industry has met regulations requiring ultra-low sulfur diesel (ULSD). However, creating this fuel requires more hydrogen and more fuel consumption, which in turn generates more CO2.
- Reducing benzene levels in gasoline requires additional fuel consumption in equipment at refineries, which leads to higher CO2 emissions.
- Cap-and-trade legislation will, either directly or indirectly, lead to proposals on Low Carbon Fuels Standards (LCFS) that can only practically be met by blending more biofuels into the fuel supply. However, a higher concentration of biofuels will exacerbate smog problems and could come in conflict with the ozone National Ambient Air Quality Standard (NAAQS) (which EPA just tightened weeks ago).
  - In addition, a significant quantity of the current biofuel stock comes from coal- fired ethanol plants. Stringent carbon restrictions could affect production from these plants and hence the overall fuel supply.
  - On a lifecycle basis, biofuels can have negative environmental impacts in terms of CO2 emissions, water quality and use, soil erosion and acidification, toxicity of pesticides, loss of biodiversity, and air pollution from "slash and burn" farming practices.

[21] Ibid, p. 3.

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- There are a number of other regulations that require control devices and systems for reduction of ozone forming compounds, criteria air pollutants, and hazardous air pollutants. The previously mentioned tightening of the NAAQS for ozone will mean hundreds of counties previously in attainment with the clean air act will now be non-attainment areas. These counties will have to spend significant dollars and resources implementing new emissions plans and businesses will have to spend significantly more money on stationary and mobile source controls. These control systems require substantial amounts of energy to operate, which could lead to an increase in CO2 emissions. Congress must recognize these requirements while addressing climate legislation.

The Committee must carefully weigh the impacts of one policy on others when developing climate legislation.

The NPRA member companies again wish to express their appreciation for the opportunity afforded by the issuance of these White Papers to engage the Committee in a robust discussion on climate change legislation. Consistent with a theme mentioned at the outset of our response, the transparency of communicating any program to the American people will greatly advance the quality of this debate. In addition to a realistic discussion of rising energy costs and potential job losses, climate change legislation again raises the question of how best to achieve carbon reductions. The debate will continue on whether to pursue the well-worn path of government mandates that create artificial markets and co-dependent price signals, or to craft a more rational policy reliant on genuine consumer demand buttressed by sound investments and incentives that will advance the goals of enhanced environmental quality at a substantially lower economic cost. We look forward to working with the Committee as it continues exploring the impacts of climate change legislation.

Sincerely,

Charles T. Drevna
President

Cc: Honorable Joe Barton
Honorable Fred Upton

Testimony of Michael Goo, NRDC Climate Legislative Director, before the U.S. House of Representatives Committee on Energy and Commerce on June 19th 2008: "Legislative Proposals to Reduce Greenhouse Gas Emissions: An Overview."

Response to follow-up questions submitted by the Honorable Edward J. Markey.

1) What magnitude of emissions reductions do you believe are achievable by 2020 and 2050?
2) How significant might the role of energy efficiency and renewable energy be in achieving these reductions?

The EPA[1] and EIA[2] analysis of the Lieberman-Warner Climate Security Act indicate that it is possible to cut emissions by at least 20 percent by 2020. EIA projects that reductions come mostly from offsets (1 billion tons) and the electric sector (about 500 million tons) as can be seen in Figure 1. Electric sector reductions come from efficiency, zero emissions generation (nuclear and renewables) and CCS. (Figure 2)

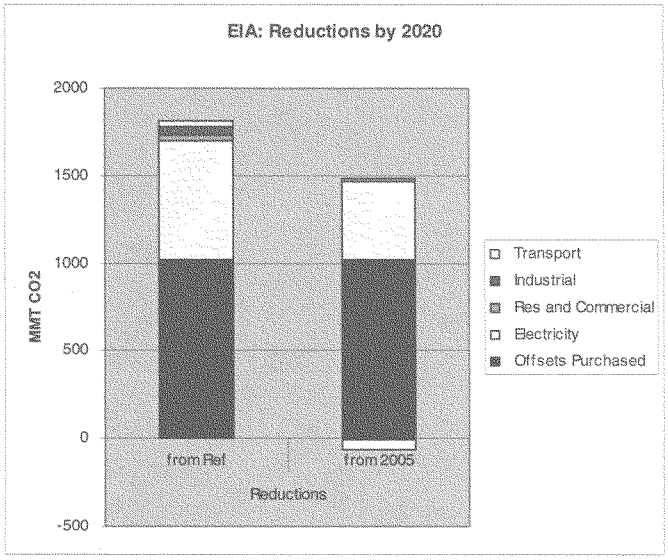

Figure 1

[1] http://www.epa.gov/climatechange/downloads/s2191_EPA_Analysis.pdf
[2] http://www.eia.doe.gov/oiaf/servicerpt/s2191/pdf/sroiaf(2008)01.pdf

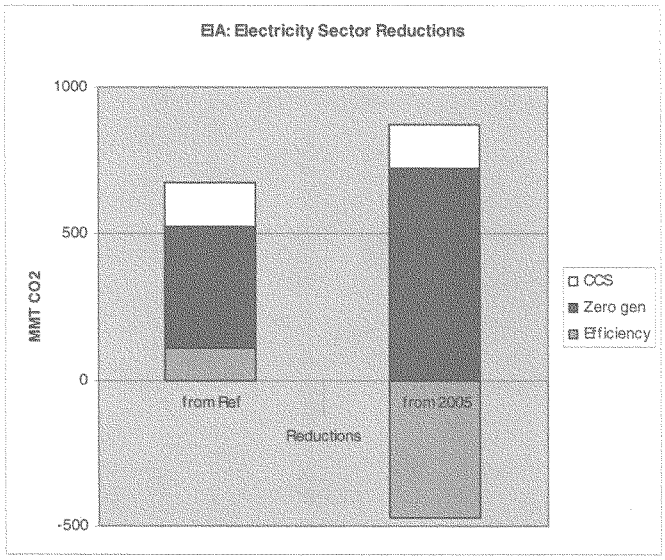

Figure 2

NRDC has developed an integrated analysis of eight categories of action that together could cut annual U.S. emissions by 10.6 billion tons by 2050, which would enable us to reduce pollution 80 percent from current levels—nearly 90 percent below business-as-usual projections of 12 billion tons by 2050.[3] Below is an excerpt from the NRDC report "The New Energy Economy."

Energy Efficiency & Renewables:

1) Energy Efficiency-

Heating fuel (oil and gas) and electricity use in buildings are the largest sources of global warming pollution in the United States, and they continue to grow as rapidly as transportation emissions. The buildings sector is expected to account for 37 percent of total U.S. greenhouse gases in 2030.[4] We already have the technology in hand to radically reduce energy use in buildings at tremendous savings to consumers, but unreasonable regulatory systems and other market failures have prevented us from unlocking this potential. McKinsey identified 0.7 Gigaton ("Gt") of building sector abatement by 2030 in their medium range case and 0.9 Gt in the high-range case, more than 90 percent of which is based on technologies that are fully available today and all of

[3] www.nrdc.org/globalWarming/blueprint/methodology.asp#emissions.

[4] McKinsey & Company, *Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?* U.S. Greenhouse Gases Mapping Initiative, Executive Report, December 2007. Note that McKinsey projects that in 2030, transportation will account for 29 percent, industrial 26 percent, agriculture 6 percent, and waste 2 percent.

which is highly likely to become available. Most strikingly, nearly all of these measures come at a negative cost per ton because the ongoing benefit of reduced energy bills (discounted at 7 percent real, 10 percent nominal interest rate) more than justify the extra up-front cost of measures such as more efficient lighting.

Electricity accounts for only about half the total energy used in buildings, but it accounts for three-quarters of the CO2 emissions from this sector because electricity from our coal-heavy grid is far more carbon intensive than the natural gas or oil used directly for heating. Through cost-effective energy-efficiency measures, we can cut overall CO2 emissions from buildings in half by 2050. Areas to target include building architecture; insulation, heating, ventilation, and air-conditioning (HVAC) equipment; major appliances and electronics; lighting; and systematic maintenance. Renewable generation technologies integrated into buildings can contribute additional cost-effective reductions in CO2 emissions from buildings. For example, solar hot water systems are already cost-competitive in almost all parts of the country.[5] Moreover, small-scale combined heat and power systems are becoming available, and industry analysts expect unsubsidized solar photovoltaics to become competitive with retail electricity rates in most parts of the United States by 2020. Ground source heat pumps will also become increasingly effective carbon abatement technologies as we reduce the carbon intensity of the electricity needed to power these heating and cooling systems.

The U.S. industrial sector (oil, steel, cement, fertilizer, etc.) emits approximately 2.2 billion tons of global warming pollution annually, representing 26 percent of U.S. annual emissions by 2030.[6] Improvements in industrial processes could result in a 50 percent decrease in global warming emissions from this sector.

Combined heat and power (CHP) is an essential opportunity for industry. These systems generate electricity while burning fuel for process heat, sharply reducing or eliminating the need to purchase electricity from power plants—cost effectively reducing CO2 emissions by half or more. Also, more efficient motors, transformers, pumps, and other industrial machinery can decrease energy waste by 15 to 20 percent using today's off-the-shelf technologies.[7] Finally, advanced industry-specific processes, including greater recycling of materials and product reformulations, can yield substantial cost-effective efficiencies.

2) Renewable energy:
Non-hydro renewables currently provide about 2 percent of our electricity. However, these technologies—including wind power, concentrating solar power, biomass power, geothermal electricity, and solar photovoltaics—have the potential to provide roughly as

[5] The Technical Potential of Solar Water Heating to Reduce Fossil Fuel Use and Greenhouse Gas Emissions in the United States. National Renewable Energy Laboratory, March 2007, p. 21, NREL/TP-640-41157.
[6] McKinsey & Company, *Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?* U.S. Greenhouse Gases Mapping Initiative, Executive Report, December 2007. Note that agriculture and waste sectors account for 8 percent of projected 2030greenhouse gas emissions beyond the 37 percent on buildings, 29 percent on transport, and 26 percent on industry.
[7] See, for example, http://eetd.lbl.gov/ea/indpart/publications/lbnl_53053.pdf.

much electricity as nuclear by 2030 and more than 40 percent of our electricity needs by 2050.[8] For example, solar photovoltaic power today provides less than 1 percent of total energy use. If prices continue to drop as anticipated, photovoltaic power could compete with retail rates by 2015 and become a significant generating technology throughout the country, with the potential to supply at least 20 percent of our electricity needs by 2050. Wind alone could provide an additional 20 percent, and other high-potential sources include geothermal and biomass. Finally, concentrating solar power, based on rows of parabolic mirrors installed in desert conditions in one leading configuration, is becoming competitive in a carbon-constrained world. For example, PG&E has announced plans to procure 1,000 MW from this source over the next five years.[9]

While some renewable resources provide intermittent power, some, such as geothermal and biomass, can provide on-demand electricity, and concentrating solar power can include thermal storage that enables production well through evening peak demand or potentially all day and all night using energy molten salt technologies. Moreover, renewable systems that are diversified across different technologies and terrain, enabled by a more robust transmission system, will have higher overall reliability. New energy storage systems, such as compressed-air energy storage, are under development. Conventional fossil resources such as peaking gas turbines can provide backup for intermittent renewables. These grid backup costs are typically modest until the penetration of intermittent renewables exceeds at least 20 percent of peak output.[10] Finally, new "smart" grid technology can help increase the reliability and efficiency of grid distribution overall and thus better handle the distributed and intermittent generation of renewables.

3) What policies would be needed to ensure the deployment of energy efficiency and renewable energy required to achieve significant emissions reductions by 2020 and 2025?

To realize the potential to minimize the cost of a cap and trade program we need policies to drive rapid adoption of increased energy efficiency throughout the U.S. Distribution of allowance revenues in cap and trade legislation can enable and enhance these policies in a way that will radically increase energy efficiency deployment as the least-cost strategy to reduce U.S. global warming emissions.

Specifically, an effective cap and trade policy will establish a separate, guaranteed allocation of allowances/funds for use in advancing energy efficiency adoption. It is critical to have dedicated funding for energy efficiency, to address existing market barriers and ensure that we achieve the benefits of energy efficiency.

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[8] The December 2007 McKinsey report indicates 164 GW of wind, 80 GW of concentrating solar power, and 148 GW of photovoltaics, for a total peak output of 392 GW versus 153 GW of nuclear for the high-range 2030 abatement action case. Assuming typical capacity factors, these renewables would produce 80-90 percent as many GWh of electricity as the 153 GW of baseload nuclear.

[9] See www.news.com/8301-10784_3-9786445-7.html and http://www.nrel.gov/csp/ for background.

[10] See, for example, www.uwig.org/operatingimpacts.html.

The buildings sector is the largest source of global warming pollution in the U.S. In 2005, buildings in the U.S. accounted for about 33 percent of U.S. GHG emissions. The building sector also has the greatest potential to deliver greenhouse gas abatement while yielding direct economic benefit, since most efficiency improvements in buildings save money over the long run. However, a range of well known non-price barriers, including split incentives, prevent building owners from achieving optimal energy efficiency.

The vast majority of potential energy efficiency opportunities will be realized through the production of efficient appliances and the improvement and replacement of the existing building stock.

Effective legislation will capture efficiency potential through the following four elements, discussed in more detail below:

1. Regular updating of national energy codes and standards for new buildings and equipment.

2. Performance-based funding allocations to states, LDCs, and municipalities to pursue efficiency in buildings.

3. Designation of funds for innovative programs targeting efficiency in new and existing buildings and appliances best implemented at the national/regional level.

4. Designation of funds for energy efficiency programs that target low-income sectors.

1. Regular updating of national energy codes and standards for new buildings and equipment.

In order to achieve GHG abatement at least cost, legislation should ensure that increasing minimum levels of efficiency will be achieved on a consistent basis. Legislation should include a requirement for regularly or automatically updating building codes and appliance and electronics efficiency standards.

National Model Energy Code
The national model building energy code should be updated to achieve overall efficiency savings goals of,
(A) 30 percent in editions of each model code or standard released in or after 2010;
(B) 50 percent in editions of each model code or standard released in or after 2020.

Targets for intermediate and subsequent years will be set by the Department of Energy (DOE) at least 3 years in advance of each target year, coordinated with the IECC and ASHRAE Standard 90.1 cycles, at the maximum level of energy efficiency that is technologically feasible and life-cycle cost effective.

Should the codes set by IECC and ASHRAE not meet the national energy goals, then DOE shall establish a modified code that meets the goals.

States must implement the national model building code and demonstrate compliance or significant improvement towards compliance. States that fail to demonstrate compliance would not receive funds generated through climate legislation. States should receive adequate funding and technical assistance to successfully adopt, implement, and comply with the national model energy code.

Additionally, more stringent voluntary energy codes or "stretch codes" should be produced so that states that desire to go beyond the national code have the ability to do so.

National Appliance Standards

The federal appliance standard program at DOE should be fully funded and instructed to aggressively pursue cost effective energy efficiency in new standards. Where possible, the scope of federal standards should be expanded and new products covered when significant energy savings are possible. The Department should update standards and test procedures regularly and streamline the rulemaking process. Climate legislation should provide the Dept with the minimum level of cost effectiveness for efficiency from which no lower standard can be set and clarify the Departments authority on a variety of contentious recurring issues. The department should establish future efficiency goals for every major appliance category covered to enable manufacturers to aggressively deploy new efficiency technologies while giving them the security they need to pursue these more efficient products.

2. Performance-based allowance/funding allocations to states, LDCs and municipalities to pursue increased end-use energy efficiency.

Distribution of auction revenue or allowances to states, load distribution companies (LDCs), and municipalities for use to advance energy efficiency in their regions should be based on performance-based metrics that reward efficiency results. While some efficiency allowance value may be distributed to states based on population or other factors – a baseline – a significant share of allowance value should be distributed in ways that reward good energy efficiency program and policy performance. In both of these cases, states, in turn, should be required to reinvest these funds in energy efficiency. This approach creates an incentive for states, utilities, and municipalities to actively support and continuously improve energy efficiency within their area of influence, encouraging them to take advantage of federal programs as well as maximize state and utility based efficiency measures.

We recommend using a "top down" regression equation to compare each state's annual non-transportation primary energy use per capita to its use in prior years, adjusting for factors such as weather and economic activity. This approach rewards both efficiency programs (e.g. a commercial new construction program or a residential retrofit program) and efficiency policies (e.g. state-level building codes or equipment efficiency standards or implementation of federal codes and standards) so that cost-effective energy efficiency

adoption can be maximized.[11] EPA, with help from DOE, should develop guidelines for evaluating energy savings.

By measuring energy use at an aggregate level and basing incentives on actual results, we ensure that funds are used effectively to achieve efficiency and greenhouse gas abatement. In addition, this strategy creates a virtuous cycle of improvements as states and LDCs must continue to deliver results in order to continue to receive funding. Finally, this strategy creates opportunities for both leading states with extensive past improvements in efficiency and for states without major existing efficiency efforts. States with strong existing efficiency programs are well-positioned to accelerate their efforts quickly. At the same time, states without major existing efforts would be able to catch up quickly by tapping into highly cost-effective retrofit opportunities once they have ramped up their administrative capacity.

Since some states are farther along in developing efficiency programs and policies than others, we recommend phasing in this performance-based distribution beginning in the third year of the cap and trade program, in order to allow trailing states to catch up.

In addition, we recommend compliance with the following basic prerequisites in order to receive this incentive funding:

a. Compliance with minimum building code requirements as described in item 1 above

b. Implementation by utilities of the rate design standards under Public Utility and Regulatory Policies Act of 1978, as added by section 532 of the Energy Independence and Security Act of 2007 (as referenced by the Dingell-Boucher discussion draft.)

3. Designation of funds for innovative programs targeting efficiency in new and existing buildings and appliances is best implemented at a national or regional level.

A range of private sector entities, including large energy consumers, energy service companies, retailers, manufacturers, real estate management firms and real estate developers can effectively deliver energy efficiency and each should be given incentives to help deliver permanent, additional and verifiable energy efficiency. Establishing nationally consistent programs for large- and small-scale private sector entities to earn incentives for delivering efficiency will allow economies of scale to develop to cost effectively deliver increased energy efficiency.

Programs should address appliances, existing buildings and new buildings.

[11] All efficiency metrics have limitations, including a "top-down" or aggregate level metric. For this reason, it is important to deploy complimentary policies including those described in this document as well as others such as energy efficiency resource standards and to promote strong evaluation, measurement and verification at the program level.

Appliances

The Super Efficient Appliance Deployment (SEAD) is a national system modeled after successful utility and state-level efficiency programs that reward retailers and manufacturers for increasing market penetration of highly efficient products.

Appliances and equipment account for more than half of current CO_2 emissions from the buildings sector and there is considerable scope for cost-effective efficiency improvements. Performance-based federal equipment and appliance standards that become more challenging over time are an essential strategy for eliminating poor performers from the market place (e.g. the lighting standards in the December 2007 Energy Independence and Security Act). However, we also need strong incentives to encourage development and deployment of super efficient devices over time.

Incentives should be established under federal cap and trade legislation for retailers, manufacturers and equipment distributors that successfully increase market share of highly efficient equipment and appliances. An additional incentive should be offered for retiring low performing existing appliance stock to remove them from the marketplace.

We see this strategy as an excellent use of federal efficiency funds since equipment and appliance support can and should be provided at national scale. In addition, this strategy would create an endless "race to the top" as manufacturers try to develop products that receive top performer status and associated support. Finally, much of the incentive funding would flow directly through to consumers in the form of rebates or discounts, but the retailers would be free to use their full marketing toolkit to sell as many higher efficiency appliances as possible—thereby maximizing consumer benefit from lower energy bills.

Buildings

The Super Efficient Buildings Incentive (SEBI) creates an incentive structure for existing buildings to dramatically improve their efficiency.

The opportunity to achieve efficiency potential in buildings is so great and the barriers are so engrained that we need national level incentives in addition to state and utility programs. Therefore, well designed, national, performance-based incentives are needed to accelerate dramatic improvement in whole-building energy efficiency.

Through an efficient buildings incentive program, commercial and residential buildings that undergo deep retrofits that radically improve measured building performance and new buildings that far exceed the required minimum code performance would receive an economic incentive.

Existing Buildings - In order to receive federal incentives, a building would need to demonstrate improvement in efficiency compared to that building in its previous state. Existing building incentives would be available in two distinct ways,

1) An incentive could be provided for demonstrated energy savings resulting from an energy efficiency retrofit. A federal incentive would be granted based on the percentage of annual energy consumption saved by a retrofit. Verification and documentation of achieved energy savings would be required.

2) Incentive for energy savings resulting from efficient building operation. A federal incentive would be available annually to buildings that reduced their energy consumption based on the previous year's consumption, while accounting for other relevant factors (such as vacancy level). An established energy benchmarking tool would be used to determine improvement.

New Buildings – New buildings would receive a federal incentive for meeting established above-code energy goals for building type and size. Metrics could be based on percent above code or percentile above code compared to similar projects.

Building Energy Performance Labeling – As a prerequisite for receiving incentive funds and as a requirement triggered by some action (such as sale, lease, refinance, or utility service change) buildings should receive an energy performance label that includes both an assessment of the buildings energy efficiency potential (asset value label) as well as its current energy efficiency performance (operational label). This metric should be established by EPA and DOE and could be used as the basis for the building efficiency incentive program described above as well as a means of improving consumer information regarding the energy use of individual buildings.

4. Designation of funds for energy efficiency programs that target low-income sectors.

In order to ensure that climate legislation does not increase costs for low-income households, a sufficient amount of allowance value should be designated for use towards improving the energy efficiency of low-income homes. This should remain distinct and separate from other programs that provide low-income bill and/or income assistance, but should leverage existing programs focusing on energy efficiency. Significantly increasing funding for low-income weatherization is one of a number of necessary strategies to reduce energy use in low-income households. Others include direct energy efficiency assistance for multi-family and manufactured homes, energy efficient appliances and lighting.

To have the greatest impact on energy bills, particularly for low-income households, energy efficiency efforts should begin as soon as possible. We recommend that a portion of emission allowances for the first few years of climate legislation be allocated and auctioned prior to the effective start date of the legislation, in order to start funding the expansion of low-income energy efficiency programs as early as 2010.

Clean energy is a good investment for taxpayers and the environment. While recent economic developments have caused some to temporarily reconsider their support for clean energy projects, the underlying drivers of high gas prices, energy security and global warming are still with us. The federal government can address our dependence on

foreign oil, reduce our global warming emissions and promote clean energy technologies through the following policies:

- *Require utilities to produce more renewable energy* – Congress should require all retail electricity suppliers to produce at least 25 percent of their power from renewable energy sources by 2025. DOE recently reported that the U.S. could get 20 percent of its electricity from wind alone.

- *Keep our clean energy industries booming* – Congress needs to extend the production tax credit (PTC) for wind, geothermal, solar and renewable electricity sources for multiple years. The lapse risk from the recent short-term extension ensures that the renewable industries will continue to see volatile investment and limited long-term commitments. In addition, the PTC is currently accessible primarily to large firms with substantial tax liabilities. The PTC also cannot be used by public entities such as rural electric cooperatives and local governments because they do not have any tax liability. Congress should expand PTC participation to public entities and smaller firms through modifications such as making the tax credits tradable.

- *Dramatically ramp up energy efficiency and renewable energy research and development* – Congress needs to at least double its current research and development (R&D) appropriations for energy efficiency and clean renewable energy technologies. Overall spending on energy R&D is $3.5 billion per year, with renewables and efficiency each receiving a fifth of that amount. Examples of the technologies this new funding would support include emerging renewable energy technologies such as photovoltaic (PV) solar, concentrating solar power, wind, marine and geothermal. Other examples include building and industrial efficiency. Congress should double (in real terms) spending on efficiency and renewable energy R&D to over $3 billion by 2013.

- *Expand R&D tax credits for business* – The R&D tax credit covers up to 20% of qualified R&D spending, and is vital to innovation in all technology sectors. Private sector spending on R&D matches increases in the tax credit 1 to 1. Congress should fix the tax credit for five years to stabilize research spending (the tax credit has expired 13 times in the past 25 years), and increase the credit from 20% to 40% of R&D spending. To target younger, more innovative firms with little taxable income, Congress should consider expanding the wage tax exemption for researchers, and allow unlimited carry forward of losses incurred for future tax relief.

- *Develop renewable energy transmission* – Congress and the administration should drive development of interstate transmission that enables deployment of location-constrained renewable electricity resources through an effective regional planning framework that includes adequate consideration of land conservation and siting concerns.

- Congress and the administration should identify key infrastructure development necessary to scale up remote renewable electricity generation through the establishment of renewable energy zones and/or other regional planning efforts.
- Congress should require the Federal Energy Regulatory Commission (FERC) to reform its transmission cost allocation and interconnection framework in a manner that addresses existing barriers in regional transmission development.
- The administration should create an inter-agency transmission task force (DOE, Bureau of Land Management, U.S. Forest Service, U.S. Fish & Wildlife Service and Department of Defense) under the Council on Environmental Quality to establish standards for federal siting and environmental review of transmission projects.
- The administration should reform and coordinate outcomes of Sections 368 and 1221 of the Energy Policy Act of 2005 (EPAct) to facilitate development of renewable energy and protection of the nation's public lands.
- Congress and the administration should support energy storage and demand-side management solutions to promote further grid reliability and minimize integration costs for variable generation.
- Congress should enhance funding for DOE to provide data and technical analysis needed to develop renewable energy transmission.

- *Ensure availability of low-cost financing* – Emerging renewable energy technologies face reduced access to finance and higher capital costs due to risk misperceptions in credit and insurance markets. Providing developers with lower-cost capital for early stage demonstration projects via a federally sponsored loan guarantee can facilitate early deployment of renewable energy, and offer independent power producers and start-ups increased access to capital. Congress should maintain the funding for loan guarantees for emerging renewable energy technology demonstration projects to $10 billion .

- *Educate consumers about clean energy solutions* – Consumers are generally uninformed about where their energy comes from, how much they use, and what they can do to save money on their energy bills. Americans would also benefit from better understanding how investment in clean energy resources boosts the economy and creates jobs. Congress and the administration should work together to promptly ramp up a national campaign that provides education on these issues.

- *Boost worker training program* – A limited supply of trained and qualified workers could prove a challenge as the renewable energy industry ramps up. The need for engineers, technicians, installers, inspectors and other experts is expected to increase significantly. Without a large and skilled employment base, labor could be a significant capacity constraint in future renewable energy development. Congress should help remove this constraint by fully funding the Energy Efficiency and Renewable Energy Worker Training Program authorized by EISA, which would also boost the employment opportunities of millions of Americans.

4. Is it possible to make significant near-term emissions reductions without significant fuel-switching to natural gas in the electric power sector?

8. Can the aggressive emissions reduction targets recommended in your testimony be met without the construction of new nuclear power plants?

The answer to both questions is yes. Refuting industry claims that major fuel switching or an increase in nuclear energy would occur with enactment of climate protection legislation a report by M.J. Bradley & Associates shows that significant emission reductions, like those required by the Lieberman-Warner Climate Security Act, can be achieved in the electric power sector without fuel switching from coal to natural gas or increase in nuclear energy[12]. The study outlines a realistic scenario where a 20 percent reduction in electric sector CO_2 emissions by 2025 could be achieved, without significant change in generation from coal, natural gas, and nuclear power compared to current levels, by deploying energy efficiency, renewable energy, and carbon capture and storage at rates that appear reasonable based on both historical experience and with incentives for these developing and deploying these technologies. The analysis assumes:

- Efficiency measures that reduce electricity demand by 10 percent below business-as-usual in 2025,
- Renewable sources are deployed at approximately twice the current rates, and
- 65GW of coal with carbon capture and sequestration (CCS) is built by 2025, or about 6 GW a year from 2015-2025.

A cap combined with focused incentives for these three activities would ensure that the near and mid-term emission reduction requirements out to 2025, like those in the Climate Security Act, can be met with no switching from coal to natural gas or increases in nuclear power. See attached M.J Bradley report.

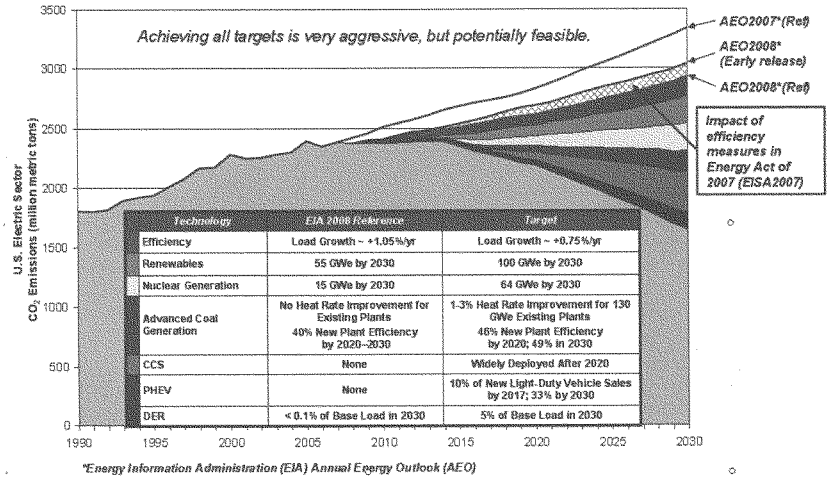
5. Is it possible to make significant near-term emissions reductions in the absence of proven carbon capture and sequestration technology in the electric power sector?

Yes, it is possible to make significant near-term emissions reductions in the electric power sector with increased energy efficiency and renewables. The M.J. Bradley report shows that emission reductions can be achieved in the electric power sector without fuel switching from coal to natural gas or increase in nuclear energy[13]. EPRI also concludes that substantial reductions can be achieved through energy efficiency and renewable energy generation. This is illustrated in the EPRI PRISM model chart below. While this analysis includes additional reductions from CCS and nuclear energy, in the near term

[12] M.J. Bradley & Associates, "Coal and Natural Gas Use in the Electric Power Sector under the Climate Security Act," June 2008. http://docs.nrdc.org/globalwarming/glo_08060401A.pdf

[13] M.J. Bradley & Associates, "Coal and Natural Gas Use in the Electric Power Sector under the Climate Security Act," June 2008. http://docs.nrdc.org/globalwarming/glo_08060401A.pdf

(i.e., out to 2020) greater the largest share of reductions comes from efficiency and renewables.[14]



Technology	EIA 2008 Reference	Target
Efficiency	Load Growth ~ +1.05%/yr	Load Growth ~ +0.75%/yr
Renewables	55 GWe by 2030	100 GWe by 2030
Nuclear Generation	15 GWe by 2030	64 GWe by 2030
Advanced Coal Generation	No Heat Rate Improvement for Existing Plants 40% New Plant Efficiency by 2020–2030	1-3% Heat Rate Improvement for 130 GWe Existing Plants 46% New Plant Efficiency by 2020; 49% in 2030
CCS	None	Widely Deployed After 2020
PHEV	None	10% of New Light-Duty Vehicle Sales by 2017; 33% by 2030
DER	< 0.1% of Base Load in 2030	5% of Base Load in 2030

6. Do you believe we should wait to set mandatory emissions reductions targets in the U.S. until carbon capture and sequestration technology is proven in the electric power sector?

7. How would the total cost of implementing a climate regime in the U.S. change if we did wait to implement mandatory emissions reductions targets until carbon capture and sequestration technology is proven in the electric power sector?

We cannot afford to wait to set mandatory emission limits. The effects on our climate system have already begun and will continue to occur, to greater and greater effect, each year that we wait. We have already waited too long, and the costs of waiting will only increase the overall cost of the program, since steeper and steeper reduction cuts will be required with each year we wait and there will greater "sunk" investment in outmoded energy technologies that do not reduce emissions from the "business as usual" scenario. Finally, and most importantly, the costs of inaction are immense and greatly outweigh the costs of action.

And, even if we could afford to wait, waiting for further developments on carbon capture and sequestration (CCS) is unnecessary, since CCS is available for deployment today. Finally, as noted in the answers to questions 1, 2 and 5, it is entirely possible to make major, near term reductions in global warming pollution without any carbon capture and sequestration technology being deployed at all. More specifics on all of the points above can be found below.

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[14] http://my.epri.com/portal/server.pt?open=512&objID=288&&PageID=225003&mode=2

We cannot afford to wait.

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. Recent 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.

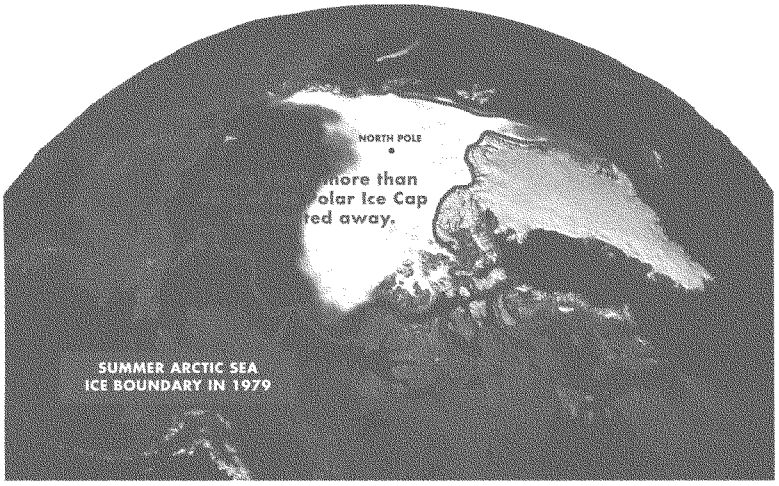

Figure 1: ARCTIC MELTDOWN - Arctic summer sea ice extent in 1979 and 2007. Source: NASA.

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 CO_2 and other global warming gases are kept from exceeding 450 ppm CO_2- 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 percent 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 percent 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 percent 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.

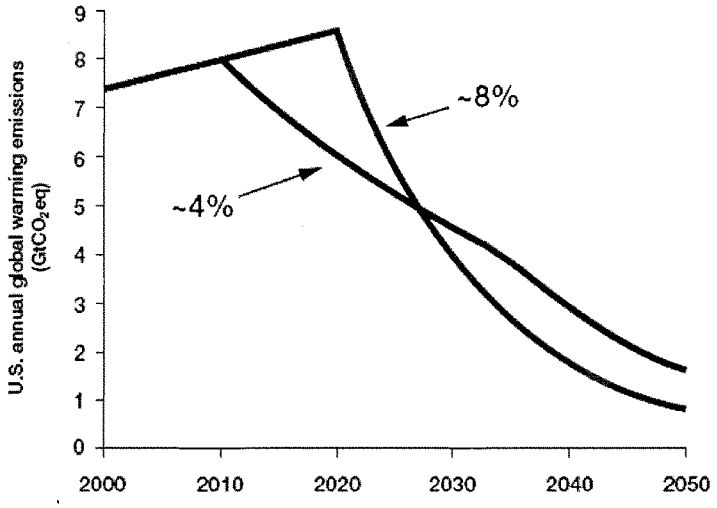

Figure 2: SLOW START... CRASH (OR BURN) FINISH
Source: Union of Concerned Scientists.

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 Carbon dioxide 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.

Costs of Inaction

The claim that climate protection is "too expensive" treats it like a discretionary expense – perhaps like a luxury car or exotic vacation that is beyond this year's budget. No harm is done by walking away from a high-end purchase that you can't quite afford.

But if we walk away from climate protection, we will be walking into danger. Unless we act now, the climate disruption will continue to worsen, with health, economic, and environmental costs far greater than the price of protection. Scholars and economists have only begun a serious assessment of the costs of inaction but it is clear from their work that it is climate disruption, *not* climate protection programs, which will wreck the economy.

