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CLIMATE CHANGE—GREENHOUSE GAS REDUCTIONS AND TRADING SYSTEM

HEARING

BEFORE THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

ONE HUNDRED EIGHTH CONGRESS

FIRST SESSION

JANUARY 8, 2003

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SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED EIGHTH CONGRESS

FIRST SESSION

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CLIMATE CHANGE—GREENHOUSE GAS REDUCTIONS AND TRADING SYSTEM

WEDNESDAY, JANUARY 8, 2003

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The Committee met, pursuant to notice, at 2:30 p.m. in room SR–253, Russell Senate Office Building, Hon. John McCain, Chairman of the Committee, presiding.

OPENING STATEMENT OF HON. JOHN MCCAIN, U.S. SENATOR FROM ARIZONA

Senator MCCAIN. Good afternoon. The National Academy of Sciences has said, "Greenhouse gases are accumulating in the Earth's atmosphere as a result of human activities causing surface air temperatures and subsurface ocean temperatures to rise. Temperatures are, in fact, rising. The changes observed over the last several decades are likely mostly due to human activities, but we cannot rule out that some significant part of these changes is also a reflection of natural variability." I want to repeat, that is the conclusion of the National Academy of Sciences.

Over the last five years, the Commerce Committee has held several hearings on climate change. Two of the last five years, 1998 and 2002, have been the warmest in terms of average global temperatures ever recorded. According to a recent report from the National Oceanic and Atmospheric Administration (NOAA), nine of the warmest years have occurred since 1990. As reported in the *New York Times* on December 31, 2002, many experts think it's more likely than not 2003 will either match or exceed the 1998 average temperature record of 58 degrees Fahrenheit.

Researchers at the University of Texas, Wesleyan University, and Stanford University recently reported in the journal, *Nature,* that global warming is forcing species around the world, from California starfish to alpine herbs, to move into new ranges or alter habits that could disrupt ecosystems. The report stated that there is very high confidence, defined as having more than 95 percent of observed changes which were principally caused by climate change, that climate change is already affecting living systems. The end result of these changes could be substantial ecological disruption, local losses in wildlife, and extinction of certain species.

This and many other reports over the years have highlighted time and again the consequences of a warming climate system. We have seen the destruction of heat-sensitive coral reefs, the melting of glaciers at unprecedented levels, the increase of wildfires, and

the spreading of diseases. A large German insurance company has estimated that global warming could cost $300 billion annually by 2050 in weather damage, pollution, industrial and agricultural losses, and other expenses.

Our international partners, the states, and private industry are reacting to this challenge. For example, California has enacted legislation that will regulate tailpipe emissions of greenhouse gases. The European Union just recently approved an emissions trading system. The World Bank has estimated that greenhouse gas trading will be a $10 billion market by 2005. Final ratification of the Kyoto Protocol rests with Russia.

Industry is also paying attention to what's happening. Law firms and insurance companies are setting up business units to deal with climate-related risks.

Thus far, however, little has actually been accomplished to reduce greenhouse gas emissions. The United States must do something, but it must also do the right thing. Many have focused on what we do not know or the uncertainties around climate change. I prefer a more sound and scientific approach of starting with what is known or given, and then proceeding to solve the problem at hand.

We cannot say with 100 percent confidence what will happen in the future. We do know the emission of greenhouse gases is not healthy for the environment. As many of the top scientists throughout the world have stated, the sooner we start to reduce these emissions, the better off we will be in the future.

In 2001, Senator Brownback and I began working to develop a solution to the climate change problem, and introduced legislation that proposed creating a registry system that would facilitate the trading of credits for the reduction of greenhouse gases. Several provisions of that bill were contained in last year's Senate-passed energy bill.

Also in 2001, Senator Lieberman and I announced our intention to develop legislation to require mandatory reductions in greenhouse gas emissions and provide for the trading of emissions allowances. We have been working with industry and the environmental community to develop legislation to move the country in the right direction and demonstrate leadership on this important issue. It will be the first comprehensive piece of legislation in this area. Not only will it not place the burden on any one sector, it would allow for the partnering across sectors through the trading system to most effectively meet the required reductions.

The bill, which we hope to introduce in the near future, will propose a cap-and-trade approach to reducing greenhouse gas emissions. It would require the promulgation of regulations to limit greenhouse gas emissions from the electricity generation, transportation, industrial, and commercial economic sectors. The affected sectors represent approximately 85 percent of the overall U.S. emissions for the year 2000. The bill also would provide for the trading of emission allowances and reductions through the Government-provided greenhouse gas database, which would contain an inventory of emissions and a register of reductions.

Given the far-reaching implications of this issue, the Secretary of Commerce and the Administrator of the Environmental Protection

Agency (EPA) or their designees have been invited to testify here today. Although the EPA did not provide a witness, I am pleased that Dr. James Mahoney of NOAA has agreed to appear and discuss the scientific research that we all agree should be the foundation of any action taken in this area.

I also thank the other witnesses here today for testifying and helping us understand the issue and its implications of the legislative proposal. I look forward to hearing about how the rest of the world, the states, and the industry are addressing climate change.

The United States is responsible for 25 percent of worldwide greenhouse gas emissions. It's time for the United States to do its part to address this global problem; and a discussion of mandatory reductions is the form of leadership that's required to address this global problem.

I thank my colleagues for their forbearance. That'll be the longest opening statement I intend to give as Chairman of this Committee.

But we are talking about a very difficult, a very complex, and a very controversial issue, but one which I think is of the absolute most critical importance to the future of this nation and the world.

[The prepared statement of Senator McCain follows:]

PREPARED STATEMENT OF HON. JOHN MCCAIN, U.S. SENATOR FROM ARIZONA

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I thank Senator Lieberman for his commitment and leadership in drafting this piece of legislative initiative. We have asked our witnesses today to review a draft of the legislation as part of their testimony. Their comments will be factored into the introduced bill. After introduction, the legislative process will continue and, as we learn more from the many stakeholders in this process, we plan to incorporate that new knowledge into the bill. We also hope that our colleagues in the Senate and the Administration will work with us to improve upon and ultimately adopt this much needed legislation.

Given the far reaching implications of this issue, the Secretary of Commerce and the Administrator of the Environmental Protection Agency (EPA) or their designees have been invited to testify here today. Although the EPA did not provide a witness, I am pleased that Dr. James Mahoney of NOAA has agreed to appear and discuss the scientific research that we all agree should be the foundation of any action taken in this area.

I also thank the other witnesses here today for testifying and helping us understand the issue and its implications of the legislative proposal. I look forward to hearing about how the rest of the world, the states, and industry are addressing climate change.

The U.S. is responsible for 25 percent of the worldwide greenhouse gas emissions. It is time for the U.S. government to do its part to address this global problem, and a discussion of mandatory reductions is the form of leadership that is required to address this global problem.

Senator MCCAIN. Senator Wyden?

STATEMENT OF HON. RON WYDEN, U.S. SENATOR FROM OREGON

Senator WYDEN. Thank you, Mr. Chairman. I want to congratulate you for choosing this as the topic for the first session, and also our colleague, Senator Lieberman. Your bipartisan approach is exactly the way to attack this issue.

By any calculation, the United States is now 25 percent of the global climate change problem, and is zero percent of the solution. The fact is, the rest of the world is now moving forward without America. Our government persists in saying that it's just not possible to do anything more than research. And I think this is a fundamental mistake.

The fact of the matter is, there is clear evidence with respect to what is causing the problem, and we know that there are concrete actions that can be taken to reduce the problem. Yet, it seems to me the United States is, in effect, saying to more than 175 other countries that what they're doing is basically wrong, and somehow when all this research is completed, we're going to convince them of the fact and they're going to change their minds. I think that's a mistake. I think we ought to be moving forward.

I see my colleague, Senator Brownback, here. He and I have introduced legislation, along with Senator Craig that is bipartisan. The FREE legislation, the Forest Resources for the Environment and the Economy, would let us move forward with carbon sequestration programs. We know, for example, the carbon sequestration programs can make a genuine difference with respect to reducing the greenhouse gas problem, but yet, we cannot get support from the Administration to move beyond research.

I support research, but it is critically important that we act. The Administration's inaction is hobbling our economy, and it is stealing growth opportunities from U.S. companies. It is robbing U.S. energy production companies of the certainty that they need when they consider whether and how to make capital investments in their plants. And the Administration's inaction is robbing U.S. farmers and forest owners of economic opportunities that exist today.

Finally, I would say, Mr. Chairman, that there is a huge opportunity to help our technology sector at a time when it is hurting. Our companies are in a position to make significant investments and create a significant number of new jobs in technologies that can reduce the global climate change problem.

I'm particularly pleased at what you, Mr. Chairman, and Senator Lieberman, and my colleague from Kansas, Senator Brownback have sought to do—which is to force some action. It is time to get beyond the research, which is certainly helpful, and translate that work into specific and concrete actions that we know, that the scientists tell us, can make a difference.

Thank you.

Senator MCCAIN. Thank you.

I'd like to welcome our newest member of the Committee, Senator Sununu.

Senator Sununu, our practice here is that when the hearing starts, whoever is here—we go by seniority, and those who come later are recognized under the early-bird rule, which I'm sure you're very familiar with. And so next is Senator Brownback.

Senator Brownback?

STATEMENT OF HON. SAM BROWNBACK, U.S. SENATOR FROM KANSAS

Senator BROWNBACK. Thank you very much, Mr. Chairman, and I appreciate your holding this hearing—the first one out of the box on this subject—and your persistence on working on it. I think it's an important issue. It's a tough issue. But you've certainly never been one to shy away from tough issues, and I'm glad you're grabbing and dealing with this one as well. And I appreciate seeing my

old friend, Joe Lieberman, working as well with Ron on this subject.

I just want to point out one narrow topic on this, because you can look at a whole array of issues to address on global climate change, and a way to address it policy-wise. The one that I want to build on is—what Ron already cited—the area of carbon sequestration and conservation practices. And you've got a witness that's going to testify about that today.

I think there are things that we can do to positively affect our net national carbon emissions that have other environmental benefits and which can have a positive effect on the overall economy, and that we can get through legislatively. I think these are things that we can get done.

Of course I'm referring to carbon sequestration and conservation practices. Mr. Krupp will tell us about some of the innovative projects that his organization is working on in the Pacific Northwest. And these are projects that not only suck carbon out of the atmosphere, but have the more tangible benefits, as well, benefits of improving water quality and preserving wildlife habitat. It's a three-win issue in doing this.

In my home state of Kansas, the potential for bringing carbon into the soil is vast. As we speak, the Chicago Climate Exchange is working out the details of a project that will, all at once, provide a new revenue stream for farmers, improve soil conservation techniques, and reduce our net carbon output. Now, some estimates I've seen believe that the potential for carbon sequestration in this pilot project could exceed the amount of carbon that Germany emits each year.

I look forward to working with the Chairman and this committee and others to consider this part of the climate change debate. I believe that if we're gentle and wise, carbon sequestration is the crossroad at which the various sides of this debate can meet while additional research is going forward in other areas, as well.

I look forward to hearing from the witnesses on the broad cross-section of the topic here, but I think clearly we have some things that we can get done and clearly should get done and that will have a broad cross-section of positive inputs on carbon, on carbon emission, on soil quality, on soil conservation, and on the environment.

Thank you, Mr. Chairman.

Senator MCCAIN. Thank you very much. Senator Brownback, may I say that that issue is transcendent in importance and, I believe, has to be part of the overall addressing of the climate change issue. I thank you for the work you've done on it.

Senator Burns?

STATEMENT OF HON. CONRAD BURNS, U.S. SENATOR FROM MONTANA

Senator BURNS. Thank you very much, Mr. Chairman. And thank you for getting the year started off right—Congress started off right—because this is, without a doubt, one of the greatest challenges that we probably have in doing something good for our planet.

Nobody has to tell me about global warming. We're going into our sixth year of drought. And we don't—we think maybe it might be permanent in Montana, so anybody who wants to buy some shoreline properties in Montana where you can play golf all winter long and ski also, you're welcome to do so.

There are two different ways that we can look at this issue, and I think the Chairman has been right, and I think my friend from Oregon's right, that we tend to stall things with the old adage of "more research is needed." There is no question that more research is needed on this issue, especially when we take a look and see what's happening around the world.

The emissions in this country continue to go down every year. So we're doing some things right. Now, last year, the *Washington Post* reported that emissions decreased last year. One of the reasons was 4.4 reduction in manufacturing output. And then, when we start talking about—start trading on—caps on emissions and—especially on carbon dioxide, we're taking a look at the cap-and-trade programs—they'll be similar to the carbon tax. And we know what the carbon tax did. It both would raise the cost of carbon-based fossil fuels, which leads to higher energy prices, and imposed costs on users and some suppliers of the energy, and we know that there is a small job loss in that. I'm not going to participate in any kind of a program that exports more jobs from this country. And we've already got a flood of jobs leaving our country, and I'm just not going to contribute to that.

We know that global climate change research is probably the biggest weather forecast of all time. And just like I say, in Montana, we're suffering from drought and it has no signs of letting up. I've never seen the snow pack in the Big Horns or the Beartooth as small as it is now. Now they're getting a little more, and, of course, most of our snows, and heavy snows, will come probably starting about the first of February up high and then moving down—on down to lower elevations as the year goes on. But, we will get the vast amount of our moisture, especially for irrigation and to recharge our rivers and stream flows, after the first of March.

So I congratulate the President. The President is working on something that we're going to be very much interested in. As you know, this summer we will have the Earth Observation Summit to improve our international observation efforts and to read and also to study our history. And I think history will tell us—or give us, pretty much, the blueprint to the future.

So, as we move forward, the global approach toward global climate change research needs to be done with the best science possible. There's no doubt about that. But I'm also confident that we must now set a strategic plan, a plan that the President has outlined, to be put forward—and we look forward to working with everybody on this committee, especially the Administration and everybody—I don't think there's anybody in this country that does not really understand the changes that are taking place around us.

And I thank you, Mr. Chairman.

Senator MCCAIN. Thank you, Senator Burns.

Senator Sununu, welcome to the Committee. You bring your experience with you from the House on these issues, and we certainly welcome you. One of my favorite states. It's going to be fun.

[Laughter.]

STATEMENT OF HON. JOHN E. SUNUNU, U.S. SENATOR FROM NEW HAMPSHIRE

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

Of course, as a new member of the Senate, it is a great pleasure to be here. And as the newest member of the Committee, I'm excited to be here, as well. My hunch is that you're not the only person in this room that harbors a special love for the state of New Hampshire.

[Laughter.]

Senator SUNUNU. But my guess is we won't hear too much more of that, at least not today.

The proposals that we'll talk about here today, as you have all made clear, have enormous environmental and economic implications, and that's why I think it's important that we have a thorough discussion and debate of new ideas, new proposals, new technologies that might deal with some of the concerns that we all share.

There are also important international implications to this discussion, because many of those that have looked long and hard at these issues recognize that in 10 or 15 years, developing nations which are not party to any of the discussion or regulations in the Kyoto Protocol will be responsible for the majority of CO_2 emissions in the world. And I think as we look at the future, as we try to predict the implications, the technical and climate implications, of CO_2 emissions, and try to formulate ideas for addressing the concerns raised here, we need to also find ways, and perhaps new technologies that might bring some of these countries into the fold, so to speak, because if, indeed, we're going to take action, you can't simply take action with regard to 1 or 2 or 10 or even 15 percent of pollutants or other emissions, like CO_2, and expect to really have a global impact and a long-term impact.

So, I'm pleased to be here. I look forward to the testimony of our witnesses and know enough about the Senate that it would be a mistake for a junior member to delay the testimony of Senator Lieberman any further.

Thank you, Mr. Chairman.

Senator MCCAIN. Thank you very much. And, again, welcome, Senator Sununu.

We'd like to welcome before the Committee our friend and colleague, Senator Lieberman.

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

Senator LIEBERMAN. Thanks, Mr. Chairman.

Senator Sununu, New Hampshire is also one of my favorite states.

[Laughter.]

Senator LIEBERMAN. And since you're the Senator from there, you could have gone on further.

[Laughter.]

Senator LIEBERMAN. Mr. Chairman, Senator Wyden, Senator Burns, Senator Brownback, thank you all. Mr. Chairman, I par-

ticularly thank you for the now more than a year in which you and I and our staffs have been working with people in the—in business and environmental communities to fashion this practical program to deal through the marketplace, not with bureaucratic mandates, but with the very real problem of global warming, which, as you and others on the Committee have said, is a problem that, not only affects the American people and will affect our children and grandchildren even more if we don't do something about it, but, to which we contribute about 25 percent of the apparent cause of the problem.

Mr. Chairman, I thank you for your leadership on environmental conservation and protection, and I appreciate particularly that you chose this as your first hearing of this new term as you begin—or reassume the chairmanship of the Commerce Committee. I view this as the first step in a very important road we are going to go down that will culminate—must culminate—with this country taking credible action to address the global problems of our warming planet.

In the—in the next day or two, Mr. Chairman, we will introduce this most comprehensive bill ever introduced in Congress to tackle the emission of greenhouse gases, and I hope our colleagues on both sides of the aisle will join us in introducing it.

Simply put, our bill is designed to heat up American innovation in order to cool down our changing planet and changing climate. Global warming is real. The year 2002, is the second-warmest year on record, slightly cooler than the record warm year of 1998, but, as Senator Burns indicated, for reasons that we're not happy about, because manufacturing is down. The ten warmest years have all occurred since 1987, with nine of them happening since 1990.

According to a NASA study released last month, the permanent summer ice cap over the Arctic ocean is disappearing far faster than previously thought, and will, at this rate, be gone—totally gone—by the end of this century, with very serious consequences for America and the planet. And just last week, two major new research studies said that global warming is already posing a very serious threat to the world's plants and animals, a danger that is likely to rise dramatically with the temperature in the coming years.

I think the debate over the science of climate change has pretty much ended after a lot of hesitation. President Bush said last year that he agreed that this was real and a problem. But unfortunately, the proposal that the Administration has put forward thus far will allow greenhouse gas emissions to keep increasing indefinitely, presenting us and our progeny in this country, in the world, with a bigger and bigger environmental crisis to tackle down the road.

Not only will our environment be threatened by this neglect, but two other effects that have been mentioned here will occur. And the first is on American business. It will suffer from regulatory uncertainty. Unwilling to make short-term investments in pollution-reduction technology because they'll be waiting to see what we, in Washington, are going to do. Business always asks for certainty in taxes and regulation and the like, and we can offer it with this proposal:

First, America's stature in the world will be affected. But more practically and importantly, some of our most critical alliances, particularly as we are at war against terrorism today, and perhaps soon against Iraq, some of our most important alliances are affected by our unwillingness to join the rest of the world in dealing with a problem that the people of some of our closest allies in the world are very anxious about.

Just in the last day or two, Prime Minister Blair—who is, obviously, our closest ally in current troubles with Iraq, and close ally and supporter, of course, in the war against terrorism—said something to this effect, Mr. Chairman, that, "Just as we, in Britain and Europe, have listened to the United States when it comes to matters such as the war on terrorism and Iraq, we must ask our allies and friends in America to listen to us when it comes to other problems." And right at the top were climate change and global warming.