The Stern Review, sponsored by the British government and directed by Sir Nicholas Stern, formerly the chief economist at the World Bank, estimated that 5 percent of world economic output would be lost, given a narrowly defined estimate of economic damages. Add in an estimate for environmental damage and for the increased chance of an abrupt climate change catastrophe, and Stern's estimates of losses from climate disruption climb to 11 percent or more of world economic output.

A recent report released by researchers at Tufts University, commissioned by NRDC, builds on the Stern Review and presents two ways of estimating the costs of inaction to the United States, both leading to staggering bottom lines[15]. A comprehensive estimate, based on state-of-the-art computer modeling, finds that doing nothing on global warming will cost the United States economy more than 3.6 percent of GDP - or $3.8 trillion annually (in today's dollars) - by 2100.

In addition, a detailed, bottom-up analysis finds that just four categories of global warming impacts -- hurricane damage, real estate losses, increased energy costs and water costs -- will add up to a price tag of 1.8 percent of U.S. GDP, or almost $1.9 trillion annually (in today's dollars) by 2100.

Costs and damages for the four detailed categories cited in the report if global warming continues include:

- Hurricane damages: $422 billion
- Real estate losses: $360 billion
- Increased energy costs: $141 billion

[15] See Ackerman, Frank A., and Elizabeth A. Stanton, Climate Change and the U.S. Economy: The Costs of Inaction, March 2009 http://www.nrdc.org/globalwarming/cost/contents.asp.

- Water costs: $950 billion

The Global Warming Price Tag in Four Impact Areas, 2025 through 2100

	Cost in billions of 2006 dollars				
	2025	2050	2075	2100	U.S. Regions Most at Risk
Hurricane Damages	$10	$43	$142	$422	Atlantic & Gulf Coast states
Real Estate Losses	$34	$80	$173	$360	Atlantic & Gulf Coast states
Energy-Sector Costs	$28	$47	$82	$141	Southeast & Southwest
Water Costs	$200	$336	$565	$950	Western states
	$271	**$506**	**$961**	**$1,873**	

Figure 3: Cost of Inaction
Source: NRDC, available at http://www.nrdc.org/globalWarming/cost/contents.asp
Authors: Frank Ackerman and Elizabeth A. Stanton, *Tufts University*

Global warming is already melting sea ice and glaciers that will contribute significantly to sea level rise. Sea level is expected to rise 23 inches in 2050 and 45 inches by 2100, with grave impacts expected for the Southeastern U.S. By 2100, an estimated $360 billion per year will be spent on damaged or destroyed residential real estate in the United States as a result of the rising sea levels inundating low-lying coastal properties. The effects of climate change will also be felt in the form of more severe heat waves, hurricanes, droughts, and other erratic weather events—and in their impact on our economy's bottom line.

Inaction on climate change also increases the chance of an abrupt, irreversible catastrophe, which would be much worse than the predictable costs of inaction discussed above. This point is emphasized in the Stern Review, and the economic analysis behind it is supported by recent research by Harvard University economist Martin Weitzman[16]. The collapse and complete melting of either the Greenland or West Antarctic ice sheets would cause sea levels to rise by 20 feet or more, causing devastation of coastal cities and regions where a large fraction of the American population lives. No one can say for certain at what temperature this will occur, but it becomes more likely as the world warms. We are taking a gamble, where

[16] *See, e.g.*, "On Modeling and Interpreting the Economics of Catastrophic Climate Change," (November 2007), where Weitzman argues that conventional cost-benefit analyses of climate change are misleading because they ignore nontrivial risks of genuine disaster. "Standard conventional cost-benefit analysis (CBA) of climate change does not even come remotely close to grappling seriously with this kind of potential for disasters. When CBA is done correctly, by including reasonable probabilities of (and reasonable damages from) catastrophic climate change, the policy implications can be radically different from the conventional advice coming out of a standard economic analysis that (essentially) ignores this kind of potential for disasters." http://www.economics.harvard.edu/faculty/Weitzman/papers/Modeling.pdf

the stakes are unbelievably high and the odds get worse the longer we stay on our current course.

In the future, global warming will cause drastic changes to the planet's climate, with average temperature increases of 13 degrees Fahrenheit in most of the United States and 18 degrees Fahrenheit in Alaska over the next 100 years. This will change the nature of where Americans live. If global warming continues unchecked, by 2100, New York City will feel like Las Vegas does today and San Francisco will have a climate comparable to that in New Orleans. In 2100, Boston will have average temperatures similar to those in Memphis, Tennessee today.

No sensible person bets his or her home on a spin of the roulette wheel. But inaction on climate change is betting the only home humanity has. Who knows, we might get lucky and win the bet; a few scientists still doubt that hurricanes are getting worse. But the consequences of a bad bet are enormous. Without arguing that Katrina was "caused" by global warming, the misery it caused the people of Louisiana and Mississippi and the continuing economic turmoil it produced are wake-up calls that show how much harm a disrupted climate can produce.

A catastrophe, such as 20 feet or more of sea level rise, is not certain to occur; we don't know enough today to say how quickly we may lock in these catastrophic events with current emission paths. But homeowners buy fire insurance although they are not likely to have a fire next year; healthy young parents buy life insurance to protect their children, although they are not likely to die next year. The most catastrophic dangers from climate change are so immense that even if we believe the chance of catastrophe is small, it is irresponsible to ignore them. Taking action against climate change is life insurance for our home planet, needed to protect everyone's children.

Costs and Benefits of Action

The debate on global warming in Washington has turned decisively from "Is it a problem?" to "What are we going to do about it and how much is it going to cost?" In fact, we can't afford not to solve global warming. Economic analyses of the cost of reducing global warming pollution do not attempt to tally the benefits of preventing global warming. As the studies just discussed make clear, the costs of inaction are far higher than the costs of reducing emissions.

Even considering only the direct economic implications, it is clear that action to reduce global warming pollution presents opportunities as well as costs, as recognized by the business and environmental leaders that have formed the US Climate Action Partnership. We need only look to California as a prime example of how aggressive implementation of climate friendly energy efficiency measures has been accompanied by strong economic growth.

Due to these measures, California's per capita electricity consumption has been level over the last 30 years while that of the US as a whole has steadily increased. Per capita electricity consumption in California is now more than 40 percent lower than in the rest of the country. Meanwhile, from 1990 to 2005 the California economy grew by more than 50 percent in real

terms, an average annual growth rate of 2.9 percent[17]. And from 2003-2006 California has had an average annual real growth rate of 4 percent, while nationally the growth rate was 3.1 percent per year[18].

The results of recent economic studies analyzing the costs of global warming cap and trade bills have shown that we can cut our global warming pollution substantially in a manner that is affordable for consumers and the US economy as a whole[19]. A number of agencies and organizations have made forecasts of the economic impacts of the Lieberman-Warner Climate Security Act (CSA), which was reported from the Environment and Public Works Committee on December 5, 2007 and considered on the floor of the Senate during the week of June 2, 2008.

The most important result from these studies of that particular bill is that, regardless of whether the study is a peer-reviewed academic or government analysis, or a non-peer reviewed industry-backed forecast, one prediction is the same: per capita household income (as measured by per capita gross domestic product, or GDP) will not decrease from today's levels. In fact, *all of the projections forecast robust economic growth*, despite the limits on global warming pollution contained in the CSA[20]. The most pessimistic GDP projection, from the Energy Information Administration (EIA), predicts GDP increasing by about 57 percent between 2011 and 2030. The business-as-usual projection for this study is growth of 57.26 percent.

Thus, macroeconomic cost analyses of the Lieberman-Warner bill suggest that climate change regulation can be enacted at little cost. Even the most pessimistic studies predict only modest decreases in GDP *growth* (as opposed to decreases in current GDP levels), and all the studies exclude the costs of inaction, which will likely greatly exceed these costs. Further, when provisions in recently enacted energy legislation (EISA) and proposed climate legislation are included in cost analyses, reductions in GDP growth are almost imperceptible.

CCS is Available Today

CCS technology is available to us today to begin deployment. With the right price signal from a cap and trade system, combined with appropriate, additional financial incentives or subsidies for deployment, the first wave of CCS can be deployed at commercial scale immediately, consistent with the time required to build a new power plant. As the Chairman and President of BP America, Robert Malone has testified,

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[17] California Department of Finance, http://www.dof.ca.gov/html/FS_DATA/STAT-ABS/TABLES/d1.xls

[18] Bureau of Economic Analysis, U.S Department of Commerce http://www.bea.gov/national/xls/gdplev.xls.

[19] See NRDC Fact Sheet"Forcasts Of the Economic Effects of Climate Change Legislation: What can We Conclude? Available at http://www.nrdc.org/legislation/factsheets/leg_08060201A.pdf

[20] See "Cutting Global Warming at Low Cost with the Lieberman-Warner Climate Security Act" http://www.nrdc.org/legislation/factsheets/leg_ 08051401A.pdf; and "New Department of Energy Study Shows Limit on Global Warming Pollution Compatible With Robust Economic Growth," http://www.nrdc.org/media/2008/080430.asp.

"CCS cannot succeed as a commercially successful emission abatement technology without the policy or regulatory frameworks that would allow commercial entities to invest in it. New technology cannot be "pushed" into industrial-scale deployment, a market is necessary to 'pull' it. ***Deploying CCS at scale is not as much a question of technology availability but of economic viability. CCS is available today to play a significant role in reducing greenhouse gas emissions and addressing climate change***".

Testimony of Robert Malone Before The Select Committee on Energy Independence and Global Warming, U.S. House of Representatives (September 21, 2007). (Emphasis added).

Research on CCS has been ongoing for many years now, with major international conferences taking place since the early 1990s. Since then, knowledge on the subject has greatly expanded, to the extent that the Intergovernmental Panel on Climate Change ("IPCC") issued a special report on CCS in 2005. An extensive Massachusetts Institute of Technology ("MIT") study on the Future of Coal in 2007 also examined CCS in depth. There is a substantial body of evidence, knowledge, and peer-reviewed literature on CCS.

In many ways, CCS is not new. There are three elements to successful geologic sequestration of carbon dioxide: capture, transportation, and sequestration. All three of these elements have been demonstrated and operated in commercial, large scale installations. There is no technical reason these elements cannot be combined to capture, transport and dispose of CO2 from coal fired power plants immediately.

The first element of CCS is the initial capture of the carbon dioxide emissions. "Pre-combustion capture" is applied to conversion processes that gasify coal, petroleum coke, or other feedstocks (such as biomass) rather than combusting them in air. In the oxygen-blown gasification process, the feedstock 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 around the world, such as in ammonia and fertilizer production. Hundreds of such industrial gasifiers are in operation today. In power generation applications as practiced today this "syngas" stream is cleaned of some impurities and then burned in a combustion turbine to make electricity in a process known as Integrated Gasification Combined Cycle ("IGCC"). 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 (the Weyburn project described below), 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.

The principal obstacle for broad application of pre-combustion capture to new power plants (and the main reason behind limited deployment of IGCC with carbon capture) is not technical, it is economic: under today's laws it is cheaper to release CO2 to the air than capture it. Other capture technologies, including post-combustion and oxyfuel combustion are currently at the bench and/or pilot demonstration stage. The cost of CO2 capture is by far the most expensive element in the CCS chain of operations, estimated to be in the region of 75% of total costs, depending on the geological setting and the distance of transport.

The second element of CCS is the transportation of captured carbon dioxide to the injection site, if needed. The use of CO2 for EOR began in the U.S. in the early 1960s. Inexpensive industrial CO2 sources, such as natural gas processing plants, were initially used, although to sustain the expansion this was quickly supplemented and eventually overshadowed by naturally occurring CO2 discovered in Colorado, New Mexico and Mississippi.

Today, there are around one hundred registered CO2 floods worldwide, almost 90% of which are in the U.S. and Canada. Some 35 million tons of CO2 annually are injected in mature oil reservoirs. These floods are primarily in the Permian Basin of Texas and New Mexico, but also in the Bighorn Basin of Wyoming, the Rangeley Field of Colorado and the Mississippi Salt Basin. In North Dakota CO2 from the Great Plains Synfuels project is captured and transported across the border to Canada, and injected into the Weyburn and Midale fields in Saskatchewan. CO2 pipelines today operate as a mature market technology and are the most common method for transporting CO2. The first long-distance CO2 pipeline came into operation in the early 1970s. In the United States, over 3,000 miles of pipeline transports more than 40 million tons CO2 per year for use in CO2-EOR. Transport of CO2 is happening today and it can happen at an even greater scale as CCS is more fully deployed.

The third element of CCS is the sequestration of the carbon dioxide in geological formations. Injection of carbon dioxide has been successfully demonstrated on a large scale, not least in the context of CO2-EOR projects, some of which like Seminole, SACROC and Wasson are injecting annual amounts of CO2 well above the quantity that a 500MW coal plant would produce.

There is also considerable scientific knowledge regarding the mechanisms for trapping carbon dioxide in sedimentary geological formations. For example, residual trapping limits carbon dioxide mobility through capillary forces. Solubility trapping occurs when injected carbon dioxide dissolves in fluids within the geological formation. Stratigraphic trapping occurs when overlying impermeable rock formations prevent upward movement of carbon dioxide from underlying reservoirs. Mineralization trapping occurs when

injected carbon dioxide forms carbonate minerals and essential becomes part of the solid rock into which it was injected.

Both the Intergovernmental Panel on Climate Change ("IPCC") and the interdisciplinary team from the Massachusetts Institute of Technology ("MIT") concluded that such sequestration methods in appropriately selected and operated geologic reservoirs are likely to trap over 99% of injected carbon dioxide over 1,000 years. This conclusion is based on existing project performance and a number of natural and industrial analogs. Nature itself has stored hydrocarbons and CO2 for millions to hundreds of millions of years, and humans have successfully stored natural gas and other fluids underground.

There are several commercial and research projects that inject carbon dioxide in sedimentary geological formations for permanent sequestration. For example, the Sleipner project in Norway has been operating since 1996 and injects about 1 million tons of CO2 annually into a deep saline formation in the North Sea. BP's In Salah project, operating in Algeria since 2004, injects a similar amount of CO2 stripped from natural gas back into the water leg of the natural gas field. The Weyburn project receives CO2 captured and transported from North Dakota to Saskatchewan and has been operating since 2000 and injects 1-2 million tons of CO2 annually.

All three of these projects include monitoring programs. The results of that monitoring indicate that the CO2 is remaining sequestered in the formations and that there is no reason to expect any CO2 leakage from these projects. These projects just mentioned provide a great deal of confidence that CO2 can remain permanently sequestered in geological reservoirs.

All components of CCS therefore – capture, transportation and injection – have been demonstrated at commercial scale in a number of industrial applications. We believe that the barriers to CCS are not technological, but rather economic and regulatory. We are joined by leaders of major industrial corporations such as NRG Energy, BP America and Tenaska who are all moving forward with CCS projects today in the United States—literally putting their money where their mouth is.

As noted above, BP believes that the CCS is "available today" And BP has joined forces with Rio Tinto in their joint venture, Hydrogen Energy, which has immediate plans to invest billions of dollars into CCS facilities in the U.S., the Middle East, Australia and Europe. Similarly, on February 19, 2008, Tenaska, Inc., publicly announced its proposal for the Trailblazer Energy Center in Texas, a 765 MW gross output and 600 MW net output supercritical pulverized coal electric generation facility with the capability to capture and deliver to the EOR markets 90 percent of CO_2 produced in the boiler. Tenaska's current plan is that the facility will be operational in 2014. Tenaska estimates that approximately 1/3 of its profit will come from revenues generated from the use of CO2 captured at the project for enhanced oil recovery.

In addition, NRG, the tenth largest power producer in the U.S. has also announced plans to move forward, together with Powerspan, to capture CO2 from its 125 MW WA Parish

plant in Fort Bend Texas, and to generate revenue from the sale of CO2 for enhanced oil recovery. NRG indicates that this plant will be operational in 2012.

Thus, as noted above, immediate deployment of CCS is not a technical or research issue as much as it is a policy and economic issue. As noted in testimony by Tenaska Vice President Gregory Kunkel:

"We have developed Trailblazer in anticipation of federal climate change legislation that would support, through placing a price on greenhouse gas emissions and other means, the significant capital and operating costs of carbon capture technology. Without climate legislation, it appears that revenues from enhanced oil recovery CO2 sales will be insufficient to cover all carbon capture costs. With proposed climate legislation, projected compliance cost savings and other effects of climate change legislation, combined with EOR revenues, would provide the needed economic incentives to build and operate Trailblazer."

Testimony of Gregory P. Kunkel, Ph.D. Vice President of Environmental Affairs Tenaska, Inc. Before the United States House of Representatives Natural Resources Subcommittee on Energy and Mineral Resources "Spinning Straw Into Black Gold: Enhanced Oil Recover Using Carbon Dioxide" June 12, 2008

Mr. Kunkel is joined by yet another prominent utility. According to the CEO of NRG Energy, David Crane:

"The company I run, NRG Energy, emits more than 64 million tons of carbon dioxide (CO2) into the atmosphere each year -- more than the total man-made greenhouse gas emissions of Norway. Why do we do it?...We do so because CO2emissions are free... in a world where CO2 has no price, removing CO2 before or after the combustion process is vastly more expensive and problematic than just venting it into the atmosphere. ...If Congress acts now, the power industry will respond. But we need to move as quickly as possible toward implementing the low-emissions ways of combusting coal that are under development or ***in the case of "coal gasification" technology, are ready for commercial deployment***. Effective incentives for these new technologies could easily and readily be included in a cap-and-trade regimen. Lawmakers need to provide both the carrot and the stick to get the CO2 out of coal."

David Crane, CEO of NRG Energy; Washington Post, October 14, 2007, (emphasis added)

Mr. Crane therefore points out that the reason that no large integrated power sector CCS project exists today is purely economic: it is simply cheaper to vent the CO_2 under today's laws instead capturing it, compressing it, transporting it to a suitable reservoir and sequestering it. However, this is not an indication of the state of readiness of the technology, as his statement makes clear.

The USDOE is leading a national research program on CCS. Although we applaud the efforts of the dedicated and talented individuals involved in this program, the resources and funding available are not in line with the deployment timescale needed for CCS to reduce emissions meaningfully. Without an economy-wide cap-and-trade scheme that prices carbon emissions, and without targeted and reliably funded (such as auction revenues, as opposed to the notoriously unreliable appropriations) incentives to bring down the costs of CCS in the initial years when the carbon price is too low and volatile to spur investment, CCS is destined to linger in the background as it has done until now.

We are convinced, however that, under the right policy framework, hundreds of MWs of power sector CCS would be deployed in the early years. The DOE's targets and timelines should not be seen as representative of the technology, or its program as the gateway to CCS. In fact, CCS is available for deployment today---what is needed is the appropriate policy, part of which could be a fund similar to that created under H.R. 6258.

A word about costs for CCS is in order. With today's off the shelf systems, estimates are that the production cost of electricity at a coal plant with CCS could be as much as 40% higher than at a conventional plant that emits its CO2. But the impact on average electricity prices of introducing CCS now will be very much smaller due to several factors. First, power production costs represent about 60% of the price you and I pay for electricity; the rest comes from transmission and distribution costs. Second, coal-based power represents just over half of U.S. power consumption. Third, and most important, even if we start now, CCS would be applied to only a small fraction of U.S. coal capacity for some time.

Finally, I should emphasize that although CCS is an important strategy to reduce CO_2 emissions from fossil fuel use, it is not the basis for a climate protection program by itself. Increased reliance on low-carbon energy resources is the key to protecting the climate. The lowest carbon resource of all is smarter use of energy; energy efficiency investments will be the backbone of any sensible climate protection strategy. Renewable energy will need to assume a much greater role than it does today. With today's use of solar, wind, biomass, geothermal and other renewable energy resources, we tap only a tiny fraction of the energy the Earth provides every day. There is enormous potential to expand our reliance on these and other resources.

9. How should a cap-and-trade program deal with the nuclear power sector?

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 suicidal 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.[21] Electricity to run these plants was supplied under long-term favorable contracts by the TVA, another quasi-

[21] "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. Appropriations 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 uncosted requirement for long-term environmental monitoring at some sites.

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 eight 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 Jan 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, particularly 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, and their corollary;

-- ever larger centralized units, to capture 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 understood 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.

10. Beyond making the nuclear power sector inherently more competitive by putting a price on carbon, should a climate regime more directly support nuclear energy deployment? Why or why not?
A climate regime should not "more directly support nuclear energy deployment." Scaling-up nuclear power worldwide is not a particularly cost-effective pathway to dramatic reductions in power plant emissions, and a global nuclear build-out raises a host of non-carbon costs and risks that must be weighed in the balance:

- Over the course of five decades, the nuclear fuel cycle has proven itself to be a costly, technically demanding, proliferation-prone, and environmentally damaging way to supply steam to turbines that generate electricity.

- Nuclear power is the only energy technology that requires an international safeguards regime to discourage countries from diverting fuel-cycle facilities and materials to make weapons.

- It is the only energy technology for which government must assume the ultimate liability for catastrophic accidents, and

- The only one in which the waste is so dangerous and enduring that government must assume responsibility for its long-term isolation from the biosphere.

- In every country where nuclear power exists, it remains a partly or completely state-run industry. Despite more than $150 billion in direct and indirect U.S. federal support over six decades, nuclear still supplies only 19% of the nation's, and 16% of global grid-tied electricity production.

- At a currently estimated cost of $0.15-$0.18 cents per kilowatt hour, electricity from new-build nuclear power plants would appear to require a carbon price in the range of $50- $100 per ton to be competitive without subsidies, a level not likely to be reached for many years under a carbon cap and trade regime.

- In all regions of the country, the following clean energy sources are available now at less cost, lower investment risk, and fewer environmental impacts than new nuclear power plants: electrical end-use efficiency; recovered waste-heat cogeneration; biogas, and small hydro. In large areas of the country, significant wind resources are available to be tapped at less cost than new nuclear power plants. In the Western half of the United States, solar thermal and geothermal resources can be developed at or below the low end of the cost range for new nuclear power plants. And in every region of the US, under a carbon cap solar PV is likely to emerge as a clean and economically relevant resource that will be a strong competitor for meeting peak afternoon loads.

- The Southeastern United States is often mentioned as being poor in utility-scale clean energy resources (e.g. wind and direct solar radiation) therefore making the only realistic option a choice between costly low-carbon nuclear, cheap-but-dirty coal, and less polluting but volatile supplies of natural gas. In reality, massive amounts of electricity from energy efficiency savings are available in the region for less than a third of the cost of new nuclear power, and these "negawatt" savings could be paired with a new generation of utility-scale thin film PV, concentrating PV, recovered waste heat cogeneration, and biogas power plants to comprise robust decentralized power supply options for the region.

- But even if one concedes that new nuclear plants are likely to play a significant role in the Southeast, it does not follow that the Federal government must subsidize them. Utilities and PUCs in this region are choosing the new nuclear option and taking the regulatory steps to put them into their customer rate base. Since 100% of the economic risk can be transferred in this fashion to the ratepayers, and the resulting stream of rate increases used to gain access to low cost construction financing, there is no reason why the federal taxpayer should assume any of the economic risks of these new nuclear plants, thereby distorting

the true cost basis for comparison with other low-carbon energy options.

11. In his written testimony, Admiral Frank Bowman from the Nuclear Energy Institute made the following statement: "if it [the loan program] is structured like the loan guarantee program authorized by Title XVII of the 2005 Energy Policy Act, in which project sponsors are expected to pay the cost of the loan guarantee, such a program would be revenue neutral and would not represent a subsidy." Do you agree with this assessment?

No. This is not unlike arguing that the only "cost" of repackaging subprime mortgages into marketable securities, was merely the administrative cost of generating the financial paperwork. In reality, U.S. Federal loan guarantees comprise contingent liabilities on US taxpayers that could balloon into very consequential sums if they are extended to a large number of reactor projects, as the industry is now seeking. They represent an advance commitment to do what the Treasury is now doing after the fact with the major investment banks – buying billions of dollars worth of bad loans.

In deregulated electricity markets, where there is no advance assurance that the output of a nuclear generation project can be sold at a profit, the economic risk involved leads to either an outright denial of financing, or else nuclear risk premiums for financing that are so high they make the entire project uneconomic. The widespread use of special purpose Limited Liability Corporations (LLCs) without any paid-in capital to own the new nuclear plants does not suggest a high degree of confidence among their sponsors, and leaves the taxpayers holding the whole bag if the projects fall apart.

12. How would you characterize the support the loan guarantee program provides to the nuclear industry?

NRDC regards nuclear power as a mature technology that has been driven toward "giganticism" in a misguided attempt to offset the persistently high costs of nuclear technology with ever larger unit sizes. But these even new larger units remain near or even above the upper end of historical costs per kilowatt for US nuclear power reactors, and with the projected costs of twin unit nuclear projects now hovering at around $17 – 18 billion, the absolute amount of capital at risk in each project has become prohibitive for the private capital markets. So despite substantial references to competition, level playing fields, and free markets, the technology as it now stands is generally not viable without some way of subsidizing the investment risks, either through a public utility rate proceeding that *forces* ratepayers to pay higher electricity rates, or through federal loan guarantees that force taxpayers to bear the lions share – 80% -- of a project's economic risk.

The current appropriated level of loan guarantee authority for nuclear reactors --$18.5 billion – is sufficient for probably two or at most three large new reactors at 80 percent loan guarantee coverage of the total project costs. NRDC believes that nuclear power is eligible to compete for economic viability under a climate bill with a host of other low-carbon technologies, but it is not deserving of further direct or indirect subsidy support.

While we are opposed to even the current level of loan guarantee support—because better low-carbon electricity options are immediately available—we note that this level is at least intellectually consistent with the original strategic vision of *subsidizing the lead units, and only the lead units, of genuinely new reactor designs that have not been previously constructed anywhere in the world.*

The original idea was that given the very long hiatus in U.S. nuclear reactor construction, and the regulatory goal of demonstrating the performance of home-grown (GE and Westinghouse) candidate designs for more economical standardized and "passively safe" reactors, there was some justification for the government, and indeed the nuclear power industry as a whole, sharing in the cost and risk of deploying the lead units of such new types, to ascertain whether a "nuclear renaissance" *could be* a cost-effective option under a declining cap for de-carbonizing the electricity sector.

What was originally posed as a question to be answered by a cooperative industry-government program is now inexplicably assumed, by nuclear power proponents, to have already been answered in the affirmative, even though the economic case for nuclear power has been getting worse, not better, and none of the new-design reactors have been completed either here or abroad. The original vision and purpose of demonstrating safer, more cost-effective standardized reactor candidates has been entirely lost in the current rush to file construction license applications establishing simultaneous eligibility for up to five different reactor types, three of which are not "new" designs at all, for production tax credits, regulatory risk insurance and additional loan guarantees.

NRDC's view that the nuclear industry has had its fair share of federal largesse is based on the following historical facts:

- Without federal assumption of excess liability for a major nuclear accident (Price-Anderson Act), the commercial nuclear industry likely would never have developed in U.S.
- Direct Federal R&D expenditures for civil nuclear power totaled $75 billion through 2004 (CRS, June 2004), more than any other single energy technology.
- Government assumed the burden and some of the costs of managing the permanent disposal of spent nuclear fuel.
- The nuclear Navy provided a steady low cost pool of trained reactor operators, educated at taxpayer expense, to staff the industry.
- Uranium was extracted from public lands without royalties to the Federal Treasury, and without (costly) observance of environmental/occupational health standards, resulting in wholesale pollution of public and tribal lands. Much unfunded liability for uranium mine cleanup still remains in the Rocky Mountain West.
- Uranium was enriched in massive government-owned facilities and provided to the civil nuclear industry at low prices that were heavily subsidized by the nuclear weapons program. The taxpayer share for D&D of this defunct government enrichment enterprise is now $10 billion.

- The Department of Energy continues to subsidize industry by giving away tens of tons of Highly Enriched Uranium (HEU) from the military stockpile for dilution and use as fuel in civil reactors.
- Without a massive government undertaking to monitor and control proliferation of nuclear materials and technology worldwide, a *global nuclear power industry would have presented too great a risk and would never have been allowed to prosper.* Government's combined diplomatic, intelligence, export-control, export-financing, safeguards, education, training, and security effort for nuclear power has surely totaled many tens and possibly hundreds of billions of dollars.
- New sources of Federal Support in the Energy Policy Act (EPACT) of 2005 included: a 1.8 cent/kWh production tax credit (indexed for inflation) for the first 6000 megawatts of new capacity, worth ~ $6 billion; "regulatory risk insurance" worth $1.75 billion; licensing cost sharing (50/50) with DOE worth $500 million or more; federal loan guarantees to remove nuclear risk interest premium and insure repayment of up to $18.5 billion in private debt financing for new reactors and $2 billion for new enrichment technology. These pre-existing and new subsidies are currently estimated to be worth about at least 4.3 cents/kWh, or $575 million per reactor per year (data for new UNISTAR 1600 MW EPR).[22]

13. Nuclear proponents claim that the environmental dangers of nuclear power are overstated and that spent fuel is purely a political issue, not a technical one. Do you agree with this assessment?

No. It is well recognized that there are unresolved technical issues related to environmental hazards associated with operations at nuclear power plants and nuclear fuel cycle facilities. For a summary of the some of the technical and other issues related to safety and security of nuclear power plants, the management and disposal of spent fuel, nuclear fuel reprocessing, and nuclear proliferation, see the Keystone Center report, "Nuclear Power Joint Fact-Finding," June 2007. [http://www.keystone.org/spp/documents/FinalReport_NJFF6_12_2007(1).pdf] This consensus report was prepared by a committee of experts from the nuclear industry, the environmental community, and various state and federal regulatory agencies. The Keystone Center report addresses technical issues associated with the security of spent fuel pools at reactor sites (beginning at p. 55), transportation of spent fuel (beginning at p. 80) and geologic disposal of spent fuel (beginning at p. 68). For a review of the failed efforts to dispose of high level nuclear waste and spent fuel in the United States, which including a discussion of some of the technical and political issues associated with spent fuel disposal, see Thomas B. Cochran, "How Safe is Yucca Mountain?," a paper

[22] Doug Koplow, "Energy Subsidies: How Much Does Nuclear Power Have in Common with Ethanol?" presentation on behalf of the Nonproliferation Policy Education Center Washington, DC, January 28, 2008, Earth Track, Inc Cambridge, MA 02140. Koplow concludes that when historically embedded hidden subsidies, such as accelerated depreciation, and the true cost of capital in a merchant power environment with a 50/50 debt equity ratio, are included, the subsidy for the huge 1600 megawatt UNISTAR EPR is on the order of 6-8 cents per kilowatt hour.

presented at a nuclear waste management symposium at Vanderbilt University, January 7, 2008. [http://docs.nrdc.org/nuclear/nuc_08010701A.pdf]

14. Assuming the federal government establishes an economy-wide cap-and-trade system, do you believe the federal government must assume long-term liability for closed carbon capture and sequestration sites to ensure we meet our emissions reductions targets?

No. NRDC believes the operator of a geologic respository should be responsible for monitoring and operations during the period of CO2 injection and for a sufficient number of years following the end of injection to demonstrate that the injected CO2 remains contained and the processes that will lead to permanent trapping are underway. Such operators should be held responsible for violations of law and other failures to exercise due care in the conduct of injection activity. We believe liability relating to such activities should be handled through private sector instruments such as contracts and insurance.

There may be a role for a government body to become the responsible entity for custody and long-term monitoring of geologic repositories following the cessation of injection and an appropriate post-injection assessment period, where the operator has demonstrated that the injected CO2 is reliably contained within the injection formation and permanent trapping mechanisms are underway. A properly selected and operated repository should be able to demonstrate a rapid and continuing reduction in the probability of any meaningful release from the formation following the injection period and the post-injection assessment period.

15. The iCAP Act (H.R. 6186) includes a detailed proposal for a greenhouse gas registry to be created under the Clean Air Act. Do you agree that a greenhouse gas registry should be created under the Clean Air Act, and do you support the proposal in this bill?

A greenhouse gas registry is needed to keep careful track of emissions from all affected sources, for both compliance and public information purposes. A cap and trade proposal depends on accurate emissions monitoring and reporting, so that each affected source is effectively held accountable for each ton of emissions. Accurate emissions monitoring and reporting is fundamental, because that is the means by which to determine how many emissions allowances each affected entity must tender to EPA each year.

Under the 1990 Clean Air Act amendments, electric power sources subject to the acid rain provisions in Title IV are required to report their emissions of carbon dioxide, as well as sulfur dioxide and nitrogen oxides. As a result, for most of these electric power sources there is a high quality hour-by-hour record of CO_2 emissions. The hour-by-hour sulfur dioxide data is the foundation of the successful acid rain cap and trade program. The CO_2 data submitted by these sources is of equal quality and will serve the same function.

This quality of data is not currently available, however, for other categories of facilities that will be subject to a greenhouse gas cap and trade system. The bill makes provision for collecting this data.

Section 705-707 of the bill create detailed emissions reporting and record-keeping requirements and requires EPA to create the necessary methodologies, protocols, and accounting procedures. These provisions cover all greenhouse gases subject to the program and all the affected sources. They appear to provide for reporting the necessary emissions data and for an EPA registry for effectively keeping track of the data for compliance purposes. Continuing the long-standing rule under the Clean Air Act, the bill appropriately provides that emissions data may not be kept confidential. The public has an important "right-to-know." Transparent public access to source-by-source, hour-by-hour emission data is fundamental to the public's right-to-know.

16. Do you believe costs of a cap-and-trade system can be adequately contained through strategies that would not compromise science-based near-term and long-term

The costs of a cap and trade system can be adequately "contained" through a variety of strategies that do not compromise science based targets. Trading, banking, and properly restricted borrowing all reduce the costs of the program. In addition, recycling of revenues to help deploy or jumpstart emission reduction strategies and technologies can also help lower the overall costs of the program. In this regard, use of revenues to incentivize energy efficiency, renewable energy and carbon capture and sequestration technologies should be a priority. As is evident, use of energy efficiency can actually save money and should be encouraged as the first and most important emissions reduction technology. As the chart below, from the McKinsey Report shows, there are numerous, short-term reduction strategies that can be undertaken at a negative cost that actually saves money.

Finally, NRDC supports the approach outlined by the NCEP and the Nicholas Institute for a "reserve auction" of borrowed allowances that would be released into the market place at a set price as a viable alternative to a so called "safety valve" that would put a fixed price on carbon emissions. Such an approach, if properly crafted, could help address cost issues without jeopardizing the integrity of the emissions cap. Versions of this approach have appeared in the Boxer/Lieberman/Warner bill (S. 3036) and in the Dingell Boucher "discussion draft." A fuller explanation of this approach appears below.

The Boxer-Lieberman-Warner Climate Security Act Substitute (S.3036 substitute) includes an innovative "cost-containment" provision designed to guard against higher-than-expected emission allowance prices and excessive price volatility without undermining the cumulative emission limits that are essential to prevent dangerous global warming (Sections 522-529). The number of allowances borrowed from future years and

offered at the cost-containment auction each year would be limited in order to preserve the integrity of the multi-year caps.

Here is how it works: A reserve of 6 billion allowances is set aside at the beginning of the cap-and-trade program using allowances drawn from the caps for 2030 through 2050. Additional allowances from the borrowed reserve would be introduced into the market if needed via a special cost-containment auction with a minimum price, held in December of each year. The minimum price in 2012 would be set by the president at a value between $22 and $30 per ton and would increase at a rate of 5 percent per year above inflation. The amount available in this cost-containment auction would be a maximum of 450 million allowances in 2012, and each successive year's amount would decline by one percent through 2027. Seventy percent of any revenue obtained from allowances sold at in the cost-containment auction would be used to achieve "make-up" emission reductions from sources not covered by the cap and 30 percent would be returned to consumers through tax reductions.

If the market clearing price of allowances – the price on which the market would settle after balancing supply and demand – fell in the expected range, i,e,, below the minimum cost-containment auction price, then no one would choose to buy allowances at the special auction in December. On the other hand, if the market clearing price of allowances exceeded the minimum cost-containment auction price during the year, then firms could plan on purchasing additional cost-containment allowances in December. Knowing that there would be an additional supply auctioned late in the year would help keep prices down.

If the market clearing price exceeded the expected range only modestly, then relatively few additional allowances would be purchased at the cost-containment auction before allowances prices returned to the minimum auction price. The full cost-containment reserve amount would be sold only if allowance prices rose substantially higher than expected.

Analyses of S.2191 by EPA and EIA give us some indication of how the market price would respond to the infusion of extra allowances. Based on these agencies' analyses of the price response to the availability of offsets, one can infer that increasing the quantity of allowances by 1 percent leads to a roughly 2.5 percent reduction in price. We can use this information to roughly estimate how the introduction of allowances from the reserve would affect market price.[23] The maximum number of allowances offered for sale in the 2012 reserve price auction, 450 million tons, represents 7.8 percent of the 2012 cap. Multiplying by the factor of 2.5 means that the cost-containment auction has the potential to buffer allowance prices by up to about 20 percent. For example, if the minimum auction price were set at $26 per ton (the middle of the allowed range), then a 450 million

[23] While there is some difference between the effect of forwarding allowances from distant future caps, as envisioned in the reserve, and an outside the cap infusion from, e.g., offsets, the period from which the allowances are forwarded are far enough in the future to make any such differences in effectiveness quite small in the initial years.

ton infusion would be enough to hold market prices at about $26 per ton as long as the underlying market clearing price without these tons was $32 or less.

If the underlying market clearing price without the extra tons was higher than $32 per ton, the cost-containment auction would still reduce market prices, but not all the way back to $26. For example, if the underlying market clearing price were $40 per ton without this mechanism the reserve price auction would be fully subscribed and allowance prices would settle at about $32.

17. The iCAP (H.R. 6186) includes a proposal to mitigate costs to consumers of climate legislation by recycling revenues from the auction of allowances back to consumers directly through rebates and tax credits. Do you believe a system such as this would be an effective way to distribute money to citizens? Do you believe there is any benefit to distributing these funds through a middle man such as utility companies?

The iCap Act uses 55 percent of the allowance value to protect the bottom 60 percent of consumers, phasing out in the 4th income quintile ($100k/married couple). The portion of the proposal that specifically attempts to mitigate costs for the lowest-income consumers follows the recommendations made by the Center on Budget and Policy Priorities (http://www.cbpp.org/pubs/climate.htm), which we are supportive of. While not experts in the tax system we believe that a system of rebates and tax credits as proposed by CBPP and as included in iCAP would be an effective way to distribute money back to consumers.

Local distribution companies can be effective at helping to lower their consumers' bills by implementing energy efficiency programs or other emission reduction measures. However, we do not believe that they are necessarily the most effective entity to distribute rebates to low-income consumers, many of whom can slip through the cracks, such as renters who do not directly pay utility bills as it is folded into their rent. CBPP has a good analysis which lays out the problems with using utilities as the "middle man" for distributing funds to low income customers (see, http://www.cbpp.org/7-18-08climate.htm). In addition, many of the energy related costs that low income consumers incur do not come from electricity or natural gas use, but rather are related to transportation and other indirect costs such as the price of food.

18. You mentioned the need for "push and pull" policies to promote development of low-carbon technologies. Please provide examples of "push" policies that you believe are necessary to promote carbon capture and sequestration and other technologies. Why will these policies be more effective than "pull" policies alone, such as funding for demonstration and deployment? Do you believe "pull" policies alone will result in adequate deployment of new technologies needed to meet the aggressive emissions reduction targets recommended in your testimony?

A September 2006 report by the Congressional Budget Office, CBO examined this issue in detail. See CBO Evaluating the Role of Prices and R&D in Reducing Carbon Dioxide Emissions. According to the CBO, "The Congressional Budget Office identified three published analyses that simulate the effect of both emissions pricing and R&D. While CBO recognizes the limitations of those modeling efforts and does not endorse any specific quantitative results, those model suggest that a combination of the two approaches—pricing emissions in the near term and funding R & D—would be necessary to reduce carbon emissions at the lowest possible cost. Further they suggest that the largest gains in efficiency are likely to come from pricing emissions rather than funding R and D." CBO Report at p. 16. CBO goes on to note that: "Those models suggest that pricing emissions would contribute more to minimizing the cost of reducing emissions than would subsidizing R and D... However, the qualitiative finding that a cost effective approach to reducing emissions would entail both funding R and D and pricing carbon is likely to remain robust...." CB Report at p. 17. Thus, while it appears that both "push and "pull" policies are necessary to achieve reductions at the lowest possible cost, the principal policy needs to be a policy that puts a price on carbon emissions. Although NRDC thus supports some limited funding for research and development efforts for carbon capture and sequestration, such funding must be combined with a price signal (from a cap and trade policy), in order to be effective in actually achieving reductions at the lowest possible cost. Without such a price signal, there is little to no realistic expectation that such technologies will actually be deployed, regardless of how much money is spent in R and D to lower the cost.

Put another way—regardless of R&D efforts to lower the cost of CCS technology, it will always be cheaper to vent CO2 into the atmosphere than to capture it and sequester it unless there is a limit on emissions. While research and development funding is needed for the medium- and long-term improvement of the technology, it is neither the gateway to the deployment of the technology, nor can it substitute for the incentive that a genuine commercial market for CO_2 capture and disposal systems will provide to the private sector.

It is also critical to understand that further research and development efforts for carbon capture and storage are not necessary as a pre-requisite to enacting limits on global warming pollution Moreover, in terms of financial incentives for deployment, the immediate need is in early deployment incentives and requirements for the first wave of CCD projects, the technology for which is available to us *today*. The amounts of capital that the private sector can spend to optimize CCD methods will almost certainly always dwarf what Congress will provide with taxpayer dollars. To mobilize those private sector dollars, Congress needs a stimulus more compelling than the offer of modest handouts for research. Congress has a model that works: intelligently designed policies to limit emissions cause firms to spend money finding better and less expensive ways to prevent or capture emissions.

Where a technology is already competitive with other emission control techniques, for example, sulfur dioxide scrubbers, a cap and trade program like that enacted by Congress in 1990, can result in more rapid deployment, improvements in performance, and

reductions in costs. Today's scrubbers are much more effective and much less costly than those built in the 1980s. However, a CO2 cap and trade program by itself may not result in deployment of CCD systems as rapidly as we need. Many new coal plant design decisions are being made literally today. Depending on the pace of required reductions under a global warming bill, a firm may decide to build a conventional coal plant and purchase credits from the cap and trade market rather than applying CCD systems to the plant. While this may appear to be economically rational in the short term, it is likely to lead to higher costs of CO2 control in the mid and longer term if substantial amounts of new conventional coal construction leads to ballooning demand for CO2 credits.

Recall that in the late 1990's and the first few years of this century, individual firms thought it made economic sense to build large numbers of new gas-fired power plants. The problem is too many of them had the same idea and the resulting increase in demand for natural gas increased both the price and volatility of natural gas to the point where many of these investments are idle today.

Moreover, delaying the start of CCD until a cap and trade system price is high enough to produce these investments delays the scale of deployment of the technology that is needed in the U.S. and other countries if we continue substantial use of coal, as seems likely. The more affordable CCD becomes, the more widespread its use will be throughout the world, including in rapidly growing economies. But the learning and cost reductions for CCD that are desirable will come only from the experience gained by building and operating the initial commercial plants. The longer we wait to ramp up this experience, the longer we will wait for what promise to be significant cost reductions to become a reality and, and to see CCD deployed worldwide.

To date our efforts have been limited to funding research, development, and limited demonstrations[24]. Such funding can be one of the necessary elements in this effort if it is wisely invested. But government subsidies--which are what we are talking about--cannot substitute for the driver that a real market for low-carbon goods and services provides. That market will be created only when requirements to limit CO_2 emissions are adopted. In this Congress, serious attention is finally being directed to enactment of such measures. Such measures combined with additional financial incentives (many of which could be funded from within the cap and trade system itself) is the fastest and surest path to rapid deployment of CCD.

Some have argued that key technologies, such as CCS, are not yet available or are only available now at exorbitant cost. Such arguments are incorrect. As discussed more fully below, the elements of today's CCS systems are actually in use today. But arguments

[24] Title VII of the Energy Independence and Security Act of 2007 (EISA) contains some provisions that, if funded, will help to make CCD a reality. These include authorizations to conduct at least seven large-scale geologic sequestration projects and separate authorizations for projects for large-scale capture of CO_2 from industrial sources. A third provision requires the U.S. Geological Survey to carry out a comprehensive assessment of capacity for geologic disposal of CO_2 . NRDC supports implementation of these provisions but we urge that they be complemented with enactment this year of a comprehensive program to cap CO_2 and other greenhouse gases, along with complementary policies to accelerate CCD deployment.

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.

THOMAS R. KUHN, ANSWERS TO SUBMITTED QUESTIONS

QUESTIONS SUBMITTED BY HON. EDWARD J. MARKEY

1. The iCAP Act (H.R. 6186) includes a proposal to mitigate costs to consumers of climate legislation by recycling revenues from the auction of allowances back to consumers directly through rebate and tax credits. Would this system provide a measure of protection from higher electricity prices to consumers?

Answer 1. Any mandatory GHG reduction program will lead to higher costs to the consumers of electricity. It is important to mitigate these impacts, especially during a transition period and especially for low-income customers. Auctions may have a role in any climate program in the latter years. However, auctions in the short to intermediate run may well increase total electricity costs to consumers because the electric utility (and its customers) wind up paying twice: once for the right to emit up to the cap (auction price) and once for investments in technologies and other emissions reductions costs.

A far more effective and efficient way to mitigate the financial impacts on customers is to rebate or flow-through the benefits of allowances to electricity customers in proportion to their use and emissions. This can be accomplished by allocating the majority of allowances to distribution utilities in the early years of a climate program, with additional allowances to generating companies in competitive electricity markets, and a gradual transition from allocations to an auction. To the extent there is an auction of allowances, auction proceeds should go toward climate technology development and deployment, as well as toward additional measures to assist low-income customers.

In addition to allocation of allowances and auction of allowances for the benefit of consumers, there are at least two other kinds of cost-containment mechanisms that are necessary to help limit the cost impacts of comprehensive cap-and-trade legislation on consumers: a price collar (i.e., floor price and ceiling price, or "safety valve") on allowances, and full and robust use of domestic and international offsets. See also my response to question 1 from the Honorable Mary Bono Mack.

2. What, if any, benefit to consumers would result from distributing these funds through utility companies?

Answer 2. Allocating allowances to local distribution companies (LDCs) with appropriate adjustment to address impacts on unregulated generators is the fairest and most efficient way to mitigate impacts of higher electricity prices on customers. LDCs have the information to assure that the benefits of allowances are rebated to customers fairly. LDCs already handle billing and have an infrastructure in place to manage the distribution of allocation proceeds. Moreover, an LDC-led process would be overseen by state utility regulators. They can assure that LDCs protect low-income customers during the transition and provide appropriate incentives to promote customer efficiency.

In comparison, there is no simple correlation between income taxes paid and electricity use or emission levels—especially for business taxpayers—so that a rebate system based on income tax payments will be inherently less effective in targeting rebates to customers.

3. What benefits may be achieved by providing funding to utilities to administer energy efficiency programs?

Answer 3. Utilities have the scope and scale to develop and implement energy-efficiency programs that can help customers achieve significant efficiency improvements. In addition, billions of dollars of new utility investments in technologies such as the smart grid are needed to support new efficiency measures, facilitate the most cost-effective adoption of carbon-reducing plug-in hybrid technologies for vehicles, and efficiently incorporate renewable and distributed energy technologies into the grid. Utilities must have appropriate business and regulatory incentives to make these programs work. Any source of additional funding for such utility programs will help promote these measures.

4. In your experience, has investment by government and by utilities in energy efficiency and renewable energy achieved emissions reductions? Do you agree that the U.S. could achieve emissions reductions through these and other strategies prior to commercial-scale deployment of carbon capture and sequestration technology?

Answer 4. Yes, investment by government and by utilities in energy efficiency and renewable energy can help to achieve emissions reductions. We agree that efficiency and renewables are the key to near-term emission reductions. Cost-effective energy-efficiency measures are the most direct way to reduce or avoid emissions and can

be implemented most quickly. However, while efficiency can reduce the growth in electricity demand (by approximately 38–48 percent by 2030), efficiency alone will not eliminate electricity demand growth. While more costly, renewable energy also avoids or reduces emissions, but not necessarily the need for generation capacity since most renewables, particularly wind and solar, only operate intermittently and require the construction of back-up generating facilities to assure that power is available whenever it is needed. In addition, widespread use of renewables, especially wind, will require extensive construction of new transmission facilities, because the best wind sites are usually far from customer locations. We estimate that utilities will need to spend $287 billion to construct new transmission facilities by 2030 to eliminate congestion in the current system, interconnect new renewable resources, and assure reliability and security for the system.

Ultimately, EEI believes that the full portfolio of technologies and measures will be needed to reduce, avoid and sequester GHG emissions in the power sector, as follows:

- Efficiency and renewables are key to near-term reductions.
- Maximizing new nuclear is key to mid-to-longer term reductions.
- The aggressive development and deployment of carbon capture and storage coupled with advanced coal technologies are necessary to preserving the coal option.
- Plug-in hybrid electric vehicles can make a major contribution to reducing net GHG emissions, as well as to reducing foreign oil dependence and consumer prices at the pump.
- Other no and low-emitting carbon technologies should be pursued, e.g., the smart grid.

See my testimony of June 19, 2008, to this Committee (pp. 5–9, discussing the so-called "PRISM" work of the Electric Power Research Institute and the need for a full technology pathway for GHG reduction, avoidance and sequestration). Any one of the above-listed sets of technologies and measures will be insufficient in and of itself to address power sector GHGs; all are important collectively. Note that the time frames for their implementation, or development and deployment, will vary. Thus, regarding your last question on implementation time frames, it is likely that energy efficiency and renewables will be important in the near term; new nuclear energy will be important in the mid-term to long term, beginning around 2016–2018; and carbon capture and storage coupled with advanced coal technologies will also be important in the mid-term to long-term, with widespread commercial deployment projected around 2025 or later.

QUESTIONS SUBMITTED BY HON. MARY BONO MACK

1. Mr. Kuhn, thank you for providing testimony at this hearing. The District I represent is reaching hot summer temperatures quickly; it was around 115 degrees in some parts the day of our hearing. So, while there's no need to heat the swimming pools, there sure is a lot of energy required to keep those air conditioners running.

Locals facing higher energy bills have asked me about climate change legislation we're debating and how it may increase their utility bills. What kinds of cost-containment mechanisms do you think should be in a comprehensive cap and trade bill so we can help ensure prices remain reasonable?

Answer 1. Assuming a comprehensive cap-and-trade bill is the mandatory GHG policy instrument that Congress focuses on, at least three kinds of cost-containment mechanisms are necessary to help limit cost impacts on consumers and our customers: allocation of allowances to GHG-intensive industries such as the power sector; a price collar (i.e., floor price and ceiling price, or "safety valve") on allowances; and full and robust use of domestic and international offsets. We expound on these mechanisms in greater detail in EEI's "Working Paper on S. 2191, 'Lieberman-Warner Climate Security Act of 2007,'" May 15, 2008, submitted to several Senate Committees and this Committee (see pp. 8–14). All congressional cap-and-trade bills that we have seen to date would result in significant costs to the economy, consumers and our customers, and none has included comprehensive and full cost-containment mechanisms that would mitigate those costs to the maximum extent possible.

The economic costs of cap-and-trade legislation are also affected by the stringency of targets and timetables and by whether those compliance timetables are harmonized with the expected development and deployment timelines of advanced climate technologies and measures. The full portfolio of technologies and measures will be needed to reduce, avoid and sequester GHG emissions in the power sector. See my testimony of June 19, 2008, to this Committee (pp. 5–9, discussing the so-called "PRISM" work of the Electric Power Research Institute and the need for a full technology pathway for GHG reduction, avoidance and sequestration). The cost dif-

ference between the full portfolio and limited portfolio approaches is vast: 45 percent increase versus 260 percent increase in real electricity prices. See also my response to question number 4 from Representative Edward J. Markey

2. I'm also trying to get a sense of supply needs we'll have in the coming years. It's surely going to affect how we can put in place technologies in any cap and trade model that can still help to meet demand. What will the country need in terms of baseload electric generation and electric utility infrastructure by, let's say, the year 2030?

Answer 2. You are correct that GHG emissions reductions, avoidances and sequestrations in the power sector must be made against the backdrop of population and economic growth. The Energy Information Administration has projected that the net demand of electric generation will increase by 30 percent by 2030, even after taking into account energy-efficiency improvements due to market-driven efficiency and stricter building codes and appliance and other efficiency standards mandated by the Energy Independence and Security Act of 2007. The technological transformation of America's power sector will occur in the face of tremendous capital investment needs in order to meet the electricity needs of a growing population and economy. Even with substantial energy-efficiency measures, new and replacement power plant capacity is projected to total 150,000 megaWatts and cost $560 billion by 2030. Transmission and distribution investment needs are projected to total $900 billion by 2030. See my testimony of June 19, 2008, to this Committee (p. 2).

Nuclear Energy Institute Responses to Follow-Up Questions
From House Energy and Air Quality Subcommittee
Re: June 19, 2008 Hearing on Climate Change

1. *Your testimony stated that you "expect four to eight new U.S. nuclear plants in operation by 2016 or so. Assuming those first plants are meeting their construction schedules and cost estimates, the rate of construction would accelerate thereafter. With the necessary investment stimulus and financing support, we could see approximately 20,000 MW of new nuclear capacity (that would be about 15 plants) on line in the 2020 to 2022 time frame, and 65,000 to 70,000 megawatts (or 45 to 50 plants) by 2030."*

a. *How many new nuclear plants do you anticipate will be built utilizing the $18.5 billion in federal loan guarantees currently authorized for new nuclear power facilities?*

It is difficult to predict how many new nuclear power plants will be built with the $18.5 billion in federal loan guarantees currently authorized. Some projects have multiple co-owners, and it is possible that not all co-owners will choose to avail themselves of the loan guarantee program. Some projects will receive partial support from the government export credit agencies of France and Japan, which testifies to the degree of confidence the French and Japanese governments have in nuclear power. Such co-financing will leverage the $18.5 billion in existing loan guarantee authority and, as a result, it may cover 3-4 projects.

Certainly, the $18.5 billion in existing loan guarantee authority will not cover all the projects that filed Part I loan guarantee applications with the Department of Energy. DOE received loan guarantee applications from 17 companies for 21 new reactors, with an aggregate loan volume of $122 billion and total project costs of $188 billion. Those applications represent 28,800 megawatts of carbon-free generating capacity and would, NEI estimates, avoid 183 million metric tons per year of CO2, 124,000 tons of NOx, and 348,000 tons of SO2 (based on a 90% capacity factor).

b. *In order to reach the second wave of 20,000 MW of new nuclear capacity that you mention, what "additional investment stimulus and financing support" do you anticipate will be necessary?*

Again, it is difficult to predict with certainty what financing support may be necessary to build new nuclear plants 10 to 15 years from now. A definitive answer would require certainty about a number of factors – prices prevailing in electricity markets when the first new nuclear plants come on line in 2015-2016, capital costs of all baseload electric technologies, commodity costs, environmental compliance costs for fossil-fueled generating capacity, natural gas prices, growth in electricity demand, the state of the U.S. economy and conditions in U.S. and world financial markets. There is, of course, no certainty on any of these issues.

As stated in my June 19 testimony, however, one of the most significant financing challenges facing new nuclear power plants is the cost of these projects relative to the size, market value and financing capability of the companies that will build them. New nuclear power plants are expected to cost at least $6-8 billion. U.S. electric power companies do not have the size, financing capability or financial strength to finance new nuclear power projects on balance sheet, on their own– particularly at a time when they are investing heavily in other generating capacity, transmission and

distribution infrastructure, and environmental controls. These first projects will need financing support – either loan guarantees from the federal government or assurance of investment recovery from state governments, or both.

The states are doing their part. Throughout the South and Southeast, including Florida, Louisiana, North Carolina, South Carolina, Texas, Virginia and Mississippi, state governments have enacted legislation or implemented new regulations to encourage new nuclear plant construction. Comparable federal government commitment is essential. The modest loan guarantee program authorized by the 2005 Energy Policy Act was a small step in the right direction, but it does not represent a sufficient response to the urgent need to rebuild our critical electric power infrastructure. Meeting these investment needs will require a partnership between the private sector and the public sector.

2. *For every nuclear power plant that has been brought on line since 1976, please provide the date the plant was ordered, the date construction began, the date construction was completed, the date the plant began generating electricity, and the number of months that elapsed between the first and last date.*

Please refer to the table starting on page 4. This table shows the date on which the project was announced (the date "the plant was ordered"); the date the Construction Permit was docketed; the date the Construction Permit was issued by the NRC (the "date construction began"); and the date the NRC issued the Operating License (the date "construction was completed"). The date "the plant began generating electricity" would fall between the Initial Criticality date when the plant began testing and the Commercial Operation date when the plant officially began providing electricity to the grid. The table is sorted by Commercial Operation date beginning May 1976.

In reviewing this data, it is important to remember that many of these plants were built and commissioned under the most unforgiving conditions.

The defining event for the 1980s-vintage plants was the accident at the Three Mile Island nuclear power plant in 1979. After that accident, nuclear power plants—both operating plants and those under construction—were engulfed in new regulatory requirements imposed by the Nuclear Regulatory Commission. The changing requirements forced extensive redesign and rework at nuclear units under construction. This stretched out construction schedules and—to make matters worse—the delays coincided with a lengthy period of double-digit inflation and national economic distress. All this combined to drive up the cost of these nuclear units to several times the original cost estimates. For some of these nuclear plants, half the total cost was interest on debt raised to finance construction.

The 104 nuclear power plants now supplying about 20 percent of U.S. electricity also were built under a two-step licensing system. Under this system, electric utilities had to secure two permits—one to build a nuclear power plant, a second to operate it. Many companies started construction before design and engineering was complete. In fact, in many cases, the design/engineering work had barely started.

This "design as you go" approach led to significant problems. The Nuclear Regulatory Commission (NRC) obviously could not finish its review and approval of the plant design until the plant was built and the power company requested an operating license.

Even before the accident at Three Mile Island, requests for operating licenses were complex and contentious. After the accident, they became even more difficult. The reviews, conducted by licensing boards, were formal adjudicatory proceedings with all the trappings of a courtroom trial—discovery, cross-examination and the like. They were typically lengthy, bitterly contested, divisive events. And they caused delays in plant operation, which added hundreds of millions of dollars to the cost.

Based on that experience, the electric power industry resolved that future nuclear power plants would be fully designed before construction began. Never again would electric utilities start building a nuclear power plant that was only partly designed, or do extensive design and engineering work during construction. The change in design philosophy was accompanied by a complete overhaul of the licensing system, which was ratified by Congress in the Energy Policy Act of 1992.

The new licensing process allows nuclear power plant designers to submit their designs to the NRC for "certification." When a design is certified, electric utilities can order that plant, confident that design and safety issues have been resolved.

The new process also lets a company request a combined license to build and operate a new nuclear unit. As long as the design is pre-approved, and as long as the plant is built to pre-approved specifications (and the Nuclear Regulatory Commission will be on-site, checking to make sure that it is), then the power company can start-up the plant when construction is complete—assuming of course, that no new safety issues have emerged.

Taken together, the new design philosophy and the new licensing system ensure that all major issues and risks—design, safety, siting and public concerns—will be settled up front before a company starts building a nuclear power plant and puts billions of dollars at risk.

In summary, the conditions that led to large cost increases for some operating nuclear power plants no longer exist. Past experience is useful in identifying the weaknesses in the regulatory process and fixing those weaknesses. Past experience does not, however, provide useful guidance as to the cost of nuclear power plants that will be built in the future, or the length of time it will take to build them.

Unit	Announced	Application Docketed	Construction Permit	Operating License	Initial Criticality	Commercial Operation	Months Between the Application Docketed and Commercial Operation
Trojan	11/11/68	6/25/69	2/8/71	11/21/75	12/15/75	5/20/76	83
Indian Point 3	4/26/67	4/26/67	8/13/69	12/12/75	4/6/76	8/30/76	112
Beaver Valley 1	10/3/67	1/5/69	6/26/70	1/30/76	5/10/76	10/1/76	93
St. Lucie 1	11/20/67	1/28/69	7/1/70	3/1/76	4/22/76	12/21/76	95
Browns Ferry 3	6/22/67	7/17/67	7/31/68	7/2/76	8/8/76	3/1/77	116
Crystal River 3	2/14/67	8/10/67	9/25/68	12/3/76	1/14/77	3/13/77	115
Brunswick 1	1/24/68	7/31/68	2/7/70	9/8/76	10/8/76	3/18/77	104
Calvert Cliffs 2	5/29/67	1/25/68	7/7/69	8/13/76	11/30/76	4/1/77	110
Salem 1	8/15/66	12/13/66	9/25/68	8/13/76	12/11/76	6/30/77	127
Joseph M. Farley 1	5/13/69	10/15/69	8/16/72	6/25/77	8/9/77	12/1/77	98
North Anna 1	10/12/67	3/21/69	2/19/71	11/26/77	4/5/78	6/6/78	111
Donald C. Cook 2	7/20/67	12/20/67	3/25/69	12/23/77	3/10/78	7/1/78	126
Davis Besse	11/1/68	8/1/69	3/24/71	4/22/77	8/12/77	7/31/78	108
Three Mile Island 2	2/3/67	4/29/68	11/4/69	2/8/78	3/27/78	10/30/78	126
Fort St. Vrain	11/1/65	10/26/66	9/17/68	12/21/73	1/31/74	7/1/79	152
Edwin I. Hatch 2	2/27/70	9/11/70	12/27/72	6/13/78	7/4/78	9/5/79	108
Arkansas Nuclear One 2	5/21/70	9/17/70	12/6/72	7/18/78	12/5/78	3/26/80	114
North Anna 2	10/12/67	3/21/69	2/19/71	4/11/80	6/12/80	12/14/80	141
Sequoyah 1	4/18/68	10/15/68	5/27/70	2/29/80	7/5/80	7/1/81	153
Joseph M. Farley 2	5/13/69	10/15/69	8/16/72	10/23/80	5/5/81	7/30/81	142
Salem 2	6/1/67	11/6/67	9/25/68	4/18/80	8/8/80	10/13/81	167
McGuire 1	11/17/69	9/18/70	2/23/73	1/23/81	8/8/81	12/1/81	135
Sequoyah 2	4/18/68	10/15/68	5/27/70	6/25/81	11/5/81	6/1/82	164
Susquehanna 1	5/10/68	4/1/71	11/2/73	7/17/82	9/10/82	6/8/83	146
San Onofre 2	1/27/70	6/1/70	10/18/73	2/16/82	7/26/82	8/8/83	158
St. Lucie 2	5/1/71	5/15/73	5/2/77	4/6/83	6/2/83	8/8/83	123
La Salle 1	5/27/70	11/3/70	9/10/73	4/17/82	6/21/82	1/1/84	158
V.C. Summer	2/12/71	6/30/71	3/21/73	8/6/82	10/22/82	1/1/84	150
McGuire 2	11/17/69	9/18/70	2/23/73	3/3/83	5/8/83	3/1/84	162
San Onofre 3	1/27/70	6/1/70	10/18/73	11/15/82	8/29/83	4/1/84	166
La Salle 2	5/27/70	11/3/70	9/10/73	12/16/83	3/10/84	10/19/84	168
Columbia 2	3/23/71	8/19/71	3/19/73	12/20/83	1/19/84	12/13/84	160
Callaway	7/16/73	6/21/74	4/16/76	6/11/84	10/2/84	12/19/84	126
Susquehanna 2	5/10/68	4/1/71	11/2/73	3/23/84	5/8/84	2/12/85	167
Diablo Canyon 1	11/20/66	1/18/67	4/23/68	9/22/81	4/29/84	5/7/85	220

Unit	Announced	Application Docketed	Construction Permit	Operating License	Initial Criticality	Commercial Operation	Months Between the Application Docketed and Commercial Operation
Catawba 1	7/26/72	10/27/72	8/7/75	7/18/84	1/7/85	6/29/85	152
Grand Gulf 1	1/21/72	11/17/72	9/4/74	6/18/82	8/18/82	7/1/85	152
Wolf Creek 1	2/20/73	5/17/74	5/17/77	3/11/85	5/22/85	9/3/85	136
Byron 1	4/9/71	9/20/73	12/31/75	10/31/84	2/2/85	9/16/85	144
Waterford 3	9/24/70	12/19/70	11/14/74	12/18/84	3/4/85	9/24/85	177
Palo Verde 1	10/30/73	10/7/74	5/25/76	12/31/84	5/25/84	1/28/86	136
Limerick 1	10/1/69	2/27/70	6/19/74	10/26/84	12/22/84	2/1/86	191
Diablo Canyon 2	2/12/68	7/1/68	12/9/70	4/26/85	8/19/85	3/13/86	213
Millstone 3	10/1/72	2/10/73	8/9/74	11/25/85	1/23/86	4/23/86	158
River Bend 1	12/1/71	9/27/73	3/25/77	8/29/85	10/31/85	6/16/86	153
Catawba 2	7/26/72	10/27/72	8/7/75	2/24/86	5/8/86	8/19/86	166
Palo Verde 2	10/30/73	10/7/74	5/25/76	12/9/85	4/18/86	9/19/86	144
Hope Creek 1	8/11/69	2/27/70	11/4/74	4/11/86	6/28/86	12/20/86	202
Shearon Harris 1	4/29/71	9/7/71	1/27/78	10/24/86	1/3/87	5/2/87	188
Vogtle 1	9/8/71	2/13/73	6/28/74	1/16/87	3/9/87	6/1/87	172
Byron 2	4/9/71	9/20/73	12/31/75	11/6/86	1/9/87	8/21/87	167
Beaver Valley 2	9/24/71	10/20/72	5/3/74	5/28/87	8/4/87	11/17/87	181
Perry 1	10/13/71	6/25/73	5/3/77	3/18/86	6/6/86	11/18/87	173
Clinton	2/10/72	10/30/73	2/24/76	9/29/86	2/27/87	11/24/87	169
Palo Verde 3	10/30/73	10/7/74	5/25/76	3/25/87	10/25/87	1/8/88	159
Fermi 2	7/26/68	4/29/69	9/26/72	3/20/85	6/21/85	1/23/88	225
Nine Mile Point 2	10/1/71	6/15/72	6/24/74	10/31/86	5/23/87	3/11/88	189
Braidwood 1	9/28/72	9/20/73	12/31/75	10/17/86	5/29/87	7/29/88	178
South Texas Project 1	6/6/73	7/5/74	12/22/75	8/21/87	3/8/88	8/25/88	170
Braidwood 2	9/28/72	9/20/73	12/31/75	12/18/87	3/8/88	10/17/88	181
Vogtle 2	9/8/71	2/13/73	6/28/74	2/9/89	3/28/89	5/20/89	195
South Texas Project 2	6/6/73	7/5/74	12/22/75	12/16/88	3/12/89	6/19/89	180
Limerick 2	10/1/69	2/27/70	6/19/74	6/22/89	8/12/89	1/8/90	239
Comanche Peak 1	7/1/72	7/20/73	12/19/74	2/8/90	4/30/90	8/13/90	205
Seabrook 1	2/1/72	7/9/73	7/7/76	10/17/86	6/13/89	8/17/90	205
Comanche Peak 2	7/1/72	7/20/73	12/19/74	2/2/93	3/24/93	8/3/93	241
Watts Bar 1	8/27/70	5/18/71	1/23/73	11/9/95	1/10/96	2/7/96	297
Source: Scientech							

3. *You mention in your testimony that "U.S. electric power companies do not have the size, financing capability of financial strength to finance new nuclear power projects on balance sheet, on their own."*

a. *According to its website, NEI's membership "includes every energy company that operates nuclear power plants in the United States." Please provide a list of the nuclear power plant owner or operator companies in the U.S. which currently have a bond rating by Moody's, Standard & Poors, or Fitch IBCA of investment grade.*

See tables on next two pages.

OWNERS/OPERATORS OF NUCLEAR POWER PLANTS WITH INVESTMENT GRADE BOND RATINGS[1]

COMPANY	Ticker	Market Cap[2]	Moody's[3]	S&P[4]	Fitch[5]
Ameren Corp.	AEE	8.17	Baa3	BBB-	BBB+
American Electric Power Co. Inc.	AEP	14.85	Baa2	BBB	BBB
Constellation Energy Group, Inc.	CEG	4.27	Baa2	BBB	BBB
Dominion Resources, Inc.	D	24.62	Baa2	A-	BBB+
DTE Energy Co.	DTE	6.40	Baa2	BBB	BBB
Duke Energy Corp.	DUK	22.33	Baa2	A-	
Edison International	EIX	12.87	Baa2	BBB-	BBB-
Entergy Corp.	ETR	16.70	Baa3	BBB	BBB-
Exelon Corp.	EXC	40.65	Baa1	BBB+	BBB+
FirstEnergy Corp.	FE	20.18	Baa3	BBB	BBB
FPL Group, Inc.	FPL	20.75	A2	A	A
Great Plains Energy, Inc.	GXP	2.61	Baa2	BBB	
NRG Energy, Inc.	NRG	5.60	Ba3	B+	B
Pacific Gas and Electric Co. (PG&E)	PCG	13.51	Baa1	BBB+	A-
Pinnacle West Capital Corp.	PNW	3.43	Baa3	BBB-	BBB-
PPL Corp.	PPL	13.99	Baa2	BBB	BBB
Progress Energy, Inc.	PGN	11.14	Baa2	BBB+	BBB
Public Service Enterprise Group, Inc.	PEG	16.49	Ba3	BBB	BBB+
SCANA Corp.	SCG	4.50	Baa1	A-	A-
Sempra Energy	SRE	12.48	Baa1	BBB+	A
Southern Co.	SO	29.02	A3	A	A
Westar Energy, Inc.	WR	2.49	Baa3	BBB-	BBB-
Xcel Energy, Inc.	XEL	8.55	Baa1	BBB+	BBB+

[1]All data is as of September 30, 2008
[2]Billions of dollars
[3]www.Moodys.com
[4]www.Standardandpoors.com
[5]www.fitchratings.com

CREDIT RATINGS SCALE			
Credit Risk	Moody's	S&P	Fitch
INVESTMENT GRADE			
Highest quality	Aaa	AAA	AAA
High quality (very strong)	Aa	AA	AA
Upper medium grade (strong)	A	A	A
Medium grade	Baa	BBB	BBB
NOT INVESTMENT GRADE or HIGH YIELD			
Somewhat speculative	Ba	BB	BB
Speculative	B	B	B
Highly speculative	Caa	CCC	CCC
Most speculative	Ca	CC	CC
Imminent default	C	C	C
Default	C	D	D

b. Why would these companies, which have investment grade bond ratings, be unable to secure the private investment capital needed to finance the construction of a new nuclear power plant?

Most companies that own or operate nuclear power plants have stable but borderline investment-grade bond ratings. This is not, in and of itself, a barrier to securing private investment capital to finance new nuclear plant construction. The major barrier is the size of the companies relative to the amount of capital investment required. New nuclear power plants are expected to cost $6-8 billion each (in 2008 dollars). The largest U.S. electric company considering the construction of a new nuclear power plant has a market value of around $40 billion; most are much smaller. An investment of that size financed on balance sheet, with full recourse to the project sponsor, would likely result in negative credit-rating and cash flow implications for the company.