Mr. Chairman, you have already described, I think, quite well, how the plan works with characteristic clarity and, by Senate standards, notwithstanding your own high personal standards, remarkable brevity, but let me underscore briefly two points. First, the environmental results. We'll achieve steady but measured progress in reducing harmful emissions into the atmosphere if this proposal is adopted, and that contrasts sharply with the Administration's prescription for business as usual. We do less than is explicitly called for under the Kyoto agreement, but we sure do a lot more than nothing here. This is real substantial progress, responsible action.

Second, the economic results. Because of the entrepreneurial model of our proposal, which is built around American businesses and farms—and Senator Brownback makes a very important point here about the potential return to America's farmers in being part of dealing through sequestration, with the problem of global warming—this model is built around America's private sector, not around the Federal Government's bureaucracy. And so we give companies total flexibility to tackle the problem as they see fit. We believe that will unleash the genius of American enterprise and create a boom of new high-paying jobs in the innovation economy as companies compete to drive down their emissions.

Mr. Chairman, finally and more broadly, global warming is, like so many other problems in life, if we put off fixing it today, it's going to become harder tomorrow, certainly more costly, and certainly more complex. However, if we have the foresight and the fortitude to act now, to act like leaders who see a problem coming over the horizon, and are prepared to do something about it today to make it better tomorrow, if we're prepared to tap the tremendous well of talent and technology that is our unique American resource, then we're going to put our nation in better environmental and economic health for the future. We're going to make this nation one that is not at the mercy of its problems, but in control of its destiny. And it takes the kind of action that is required by our proposal.

I urge my colleagues, on both sides of the aisle, and people on—leaders on both ends of Pennsylvania Avenue to take a good open-minded look at our proposal. We've worked real hard at it. We've

got some—as you'll hear today, some impressive support from both the business community and the environmental community. We ought to be able to make this a bridge to action.

Mr. Chairman, again, I thank you for your leadership, and I look forward to working with you and other members of the Committee to move our legislation along.

Senator MCCAIN. Thank you very much, Senator Lieberman. I know you have other pressing duties, and we thank you for your statement. And we're going to have a lot of very interesting aspects of this issue, and I look forward to working with you as we address this very vital issue.

Thank you very much, Senator Lieberman.

Senator LIEBERMAN. Thank you.

Senator MCCAIN. Congressman Inslee was going to be here, but—oh, here he is.

Welcome, Congressman Inslee. Thank you.

STATEMENT OF HON. JAY INSLEE,
U.S. REPRESENTATIVE FROM WASHINGTON

Mr. INSLEE. Thank you, Senator. Thank you, Senator McCain, Senator Lieberman, and all the senators involved in this.

You know, I think this is a really great day, because this day, the U.S. Senate's been caught in the act of leadership. And you have decided——

Senator MCCAIN. Thanks for the compliment.

[Laughter.]

Senator BURNS. You're treading on thin ice already.

[Laughter.]

Senator BURNS. Getting thinner.

Mr. INSLEE. And we need it. We need it. We need it, because we need leaders who will not sing Nero's song, which he sang as Rome burned, which was, "We need more research." And you've decided to sing a different song of saying, we ought to take action. And I think if you look back in a few decades, you may find that today's hearing was one of the most important hearings of this Congress.

And I just have two comments, and perhaps one suggestion. The first comment is that I believe that what you have proposed, the basic thread of what you have proposed, is entirely consistent with two basic American values. The first is the basic American value of American realistic common sense. And the second is the basic American value of optimism in our technological abilities. And I want to address why I think those values—you've hit the mark in the basic thrust of the bill you intend to propose, which we intend to, in some way, join in the House on a bipartisan basis.

First, and—because of realism and common sense, Americans now are becoming familiar with this graph over here, which is an absolutely unambiguous, scientifically unchallengeable fact of nature, which is the concentrations of carbon dioxide in our atmosphere are not only rising, but they're exploding. Because if you see with the dawn of the industrial age, and now we're in the—in this century, this chart doesn't just rise; it explodes, unless the U.S. Senate and the U.S. House and this Congress take some action. And people know—because it's an unambiguous fact that CO_2 has

some warming propensity—that there are going to be some changes to our climate. And people get that.

And Senator, let me tell you how much they get it in my neck of the woods. In the Yakima Valley, which is a largely agricultural producing area in eastern Washington, you've got the Yakima River system. And it irrigates apples, peaches, and hops—tremendous agricultural area. Those folks who drive tractors, who figure out their budget, have now figured out something else. They have got to spend close to a billion dollars developing new irrigation storage facilities to make up for the snow pack that's going to be gone when the snow level rises in the next several decades. And they are now coming to Congress, or shortly will be, to try to help finance this multimillion-dollar project to solve this problem. The reason——

Senator BURNS. Where is this?

Mr. INSLEE. This is the Yakima River in eastern Washington.

The reason I mention this is that when people, on a day-to-day basis, factor into their business decision-making the necessity of dealing with this problem, it's high time for us to do the same thing in Congress. And we've all heard the apocryphal stories which are true of dead Intuit Indians popping up to the surface of the tundra in the Arctic because the tundra is melting, and the polar ice cap being 10 percent reduced in scope and 30 to 40 percent already reduced in depth.

You know, in Glacier National Park—I was there a few weeks ago, and the dark humor is, they're going to need to change the name to "Puddle National Park" in several decades. And that is a realistic projection of what could happen if we don't act here in Congress.

But what is happening is, the American people are exercising their common sense in realizing that we've simply got to act. And unfortunately, all the U.S. Government has offered to date is a voluntary system. And we know that you can run a bake sale on a voluntary system, but you can't run a global climate change program on a voluntary system. And your stepping into the breach is very much appreciated. And I'm working with a group in the House to try to change the ostrich position to the eagle position when it comes to climate change.

The second issue, second comment, I want to make. It's consistent with the American value of optimism. You know, if you look at the debate that has raged about this subject—it's extremely controversial, because it's a tough one—I posit that it's a debate between the optimists and those who are not so optimistic about our technological abilities, because those of us who are optimists believe that the nation who followed John F. Kennedy to the Moon can follow the U.S. Senate and the House to some meaningful reduction of global climate change gases. That's the theory of optimism, and it's well-placed.

Look at what British Petroleum did. Here's an American corporation, certainly not an avant garde—you know—wacko environmental outfit. Under the leadership of Chairman Brown, they decided to reduce their greenhouse gas emissions to 1990 levels in 11 years. They made a corporate decision to do that. A pretty visionary thing for a corporation to do. And what did they do? They re-

duced it to 10 percent less than their 1990 emissions, and they did it in 3 years instead of 11 years. Here's a hard-headed bottom-line corporation that showed the American business industry that this can be done. This is really weird. This isn't pointy-head academics talking about this. So, we know that this job can be done.

And I also want to suggest that this is an economic issue. You know, you had the missile gap in the 1960s. You've got a clean technology gap that's widening right now. Why should the leader in clean cars be Japan? Why should the leader in wind-turbine technology be Denmark? Denmark is ahead of the United States on wind-turbine technology. Why should the leader in solar-cell technology be Germany? We should be the leader in all of these technologies, because the world's going to beat a path to the door, and we need some Federal leadership to do that.

We're starting to do that in the State of Washington. We've got the Zantech Corporation making inverters up in Mount Vernon. We've got the largest wind-turbine generator in North America in southeastern Washington State. We have the capability. This is an economic-development issue.

And let us not forget the national-security ramifications of reducing our addiction to foreign oil. There is a study done by the last Administration which concluded that—if we had continued our efficiency gains of the late 1990s, we could save potentially 5 million barrels of oil a day. Now, to put that in perspective, we only import about 8 million barrels a day. That's a significant reduction in having to be addicted to the Mideast fuel. If we adopt the renewable-energy technologies that are already available, the studies show we could save 3 million barrels a day. We have these technologies now. We need some leadership, and I want to thank you.

Third, just a small suggestion. I think it's very important that all of us, when we talk about limiting greenhouse gas emissions, try to incorporate in our proposals ways to get there. And I hope that in all of our bills we pass, we'll have a commitment to the R&D budget increase that is necessary from the U.S. Federal Government to help the emergence of these new technologies. And perhaps this is something we can incorporate in these bills as we go through to make sure that we stay on the message of optimism.

So, in that spirit of optimism and can-do, I want to thank you and stay for any questions that I might be able to answer.

Senator MCCAIN. Well, thank you very much, Congressman Inslee. You make a very eloquent and informative statement, and we thank you for coming over, and we look forward to working with you.

Mr. INSLEE. We will be working on a bipartisan basis, I hope, in the House. Thank you.

Senator MCCAIN. Thank you, sir.

Now, we'd like to ask the Honorable James Mahoney, the Assistant Secretary of Commerce for Oceans and Atmosphere, and Director of the U.S. Climate Change Science Program of the U.S. Department of Commerce, to come forward and join us.

Welcome, Secretary Mahoney. Thank you for taking the time to be with us today, and we look forward to hearing your statement.

STATEMENT OF HON. JAMES R. MAHONEY PHD., ASSISTANT SECRETARY OF COMMERCE FOR OCEANS AND ATMOSPHERE, DEPARTMENT OF COMMERCE, AND DIRECTOR, U.S. CLIMATE CHANGE SCIENCE PROGRAM

Dr. MAHONEY. Thank you, Mr. Chairman. Senator McCain, Senator Wyden, Senator Burns, Senator Sununu. It's an honor for me to be here in front of you, and it's a pleasure for me to be here for a third time in the last year since you first grilled me in my confirmation hearing a year ago this month, as a matter of fact. I hope I can demonstrate some progress over the little less than a year since I began my position.

I'm here today to present testimony on the Administration's strategic plan for Federal research on climate change, and specifically to talk about the uniquely successful workshop on that strategic plan, which was held here in Washington this last month. That workshop involved participation from a little over 1,300 climate specialists from the United States, representing 47 of the 50 states, and from 36 other nations. We believe it was the largest single group debating what we know and where we should go on issues of climate change that we've ever had in a single event.

Even more than the sheer numbers, though, we are especially proud to be held to the measure of openness and transparency that we tried to strike in publishing that plan and opening that workshop to the broadest possible kind of comment and critique, and that's the path we're on. It's the path we're on in trying to lay out our scientific information for the American public, for the international public, and, of course, very much for you here in the Senate and the House of Representatives, as well. And that's my purpose here today.

In my statement, to limit my time speaking so that I can give the floor back to you, I want to simply highlight, of course, a few key points. And if you're following along, I tried to summarize some of these at the very front, in the first couple of pages. We view the Federal Government Climate Change Science Program as trying our very best to fill the role of credible fact-finder about the tremendously complex set of information that we have relative to climate and global change.

And I might put three legs on the stool related to that. One is clearly the science and the science uncertainty that we're dealing with. Second, we have a special interest in improving our ability to monitor regionally and globally the interactions between climate and ecosystems that are so much at the core of the discussions we've already been hearing here in the last half-hour. And third, we are attempting to use all of the science, $20 billion worth invested by the U.S. taxpayers over the last 13 years, to develop the ability to answer a series of if-then questions so that—on a basis of agreed debate and peer review—we can start addressing the issues of "If we do this, what do we expect? And what are the social and economic consequences as well as the ecosystem consequences of those actions?"

This is the way that we're trying to be responsive and responsible to your direction under the Global Change Research Act, in the first case, and to the direction of the President, who has asked to have this work accelerated, in his statements beginning in 2001.

Moving quickly, we have put together, at the President's direction, a major new integrated management structure for all of this work. There are 13 Federal agencies involved in this research and we count on the books and on the budgets you see, $1.7 billion annually for this research. In fact, this last year we looked at the related research recounted in other accounts, and the total for the U.S. is about $3 billion a year in the research. And certainly, the public is due to receive very able answers from this research.

Third, I'll reserve for a few minutes just to make a quick comment about this draft strategic plan that we've used to try to begin a robust discussion. Fourth, on the same workshop I mentioned a minute ago, I have a couple of other comments I want to make before I conclude.

And I'll turn, fifth, out of these ten summary points, to note that we have specifically asked the National Academy of Sciences to take on a very special task relative to this new focused planning, public review, and international review of our activity. The Academy has appointed a special 17-member expert committee, and the Academy will, of course, use its normal full system of structure, including careful review internally, to assure the high quality of its report in this area.

They have read our *Discussion Draft Strategic Plan*. They attended and participated among the 1300 in this workshop. They are preparing two reports for the Nation in the next few months. They're doing one report rather quickly so that they can give us guidance as we complete this plan, and then they will look at the whole thing, and later, by the end of the summer of this year, will produce another report in which they will lay out their view of the path we're on in our science, our measurement, our technology reviews, and all the rest of it as part of that activity.

Next, we are talking planning here because we felt it was necessary to cast a proper eye on what questions we are addressing. What can we answer? What new information can we bring to the table over the next year, two years, three, four years? This is the time frame that the President has asked for. We want to be clear that we complete this updated plan after we have resolved all the comments we have received, and we have received hundreds already since that workshop during the open-comment period. Now, we'll be turning our direction directly to reporting findings and results and reporting analyses of what if-then types of questions.

So, that's what's on the horizon immediately for this work, in addition, of course, to carrying on the important fundamental basic research.

Next, a point on integrating science and technology. We have a very strong theme that the ultimate answers to the global warming challenges will be technologically driven, and the technologies that we'll be talking about, in most cases, do not exist today, or at least are not commercialized today, and we need our science to point us in the proper directions about the priorities there. We also need our science, when we look at technologies, to look at the intended consequences, as well as the unintended consequences, of major technological shifts.

Ninth out of these ten summary points, I'm pleased to announce here today that the Bush Administration is sponsoring a major

global Earth-observing summit which will be held here in the summer of this year. And we're doing that specifically to put the proper attention on the importance of integrated ecosystem and climate observations worldwide, and to encourage our partners in both the developed world and the developing world to really take the excellent measurement systems we already have and get them to the level that we can answer questions near- and long-term in the way that we need to. That will be a major U.S.-led initiative. It will happen in the summer, and it will be a precursor to suggestions we expect to table at the Ninth Council of the Parties under the U.N. Framework Convention, when that is held next December. So we're on a very active program of developing these steps.

Tenth of my ten summary points, we earnestly ask for dialogue from the Senate, from the House, and from, as we have, the general public. We are more than willing to work with you and your staff. My colleagues and I—will rue that I say—we will say that we welcome questions. There's always a heavy workload with that, but—but we take seriously the sense that there is a major investment in this research and we have to make better use of it, and that's the path that we're on.

Just before concluding, having gone through that as kind of the structure for this, I'd like to take just a couple of minutes on the Strategic Plan. And I'll just name the guidelines we put in place to develop this comprehensive plan. First, we said it had to be driven by questions. This is not just scientific research. The questions in all the areas are aimed at the issue of, "What do we know? What are the consequences?"

Second, we're looking at and integrating the near-term questions—because they're on the table here—with the long-term view, because we have a decades-long issue of both the challenge of global climate change issues and the response that we expect.

Third, we've gone out by every conceivable means to get the science community around the world, the stakeholder community around the world, to deal with these questions with us. And I might note that in that stakeholder community, somewhat in the sense of Senator Burns' comments and others' before, the regional resource managers concerned with water supply, agriculture, and other systems have a great need for understanding the climate variability data we have, and we're trying to bring that to their attention.

That's the nature of some of this, and I will close with a comment about this workshop which I have mentioned. It was very pleasing, because I think we had strong, but very civil discussion among those of very different points of view. The general feeling, I will say—and others can give their comment—was a remarkable openness and civility while having sharp debate. We've indicated the list of major Government and international leaders who spoke in the conference. Even more importantly, we've indicated in the prepared statement the list of 24 specialty topics that were covered. All of that is on our website. All of the comments and, of course, the plan and the final plan will be on the website as well.

And I would just mention that at the workshop, and as a theme for this discussion today, I would make one point about where we view all of this. And I said it at the beginning of the workshop, and

I certainly want to have my statement today include this: We view, and I view, that the status of the Earth and climate system is the capstone environmental issue of our generation, and it will be for the generation of our children, as well.

And there's a corollary to that. This issue is so big and so challenging, massively uncertain in many cases now, massively costly and dislocating as to what we may need to do about it, that because of the importance of the issue, we not only need to understand it, but we need to really drive the development of new classes of technology. And I would argue that we need to be careful not to simply assume we can do something short-term and get there. If our concerns bear out over the months and years ahead, then we really need to be moving toward fundamental shifts in technology.

And the other part of the theme, we are using this whole climate-science effort and our allied effort in the technology area to really address the question of, first, what can we do about the uncertainties that exist—not so much about "Is there any global warming or not?" That issue is virtually settled, but on the issue of differentially, what makes a difference, and where can we get—and there's a world of places—there's a world of initiative we still need on that issue, and we're very much after that.

I'll conclude by calling your attention to this major Earth-observing summit that will run this summer. We believe it will be a clear example of U.S. leadership in this area. We're pleased to see that come forward.

Mr. Chairman and all of you on the Committee, I thank you for hearing me in this statement.

[The prepared statement of Dr. Mahoney follows:]

PREPARED STATEMENT OF HON. JAMES R. MAHONEY, PH.D., ASSISTANT SECRETARY OF COMMERCE FOR OCEANS AND ATMOSPHERE, DEPARTMENT OF COMMERCE, AND DIRECTOR, U.S. CLIMATE CHANGE SCIENCE PROGRAM,

Good afternoon Senator McCain, Senator Hollings and Members of the Committee. I am James R. Mahoney, Assistant Secretary of Commerce and Deputy Administrator of the National Oceanic and Atmospheric Administration (NOAA). I am appearing today in my capacity as Director of the United States Climate Change Science Program (CCSP). CCSP integrates the Federal research on global change and climate change, as sponsored by thirteen Federal agencies (the Departments of Agriculture, Commerce, Defense, Energy, Health and Human Services, Interior, State, and Transportation; together with the Environmental Protection Agency, the National Aeronautics and Space Administration, the National Science Foundation, the Agency for International Development, and the Smithsonian Institution) and overseen by the Office of Science and Technology Policy, the Council on Environmental Quality, the National Economic Council and the Office of Management and Budget. In February 2002 President Bush created a new cabinet-level management structure, the Committee on Climate Change Science and Technology Integration, to manage the over $3 billion annual budget of federal climate change research and technology development programs. CCSP, which integrates the work of the U.S. Global Change Research Program (USGCRP) created by the Global Change Research Act of 1990 with the Climate Change Research Initiative (CCRI) launched by the President in June 2001, is a key element of the President's climate science and technology development management structure.

In response to your invitation, I am very pleased to have this opportunity to present testimony on the Administration's November 2002 *Discussion Draft Strategic Plan* for federal research on climate change, and on the uniquely successful workshop on the draft plan, held in Washington, D.C., on December 3–5, 2002. The workshop was designed to facilitate extensive discussion and comments on the draft plan from all interested domestic and international groups and individuals, including the scientific community, a wide range of stakeholders, interested members of the public, and the media. The open comment period begun before the workshop

continues until a deadline of January 18, 2003, for receipt of written comments. We look forward to providing this Committee, as well as other interested elements of the Congress, with a report on the comments and their resolution—and with the updated strategic plan—by the end of April 2003, as announced in the workshop documents. I note that all elements of the strategic planning process, including the *Discussion Draft Strategic Plan*, all of the workshop proceedings and all written public comments, will be available at the website *www.climatescience.gov*.