In addition, many investors believe new nuclear plants face political and regulatory risks because they have not been built in the United States in nearly two decades. The financial markets remember the longer-than-expected construction times and cost overruns experienced during construction of today's operating plants. Although the federal government has created a more efficient and predictable licensing process which should eliminate or significantly lower the risk of construction delays, investors remain concerned about the potential consequences of licensing delays, given the high cost and long development times for nuclear power plants. The federal loan guarantee is required to offset those perceived risks and assist in bringing new nuclear technologies to market.

c. Please list the electric power companies who have applied for, and been denied, investment capital to finance the construction a new nuclear power plant.

No companies have applied for and been denied investment capital for construction of new plants recently. As of September 29, 2008, DOE had received loan guarantee applications from 17 companies for 21 new reactors, with an aggregate loan volume of $122 billion and total project costs of $188 billion. For these companies, the applications are the first step towards securing the financing to construct a new nuclear power plant. Without a federal loan guarantee, it will be difficult for these companies to access credit markets on reasonable and competitive terms.

For the reasons noted above, electric power companies are unlikely to seek access to the capital markets without the assurance associated with federal loan guarantees.

d. What financing capability or financial strength do you believe a company would need to have in order to finance new nuclear power projects on balance sheet, on their own?

Companies considering the construction of new nuclear power plants are actively seeking supplementary financing sources and structures in order to improve project economics. These include loans and loan guarantees from foreign banks and export credit agencies (ECAs), co-ownership agreements with electric cooperatives and municipalities, and (in regulated states) the recovery of carrying costs during construction (Construction Work in Progress or CWIP). These types of arrangements, as well as the federal loan guarantee program, all help to improve the economics of new nuclear power by limiting the impact of the project on company cash flows and credit quality. The more favorable financing terms these companies can secure, the lower the cost of electricity consumers will ultimately pay.

In terms of size, financing capability and financial strength, $6-8 billion projects are not unique in the energy business, but such projects are typically undertaken by much larger companies – like the major oil companies – with market values many times greater than the U.S. electric companies. ExxonMobil, for example, has a market capitalization of approximately $400 billion. The largest U.S. electric company has a market cap of approximately $40 billion.

e. Is there a point in the future in which a company would be able to finance a nuclear power plant without the aid of a federal loan guarantee?

Certainly not in the immediate future. The energy loan guarantee program authorized by the 2005 Energy Policy Act is intended to encourage the construction of low-carbon energy projects that may be difficult to finance on reasonable terms. As noted in answers to previous questions, investors believe new nuclear plants face political and regulatory risks because they have not been built in the United States in nearly two decades. The financial markets remember the longer-than-expected construction times and cost overruns experienced during construction of today's operating plants. Although the federal government has created a more efficient and predictable licensing process which should eliminate or significantly lower the risk of construction delays, investors remain concerned about the potential consequences of licensing delays, given the high cost and long development times for nuclear power plants. The federal loan guarantee is required to offset those perceived risks and assist in bringing new nuclear technologies to market.

In general terms, loan guarantees are used to correct market imperfections. The Office of Management and Budget has identified four causes of market imperfections that justify use of loan guarantees: (1) inadequate information, (2) limited ability to secure resources, (3) imperfect competition and (4) externalities. New nuclear plants qualify under the first and fourth conditions: Inadequate information (investors cannot measure and price the political/regulatory risk), and externalities (the size of nuclear plants relative to the size of the companies that will build them). Loan guarantees will be necessary as long as these market imperfections exist.[1]

In addition, the regulations governing the loan guarantee program impose limits (in 10 CFR 609.2) on the number of projects that can receive loan guarantees.

f. When might that be and what conditions would be required for that to happen?

The successful construction and operation of a number of new nuclear power plants of various designs in the United States would help to overcome the perceived political and regulatory risks noted in answers to previous questions. As noted earlier, however, it is difficult to predict the level of financing support that might be necessary for any clean energy technology, including nuclear power, absent certainty as to conditions in the energy markets and the capital markets 10-15 years hence.

More broadly, expansion of nuclear power in the United States depends on stable and sustained energy and environmental policies, which recognize that meeting America's energy and environmental needs will require aggressive deployment of a broad-based portfolio of technologies –

[1] See pp. 67-68 of *Analytical Perspectives*, Budget of the U.S. Government, Fiscal Year 2008, for a more detailed discussion of market imperfections in credit markets and the role of federal loan guarantees.

including energy efficiency, renewables, high-efficiency coal-fired generating capacity, carbon capture and storage, nuclear power, distributed resources and plug-in hybrid electric vehicles.[2]

4. *You mention in your testimony that "new nuclear plant construction will also lead to new investment in the supply chain-in new manufacturing facilities to produce pumps, valves, pipe, electrical cable and other equipment and components. That will create more jobs, new opportunities and higher economic growth, and allow the United States to reclaim economic opportunity that has moved overseas over the last several decades."*

a. What is the current state of domestic manufacturing of nuclear-certified components?

The domestic nuclear manufacturing infrastructure has declined from its peak in the early to mid-1980s. With the advent of significant new nuclear construction globally, as well as the ongoing refurbishment and upgrade of the current nuclear fleet, NEI is seeing significant investment and expansion in the domestic nuclear manufacturing infrastucture. Today, there are 201 companies that hold nuclear certificates around the world; 54 percent are located in North America (120 in total, 115 in the United States and 5 in Canada). Of the total of 505 nuclear certificates that are held globally, 258 are held by U.S. firms. This represents an increase from just 225 nuclear certificates held by U.S. firms 12 months ago. (Note: A single company may hold multiple certificates.)

b. How has this industry changed in the United States over the last three decades?

As nuclear construction slowed in the 1980s and 1990s, the U.S. nuclear manufacturing base contracted. Many of the firms that continued to be involved in the U.S. nuclear market focused their efforts on supplying the operating nuclear fleet. Some companies focused their efforts on supplying the nuclear navy and let their commercial nuclear certifications lapse. In addition, there was some consolidation within the industry as companies were acquired by others and still other firms shifted their production to the non-nuclear sector. Recently, with the global nuclear renaissance and new nuclear construction moving toward reality in the United States, U.S. companies are re-entering the commercial nuclear market, making significant investments in new machinery and factories, and hiring workers.

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[2] Realistic assessments of how to reduce U.S. electric sector carbon emissions show that there is no single technology that can, by itself, slow and reverse increases in carbon emissions. A portfolio of technologies and approaches will be required. Recent analysis by the Electric Power Research Institute (EPRI) demonstrates this. (See http://mydocs.epri.com/docs/public/DiscussionPaper2007.pdf.) The EPRI analysis starts with the EIA forecast of electric sector carbon emissions in 2030 (2.9 billion tons), then assembles the portfolio of technologies and approaches that could reduce the sector's carbon emissions to 1990 levels (1.8 billion tons) by 2030. The portfolio necessary to achieve the 1990 level of carbon emissions includes:

1. aggressive efficiency programs to reduce electricity demand growth from 1.05 percent/year to 0.75 percent/year
2. 100,000 MW of new renewable energy capacity (instead of the 55,000 MW in EIA's reference case)
3. 64,000 MW of new nuclear generating capacity, in addition to the 100,000 MW now operating
4. significant improvements in the efficiency of existing coal-fired power plants and widespread deployment of carbon capture and storage beyond 2020
5. significant penetration of plug-in hybrid electric vehicles, and
6. expanded reliance on distributed (small-scale) resources, in place of large central station power plants.

Market studies indicate that the manufacturing supply chain, commodities and work force will be adequate for the first wave of new nuclear plants. As these first new plants progress through construction and it becomes clear that the nuclear renaissance is sustainable, the manufacturing sector will respond to rising demand with increased production.

A market assessment by MPR Associates, Inc., commissioned by the Nuclear Energy Institute in 2007, evaluated whether manufacturing capacity would be sufficient for 12-17 new nuclear plants under construction between 2010 and 2013, two to three times the number of plants that will realistically begin construction by that time. Since the competition for nuclear components is global, the study also assumed that up to 45 new reactors will become operational around the world between 2010 and 2013. The study also took into account petrochemical and fossil fuel industry equipment demand, as some of the manufacturing capacity is shared with the nuclear industry.

The study addressed components most likely to be potentially in short supply, including reactor pressure vessels; steam generators; turbine generators; ASME Class 1, 2, and 3 N-stamp pumps; large and small ASME N-stamp heat exchangers; ASME N-stamp valves; transformers; large-bore (>12 inches) alloy and stainless steel piping; plant simulators; nuclear-grade batteries; nuclear-grade insulation for mechanical components (e.g., piping), and explosive squib valves.

The study concluded that "beyond the limited availability of forgings, this assessment did not identify any other equipment manufacturing capacity constraints that would impact the initial set of U.S. plant construction starts in the 2010 to 2011 timeframe." Since the study assumed nine reactors under construction at that time, a lesser number (four to eight) should have adequate component supply.

Because Japan Steel Works (JSW) is the only manufacturer of ultra-heavy (>350 tons) forgings in the world, the study identified ultra-heavy forging capacity constraints as a "manufacturing concern and associated construction schedule risk." These ultra-heavy forgings are for the manufacture of nuclear steam supply system (NSSS) components such as the vessel head, various reactor vessel belt segments and parts of the steam generator. The study also noted that heavy forgings (150-350 tons) for Balance of Plant (BOP) components such as the generator rotor and monoblock low-pressure turbine rotor "also have a limited supply."

The ultra-heavy forgings for the first wave of U.S. nuclear plant construction have already been manufactured, ordered or companies have reserved a place in JSW's construction schedule. This includes ABWR, ESBWR, EPR and AP1000 reactors. Given that, NEI anticipates no problem for supply of ultra-heavy forgings required for the initial phase of the new build in the United States.

JSW announced in October 2007 that it will increase production of ultra-heavy and heavy forgings for NSSS "sets" (reactor vessels and steam generators). Capacity expansion will increase production to four NSSS sets per year in 2007 and 5.5 sets by 2008, and then to 8.5 sets annually by 2010. JSW has said it is fully booked for nuclear products through 2010, and has begun discussions with customers for deliveries beginning in 2011. In addition, other suppliers in the United Kingdom, France and South Korea are planning to re-enter the market for heavy forgings. Thus, there is reason for optimism about the availability of ultra-heavy and heavy forgings for construction of the second wave of new plants in the United States as well.

c. *Excluding the pouring of concrete, approximately what percentage of the materials and components going into a new nuclear plant would be produced in the United States?*

While currently some elements of a nuclear plant may only be sourced overseas, the total percentage of components and materials sourced in the U.S. will vary significantly depending on plant design and other factors. Strategic sourcing agreements between NSSS vendors, EPC contractors and others will impact source selection. In addition, availability of foreign (non-U.S.) project financing will likely be tied to agreements that plant components will be sourced from the country that supplies that financing. For example, new plant financing secured through the government of Japan will likely result in a greater portion of plant components to be sourced in Japan.

d. What portion of the skilled nuclear work force would have to be imported from other countries in order to design, build, and operate the number of reactors you propose by 2016, by 2020, and 2030?

The vast majority of the skilled work force needed to design, build and operate reactors in the United States will be drawn from the U.S. labor market. Most companies working towards design certification of their reactor designs have completed their work in their U.S. offices with U.S. engineers. As detailed engineering work continues through construction, NEI expects that this work will continued to be supported by the U.S. offices of the reactor vendors.

During the construction phase, NEI expects that, with the exception of a few specialists, the construction and project management work force will be drawn from the United States. During plant operations, virtually all of the skilled work force is expected to come from the United States. The industry has initiated a major effort to systematically develop the domestic work force. Currently there are 42 community colleges providing technician-level training for the nuclear industry. The industry is working with these institutions to ensure that enough qualified workers are available to replenish the workforce at the operating 104 U.S. nuclear units. Staff for new units would also be sourced through these pipelines. Industry is also working with organized labor unions to ensure sufficient numbers of skilled craft labor.

e. Do you believe the $13 billion in construction, operation, R&D, and shut down subsidies included in the EPAct combined with the $20.5 billion in loan guarantees for new nuclear facilities and front-end nuclear activities is sufficient incentive to induce substantial growth in domestic manufacturing of nuclear-certified components and grow the domestic nuclear work force?

By my calculations, the 2005 Energy Policy Act does not include $13 billion of subsidies. The legislation provides three incentives to stimulate investment in new nuclear power plants – limited production tax credits, loan guarantees, and standby support (a potential total of $2 billion of insurance against delays in project construction or operation caused by licensing or litigation). The cost to the federal government of providing loan guarantees and standby support is paid by the project sponsor and does not represent a subsidy. The production tax credit of 1.8 cents per kilowatt-hour for 6,000 megawatts of new nuclear capacity for the first eight years of operation potentially represents a $6 billion cost to the federal government. That cost must, however, be weighed against the tax and non-tax benefits produced by that nuclear generating capacity.

Using a methodology developed by the Research Triangle Institute, the Nuclear Energy Institute has performed analyses of the economic benefits of nuclear plants across the country.[3] These analyses

[3] See http://www.nei.org/financialcenter/economic_benefits_studies/

show that the benefits of a typical nuclear power plant over its 40-year operating lifetime range from $27.5 billion to $32 billion. This is a net present value and includes local, state and federal taxes; salaries paid to the personnel who operate the plant and the indirect employment that results from the nuclear plant (e.g., all the jobs and business establishments necessary to support the nuclear plant's work force) and the value of the electricity produced by the plant. The $6 billion cost to the taxpayer of the nuclear production tax credit must, therefore, be compared to the $165 billion to $192 billion benefit. In my view, this is an attractive return on investment.

As to whether the incentives for new nuclear power plant deployment in the Energy Policy Act will stimulate expansion of the nuclear supply chain and the nuclear work force, the answer is clear. The prospect of new nuclear construction in the U.S. and the nuclear construction cycle now underway around the world is leading to growth in the domestic nuclear supply chain and growing numbers of students enrolled in programs to prepare them to enter the nuclear work force, as discussed above. While these signals and the market response are very positive, more could be done to position U.S. workers and U.S. industry to take advantage of this growing market domestically and abroad.

f. What level of government commitment to the nuclear industry is needed to send such a signal to the market that would lead to substantial investment in domestic manufacturing and human resources?

In addition to the commitments the government has already made to spur the development of new nuclear units in the U.S., I would encourage the federal government to pursue policies to ensure the construction of new nuclear units in the U.S., to assist U.S. companies in accessing the growing international nuclear market, and to help U.S. firms to prepare the work force needed for domestic and international nuclear business. For example, recent Congressional approval of the U.S.-India 123 agreement was a very positive step in this direction, by helping to open the nuclear market in India. In addition, the federal government should consider the following approaches:

- Greater coordination among federal agencies to promote nuclear technology, products and services companies as they seek business overseas.
- Renewed international efforts to promote the Convention on Supplementary Compensation so that industry can pursue international nuclear business opportunities without fear of an absent or inconsistent liability regime.
- Tax credits and other technical assistance for industry as they seek to enter or expand their business in the U.S. and international nuclear market.
- Tax credits and other education and training programs to promote job creation and training of workers to enter the highly skilled and highly paid nuclear workforce.
- A comprehensive program including scholarships, fellowships, infrastructure support and R&D opportunties targeting the expansion of university nuclear engineering, science and technology education.

5. In its recently published Energy Technology Perspectives 2008, the International Energy Agency (IEA) projects that to meet a scenario of 50 percent reduction in energy related CO2 emissions by 2050, 32 new nuclear power plants totaling 32,000 megawatts would need to be constructed around the world every year. This compares to three new nuclear units totaling 1,857 megawatts coming online last year, two new units totaling 1,490 megawatts in 2006, and four new units totaling 3,821 megawatts in 2005.

a. How do these IEA growth projections compare to historical periods of rapid growth in the nuclear industry?

The *Energy Technology Perspectives 2008* study referenced in the question includes several paragraphs that discuss historical periods of rapid growth which address this question. For example, on page 299:

> "Between 1970 and 1990, new nuclear plants were adding around 17 GW [17,000 megawatts] every year to global electricity-generating capacity. In the 1980s, 218 power reactors started operation, at an average of one every 17 days [about 20,000 megawatts per year]. This was mostly in France, Japan and the US. The average output of these new plants was 925 MW [megawatts].
>
> "[Analysis of] the number of global new reactor grid connections annually from 1955 to the present day, together with a five-year moving average [shows that] annual grid connections peaked in 1984 and 1985 at 33 per year; the five-year moving average peaked around 27 per year."

b. What would be required to enable the industry to meet these historic high levels of new capacity output and to then go beyond them?

I believe that new nuclear plant deployment requires a public-private partnership, in which private industry, the federal government and state governments work together to create the business and investment conditions necessary to support financing and construction of new nuclear power plants in the United States.

Certainly, all the trends are moving in the right direction:

- The performance of the 104 operating plants, the platform from which a new nuclear construction cycle is being launched, is at record levels of safety and reliability. The U.S. nuclear fleet last year operated at almost 92 percent of full-time rated power, the highest capacity factor ever. Output was an all-time record, over 800 billion kilowatt-hours – mostly the result of high capacity factors, but also due to more capacity available, both because of power uprates and the restart of Browns Ferry Unit 1 last May. High output obviously drives economic performance to the great benefit of America's electricity consumers. We estimate production cost last year was $17.60 per megawatt-hour – cheaper than coal and one-quarter the cost of gas-fired generation.
- The Nuclear Regulatory Commission has finalized its new Part 52 licensing procedures, and has received sixteen applications for construction/operating licenses for 25 new reactors.
- The NRC has already certified two advanced reactor designs. Two more were submitted for certification last year. One was submitted this year.
- At least three project sponsors have reached agreement with their vendor and constructor on the terms and conditions of engineering-procurement-construction contracts – a major step in the direction of nailing down a firm cost estimate and producing a credible project cost.
- A number of states – including Florida, Louisiana, North Carolina, South Carolina, Texas, Virginia and Mississippi – have passed legislation or implemented regulations to provide incentives, or greater assurance of investment recovery, to companies that build new nuclear plants.

- The Florida Public Service Commission has reached a formal determination that there is a need for the four new reactors proposed by Florida Power and Light and Progress Energy Florida at Turkey Point and the Levy County site.
- As noted in answers to question #4, there is unmistakable evidence of growth in the nuclear supply chain, partly in response to the real prospect of new nuclear plant construction in America, partly in response to the global nuclear construction cycle now underway. Thirty new N-stamps have been issued in the United States since September 2007, bringing the total to 258. Alstom has announced plans to invest over $200 million in a steam turbine manufacturing facility in Chattanooga, TN – creating 350 new jobs in the process. Holtec plans to double the size of its fabrication and manufacturing facility for nuclear components in Turtle Creek, PA, adding 500 jobs over the next five years to the 70 already in place. Curtiss-Wright has announced a new $62-million manufacturing facility in Allegheny County, PA, and Shaw and Westinghouse are building a new construction facility in Louisiana.
- Public support is at record levels. NEI's latest tracking poll shows a record-high 74 percent of Americans favor nuclear energy, with only 24 percent opposed. The favorability mark is 11 percentage points higher, and the unfavorability level nine percentage points lower than was the case just five months ago. The new survey also found that 69 percent of Americans believe the United States should definitely build more nuclear power plants in the future – a 10 percentage point gain from April. Three-fourths of respondents say they would find it acceptable to add a new reactor at the nearest existing nuclear power plant site – a nine-point jump from April's result. These unprecedented levels of support reflect growing concerns about energy and focus on energy alternatives.

c. *Assuming that the United States and most of the rest of the world decide not to reprocess spent uranium fuel, how much waste would be generated by (i) 2016 for the four to eight new plants you anticipate will be brought on line; (ii) 2020 for the fifteen additional plants that you anticipate; (iii) 2030 for the forty-five to fifty plants; and (iv) 2050 if 32,000 megawatts of new nuclear power were to come online every year between now and then? For each answer, please compare the amount generated to the capacity of the Yucca Mountain storage facility.*

(i), (ii), (iii) At present, 70,000 metric tons of heavy metal (MTHM), roughly equivalent to 70,000 metric tons of uranium (MTU), of storage capacity has been authorized, with a projection that 63,000 MTHM or MTU would be used for commercial spent nuclear fuel. According to a study by the Electric Power Research Institute (EPRI), the technically calculated actual capacity of the Yucca Mountain repository is as much as nine times the arbitrary capacity limit in the Nuclear Waste Policy Act, or approximately 570,000 MTU as an actual limit. Eight new nuclear power plants in operation by 2016, a total of up to fifteen new nuclear power plants in operation by 2020, and a total of fifty new nuclear power plants in operation by 2030 would result in a total of 154 nuclear power plants in operation. Through 2050, this will result in about 182,000 MTU used fuel (including used fuel in storage today). This is 32% of the actual Yucca Mountain capacity.

Assuming that the number of nuclear plants in operation is held steady at 154 (with needed replacements) through the year 2100, the total amount of used fuel generated through 2100 (including what is in storage today) will reach about 352,000 MTU, which is 62% of the actual Yucca Mountain capacity.

The development of advanced recycling technologies would greatly expand the capacity for disposal at Yucca Mountain and reduce the total volume of material to be disposed.

(iv) Currently, there are about 370,000 MWe nuclear generation capacity worldwide. Adding 32,000 MWe each year worldwide from 2009 through 2050 will result in a total of about 888,000 MTU used fuel through the year 2050. Currently, the US has about 27% of the world commercial nuclear capacity. If this ratio continues, there would be about 240,000 MTU used fuel stored in the US by 2050 (which is larger than the 182,000 MTU shown above, because a 27% share of the annual 32,000 MWe growth is much greater than the growth rate assumed in the previous questions). 240,000 MTU is about 42% of the actual Yucca Mountain capacity.

d. How many tons of nuclear waste is currently being stored temporarily at reactor sites around the United States?

59,000 MTU commercial used fuel is in temporary storage at 72 sites.

e. Assuming a 70,000 ton limit for nuclear waste storage at Yucca Mountain, how many Yucca Mountain-sized facilities would there need to be around the world by 2050 in order to safely store the amount of waste generated from existing nuclear facilities and the additional 32,000 megawatts per year of new generation built under the aforementioned IEA scenario?

To dispose of the 888,000 MTU determined in question 5.c.(iv) above, theoretically assuming no progress in advanced reprocessing technology and imposing the non-technical artificial 70,000 MTU constraint, would require 13 of these artificially-sized repositories. The 70,000 MTU limit on Yucca Mountain was artificially imposed in the Nuclear Waste Policy Act to spur development of repository capacity. Since Yucca Mountain has made significant progress over the past few years (*e.g.,* License Application submitted and accepted for review), and the second repository program was cancelled by Congress in the 1987 Nuclear Waste Policy Act Amendments, the limit has accomplished its purpose and should be removed from the law. Developing advanced recycling technologies will minimize the number of repositories needed worldwide.

6. The Congressional Budget Office (CBO) found in its May 2008 report, "Nuclear Power's Role in Generating Electricity," that "carbon dioxide charges of about $45 per metric ton would probably make nuclear generation competitive with conventional fossil-fuel technologies as a source of new capacity, even without EPAct incentives."

a. Do you agree with CBO's analysis?

I agree that a price on carbon dioxide improves the economics of new nuclear power compared to conventional fossil-fuel technologies.

Like all new generating capacity, there is uncertainty about the capital cost of new nuclear generating capacity. Credible estimates of overnight capital costs range from $2,400/kWe to as much as $4,540/kWe. It is not clear to me that the $45 per metric ton CBO number is meaningful. This variation in costs can be attributed to several factors:

- uncertainty about escalation of commodity prices and wages
- the fact that design work is not complete and, until it is, it will be impossible to produce a precise cost estimate

It is important to recognize that capital costs are only the starting point for any analysis of new generating capacity. A more accurate measure of economic competitiveness, and one that is more

important to regulators and consumers, is the cost of electricity produced by a particular project compared to alternative sources of electricity and to the market price of electricity when the power plant starts commercial operation. This generation cost takes into account not only capital and financing costs, but also the operating costs and performance of a project.

Analysis by generating companies, the academic community, and independent financial experts shows that even at capital costs in the $4,000/kWe to $6,000/kWe range, the electricity generated from nuclear power can be competitive with other new sources of baseload power, including coal and natural gas. These results are absent any restrictions on carbon dioxide emissions. With regional or national programs that put a significant price on carbon emissions, nuclear power becomes even more competitive.[4]

b. Why doesn't NEI support legislative proposals that would put a price on carbon emissions, thereby dramatically increasing nuclear power's competitiveness in the market over the long-term?

I, and the Nuclear Energy Institute, do support federal legislation to reduce carbon emissions, and the NEI Executive Committee approved Climate Change Principles (enclosed as pages 19 through 21) to that effect in 2007.

NEI supports federal action or legislation to reduce carbon dioxide and other greenhouse gas emissions that:

- involves all sectors of the economy and all sources of greenhouse gases
- assures stable, long-term public/private funding to support the development and deployment of needed technology solutions
- assures compliance timelines are consistent with those of expected development and deployment of needed technologies
- employs market mechanisms to secure cost-effective GHG reductions, and provide a reasonable transition and an effective economic safety valve
- establishes a long-term price signal for carbon that is moderate, does not harm the economic competitiveness of U.S. industry, and stimulates future investments in zero- or low-carbon technologies and processes
- addresses regulatory or economic barriers to the use of carbon capture and storage, and increased nuclear, wind or other zero- or low-GHG technologies
- minimizes economic disruptions or disproportionate impacts
- recognizes early actions/investments made to mitigate GHG emissions
- provides for the robust use of a broad range of domestic and international GHG
- provides certainty and a consistent national policy
- recognizes the international dimensions of the challenge and facilitate technology transfer.

[4] See *A Perspective on the Cost of New Generating Capacity*, http://www.nei.org/resourcesandstats/documentlibrary/reliableandaffordableenergy/whitepaper/the_cost_of_new_generating_capacity/

NUCLEAR ENERGY INSTITUTE
POSITION ON CLIMATE CHANGE
July 2007

Reducing carbon emissions, while fostering sustainable development, will be a major global challenge of the 21st century. The Nuclear Energy Institute supports federal action or legislation to reduce greenhouse gas emissions. Any such federal initiative should:

- Involve all sectors of the economy, and all sources of greenhouse gas (GHG);
- Assure stable, long-term public/private funding to support the development and deployment of needed technology solutions;
- Assure compliance timelines consistent with the expected development and deployment timelines of needed technologies;
- Employ market mechanisms to secure cost-effective GHG reductions, and provide a reasonable transition and an effective economic safety valve;
- Establish a long-term price signal for carbon that is moderate, does not harm the economic competitiveness of U.S. industry and stimulates future investments in zero- or low-carbon technologies and processes;
- Address regulatory or economic barriers to the use of carbon capture and storage and increased nuclear, wind or other zero- or low-GHG technologies;
- Minimize economic disruptions or disproportionate impacts;
- Recognize early actions/investments made to mitigate greenhouse gas emissions;
- Provide for the robust use of a broad range of domestic and international GHG offsets;
- Provide certainty and a consistent national policy; and,
- Recognize the international dimensions of the challenge and facilitate technology transfer.

Nuclear energy is a vital source of electricity that can meet the Nation's growing energy needs with a secure, domestic energy supply that also protects air quality.

- The 104 nuclear power plants in the United States produce electricity without emitting criteria pollutants or greenhouse gases, thus making existing and future nuclear generating capacity an important component of continued air quality improvement nationwide.

- Maintaining the ability to continue to operate existing nuclear plants and build new ones depends on support by the public and policy-makers. Recognition of the role nuclear energy and other non- or low-emitting technologies play in maintaining and improving air quality will increase public and policy-maker support.

- Nuclear energy can achieve recognition for its environmental attributes without compromising the economic position of other generating sources. In fact, incremental nuclear generating capacity can reduce the compliance burden and cost that would otherwise fall on other generating capacity.

A credible program to reduce greenhouse gas emissions will require a portfolio of technologies and approaches, and nuclear energy is an indispensable part of that portfolio. Emissions avoided by nuclear energy play an integral role in the continuing improvement of air quality and in reducing greenhouse gases. Emissions prevention has value just like emissions reduction.

- Nuclear energy's strategic value is clear from past performance. America's nuclear energy companies have achieved significant voluntary reductions in carbon emissions since 1994 as part of the U.S. Department of Energy's *Climate Challenge* and *Climate Vision* programs. Increased production from U.S. nuclear plants is responsible for the largest share of emissions reductions reported through these voluntary programs—36 percent of reductions from all sectors of the economy and 54 percent of the reductions reported from the electric sector alone.

- Nuclear energy's strategic value is equally clear looking forward. According to the International Energy Agency (*World Energy Outlook 2006*), electricity production worldwide is expected to increase by 94 percent by 2030. Carbon dioxide emissions from that additional electricity production will increase by 7 billion tons over today's level. If nuclear energy in 2030 met 23 percent of global electricity needs – as it does today in the OECD nations – it would reduce global greenhouse gas emissions by 3.4 billion metric tons – cutting the projected 7-billion-ton increase almost in half.

Achieving a significant expansion of nuclear power in the United States will require sustained federal and state government policies relating to nuclear energy. The new nuclear power projects now in the early stages of development will not enter service until the 2015-2020 period. Instability and lack of certainty between now and then will make significant expansion of nuclear energy impossible. Like all other advanced energy technologies, accelerated deployment of new nuclear power plants requires sustained policy support in several areas.

- Investment protection and investment stimulus for new nuclear plant construction must be commensurate with the investment risks and financing challenges facing companies interested in building new nuclear power plants. At a minimum, the federal government must ensure workable implementation of the energy loan guarantee program created by the Energy Policy Act of 2005. In addition, policymakers must recognize that investment in new nuclear plants will strain the financing capability of even the largest U.S. electric companies, and work cooperatively with industry and state governments to implement policies necessary to mitigate this financing challenge.

- The federal government must demonstrate visible progress toward implementation of a used fuel management program. This program must include:

  (1) near-term steps to sustain public and political confidence in nuclear energy—e.g., a statutory or administrative reaffirmation of the Nuclear Regulatory Commission's "waste confidence" policy, a new standard contract obligating the Department of Energy to accept used fuel from new nuclear plants, and filing of a license application for the Yucca Mountain project according to the current schedule of June 2008
  (2) medium-term steps, including a robust research and development program to demonstrate advanced fuel cycle technologies, and development of the federal interim storage facilities necessary to demonstrate the federal government's ability to meet its obligations under the Nuclear Waste Policy Act
  (3) longer-term initiatives, including deployment of advanced fuel cycle technologies and construction and operation of a permanent disposal facility, when needed.

- The industry and the financial community must have confidence that the nuclear regulatory process provides the level of stability and predictability necessary to support a large capital investment program. Simply maintaining nuclear energy at 20 percent of U.S. electricity supply will require construction of approximately 25 new nuclear power plants by 2030—approximately a $175 billion investment. Absent a high degree of confidence in the regulatory process, neither electric generating companies nor the capital markets will consider new nuclear power plants an acceptable investment opportunity.

- The long-term future of nuclear energy depends on bipartisan consensus on the pace and scope of a nuclear energy research, development and demonstration program. Such a program must have sustained bipartisan support and strike an appropriate balance between:

  (1) near-term activities cost-shared with the industry, like the Nuclear Power 2010 Program, which supports near-term commercial deployment
  (2) longer-term, government-funded imperatives, including development and demonstration of advanced gas-cooled reactors, and of advanced fuel cycle technologies with the potential to extract additional energy from used nuclear fuel and reduce the volume and toxicity of nuclear waste byproducts that require disposal.

- Nuclear energy must be recognized as clean energy in legislative and regulatory proposals to provide incentives for low-emission electricity generation. Additional production from nuclear energy—either as a result of power uprates at existing plants, license renewal of existing plants, or construction of new plants—should receive the same treatment as other emission-free sources of electricity. If federal or state laws or regulations provide explicit economic credit to renewable energy or energy efficiency for emissions prevented, additional nuclear energy production should receive equal recognition.

7. *Your testimony states, "If it is structured like the loan guarantee program authorized by Title XVII of the 2005 Energy Policy Act, in which project sponsors are expected to pay the cost of the loan guarantee, such a program would be revenue-neutral and would not represent a subsidy." A loan guarantee allows lenders to base interest rates on the credit risk of the guarantor – in this case the default rate of the federal government – rather than the actual risk of the project. This lowers the cost of capital enormously. Analysis by Doug Koplow and Earth Track finds the value of the loan guarantee to a nuclear operator is about 5.8-8.4 cents/kWh. Over the life of a 30-year loan guarantee, they find this subsidy is worth $13 billion in nominal dollars for a single 1600 MW Evolutionary Power Reactor.*

a. *Do you agree that a loan guarantee lowers the cost of capital? If the answer is No, please provide citations to any economic literature that supports that conclusion.*

I absolutely agree that a loan guarantee can lower a project's weighted average cost of capital, depending on the degree of leverage in the project's capital structure. NEI has not evaluated the Earth Track analysis referenced in the question. The primary beneficiary of the reduced busbar cost accruing to the lower weighted average cost of capital is the consumer of the nuclear plant's electricity. But in any case, I do not agree that the loan guarantee program is a subsidy, because project sponsors will pay the cost associated with providing the loan guarantee. That cost will reflect the federal government's risk in providing the guarantee, just as the interest rate on a commercial loan reflects the bank's risk. Webster's defines "subsidy" as a "grant" in all three definitions provided. Since industry pays for this incentive, I consider it not to be a government "grant," and therefore not a subsidy.

b. *If the answer is Yes to the previous question, how much do you believe a loan guarantee lowers the cost of capital for a nuclear operator?*

The primary benefit of the loan guarantee is that it allows a company to use a project-finance structure to finance an eligible project non-recourse to the sponsor's balance sheet. It also allows a more highly leveraged capital structure and allows a project sponsor to obtain debt at more favorable interest rates. This results in a lower weighted average cost of capital (WACC) and a lower cost of electricity from the project. Obviously, a project that is financed using a capital structure with 80 percent debt and 20 percent equity has a lower WACC than a project financed using the more conservative 50/50 debt/equity capital structure typical of regulated utilities. The precise difference in cost of capital depends on assumptions about cost of debt and returns on equity. The major benefit of the loan guarantee derives from the leverage, not the spread in interest rates between government-guaranteed debt and commercial debt.

c. *In your testimony, you discuss the wide social benefits of nuclear power. What are the social costs, if any, that you see attached to taxpayer-subsidized expansion of nuclear power?*

I do not see any material social cost associated with taxpayer support of nuclear power. In fact, federal (and, for that matter, state-level) support for nuclear power serves a public good. More than for most other energy sources, studies of the benefits and costs of nuclear energy often internalize costs of the entire fuel cycle and plant life cycle and ignore non-monetary benefits. Nuclear power plants deliver a number of benefits, including: large-scale, safe production of electricity that supports the reliability of the electric grid; carbon-free electricity; a small life-cycle environmental footprint, comparable to hydroelectric energy, and forward price stability, among others. Most

analyses and government policies do not generally attach an economic value to these positive attributes.

I enclose a recent study that documents federal expenditures for various energy sources over the past fifty years. This study shows that since 1950 nuclear energy has received nine percent of the total while renewable energy has received a comparable six percent. Since 1994, federal spending on nuclear energy R&D has been less than R&D spending on renewable energy research. Both federal spending categories (nuclear and renewable) contribute to the common good, in my opinion. This study's findings are summarized on page 24 and the entire study is attached after page 26.

d. What impact does the socialization of downside financial risk and assurance of capital recovery have on the incentive to minimize costs and maximize construction and operational efficiency?