SUMMARY OF THIS STATEMENT

1. "**Credible Fact Finder**": Responding to the direction of President Bush that the best available scientific information be developed to support decision making on global climate change issues, CCSP has developed its strategic planning and public review processes to facilitate "credible fact finding" on: (a) key **climate science** issues, (b) comprehensive, high quality climate and ecosystem **observing and data management systems**, and (c) the development of meaningful **decision support resources** in the form of responses to "if . . ., then . . ." questions, which depends on achieving significant progress under (a) and (b) above.

2. **New, Integrated Management Structure:** The CCSP has implemented a comprehensive, interagency management structure to assure effective and efficient deployment of approximately $1.7 billion (annual budget) in directly sponsored research and $1.3 billion of related research conducted by the thirteen CCSP collaborating Federal agencies. During the past nine months this new management structure has: (a) completed a comprehensive strategic review of the ongoing research programs in all CCSP collaborating agencies, (b) produced an interagency integrated climate science budget request for FY 2004, to be included in the President's budget request to be sent to Congress, and (c) prepared the basis for operational interagency management of the FY 2003 appropriated budgets when they become available.

3. **November 2002 Discussion Draft Strategic Plan:** The CCSP recently published an extensive "draft for discussion" of its new 10-year strategic plan. The draft plan is structured around **key questions** in the science, observations and decision support areas, to encourage a focus on the information needed to underpin public discussion of climate change issues. *The Discussion Draft Strategic Plan* responds to the requirements for periodic updates as specified by the Global Change Research Act of 1990 (PL 101–606), and to the direction of President Bush that climate change research activities be accelerated, so as to provide the best possible scientific information that can be developed in the near term. *The Discussion Draft Strategic Plan* (discussed further below) is available on the web site *www.climatescience.gov*.

4. **December 3–5, 2002, Workshop on the Discussion Draft Strategic Plan:** The workshop held last month here in Washington was a key element in the process of developing the scientific basis to evaluate the effectiveness and efficiency of a range of climate change mitigation and adaptation options. The workshop was the most highly attended and structured discussion of climate change issues held to date, and it was conducted with a 100 percent commitment to open and transparent discussion of the issues. The workshop is discussed extensively later in this statement, and all of the documentation on the workshop proceedings also appears on the web site *www.climatescience.gov*.

5. **Comprehensive Review by the National Academy of Sciences:** CCSP has requested that the National Academy of Sciences (NAS)—National Research Council conduct a comprehensive review of the draft and final versions of the CCSP Strategic Plan. The Academy appointed a special 17-member committee of experts in the physical, biological, social and economic sciences, and this committee reviewed the *Discussion Draft Strategic Plan*, and participated throughout the recent workshop. The NAS committee will provide preliminary public recommendations by February 2003 to assist in the update of the strategic plan. The committee will provide a second public report in September 2003, commenting on the updated strategic plan as well as the open public review process being used to develop the strategic plan and the subsequent findings to be reported by CCSP.

6. **Updated CCSP Strategic Plan Scheduled for April 2003:** CCSP will publish its updated strategic plan for the climate science program by the end of April 2003, after consideration of all of the workshop discussions and the full range of the written comments received by the January 18, 2003, deadline for comments. The plan, which will be subject to future modification as warranted by the emergence of key science findings and key public questions to be addressed, will guide the conduct of the federal research activities during the critical next few years of public discussion about climate change.

7. **Shift to the Reporting of Findings After the Strategic Plan is Completed:** As described in the *Discussion Draft Strategic Plan*, CCSP will focus on the development of structured, climate science findings after the updated strategic plan is completed in April 2003. Future reports will address the three principal foci of the strategic plan: (a) **reducing key scientific uncertainties**, (b) designing and implementing a **comprehensive global climate and ecosystem monitoring and data management system**, and (c) providing **decision support resources** to support public evaluation of climate change response options, based on evaluation of a wide range of scenarios and response options.

8. **Integration of Scientific and Technological Developments:** One of the principal themes of the workshop was the likely need for breakthrough technology options to address the long-term challenge of global climate change. The only effective approaches to long-term global stabilization and ultimate reduction of net greenhouse gas emissions, if found necessary, will require major new technologies, not simply incremental improvements of current technology. The likely growth of global population and economic output in the upcoming decades will only amplify this need. CCSP is working closely with the Climate Change Technology Program to assure that: (a) science drives the definition of technology needs, and (b) science is used to evaluate both the *intended* and the *unintended* consequences of proposed technology innovations.

9. **Major US-Led Earth Observation Summit Announced:** Building on the need for a truly integrated global climate and ecosystem observing and data management system as documented in the CCSP *Discussion Draft Strategic Plan* and discussed extensively during the December workshop, the Administration is taking the initiative to host an **Earth Observation Summit** to be held in Washington, D.C., during the summer of 2003 time frame. The meeting will bring together senior international government and nongovernment leaders in climate science, technology and environment, to develop a commitment to a new level of comprehensive, climate-quality global monitoring, and to initiate the planning to implement this commitment. The meeting (further described later in this statement) will target the Science Advisors and the Science or Technology Ministers of the G–8 nations and other nations, and will serve as a foundation for reinvigorating comprehensive observation of the Earth's climate system, which will be a focus of the December 2003 *Conference of the Parties* of the United Nations Framework Convention on Climate Change.

10. **Request for Congressional Dialogue and Input to the Strategic Plan:** The climate change science strategic planning process has already benefited from a wide range of review and comment (before, during and after the recent workshop) by the domestic and international climate science community, by a large group of stakeholders representing diverse interests on climate change issues, and by the rapidly increasing group of users of climate change information and projections. We invite comments and questions by members and staff of the Senate and the House of Representatives so that the question-based strategic plan can be fully responsive to the public interest. We have already engaged in briefings with a number of members and staff, and we are prepared to respond promptly to other requests for briefings or written responses to questions.

The remainder of this statement provides further details in four of the key areas mentioned above: (1) background information on the U.S. Global Change Research Program and the Climate Change Research Initiative; (2) the November 2002 CCSP *Discussion Draft Strategic Plan*; (3) the December 2002 Workshop on the draft strategic plan, including its purpose, structure, operations and feedback to date; and (4) the summer 2003 U.S.-led Earth Observation Summit planned to promote a new level of state-of-the-science measurement and data management capability to support decision making about global change.

I. BACKGROUND ON THE U.S. GLOBAL CHANGE RESEARCH PROGRAM AND THE CLIMATE CHANGE RESEARCH INITIATIVE

The U.S. Global Change Research Program (USGCRP), well known to many in this audience, was launched as a series of research initiatives in 1987, and was codified by the Global Change Research Act, which was signed into law by President George H.W. Bush in 1990. To date, over $20 billion of research funding has supported the USGCRP, which has contributed significantly to the international body of research, monitoring and computer modeling of global change over the past 15 years. The USGCRP is continuing its major role in the exploration, discovery and analysis of global change phenomena, and is sharing the results of this research with the entire world community.

In May 2001, the Bush Administration asked the National Academy of Sciences—National Research Council to provide an updated evaluation of key questions about

climate change science, in view of the body of research developed by the international climate science community, with specific reference to the recently completed Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). The findings of the NAS Committee on the Science of Climate Change, reported in June 2001, continue to guide the development of the focused climate research and technology programs announced by President Bush also in June 2001:

"Greenhouse gases are accumulating in Earth's atmosphere as a result of human activities, causing surface air temperatures and subsurface ocean temperatures to rise. Temperatures are, in fact, rising. The changes observed over the last several decades are likely mostly due to human activities, but we cannot rule out that some significant part of these changes is also a reflection of natural variability."

"Because there is considerable uncertainty in current understanding of how the climate system varies naturally and reacts to emissions of greenhouse gases and aerosols, current estimates of the magnitude of future warming should be regarded as tentative and subject to future adjustments (either upward or downward). Reducing the wide range of uncertainty inherent in current model predictions of global climate change will require major advances in understanding and modeling of both (1) the factors that determine atmospheric concentrations of greenhouse gases and aerosols, and (2) the so-called 'feedbacks' that determine the sensitivity of the climate system to a prescribed increase in greenhouse gases. There is also a pressing need for a global system designed for monitoring climate."

"Making progress in reducing the large uncertainties in projections of future climate will require addressing a number of fundamental scientific questions relating to the buildup of greenhouse gases in the atmosphere and the behavior of the climate system. Issues that need to be addressed include: (a) the future usage of fossil fuels; (b) the future emissions of methane; (c) the fraction of the future fossil fuel carbon that will remain in the atmosphere and provide radiative forcing versus exchange with the oceans or net exchange with the land biosphere; (d) the feedbacks in the climate system that determine both the magnitude of the change and the rate of energy uptake by the oceans, which together determine the magnitude and time history of the temperature increases for a given radiative forcing; (e) details of the regional and local climate change consequent to an overall level of global climate change; (f) the nature and causes of the natural variability of climate and its interactions with forced changes; and (g) the direct and indirect effects of the changing distributions of aerosols. Maintaining a vigorous, ongoing program of basic research, funded and managed independently of the climate assessment activity, will be crucial for narrowing these uncertainties."

"Because of the large and still uncertain level of natural variability inherent in the climate record and the uncertainties in the time histories of the various forcing agents (and particularly aerosols), a causal linkage between the buildup of greenhouse gases in the atmosphere and the observed climate changes during the 20th century cannot be unequivocally established. The fact that the magnitude of the observed warming is large in comparison to natural variability as simulated in climate models is suggestive of such a linkage, but it does not constitute proof of one because the model simulations could be deficient in natural variability on the decadal to century time scale."

I also quote from a February 2002 statement of President Bush, responding to the NAS report:

"Addressing global climate change will require a sustained effort, over many generations. My approach recognizes that sustained economic growth is the solution, not the problem—because a nation that grows its economy is a nation that can afford investments in efficiency, new technologies, and a cleaner environment."

President Bush took several steps to address climate change issues in June 2001, including issuing a new challenge to the climate change scientific and technological communities. He created the Climate Change Research Initiative (CCRI) and the parallel National Climate Change Technology Initiative (NCCTI), and asked federal science and technology specialists to take on new responsibilities to accelerate the development of policies to respond to climate change issues. Specifically, a short-term focus (defined as covering 2 to 5 years) was assigned to CCRI, to speed the development of information that can improve science-based decision-making.

In February 2002 President Bush further strengthened the climate change science and technology programs by creating a new cabinet-level management structure, placing responsibility and accountability for the $3+ billion annual budget science and technology programs in the relevant cabinet departments. In September 2002, Commerce Secretary Evans and Energy Secretary Abraham reported to the President on the first six months of climate change science, technology and emission reduction activities achieved under the new cabinet-level management structure. The report from Secretaries Evans and Abraham, which includes the organization chart

for the federal program, is attached to this statement. Implementation of the President's new management structure has resulted in several actions that have strengthened the federal programs in climate change science and technology development. For example:

- A thorough reevaluation of the climate change science programs in all 13 participating federal agencies was completed in August 2001. This has created a substantial new basis for interagency collaboration, and has provided the essential background for preparation of the interagency CCSP *Discussion Draft Strategic Plan.*
- A full interagency crosscut of the FY 2004 climate change research budget request was prepared in September 2002. This integrated interagency budget crosscut will facilitate efficiency and effectiveness in the commitment of future budget resources to the climate change science program.
- The interagency science and technology programs are now being reviewed on a frequent basis by high-level appointees of President Bush. For example, the President has designated an operating review committee composed of deputy cabinet level officials representing each of the collaborating agencies. This review committee has held a full agenda meeting nearly every month since the President designated its oversight responsibility in February 2002, and has been responsible for achieving a substantially improved level of integration among the federal climate science and technology programs, together with the voluntary emission reduction programs and the several international collaborative programs in which the United States participates.

CCSP is designed to serve in a "credible fact finder" capacity, providing a source of credible and useful information in three broad categories:

1. **Science:** The causes and projected effects of global climate change, including the understanding of both individual processes and multiple-factor interactions.
2. **Observations and data:** Observing system design and measurement methodologies for climate and ecosystem parameters, including high quality data archives, to facilitate trend analyses and other measurement-based scientific studies.
3. **Decision support resources:** Evaluation of "If . . .", then . . ." questions, which depends on achieving significant progress under (1) and (2) above.

The research activities sponsored by the CCSP are designed to provide critical information about a number of the natural resource issues affected by climate variability and change. This will involve both a focus on *national and global* level mitigation and adaptation issues as well as a focus on *regional and sectoral* adaptation responses to climate variability.

II. THE DISCUSSION DRAFT STRATEGIC PLAN FOR THE U.S. CLIMATE CHANGE SCIENCE PROGRAM

The CCSP *Discussion Draft Strategic Plan* outlines a comprehensive, collaborative approach for developing a more accurate understanding of climate change and its potential impacts. It builds upon the significant investments we have already made in climate change science, and it is guided by the priority information needs identified by stakeholders and scientists, both nationally and internationally.

The *Discussion Draft Strategic Plan*, the comprehensive workshop discussions and written comment processes, and the ongoing review by the National Academy of Sciences were all designed to support the "credible fact finder" role of CCSP. The following guidelines are being used to advance the CCSP "credible fact finder" strategy:

1. **Question-based strategic plan:** The draft plan was developed from a series of key questions in each of the principal climate change science topic areas. For each question the draft plan summarized the current state of knowledge; described the improved information expected within the next 2 to 4 years and beyond; and reviewed the uncertainties unlikely to be resolved within 2 to 4 years. This question-based approach fosters agreement on the appropriate questions to be addressed, and it enhances communication among the large number of contributors to and users of the strategic plan.

2. **Integration of Long Term USGCRP and Short Term Focused CCRI Studies:** USGCRP has largely focused on long-term studies in key science areas, including atmospheric composition, climate variability, the carbon cycle, the water cycle, climate-ecosystem interactions, human dimensions of climate change, land use/land cover interactions with regional climate change, and climate model development and evaluation. CCRI has a short-term focus on reducing scientific uncertainty where possible, developing integrated global observing systems for oceans, atmosphere and ecosystems, and developing decision support resources to enhance public

and policy-maker evaluation of climate change response options. The CCSP integrated management of the USGCRP and CCRI helps bridge the *discovery and characterization* focus of USGCRP and the *differentiation and strategy investigation* focus that President Bush called for in the CCRI.

3. **Combined scientific community and stakeholder review:** All of the strategic plan review actions (including the workshop, the written comment period and future opportunities to comment on CCSP draft findings) are intended to encourage review, comments, challenges, questions and alternative recommendations from both the international scientific community and the various interested stakeholder communities.

4. **Policy relevant but policy neutral analyses:** The CCSP studies are intended to be policy relevant (i.e., focused on the range of climate change outcomes and response options of interest to the United States and other governments) while remaining policy neutral to assure credibility among all interested stakeholders. The CCSP studies and reports do not recommend specific policy options; instead, the studies address "If . . .", then . . ." questions that explore the projected outcomes of various policy options.

5. **Transparency and comprehensiveness guidelines:** CCSP has a policy of full transparency in its plans, reports and data records. To maintain credibility among users of the CCSP analyses and projections, CCSP draft and final plans, reports of findings and projections of future outcomes will be posted on publicly accessible web sites, and all comments communicated by interested stakeholders also will be posted for public review. CCSP will aim to make its analyses comprehensive (i.e., covering the range of plausible policy options) within the limits of the resources available for analysis. Moreover, CCSP will facilitate comparison with other studies whenever possible.

6. **Reporting of the basis for findings and the degree of certainty in findings:** CCSP aims to describe the basis for each of its key findings and projections, with sufficient detail to allow independent reviewers to replicate the underlying analyses. CCSP will also characterize the degree of certainty associated with each of its key findings and projections. Where appropriate, "confidence level" descriptions will be used to communicate these characterizations. The introduction of uncertainty is not intended to imply a basis for inaction. In cases where the uncertainty of analyses or projections is so large as to make the discrimination between options impractical, this finding will be reported directly.

III. THE U.S. CLIMATE CHANGE SCIENCE PROGRAM STRATEGIC PLAN WORKSHOP

A. Themes for the Workshop

Two important themes were used to guide the workshop deliberations:

- The status of the entire Earth and climate system is a **capstone issue** for our generation and will continue to be so for our children. The Administration fully embraces the need to provide the best possible scientific basis for understanding the complex interactions that determine the constantly changing nature of our Earth's life support systems. Ultimately a **new generation of technology**, not yet developed or commercially demonstrated in most cases, will likely be needed to achieve a long-term balance between the lifestyle aspirations of the global population and the protection of essential Earth systems.
- The 13 Federal agencies sponsoring the Climate Change Science Program, together with the Administration's senior science and policy leaders, intended that the workshop serve to accelerate the application of basic climate research to address the "fundamental uncertainties" identified by the National Academy of Sciences and to evaluate response strategy options. This is consistent with the President's call to focus on the profoundly important—and challenging—range of fundamental scientific uncertainties, technology development and public policy questions that we need to address.

B. The Workshop Experience

The workshop was a seminal event in the consideration of global climate change issues, attended by a very large group of United States and international climate specialists and stakeholders.

- More than 1,300 climate specialists participated in the workshop, including individuals from 47 states and 36 nations. This appears to be the largest-ever participation in a focused climate science review program. Participants included substantial representation from all of the climate science areas, as well as ex-

tensive representation from each of the principal domestic and international stakeholder groups dealing with climate science issues.