In my view, there is no impact. Nuclear power plants are multibillion-dollar projects that will require an equity investment of about 20 percent – roughly one billion dollars or so – in order to qualify for a loan guarantee. This large amount of capital investment ensures that companies will proceed cautiously and prudently to make sure that projects are completed successfully.

e. What is the financial benefit to the nuclear power industry bestowed by the limitation on liability contained in the Price-Anderson Act?

The Price-Anderson Act provides no-fault insurance to benefit the public in the event of a nuclear power plant accident the Nuclear Regulatory Commission deems to be an "extraordinary nuclear occurrence." The costs of this insurance, like all the costs of nuclear generated electricity, are borne by the industry, unlike the corresponding costs of some other power sources. Risks from hydropower mishaps (dam failure and resultant flooding), for example, are borne directly by the public. The 1977 failure of the Teton Dam in Idaho caused $500 million in property damage, but the only compensation provided to those affected was about $200 million in low-cost government loans.

There is no cost to the taxpayer under the Price-Anderson framework. However, insurance pools have paid roughly $200 million in claims and the nuclear power industry has paid $21 million to the federal government in indemnity fees. The Act has proven so successful that Congress has used it as a model for legislation to protect the public against potential losses or harm from other hazards, including faulty vaccinations, medical malpractice and toxic waste.

Effective October 29, 2008, nuclear plant licensees must provide a total of more than $12 billion in insurance coverage to compensate the public in the event of a nuclear accident. This total was recently increased from the previous more-than-$10 billion in coverage. No portion is borne by taxpayers or the federal government. This protection consists of two tiers. The primary level provides $300 million in liability insurance. This first-level coverage consists of the liability insurance provided by two private insurance pools. The pools are groups of insurance companies pledging assets that enable them to provide substantially higher coverage than an individual company could offer. If this amount is not sufficient to cover claims arising from an accident, secondary financial protection applies. For this second level, each nuclear plant must pay a retrospective premium equal to its proportionate share of the excess loss, up to a maximum of $117.495 million per reactor per accident. Currently, all 104 operating nuclear reactors are participating in the secondary financial protection program. If liability claims exceed the $12 billion limit, Congress will determine how to apportion those claims.

Analysis of Federal Expenditures for Energy Development
Quick Facts

- The federal government has provided $725 billion for energy development since 1950.
- Tax concessions are the largest type of incentive, amounting to about 45 percent of all incentives.
- Federally-funded regulation and R&D, at about 20 percent each, are the second and third largest incentives.
- The commercial nuclear energy R&D program peaked at $2.8 billion in 1978 and declined steadily thereafter, reaching a low of $75 million in 2001.
- From 1976-2006, six percent of the total of $28 billion in nuclear energy R&D expenditures has been devoted to light-water reactors, which generated 807 billion kilowatt-hours of electricity in 2007.
- Through 2006, total federal R&D funding for renewables was about $19.1 billion, with 90 percent of the funding occurring after 1975.
- Between 1976 and 2006, the photovoltaics program received the largest share of renewable energy R&D at $3.4 billion (20 percent of the total). The biomass/biofuels program received the second largest at $2.9 billion (17 percent of the total).

8. *Historically, federal credit programs guarantee hundreds or thousands of loans per year in which the risks are fairly homogenous across the universe of loans, as is the case with student loans, affordable housing, and other programs you cite in your testimony as examples that "serve the public good and the national interest." However, for the extremely large Title XVII loan guarantees, the terms and conditions of the guaranteed debt and the associated risks are highly variable between technologies and projects. The number of loans is very small but the value of each loan – especially those for nuclear facilities-is anticipated to be extremely large. Accurately determining the credit subsidy cost for a nuclear applicant will be extraordinarily difficult, if not impossible, given the large number of variables, their interactivity, and the difficulty in quantifying many of them. Unlike most federal credit programs that are ongoing and deal with a large number of loans, DOE will be unable to learn through experience and adapt the credit subsidy cost formula as nuclear plant defaults unfold more or less frequently than anticipated. There is an incentive for the industry as a whole to work with DOE to ensure credit subsidy costs are adequate to cover defaults so as to demonstrate viability. Yet there is also incentive for individual loan applicant companies to work with DOE to minimize the credit subsidy cost because it would directly impact the profitability of the project and company.*

I do not agree with a number of the unsupported assertions in the statement above which serve as a premise to the following two questions. I do not agree with that premise:

- I do not believe it is correct that all (or even most) "federal credit programs guarantee hundreds or thousands of loans per year in which the risks are fairly homogenous across the universe of loans." A number of successful federal credit programs – e.g., the Export-Import Bank and the Overseas Private Investment Corp. – do not guarantee "hundreds or thousands" of loans per year. In the case of OPIC, which provides political risk insurance (among other services) to U.S. companies doing business overseas, the risks are not homogeneous, but highly country-specific. Despite this, OPIC (and Ex-Im Bank) are able to price risks appropriately and operate successful programs.
- I do not agree that for the "extremely large Title XVII loan guarantees, the terms and conditions of the guaranteed debt and the associated risks are highly variable between technologies and projects." First, many of the projects eligible for loan guarantees under Title XVII are not "extremely large." Cellulosic ethanol projects, for example, typically have total project costs in the hundreds of millions of dollars, compared to multi-billion-dollar nuclear power projects. Second, although there are material differences between the relatively small projects eligible for Title XVII loan guarantees and the "extremely large" projects (like nuclear power plants), I do not see any material differences or variability among nuclear power projects that would make risk assessment particularly challenging.
- I do not agree with the speculation that "[a]ccurately determining the credit subsidy cost for a nuclear applicant will be extraordinarily difficult, if not impossible, given the large number of variables, their interactivity, and the difficulty in quantifying many of them." In fact, the process of determining the appropriate credit subsidy cost for a nuclear project is a relatively straightforward exercise, and relies on a rigorous assessment of the creditworthiness of the project, which can be accurately measured using well-established project finance ranking criteria and historical data on default probabilities and recovery rates and other factors.
- I consider speculation about whether "there is incentive for individual loan applicant companies to work with DOE to minimize the credit subsidy cost because it would directly impact the profitability of the project and company" to be largely irrelevant, given the regulations governing the clean energy guarantee program. Credit subsidy costs for any eligible project require

approval from the Secretary of Energy, the Secretary of the Treasury and the Office of Management and Budget. This system of checks and balances ensures that subsidy costs are calculated appropriately, without regard to the presumed wishes or motivation of any individual company.

- I do not accept the implication that nuclear projects will default on their guaranteed loans, as suggested by the assertion: "as nuclear plant defaults unfold more or less frequently than anticipated." I do not expect any defaults on nuclear projects. In the case of new nuclear power projects, the companies will have significant shareholder equity ($1 billion or more per project) at risk. This equity is in a "first-loss" position – i.e., the company forfeits that equity in the event of default. For most electric companies, such a loss would be unsustainable. The significant amount of money at risk imposes a high level of discipline on investment decisions. As a result, the companies seeking loan guarantees for nuclear power plants have a powerful incentive to ensure that projects are properly developed, constructed, operated and maintained to achieve commercial success. The federal government's interest and the company's interest are completely aligned. Like the federal government, the nuclear companies wish to avoid default at all costs.

a. *How are NEI and member companies dealing with these split incentives when working through the risk assessment and application process with DOE and OMB?*

As noted, I and my member companies do not believe there are any "split incentives." The nuclear industry's sole interest is in working cooperatively with the federal government to establish a viable and sustainable loan guarantee program. A viable program includes accurate assessments of project risk and credit subsidy costs fairly calculated that incorporate that risk assessment.

b. *What impact will the small number of very high value loans and the relatively short time period to distribute them have on DOE's ability to precisely pinpoint the appropriate credit subsidy cost?*

No impact. The clean energy loan guarantee authorized by the 2005 Energy Policy Act employs a disciplined process to evaluate projects, and to identify creditworthy projects that qualify for federal government credit support. The process includes financial analysis, due diligence and underwriting performed by expert outside financial, technical and legal advisors to assist in the underwriting, negotiation, documentation, and monitoring of the projects. As noted previously, the strength and creditworthiness of the project can be measured by well-established indicators such as the credit rating of the project sponsor, project capital structure, project cash flow, strength of power purchase agreements, borrower's exposure to market and commodity risks and mechanisms to hedge those risks, management and operator experience, terms and conditions of engineering-procurement-construction contracts, etc.

Analysis of Federal Expenditures for Energy Development

September 2008

By
Management Information Services, Inc.
Washington, D.C.

Prepared for
The Nuclear Energy Institute
Washington, D.C.

Executive Summary

For decades the federal government has employed a variety of incentives to support research, development and deployment of energy sources. The types, amounts and targets of federal incentives have changed substantially over time, making it difficult to follow where these expenditures have gone and what they have done for the nation's energy supply.

To gain insight into the history of energy incentives, the Nuclear Energy Institute (NEI) asked Management Information Services Inc. (MISI) to prepare an independent assessment. The findings provide a quantitative compilation of the amounts and types of incentives provided from 1950 to 2006 and the energy sources targeted with each type of incentive. As summarized in Exhibit 1 below, the findings indicate that the largest beneficiaries of federal energy incentives have been oil and gas, receiving more than half of all incentives provided since 1950. The federal government's primary support for nuclear energy development has been in the form of research and development (R&D) programs, one of the more visible types of incentives identified. Over the last decade (since 1997), federal spending on R&D for coal and renewables has exceeded spending on nuclear energy R&D.

Exhibit 1 – Summary of Federal Energy Incentives, 1950–2006

(Billions of 2006 Dollars[1])

TYPE OF INCENTIVE	ENERGY SOURCE							SUMMARY FOR INCENTIVE TYPE	
	Oil	Nat. Gas	Coal	Hydro	Nuclear	Renewable[2]	Geothermal	Total	Share
Tax Policy	173	88	31	12		20	2	326	45%
Regulation	116	3	7	5	11			142	20%
R&D	7	6	32	1	67	19	3	135	19%
Market Activity	5	2	2	59		2	2	72	10%
Gov't Services	31	1	14	1	1	2		50	7%
Disbursements	3		8	2	-14	2		1	~0%
Total	**335**	**100**	**94**	**80**	**65**	**45**	**7**	**726**	
Share	46%	14%	13%	11%	9%	6%	1%		100%

[1] All estimates quoted are in constant 2006 dollars, unless otherwise noted, and refer to actual expenditures in the relevant fiscal year, rounded to the nearest billion. Totals and percentages may differ slightly due to independent rounding.

[2] Renewables are primarily wind and solar energy sources.

About Management Information Services, Inc.

MISI is an internationally recognized, Washington, D.C.-based economic research and management consulting firm with expertise on a wide range of complex issues, including energy, electricity and the environment. The MISI staff offers capabilities in economics, information technology, engineering and finance and includes former senior officials from private industry, federal and state government, and academia.

Over the past two decades, MISI has conducted extensive proprietary research and since 1985 has assisted hundreds of clients, including Fortune 500 companies, nonprofit organizations and foundations, academic and research institutions, and state and federal government agencies including the White House, the U.S. Department of Energy, the U.S. Environmental Protection Agency, the Energy Information Administration, the U.S. Department of Defense, NASA, and the U.S. General Services Administration. In recent years, MISI has analyzed energy incentives for the U.S. Department of Energy and the National Academy of Sciences, among others.

For more information, please visit the MISI Web site at *http://www.misi-net.com*.

Contents

Exhibits

I. Introduction

With concern about the price and availability of energy increasing, public interest in the role of federal incentives in shaping today's energy marketplace and future energy options has risen sharply. That interest has met with frustration in some quarters and half-truths in others because of the difficulty in developing a complete picture of the incentives that influence today's energy options. The difficulty arises from the many forms of incentives, the variety of ways that they are funded, managed and monitored, and changes in the agencies responsible for administering them. It is no simple matter to identify incentives and track them through year-to-year changes in legislation and budgets over the 50-plus years that federal incentives have been a significant part of the modern energy marketplace.

To better understand the history of federal energy expenditures, the Nuclear Energy Institute (NEI) asked Management Information Services, Inc. (MISI) to develop a comprehensive profile of incentives employed as instruments of federal energy policy. MISI's long history of research and publications in energy and economics for the National Academy of Sciences, the U.S. Department of Energy and others assured that MISI would provide the expertise and objectivity necessary to collect and analyze the data required for this independent assessment.

The findings of this study provide a quantitative compilation of the amounts expended from 1950 to 2006, the types of incentives provided and the energy sources targeted with each type of incentive. The findings indicate that the largest beneficiaries of federal energy incentives have been oil and gas, receiving more than half of all incentives provided since 1950. The federal government's primary support for nuclear energy development has been in the form of research and development (R&D) programs, one of the more visible types of incentives identified. In the past 10 years, federal spending on R&D for coal and renewables has exceeded expenditures for nuclear energy R&D.

Section II summarizes the data sources and analytical methods used in this study. Section III describes the six types of incentives identified in this study. Section IV compares the amount expended on incentives for the seven energy sources examined. Section V focuses on expenditures for one of the more visible types of incentives, R&D. Section VI offers conclusions from the study.

II. Sources and Methods

Information presented in this report was compiled from publicly available budget documents prepared by federal agencies with a role in energy development. The agencies are identified in Appendix 1 and include the U.S. Department of Energy and its predecessors, the U.S. Nuclear Regulatory Commission, the Office of Management and Budget (OMB) and others. The types of documents examined for this study include congressional budget submissions, requests, justifications, revisions and program defenses. Additional information on sources is provided in Appendix 2.

Agency programs included in this study were selected on the basis of the authors' expertise in economic and energy policy analysis. The authors examined program documents and determined the types and amounts of incentives provided by each program. Additional information on programs included in this study is provided in Appendix 3. The authors translated current-year expenditures (nominal dollars) into constant 2006 dollars using price deflators derived from data published by OMB, Congressional Budget Office, and the U.S. Department of Commerce's Bureau of Economic Analysis (BEA). The constant dollar values were then compiled by incentive type and tabulated for presentation. The price deflator values are listed in Appendix 4.

III. Types of Federal Expenditures on Energy

The federal government has employed a variety of incentives to encourage the development of domestic energy resources. Incentives for energy have taken many forms, including direct subsidies, tax concessions, market support, technology demonstration programs, research and development (R&D) programs, procurement mandates, information generation and dissemination, technology transfer, directed purchases, and government-funded regulations. This analysis aggregates the various incentives into six categories:

- tax policy
- regulation
- research and development
- market activity
- government services
- disbursements.

General characteristics and examples of these six types of incentives are provided below.

A. Tax Policy

Tax policy includes special exemptions, allowances, deductions, credits, etc., related to the federal tax code. Tax policy has been, by far, the most widely used form of incentive mechanism, accounting for $325 billion (45 percent) of all federal expenditures since 1950. The oil and gas industries, for example, receive percentage depletion and intangible drilling provisions as an incentive for exploration and development. Federal tax credits and deductions also have been utilized to encourage the use of renewable energy.

B. Regulation

This category encompasses federal mandates and government-funded oversight of, or controls on, businesses employing a specified energy type. Federal regulations are an incentive in the sense that they can contribute to public confidence in, and acceptance of, facilities and devices employing a new or potentially hazardous technology. Federal regulations or mandates also can directly influence the price paid for a particular type of energy. Thus, it is not surprising that federal mandates and regulations have been an important part of energy policy, accounting for $141 billion (20 percent) of energy incentives.

For this analysis, two types of federal expenditures associated with regulation were identified: 1) gains realized by energy businesses when they are exempt from federal requirements that raise costs or limit prices, and 2) costs of federal regulation that are borne by the general budget and not covered by fees charged to the regulated industries.

An example of the first type of regulatory incentive comes from the oil industry, which has benefited from:

- exemption from price controls (during their existence) of oil produced from "stripper wells"
- the two-tier price control system, which was enacted as an incentive for the production of "new" oil the higher-than-average rate of return allowed on oil pipelines.
- The higher-than-average rate of return allowed on oil pipelines.

An example of the second type of regulatory incentive comes from the nuclear energy industry. Through the NRC (and its predecessor, the U.S. Atomic Energy Commission), the federal government regulates the design and operation of nuclear plants to ensure protection of public health and safety. In this case, an independent, credible federal regulatory regime promotes public and investor confidence in commercial nuclear enterprises around the country. The cost of regulating nuclear safety through the NRC/AEC through 2006 was almost $11 billion. This amount includes the cost of administering both agencies (AEC to 1975 and the NRC from 1975 forward) as well as credit for regulatory user fees paid by electric utilities. Since 1991, these user fees have offset most of the NRC's operating budget.

C. Research and Development

This type of incentive includes federal funding for research, development and demonstration programs. Of the $725 billion in total federal spending on energy since 1950, research and development funding comprised about 19 percent ($136 billion).

D. Market Activity

This incentive includes direct federal government involvement in the marketplace. Through 2006, federal market activity totaled $72 billion (10 percent of all energy incentives). Most of this market activity was to the benefit of hydroelectric power and, to a much smaller extent, the oil industry.

Market intervention incentives for hydroelectric energy include the prorated costs of federal construction and operation of dams and transmission facilities. These costs are prorated because beginning in the 1930s, federal dams and water resource projects have been multi-purpose. The results of these investments include flood control, navigation, recreation, regional development and other benefits in addition to hydroelectric power. Therefore, it is necessary to estimate the portion of the net investment in construction and operation of dams allocated to power development and the relevant transmission facilities.

Market activity incentives for the oil industry include the relevant planning, leasing, resource management and related activities of the U.S. Department of the Interior's (DOI) Bureau of Land Management (BLM).

E. Government Services

This category refers to all services traditionally and historically provided by the federal government without direct charge and totaled $51 billion through 2006, representing 7 percent of total incentives. Relevant examples include the oil industry and the coal industry.

U.S. government policy is to provide ports and inland waterways as free public highways. In ports that handle relatively large ships, the needs of oil tankers represent the primary reason for deepening channels. They are usually the deepest draft vessels that use the port and a larger-than-proportional amount of total dredging costs are allocable to them. The authors estimated the expenditures for federal navigation programs and allocated these costs as a petroleum subsidy according to the ratio of petroleum and petroleum-based products carried to all waterborne trade. Similarly, to estimate the incentives for coal production from federal expenditures for ports and waterways, the costs for all improvements were multiplied by coal's share of the tons of total waterborne commerce.

F. Disbursements

This category involves direct financial subsidies such as grants. Since 1950, direct federal grants and subsidies have played a very small role in energy policy, accounting for $300 million, a negligible fraction of total incentives.

An example of federal disbursements is subsidies for the construction and operating costs of oil tankers. For nuclear energy, federal disbursements are negative, meaning the industry pays more than it receives in disbursements as a result of the contributions the industry makes to the Nuclear Waste Trust Fund. As of 2006, the Nuclear Waste Trust Fund had accumulated a $14 billion surplus. The entry shown in Exhibits 1 and 2 for disbursements to nuclear energy is shown as a negative value to reflect the industry's overpayment compared to what has been disbursed on its behalf.

IV. Amounts and Recipients of Federal Expenditures

The amounts and recipients of each type of incentive are summarized in Exhibit 2, which shows that:

- The federal government has provided an estimated $725 billion for energy developments since 1950.
- The largest type of incentive has been tax concessions, amounting to about 45 percent of all incentives.
- Federally funded regulation and R&D, at about 20 percent each, are the second and third largest incentives.

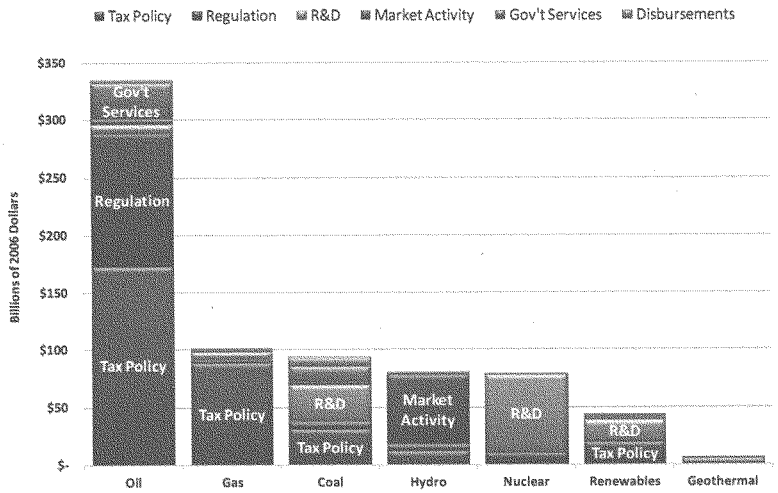
Exhibit 2– Summary of Federal Energy Incentives, 1950–2006
(Billions of 2006 Dollars[3])

TYPE OF INCENTIVE	ENERGY SOURCE							SUMMARY FOR INCENTIVE TYPE	
	Oil	Natural Gas	Coal	Hydro	Nuclear	Renew-ables[4]	Geo-thermal	Total	Share
Tax Policy	172.9	88.3	30.7	12.1		19.6	1.6	325.2	45%
Regulation	115.6	3.3	6.9	4.7	10.9			141.1	20%
Research & Development	7.4	6.2	31.5	1.3	66.8	19.1	3.3	135.6	19%
Market Activity	5.1	2.0	2.3	59.3		1.6	1.5	71.8	10%
Government Services	31.1	1.4	13.9	1.4	1.3	2.0		51.1	7%
Disbursements	2.6		8.1	1.7	-14.3	1.6		0.3	~0%
Total for Energy Source	**334.7**	**101.2**	**93.4**	**80.5**	**64.7**	**43.9**	**6.4**	**724.8**	
Share of All Incentives	46%	14%	13%	11%	9%	6%	1%		100%

The dominance of oil and gas incentives is apparent in Exhibit 3.

[3] All estimates quoted are in constant 2006 dollars, unless otherwise noted, and refer to actual expenditures in the relevant fiscal year. Deflators used in calculating constant dollar values are provided in Appendix 4.
[4] Renewables are primarily wind and solar energy sources.

Exhibit 3 – Comparison of Federal Expenditures for Energy Development, 1950–2006



Federal tax concessions for oil and gas are the largest of all incentives, amounting to about 80 percent of all tax-related allowances for energy. Regulation of prices on oil for stripper wells or new wells comprises the second largest amount of incentives aimed at a particular energy type.

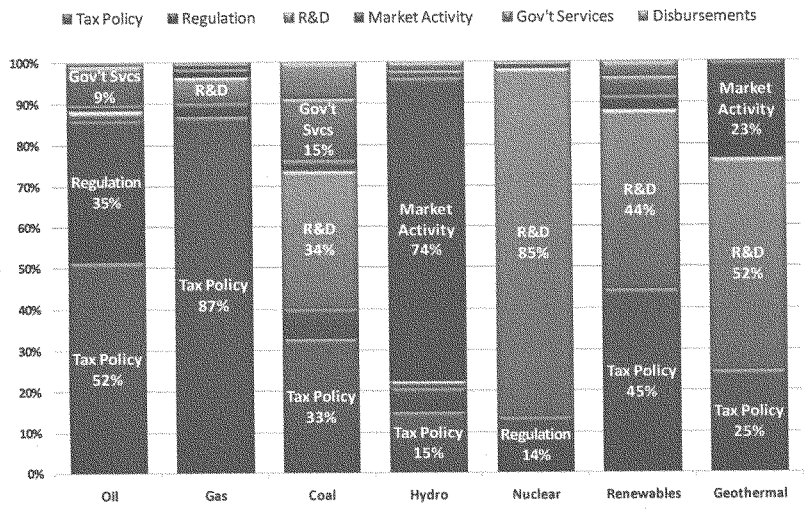
In the R&D category, nuclear energy received about half of the expenditures since 1950 and coal about a quarter of the total.

Some additional observations on the data:

- Oil and gas received approximately 60 percent ($436 billion) of federal spending to support energy since 1950. Oil alone received more than three-fourths ($335 billion) of this amount.
- Coal received approximately 13 percent ($93 billion) of federal spending.
- Nuclear received approximately 11 percent ($81 billion) of federal spending.
- Hydro received approximately 11 percent ($81 billion) of federal spending.
- Wind, solar and geothermal received approximately 7 percent ($50 billion).
- Nuclear energy was the target of about half ($67 billion) of the government's spending on energy R&D.
- About $39 billion (almost 60 percent) of the total spent on nuclear energy research since 1950 was spent before 1975 to explore a range of reactor concepts and potential applications for military and civilian uses.

Each energy type benefits from a mix of federal incentives. For the period 1950 to 2006, the mix for each energy type is illustrated in Exhibit 4.

Exhibit 4 – Mix of Federal Expenditures for Each Energy Source



V. Research and Development Programs

Although research and development (R&D) is not the largest category of incentives provided by the federal government, it is the largest for nuclear energy. To put the nuclear R&D numbers into context, it is important to understand the overall trends in federally supported research.

The federal role in energy R&D became prominent in the 1950s, largely as a result of the Atomic Energy Acts of 1946 and 1954. During that time, the federal government invested significantly in energy-related R&D, particularly that relating to commercialization of nuclear technology as a source of electricity.

In the mid-1970s, federal support for all energy R&D grew sharply after the oil price shocks, with 1976 marking the beginning of rapid growth. This was the first budget year in which the then "reformed" federal energy organizations[5] were fully in place and the first year in which federal energy R&D funding priorities were broadly redirected from those extant before the oil crisis. For this reason, this report analyzes expenditures since 1950 to capture the heyday of nuclear research in the 1950s and early 1960s, but it focuses on the years 1976 to 2006, when oil prices were a critical factor in shaping energy policy. Additional information on the approach taken in analyzing and compiling federal R&D funding is provided in Appendix 5.

The nuclear energy R&D programs analyzed include those designed to promote civilian nuclear energy and to provide the technological base to support industry efforts to develop nuclear power as a source of baseload electricity. Generally, federal nuclear funding has been invested in services, products and technologies that are beyond the capability of private industry to fund alone. The nuclear R&D programs compiled for this analysis were funded by the U.S. Atomic Energy Commission, the U.S. Energy Research and Development Administration (ERDA) and DOE between 1950 and 2006. The compilation excludes defense atomic energy R&D programs (except for the portion that was directly applicable to the civilian nuclear program) as well as the fusion program. Fusion represents a distinct technology with little direct application to current commercial nuclear energy. The compilation excludes the waste management and environmental restoration expenditures associated with the civilian nuclear energy program, as these are included under generic incentives for nuclear energy, discussed previously in Section III. The nuclear energy R&D programs are discussed in more detail in Appendix 6.

The coal R&D program includes a variety of technologies for promoting the use of coal in an environmentally responsible manner. Programs compiled here include R&D on all aspects of coal technology funded at DOI's Bureau of Mines (BOM) from 1950 to 1996; environment-related coal R&D at the U.S. Environmental Protection Agency since the early 1970s; and the ERDA/DOE coal R&D program since 1976. Coal R&D programs are discussed in more detail in Appendix 7.

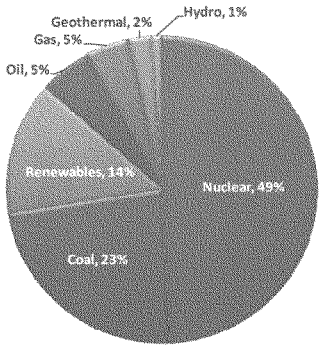
The renewable energy program is defined to include solar energy in all of its manifestations, e.g., photovoltaics, solar thermal systems, biomass and wind. It excludes all other renewable energy sources, specifically hydroelectric power and geothermal power, which are tabulated individually, and fusion energy. It includes all applicable renewable energy R&D undertaken between 1950 and

[5] The Federal Energy Administration, the Energy Research & Development Administration, and the NRC. Additional background on the federal agencies having a role in implementing federal energy policy is provided in Appendix 1.

2006 at ERDA, DOE, NASA, National Science Foundation (NSF), U.S. Department of Agriculture (USDA), AEC and other federal agencies. The renewable energy R&D programs are discussed in more detail in Appendix 8.

The distribution of federal R&D expenditures since 1950 is shown in Exhibit 5.

Exhibit 5 – Allocation of Federal R&D Expenditures, 1950–2006



Analysis of federal budget data since 1950 shows:

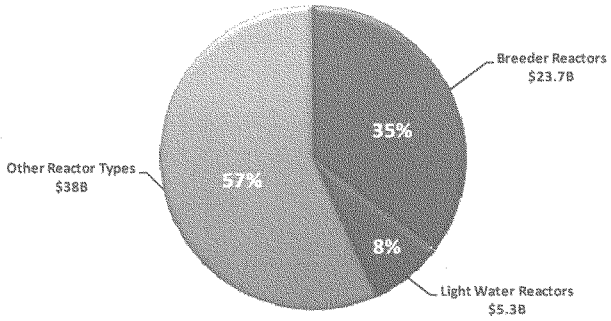
- Almost 90 percent of federal energy R&D spending was targeted at three energy types: nuclear, coal and renewables[6].
- Prior to 1976, the primary focus of federal R&D funding was nuclear energy, with an emphasis specifically on research on commercial applications of light water reactors and development of breeder reactors.
- The commercial nuclear energy R&D program peaked at $2.8 billion in 1978 and declined to a low of $75 million in 2001.
- Since 1976, only 6 percent of the total of $28 billion in nuclear energy R&D expenditures has been devoted to light water reactors.
- Of the total nuclear energy R&D expenditures from 1976 to 2006, 52 percent ($14.5 billion) was devoted to the breeder program. Since 1950, the breeder program consumed 35 percent—$23.7 billion of $67 billion—of civilian nuclear energy R&D. Funding for research on the breeder reactor ended in 1988.

[6] Of the energy sources commonly considered "renewables," hydro is tracked separately in this report and geothermal R&D funding was negligible compared to wind and solar R&D funding.

- The light water reactor program always has been a small portion of nuclear energy research, accounting for $5.3 billion (8 percent) of the $67 billion total R&D expenditures. Light water reactor technology produces about 20 percent of the nation's electricity.
- More than $38 billion was spent on R&D of other reactor types, including heavy water reactors, organic moderated reactors and gas cooled reactors, among others.

The distribution of funds for nuclear R&D is shown in Exhibit 6 below.

Exhibit 6 – Allocation of Nuclear R&D Funding, 1950–2006



- Research and development expenditures for nuclear, coal and renewables expanded greatly after 1975, but this increase was especially marked for coal and renewables. Between 1976 and 2006 the federal government spent more than six times as much on coal R&D as it had in the previous quarter century and more than 10 times as much on wind and solar R&D.
- Annual R&D expenditures for all three technologies peaked between 1979 and 1981 and then declined dramatically. This decline continued through the late 1990s, as shown in Exhibit 7. Cumulative expenditures on R&D from 1976 to 2006 are shown in Exhibit 8. In the final 10 years of the study period (1997 to 2006), the cumulative expenditure for nuclear R&D was less than half that for coal and renewables (wind and solar), as shown in Exhibit 9.

Exhibit 7 – Annual Federal R&D Expenditures, 1976–2006

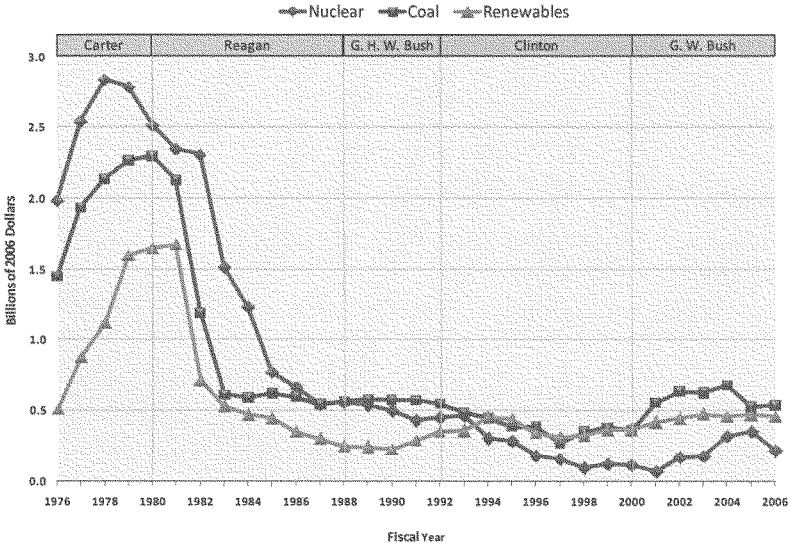


Exhibit 8 – Cumulative Federal R&D Expenditures, 1976–2006

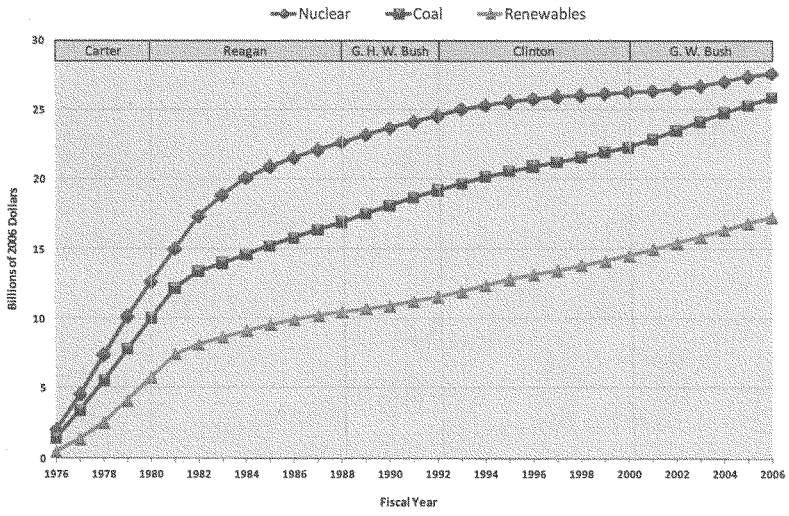
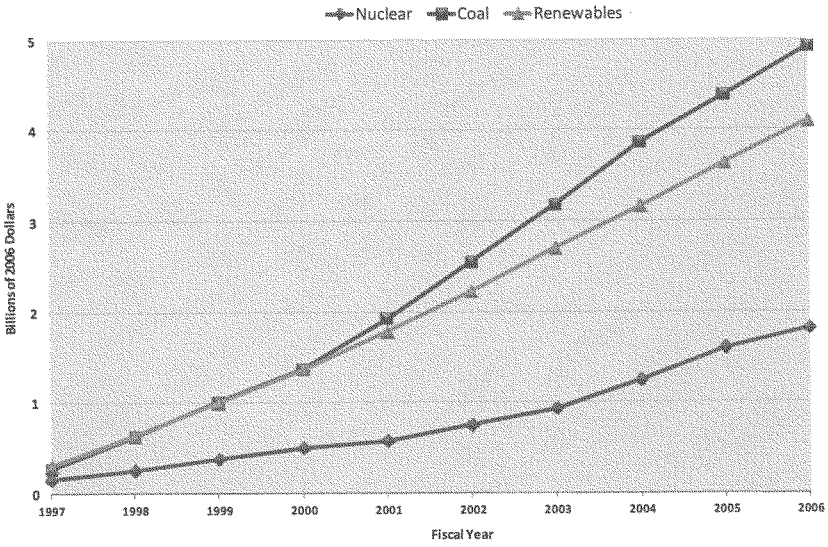


Exhibit 9 – Cumulative Federal R&D Expenditures, 1997–2006



Conclusions

The common perception that federal energy incentives have favored nuclear energy at the expense of renewables, such as wind and solar, is not supported by the findings of this study. The largest beneficiaries of federal energy incentives have been oil and gas, receiving more than half of all incentives provided since 1950. The federal government's primary incentive to nuclear energy has been in the form of R&D programs, one of the more visible types of incentives identified. Since the end of funding for the breeder reactor program in 1988, federal spending on nuclear energy research has been less than spending on coal research and since 1994 has been less than spending on renewable energy research as well.

Appendix 1 - Summary of Federal Energy Organizations

Until the early 1970s, energy policy was a low priority for the federal government, and responsibility for policy and funding was scattered throughout the government in the U.S. Atomic Energy Commission, the U.S. Department of the Interior, the U.S. Department of Treasury, the U.S. Department of State and other agencies. This changed dramatically during 1973, as the Arab oil embargo and the ensuing increases in oil prices focused the nation's attention as never before on the "energy crisis."

Reacting to this crisis atmosphere, President Nixon established the Federal Energy Office (FEO) by executive order in December 1973 to coordinate policy and to administer the increasingly complex energy regulations and allocation mandates. The Federal Energy Administration Act of 1974 transferred FEO's responsibilities to the newly created U.S. Federal Energy Administration (FEA).

In 1974, Congress also greatly expanded the federal government's role in energy R&D by creating the U.S. Energy Research and Development Administration (ERDA) as the focus of the nation's energy research efforts. The rationale for the creation of ERDA was threefold:

- There was a need for a single agency within which the government's greatly increased interest in and funding for energy R&D could be concentrated and centralized.
- It was felt that even a "reformed" AEC would be perceived as favoring nuclear energy over other options.
- There was concern that the AEC's dual functions of regulating the nuclear energy industry as well as funding research and promoting the development of nuclear energy were incompatible.

Comment [VLB1]: This is confusing. Maybe restate: "There was a need for a single, centralized government agency to manage the government's funding for energy R&D."

In 1975 the AEC was abolished and its regulatory functions were transferred to the U.S. Nuclear Regulatory Commission, its energy research functions were transferred to ERDA, and many—but not all—of the energy research programs scattered among different federal agencies were transferred to ERDA. FEA continued to administer most energy regulations—primarily petroleum and natural gas price controls and allocations.

During 1976 and 1977, Presidents Ford and Carter both recommended the creation of a centralized, Cabinet-level energy department, and in 1978 the energy bureaucracy was again reorganized. ERDA and FEA became part of the newly formed U.S. Department of Energy, while the Nuclear Regulatory Commission remained an independent agency. The U.S. Federal Power Commission, which had been an independent agency since its inception, became the semiautonomous U.S. Federal Energy Regulatory Commission (FERC) within DOE.

In the early 1980s, the Reagan Administration proposed abolishing DOE and in the fiscal 1983 budget proposed transferring the energy R&D budget to an "Energy Research and Technology Administration" to be created within the Commerce Department. However, this proposal was not implemented, and the federal energy bureaucracy has remained relatively intact since 1978.

A list of acronyms for these and other federal agencies mentioned in this report is provided below.

List of Acronyms

AEC	U.S. Atomic Energy Commission
BEA	Bureau of Economic Analysis, U.S. Department of Commerce
BLM	Bureau of Land Management, U.S. Department of the Interior
BOM	Bureau of Mines, U.S. Department of the Interior
CBO	Congressional Budget Office
DOE	U.S. Department of Energy
DOC	U.S. Department of Commerce
DOI	U.S. Department of the Interior
EPA	U.S. Environmental Protection Agency
ERDA	U.S. Energy Research and Development Administration
FEA	U.S. Federal Energy Administration
FEO	U.S. Federal Energy Office
FERC	U.S. Federal Energy Regulatory Commission
NASA	National Aeronautics and Space Administration
NSF	National Science Foundation
OMB	Office of Management and Budget
OTA	Office of Technology Assessment
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey, U.S. Department of the Interior

Appendix 2 - Sources and Methods

Part A of this appendix discusses the source documents used in this study. Part B shows how federal programs identified in this study align with the incentive types and energy sources tabulated herein.

A. Source Documents

The major sources for the data in this report include the federal budget documents compiled by the U.S. Departments of Energy, Interior, and Agriculture, the U.S. Environmental Protection Agency, the Office of Management and Budget, the Congressional Budget Office, the U.S. Nuclear Regulatory Commission, the Energy Research and Development Administration, the U.S. Atomic Energy Commission, the Office of Technology Assessment (OTA), the National Aeronautics and Space Administration, and other federal agencies. Significant source documents are listed in Exhibit 10.

Exhibit 10 – Source Documents

PERIOD	SOURCES
1950–2006	OMB's annual "Budget of the United States Government," its appendices and its special studies.
1950–1978	DOE-funded study, "An Analysis of the Results of Federal Incentives Used to Stimulate Energy Production," Richland, Washington: Bruce W. Cone, et. al., Battelle Pacific Northwest Laboratory, 1980.
1975–2006[7]	The annual budgets and supporting documents of DOI, USDA, NASA and EPA.
1978–2006	DOE's annual budgets, their appendices and special reports, and detailed congressional budget submissions, requests, justifications, revisions, and program defenses.
1983	Budget of the Department of Commerce (the Reagan administration had proposed abolishing DOE and its research functions were to be transferred to a newly created Energy Research and Technology Administration within Commerce).
1975–1978	ERDA's annual budgets, their appendices and special reports, and ERDA's detailed congressional budget submissions, requests, justifications, revisions and program defenses.
1950–1974	AEC's annual reports and their appendices, AEC special studies, annual AEC financial statements, and congressional hearings documents from the Joint Committee on Atomic Energy.

[7] Includes the 1976 "Transition Quarter," running from July 1, 1976 through September 30, 1976, as the Congress shifted the start of the federal fiscal year to October 1, where it remains.

The inflation and gross domestic product estimates for 2006 were those contained in the "Budget of the United States Government, Fiscal Year 2007." The R&D expenditure estimates used were the actual dollars as expended in the year in question.

In addition, invaluable assistance was rendered to the authors by numerous individuals in the respective federal agency programs, budget and comptroller offices, federal librarians, the DOE historian, and by current and former staff from the relevant federal agencies and the U.S. Congress.

B. Alignment of Federal Programs to Incentive Categories

The incentives discussed in this report are the major ones that have been used by the federal government to stimulate energy development and account for 90 to 95 percent of the incentive costs estimated through 2006. Exhibit 11 summarizes the alignment of key federal programs to the incentive types and energy sources identified in this study.

Exhibit 11 – Alignment of Federal Programs to Incentive Types

Targeted Energy	Federal Program or Activity	Incentive Type	Year Started
Nuclear	Research and Development Activities	R&D	1950
	Regulation of Commercial Nuclear Energy	Regulation	1960
	Waste Management and Disposal	Disbursements	1982
	Enrichment Plants	Market Activity	1943
	Liability Insurance	Disbursements	1957
	Uranium Mining Industry	Market Activity	1971
	Nuclear Waste Fund	Disbursements	1982
	All Other Federal Support Activities	Government Services	1950
Coal	Research and Development Activities	R&D	1950
	U.S. Geological Survey	R&D	1950
	Bureau of Land Management	Market Activity	1950
	Percentage Depletion Allowance	Tax Policy	1950
	Mine Health and Safety	Regulation	1950
	Bureau of Mines	R&D	1964
	Black Lung Disability Trust Fund	Disbursements	1977
	Abandoned Mine Reclamation Fund	Disbursements	1977
	Transportation, Ports and Waterways	Government Services	1950
Oil	Research and Development Activities	R&D	1951
	U.S. Geological Survey	R&D	1950
	Bureau of Land Management	Market Activity	1950
	Bureau of Mines	R&D	1964
	Percentage Depletion Allowance	Tax Policy	1950
	Maintenance of Ports and Waterways	Regulation	1950
	Stripper Well Price Incentives	Regulation	1944–45; 1974–81
	Regulation	Regulation	1974
	Intangible Drilling Expenses	Tax Policy	1950
	High Rate of Return for Oil Pipelines	Regulation	1921–51
	Leaking Underground Storage Tank Trust Fund	Disbursements	1986

Exhibit 11 – Alignment of Federal Programs to Incentive Types

Targeted Energy	Federal Program or Activity	Incentive Type	Year Started
	Oil Spill Liability Fund	Disbursements	1986
	Subsidies for Oil Tankers	Disbursements	1970
	Royalty Relief	Tax Policy	1995
Natural Gas	Research and Development Activities	R&D	1951
	Regulation	Regulation	1938
	Wellhead Price Controls	Regulation	1955
	U. S. Geological Survey	R&D	1950
	Bureau of Land Management	Market Activity	1950
	Pipeline Safety Fund	Disbursements	1979
	Section 29 Tax Credits	Tax Policy	1980
	Intangible Drilling Expenses	Tax Policy	1950
	Royalty Relief	Tax Policy	1995
Hydroelectric Energy	Research and Development Activities	R&D	1950
	Construction and Operation of Federal Dams	Market Activity	1933
	Exemption of Pwr Revenues From Fed Taxation	Tax Policy	1938
	Low Interest Loans	Market Activity	1933
	Federal Regulation	Regulation	1971
	Construction/Operation of Fed Transmission Sys	Market Activity	1936
Renewables (Solar and Wind)	Research and Development Activities	R&D	1950
	Tax Credits and Deductions	Tax Policy	1978
	Federal Programs and Disbursements	Disbursements	1976
	Market Activities and Demonstration Programs	Market Activity	1976
	Renewable Energy Production Incentive	Disbursements	1993
	Commodity Credit Corporation Programs	Government Services	2001
	All Other Federal Support Activities	Government Services	1973
Geothermal	Research and Development Activities	R&D	1950
	Tax Credits and Deductions	Tax Policy	1978
	Market Activities and Demonstration Programs	Market Activity	1976

Comment [VLB2]: The title for Exhibit 11 won't let me write (cont'd) after "Types" Not sure how to do that without changing the first title

Appendix 3 – Application of Incentive Types to Energy Sources

The following notes give additional explanation for the estimates of incentive costs provided in this report (e.g., Exhibit 1).

1. **Nuclear Energy.** Through 2006, federal incentives for nuclear netted to almost $65 billion—9 percent of the federal incentives for energy development.

   a. Tax Policy. Prior to the Energy Policy Act of 2005 (EPAct 2005), there were no tax incentives specifically designed to subsidize nuclear energy[8]. In EPAct 2005, Congress provided $6 billion in production tax credits for new nuclear plants.

   b. Regulation. Approximately $10.9 billion through 2006; includes the cost of administering the NRC/AEC and is net of the regulatory user fees paid by utilities.

   c. R&D. Primarily AEC, ERDA and DOE expenditures, totaling $66.8 billion through 2006.

   d. Market Activity. There has been no direct federal government involvement in market activity with respect to commercial nuclear energy.

   e. Government Services. Federal support activities related to nuclear energy development exist in about 45 departments and agencies other than DOE and the NRC, but the expenditures are very small compared to the funds spent by DOE and the NRC. The authors estimated that through 2006 the total for all other federal incentives and support activities was about $1.3 billion.

   f. Disbursements. There initially were federal disbursements for nuclear energy for waste management and disposal; these funds are included under R&D monies. However, under the Nuclear Waste Policy Act of 1982, nuclear utilities are assessed the costs of developing a high-level waste repository for spent fuel from nuclear plants. Through 2006 this fund had accumulated $20 billion more than had been disbursed. Through 2006 the federal government has expended approximately $5.7 billion for environmental restoration related to commercial nuclear energy. Thus, federal disbursements for nuclear energy net to -$14.3 billion

[8] See the discussion in Roger H. Bezdek and Robert M. Wendling's "Costs and Results of Federal Incentives for Commercial Nuclear Energy," Energy Systems and Policy, Vol. 15, 1991, pp. 269-293, and U.S. Energy Information Administration, Federal Financial Interventions and Subsidies in Energy Markets, September 1999. The Tax Reform Act of 1986 included a 15-year accelerated depreciation period for nuclear power plants. However, under the reference tax law standard used by the U.S. Department of the Treasury, OMB, and the Joint Committee on Taxation of the U.S. Congress to estimate tax expenditures, the system of depreciation allowances provided by this act is the reference tax law baseline for investments. Thus, there are no specific tax expenditures for nuclear from accelerated depreciation.

2. **Coal.** Through 2006, federal incentives for coal totaled $93.4 billion—13 percent of the federal incentives for energy development.

   a. Tax Policy. Through 2006 the authors estimated that the percentage depletion allowance for coal, the expensing of exploration and development costs, capital gains treatment of royalties on coal, and exclusion of interest on energy facility bonds resulted in a tax subsidy of $30.7 billion.

   b. Regulation. Federal expenditures for regulating mine health and safety and other aspects of the coal industry totaled $6.9 billion through 2006.

   c. R&D. Through 2006, the coal industry received $31.5 billion in R&D funding. Most of these expenditures were federal coal R&D monies. However, significant expenditures were also derived from prorated expenditures of selected U.S. Geological Survey and BOM programs.

   d. Market Activity. Market activity incentives for the coal industry totaled $2.3 billion through 2006, through the activities of BLM and other federal agencies.

   e. Government Services. Federal support of ports and waterways (primarily through the U.S. Army Corps of Engineers), allocated and prorated to the coal industry totaled $13.9 billion through 2006.

   f. Disbursements. As of 2006, the Black Lung Disability Trust Fund had a negative balance of $9.9 billion, and the Abandoned Mine Reclamation Fund had a positive balance of $1.8 billion, resulting in net federal disbursements for the coal industry of approximately $8.1 billion.

3. **Oil.** Through 2006, federal incentives for oil totaled $335 billion—46 percent of the federal incentives for energy development.

   a. Tax Policy. The authors estimate that, through 2006, tax incentives for the oil industry totaled $172.9 billion. These tax expenditures resulted primarily from the percentage depletion allowance and from deducting as a current expense "intangible drilling and development costs."

   b. Regulation. Incentive costs under this category totaled $115.6 billion through 2006. These resulted from: 1) the exemption from price controls (during their existence) of oil produced from "stripper wells;" 2) the two-tier price control system, which was enacted as an incentive for the production of "new" oil; 3) the costs of oil industry regulation; and 4) the higher-than-average rate of return allowed on oil pipelines.

   c. R&D. Through 2006, federal R&D incentives for the oil industry totaled $7.4 billion. These resulted from: 1) federal R&D expenditures for the oil industry, and 2) the prorated costs of selected USGS and BOM programs.

d. Market Activity. Market activity incentives for the oil industry refer to the planning, leasing, resource management and related activities of the BLM. The authors estimated that the prorated costs of these totaled $5.1 billion through 2006.

e. Government Services. Government services incentives ($31.1 billion) resulted primarily from the prorated cost of maintaining ports and inland waterways and, to a lesser extent, from the support of numerous federal agencies through 2006.

f. Disbursements. Through 2006, the federal government disbursed approximately $5.8 billion to the oil industry, primarily through subsidies for construction and operating costs of oil tankers. However, as of 2006, the combined balances in the Leaking Underground Storage Tank Trust Fund and the Oil Spill Liability Fund totaled $3.2 billion. Thus, the net federal disbursements for the oil industry totaled $2.6 billion through 2006.

4. **Natural Gas.** Through 2006, federal incentives for natural gas totaled $101 billion—14 percent of the federal incentives for energy development.

a. Tax Policy. The authors estimate that through 2006, tax incentives for the natural gas industry totaled $88.3 billion. These tax expenditures resulted primarily from: 1) the percentage depletion allowance and from deducting as a current expense "intangible drilling and development costs"—both allocated on the basis of wellhead values and 2) the alternative fuel production credit.

b. Regulation. Incentive costs under this category totaled $3.3 billion through 2006. These resulted from the net effects of the costs of federal regulation and the net effects of wellhead price controls, which historically have served at some times as an incentive and at other times as a disincentive for natural gas production.

c. R&D. Through 2006, federal R&D funds for the natural gas industry totaled $6.2 billion. These resulted from federal R&D expenditures for the gas industry and the prorated costs of selected USGS and BOM programs.

d. Market Activity. Market activity incentives for the natural gas industry refer to the planning, leasing, resource management and related activities of the BLM. The authors estimated that the prorated costs of these totaled $2.0 billion through 2006.

e. Government Services. Traditional services incentives ($1.4 billion) resulted primarily from miscellaneous services provided by the federal government to the industry through 2006.

f. Disbursements. Federal government disbursements to the natural gas industry were negligible.

5. **Hydroelectric.** Through 2006, federal incentives for hydroelectric energy totaled $80.5 billion—11 percent of the federal incentives for energy development.

a. Tax Policy. The authors estimate that, through 2006, the exemption of power revenues from federal taxes resulted in a tax expenditure subsidy for the development of hydroelectric energy of $12.1 billion.

b. Regulation. Expenditures for the regulation of hydroelectric energy through FERC and other regulatory agencies totaled approximately $4.7 billion through 2006.

c. R&D. Through 2006, federal R&D expenditures for hydroelectric energy in DOE, its predecessors and the U.S. Army Corps of Engineers totaled approximately $1.3 billion.

d. Government Services. Traditional services through the support of numerous federal agencies resulted in a subsidy for hydroelectric energy of $1.4 billion through 2006.

e. Market Activity. Market activity incentives for hydroelectric energy include federal construction and operation of dams and transmission facilities—estimated as the portion of the net investment in construction and operation of dams allocated to power development and the relevant transmission facilities—and the net expenditures of the power marketing administrations. These incentives totaled $59.3 billion through 2006.

f. Disbursements. Through 2006 the federal government disbursed $1.7 billion for hydroelectric energy development.

6. **Renewables.** Through 2006, federal incentives for renewables (solar, wind and biofuels) totaled $43.9 billion—6 percent of federal incentives for energy development.

a. Tax Policy. The authors estimate that, through 2006, tax incentives for renewable energy totaled $19.6 billion. These tax expenditures resulted primarily from targeted, exclusive federal tax credits and deductions for renewable energy applications for individuals and businesses beginning in 1978—including the alcohol fuel credit and the partial exemption from the excise tax for alcohol fuels.

b. Regulation. Federal regulation costs for renewable energy were negligible.

c. R&D. Through 2006, federal R&D incentives for renewable energy totaled $19.1 billion. These resulted primarily from federal R&D expenditures by ERDA and DOE.

d. Government Services. Government services incentives of $2 billion resulted primarily from miscellaneous services provided by various federal agencies, including the Commodity Credit Corporation, to encourage renewable energy development.

e. Market Activity. Market activity incentives for renewable energy include commercialization programs, demonstration projects and outreach programs and totaled $1.6 billion through 2006.

f. Disbursements. Federal disbursements to encourage renewable energy utilization through various federal programs, including the Renewable Energy Production Incentive, totaled $1.6 billion through 2006.

7. **Geothermal Energy**. Through 2006, federal incentives for geothermal energy totaled $6.4 billion—1 percent of the federal incentives for energy development.

a. Tax Policy. The authors estimate that, through 2006, targeted tax expenditure incentives for geothermal energy totaled $1.6 billion.

b. Regulation. Federal regulation costs for geothermal energy were negligible.

c. R&D. Through 2006, federal R&D spending for geothermal energy totaled $3.3 billion. These resulted primarily from federal R&D expenditures by ERDA and DOE.

d. Government Services. Government services incentives for geothermal energy were negligible.

e. Market Activity. Market activity incentives for geothermal energy include commercialization programs and demonstration projects and totaled approximately $1.5 billion through 2006.

f. Disbursements. Federal disbursements to encourage geothermal energy were negligible.

Appendix 4 – Current and Constant Dollar Estimates

This analysis spans a period of 56 years (1950–2006), during which the general price level in the United States increased more than sixfold. Further, price increases were not distributed uniformly over the period, with the most severe inflation occurring in the early 1950s, the 1970s and early 1980s. Thus, the only meaningful way to compare and analyze federal energy R&D expenditures over this period is to use values expressed in constant dollars. Obviously, it would be misleading to equate an R&D dollar expended in 1973 with one spent in 2006, since the price level in the latter year is more than three times that of the former year. Aside from the general distortions, use of current dollar data in the analysis would, for example, seriously undercount nuclear energy R&D expenditures incurred during the 1950s and 1960s, which were substantial, and overestimate R&D funding for solar and renewable energy programs, which only began to be substantial during the mid-1970s. Therefore, throughout this report all the estimates given are stated in constant 2006 dollars.

The authors derived the constant 2006 dollar data (2006 = 1.00) using GDP deflators to convert current dollar data into 2006 base year estimates. It is preferable in an analysis such as this to use the GDP deflators instead of the more widely known U.S. Consumer Price Index deflators.

The U.S. Consumer Price Index is a measure of the average change in prices over time in a fixed "market basket" of goods and services purchased either by urban wage earners and clerical workers or by all urban consumers and is compiled by the Bureau of Labor Statistics of the U.S. Department of Labor. The index is based on prices of food, clothing, shelter, fuels, transportation fares, charges for doctors' and dentists' services, drugs, etc. purchased for day-to-day living. In calculating the index, each item is assigned a weight to account for its relative importance in consumers' budgets. Price changes for the various items in each location are then averaged.

The index is the most widely publicized measure of inflation, and it is broad-ranging and readily comprehensible. However, the implicit GDP deflator is the most comprehensive price index available—not the U.S. Consumer Price Index.

The implicit price deflator (IPD), compiled by the Bureau of Economic Analysis of the U.S. Department of Commerce, is a by-product of the deflation of GDP and is derived as the ratio of current- to constant-dollar GDP (multiplied by 100). It is the weighted average of the detailed price indices used in the deflation of GDP, but they are combined using weights that reflect the composition of GDP in each period. Thus, changes in the implicit price deflator reflect not only changes in prices but also changes in the composition of GDP. It is issued quarterly by BEA.

The IPD is not independently derived by a direct price collection program. Rather, as noted, it represents the ratio between current-dollar GDP and constant-dollar GDP multiplied by 100. The result is an aggregate price index that is affected by changing expenditure patterns each year. Because of its indirect derivation, the quality of the IPD is closely correlated to that of the various price series used in converting national output to constant dollars. In contrast, the U.S. Consumer Price Index is a fixed weight index in which the contents of the "market basket" are kept constant over a long period (five to 10 years). It is specifically designed to measure directly changes in prices of identical or comparable items over time.

Conceptually, the IPD measures the general price level of all final goods and services (including government) produced during a specific period. Thus, the IPD is the only official index that attempts to measure overall price behavior of all goods and services in the nation. The U.S. Consumer Price Index is restricted to a narrower universe. The movement of the IPD usually closely parallels the movement of the U.S. Consumer Price Index but is rarely identical to it. The implicit GDP deflators are the ones used in this study, and the deflators for 1950–2006 are listed in Exhibit 12.

Exhibit 12 – U.S. Gross Domestic Product Deflators Used
(2006 = 100)

YEAR	GDP DEFLATOR	YEAR	GDP DEFLATOR	YEAR	GDP DEFLATOR
1950	14.25	1970	23.73	1990	70.31
1951	15.27	1971	24.91	1991	72.77
1952	15.53	1972	26.00	1992	74.44
1953	15.72	1973	27.45	1993	76.16
1954	15.87	1974	29.92	1994	77.78
1955	16.15	1975	32.75	1995	79.37
1956	16.71	1976	34.64	1996	80.88
1957	17.27	1977	36.84	1997	82.22
1958	17.66	1978	39.43	1998	83.13
1959	17.88	1979	42.70	1999	84.34
1960	18.13	1980	46.57	2000	86.18
1961	18.34	1981	50.95	2001	88.24
1962	18.59	1982	54.05	2002	89.78
1963	18.78	1983	56.19	2003	91.70
1964	19.07	1984	58.30	2004	94.30
1965	19.42	1985	60.08	2005	97.15
1966	19.97	1986	61.40	2006	100.00
1967	20.59	1987	63.08		
1968	21.47	1988	65.23		
1969	22.53	1989	67.70		

Appendix 5 - Reconciliation of R&D Program Categories and Budget Data

Substantial resources were devoted in this study to program and budget reconciliations for the three technologies on which this analysis of R&D focused—nuclear, coal and renewables. Required here were detailed R&D expenditures by technology, program and subprogram components over a period of 56 years. The major challenges in deriving these data included the following:

- The R&D expenditures involved spanned nearly six decades, during which some of the programs, subprograms and/or technologies did not exist.
- The interest (and detailed information available) varied in cycles over the period, from acute intensity to a total lack thereof.
- A coherent, readily identifiable R&D program for one of the technologies (renewables) did not even exist until the mid 1970s.
- The budget estimates for nuclear energy R&D during most of the 1950s were classified and intentionally aggregated so as to be indiscernible.
- Program and budget classifications for all three technologies changed—something sometimes significantly—on almost a year-by-year basis.
- Individual R&D programs and subprograms were continually redefined, reclassified, disaggregated and reaggregated.
- Similar programs had different titles, definitions and subprogram components across different federal agencies.
- Some R&D programs appeared, disappeared and then later reappeared under different definitions and headings.
- Budget expenditures estimates for the R&D programs were available according to different accounting conventions: appropriations, adjusted appropriations, authorizations, obligations, outlays, expenditures, etc.
- During 1976, the federal fiscal year was redefined.
- Usually the budget expenditures for a specific detailed program for a given year differed depending on the source, program definition, year the estimate was made, inclusion or exclusion of carry-forward monies and/or rescissions, amount of reprogramming incorporated, the accounting of "overhead" (management, program direction, policy and analysis, planning, etc.), the distinction made between operating and capital expenses, the way that funds allocated to the DOE labs were classified, and other factors.

Given these challenges, this analysis was driven by three major principles:

1. The authors wished to distinguish between the period 1950-1975 and 1976-2006, with most of the analysis and budget detail devoted to the latter period.

As noted in the report, 1976 was a watershed year for federal energy R&D, as it represents the first year when the nation's reordered energy R&D budget priorities were firmly in place. Further,

prior to 1976 the budget detail for some energy R&D programs—coal and especially those in the renewables area—was lacking.

2. Second, in deriving R&D program categories for the period 1976-2006 the authors desired classifications that were comprehensive and contained meaningful program detail.

To list for each of the 30 years every program or subprogram that existed in any year would have made a meaningful time series analysis of the budget priorities impossible. On the other hand, in aggregating and classifying the budget categories, meaningful programmatic detail—that was both consistent and accurate—had to be preserved.

3. Third, the R&D expenditure estimates used were actual dollars as expended in the year in question.

As noted, the budget expenditures for a specific detailed program for a given year differed depending on the source, program definition, year the estimate was made, inclusion or exclusion of carry-forward monies and/or rescissions, amount of reprogramming incorporated, the accounting for "overhead" (management, program direction, policy and analysis, planning, etc.), the distinction made between operating and capital expenses, the manner in which funds allocated to the DOE labs were included, and other factors. Thus, the answer to the question "How much money was spent on energy R&D program X in year Y?" can be answered in several different ways, depending both on how the program is defined and the way that the expenditure estimate is derived.

The definition of an energy R&D program can differ even for seemingly identical programs. For example:

- Is the program inclusive or exclusive of overhead?
- Does the program include both operating and capital expenditures?
- Is the program inclusive of all the appropriate subprogram elements?
- Does the program include the appropriate functions at the DOE labs?
- Is the program inclusive of other agencies' expenditures on the same function?

In their reconciliations the authors strove to aggregate the program definitions as much as possible in a consistent manner. Thus, for example, an expenditure estimate for the breeder program includes all monies spent on that program irrespective of the source of funds or the organization that spent them.

Concerning expenditures in the year in question, program expenditures estimates will often differ significantly and a definitive estimate is not usually available until two or three years hence in the appropriate budget documents. Thus, the definitive estimate of the funds actually expended on a specific, detailed energy R&D program (incorporating all rescissions, pass-throughs, carry-forwards, etc.) in 2006 would not be available until the DOE and the OMB budget documents for 2007 or 2008 are available. The authors' budget estimates of actual monies "as spent in the year in question" were thus based, where possible, on the DOE and OMB budget documents subsequently published two or three years hence—after the final revisions had been made.

Appendix 6 - Nuclear R&D Expenditures

A. Background

Policymakers recognized early that, although nuclear energy had great potential, its development involved larger financial resources and risks than were feasible for private industry alone. Through federal leadership, an arrangement was established with industry to provide a framework to address the risks and to develop the resource. Development early of the commercial nuclear energy program derived from personnel, facilities, technology and contracting policies that had their genesis in World War II. The technology grew out of military applications of atomic power—the weapons and naval reactor programs—and control was exercised by the federal government under conditions of secrecy.

The Atomic Energy Act of 1946 (AEA) created the basis for development of nuclear energy, transferring the atomic energy program to civilian control. The act established two entities to develop nuclear energy: the AEC in the executive branch (with the charter to develop fission energy) and the Joint Committee on Atomic Energy in Congress. AEC contracting arrangements created a third party, the industrial suppliers, and through 1974 this three-member group remained a stable coalition working together to commercialize the technology.

The 1954 AEA amendments paved the way for industrial participation in nuclear energy development by declassifying information, establishing procedures by which private interests could obtain required classified data, and permitting private industry to own and operate nuclear reactors. Subsequently, the 1964 AEA amendments permitted private ownership of fissionable material, and full private ownership was reached in steps over a period of years. The AEC encouraged the growth of the industry, and because of the financial risks involved, a framework of government-industry cooperation was developed for financing early nuclear energy plants. The Civilian Reactor Development Program (CRDP) provided R&D support, access to technology, waiver of fuel use charges, fuel fabrication and the training of personnel. The AEC's goal of transferring the federally developed reactor and fuel cycle technologies to the private sector was achieved, and all steps in the fuel cycle are currently either funded or handled directly by industry.[9]

As noted in Appendix 1, by the mid-1970s there was concern that the AEC's dual functions of regulating the industry as well as funding research and promoting the development of nuclear energy were incompatible. In 1975, the AEC was abolished and its regulatory functions were transferred to the NRC, while its research functions were transferred to ERDA. In 1977, ERDA became part of DOE.

Federal policy has succeeded in creating a viable commercial nuclear energy industry that has developed into a significant portion of the nation's energy resource base. In 2006, nuclear energy produced about 20 percent of U.S. electricity and supplied approximately 8 percent of total U.S. energy consumption.

[9] The federal government's nuclear energy commercialization program was successful and, at present, all costs and externalities are borne by private industry.

B. The Commercial Nuclear Energy Research Program

DOE's nuclear energy programs are designed to promote civilian nuclear energy and to provide the technological base to support industry efforts to continue the development of nuclear power as an economic and environmentally acceptable means of generating baseload electric power. The R&D program has included research on light water reactors, breeder reactor systems, fuel reprocessing technologies, space power systems, advanced radioisotope power systems, nuclear energy plant optimization and other technologies. The major program components supported since 1976 include:

- Nuclear Energy Research Initiative
- isotope support
- Advanced Fuel Cycle Initiative
- commercial nuclear waste
- spent nuclear fuel
- light water reactors
- converter reactors (other than light water)
- advanced nuclear systems
- facilities
- advanced radioisotope power systems
- space reactor power systems
- nuclear fuel cycle
- the breeder program
- remedial action
- university reactor fuel assistance and support
- Nuclear Hydrogen Initiative
- Advanced Nuclear Medicine Initiative
- advanced test reactor fusion irradiation
- program direction
- policy and management and miscellaneous
- civilian waste R&D.

C. Research and Development Expenditures

Nuclear energy development has relied from inception on a broad R&D program conducted by national laboratories, industrial concerns, and private and public institutions under federal contract, as well as by industrial firms with their own funding. To develop commercial reactors, the AEC's program had two main thrusts: to develop basic R&D and to build demonstration plants in partnership with industry. Prior to the late 1960s, the AEC's goal was commercialization of LWR technology.

Through the 1970s the major federal incentive for nuclear energy was the AEC Civilian Reactor Development Program. Approximately 81 percent of the R&D funds allocated to nuclear energy by the federal government from 1950 to 1978 was spent through CRDP, and the remaining 19 percent was disbursed through other program categories.

Developmental fission reactors and the early cooperative power reactor projects were also supported through the CRDP program. From the late 1960s through the early 1980s, the liquid metal fast breeder reactor program received substantial funding, especially the Clinch River Breeder reactor before its construction was canceled in 1983. A DOE-funded study by Battelle

Pacific Northwest Laboratory estimated that, through 1975, federal expenditures for commercial nuclear energy R&D totaled $38.9 billion (2006 dollars)[10].

The following series of tables reveals how R&D expenditures were broken out in the AEC budget from 1950 to 1975. Because the breakouts vary, it is not feasible to present the data in one continuous table with a consistent set of line items across the entire 25-year period.

Exhibit 13 shows AEC nuclear reactor R&D expenditures for the period, 1950–1962. It illustrates that, during the early years of the AEC nuclear research program, $24 billion was spent on nuclear reactor R&D, but only $2.1 billion (9 percent) of these funds were expended on LWR research.

[10] See Bruce W. Cone, et. al., "An Analysis of Federal Incentives Used to Stimulate Energy Production," Richland, Washington: Battelle Pacific Northwest Laboratory, 1980, Chapter IV.

Exhibit 13 – Nuclear Reactor Research and Development Expenditures, 1950–1962 (Millions of 2006 Dollars)

PROGRAM	EXPENDITURES
Civilian Nuclear Power Reactors	4,867
Light Water Reactors	
Pressurized Light Water	1,511
Boiling Light Water	544
Heavy Water	319
Organic Moderated	378
Gas Cooled	577
Sodium Cooled	1,478
Other Studies and Development	59
Army Reactors	465
Naval Reactors	6,523
Merchant Ship Reactors	284
Missile and Space Propulsion	1,565
Aircraft Propulsion	3,130
Auxiliary Power Sources	656
General	6,504
TOTAL	23,995

Exhibit 14 tells a similar story for AEC expenditures for the years 1963–1975. As summarized in Exhibit 15, the AEC expenditures focused on two major program thrusts of the federal nuclear energy R&D program: the LWR program and the breeder program. Once again, reactor R&D expenditures are a small portion of the total AEC budget ($31.2 billion out of $151 billion—about 21 percent), and expenditures for light water reactor research were a small portion of reactor R&D funds—$1.4 billion out of $31.2 billion, about 4.5 percent. These later data illustrate that, based on policy decisions made during the early 1960s, the AEC reactor development research program increasingly emphasized the breeder reactor. This emphasis resulted from major AEC policy decisions in the early 1960s to concentrate on breeder reactor development based on estimated long-term scarcity of uranium to fuel LWRs. Between 1963 and 1975, nearly 25 percent of all reactor R&D funds were devoted to the breeder program—$7.6 billion out of $31.2 billion. By the early 1970s, the breeder research program was clearly dominant, accounting for nearly half of all reactor R&D funds, and the light water reactor program was negligible.

Exhibit 14 – Summary of U.S. AEC Expenditures by Major Program, 1963–1975
(Millions of constant 2006 dollars)

	FY63	FY64	FY65	FY66	FY67	FY68	FY69	FY70	FY71	FY72	FY73	FY74	FY75	Total
Nuclear Materials	6,325	5,312	4,500	3,939	3,482	3,087	2,779	2,373	2,164	2,161	2,257	2,351	1,274	42,003
Weapons Development	3,902	4,435	4,127	3,839	3,751	3,828	4,188	3,981	3,963	3,885	3,728	3,316	1,742	48,685
Development of Nuclear Reactors	2,846	3,106	2,910	2,574	2,693	2,680	2,370	2,281	2,178	2,113	2,127	2,060	1,233	31,171
LWRs	175	243	201	164	179	117	93	67	51	52	31	11	7	1388
Breeder Reactors	112	270	400	443	510	663	602	567	590	711	960	876	857	7558
All Other Reactors	2,559	2,593	2,309	1,968	2,004	1,900	1,675	1.647	1,537	1,349	1,137	1,179	369	22,225
Physical Research	1,115	1,191	1,283	1,394	1,489	1,514	1,548	1,488	1,381	1,155	1,308	1,320	584	16,768
Biomedical and Environmental Research	398	424	459	479	484	483	461	479	446	448	473	497	304	5,838
Administration, Regulation and Misc.	604	639	623	611	577	649	620	488	400	641	345	85	324	6,605
Total Cost of Operations	15,189	15,108	13,902	12,836	12,476	12,241	11,966	11,089	10,532	10,403	10,237	9,629	5,460	151,069

Exhibit 15 – Summary of Federal R&D Expenditures for Nuclear Energy, 1950–2006
(Billions of 2006 dollars)

	1950–1975	1976–2006	Total 1950–2006
Light Water Reactor R&D	3.5	1.8	5.3
Breeder R&D	9.2	14.5	23.7
Other Nuclear Energy R&D	26.2	11.8	38.0
Total	38.9	28.1	67.0

Exhibit 16 shows the components of the ERDA/DOE nuclear energy R&D program for the years 1976-1997; Exhibit 17 shows federal nuclear energy R&D expenditures for 1998–2003; and Exhibit 18 shows federal nuclear energy R&D expenditures for 2004–2006. The authors estimate that the federal government spent $66.8 billion (2006 dollars) on commercial nuclear energy R&D through 2006 (Exhibits 13–18). These figures include R&D contributions from programs directly supportive of nuclear energy as an electricity generation source. Funds also were expended for the breeder program (including Clinch River), development of facilities such as the Fast Flux Test Reactor and basic R&D.