- The workshop set a high standard for open and transparent proceedings—which was the goal of the Administration. The *Discussion Draft Strategic Plan* was published for review by all participants prior to the workshop; all plenary sessions (including all keynote addresses) were recorded and posted on the website for public review and use; findings of all 24 specialty sessions were documented for public use; all invited commenter presentations are currently being posted on the website; and all written comments received up to January 18, 2003, will be posted on the website.
- The principal science leaders and the relevant cabinet-level agency leaders in the U.S. government all participated in the workshop, along with the principal international climate science leaders. These included:

- Hon. Spencer Abraham, Secretary of Energy
- Dr. Bruce Alberts, President of the National Academy of Sciences
- Dr. Samuel W. Bodman, Deputy Secretary of Commerce (on behalf of Secretary Donald L. Evans, who was out of the country during the workshop)
- Hon. Robert Card, Under Secretary of Energy
- Dr. Rita R. Colwell, Director of the National Science Foundation
- Hon. David Garman, Assistant Secretary of Energy
- VADM Conrad C. Lautenbacher, USN (Ret), Administrator, National Oceanic and Atmospheric Administration
- Dr. John H. Marburger, Director, Office of Science and Technology Policy
- Prof. G.O.P. Obasi, Secretary General, World Meteorological Organization
- THon. Sean O'Keefe, Administrator, National Aeronautics and Space Administration
- Dr. R. K. Pachauri, Chairman, Intergovernmental Panel on Climate Change
- Hon. Christine Todd Whitman, Administrator, Environmental Protection Agency

- Approximately 225 climate specialists were invited participants during the specialty sessions of the workshop, including presenters of the plan elements, invited review panelists, moderators and rapporteurs. More than 300 other individuals provided comments during the specialty sessions. The specialty sessions focused on specific themes of the strategic plan as well as crosscutting themes in the plan. The 24 specialty discussion sessions during the workshop were:

  1. Emerging Climate Science Issues
  2. Observations and Monitoring Systems
  3. Atmospheric Composition
  4. Carbon Cycle
  5. Climate Modeling
  6. Climate—Land Use/Land Cover Interactions
  7. Climate Variability and Change
  8. Water Cycle
  9. Human Contributions and Responses to Climate Change
  10. Climate-Quality Data Management Systems
  11. Scenario Development to Support National-Scope Decisions
  12. International Collaboration
  13. Climate Variability and Change (second session of topic #7)
  14. Climate—Ecosystem Interactions
  15. Resolution of Disparities in Tropospheric Temperature Records
  16. Stabilizing Greenhouse Gases in the Earth's Atmosphere: Opportunities for Technology and Innovation
  17. Resource Management Decision Support
  18. Grand Challenges in Observations, Modeling and Information Systems
  19. Crosscut: Climate Variability—Atmospheric Composition—Water Cycle
  20. Crosscut: Carbon Cycle—Ecosystems—Land Use/Land Cover
  21. Interactions Between Data, Observations and Modeling
  22. Scenario Development and Risk-Based Decision Support
  23. Applied Climate Modeling
  24. Reporting and Outreach Plans

- We have invited all interested persons, whether they attended the workshop or not, to submit written comments on the draft strategic plan to be posted on the website, up to the cutoff date of January 18, 2003. We will consider all comments in developing the updated version of the strategic plan, scheduled for April 2003.

- At the request of CCSP, the National Academy of Sciences—National Research Council has appointed a 17-member expert committee, including physical, biological and social scientists and economists. The NAS committee reviewed the *Discussion Draft Strategic Plan* prior to the workshop; they participated in the workshop; they will review the public comments posted on the website; and they will issue two reports during 2003 expressing their conclusions and recommendations regarding the objectivity, quality and comprehensiveness of the draft and final versions of the new strategic plan, and regarding its implementation.

C. Feedback from the Workshop

The general response to the process of providing a public draft plan prior to the workshop, encouraging fully open discussion at the workshop, and accommodating written comments received after the workshop was extremely positive.

The following lists illustrate some of the general and specific comments received at the workshop. These comments are not priority-ranked, because the open comment period is still under way.

Illustrative general comments: General recommendations voiced at the workshop included:

1. Prioritize and sequence the scientific research needs and identify the resources required to carry out the high-priority science.
2. Create a more holistic strategic plan; the individual chapters in the discussion draft were not adequately cross-linked.
3. Provide realistic timelines for the science goals.
4. Clarify the interagency process for implementing the plan.
5. Note that resource limitations are not only financial, but also include hardware capabilities and human capital.
6. Balance short-term and long-term science goals and activities, with reasons for each.
7. Increase the attention to the detection and attribution of climate change impacts.
8. Encourage accelerated development of climate models, especially for applied analyses of scenario projections.
9. Facilitate stakeholder communication with the scientific community, including international stakeholders.
10. Develop requirements and guidelines for regional climate change analyses.
11. Build on the lessons learned from the National Assessment, particularly in terms of researcher-stakeholder interactions and the need for objective analysis.
12. Develop a strategy for studying and forecasting potential nonlinear and abrupt climate changes.
13. Designate focused research programs that address specific, significant, known scientific uncertainties about climatic change, and that assign agency responsibilities for quantifying the degree and nature of scientific uncertainties.

Illustrative specific comments: The following list is a sample of the many hundreds of specific recommendations voiced during the workshop:

1. To reduce the uncertainty in the estimates of climate sensitivity, the uncertainties in radiative forcing must be reduced, and observations and analyses of Earth's surface temperature must be continued.
2. There should be a major focus on aerosols, emphasizing the regional nature of aerosol emissions and impacts and the importance of Asia, Africa, and Amazonia.
3. An increased focus on the global hydrologic cycle, particularly water vapor and water budgets, is needed.
4. The high prioritization of aerosol effects on climate was endorsed, but stratospheric and tropospheric ozone issues also need to receive a high prioritization.
5. Effective study of climate feedbacks from polar regions will require a substantial integrated observation field program.
6. A coordinated combination of scientific research, observations, and modeling will improve understanding of climatic change.
7. Many communities will need to be involved in prioritizing and implementing studies of land-use change, including local stakeholders and international partners.
8. Linkages between the water cycle, carbon cycle, ecosystems, and land-use change should be emphasized.
9. The importance of economics and technology in predicting future land-use change should be emphasized.
10. It is essential that funding of basic scientific research that may lead to unanticipated insights, results, and breakthroughs be continued.

11. Missing items in the plan include the need for improved greenhouse gas emissions inventories and the effects of aviation on climate.
12. The plan should more fully address ecosystem and social science data and research linked to global change.
13. Sophisticated systems should be planned (and then implemented) to enable all users to search and retrieve global change data via the internet, including delivery of near-real time global temperature data sets.
14. Climate variability should be cast in a probabilistic context.
15. Guidelines for monitoring the effects of climate change on ecosystems, both on land and in the ocean, should be provided.
16. A greater emphasis is needed on how feedbacks are changing and how they could play out in the future.
17. Dynamic performance monitoring of an integrated climate observing system is needed with resources to address and fix problems in near-real time.
18. Providing decision support is not only a two–four year problem—the need will continue indefinitely in the future.
19. Uncertainty analysis is key to providing meaningful decision support resources.
20. Regional analyses are particularly needed by resource managers dealing with climate variability for design applications.
21. Resources are limiting the rate of progress in applied computer modeling.
22. Scenarios must integrate science insights and knowledge from other sources (e.g., indigenous perspectives).
23. The computational requirements for climate modeling could easily make use of a million-fold increase in computing power over the time period of the CCSP.
24. There is not enough emphasis on impacts and adaptation analysis.
25. Continuous scientific evaluation of technology options (especially breakthrough technologies) is needed.
26. The context of the two-center climate modeling strategy must be defined within the overall CCSP strategy.
27. An outreach strategy is needed for "multiple publics" and stakeholders.
28. Seasonal-interannual timescales should serve as test beds for elucidating the processes and mechanisms important to climate change.
29. Higher resolution (regional) models are needed for both better simulations of regional climates and users/customers who want regional details.
30. Make GCOS Upper-Air Network (GUAN) into an Upper Air Climate Reference Network.
31. Independent measurements (e.g., GPS, Lidar, proxy measurements, biological and new technologies) and multiple independent analysis groups are needed to resolve disparities in tropospheric temperature records.
32. Long-term funding, access to dedicated supercomputers, full and open access to data, and stewardship of historical data are all major challenges to observations, modeling, and information systems.

D. Next Steps After Completion of the CCSP Strategic Plan

Following the April 2003 completion of the new strategic plan, CCSP will focus on the reporting of findings and "if . . ., then . . ." analyses to the interested national and international communities. We plan to report findings using the same open and transparent approach as adopted for the *Discussion Draft Strategic Plan* and the workshop. The goal is for the Climate Change Science Program to serve as "credible fact finder" on the challenging issues associated with characterizing and, where necessary, mitigating and adapting to climate change.

IV. ANNOUNCEMENT OF A SUMMER 2003 EARTH OBSERVATION SUMMIT

As part of the Administration's plan to enhance the use of sound science, credible decision support methods, and high quality observations on oceans, climate, and ecosystems, the Administration is taking the initiative to host an **Earth Observation Summit** in Washington, D.C., in the summer of 2003. The CCSP workshop provided the starting point for this high-level event, which will serve as a foundation for reinvigorating the Earth's observing system. This activity is being coordinated through the National Science and Technology Council's Committee on Environment and Natural Resources.

Although our capability to provide global observations of the Earth system is at an all-time high, the requirements for comprehensive, integrated climate and ecosystem observations are also demanding. The investments made by the United States over the past decade through the USGCRP, as well as by our foreign partners (notably in Europe and Japan), have provided unprecedented global views of

the Earth as a complex, interacting system. However, such advances do not limit the need for highly calibrated and well-distributed in-situ measuring systems, especially in developing countries and countries with economies in transition.

The Earth Observation Summit will be significant at the international level, particularly for **meeting the needs of sustainable development and international environmental conventions** such as the U.N. Framework Convention on Climate Change.

The expected applications for a fully integrated Earth observation system are many, including natural resource management, daily weather prediction, El Niño prediction, and evaluation of climate models. The ultimate goal is transparency in the global acquisition and use of climate and ecosystem information, and better international coordination in creating the measurement and data management resources. Seamless acquisition and long-term storage of data on the Earth's biological, physical and chemical cycles—water, carbon, open ocean nutrients, atmospheric chemistry, energy balance, etc.—are essential to fill in the data gaps for more accurate modeling. Global data collection will provide earlier and better forecasts of extreme natural events that can lead to major benefits in energy use, and in food and water management.

To achieve an integrated global observing system, a significant number of developed countries and organizations must be willing to commit the necessary resources to make it happen. The Earth Observation Summit will bring together senior international governmental and nongovernmental leaders for science, technology and the environment involved in global Earth observation. We plan to invite the Science Advisors or Science and Technology Ministers of the G–8 and other developed nations to participate in the summit. We aim to join the participants in a renewed evaluation of the benefits of an integrated global observing system. We believe this summit is especially timely as all nations prepare to review the adequacy of the Earth's climate observing system at the Ninth Conference of the Parties to the U.N. Framework Convention on Climate Change in December 2003.

CLOSING COMMENT

Comprehensive, objective, transparent and well-reviewed scientific inquiry must be the core methodology used to evaluate the highly complex relationships between natural and anthropogenic influences on Earth systems, and to project potential outcomes of the many different investment and action strategies that have been proposed to mitigate or adapt to potential changes in global conditions. If we fail to fully evaluate the scientific information bearing on global change, we would be subject to the justifiable criticism that our strategy to cope with potentially our largest-ever investment in environmental management would be seen as a "ready-fire-aim" approach. CCSP will provide substantial, credible information to inform the public search for effective and efficient strategies responsive to the challenges of global climate change.

ATTACHMENTS

1. The original announcement and invitation to participate in the climate science workshop (one page) is attached.
2. The September 2002 letter report from Commerce Secretary Evans and Energy Secretary Abraham to President Bush is also attached. It provides an update on the progress on the climate change science and technology programs and the voluntary emission reduction program under the new cabinet-level management structure initiated by President Bush in February 2002.

Announcement and Invitation

U.S. Climate Change Science Program: *Planning Workshop for Scientists and Stakeholders*

The Workshop. The U.S. Climate Change Science Program will hold a comprehensive *Workshop on the U.S. Climate Change Science Program*, from December 3–5, 2002 in Washington, D.C., to receive comments on a discussion draft version of its Strategic Plan for climate change and global change studies. The U.S. Climate Change Science Program incorporating the U.S. Global Change Research Program (USGCRP) and the Climate Change Research Initiative (CCRI) is jointly sponsored by 13 U.S. Government agencies. The workshop will review the USGCRP/CCRI plans with emphasis on the development of short-term (2–5 years) products to support climate change policy and resource management decision-making.

Background. The U.S. Global Change Research Act of 1990 initiated the USGCRP that continues today as a major sponsor of global change research. In June 2001, President George W. Bush directed the USGCRP agencies to develop a focused Climate Change Research Initiative (CCRI) with the goal of accelerating the USGCRP research activities in the next 2 to 5 years, to assist in the development of public policy and natural resource management tools related to climate change issues. When finalized, the draft strategic plan reviewed during and after the workshop will provide the principal guidance for the U.S. global change and climate change research programs during the next several years, subject to revisions as appropriate to respond to newly-developed information and decision support tools.

Purpose of Workshop. The workshop responds to the President's direction that the U.S. global change and climate change science programs must be objective, sensitive to uncertainties, and well documented for public debate. The U.S. global change and climate change research programs must consistently meet the highest standards of credibility, transparency, and responsiveness to the scientific community, as well as to all interested user groups, and our international partners. To assure the continued scientific credibility of the U.S. Climate Change Science Program, the workshop will provide a comprehensive review of the discussion draft of the strategic plan. The workshop discussions, supplemented by written comments submitted during a 30-day post-workshop period, will be reflected in the final strategic plan.

Who Should Attend?

- Members of the scientific community interested in reviewing and commenting on the plans and expected deliverables of the USGCRP/CCRI research program
- Members of the climate stakeholder and resource management communities interested in commenting on the planned application of the USGCRP/CCRI scientific, economic, and energy system information to policy and resource management decisions
- Members of the international climate change community interested in reviewing and discussing the updated U.S. research and decision support plans

Workshop Topics. The workshop will include a plenary session each day, as well as the following breakouts:

- Observations, Monitoring, and Data Management
- Scenario Development and Evaluation
- Climate Models: Implementation and Application
- Decision Support Tool Development
- Atmospheric Composition
- Carbon Cycle
- Water Cycle
- Climate Variability and Change
- Ecosystem Interactions: Forcing and Feedbacks
- Human Contributions and Responses to Climate Change
- Land Use/Land Cover Change
- International Scientific Collaboration
- Public Communication of Information and Findings

Invited Keynote Speakers. Several senior U.S.-based and international science and user group leaders have been invited to be keynote speakers for the plenary sessions. A partial list of invited keynote speakers includes:

- Dr. Bruce Alberts, President, NAS
- Hon. Robert Card, Under Secretary of Energy
- Dr. Rita R. Colwell, Director, NSF
- VADM Conrad C. Lautenbacher, Administrator, NOAA
- Dr. John H. Marburger, Director, OSTP, EOP
- Prof. G.O.P. Obasi, Secretary General, WMO
- Hon. Sean O'Keefe, Administrator, NASA
- Dr. R.K. Pachauri, Chairman, IPCC

MARRIOTT WARDMAN PARK HOTEL,
2660 Woodley Road, Washington, DC.

Workshop/Reviewer Process. The workshop will include daily plenary sessions and several breakout sessions. Each breakout session will begin with a summary presentation of an element of the *Discussion Draft Strategic Plan,* and will include invited reviewer comments, as well as general attendee comments. Summary records will be prepared for every session.

Publication of the Discussion Draft Strategic Plan. The Discussion Draft Strategic Plan will be posted on the website *www.climatescience.gov* by November 11, 2002 for scientific and public review. Comments, questions and suggestions are welcomed from both scientific and stakeholder communities during and after the workshop. Comments can be submitted up to January 18, 2003.

Oversight by the National Academy of Sciences. An advisory committee appointed by the National Academy of Sciences (NAS) will undertake an independent review of the *Discussion Draft Strategic Plan,* and will give consideration to the scientific and stakeholder community comments during and after the Workshop.

Product. The U.S. Climate Change Science Program will be responsible for preparation of the final version of the strategic plan, based on its evaluation of information presented at the workshop and/or posted on its website, as well as full review of the recommendations developed by the NAS. The final strategic plan will be published in April 2003.

Sponsoring Agencies. The Departments of Agriculture, Commerce, Defense, Energy, Health and Human Services, the Interior, State, and Transportation; Environmental Protection Agency; National Aeronautics and Space Administration; National Science Foundation; Smithsonian Institution; and U.S. Agency for International Development.

Schedule. Tuesday, December 3: 9:30 a.m.–5:30 p.m.
Wednesday, December 4: 8:30 a.m.–5:30 p.m.
Thursday, December 5: 8:30 a.m.–4:00 p.m.

Registration and Logistical Information is available at the website *www.climatescience.gov.*

Questions about Workshop Objectives and Presentations:

James R. Mahoney, Ph.D.
Assistant Secretary of Commerce for
Oceans and Atmosphere, and
Director, U.S. Climate Change Science Program
workshop@climatescience.gov

THE SECRETARY OF COMMERCE,
Washington, DC, September 9, 2002

The PRESIDENT,
The White House,
Washington, DC.

Dear Mr. President:

We are writing to report on our progress since you established a new management structure to lead the comprehensive Federal climate change science and technology program. You designated that a cabinet-level Committee on Climate Change Science and Technology Integration, which we jointly lead with annual rotation as Chairman, take direct responsibility for operational oversight of the interagency programs in climate change science and technology development. The Committee's oversight function is greatly assisted by the regular participation of Office of Science and Technology Policy Director John Marburger and Council on Environmental Quality Director James Connaughton. The senior management supervision of climate science and technology development also includes the deputy secretary-level Interagency Working Group on Climate Change Science and Technology, as illustrated in the enclosed figure.

On June 11, 2001, you committed the Federal Government to pursue a broad range of strategies to address the important issues of global climate change by launching three initiatives: the Climate Change Research Initiative to accelerate science-based climate change policy development, the National Climate Change Technology Initiative to advance energy and sequestration technology development, and increased international cooperation to engage and support other nations on climate change and clean technologies. Moreover, on February 14, 2002, you com-

plemented these initiatives by calling for increased incentives to reduce greenhouse gas emissions through improvements to the Department of Energy's Voluntary Reporting of Greenhouse Gases Program. This letter provides you with an update on progress being made in these four related areas: (1) federal climate research, (2) technology development, (3) the voluntary emissions reduction program, and (4) collaborative international activities being led by the Department of State.

Federal Climate Research

Comprehensive activities are under way to accelerate the elements of our Nation's climate and global change research, monitoring, and decision tool development that will provide the most useful information to inform public discussion on climate change issues in a timely way. This work is being carried out in the new observation-rich era that is emerging as a result of the significant U.S. investments in monitoring systems that allow us to better characterize and understand the Earth system.

We have asked the Climate Change Science Program Office (CCSPO) to undertake consolidated interagency management of the U.S. Global Change Research Program (USGCRP), conducted according to the provisions of the Global Change Research Act of 1990, and the Climate Change Research Initiative (CCRI). This will ensure internal consistency of the focused CCRI studies within the larger body of global change research conducted by the USGCRP and other supporting programs.

A comprehensive interagency inventory of climate and global change research programs was initiated by CCSPO in May. This essential stocktaking exercise (the first conducted in several years) will enhance coordination, efficiency, and effectiveness of the entire research effort. All CCSPO agencies have fully participated in this inventory and these include: Department of Commerce, Department of Energy, National Science Foundation, National Aeronautics and Space Administration, Department of Agriculture, Environmental Protection Agency, Department of the Interior, Department of Health and Human Services, Smithsonian Institution, Department of State, Agency for International Development, Department of Defense, and Department of Transportation. The inventory review has also involved the Office of Science and Technology Policy, the Office of Management and Budget, and the Council on Environmental Quality. An analysis of the inventory will be completed by mid-September, and will provide important input to the specification of priority CCRI elements in FY 2004 budget planning. We are also developing metrics for each of the CCRI and USGCRP research programs so that we can effectively assess their progress.

The annual report describing the ongoing activities and plans of the USGCRP, *Our Changing Planet*, is undergoing agency review, and will be published in October. This FY 2003 edition of *Our Changing Planet* incorporates information on the CCRI, including plans aimed at accelerating the reporting of scientific information to support public discussion of climate change issues.

A fully-updated strategic plan for U.S. global change research is under development. This will be the first comprehensive update to the strategic plan for the USGCRP (and CCRI) since the original plan resulting from the 1990 Global Change Research Act was adopted. A draft of the updated plan will be made available for public comment by early November and will undergo comprehensive review by the scientific community, interested stakeholders, the general public, and interested international specialists at the *Workshop on U.S. Climate Change Science Program* to be held in Washington, D.C., on December 3–5, 2002. The workshop will "jump start" a comprehensive review of the updated research and reporting plans for U.S. global change research. The workshop will focus on key unresolved scientific issues, plans for needed global climate and ecosystem monitoring systems, and plans to develop and demonstrate decision-support tools to facilitate public discussion about climate change issues. The workshop will also review plans and schedules for future USGCRP/CCRI reports on specific findings. A final version of the strategic plan, taking account of workshop and other written comments, as well as National Academy of Sciences' review comments, will be published in April 2003.

All these activities are being carried out in support of the implementation of our new research strategy, which focuses on three broad tiers of activities: (1) *scientific inquiry*, which has been the core activity over the years, with several key uncertainties continuing to need resolution; (2) *observations and monitoring systems* which have always been a key part of the program, but have often been insufficiently integrated to support strategy analyses; and (3) development of *decision -support tools*, including detailed analyses of projected environmental, economic, and energy system outcomes of various scenarios. The CCRI activities will enhance the larger ongoing USGCRP by providing targeted focus to each of these three tiers where significant

improvements in decision-relevant information is possible during the next 2 to 5 years.

CCSPO staff is regularly involved in discussions with a wide array of members of the national and international scientific communities, and with a broad group of climate stakeholder representatives. The program office encourages comments and critiques from all sources and welcomes in-person discussions, subject only to the practical limitations of staff time. With respect to staff, the USGCRP coordinating office staff is being augmented with specialists to address the focused CCRI questions.

Technology Development

The National Climate Change Technology Initiative (NCCTI) is continuing its in-depth review of federal research and development (R&D) activities, and is developing approaches to pursue advanced technologies that can yield cost-effective means to mitigate the risks associated with climate change. The current state of U.S. climate change technology R&D is being assessed and ways to strengthen basic research, enhance private-public partnerships, and promote cutting-edge technologies are being examined. Options for improving technologies for measuring and monitoring greenhouse gas emissions are being explored by the Department of Energy and other collaborating agencies.

To find creative ways to motivate the development of innovative technologies, a process of open solicitations for technologies to compete against each other using the criteria of emissions reduction, avoidance, or sequestration potential is being pursued. This approach will help ensure that all possible options are explored.

High priority technologies that are now being pursued include: hydrogen-based energy systems, biofuels, low-speed wind turbines, fuel cells for transportation, zero net energy buildings, CO_2, capture and geologic sequestration, terrestrial sequestration research in forest management, and agricultural land management. Recent examples of progress in these areas include:

Fuel Cells for Transportation—The transport sector accounts for about one-third of U.S. carbon emissions, of which slightly more than half are from light-duty passenger vehicles. These carbon emissions from transportation can be sharply reduced or eliminated if the vehicles are fueled by hydrogen, with carbon emissions, if any, from hydrogen production sequestered. A major effort is under way to enable the development of a hydrogen production and delivery infrastructure.

Additionally, a key companion technology is the hydrogen fuel cell. The Department of Energy plans to accelerate fuel cell R&D in several areas. The new FreedomCAR research partnership will focus on developing technologies such as fuel cells and hydrogen from domestic renewable sources. The long-term results of this cooperative effort will be cars and trucks that are more efficient, less expensive to operate, and emit no harmful pollutants or greenhouse gases.

CO_2 Capture and Sequestration—Research and development to better understand the natural processes by which carbon is converted, recycled, and reused in natural systems, particularly in deep geologic settings, is being carried out. The scientific basis for large-scale carbon sequestration in geologic reservoirs, such as coal seams, deep brine fields, and oil and gas reservoirs is being studied. Research awards were recently made in this area and a consortium of fossil energy stakeholders, state and local agencies, technology developers, and university researchers is being formed to examine diverse sequestration approaches, especially in the geologic area.

Agriculture and Forestry—The Federal Government is enhancing conservation programs that have the benefit of sequestering carbon in forested areas, including their soils, and offsetting agricultural emissions of greenhouse gases. These programs include the Conservation Reserve Program, which assists farm owners and operators to conserve and improve soil, water, air, and wildlife resources by removing environmentally-sensitive land from agricultural production and returning it to long-term resource-conserving (including carbon) cover; the Environmental Quality Incentives Program, which helps producers make beneficial and cost-effective changes to cropping and grazing systems, nutrient and pest management, and conservation measures to improve soil, water, and related natural resources; the Wetland Reserve Program, which restores and protects wetlands with the result that carbon is stored in those ecosystems; and the Forest Stewardship Program, which provides additional technical and financial assistance to nonindustrial, private forest owners.

Voluntary Emissions Reductions Programs

On July 8, 2002, we joined Agriculture Secretary Veneman, and Environmental Protection Agency Administrator Whitman, in recommending improvements to the Department of Energy's Voluntary Reporting of Greenhouse Gases Program. The

primary goal of these improvements is to create a comprehensive and transparent program to report and credit real greenhouse gas reductions.

The proposed improvements also include developing fair, objective, and practical methods for reporting baselines, calculating real results, and awarding transferable credits for actions that lead to real greenhouse gas reductions. Developing such methods is central to achieving the objective of "measurement accuracy, reliability, and verifiability," as specified in your February 14, 2002, direction to the four of us.

We are aggressively pursuing improvements in the Voluntary Reporting of Greenhouse Gases Program. Elements of this process include stakeholder workshops; updating technical guidelines; public comment periods to review the revised guidelines; developing reporting forms, software, and a public-use database; and Office of Management and Budget clearance of the new reporting forms. After completion of this process, we plan to adopt new guidelines by January 2004, for reporting 2003 annual data. The process will fully engage the many stakeholders who are concerned about climate change.

In addition to improving the voluntary emissions reduction registry, the Department of Energy and the Environmental Protection Agency have been working with energy intensive companies and industry sectors to identify opportunities for cost-effective greenhouse gas reductions and to facilitate consensus building on common reporting methodologies and voluntary strategies.

Support for Collaborative International Activities

The United States continues to lead all nations in research and technology development directed at climate change. We are maintaining our support of the U.N. Framework Convention on Climate Change (UNFCCC) and the Intergovernmental Panel on Climate Change (IPCC). We are especially pleased that Department of Commerce scientist Dr. Susan Solomon was recently elected co-chair of the IPCC Working Group I, focusing on the scientific information regarding climate change.

The Department of State reports that numerous high-level interagency bilateral climate dialogues are in progress. These include support of joint climate change programs, scientific research programs, as well as technical and policy discussions in Australia, Canada, Central America (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama), European Union, India, Italy, Japan, and People's Republic of China. The Department of State leads these bilateral efforts, which involve several other agencies, including the Department of Energy, Department of Commerce, U.S. Agency for International Development, Environmental Protection Agency, Department of Agriculture, and Department of Transportation. More high-level bilateral activities are expected in the near future, including joint research and cooperation with Brazil, Mexico, Republic of Korea, Russian Federation, South Africa, and Ukraine. In addition, the Departments of State and Energy co-chair a newly established interagency Task Force on International Energy Cooperation to oversee collaborative efforts on the research, development and deployment of current and emerging cleaner energy technologies.

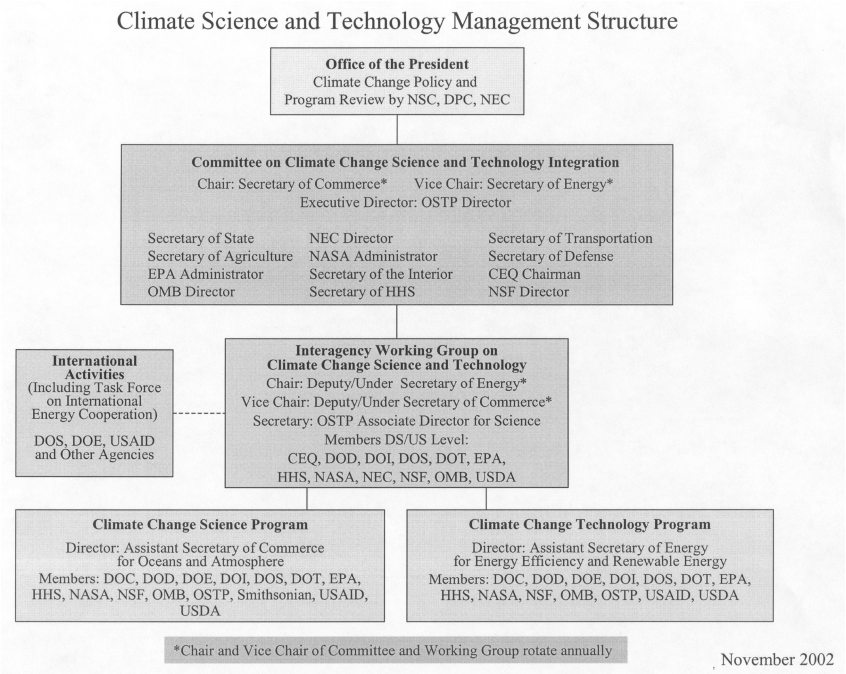
U.S. obligations under the UNFCCC are being met through broad-based interagency activities in many other countries. These include diplomatic engagements (including Ministerial meetings), institution and long-term capacity building (an example is U.S. support for development of climate offices in the Ukraine), education and training on key issues of significance to the United States (such as international workshops on monitoring of greenhouse gases), technology-focused support and assistance (for example, the June U.S.-Indo workshop on fuel cells), and mitigation programs (such as methane emissions reduction and improved forest management practices). Additional international efforts include recent meetings with the Asia-Pacific Economic Cooperation (APEC) and representatives from several European nations to develop support for a global observing system, and numerous initiatives to transfer clean energy technology to developing and transition countries, measure greenhouse gas emissions, promote improved land use to capture and store carbon in soils and plants, assess potential impacts of climate change in other countries, and develop capacities to adapt to potential climate change. We are also promoting tropical forest conservation through the Tropical Forest Conservation Act, thereby helping to address the world's greenhouse gas problem through the storage of carbon in tropical forests.

Our interagency activities will continue on a very active path forward, involving science and technology improvements, substantial enhancement of the Emission Reduction Program, and rapidly increasing international collaboration to address the important issues associated with climate change. We will provide similar updates on our progress every 6 months, and more frequently when warranted by specific developments.

Respectfully,

DONALD EVANS,
Secretary of Commerce, and Chairman of the Committee on Climate Science and Technology Integration

SPENCER ABRAHAM,
Secretary of Energy, and Vice-Chairman of the Committee on Climate Science and Technology Integration



Senator MCCAIN. Thank you very much, Dr. Mahoney. And your complete statement, which is a very detailed and helpful one, will be made a part of the record. Thank you for appearing here today.

As you've heard discussed a couple of times here, we've—according to your organization, NOAA's data, the 2002 average global temperature was the second warmest on record. The ten warmest years have all occurred since 1987, with nine of them since 1990. The Greenland ice sheet suffered from the greatest surface melt in the 24-year satellite record in 2002. Many are predicting the global average temperature in 2003 will match or exceed the record 1998 temperature. I could go into many other manifestations of this situation, such as 70 percent of the coral reefs in the world dying, et cetera. Some of those stories are anecdotal; many of them are backed with scientific evidence.

How do you explain the significance of all this data?

Dr. MAHONEY. Well, Mr. Chairman, first, I'd begin by noting your opening statement began with a quote from the National Academy of Sciences report, the report requested by the Administration in 2001. I'd note that the same quote begins my statement about our strategic plan. And I think there's a commonality here. That is, we have a body of evidence. We asked the academy to review it. The IPCC—the Intergovernmental Panel on Climate Change—has reviewed this extensively. The U.S. is a major participant there. We're deeply involved in the Fourth Assessment Report-planning for IPCC these days.

And in all of that body of evidence, I think we could draw a conclusion and the President has drawn this as well—that is that we do have evidence of global climate change.

I think it's important to cite that there are substantial uncertainties about causes. And because of that uncertainty about causes, there's also substantial uncertainty about the mitigation methods that might be effective in time. So I would not use the time of this committee to try to debate the question of whether there is any evidence of global change. I believe that the President has said that there is, and I believe he has laid out a program that is aimed at trying to address, on the science side, questions of how can we better understand it. And let's understand, in particular, what we do about it, because that's not easy to see. And he has laid out a program to enhance these technology initiatives and a program of a series of steps that are intended to reduce the emissions that would occur otherwise.

So on the—on the point you started with, and I'll stop my answer there, I wouldn't—I wouldn't presume to argue your basic point back to the Committee.

Senator MCCAIN. Well, I guess—I know that you know that what I'm trying to get at here is—the National Academy of Sciences went on to say that greenhouse gases are accumulating in the Earth's atmosphere as the result of human activities, causing surface air temperatures and sub-surface ocean temperatures to rise. And I think, in all fairness, we cannot rule out that some part—some significant part of these changes is also a reflection of natural variability. But they conclude that it's a result of human activities.

And the criticism that has been directed at your very noble efforts is that the U.S. has invested about $20 billion over the last ten years in research in this area, and yet, as I understand it—and perhaps you can help me out here—the Administration's position is that we need to do more research, rather than take concrete action. Is that an inaccurate characterization of what you're doing?

Dr. MAHONEY. Senator McCain, I believe it's inaccurate. I think neither you nor I would argue against more research in its place, so I'm not going to say that I have a problem with that part. Yes, we need more research, for a number of reasons, but I fundamentally dispute the concept that there is no action being taken by this Administration otherwise.

Senator MCCAIN. What action could you tell me is being taken?

Dr. MAHONEY. I think there's substantial action underway in the technology development area. I think there's substantial action underway in the voluntary emission-reduction program.

And I would note one part of that, because I've had the chance to participate in the Administration's senior management review and development—the developments of that plan—I am delighted, under American jurisprudence that we are beginning with a voluntary program among companies, and there are many—there are, for example, 31 corporations now in the EPA Climate Leaders Program, who are willing to join the 1605(b) major emission-reduction program voluntarily right now.

In my view, if we started at the beginning with a mandatory program, I would see the possibility of years of litigation about the "devil-in-the-details" kind of issues. How do we credit things when a company sells a division or closes this or opens something else, and the like? I believe——

Senator MCCAIN. They're doing that pretty successfully in Europe—not mired down in litigation with a cap-and-trade practice in the European countries.

Dr. MAHONEY. Well, I—my comment included the comment of the American jurisprudence system. It's my observation that we might well see, under property-rights arguments, major challenges to some of those issues under a mandatory system. I personally believe that we have the opportunity to prove concepts by engaging those companies—and there are many—who are willing to take this up effectively at this time.

Senator MCCAIN. Well, I thank you, Doctor. We just, I guess, have a fundamental difference of opinion. I don't think a voluntary program meets the urgency of the situation. I just don't envision that, it would be bogged down in lawsuits because we pass laws all the time that require certain actions to be taken in order to comply with the law.

But I thank you. I do appreciate all the work that you're doing. I'd be interested in hearing more about the technology that's being developed. But I would hope also, that the Administration, in its deliberations, would look at what's being accomplished in Europe in the cap-and-trade business, which, according to predictions, could be as much as a $10 billion business in a few years.

I thank you for appearing today, Dr. Mahoney, and we look forward to working with you.

Senator Wyden?

Senator WYDEN. Thank you, Mr. Chairman. I will tell you, with all due respect, Dr. Mahoney, I just don't think these workshops are going to cut it. I think when you look at what comes out of them, there's just no "there" there when it comes to really dealing with the problem. And the question I'd like to start with is what evidence, short of flooding of the National Mall, would persuade the Administration to actually support a cap on greenhouse gas emissions?

Dr. MAHONEY. Well, Senator, with respect, I think you're asking me to take my role in a science program and do something sort of above my pay grade to say how the policy decisions are made relative to balancing the very substantial economic dislocations that may relate to some of these climate change initiatives. For example, just to cite a data point rather than to take only that point, some of the projections relative to complying with the Kyoto agreement that have been produced outside of government in the last

few years project annual costs, in current dollars, of $400 billion forever. I would think, as a citizen, that any administration would want to be very careful about looking at the issues of economic dislocation, and finding the best technology solutions to develop policies here. If it came down to a bumper sticker, it would come down to the issue about what exactly should we do? And I think honest people can disagree about what exactly ought to be done.

Senator WYDEN. Well, certainly honest people can disagree. The problem is, nobody in the world agrees with us. I mean, you keep talking about international cooperation, and I'm hunting and pecking for somebody who's anxious to pursue the approach the Administration wants with us.

Let me ask you about something that clearly relates to the science agenda. In 1992, the United States signed and ratified the U.N. Framework Convention on Climate Change. It set goals stabilizing greenhouse-gas concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system. It said such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change.

Now, we had testimony in this committee last summer, and it's also in the Climate Action Report, that greenhouse gas emissions are going to increase by 43 percent between 2000 and 2020. So, in your scientific opinion, has our country even met the goal that was laid out in 1992? That's, in effect, a decade ago.

Dr. MAHONEY. Well, the goal that was laid out in 1992 turns on a definition of "dangerous impact," and I think those issues are very much in debate. Is the U.S. on a path today that will reduce total greenhouse gas and total CO_2 emissions now and over the next few years? Not directly by the actions now. I agree with that statement.

I would also note, since you've made the reference about other nations, I noticed in the paper the other day, Italy's population is 38 million today. It's projected to be 31 million by 2012. Italy will have little difficulty in meeting the Kyoto goal, for example, because it will have almost 25—or will have 20 percent fewer people. Germany has a stable population. The U.S. has a massively growing population. So there are considerations about what is equity, and what do we measure when we talk about meeting these goals and we look among our international partners.

Senator WYDEN. Are you counting Italy now as coming out for the Administration's approach?

Dr. MAHONEY. No, Senator. I was——

Senator WYDEN. Everywhere I look, Dr. Mahoney, I see scientists who say you have to go further than the Administration's approach. The world is saying that you have to go further. The reason I asked you about other nations is, I think that's an important measure. The world thinks we're sitting on the sidelines and if you can maybe furnish for the record some evidence from other countries, I would find that useful, because I think it's very telling. The President is right to stress international cooperation as a way to deal with a variety of problems. The world does not agree with our position, and they do not agree by an overwhelming majority.

To pursue this question on science issues, you all, at the recent climate conference, had Dr. Warren Washington, the Director of

the National Science Board, stated, and I'll quote here, "We should start doing something now. We should get started even though we don't have all of the answers now." What would be your response to that? At a minimum, it seems to me, you've got a chance to use the science that is out there now. Senator Brownback, Senator Craig and I have put bipartisan bills in front of you, bills that are backed by significant segments of American industry—agriculture, the technology sector, the farming sector—these are bipartisan bills. Isn't what Dr. Warren Washington said at your climate conference something that would justify going beyond where the Administration is today?