The data primarily reflects R&D expenditures on nondefense-related programs, including advanced light water reactors and other reactor technologies. The R&D expenditures for supporting technologies (waste management and reactor safety research) also are included, as are research funds for advanced radioisotope power systems, facilities, space reactor power systems and related programs. Expenditures for the fusion program are not included, as fusion represents a distinct technology with little direct application to current commercial nuclear energy.

In deriving these estimates, it was assumed that the military nuclear programs contributed technological information to the commercial nuclear energy program in an amount about equal to that which the military programs received from the commercial program. The one exception to this is the submarine propulsion program, which made significant technological and personnel contributions in the 1950s to industry LWR programs. Although much of the program was classified, the transfer of personnel from the naval program to industry carried both the expertise and technology into the industry development programs. Important contributions from the submarine program include zirconium technology, reactor control (including nuclear constants and codes), piping and pressure vessel design.

Exhibit 16 – Federal R&D Expenditures for Nuclear Energy, by Major Program, 1976–1997
(Millions of constant 2006 dollars)

	FY76	76tq	FY77	FY78	FY79	FY80	FY81	FY82	FY83	FY84	FY85	FY86
Nuclear Energy R&D	1,884	572	2,538	2,836	2,789	2,514	2,346	2,308	1,519	1,211	724	635
Commercial Nuclear Waste	101	55	333	333	477	503	618	462	79	47	---	---
Spent Nuclear Fuel	---	---	---	13	27	27	46	---	---	---	---	---
Converter Reactor Systems	139	70	194	259	299	148	141	201	147	167	277	81
Light Water Reactor	7	10	29	35	60	67	88	105	72	97	88	81
Other Converter Reactor Systems	132	60	165	224	239	82	52	96	75	70	189	---
Advanced Nuclear System	120	36	121	165	136	89	94	83	72	60	48	214
Facilities[11]	---	---	---	---	---	---	---	---	---	---	---	223
Advanced Radioisotope Power System	---	---	---	---	---	---	---	---	---	---	---	34
Space Reactor Power System	---	---	---	---	---	---	---	---	---	---	---	34
Nuclear Fuel Cycle	---	---	---	---	---	---	---	113	80	---	---	---
Breeder Program	1,524	411	1,890	2,067	1,850	1,715	1,447	1,369	1,025	759	344	33
Remedial Action	---	---	---	---	---	---	---	80	117	178	---	---
University Reactor Fuel Asst. & Support	---	---	---	---	---	---	---	---	---	---	---	---
Advanced Test Reactor Fusion Irradiation	---	---	---	---	---	---	---	---	---	---	---	---
Program Direction	---	---	---	---	---	32	---	---	---	---	52	17
Policy Management & Misc.	---	---	---	---	---	---	---	---	---	---	3	---
Civilian Waste R&D	---	---	---	---	---	---	---	---	---	20	45	26
Total Nuclear Energy Supply R&D	1,884	572	2,538	2,836	2,789	2,514	2,346	2,308	1,519	1,230	769	661

[11] Includes Oak Ridge and Test Area Reactor Management.

Exhibit 16 – Federal R&D Expenditures for Nuclear Energy, by Major Program, 1976–1997
(Millions of constant 2006 dollars)

	FY87	FY88	FY89	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	Total 76–97
Nuclear Energy R&D	537	552	538	497	428	444	457	304	284	182	157	26,255
Commercial Nuclear Waste	---	---	---	---	---	---	---	---	---	---	---	3,007
Spent Nuclear Fuel	---	---	---	---	---	---	---	---	---	---	---	113
Converter Reactor Systems	56	51	44	35	53	86	79	75	80	48	45	2,773
Light Water Reactor	56	51	44	35	53	86	79	75	80	48	45	1,390
Other Converter Reactor Systems	---	---	---	---	---	---	---	---	---	---	---	1,383
Advanced Nuclear System	123	147	116	86	80	80	80	55	51	32	23	2,109
Facilities *	209	188	208	248	130	133	124	41	32	20	17	1,573
Advanced Radioisotope Power System	34	33	58	71	105	69	71	69	76	59	45	722
Space Reactor Power System	79	119	100	45	46	55	40	35	1	---	---	553
Nuclear Fuel Cycle	---	---	---	---	---	---	---	---	---	---	---	193
Breeder Program	23	---	---	---	---	---	---	---	---	---	---	14,456
Remedial Action	---	---	---	---	---	---	---	---	---	---	---	374
University Reactor Fuel Asst. & Support	---	---	---	---	---	---	---	---	4	3	4	12
Advanced Test Reactor Fusion Irradiation	---	---	---	---	---	---	---	---	3	2	1	7
Program Direction	13	14	12	13	14	22	19	14	17	9	11	260
Policy Management & Misc.	---	---	---	---	---	---	45	15	19	10	11	103
Civilian Waste R&D	11	9	3	1	1	8	7	1	1	---	---	132
Total Nuclear Energy Supply R&D	548	561	541	498	429	452	464	305	285	182	157	26,387

Exhibit 17 – Federal R&D Expenditures for Nuclear Energy, by Major Program, 1998–2003
(Millions of constant 2006 dollars)

	FY98	FY99	FY00	FY01	FY02	FY03	Total 98-03
University Reactor Infrastructure and Education Assistance	9	13	14	13	20	20	89
Nuclear Energy Plant Optimization	---	---	5	5	7	5	22
Nuclear Energy Research Initiative	---	22	25	31	24	19	121
International Nuclear Energy Research Initiative	---	---	---	8	10	7	25
Next Generation Nuclear Plant	---	---	---	---	---	3	3
Generation IV R&D	---	---	---	4	4	9	17
Nuclear Power 2010	---	---	---	3	9	35	47
Civilian R&D (ATW)	---	---	9	---	---	---	9
Nuclear Hydrogen Initiative	---	---	---	---	---	2	2
Isotope Support	23	26	22	---	---	---	71
Advanced Radioisotope Power Systems	48	44	34	---	---	---	---
Advanced Nuclear Medicine Initiative	---	---	---	3	---	---	---
Advanced Fuel Cycle Initiative	---	---	---	---	86	62	148
Test Reactor Area Landlord	9	9	---	---	---	---	---
Program Direction	9	11	12	5	13	14	64
Total DOE Nuclear Energy Supply R&D	98	125	121	72	173	176	765

Exhibit 18 – Federal R&D Expenditures for Nuclear Energy, 2004–2006
(Millions of constant 2006 dollars)

	FY04	FY05	FY06	Total 04-06
University Reactor Infrastructure and Education Assistance	24	25	24	73
Nuclear Energy Plant Optimization	3	3	0	6
Nuclear Energy Research Initiative	6	3	0	9
Generation IV R&D	29	41	45	115
Nuclear Power 2010	20	52	56	128
Nuclear Hydrogen Initiative	6	9	20	35
Advanced Nuclear Medicine Initiative	139	128	14	281
Advanced Fuel Cycle Initiative	70	70	70	210
Program Direction	20	21	11	52
Total DOE Nuclear Energy Supply R&D	317	352	240	909

The financial contribution from the submarine propulsion R&D programs was assumed to be 50 percent of the total spending on submarine propulsion R&D programs in 1950, declining linearly to zero in 1959. The resultant contribution of the nuclear submarine program to the commercial nuclear energy R&D program was approximately $400 million (2006 dollars).

There is no simple way to prove the important assumption about the relationship between the defense and civilian nuclear research programs. In the early years of the nuclear energy program, the weapons programs developed many aspects of the emerging commercial nuclear power program. Methods of handling radio-active materials, neutron diffusion codes, critical experiment technology and other information were largely applicable to the commercial program.

However, the commercial program developed around an alternative fuel form (uranium oxide rather than uranium metal), cladding material, pressure barrier (vessel rather than tube), moderator (light water instead of graphite or heavy water), and reactor components. Technology from these developments became available to the weapons program. Fuel reprocessing technology, as then conceived for commercial nuclear power, was based on weapons program-developed processes, but it was not envisioned that these processes would become commercial. Waste management technology was being developed for both applications.

The LWR technology grew out of the military reactor program. However, fuel forms differ and reactor components are substantially larger and of different designs for the commercial market. Compactness and long-life are much more important to military applications. Further, much of the military technology was classified, though most of the commercial technology was reported in open literature and was thus available for military application.

Nevertheless, the civilian power reactor program was strongly influenced by and benefited from the military programs. For example, the choice of a pressurized water reactor system over the other systems stems from the specific industry experience with this reactor type as part of the military program. Second, the availability of excess enrichment capacity made it economic to select the LWR option, rather than a graphite-moderated, gas-cooled natural uranium system. Third, the nuclear infrastructure, industry, universities, and national laboratories existed because of military programs. Finally, civilian reactor research could be carried out in laboratories staffed and equipped through military programs at the marginal cost of the research.

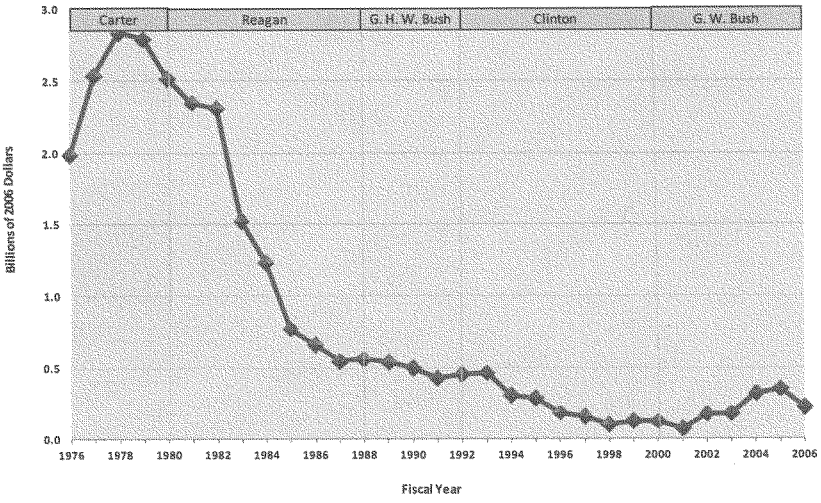
D. Major Findings

Focusing primarily on the period 1976–2006, the authors find:

- The commercial nuclear energy R&D program peaked at $2.8 billion in 1978 and declined steadily thereafter, reaching a low of $75 million in 2001. The trend in federal spending on nuclear energy R&D is shown in Exhibit 19.
- Since 1976, only 6 percent of the total of $28 billion in nuclear energy R&D expenditures has been devoted to LWRs.

- Of the total nuclear R&D expenditures over this period, more than half, 52 percent ($14.5 billion), were devoted to the breeder program. Since 1950 the breeder program consumed 35 percent—$23.7 billion of $67 billion—of civilian nuclear energy R&D, and over half of the funds expended since 1976.
- The light water reactor program always has been a small portion of nuclear energy research, accounting for only $5.3 billion (8 percent) of the $67 billion total R&D expenditures. Nevertheless, light water technology currently supplies 20 percent of the nation's electricity.
- From the early 1970s through the mid-1980s, the breeder program dominated all other nuclear energy research programs, accounting for well over half of the R&D funding.

Exhibit 19 – Federal Nuclear R&D Timeline, 1976–2006



Appendix 7 - Coal R&D Expenditures

A. Background

The U.S. has relied on coal as a major energy source for years, and it currently provides about half of the nation's electricity and about one-quarter of its total energy supply. Nevertheless, for many years the coal industry operated at relatively low earnings compared to other major U.S. industries. In addition, the industry lacked the highly specialized multi-disciplinary laboratories and skills required for effective research.

Over the past five decades, the federal government has funded a substantial coal research program, including R&D for coal production, resource assessment, mining techniques, mining health and safety, coal utilization, and pollution control and abatement. This research has been conducted at the Bureau of Mines of the U.S. Department of the Interior, the EPA, ERDA and DOE.

From the 1940s through 1996 (when it was abolished), the BOM conducted extensive R&D pertaining to coal mining, preparation and utilization and coking coal characteristics. This research included mining methods and systems, mechanization of operations, coal cleaning processes, and factors to increase the productivity of mines, as well as experiments in longwall mining, the use of diamond drills and the development of roof bolting. For many years, the BOM made field and laboratory examinations and analyses of the chemical constituents of coal on a mine-by-mine basis and regularly published reports on them. In addition, the BOM developed improved coal treatment technologies to upgrade the quality of coal by reducing the amount of ash, sulfur and other coal constituents.

The major growth market for coal (aside from exports) is the electric utility industry, which is continually expanding to meet increased requirements for electric power. Among the major factors limiting the use of coal are environmental regulations, particularly air pollution standards, which prescribe limits on particulates, sulfur dioxide, nitrogen oxide and other coal residuals.

Extensive research is underway within federal agencies to provide viable anti-pollutant processes, including different types of scrubbers, fluidized bed combustion, solvent refining and other processes. This includes expenditures by the Environmental Protection Agency—in addition to those expended by the BOM and DOE—for research to mitigate the environmental impact of using coal as a fuel, especially for electricity generation.

In addition to research and development on coal combustion techniques, DOE has engaged in extensive research on coal gasification, coal liquefaction, pulverized coal combustion, carbon sequestration and solvent refining. Considerable research also has been conducted by both the federal government and industry on the preparation of coal to reduce impurities, including sulfur, as an alternative to post-combustion abatement. Research on new uses of coal, including low-rank coals such as lignite, has been conducted for many years.

The residual content of coal has become an increasingly important factor in the production and utilization of coal, as has the relative heating values (Btu) of coals, both in their direct relation to environmental regulations and their costs. Generally, coals of high Btu value command the highest prices.

B. The Coal Research Program

Coal R&D includes a wide variety of technologies for promoting the use of coal in an environmentally responsible manner, recognizing the expected increase in U.S. coal consumption in coming decades. The objective of this program has been to conduct research necessary to strengthen the scientific and engineering technology base on which industry can draw in developing new products and processes. The program funds generic and technology-based research and development and environmental research. It supports experimental facilities with unique capabilities and includes pilot plants and test facilities where operation results in net revenues to the federal government. The research program provides for a limited federal role in support of longer-term, high-risk R&D conducted at universities, national labs and the Energy Technology Centers, as well at private sector firms. Today, the coal program includes the Coal Research Initiative (which includes the Clean Coal Power Initiative, FutureGen and the core coal R&D program) and fuel cells.

The Clean Coal Power Initiative (CCPI), started in 2002[12], is a cooperative, cost-shared program between the government and industry to demonstrate emerging technologies in coal-based power generation to help accelerate their commercialization. The nation's power generators, equipment manufacturers and coal producers help identify the most critical barriers to coal's use in the power sector. Technologies will be selected with the goal of accelerating development and deployment of coal technologies that will economically meet environmental standards while increasing the efficiency and reliability of coal power plants.

The FutureGen project, started in 2003, was intended to establish the capability and feasibility of co-producing electricity and hydrogen from coal with near-zero atmospheric emissions, including those from carbon. It planned to employ a public/private partnership to demonstrate technology, ultimately leading to near-zero atmospheric emission plants (including carbon) that are fuel-flexible and capable of multiproduct output and electrical efficiencies over 60 percent. The FutureGen-type plants were originally expected to produce electricity at prices no more than 10 percent above that of comparable plants that do not use carbon sequestration, such as coal, biomass or petroleum coke.

The advanced coal R&D effort focuses on all the key technologies needed for FutureGen, such as carbon sequestration, membrane technologies for oxygen and hydrogen separation, advanced turbines, fuel cells, coal-to-hydrogen conversion gasifier-related technologies, and other technologies. Some CCPI activities complement FutureGen and will help drive down the costs of Integrated Gasification Combined Cycle (IGCC) systems and other technologies for near-zero atmospheric emission plants.

The fuels and power systems program provides important research for FutureGen to reduce dramatically coal power plant emissions (especially mercury) and significantly improve efficiency to reduce carbon emissions, leading to a viable near-zero atmospheric emissions coal energy system.

[12] See *http://www.netl.doe.gov/publications/factsheets/program/Prog052.pdf.*

The Innovations for Existing Plants program has a near- to mid-term focus on improving overall power plant efficiency and developing advanced cost-effective environmental control technologies, with a focus on mercury, for retrofitting existing power plants and other coal technologies, including those developed in support of the FutureGen project.

The IGCC program will continue to develop technologies for gas stream purification to meet quality requirements for use with fuel cells and conversion processes, impurity tolerant hydrogen separation technology; to enhance process efficiency; and to reduce costs and energy requirements for producing oxygen using advanced technologies such as membranes.

The advanced turbines program is focused on creating the technology base for turbines that will permit the design of near-zero atmospheric emission IGCC plants and a class of FutureGen plants with carbon capture and sequestration. Program research focuses on developing enabling technology for high-efficiency hydrogen and syngas turbines for advanced gasification systems that will permit the design of near-zero atmospheric emission FutureGen plants with carbon capture and sequestration.

The carbon sequestration program is developing a portfolio of technologies that reduce greenhouse gas emissions. The program focuses primarily on developing capture and separation technologies that dramatically lower the costs and energy requirements for reducing carbon dioxide emissions from fossil-based (especially coal) energy plants. The program goal is to research and develop a portfolio of safe and cost-effective greenhouse gas capture, storage and mitigation technologies by 2012, leading to substantial market penetration beyond 2012.

The mission of the fuels program is to conduct the research necessary to promote the transition to a hydrogen economy. Research targets cost reduction and increased efficiency of hydrogen production from coal feed stocks as part of the Hydrogen Fuel Initiative and in support of the FutureGen project.

Advanced research projects seek a greater understanding of the physical, chemical, biological and thermodynamic barriers that limit the use of coal and other fossil fuels. The program funds two categories of activity. The first includes applied research programs to develop the technology base needed for the development of super-clean, very-high efficiency coal-based power and coal-based fuel systems. The second is a set of crosscutting studies and assessment activities in environmental, technical, and economic analyses, coal technology export, and integrated program support.

The objectives of the fuel cells activity are to provide the technology-based development of low-cost, scalable and fuel flexible fuel cell systems that can operate in central coal-based power systems, as well as to have applications in other electric utility (both central and distributed), industrial and commercial/residential markets.

The major program components supported since 1976 include:

- gasification combined cycle
- pressurized fluid bed
- fuel cells
- carbon capture and sequestration
- transportation fuels and chemicals
- control technology and coal preparation
- advanced research and technology development
- coal liquefaction
- combustion systems
- heat engines
- magnetohydrodynamics
- surface coal gasification
- underground coal gasification
- mining R&D
- advanced environmental control technology
- FutureGen
- Clean Coal Power Initiative
- program direction and management support
- miscellaneous coal R&D
- coal research at EPA
- coal research at the BOM.

C. Federal Coal R&D Expenditures

As discussed, coal research programs supported by the federal government between 1950 and 1975 were conducted within the BOM and, since the early 1970s, also within EPA. These expenditures are shown in Exhibit 20, which illustrates that, over the 26-year period, the federal government invested $5.2 billion in coal R&D programs. Coal R&D was relatively constant in real terms during the 1950s, increased gradually between 1960 and 1968, and then increased more than eightfold between 1969 and 1975.

Exhibit 20 – Summary of Federal R&D Expenditures for Coal, 1950–1975
(Millions of 2006 dollars)

Year	Expenditures	Year	Expenditures
1950	86	1963	103
1951	81	1964	107
1952	81	1965	98
1953	80	1966	109
1954	63	1967	128
1955	52	1968	155
1956	57	1969	141
1957	62	1970	167
1958	74	1971	279
1959	72	1972	404
1960	86	1973	604
1961	101	1974	838
1962	100	1975	1,143

Exhibits 21 through 25 show the detailed federal coal R&D programs undertaken at ERDA, DOE, EPA and the BOM between 1976 and 2006. Over this period, coal R&D expenditures totaled more than $26 billion, as summarized in Exhibit 26. They increased rapidly from 1976 through 1980, reaching an all-time high of $2.3 billion in 1980, as shown in Exhibit 27. Expenditures decreased slightly to $2.1 billion in 1981, and then decreased drastically, falling by nearly three-quarters to $590 million by 1984. Thereafter, coal R&D expenditures remained relatively constant until 1990 and then decreased gradually thereafter, declining to $274 million in 1997—at which time they were, in real terms, only 12 percent of their 1980 total. However, by 2001, coal R&D funding had increased to $838 million — the highest level in two decades. In 2006, coal R&D expenditures totaled $538 million.

Exhibit 21 – Federal R&D Expenditures for Coal, by Major Program, 1976–1988
(Millions of constant 2006 dollars)

	FY76	76tq	FY 77	FY78	FY79	FY80	FY81	FY82	FY83	FY84	FY85	FY86	FY87	FY88
U.S. DOE	1,010	260	1,354	1,562	1,739	1,788	1,657	929	442	376	401	389	322	350
Control Technology & Coal Preparation	--	--	--	--	--	--	--	48	52	47	62	55	62	70
Advanced Research & Technology Development	108	27	127	135	115	139	104	109	68	70	70	56	52	40
Coal Liquefaction	301	79	321	300	514	490	690	445	71	52	45	55	40	43
Combustion Systems	142	43	161	183	147	171	127	80	45	33	52	48	24	40
Heat Engines	--	--	--	--	145	144	94	29	10	12	21	21	20	29
Magnetohydrodynamics	104	27	116	194	149	185	167	55	55	55	53	47	45	56
Surface Coal Gasification	239	48	413	569	399	389	226	104	72	68	56	69	41	36
Underground Coal Gasification	--	--	--	--	37	23	21	15	11	11	13	8	3	4
Mining Research & Development	--	--	149	167	190	154	89	22	--	--	--	--	--	--
Advanced Environmental Control Tech	--	--	--	--	17	55	104	--	--	--	--	--	--	--
Program Direction & Management Support	--	--	--	--	25	27	25	23	59	29	29	33	34	32
Miscellaneous	117	36	67	13	--	11	11	--	--	--	--	--	--	--
U.S. EPA	217	70	347	322	332	354	351	168	97	113	145	141	143	139
Bureau of Mines	205	48	237	254	194	154	120	92	72	100	76	65	77	75
Total Coal Energy R&D	1,432	377	1,937	2,138	2,264	2,296	2,128	1,189	611	590	623	596	542	564

Exhibit 22 – Federal R&D Expenditures for Coal, by Major Program, 1989–1997
(Millions of constant 2006 dollars)

	FY89	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	Total 76-97
U.S. DOE	365	377	377	339	280	247	205	228	146	15,144
Control Tech & Coal Preparation	75	85	79	69	57	59	52	43	36	950
Advanced Research & Tech Devel.	40	37	44	41	36	37	31	25	21	1,530
Coal Liquefaction	48	51	60	53	49	33	33	19	12	3,802
Combustion Systems	41	48	52	52	49	59	53	53	38	1,743
Heat Engines	35	31	34	24	4	--	--	--	--	652
Magnetohydrodynamics	57	58	56	55	40	7	--	--	--	1,578
Surface Coal Gasification	34	34	21	14	14	21	13	10	9	2,898
Underground Coal Gasification	1	1	1	--	--	--	--	--	--	149
Mining Research & Development	--	--	--	--	--	--	--	55	7	832
Advanced Env Control Tech	--	--	--	--	--	--	--	--	--	176
Program Direction & Mgt. Support	34	33	32	31	31	32	23	24	24	578
Miscellaneous	--	--	--	--	--	--	--	--	--	254
U.S. EPA	131	120	113	128	127	119	105	157	128	4,065
Bureau of Mines	81	79	81	79	77	81	75	4	--	2,327
Total Coal Energy R&D	577	576	572	545	484	446	385	389	274	21,537

Exhibit 23 – Federal Coal R&D, 1998–2000

(Millions of constant 2006 dollars)

	FY98	FY99	FY00	Total 98–00
U.S. DOE	216	246	242	704
Advanced Electric Power Systems	83	104	91	278
Advanced Pulverized Coal Technology	20	17	2	39
Indirectly Fired Cycle	5	9	8	22
Gasification Combined Cycle	26	38	40	104
Pressurized Fluid Bed	22	17	14	53
Advanced Research and Environmental	15	23	27	65
Advanced Clean Fuel Research	18	19	22	59
Coal Preparation	5	5	4	14
Coal Liquefaction	8	11	8	27
Steelmaking Feedstock	4	---	8	8
Advanced Research and Environmental	1	2	2	5
Advanced Research and Tech Development	22	24	26	72
Fuel Cells	48	52	52	152
Miscellaneous R&D	8	8	7	23
Program Direction and Management Support	37	39	44	120
U.S. EPA Coal R&D	134	138	117	389
Total Federal Coal R&D	350	384	359	1,093

Exhibit 24 – Federal Coal R&D, 2001–2003

(Millions of constant 2006 dollars)

	FY01	FY02	FY03	Total 01–03
U.S. DOE	444	526	526	1,496
Clean Coal Power Initiative	---	162	159	321
Central Systems	226	104	101	431
Innovations for Existing Plants	23	25	24	72
Advanced Systems				
Integrated Gasification Combined Cycle	47	47	47	141
Pressurized Fluidized Bed	13	12	11	36
Turbines	35	20	19	74
Power Plant Improvement Initiative	108	---	---	108
Sequestration	22	35	43	100
Fuels	26	37	33	96
Transportation Fuels and Chemicals	9	28	23	60
Solid Fuels and Feed stocks	4	5	7	16
Advanced Fuels Research	5	4	3	12
Steelmaking	8	---	---	8
Advanced Research	33	34	35	102
Coal Utilization Science	7	7	10	24
Materials	8	8	10	26
Technology Crosscut	14	12	12	38
Other Advanced Research	4	7	3	14
Fuel Cells	60	63	64	187
Miscellaneous R&D	11	16	16	43
Program Direction and Management Support	66	75	76	217
U.S. EPA Coal R&D	111	110	100	321
Total Federal Coal R&D	555	636	626	1,817

Exhibit 25 – Federal Coal R&D, 2004–2006
(Millions of constant 2006 dollars)

	FY04	FY05	FY06	Total 04–06
U.S. DOE	578	436	451	1,465
Clean Coal Power Initiative	181	49	50	280
Central Systems	96	81	99	276
Sequestration	43	45	67	155
Fuels	33	32	29	94
Advanced Research	40	43	38	121
Fuel Cells	73	77	62	212
Program Direction and Management Support	112	109	106	327
U.S. EPA Coal R&D	99	90	87	276
Total Federal Coal R&D	677	526	538	1,741

Exhibit 26 – Federal Coal R&D, 1976–2006
(Millions of constant 2006 dollars)

	76–97	98–00	01–03	04–06	Total
U.S. DOE	15,144	704	1,496	1,465	18,809
U.S. EPA Coal R&D	4,065	389	321	276	5,051
BOM	2,327				2,327
Total Federal Coal R&D	21,536	1,093	1,817	1,741	26,187

Note: The BOM ceased operations in 1996.

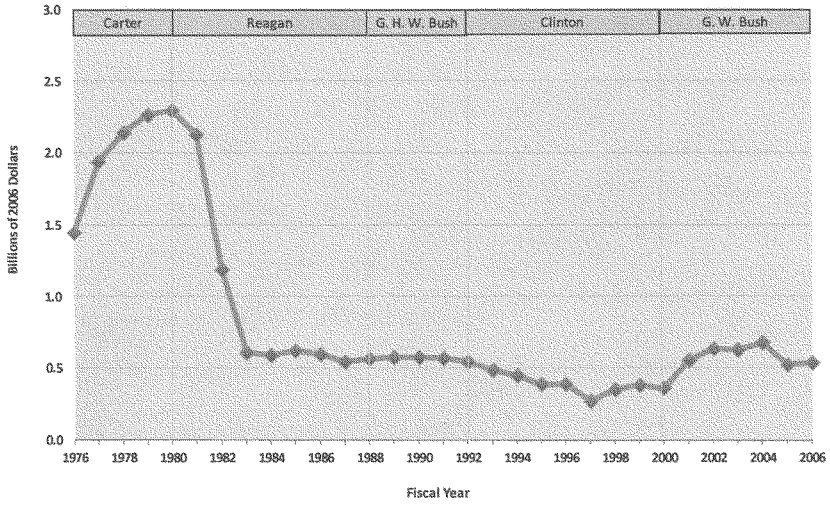
D. Major Findings

Focusing on the period 1976–2006, the authors find that:

- The largest share of R&D funds was allocated to environment-related coal research programs at EPA, which expended $5.1 billion, 20 percent of the total. When combined with the environmental research programs within DOE, environmental research accounted for about 25 percent of the R&D budget.
- Coal liquefaction received the second largest share of the coal R&D budget—15 percent ($3.8 billion).
- R&D expenditures for surface coal gasification totaled $3 billion—11 percent of the total.
- The research program at the BOM, which consisted of a variety of coal-related research programs, expended $2.3 billion over this period—9 percent of the total.

- Research spending on combustion systems totaled $2.5 billion (10 percent of the total), and spending on magnetohydrodynamics totaled $1.5 billion (6 percent of the total).
- In constant dollars, federal funding of coal R&D bottomed out in 1997 at $274 million; by 2006 coal R&D had increased to $538 million, almost double the 1997 level (see Exhibit 27 below).

Exhibit 27 – Federal Coal R&D Timeline, 1976–2006



Appendix 8 - Renewables R&D Expenditures

A. Background

Renewable energy sources generally include solar energy (including solar heating, photovoltaics, passive systems, wind, solar thermal systems, etc.), hydroelectric power, geothermal power, alcohol fuels, and nuclear fusion. Renewables supply about 6 percent of the nation's energy, mostly in the form of hydroelectricity, geothermal energy and biomass in the wood products industry.

Of the $130.8 billion in federal energy incentives for hydroelectric power, geothermal energy and renewables, $23.7 billion were in the form of R&D expenditures, $19.1 billion of which were expended on solar and renewable energy[13]. Therefore, when discussing R&D funding in this study, renewable energy is defined narrowly to include solar energy, wind and alcohol fuels, but to exclude hydroelectric power, geothermal energy and nuclear fusion.

The history of renewable energy in the United States has been decidedly cyclical, characterized by periods of intense interest and activity and optimistic forecasts, followed by periods of slackened interest and pessimism. Between 1900 and the late 1920s, thriving solar water heating industries developed in Florida and California, only to be displaced by inexpensive natural gas and oil during the 1930s.

During the late 1940s and early 1950s, the federal government paid increased attention to renewable energy, reflecting general concerns of impending resource scarcities. This interest reached its height in the Paley Commission report issued in 1953, which questioned the future adequacy of U.S. energy resources and recommended increased R&D support for energy—including solar and renewable energy. Among other things, the Paley report predicted that by 1975, 13 million solar water heating systems would be installed throughout the United States, providing 10 percent of the nation's total energy requirements[14].

This concern over U.S. energy policy quickly evaporated during the 1950s and the next serious evidence of federal interest was the Cambel report on U.S. energy resources, technology, policy and research. This encyclopedic White House study advocated a vastly increased U.S. energy R&D effort in almost all areas, including solar and renewable technologies[15]. With the other concerns of the 1960s, however, this report also generated little interest and the nation's attention to energy problems remained unfocused for another decade.

Amid the energy concerns of the early 1970s, renewable energy was "rediscovered" during 1973–1974. Very shortly after, technologies that had been virtually ignored and programs that were practically nonexistent were being advanced as solutions to the nation's energy problems. In his April 1977 energy message, President Carter made renewables a cornerstone of the nation's energy strategy. This time, however, resources followed rhetoric, and the renewable energy budget continued to increase rapidly throughout the decade.

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[13] See Table 1 in Section IV of this report.

[14] The Paley Report is given in the U.S. National Security Resources Board, "The Objectives of the United States Material Resources Policy and Suggested Steps in Their Accomplishments," Washington, D.C., 1952.

[15] See Ali Cambel, "Energy R&D and National Progress," Washington, D.C., 1966.

By the early 1980s, the combination of a new administration, the collapse of oil prices and the power of OPEC, and new national priorities de-emphasized the role of renewables, as indicated by the rapid decline in R&D funding. By the early years of the 21st century, the situation again had changed, and increased concerns about U.S. dependence on imported oil, global warming and related environmental issues increased federal officials' attention to renewable energy.

B. The Renewable Energy Research Program

The federal government supports R&D of promising renewable energy technologies that will increase the environmentally compatible production of domestic energy resources. DOE works with industry to strengthen the technology base leading to new products and processes for the commercial market. Renewable energy R&D activities range from basic research in universities and national laboratories to applied R&D and proof-of-concept projects with industrial firms. The aim of the program is to strengthen the nation's energy security, promote energy efficiency, and increase industrial competitiveness and federal technology transfer, and it supports R&D efforts in energy efficiency and renewable technologies in utility, building, transportation and industry sectors. Renewable energy technologies currently under development will increase the contribution that renewables make to the nation's energy needs by reducing the technologies' costs and improving their performance.

Most renewable energy research is being conducted by DOE, but a small research program in photovoltaics is being carried out at NASA, and substantial research in biomass and alcohol fuels is underway in USDA. The major program components supported since 1976 include:

- solar buildings technology research
- photovoltaic energy systems
- solar thermal energy systems
- biomass and biofuels energy systems
- wind energy systems
- ocean energy systems
- hydrogen
- international solar energy program
- solar technology transfer
- program support
- resource assessment
- program direction
- electric energy systems
- energy storage systems
- renewables R&D within the conservation program
- renewable energy research at the USDA (primarily on biomass and alcohol fuels) and at NASA (primarily on photovoltaics).

C. Renewable Energy R&D Expenditures

The authors estimate that, through 1975, the federal government's R&D expenditures for solar and renewable energy (excluding hydroelectric power and geothermal energy) totaled approximately $1.7 billion (2006 dollars). The institutional breakdown of these expenditures was as follows:

- NASA, and its predecessors, the National Advisory Council on Aeronautics and the military space programs—$650 million
- National Science Foundation—$480 million

- AEC—$140 million
- USDA—$240 million
- All other federal agencies—$240 million

These estimates were derived from federal government budget data over the period and from conversations with federal program managers and analysts who have studied the issue. The estimates are conservative, and other researchers have estimated that considerably more funds were devoted to renewable energy R&D prior to 1975. For example, Wilson Clark estimated that, in 1974 alone, the federal government spent $183 million ($641 million in 2006 dollars) on renewable energy (excluding hydroelectric power and geothermal energy).[16]

Clark's data indicate that the authors' estimates could be low by a factor of two or three. His work is notable because he is a strong advocate for solar and renewable energy and a severe critic of reliance on fossil fuels and nuclear energy. He used the estimate of federal renewable energy R&D spending of $183 million in 1974 as an example of how little the government was spending in relation to the funding priority he felt renewables should be receiving.[17] Thus, if anything, the authors' estimates may tend to be conservative; that is, they may be underestimating pre-1975 federal R&D expenditures on renewable energy.