Dr. MAHONEY. Well, let me start by saying I have the highest regard for Dr. Warren Washington. I've worked with him closely for many, many years. He is a great American scientist. His view, therefore, has a lot of weight.

At the same time, I would note that Dr. Washington is speaking about this in a capacity, looking at part of the issue. I think it's fair to say that government has to look at the issue of, how we make the progress we need to make while balancing many other real concerns, including the health of the economy, on the matter.

As the President pointed out in his statement a year ago, it's axiomatic that advanced environmental control only occurs when economies are healthy. And we see that around the world. I have no dispute with Dr. Washington saying this, but I don't think that that especially represents the view of an administration responsible for balancing many considerations.

I'm not here to argue for or against a particular course of action. I want to make it clear, my responsibility is to lay out what we know about the science. We're trying our very best to do that.

Senator WYDEN. My time is up. I would only say, Secretary Mahoney, while nobody disputes, here, the value of research—and we are going to support continuing it—when people like Warren Washington, whom you say you respect and have attested to your admiration for today—said it's time to go beyond that, I hope that somehow this will serve as a wake-up call for the Administration.

I thank you.

Senator MCCAIN. Senator Burns?

Senator BURNS. Thank you, Mr. Chairman.

You pretty much answered, Dr. Mahoney, the—most of the elements of the Administration's strategic plan for the program, and I understand that there are numerous subjects that come out of the workshop that you have identified for further study. Could you give me a list of—or give me an idea of some of those things on that list and what you think must be done?

Dr. MAHONEY. Yes, Senator Burns, I'd be glad to. And I'll try to do it in quick form so that you can use——

Senator BURNS. Okay.

Dr. MAHONEY.—use your time well.

I'll start with the idea, if I have to put things on a bumper-sticker level, what we want out of all the science is the issue of, what exactly should we do? What are the courses that can get us the protection we need at the best cost and the best effectiveness on both a short- and then a long-term basis?

But then, in terms of specific questions and comments, you have, probably, my written statement. And pages 11 through 13 of that—and I'll say for the—for anyone who's listening, otherwise, this is all on the website, too, so it's all fully available—we've been asked to really deal with cross-cutting links, look at issues between ecosystem impact and climate impacts in both directions. We've been asked to really focus on identifying the kinds of technologies that can make a big difference.

Let me give an example about that. A move of—take CAFE limits—Corporate Average Fuel Economy limits—well-known to this Committee. If we were to increase the CAFE limits, there's no doubt that brings an environmental and a greenhouse-gas benefit. But if we take, in a generation's time—15 or 20 years—petroleum-based engines out of motor vehicles, in favor of hydrogen fuel cells, then we take almost a third of the greenhouse gas emissions off the table for the U.S. And so, the kind of issue for us to project is, How far should we go with incremental increases or incremental improvements that get incrementally and quickly more costly, versus how much should we, in fact, look at the opportunities, as the Administration is doing through DOE with the FreedomCAR, with the major motor vehicles manufacturers and this kind of issue?

And I think there are many other examples. I would cite, again, we got many comments back about—we have a great panoply of environmental and climate data. We can do much better providing climate information to help the water-resource management that you mentioned, and forestry management. Almost independent of what's changing over 10 or 15 or 50 years, we know now and we can do a better job of designing transport systems, dam systems, and all the rest, and we've been pushed to provide more of that. And I think that that's a real benefit for the Nation.

Senator BURNS. Also recommended out of this workshop, was a global observation system. Do you support that idea? And how would we deploy such a tool?

Dr. MAHONEY. Yes. I strongly support it. And I want to point out at the outset that the U.S. has been absolutely the world leader in developing and implementing a global observing system over the last decade and even in the decades before that.

I'd cite the work of NASA, in particular, and my own agency, NOAA. Of course, we all are familiar with the weather and oceanographic stations and NASA's satellite stations. There's been much development and implementation of a great system already. But the more we look, the more we agree that what we need to do is take the other step to make sure that we really get the data together, get the observations and the requirements for them together, and get the data quality and its archiving and its ability to be accessed together, so that we can really look at trend information, going forward.

To give one very specific example, El Niño, the great biennial oscillation that was discovered in the 1980s, until that appeared, because of observations, no one was even thinking about the possibility that there were two-year cycles in our weather. As you know, we're back in an El Niño condition right now. We're seeing massive storms on the West Coast and the like. That has opened our eyes about phenomena that we never knew, that greatly influence agri-

culture, water management, and all the rest, around the world, not only in the U.S. We believe there are more benefits coming from this, and this is why the Administration is taking the lead on behalf of the U.S. to really bring the rest of the world here to Washington at the highest government level to discuss these issues in preparation for the U.N. session that will run in December of this year so that we can take some concrete steps by then.

Senator BURNS. We are nearing—we are nearing enough nations signing the Kyoto Protocol recommendations. And will you also be making plans—once Russia decides that this is a good thing for their country and is ready to make the offer of some responsibility for their contribution to the greenhouse situation; once China makes up its mind that it wants to—as do all the countries around the world—to put into place some mandatory conditions that we might observe in this country?

Dr. MAHONEY. Well, I think there are some very big "ifs" in that, Senator.

Senator BURNS. There are always "ifs."

Dr. MAHONEY. Well, as you know, the Kyoto Accord sets no requirements for emission reduction in the developing nations. And so, China, India, Brazil, Indonesia, and so forth, have no requirements under the Kyoto Accord to control anything. The requirements fall on the developed countries. That was one of the big concerns. It was the reason that this Senate voted 95-to-nothing to advise the President in 1997, just over five years ago now, that it would—but it did not prefer signing that—or did not prefer the U.S. joining in that Accord. I think there's a big hypothetical on the issue that, as we understand from our science, from our monitoring, and from some very challenging issues of international equity about what works for five years, ten years, and what works in the long-term, I have no doubt that the discussions will continue about what's the best path forward. But the view has been that the Kyoto Accord, uniquely relative to the U.S., would have a very heavy adverse effect in its current form. Even if Russia signs and the Accord comes into force, I don't see that the Administration—and I know it's the President's position, not—would go forward to then become a signatory to that. I think that, like anything else, the issue is on the table as to—as we learn, what is the right path forward.

Senator BURNS. Well, may I follow up with just one question?

It's my observation that, even though we find the Kyoto Accords somewhat unacceptable in this country, I do not believe it serves the issue very well or this country very well just to stop talks on the international level on what we can do and should do. I think those talks and that dialogue have to continue.

And I thank you, Mr. Chairman.

Senator MCCAIN. Thank you, Senator Burns.

Senator Sununu?

Senator SUNUNU. Thank you, Mr. Chairman.

One point of clarification there. You mentioned countries, developing countries, that weren't included in Kyoto—China, Brazil, India, Indonesia—but I think it is the case, while they're not bound by any reductions, they do get to vote to ratchet up the reductions on all of the signing countries. I think they get a vote. And when

a level—a certain level of countries—I think 75 percent of the countries, including developing countries—vote to make a change in the treaty, then that change would go into effect. So while they're not bound by any reductions, as I've come to understand the treaty, they actually do get a vote to change the terms of the agreement.

You mentioned the voluntary program in the United States that you've been working on. How do you measure the success of that program?

Dr. MAHONEY. We measure the success of it by inventorying reductions in emissions. And we are in the process of running the development of those activities, right now engaging dozens and dozens of industries across the country. And I know the comment—I'd also measure this by a sense of, can we get something in operation and get it moving very quickly? And "quickly," when we think of making major corporations move and we think in the Washington sense, is probably a year or two; it's not this week or this month.

I note, by comparison, after "Superfund" passed, it was almost a decade before there was nearly any clean-up because—there was so much litigation about the endpoint standards and all the rest of it. So my measure of success in the voluntary program is that if, in a reasonable time—and I would take "reasonable" to be in the range of about two years; hopefully quicker—but if, within a couple of years, we can show real progress, I think that is much faster than the time-scale we might see with a prescribed mandatory program. That's why I feel that working——

Senator SUNUNU. Sure, that—your time table is two years——

Dr. MAHONEY. Yes.

Senator SUNUNU.—to achieve real progress, I guess. And my question was, how do you measure progress?

Dr. MAHONEY. The progress is measured specifically by reductions in the total emissions, or the net emissions——

Senator SUNUNU. The sort of aggregate reductions in emissions.

Dr. MAHONEY. That's right. The CO_2, typically, or all greenhouse gases.

Senator SUNUNU. And what would be your goal for aggregate reductions in that two-year period?

Dr. MAHONEY. Well, the goal, I think, is better stated in the President's goal which is the 18 percent reduction in intensity—or, in other words, an 18 percent improvement in emission efficiency—by the year 2012. And it's our intent to meet that goal, which is a very onerous one, for the U.S.

Senator SUNUNU. So, are you going to measure progress by aggregate emissions or by a reduction in intensity? Those are really two different measurements, aren't they?

Dr. MAHONEY. Both measurements will be fully available. They convert one to the other, although the conversion is not all that easy. But I——

Senator SUNUNU. I'm trying to make it easy for you, though. If you sort of pick one and then focus on one, and then you don't achieve the other, you're less—much less likely to come back here, whether I'm still a Senator or not, and have someone say, "Aha, but you didn't achieve the other. Even though you reduced the intensity, aggregate output increased."

Dr. MAHONEY. The primary measure, because it's consistent with the Administration's program, is intensity. And we also will be reporting aggregate reductions overall. But the primary measurement is intensity.

Senator SUNUNU. Where does the United States rate today, compared to all other countries, on intensity? We know we are responsible for 25 percent. I assume that means aggregate. We emit more CO_2 than any other country, but where do we rate in terms of intensity?

Dr. MAHONEY. To give the honest answer, I can't. I don't know, so I don't want to guess, Senator.

Senator SUNUNU. And I assume intensity is, what, output of CO_2 per dollar of economic output, or——

Dr. MAHONEY. Per——

Senator SUNUNU.—per BTU?

Dr. MAHONEY.—per dollar of economic output. But I would note one thing that I do know, that the intensity in the U.S. improved 12 percent through the 1990s, and we're projecting under the President's plan, another 18 percent improvement in that—in the period out to 2012.

Senator SUNUNU. Could I ask you to put together a summary of intensity, at least for a select number of countries, including the United States, so we can see—given that you've said this is the measure by which you will determine whether you're successful or not, I would think we'd want to know—at least how we're doing compared——

Dr. MAHONEY. I would be——

Senator SUNUNU.—with some other countries.

Dr. MAHONEY. I'd be delighted to.

Senator SUNUNU. Thank you very much.

Senator MCCAIN. Senator Nelson. And before Senator Nelson—well, Senator Nelson, go ahead.

STATEMENT OF HON. BILL NELSON, U.S. SENATOR FROM FLORIDA

Senator NELSON. I would defer to you, Mr. Chairman.

Senator MCCAIN. Go ahead.

Senator NELSON. You mentioned NASA. We're going to have a global surveillance ready in NASA by 2004. What's going to be their contribution to your overall efforts at measuring climate change?

Dr. MAHONEY. Well, NASA is the biggest single contributor to this overall climate change program right now because of the major role NASA plays with its spacecraft observations, with the Mission to Planet Earth series and the Whole Earth Observation series of satellites and data analysis.

I'd just add, Senator, that NASA does much more than simply observe. NASA provides first-rate science, analysis, and computer models in its work, as well, so it is a major contributor to the national effort.

Senator NELSON. Mr. Chairman, you will know that global warming will have as much effect on my State as any with the vast coastline, with most of the population of Florida being on the coast, with the fact that, even though we're a land called "Paradise,"

we're a peninsula sticking down into the middle of something known as "Hurricane Highway," and the fact that global warming will increase the intensity of storms and their frequency, not even to speak of pestilence, as a result of a warm climate, and not even to speak of the question of the coral reefs. Does this Administration agree that global warming has resulted in the bleaching of coral reefs?

Dr. MAHONEY. Well, I don't know that I'd want to make the broad statement that, "the Administration agrees." I don't know if that has been brought to the attention of the whole Administration. Does the science support the argument that there is bleaching? I would say yes, the weight of evidence is that there is evidence of bleaching. I would dispute some of the percentage numbers we've seen, but I think that there's persuasive science that suggests this is a concern.

Senator NELSON. Well, there's a fellow named Lautenbacher.

Dr. MAHONEY. Yes.

Senator NELSON. Is he the NOAA administrator?

Dr. MAHONEY. Yes. Admiral Conrad Lautenbacher is my immediate boss. He's administrator, I am deputy at NOAA.

Senator NELSON. Well, he said that the U.S. was ten years away from a definitive answer on the causes of climate change. Now, you have an enormously impressive background in public health. What do you think about waiting ten years, and the public health risk, to get around to some definitive answer on the causes of climate change?

Dr. MAHONEY. Well, Senator, I don't know the context in which the ten-year reference was made. I think reasonable people could easily say—for example, if we're talking about really understanding better what we've got and what the causes are and all the rest, I could understand many people, myself included, who might say—you know, we need ten years to get there. So, I want to be somewhat careful about that hypothetical.

I'd go back to what I said a few minutes ago, and that Senator McCain, in his opening comments from the chair made—that is, the Academy report is pretty clear, President Bush was very clear in his statements in 2001, and it is our view that there is real evidence of global change, and that it is seen to be likely that there are significant human effects, but there is also substantial uncertainty about their scope and about what would make a difference.

Senator NELSON. And do you think that carbon dioxide from fossil fuels is the dominant contributor to this change that you just mentioned?

Dr. MAHONEY. It is most likely the most important contributor. Probably the next-most important contributor—and maybe 50 to 60 or 67 percent in importance at the extreme is CO_2—is the existence of aerosols in the atmosphere, the fine particles, especially aerosols that result from basically low-temperature combustion in home heating units and the like that are used literally by the hundreds of millions in many developing countries around the world.

We have major research underway right now about the so-called "Asian Brown Cloud" issue, which has major health effects, as well as climate impact. It has been tagged with Asia because of the ob-

vious sources in China and India and Indonesia, but it is not unique to that area.

So, when we talk about the greenhouse gases, they're the whole set, basically carbon-based gases including carbon dioxide, methane, many others of the higher hydrocarbons. But the aerosol contribution is one of a special note. And when we talk about strategies for improving and protecting public health and improving the safety of the world, part of the issue for us, as a science question, is, how well can we sort these things out? Because we are at the verge of making very substantial global investments, the better we can understand what will get us improvement and protection, and what is better than something else, the better we'll do that job.

Senator NELSON. You know, the United States has a PR problem abroad, with other countries, because they don't think we're serious about doing something about climate change. And in part, a good bit of that impression was due to how we handled the Kyoto proposal. If you were handling Kyoto over, how would you do it, Dr. Mahoney?

Dr. MAHONEY. Well, I'll give you a personal opinion if I can use my phrase that "it's above my pay grade," because I never forget—and it's not a cop-out—but government has to balance many things. I'd start from the matter that when that Accord was negotiated, there was a typical cliffhanger, twelfth-hour negotiation about that. I'd like to think, personally, I would not have gotten to the endpoint that we signed, to when we agreed to the Kyoto Accord in the first case. So that's where I would start my handling of it.

I'd next note that—the 95-to-nothing vote by the Senate saying, "This isn't right for the U.S.," and then go forward from there.

And I'm aware that we have a PR problem. I believe that we are engaging our partner nations in any number of forums these days on these issues. We have a vast array of bilateral and multilateral partnerships right now, and I think we understand the issues. I think we expect to see our colleague nations understand the seriousness of our commitment to move forward in a number of areas and, in particular, to advance technology. And, very much in the sense of what Senator Lieberman said in his opening comments here too, hopefully this will be to the benefit of the American economy by bringing more production and primarily-good production here to the American economy in the technology area.

Senator NELSON. Thank you, Mr. Chairman. Did EPA refuse your invitation to come?

Senator MCCAIN. Declined.

[Laughter.]

Senator MCCAIN. Senator Ensign?

STATEMENT OF HON. JOHN ENSIGN, U.S. SENATOR FROM NEVADA

Senator ENSIGN. Thank you, Mr. Chairman. Just a brief opening—a couple of comments.

There is, obviously—I think most of the scientific world believes that there is significant global warming going on. There is, I think, a question, as far as the human factor, that you've pointed out, and I think that's one of the most important questions to answer, from a scientific perspective, because that's really what we can control.

We can't really control natural causes. And when we look historically, there are major climatological changes, historically—we can see that in the polar icecaps and the history of the various thicknesses that have gone on over geologic time.

But regardless of how or what the scientific evidence shows on global warming and the human effect, I think that there are great arguments for us to try to get less dependent on fossil fuels anyway, simply from a strategic standpoint. I think there's a very strong argument that the amount of money that we spend keeping oil flowing to the United States from outside of the United States—there are very, very strong arguments that it makes us less safe as a country. Certainly much of the terrorism that's financed around the world seems to be, at least, coming from certain parts of the world, and especially it empowers some of those states to have state-sponsored terrorism. It improves their coffers, I guess, is the best way to say it.

And so, I actually think that it's important for us as a country, to look—even if global warming weren't occurring, for us to look toward becoming less dependent on fossil fuel, as you mentioned, fuel cells. There are many other ways, obviously, and potential technologies that we can look at for the future, and I think it's very important that this body, and this Committee, in particular, and your agency—look at how we can, as a Government, partner with the private sector in developing and bringing some of these technologies to the marketplace. We need to ensure that people will use them and where they're convenient—where they can actually become mass-marketed instead of just, one fleet of cars here, or whatever it is—becomes a regular part of our everyday lives.

And I agree with Senator Lieberman's comments and others that talk about how that actually can be a huge benefit to our economy, simply because if we can develop those technologies, other countries are going to want those, and that can really help us try to export some of those technologies. So, I'm encouraged by some of the comments that the Administration is wanting to go in that direction, and I want to work with the Administration and my colleagues who share some of the same visions, because I think it's absolutely critical that we do this as a Nation.

You know, global warming can be controversial to all the people it wants to be controversial to, but when we look at this strictly from a security standpoint, in my opinion, regardless of how you feel about all the other arguments, you can agree that we need to go that direction simply from a security standpoint.

Just any comments you have.

Dr. MAHONEY. Well, Senator, first of all, thank you. I appreciate the comments. And, they are something that are very agreeable to me in my personal view, certainly, and I think—the view of the Administration, as well. I would note, at this workshop last month, we were delighted to feature some discussions that were led by representatives of a major international corporate group led by ExxonMobil, who has just made a commitment of $100 million for technology-development work in a program that they are sponsoring after a competition that's led by Stanford University. And that represents the private sector getting money into our major academic institutions specifically looking to advance technologies in those

areas which are of this nature, generally breakthrough technologies—not incremental changes, but a different way to do things. We are in the process of working very closely, happy to say, that's private and university. We won't co-opt and slow it down with bureaucracy, but we're doing all we can to collaborate with them. We'll be having other ongoing collaboration. We're making sure that we provide access to our information and our facilities as much as it can help that whole program. So, that's one example of this thing.

And I'd mention the example—when you look at the sectors that lead to—that bring greenhouse gases to the atmosphere in the U.S. economy—and these proportions are different in other places—the manufacturing sector in the U.S. is 25 percent. It's down a lot. And we'll squeeze more out the next few years. That's part of what's happening. But the motor vehicle sector, and transportation sector, generally, continue to increase, and they are now 30 percent and growing.

And so, I'd just suggest the thought of an experiment that instead of cutting 30 percent to 27, 26, 25 percent, we could cut from 30 percent to zero over 20 years by changing our technology and eliminating the use of motor vehicles—or of oil—petroleum—to drive those vehicles, we'd be on the right track. And it's fascinating that Exxon-Mobil, in that business, is supporting this kind of technology development. I think they'll have plenty of market for petroleum products around the world—in fact, maybe a more stable market if we can see some of these things move in that direction. So, I hope we'll see an era of substantial increase in this kind of private-public-academic cooperation.

Senator ENSIGN. Well, thank you, Mr. Chairman. I appreciate your leadership on this. These are very important hearings to have, and hopefully we can look to solutions in the future. Thank you.

Senator MCCAIN. Thank you, Senator Ensign.

Senator Wyden has a 30-second issue.

Senator WYDEN. Thank you, Mr. Chairman.

Just on the nature of research, in 1992, Dr. Mahoney, the U.N. Convention said we ought to stabilize greenhouse gas concentrations at a level that would prevent dangerous interference with the climate system. What is your definition of a dangerous level of emission?

Dr. MAHONEY. Senator, I think—I used "capstone issue" in my statement today. I used it in the workshop. I would say, in this field, that's a "capstone issue," and it's part of the difficulty we have. If you look around the world right now, it's not just a U.S., but a global problem. Everybody's wrestling with this.

We know some things. We know that CO_2 concentrations—to use that as the best surrogate—have gone from 280 parts per million pre-industrial time to 360 parts per million, and we expect them to go up much more. Begs the question, should they be back to 280 someday? Should they be 360, 400, 500, 600, 700? Our British colleagues, who are actively working on emission reductions, as you know, are exploring the 400-, 500-, 600-type scenarios. No one, to my knowledge, has a good handle on that yet, and I hope that our research and debate will help surface that question more.

I don't mean to duck it, but it's one where no one has wanted to play the first card so far, and we have to deal with that question, whether it's by that measure, or by the measure of the effects in the world.

Senator MCCAIN. Thank you, Dr. Mahoney. Let me just tell you what bothers me a little bit about the voluntary thing before we close here. And there's an article by John Fialka in the *Wall Street Journal,* The Bush Administration's, Mr. Samuel Bodman, whom you work with, "Deputy Secretary at the Commerce Department, said U.S. emissions are expected to grow by 30 percent during the next decade, resulting in a net increase of 12 percent if the Bush target is achieved." That's a little disturbing.

But I want to thank you, Dr. Mahoney, for being here today. We look forward to working with you. And I think that the event that you held recently was very helpful in educating a lot of people about the issue, and I—we look forward to working with you. Thank you for appearing here today.

Dr. MAHONEY. Thank you, Senator. Thank you, Senator Wyden.

Senator MCCAIN. Alright. The last panel will be Ms. Eileen Claussen, the President of The Pew Center on Global Climate Change, Mr. Jack Cogen, President of Natsource; Mr. Fred Krupp, President of the Environmental Defense Fund; and Mr. Randy Overbey, the President of ALCOA Power Generating, Incorporated.

I'd like to welcome all of our witnesses. Thank you for your patience. It's obvious that this issue has a lot of attention from many of the members.

Ms. Claussen, we'll begin with you. Welcome.

STATEMENT OF EILEEN CLAUSSEN, PRESIDENT, PEW CENTER ON GLOBAL CLIMATE CHANGE

Ms. CLAUSSEN. Thank you very much, Mr. Chairman, Senator Wyden. It's a pleasure to be here.

My name is Eileen Claussen, and I'm the President of the Pew Center on Global Climate Change, a nonprofit, nonpartisan organization dedicated to providing credible information, straight answers, and innovative solutions in the effort to address climate change.

The Pew Center, and the 38 companies that comprise its Business Environmental Leadership Council, accept the view of most scientists that enough is known about the science and environmental impacts of climate change for us to take action now. Although the climate change issue must ultimately be addressed globally, the United States must take responsibility for its own emissions, currently 24 percent of the global total.

Let me begin by describing efforts in other countries to address climate change. Virtually all industrialized nations have committed themselves to reducing their greenhouse gas emissions, most to levels below their emission levels in 1990. Despite U.S. opposition to the Kyoto Protocol, the United States' closest allies, including the European Union, Canada, and Japan, support the Protocol and have moved forward with ratification. The Protocol is likely to enter into force later this year, when Russia is expected to ratify it.

In anticipation of entry into force, and on a parallel track, governments are deeply engaged in developing and implementing domestic policies to meet their Kyoto targets and are looking to emissions trading to help them do so. Last month, for example, the European Council reached an agreement on the establishment of a mandatory trading system for carbon dioxide. This system will encompass all the member states of the European Union, including the ten approved for new membership in 2004. Member states overcame some political differences to reach agreement on this system, and its operation will provide valuable lessons for the future of greenhouse gas emissions trading.

We are seeing activity in developing countries as well. China, India, Mexico, Brazil, and others, are undertaking measures, including market and energy reforms, fuel switching, and pollution controls that have had the indirect effect of reducing the growth of their countries' combined greenhouse gas emissions by nearly 300 million tons a year.

In the United States, the greenhouse gas targets set by national policy will, in fact, allow for continued significant growth in emissions for at least the next decade, estimated at 30 percent over 1990 levels by 2012. But at the State level, steps are being taken to reduce emissions. At least two-thirds of the states have programs that, while not necessarily directed at climate change, are achieving real greenhouse gas emission reductions. For example, Texas and 11 other states require electric utilities to provide a certain amount of power from renewable energy sources. And actually, Governor Pataki today said that New York would join those States and will set a renewable portfolio standard. So, it'll be Texas plus 13—plus 12.

New Hampshire, Oregon, and Massachusetts are regulating carbon dioxide emissions from power plants. Nebraska, Illinois, North Dakota, Oklahoma, and Wyoming are taking steps to allow agricultural interests to sell stored or sequestered carbon as a commodity. California has enacted a law to require reduction of greenhouse gases emitted from cars, sport utility vehicles, and light-duty trucks. State leadership in addressing climate change has been striking.

Equally striking, I think, has been the leadership demonstrated by the private sector. Forty major corporations with substantial U.S. operations have established voluntary greenhouse gas reduction targets. These efforts are substantial and commendable, but they are hardly enough. The companies that are truly committed to tackling climate change know that we will never achieve the deep emission cuts necessary unless everyone moves far enough and fast enough in the right direction, and that will happen only when the Government requires it.

In this context, the draft bill we are discussing today represents an important milestone. Its enactment would establish a comprehensive national framework that would put the United States on a path toward significant long-term emission reductions. The draft act incorporates several critical features. It would establish ambitious environmental goals through binding caps on greenhouse gas emissions. It would provide companies the flexibility they need to reduce emissions as cost-effectively as possible, allowing emis-

sions trading across sectors, gases, national borders, and providing credit for carbon storage through sequestration. It would take a phased approach, allowing time for the capital and technology investments needed to achieve deeper emissions cuts over the long term, and it would seek to treat all affected parties fairly, recognizing the reductions of those who have taken the lead in reducing their emissions and assisting consumers, workers, and communities affected by climate change policy.

As with any legislation this far-reaching and complex, there is room for debate on the specifics, even among those who share the act's objectives and support its broad approach. Nonetheless, the draft act offers a solid foundation for crafting an effective national climate policy that draws on America's strengths, and begins to fulfill its responsibility to protect our global climate.

We appreciate the vision and leadership that you have shown with Senator Lieberman in drafting this bill, and look forward to providing any assistance that might be useful to the Committee as it proceeds to act on it.

Thank you.

[The prepared statement of Ms. Claussen follows:]

PREPARED STATEMENT OF EILEEN CLAUSSEN, PRESIDENT, PEW CENTER ON GLOBAL CLIMATE CHANGE

Mr. Chairman and Members of the Committee, thank you for this opportunity to testify regarding the draft American Investments for Reduction of Emissions Act of 2003. My name is Eileen Claussen, and I am the President of the Pew Center on Global Climate Change.

The Pew Center on Global Climate Change is a non-profit, non-partisan, and independent organization dedicated to providing credible information, straight answers, and innovative solutions in the effort to address global climate change. Since 1998 the Pew Center has published 43 peer-reviewed reports—aimed primarily at policymakers and opinion leaders—on the science and environmental impacts of climate change, the economic costs and benefits of climate change policies, domestic and international policy alternatives for addressing climate change, and technology options for reducing greenhouse gas emissions. Thirty-eight major companies in the Pew Center's Business Environmental Leadership Council (BELC), most included in the Fortune 500, work with the Center to educate the public on the risks, challenges, and solutions to climate change. The BELC companies do not contribute financially to the Center.

The Pew Center accepts the view of the great majority of scientists that enough is known about the science and environmental impacts of climate change for us to take action now. As noted in 2001 by the National Research Council of the National Academy of Sciences, "[g]reenhouse gases are accumulating in Earth's atmosphere as a result of human activities, causing surface air temperature and subsurface ocean temperature to rise."[1] The potential consequences of this warming include sea-level rise and increases in the severity or frequency (or both) of extreme weather events, including heat waves, floods, and droughts, with potentially major impacts to U.S. water resources, coastal development, infrastructure, agriculture, and ecological systems.[2] We consider the risk of these and other consequences sufficient to justify action to reduce greenhouse gas emissions significantly. Moreover, much of this action must occur in the United States, which produces 24 percent of global emissions, making it the world's largest greenhouse gas emitter. U.S. greenhouse

[1] "Climate Change Science: An Analysis of Some Key Questions," Committee on the Science of Climate Change, National Research Council, 2001.

[2] Wigley, T.M.L., 1999, *The Science of Climate Change: Global and U.S. Perspectives,* Pew Center on Global Climate Change; Neumann, J.E., G. Yohe, R. Nicholls, and M. Manion, 2000, *Sea-Level Rise and Global Climate Change: A Review of Impacts to U.S. Coasts*, Pew Center on Global Climate Change; Frederick, K.D. and P.H. Gleick, 1999, *Water and Global Climate Change: Potential Impacts on U.S. Water Resources*, Pew Center on Global Climate Change.

gas emissions are expected to grow by 12 percent by 2012 under current Administration policy.[3]

The Pew Center also believes that the cost to the United States of meeting a given emissions target can vary substantially depending on the policy approach taken. In general, the most cost-effective approaches allow emitters flexibility in deciding how to meet a target; provide early direction so targets can be anticipated and factored into major capital and investment decisions; and employ market-based mechanisms, such as emissions trading, to achieve reductions where they cost the least.

The Pew Center welcomes this opportunity to share its views on the draft American Investments for Reduction of Emissions Act of 2003, which, when introduced, will be the most significant piece of climate change legislation ever put before Congress. To provide some context for the Committee's review of this draft legislation, I would like to begin with an overview of climate change efforts already being undertaken by other countries, as well as by states and industry here in the United States.

Because climate change is a global challenge that requires a global solution, I think it is important that a discussion of U.S. policy start with a full understanding of how the issue is being addressed elsewhere in the world. I would like to emphasize two points: virtually all industrialized nations have now committed themselves to reducing their greenhouse gas emissions; and most view emissions trading as an essential component of their climate change strategies.

More than ten years ago, at the Earth Summit in Rio de Janeiro, the United States joined other nations in approving the United Nations Framework Convention on Climate Change. Recognizing that additional efforts were necessary to effectively address climate change, the parties subsequently negotiated the Kyoto Protocol, which sets binding emission targets for industrialized countries. While far from perfect, the Protocol represents a significant diplomatic achievement. Largely at the insistence of the United States, the Protocol includes several innovative mechanisms to ensure that emissions are reduced as cost-effectively as possible, chief among them an international system of emissions trading.

The present U.S. Administration has made clear it will not submit the Kyoto Protocol to the Senate for ratification. Nevertheless, other countries, including the United States' closest allies, continue to support the Protocol and have moved forward with ratification. Last month, Canada became the 100th country to ratify the agreement. Apart from the United States, Australia is the only country to state explicitly that it is not prepared to ratify the Kyoto Protocol. However, the Australian government remains committed to meeting its Kyoto emissions target and has not ruled out ratifying the treaty at a future date. The Protocol still must be ratified by Russia in order for it to enter into force. Russia has announced its intention to ratify the treaty, and is expected to do so later this year.

On a parallel track, governments are deeply engaged in developing and implementing domestic policies to meet their Kyoto targets. Japan, for instance, has set national targets for carbon dioxide and for other greenhouse gases, and is developing more than 100 measures to improve energy efficiency, promote renewable energy, enhance carbon sequestration and advance other efforts to reduce emissions. In addition, the Canadian government recently adopted a comprehensive plan that calls for binding emissions reduction agreements with industry, increased government support for technology research, and targeted measures such as energy efficiency standards.

Some countries are contemplating emissions reductions well beyond those required under the Kyoto Protocol. The German government has said it is prepared to reduce emissions 40 percent below 1990 levels by 2020, provided other countries agree to steeper cuts as well. In the United Kingdom, the Royal Commission on Environmental Pollution is recommending a 60 percent reduction in U.K. emissions by 2050, and Prime Minister Blair has called for a similar reduction worldwide.

Each of these countries is pursuing a strategy tailored to its national circumstances, such as its energy mix, regulatory culture, and economic profile. And each, it is worth noting, is looking to emissions trading to help meet its target. Some may rely primarily on the international trading system established under the Kyoto Protocol, while others are developing domestic systems of their own. The European community, which at first viewed U.S. arguments for emissions trading with deep skepticism, is now leading the way in establishing greenhouse gas markets. In Denmark, a cap-and-trade system regulating carbon emissions from the power sector was enacted in 1999. Last year, the U.K. became the first country to introduce a

[3] "Pew Center Analysis of President Bush's February 14th Climate Change Plan," Pew Center on Global Climate Change, 2002, available at http://www.pewclimate.org/policy/response—bushpolicy.cfm.

broad-based greenhouse gas trading system. While voluntary in nature, the U.K. system provides strong incentives for companies to take on binding emissions targets. These and other systems are still in their early stages, but the volume of trading is rapidly increasing. A recent World Bank study projected that the number of greenhouse gas credits traded worldwide would increase four-fold from 2001 to 2002. In the first trade under the Kyoto system, a Japanese firm last month purchased 200,000 credits from which Slovakia intends to invest the proceeds in domestic emissions reduction projects.

One of the most significant steps in the development of the greenhouse gas market came last month when the European Council reached agreement on the establishment of a European trading system for carbon dioxide. This system, which is subject to final approval by the European Parliament, will encompass all the member states of the European Union (including the ten approved for new membership in 2004), which have a combined economy larger than that of the United States. In its initial phase, the system will cover six sectors—including electric utilities, steel producers, and oil refiners—which together account for nearly half of Europe's carbon dioxide emissions. Individual member states will set targets and allocate allowances among their emitters, and facilities that fail to meet their targets will face significant penalties. The system is designed to be compatible with the Kyoto system and with other national systems, but trading will be permitted only with countries that have ratified the Kyoto Protocol. Member states overcame strong political differences to reach agreement on this system, and its operation will provide valuable lessons for the future of greenhouse gas emissions trading.

I would like to offer one final note on what is happening internationally. As you know, one of the chief criticisms of the Kyoto Protocol is that it does not establish greenhouse gas emissions limits for developing countries. Whether or not one believes the Kyoto Protocol is fair in this respect—and I happen to believe it is—I think the more important question is whether or not developing countries are in fact taking steps to limit their emissions. The Pew Center recently undertook an analysis of climate change mitigation in six developing countries, including China, India, Mexico, and Brazil.[4] We identified many measures underway in those countries that, while not necessarily motivated by climate concerns, are significantly reducing the growth of their greenhouse gas emissions. We calculated that these measures—which include market and energy reforms, fuel switching, and pollution controls—have reduced the growth of these countries' combined greenhouse gas emissions by nearly 300 million tons a year. These findings suggest significant opportunities to further reduce emissions growth in developing countries while helping them to achieve stronger economic growth and other development priorities.

Clearly, significant greenhouse gas reduction activities are occurring abroad, but U.S. states are undertaking important activities as well. In fact, the recent state leadership in addressing climate change has been striking. At least two-thirds of the states have programs that, while not necessarily directed at climate change, are achieving real greenhouse gas emissions reductions. Measures that have proven controversial at the Federal level, such as renewable portfolio standards and mandatory reporting of greenhouse gas emissions, have been implemented at the state level, often with bipartisan support and little controversy.

The Pew Center recently published a report on state initiatives to reduce greenhouse gas emissions.[5] This report found that Texas and eleven other states have enacted legislation that requires utilities to provide a certain amount of renewable power as part of their total offering of electricity. Texas has also established a Renewable Energy Credits (RECs) Trading Program that gives utilities considerable flexibility in meeting the requirement. Under this market-based program, every certified renewable energy project in Texas produces one credit for every kilowatt-hour of electricity that it generates. These credits can be purchased by electricity providers to meet any shortfall in their own generation of renewable energy. A carbon cap-and-trade program would work on the same principle.

Important work is being done in other states, as well. New Hampshire and Massachusetts have recently started directly regulating carbon dioxide emissions from power plants. Nebraska, Illinois, North Dakota, Oklahoma, and Wyoming are linking agricultural policy with greenhouse gas reduction, and are taking steps to allow agricultural interests to sell stored, or "sequestered," carbon as a commodity. California has enacted a law to require reduction of greenhouse gases emitted from cars,

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[4] Chandler, W., R. Schaeffer, Z. Dadi, P.R. Shukla, F. Tudela, O. Davidson, and S. Alpan-Atamer, 2002, *Climate Change Mitigation in Developing Countries,* Pew Center on Global Climate Change.

[5] Rabe, B., 2002, *Greenhouse & Statehouse: The Evolving State Government Role in Climate Change,* Pew Center on Global Climate Change.

sport utility vehicles (SUVs), and light-duty trucks. And the New England governors have joined with the premiers of the five eastern provinces of Canada in committing to reduce regional greenhouse gas emissions to 1990 levels by 2010 and to ten percent below 1990 levels by 2020.

There are similar examples of leadership in industry. A growing number of companies are voluntarily committing themselves to greenhouse gas reduction targets. At last count, the Pew Center had identified more than 40, most either based in the United States or with significant U.S. operations. BP, for example, has reduced greenhouse gas emissions to 10 percent below 1990 levels—eight years ahead of target—and now has pledged to keep them there at least until 2010. Alcoa is working to reduce its greenhouse gas emissions by 25 percent below 1990 levels by 2010. DuPont is aiming for a 65 percent reduction below 1990 levels, also by 2010.