Exhibit 28 summarizes expenditures for renewable energy research from 1976 to 2006.

Exhibit 28 – Federal Renewables R&D, 1976–2006

(Millions of constant 2006 dollars)

	76-97	98-03	04-06	Total
U.S. DOE	12,851	2,208	1,246	16,253
U.S.D.A.	563	157	123	844
NASA	190	32	20	240
Total	13,604	2,397	1,389	17,337

Exhibits 29 through 31 show the program details for the renewable energy program from 1976 to 2006. As noted previously, total federal R&D expenditures on renewables through 1975 were approximately $1.7 billion. Most of this R&D was conducted by NSF, AEC, NASA and USDA. Through 2006, total federal R&D funding for renewables was about $19.1 billion, with 90 percent of the funding occurring after 1975.

The renewable energy R&D program grew very rapidly during the 1970s, from about $45 million per year in 1972 to nearly $1.7 billion annually by 1981. Program funding peaked in 1981 and then

[16] Wilson Clark, "Energy for Survival: The Alternative to Extinction," Garden City, New York: Anchor Books, 1976, p. 353.
[17] See the discussion in Ibid., pp. 352-354.

declined rapidly and substantially. Funding in 1982 ($712 million) was less than half that of the previous year, and by 1990 it reached a low point of $226 million—in real terms less than half of what it had been in 1976. Since 1990, funding for the program has more than doubled, reaching $459 million in 2006.

Exhibit 29 – Federal R&D Expenditures for Renewable Energy, by Major Program, 1976–1997

(Millions of constant 2006 dollars)

	FY76	FY76	FY77	FY78	FY79	FY80	FY81	FY82	FY83	FY84	FY85	FY86
Solar Energy	356	108	678	816	1,282	1,334	1,340	526	378	325	312	245
Solar Buildings Technology Research	111	33	79	81	225	197	143	45	23	29	17	13
Photovoltaic Energy Systems	68	22	170	205	299	336	292	145	108	89	100	69
Solar Thermal Energy Systems	86	22	260	262	291	326	247	104	93	79	60	44
Biofuels Energy Systems	15	7	29	57	105	128	132	60	38	51	53	46
Wind Energy Systems	44	15	60	94	149	144	167	67	58	48	51	43
Ocean Energy Systems	19	7	40	94	103	105	81	37	21	11	8	9
International Solar Energy Program	--	--	--	--	--	--	32	8	19	1	1	4
Solar Technology Transfer	7	3	40	24	35	55	86	20	7	4	11	4
National Renewable Energy Lab.	--	--	--	--	--	15	21	--	--	--	--	3
Program Support	--	--	--	--	--	10	14	--	2	1	1	1
Resource Assessment	--	--	--	--	--	--	--	--	--	--	--	1
Program Direction – Other Solar Energy	7	--	--	--	75	19	127	41	11	11	9	9
Electric Energy Systems	27	12	40	79	80	85	83	41	32	34	36	21
Energy Storage Systems	49	19	93	159	161	152	152	74	48	47	33	29
Solar/Renewables R&D in Conservation	10	3	21	24	35	41	48	20	19	20	21	21
DOE Solar/ Renewables Tech. Base	442	142	832	1,078	1,558	1,612	1,623	661	477	425	401	316
USDA Solar/ Renewables R&D	15	7	26	31	31	32	40	41	43	36	33	24
NASA Solar/ Renewables R&D	15	3	14	13	12	11	11	10	10	9	9	9
Total Federal Solar/Renewables R&D	472	152	873	1,121	1,600	1,655	1,674	712	529	470	443	349

Continued

Exhibit 29 – Federal R&D Expenditures for Renewable Energy, by Major Program, 1976–1997

(Millions of constant 2006 dollars)

	FY87	FY88	FY89	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	Total
Solar Energy	205	153	140	131	178	239	249	326	326	249	227	10,122
Solar Buildings Technology Research	10	9	8	1	2	2	3	7	4	2	2	1,046
Photovoltaic Energy Systems	67	56	56	52	65	81	87	103	107	75	71	2,722
Solar Thermal Energy Systems	37	26	23	22	26	40	36	44	37	29	26	2,219
Biofuels Energy Systems	40	26	20	23	46	53	64	76	65	65	65	1,266
Wind Energy Systems	27	14	13	13	15	29	32	38	57	38	35	1,251
Ocean Energy Systems	9	7	7	7	3	2	1	1	0	0	0	568
International Solar Energy Program	1	1	1	1	1	2	2	7	11	4	1	97
Solar Technology Transfer	4	4	3	2	2	1	2	26	17	13	0	372
National Renewable Energy Laboratory	1	1	1	1	8	17	10	8	8	1	3	98
Program Support	1	1	1	1	1	1	1	7	0	0	0	44
Resource Assessment	1	1	1	1	1	1	1	2	4	2	0	17
Program Direction –Other Solar Energy	7	7	7	7	7	8	9	9	15	17	23	421
Electric Energy Systems	19	24	36	26	38	43	43	64	46	40	33	981
Energy Storage Systems	27	24	20	17	19	10	13	8	7	2	4	1,166
Solar/Renewables R&D in Conservation	20	17	17	23	24	29	34	37	38	32	29	582
DOE Solar/ Renewables Energy Tech.	270	218	213	197	259	321	338	435	417	323	293	12,851
Dept. of Agriculture Solar/ Renewables R&D	22	21	22	21	20	22	15	17	17	14	14	563
NASA Solar/ Renewables R&D	9	9	8	8	8	8	3	3	3	3	3	190
Total Federal Solar/Renewables R&D	301	248	242	226	286	350	357	456	437	340	311	13,603

Exhibit 30 – Federal Renewable Energy R&D, 1998–2003
(Millions of constant 2006 dollars)

	FY98	FY99	FY00	FY01	FY02	FY03	Total 98–03
Solar Energy							
Solar Buildings Technology Research	3.3	4.4	2.2	4.4	3.3	4.4	22.0
Photovoltaic Energy Systems	77.4	84.0	75.3	85.1	78.5	79.6	479.9
Solar Thermal Energy Systems	20.1	19.6	17.5	16.4	14.2	5.5	93.3
Zero Energy Buildings	--	--	--	--	1.1	8.7	9.8
Biopower/Biofuels Energy Systems	70.9	85.1	79.6	97.1	98.2	93.8	524.7
Wind Energy Systems	39.3	40.4	37.1	45.8	42.5	45.8	250.9
International Renewable Energy Program	1.1	7.6	5.5	5.5	3.3	3.3	26.3
National Renewable Energy Laboratory	1.1	4.4	1.1	4.4	0.0	0.0	11.0
Program Support	--	--	5.5	4.4	1.1	1.1	12.1
Program Direction	13.1	16.4	16.4	17.5	17.5	9.8	90.7
Hydrogen R&D	19.6	26.2	27.3	30.5	32.7	41.4	177.7
Electric Energy Systems and Storage	51.3	48.0	42.5	58.9	76.4	78.5	355.6
Renewables R&D in DOE Conservation	10.9	12.0	32.7	27.3	40.4	30.5	153.8
USDA Renewables R&D	10.9	10.9	15.3	19.6	33.8	66.5	157.0
NASA Solar	4.4	4.4	5.5	5.5	5.5	6.5	31.8
Total Federal Solar/Renewables R&D	323.4	363.4	363.5	422.4	448.5	475.4	2396.6

Exhibit 31 – Federal Renewable Energy R&D, 2004–2006
(Millions of constant 2006 dollars)

	FY04	FY05	FY06	Total 04-06
Solar Energy				
Solar Buildings Technology Research	8	6	7	21
Photovoltaic Energy Systems	77	78	75	230
Solar Thermal Energy Systems	3	3	3	9
Biopower/Biofuels Energy Systems	98	91	73	262
Wind Energy Systems	42	42	44	128
International Renewable Energy Program	6	6	3	15
Program Support	7	6	2	15
Program Direction	18	20	19	57
Hydrogen	85	97	99	281
Fuel Cells	67	77	84	228
USDA Renewables R&D	43	37	43	123
NASA Solar R&D	6	7	7	20
Total Federal Solar/Renewables R&D	460	470	459	1,389

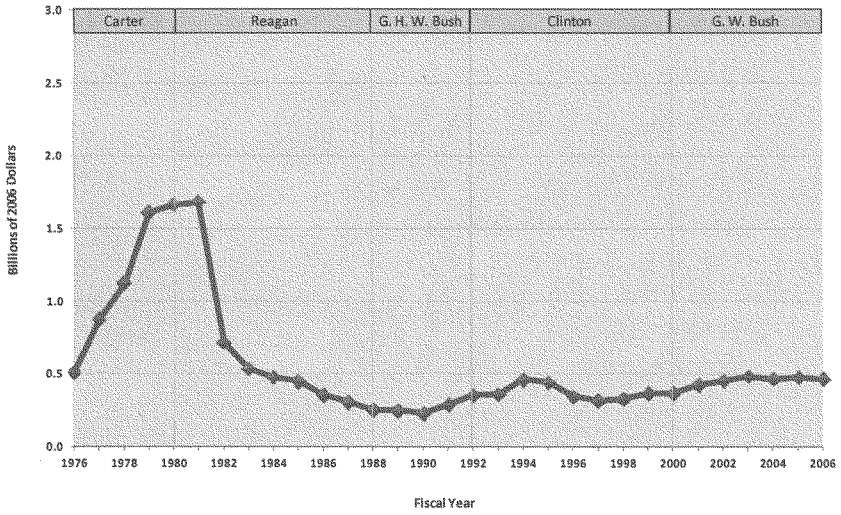
D. Major Findings

The authors find:

- The photovoltaics program received the largest share of renewable energy R&D funds between 1976 and 2006—$3.4 billion (20 percent of the total).
- Since 1950, photovoltaics have received 23 percent of all renewable energy R&D expenditures—approximately $3.9 billion.

- The program receiving the second largest share of research support between 1976 and 2006 was the biomass/biofuels program in DOE and USDA—$2.9 billion (17 percent of the total).
- The third largest share of R&D funds expended since 1976 was spent on the solar thermal systems program, which received $2.4 billion (14 percent of the total).
- Between 1976 and 2006, wind energy R&D programs received $1.6 billion—about 9 percent of total renewables R&D funding over this period. The trend in federal spending on renewables R&D is shown in Exhibit 32.
- Over the past decade, the funding priorities for solar buildings technology and ocean energy systems have been greatly reduced, while the research priorities for biofuel/biomass energy systems and hydrogen R&D have increased.

Exhibit 32– Federal Renewables R&D Timeline, 1976–2006



EMILY FIGDOR, RESPONSES TO QUESTIONS FROM HON. EDWARD J. MARKEY

1. What magnitude of emissions reductions do you believe are achievable by 2020 and 2025?

The latest science must dictate the emissions reductions that the United States achieves by 2020 and 2025. According to the Intergovernmental Panel on Climate Change, to prevent temperatures from rising by more than 2 degrees Celsius, industrialized countries as a whole must reduce emissions by at least 25–40 percent below 1990 levels by 2020. The United States must contribute its share of this target by achieving significant domestic reductions as well as by providing funding to reduce international deforestation and to transfer clean technology to developing countries.

The United States has many tools that it can apply to the task of reducing domestic emissions, including a history of technological innovation and a growing body of policy experience being developed in the states. Indeed, the United States already has the technology needed to achieve these near-term emissions reduction targets. For example, a 2006 Environment America report found that the United States could reduce its global warming emissions by 19 percent below 2004 levels by 2020 by achieving five simple and technologically feasible targets for energy efficiency and renewable energy development (along with keeping emissions of non-carbon dioxide global warming pollutants constant). More recently, a December 2007 report by McKinsey & Company found that the United States could reduce its annual emissions by as much as 28 percent below 2005 levels by 2030 by relying solely on tested approaches and high-potential emerging technologies.

2. How significant might the role of energy efficiency and renewable energy be in achieving these reductions?

Energy efficiency and renewable energy are absolutely essential to ensuring that global warming emissions reductions are achieved at the least possible cost and with the greatest long-term benefits.

3. What policies would be needed to ensure the deployment of energy efficiency and renewable energy required to achieve significant emissions reductions by 2020 and 2025?

The key energy efficiency and renewable energy policies needed include the following:

- A renewable electricity standard that will ensure that America gets at least 25 percent of its electricity from renewable sources by 2020.
- An energy efficiency resource standard for electric and gas utilities that requires that energy efficiency improvements play an important role in meeting future energy needs.
- Strong energy efficiency standards for vehicles and appliances.
- Strong building energy codes designed to improve the efficiency of homes and businesses. The Federal Government also should encourage the construction of green buildings and zero-energy buildings that go "beyond code" and should adopt measures to encourage or require the use of small-scale renewable energy technologies like solar water heaters, geothermal heat pumps, or solar panels on new residential and commercial buildings.
- Transportation and land-use policies that provide Americans with viable alternatives to driving by encouraging the development of compact, walkable neighborhoods where automobile use is an option, not a requirement, and increase investment in modern public transportation.
- Policies to reduce global warming pollution and promote sustainable practices in other parts of the economy, including policies to encourage recycling, efficient use of water, sustainable agriculture, and more energy efficient industrial practices.

4. Is it possible to make significant near-term emissions reductions without significant fuel-switching to natural gas in the electric power sector?

Yes, if the United States couples aggressive investment in energy efficiency with policies that encourage the retirement of older, highly-polluting power plants and the addition of new renewable energy capacity.

5. Is it possible to make significant near-term emissions reductions in the absence of proven carbon capture and sequestration technology in the electric power sector?

Yes, the United States already has the technology needed to achieve the near-term emissions reductions demanded by the science using energy efficiency and renewable energy alone.

6. Do you believe we should wait to set mandatory emissions reduction targets in the U.S. until carbon capture and sequestration technology is proven in the electric power sector?

No, waiting to reduce U.S. emissions until carbon capture and sequestration technology is proven in the electric power sector almost surely would foreclose our opportunity to stave off catastrophic effects of global warming. According to the IPCC, to keep the rise in global temperatures from exceeding 2 degrees Celsius, global emissions must peak no later than 2015. The United States has sat on the sidelines for far too long already and must begin to achieve real and sustained cuts in emissions immediately.

7. How would the total cost of implementing a climate regime in the U.S. change if we did wait to implement mandatory emission reduction targets until carbon capture and sequestration technology is proven in the electric power sector?

Given that carbon dioxide is a persistent gas that can remain in the atmosphere for more than 100 years, the longer we allow the pollutant to build up in the atmosphere, the deeper the pollution cuts ultimately will need to be to stabilize greenhouse gas concentrations at a level that avoids dangerous consequences and the higher the overall cost of the program. If action to reduce emissions is delayed by 20 years—the potential time it could take until carbon capture and sequestration technology is proven in the electric power sector—the United States would need to reduce emissions at an annual rate that is three to nine times greater than would be required for immediate action to meet the same temperature target.

8. Can the aggressive emissions reduction targets recommended in your testimony be met without the construction of new nuclear power plants?

Yes, given an aggressive push to improve energy efficiency and expand the production of renewable energy, the United States could reduce its total domestic emissions by 80 percent by 2050.

9. How should a carbon cap-and-trade program deal with the nuclear power sector?

The cap-and-trade program should auction 100 percent of pollution allowances and preclude any special "set-asides" of emission allowances for non-emitting technologies, such as nuclear power.

10. Beyond making the nuclear power sector inherently more competitive by putting a price on carbon, should a climate regime more directly support nuclear energy deployment? Why or why not?

No, nuclear power is extraordinarily expensive and would take a decade or more to deploy. By contrast, many energy efficiency investments pay economic dividends and can be deployed in significant numbers in the near future. Renewable energy technologies, such as wind and solar power, have come down in cost significantly in recent years, are already cost-competitive with nuclear power in many circumstances, and can be successfully deployed on a time-scale of months to a few years. Lavishing even more federal subsidies on a nuclear industry that has already consumed tens of billions of taxpayer dollars would reduce the amount of funding available for truly clean technologies that can make a difference in the short-term.

11. In his written testimony, Admiral Frank Bowman from the Nuclear Energy Institute made the following statement: "If it [the loan program] is structured like the loan guarantee program authorized by Title XVII of the 2005 Energy Policy Act, in which project sponsors are expected to pay the cost of the loan guarantee, such a program would be revenue neutral and would not represent a subsidy." Do you agree with this assessment?

No. First, the industry would be receiving a loan that private investors have been unwilling to provide. Nuclear industry executives have flatly stated that they will not proceed with the construction of new reactors without government backed loans. Second, the Congressional Budget Office has estimated that there will be a 50 percent default rate on the loans, which will leave taxpayers on the hook for billions in failed nuclear loans.

12. How would you characterize the support the loan guarantee program provides to the nuclear industry?

It is an unwarranted subsidy to the nuclear industry.

13. Nuclear proponents claim that the environmental dangers of nuclear power are overstated and that spent fuel is purely a political issue, not a technical one. Do you agree with this assessment?

No, there is no country on earth which has solved the nuclear waste problem—that is, how to isolate it from humans and other living things for at least a quarter of a million years.

14. Assuming the Federal Government establishes an economy-wide cap-and-trade system, do you believe the Federal Government must assume

long-term liability for closed carbon capture and sequestration sites to ensure we meet our emissions reduction targets?

While long-term monitoring of such sites will be critical to ensuring that we meet our emission reduction targets, the cost must be paid for by the operators of the sites, not taxpayers.

15. The iCAP bill (H.R. 6186) includes a detailed proposal for a greenhouse gas registry to be created under the Clean Air Act. Do you agree that a greenhouse gas registry should be created under the Clean Air Act, and do you support the proposal in this bill?

Yes, a greenhouse gas registry should be created under the Clean Air Act, and Environment America supports the greenhouse registry in the iCAP bill.

16. Do you believe the costs of a cap-and-trade system can be adequately contained through strategies that would not compromise science-based near-term and long-term emissions reduction targets? Please provide examples of the cost containment strategies that would meet this criteria.

Yes, to reduce the cost of a cap-and-trade system to the American economy, while preserving the environmental integrity of the program, the United States should achieve the three objectives detailed below.

1) Improve the energy efficiency of the U.S. economy. Technically feasible, cost-effective improvements in energy efficiency already have the potential to save vast amounts of energy in the United States. Energy efficiency provides several important benefits: it reduces demand for imported fossil fuels, keeping money within the American economy; it creates domestic jobs; and it reduces the cost of achieving reductions in global warming pollution by reducing demand for energy. Moreover, saving electricity through increased efficiency is often less expensive than building new power generation capacity.

There are many policy tools—including efficiency standards for buildings, vehicles and equipment, energy efficiency portfolio standards for electricity providers, and financial incentives for the deployment of energy efficient equipment—that can be used to improve energy efficiency in the United States. Mandatory federal energy efficiency standards are already playing an important role in saving energy, reducing pollution, and saving money. According to the American Council for an Energy-Efficient Economy, energy efficiency standards saved consumers $50 billion on their energy bills between 1990 and 2000, with the benefits of the standards outweighing the costs by a factor of 3-to-1.

Deploying energy efficiency standards and programs as part of an overall climate strategy will enable the nation to achieve greater emission reductions at lower cost.

2) Develop and require the deployment of renewable energy technologies. Policies to develop and promote new clean energy technologies play a key role in achieving emission reductions cost-effectively. Renewable energy technologies are particularly important, as they produce no global warming emissions and are potent domestic job-creators. To achieve the steep reductions in global warming emissions that will be needed in future years, the United States will need to rely on the nation's vast potential for carbon-free energy production. Public policy can play a key role in bringing renewable energy technologies to the point of market readiness via increased federal funding for renewable energy research and development and renewable energy standards for electricity production and vehicle fuels. It is critical that public policies communicate a firm, sustained commitment to renewable energy, thereby providing investors, utilities, and others with confidence to make long-term investments in renewable energy.

3) Align economic incentives with the goals of climate policy. For decades, fossil fuels have received the lion's share of federal energy subsidies. As of 1999, fossil fuels received nearly half of all federal energy subsidies, with renewable energy receiving 18 percent (with most of those subsidies targeted at ethanol production) and conservation programs receiving only 4 percent. In addition, a poorly designed cap-and-trade system in which emission allowances are distributed for free can have perverse economic impacts—providing windfall profits for the owners of polluting facilities at the expense of consumers and minimizing incentives for technological innovation.

By shifting federal subsidies toward clean energy technologies and ensuring that any cap-and-trade system provides the proper incentives for clean energy development, the United States can ensure that taxpayer dollars are not used at cross-purposes with the nation's climate protection goals and minimize the cost of emission reductions to consumers.

17. The iCAP bill (H.R. 6186) includes a proposal to mitigate costs to consumers of climate legislation by recycling the revenue from the auction of allowances back to consumers directly through rebates and tax credits. Do you believe a system such as this would be an effective way to distribute

money to citizens? Do you believe there is any benefit to distributing these funds through a middle man, such as utility companies?

Yes, Environment America supports the iCAP bill's provisions to recycle the revenue from the auction of allowances back to consumers directly through rebates and tax credits. Recycling auction revenue to consumers directly is more efficient and effective than distributing these funds through a middle man, such as utility companies.

18. In your testimony, you mention that "of the five bills [including H.R. 6186], the Safe Climate Act, which was the first of these bills to be introduced in the Congress, has the strongest science-based framework." Please explain.

The Safe Climate Act covers all sources of U.S. global warming emissions, whereas the iCAP bill covers an estimated 87 percent of U.S. emissions. As a result, the iCAP bill's cap-and-trade system and complementary policies aim to reduce total U.S. emissions by an estimated 73–75 percent by 2050. While the bill includes a scientific review mechanism, the science already demands reductions of 80 percent by 2050.

JASON GRUMET, RESPONSES TO QUESTIONS FROM HON. JOHN D. DINGELL

1. In your testimony you spoke about the research and development "valley of death." How would you design a technology program to remedy this problem? Should such a program be designed to benefit multiple technologies? Why or why not?

The National Commission on Energy Policy recommends the creation of a serious and systematic "early deployment" program for low- and zero-carbon technologies. The goal of such a program would be to create effective, accountable, and performance-oriented approaches to accelerate commercialization for promising technologies.

Although current levels of effort in energy research, development, and demonstration certainly need to be increased, the biggest deficits may well be in efforts to bridge the gap, or "valley of death," between technology demonstration and full commercial competitiveness. Such efforts, in which the government's role should be concentrated on options promising substantial public benefit, may include government procurement programs, reverse auctions for subsidies for specified quantities of energy from advanced options, loan guarantees for "first movers" using new technologies at commercial scale, and tax incentives. While this program should be designed to benefit multiple technologies, there will be policy options that are better suited to particular technologies. Not all such interventions will necessarily be expensive for the government; loan guarantees for well chosen options may not be, for example, since for such options the probability of the guarantees being called upon will be small.

2. In your testimony you noted that "over-reliance on offsets could undermine program goals and political support" for climate legislation. What protections do you believe are needed to ensure offsets are real, additional, verifiable, and enforceable? What do you believe should be the maximum level of domestic and international offsets allowed into a national cap-and-trade system?

The Commission believes that a carefully designed offsets provision is a critical catalyst for cost-effective measures not otherwise covered by the trading program. A credible offset program must reflect the differing levels of certainty and verifiability associated with different types of projects. This might be achieved through a tiered system whereby the most easily verified project types could use a streamlined procedure to apply for allowances while projects that are more difficult to verify would require more extensive documentation and review. In addition, a cap and trade program might provide allowances from a set-aside within the overall pool of available allowances to provide incentives to the agriculture and forestry sectors for an important set of greenhouse-gas mitigation options.

Regarding the maximum level of offsets allowed, the Commission is concerned by proposals that rely on offsets as a principal means of near-term cost-containment. Although we have not advocated any set limit, the Commission has noted that proposals that expect to achieve significant (>10 percent) compliance through offsets in the near term will be obligated to create a substantial enforcement bureaucracy or risk an influx of illegitimate credits. Either of these outcomes would badly undermine the viability of a meaningful domestic offset program.

3. In your testimony you noted the needed to protect low-income households from the costs of climate legislation. The iCAP Act (H.R. 6186) includes a proposal to mitigate costs to consumers by recycling revenues from the auction of allowances back to consumers directly through rebates and tax credits. Do you believe a system such as this would be an effective way to distribute money to citizens?

We applaud the general approach taken in H.R. 6186, which is consistent with our view that steps should be taken to protect low-income households from the costs of climate legislation. We think this is a critical issue that needs additional analysis as we move forward with legislation. Building on existing work by the Center for Budget and Policy Priorities, Resources for the Future, and others, Commission staff is beginning an extensive effort to explore how the household costs of different climate policies might be mitigated. We expect to look at a number of issues, including how costs vary across regions and how different rebate or tax mechanisms impact different income groups.

4. In your testimony you advocated the use of "positive inducements" in addition to "negative consequences" to engage our major trading partners and address competitiveness concerns. What "positive inducements" do you suggest? Do you support the creation of an international clean technology fund like the one proposed in the iCAP Act (H.R. 6186) What benefits do you expect would be realized from such a fund?

An international clean technology fund could be an important component of an overall strategy to address emissions in key developing countries. In our 2004 recommendations, the Commission called for a tripling of expenditures to promote and participate in cooperative international efforts to advance energy research, development, demonstration, and deployment. More recently, in our 2007 updated recommendations, we advocated creating "stronger incentives for comparable action on the part of key trading partners by using a share of the public revenues generated by a greenhouse-gas trading program to provide technical and financial resources for the transfer of low-carbon technology." We are still assessing how such a fund might be most effective. However, we believe that if such a program is included in a domestic climate bill, it should have a strategic framework that ensures that investments are made in technologies that can help transform the energy economies of key developing countries. It should also be structured to create incentives for China, India, and other major developing countries to take on their own significant greenhouse gas reduction commitments. Finally, it might be feasible to design a fund to encourage the export of U.S. produced technology to developing countries.

ONE HUNDRED TENTH CONGRESS

U.S. House of Representatives
Committee on Energy and Commerce
Washington, DC 20515–6115

JOHN D. DINGELL, MICHIGAN
CHAIRMAN

September 25, 2008

Mr. Paul Cicio
President
Industrial Energy Consumers of America
1155 15th Street, NW, Suite 500
Washington, DC 20005

Dear Mr. Cicio:

Thank you for appearing before the Subcommittee on Energy and Air Quality at the June 19, 2008, hearing entitled, "Legislative Proposals to Reduce Greenhouse Gas Emissions: An Overview". We appreciate the time and effort you gave as a witness before the subcommittee.

Under the Rules of the Committee on Energy and Commerce, the hearing record remains open to permit Members to submit additional questions to the witnesses. Attached are questions from a subcommittee Member for inclusion in the record. In preparing your answers to these questions, please include the text of the questions along with your response.

To facilitate the printing of the hearing record, your responses to these questions should be received by no later than the close of business on **Thursday, October 9, 2008**. Your written responses should be delivered to 2322-B Rayburn House Office Building and faxed to (202) 225-2899 to the attention of Rachel Bleshman. An electronic version of your response should also be sent by e-mail to Ms. Bleshman at **rachel.bleshman@mail.house.gov**. Please send your response in a single Word formatted document.

Thank you for your prompt attention to this request. If you need additional information or have other questions, please contact Rachel Bleshman with the Committee staff at (202) 225-2927.

Sincerely,

JOHN D. DINGELL
CHAIRMAN

Attachment

cc: The Honorable Joe Barton, Ranking Member
Committee on Energy and Commerce

The Honorable Rick Boucher, Chairman
Subcommittee on Energy and Air Quality

The Honorable Fred Upton, Ranking Member
Subcommittee on Energy and Air Quality

The Honorable Edward J. Markey, Member
Subcommittee on Energy and Air Quality

The Honorable Edward J. Markey

1. Your testimony stated, "High natural gas prices have significantly contributed to the loss of 3.3 million manufacturing jobs (19 percent) since 2000." Please explain how this figure was calculated.

2. Your testimony called for increasing domestic natural gas supplies by encouraging "Presidential and Congressional action to remove outer continental shelf moratoriums and speed up construction of the Alaska Natural Gas Pipeline." The EIA has concluded that if the Outer Continental Shelf was opened for drilling, we would not see a single barrel of oil until 2017 and that the impact on prices before 2030 would be "insignificant." In its mean ANWR oil resource case, production would begin in 2018 and reach peak production a decade later. Additional oil production would reach 780,000 barrels per day in 2027. The opening of ANWR is projected to reduce the price of low-sulfur, light crude oil by $0.75 per barrel in 2025 for the mean oil resource case.

    a. Do you agree with EIA's analysis?

    b. Do you believe allowing this additional exploration and drilling would significantly impact the competitiveness of energy-intensive industries in the United States or relieve consumers currently dealing with high energy bills? Please explain.

    c. How will increasing global demand from India, China, and other rapidly growing economies impact energy markets? Will the additional production from the domestic regions you mention offset the increasing global demand enough to drive oil and gas prices below current levels?

3. Your testimony stated that all climate legislation introduced to date does "not set emission reduction targets with timetables that match the availability of cost effective commercial technology such as carbon capture and sequestration and nuclear capacity for the power sector to reduce their emissions."

    a. To what extent do you think solar PV, solar thermal, wind, geothermal, biomass, cogeneration, and efficiency can contribute to meeting energy needs and emissions reduction targets?

    b. These low- and no-carbon options are already available and we are witnessing declines in their unit costs. Given the uncertainties surrounding the viability of CCS and the economic effectiveness of nuclear power, why should greenhouse gas regulations wait? Taking global warming as a given and the costs of inaction seriously, would it not be reckless to continue allowing emissions to rise while waiting for CCS or nuclear to proven themselves viable and economically effective when alternatives exist today?

Answers to questions posed by the Honorable Edward J. Markey:

1. The comment "High natural gas prices significantly contributed to the loss of 3.3 million jobs (19 percent) since 2000," is not derived from a calculation. The comment is a reflection of comments from our companies who are most often the largest manufacturers in each of the energy intensive industry sectors. All of these sectors, with the exception of cement have reported significant shut down of facilities especially during the time frame of 2000 to 2003. We do not know of a study or resource that has surveyed companies to answer your question numerically.

   These industries are energy and capital intensive (not people intensive) and the vast majority of them built their manufacturing plants based upon the economics of natural gas prices ranging from $2.00 - $3.00 per mm Btu in the 1970s, 1980s and 1990s. So when natural gas prices jumped up to $4.50 per mm Btu in 2000 and continued to rise to $5.90 per mm Btu in 2003, many were no longer competitive and shut down. US manufacturing lost 2.7 million jobs from 2000 to 2003.

   Consistent with the shut down of these plants, imports of energy intensive products that were flat from 2000 to 2003 rose a staggering 78% from 2003 to 2007 to displace that US production.

2. Yes, we disagree with the EIA as it relates to natural gas. We cannot make comment on crude oil and your questions related to ANWR. Our trade associations is primarily focused on natural gas and are not large consumers of crude oil products nor does its price have a significant impact on our competitiveness when compared to natural gas or electricity.

   There are two reasons why we disagree with the EIA on natural gas. One reason stems from the important point that US natural gas is not priced globally like crude oil nor is global demand a factor for natural gas pricing at this point. If we do not increase domestic production, and we become dependent upon global LNG supply, global demand will have a direct impact on our domestic natural gas price. And, we won't like the results.

   Today, natural gas is a North American or regionally priced product and is reflective of US and Canadian demand and supply. This means that if the US increases supply relative to demand, the price will decrease. Because of that, relatively small increases in supply can have a relatively significant and positive impact on the price.

   It is for this reason that we believe increased supply of natural gas relative to demand will decrease prices in the US relative to other countries and directly increase the competitiveness of domestic manufacturers. Secondly, because natural gas fired power generation is setting the marginal price of electricity in a growing portion of the country, if natural gas prices go down, so will the price of electricity. Importantly, any benefit received by manufacturing would also be enjoyed by homeowners and farmers alike.

Secondly, there are many places that are in the OCS moratorium (now removed) that has abundant supplies of natural gas that are within close proximity to existing hydrocarbon production infrastructure. These areas, if permitted to allow exploration could start delivering natural gas in three to five years.

Such areas exist in the areas just north of Lease 181 in the Gulf of Mexico. It is a substantial area that is adjourned to the area referred to as the Destin Dome. Some of this area has already had seismic and is known to have greater than 3 trillion cubic feet of natural gas. We have been informed that this is a natural gas producing area with very little crude oil. Given our natural gas demand growth rate of .26 trillion per year since 2000, the Destin Dome supply could accommodate US growth demand for more than 11 years. We would be happy to bring a map of the Gulf of Mexico to your office that clearly illustrates the significant size of this area and its approximation to existing infrastructure.

Even more importantly, the history in the Gulf of Mexico consistently proves that the more drilling that is allowed to occur, and as the production companies become more familiar with the geologic formations, the more natural gas that they find. Through time, it has been proven time and again that all past estimates of the Gulf of Mexico reserves have been understated.

Increasing demand by China, India and other rapidly growing nations will increase relative demand for all hydrocarbon resources. And, as their demand increases it will exert upward pressure on global prices of hydrocarbons. This is all the more important reason to increase domestic supplies of all hydrocarbons to better insulate the US from supply disruptions. Producing more crude oil means at least we will have access to the physical product albeit, at a globally determined price. This is a national security issue.

3. a.) Make no mistake the US should act right now to reduce its ghg emissions and not wait - but actions should be cost effective and when federal dollars are spent, should extract maximum benefit to the economy and its tax payers. And, while there has been unprecedented funding for renewable energy, we would like to make the case that investing those same dollars in the manufacturing sector could yield greater reductions and create more jobs than that of the renewable energy area. This should be the subject of another hearing, especially given our comments about "waste energy" below.

   For a manufacturing organization to address the question of whether various forms of power can contribute to meeting our ghg reduction goals, cost and reliability of supply must be addressed simultaneously. PV, solar thermal, wind and geothermal should contribute to our national and global reduction efforts but are not reliable to run our factories and are more expensive. Plus, increased use of renewable energy requires power companies to build more back up power generation that will be based on natural gas which puts even more upward pricing pressure on natural gas. The costs of adding transmission and distribution capacity to accommodate renewable energy is enormously expensive. Without doing it carefully, increased supply of renewable energy destabilizes the reliability of the grid.

Woody biomass is a feedstock for our paper industry and we have significant reservations about how much should be used by other industries for power generation. The paper industry is already at a competitive disadvantage to several developing countries that are not limited by woody biomass supply and have lower costs. If we are not careful, we will drive this important industry offshore, which is what has happened in most of Europe.

The real opportunity to significantly reduce ghg emissions that are not being capitalized upon is "waste" energy from the power sector and manufacturing. First and foremost, because energy is a "pass through cost" for the electric power sector, there is no financial reason to reduce it. That is fundamentally wrong. Plus, as you are aware, the Clean Air Act regulations make it difficult if not impossible for them to make changes to their plants because of New Source Review (NSR). Common sense says that because of the number of these power plants and their scale, significant ghg reductions could occur by just making changes to NSR and addressing the "pass thru cost" issue that would dwarf the ghg reductions achievable by the renewable area and at less cost. Improving energy efficiency reduces the need to build new power plants.

Secondly, manufacturing plants have waste heat that can be used to produce steam and power that could be sold to other manufacturers or commercial buildings or sold to electric utilities if regulations were changed and the projects became economic. Manufacturers are willing to utilize and sell its waste energy but between the unwillingness of the electric utilities to buy the power and connect us to the grid at a reasonable price – and existing regulations - it is almost impossible nowadays to do such projects. The manufacturing community cannot utilize this waste energy without the help of Congress. In this case, these forms of distributive energy would increase the reliability of the grid.