The Pew Center recently studied several companies that have taken on targets and found they are motivated by several things.[6] They believe the science of climate change is compelling. They know in time the public will demand strong climate protections, and they can get ahead of the curve by reducing their emissions now. They want to encourage government policies that will work well for business. They also cite one other important motivation: To improve their competitive position in the marketplace. That, in fact, has been the result. The companies are finding that reducing emissions also helps to improve operational efficiencies, reduce energy and production costs, and increase market share—all things that contribute to a healthier bottom line. While addressing climate change is not necessarily profitable, the evidence so far suggests it is certainly affordable.

To summarize: Other countries are moving forward to address climate change, and, in the United States, states and companies are exercising leadership to fill the void left by inaction at the federal level. In this context, I believe the draft American Investments for Reduction of Emissions Act of 2003 represents an important milestone in the effort to ensure that the United States does its part to address global climate change. Its enactment would establish a comprehensive national framework that would put the United States on a path toward significant long-term emissions reduction.

The draft Act incorporates several features that would be critical to the success of a national climate change strategy. First, it would establish ambitious environmental goals through binding caps on greenhouse gas emissions. Recognizing the need for reductions from all the major sectors, the Act would apply this cap economy-wide, providing an important signal to key players throughout the economy to increase energy efficiency and develop alternative fuels and technologies to reduce greenhouse gas emissions.

Second, the Act would provide companies with the flexibility they need to reduce emissions as cost-effectively as possible. It would establish a rigorous nationwide system allowing emissions trading across sectors, gases, and national borders, and would provide reasonable credit for carbon storage through sequestration.

Third, the Act would take a phased approach that respects economic realities. As mentioned, our work has demonstrated that there are many cost-effective—in fact, cost-saving—opportunities to reduce emissions in the short- and perhaps medium-term. However, achieving the emissions cuts ultimately needed to avert the most adverse consequences of climate change is not a cost-free proposition. The Act's phased approach would take advantage of the relatively easy steps now readily available, while allowing time for the capital and technology investments needed to achieve deeper emissions cuts over the long term.

Finally, the Act would seek to treat all affected parties fairly. It would recognize the real and verifiable reductions of those who have taken the lead in reducing their emissions, and would provide assistance to consumers, workers, and communities affected by climate change policy.

As with any legislation this far-reaching and complex, there is significant room for debate on the specifics, even among those who share the Act's objectives and would support its broad approach. Nonetheless, we believe the draft Act offers a solid foundation for crafting an effective national climate policy that draws on America's strengths and begins to fulfill its responsibility to protect our global climate. We appreciate the vision and leadership shown by Senators McCain and Lieberman in drafting the American Investments for Reduction of Emissions Act of 2003 and look forward to providing any assistance that might be useful to the Committee as it acts on the bill.

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[6] Margolick, M. and D. Russell, 2001, *Corporate Greenhouse Gas Reduction Targets,* Pew Center on Global Climate Change.

Senator McCAIN. Thank you very much, Ms. Claussen. Thank you for all your hard work on this issue.

Mr. Cogen?

STATEMENT OF JACK COGEN, PRESIDENT, NATSOURCE

Mr. COGEN. Good afternoon, Mr. Chairman and Mr. Wyden. Thank you for inviting me to testify.

My name is Jack Cogen, and I am the President of Natsource, LLC, an energy and environmental commodity broker headquartered in New York City. Natsource also has offices in Europe, Japan, Canada, and down here in Washington. We're among the largest brokers in environmental commodities, including SO_2, NO_X, and greenhouse gases.

My testimony today will focus specifically on the greenhouse gas trading provisions of the draft legislation entitled Market Investments and Reductions of Emissions Act 2003.

At the outset, I want to acknowledge the wide range of opinion as to what is the most appropriate policy response to address climate change. Natsource does not take a position on whether or how much greenhouse gas emissions should be reduced. Rather, the draft legislation that's the subject of this hearing reflects the view that a relatively broad cap with emissions trading is the most appropriate response.

Based on my company's experience with emissions markets, the most effective trading programs generally have the following characteristics: They are cap-and-trade systems with well-defined emissions limitations. They provide significant compliance flexibility. They feature strong enforcement provisions and penalties to ensure compliance and instill confidence in the program. They are relatively simple. They provide companies with the certainty—and I can't emphasize that enough—the certainty they need to plan and implement cost-effective strategies over time.

The remainder of my statement will address the extent to which the draft bill, specifically Title I, is consistent with these elements. Of the various emissions trading markets in which Natsource participates, the Acid Rain Program and the NO_X OTC Budget Program have been among the most effective, because they establish a well-defined emissions cap for regulated sources.

Similarly, the draft legislation would establish a well-defined emissions cap. Assuming effective enforcement, the overall emissions reductions required by these caps can be anticipated with a high degree of certainty. Legislation would also need to provide clearer guidance regarding allocations so that covered entities would have more certainty to plan long-term investment and compliance strategies.

I should point out that the draft bill would allow the Secretary of Commerce to revisit the level of the emissions caps. While this provision may be desirable because of the evolving state of knowledge about climate change, it nonetheless leaves open the possibility that emissions-reduction requirements could change in the future. This would substantially increase the difficulty of making forward sales, which are essential for the financing of abatement investments.

Emissions trading provides compliance flexibility that allows participants to seek out low-cost emissions reductions. In both the Acid Rain Program and the NO_X Budget Program, cost savings have been estimated in the billions of dollars, largely because of considerable flexibility provided by emissions tradings and robust markets.

Several provisions contained in the draft bill would help to lower costs compared with less flexible approaches. First, the scope of the trading program would take advantage of lower reduction costs in some sectors. Second, the ability to bank unused allowances for future use would enable sources to optimize the timing of their emissions-reduction activities. Third, allowing U.S. emitters to purchase approved allowances from abroad provides a potentially cost-effective compliance option, as does sequestration.

However, imposing quantitative limits on the ability of U.S. companies to use emissions allowances from other nations would restrict access to a potentially cost-effective supply of reductions and raise the overall cost of the emissions-reduction program. The draft bill would also limit the use of sequestration credits; likewise, contributing to higher costs.

Violations are rare in the Acid Rain Program and the NO_X OTC Budget Program because of effective compliance provisions that have created confidence in the value of the tradeable commodities and contributed to the development of a robust allowance market. In my view, the proposed bill's emissions monitoring provisions, greenhouse-gas allowance tracking system, and penalties for excess emissions would provide an adequate deterrent to potential violators.

The relative simplicity of the Acid Rain Program has contributed to the development of a robust SO_2 allowance market and significant cost savings. In contrast, the NO_X Budget Program's cost savings have been constrained by complex banking provisions and uncertainty about future requirements under the NO_X SIP Call, which have made emitters more reluctant to engage in potentially beneficial trades. The draft bill generally appears to be consistent with this need for simplicity.

That concludes my remarks, Mr. Chairman. I want to commend you and Senator Lieberman for recognizing the importance of market mechanisms to achieving cost-effective emissions reductions. You and other lawmakers will ultimately decide whether a cap-and-trade system for greenhouse gases should be adopted in the U.S.

I'd be glad to respond to questions. Thank you.

[The prepared statement of Mr. Cogen follows:]

PREPARED STATEMENT OF JACK COGEN, PRESIDENT, NATSOURCE

Good afternoon, Mr. Chairman and Members of the Committee. Thank you for inviting me to testify. My name is Jack Cogen and I am the President of Natsource LLC, an energy and environmental commodity broker headquartered in New York City. Natsource also has offices in Europe, Japan, Canada, and Washington, D.C.

Description of Natsource and Its Experience in Climate Change

Natsource facilitates physical and derivatives transactions of electricity, natural gas, coal, emissions permits, emissions reductions, and renewable energy certificates. Natsource's Greenhouse Gas (GHG), Renewable Energy, Strategic Services, and Brokerage Unit utilizes the company's first-hand knowledge of energy and envi-

ronmental markets, and its domestic and international public policy expertise on global climate change and related environmental issues, to provide consulting and strategic services to corporations, international financial institutions, and governments seeking the most recent information on markets and policy trends to shape their strategies.

Natsource has developed one of the largest brokerage operations of environmental commodities in the world, with brokers and policy experts in the United States, United Kingdom, Canada, Australia, and Japan. We are among the largest brokers of sulfur dioxide and nitrogen oxides in the United States and of renewable energy certificates and greenhouse gases in the world. In 2002, Natsource brokered the first swap of UK and Danish greenhouse gas allowances, and in 2001, brokered the first transactions in allowances from the UK and Danish greenhouse gas emissions trading programs—the world's first greenhouse gas trading systems. In 2000, Natsource brokered first-of-their-kind transatlantic and transpacific greenhouse gas transactions and the largest transatlantic greenhouse gas transaction.

Recent Greenhouse Gas Market Activity

A recent review of international greenhouse gas emissions trading conducted by Natsource for the World Bank concluded that market activity between 2001 and June 2002 significantly increased in volume when compared to the previous 5 years. The report was commissioned by PCF*plus*, the research arm of the World Bank's Prototype Carbon Fund. Natsource provided a similar analysis for PCF*plus* in 2001 that reviewed market activity from 1996 to 2001.

Our key conclusions from the report include: (1) approximately 40 million metric tons were traded between 2001 and June 2002, compared to the 55 million metric tons that Natsource estimates were transacted between 1996 and 2001 and nearly doubling total market volume; (2) the first trades of greenhouse gas compliance instruments occurred in the UK and Danish markets; (3) trading of reductions generated from projects undertaken in Latin America, Asia, and Africa increased; (4) trading of reductions generated by fuel switching, energy efficiency, and renewable energy increased; and (5) Verified Emissions Reductions traded in the range of US$1 and $5 per metric ton of carbon dioxide equivalent, while UK allowances traded as high as US$18.60 (L12) per metric ton of CO_2e. The trading volume estimates provided by Natsource are conservative. Other market participants have estimated higher levels of trading activity.

The trend in increased trading activity will likely continue in the future as national, regional, and international greenhouse gas emissions trading programs develop over the next five years.

Comments on Draft Legislation

My testimony today will address draft legislation entitled the "American Investments for Reduction of Emissions Act of 2003" from the perspective of my company's considerable experience with greenhouse gas emissions trading, as well as trading in sulfur dioxide and nitrogen oxide allowances. My comments will focus specifically on Title I of the bill, "Market Driven Greenhouse Gas Reductions," and the extent to which the trading design and mechanisms in the bill will facilitate achieving environmental and economic objectives.

Natsource provides strategic counsel and brokerage services to its clients, but the firm does not take a position on whether or not greenhouse gas emissions should be reduced. Many of our clients have their own views about this question and engage Natsource to provide advice and analytical support for assessing and managing financial risk caused by limitations on greenhouse gas emissions.

At the outset, I want to stipulate that the single most irrefutable fact about climate change is that there is a wide range of opinion as to what is the most appropriate policy response to address climate change. Trading is but one means of achieving emissions reductions. There are others such as regulatory measures, research and development into new technologies and financial incentives. This testimony does not address the efficacy of those but focuses on our company's experience in emissions markets. The draft legislation that is the subject of this hearing reflects a view that a relatively broad cap-and-trade system is an economically efficient mechanism to reduce greenhouse gas emissions. This would be the first piece of legislation in Congress that proposes to extend greenhouse gas emissions reduction requirements beyond the electric utility sector, which was the focus of legislation introduced by Senators Jeffords and Carper in the 107th Congress. With Title I of the draft bill as the framework for an emissions reduction program, my testimony will address provisions that deal with greenhouse gas emissions trading and markets, particularly the extent to which the bill's provisions represent an economically efficient, market-based system for reducing greenhouse gas emissions.

It is also important to note that simplicity is one of the most important elements necessary to create an efficient market. If the private sector is provided with a target and a workable policy framework, for the most part, experience has shown they will figure out how to achieve cost-effective compliance with their emissions limitations. The more complex the policy framework and the more constrained the market, the greater compliance costs will be. My testimony looks at those essential elements necessary to create a workable trading market.

Capping Emissions

Of the various emissions trading markets in which Natsource participates, the Acid Rain Program and the NO_X OTC Budget Program have been effective in achieving significant reductions at low cost. One of the key features that these two successful programs share is a well-defined "cap," or a maximum mass-based limitation on regulated sources' emissions in a given year. The cap allows regulated firms to plan their investment and production decisions more efficiently based on the value of emissions reductions.

These emissions caps have been essential to ensuring that the programs achieve tangible and predictable environmental benefits. For example, in the case of the Acid Rain Program, the Environmental Protection Agency (EPA) reports that in 2001, regulated emissions sources reduced their aggregate emissions by approximately 39 percent relative to 1980 levels, or 33 percent relative to 1990 levels.[1] In contrast, the environmental performance of trading programs that utilize limits other than caps is considerably less certain.

The greenhouse gas emissions trading system envisioned in the bill currently under consideration recognizes the importance of a well-defined emissions cap. It would require emissions sources in four key emitting sectors of the economy to reduce their greenhouse gas emissions to 2000 levels by 2010 and to 1990 levels by 2016. Assuming effective enforcement of the system's provisions, the emission reductions required by these caps can be anticipated with a high degree of certainty from the system's outset.

Flexibility

The great advantage of emissions trading relative to alternative policy approaches is the flexibility provided to sources to determine how best to comply with their emissions limitations. Under an emissions trading system, emitters may choose either to reduce their own emissions or to acquire surplus allowances from another emitter that managed to over-comply with its own emissions limitation. Whenever emitters face different internal emissions reduction costs, this opportunity to trade creates a win-win situation for both buyers and sellers. Companies purchasing allowances are able to comply with their emissions limitation more cheaply than if they had been required to carry out internal emissions reductions, and companies selling allowances are able to reap a financial gain from improving their environmental performance. The financial benefits can then be used to invest in additional emissions reductions. For example, in 1998 and 1999, Public Service New Hampshire used proceeds from the sale of NO_X allowances to finance the installation of equipment that has significantly reduced their NO_X emissions.

In both the Acid Rain Program and the NO_X Budget Program, cost savings have been estimated in the billions of dollars, owing largely to emitters' ability to trade with one another, or to use other compliance options, and to save or "bank" unused allowances for future use. In addition, the opportunity to bank allowances has motivated significant over-compliance in both programs. During the first 7 years of the Acid Rain Program, for example, regulated sources had exceeded the required level of SO_2 emissions reductions by a cumulative total of 9 million tons.[2]

Several emissions trading provisions contained in the draft bill should help to achieve cost savings in reducing greenhouse gas emissions. First, the envisioned greenhouse gas trading program would apply to a broad range of economic sectors that face different internal emissions reduction costs. It is these differences in internal abatement costs among firms and sectors that make gains from trade possible. Second, the ability to bank unused allowances for future use and, conditional on achieving additional future reductions, to "borrow" future allowances for current use would enable sources to optimize the timing of their emissions reduction activities in order to achieve maximum environmental benefit at minimum cost. For example, the banking provision in the Acid Rain Program has allowed emitters to achieve a significant savings in compliance costs while planning for future compliance costs

[1] Environmental Protection Agency (2002) "Acid Rain Program—2001 Progress Report," Office of Air and Radiation, November, Washington, D.C.

[2] Ibid.

in an effective fashion. Third, internal emissions reduction costs vary considerably from country to country. Allowing emitters based in the U.S. to take advantage of these cost differentials by purchasing allowances from abroad should further reduce compliance costs. Finally, sequestration of carbon dioxide is another cost-effective option for reducing atmospheric concentrations of greenhouse gases. Sequestration activities, such as reforestation, also yield additional co-benefits such as preservation of wildlife habitat. The bill's provision, granting credit for sequestration activities, would provide an incentive for emitters to carry out such activities.

Limitations on Flexibility

In light of the many benefits associated with the flexibility inherent in emissions trading, I should note the bill's constraints on the use of allowances acquired from abroad and of credits generated through sequestration activities. We know that the location in which greenhouse gas emissions reductions occur is immaterial to the level of global greenhouse gas emissions. However, from an economic perspective, the location in which reductions occur is of considerable importance, since countries and facilities within countries face different internal emissions reduction costs. The ability of U.S. companies to take advantage of international cost differentials while meeting their collective emissions limitation depends on their having the ability to seek emission credits from abroad without constraints. The proposed quantitative limits on the import of credits would raise the overall costs of achieving the program's greenhouse gas targets by reducing the extent to which U.S. companies would be able to access this potential source of lower cost reductions. Limitations on the use of sequestration credits would have a similar effect in raising overall reduction costs. I should point out that the U.S. opposed all qualitative and quantitative constraints on flexibility in international climate change negotiations recognizing that constraints increase the costs of compliance.

Ensuring Compliance

Sources and regulators must know that there will be clear penalties for non-compliance with emissions limitation requirements. During the seven years since the Acid Rain Program began, only two sources have violated their emissions limitations. In a program whose 2001 emissions cap amounted to 9,553,657 tons of SO_2, the eleven tons of excess emissions involved in these two violations point to an outstanding record of compliance.[3] The program's financial penalties for non-compliance provide significant incentives for compliance. Similarly, violations in the NO_X OTC Budget Program during 2001 amounted to a mere 57 tons of NO_X out of a total allocation of 195,401 tons.[4] The rarity of violations in these two programs can be attributed to the existence of effective compliance provisions. These include an accurate emissions reporting system, a simple and reliable system for tracking sources' holdings and transfers of allowances, and strong financial penalties for those sources that exceed their emissions limitations. In addition to ensuring the programs' environmental integrity, these strong compliance provisions have also helped to assure potential market participants of the value of the programs' tradeable commodities, thus making possible the cost savings associated with development of a robust allowance market.

In my view, each of these compliance provisions is addressed in the bill under consideration. The bill's emissions monitoring provisions, greenhouse gas allowance tracking system and penalties for excess emissions would provide an adequate deterrent to potential violators.

Simplicity and Regulatory Certainty

Emitters' willingness to engage in emissions trading depends largely on their understanding of the trading program's provisions and on their confidence that they can plan their future operations according to the nature of those provisions. The simplicity and high level of regulatory certainty under the Acid Rain Program are two reasons for the development of the program's robust and mature emissions allowance market. Emitters in the program understand how trading can benefit them, and they optimize their future operations on the basis of this knowledge. As a result, cost savings have been significant.

In contrast, cost savings under the NO_X Budget Program are probably somewhat smaller than they might otherwise have been because of complexity and regulatory uncertainty in the program. Complex banking provisions have caused emitters to "leave value on the table" by declining to engage in potentially beneficial trades

[3] Ibid.

[4] Environmental Protection Agency (2002) "2001 OTC NO_X Budget Program Compliance Report," Office of Air and Radiation, March 26, Washington, D.C.

whose implications were difficult to understand. Uncertainty about the relationship between the status of the NO_X OTC program's successor program, the "NO_X SIP Call," made it hard for emitters to anticipate what reductions would be required of them in the future, and this uncertainty reduced emitters' ability to reduce compliance costs by optimizing their emissions reduction investments over time.

Generally speaking, the greenhouse gas trading system outlined in the draft bill appears to be consistent with the need for simplicity. I would urge the Committee to keep this need in mind, as well as the need for regulatory certainty regarding allocations, as legislation is debated.

Closing

In closing, Mr. Chairman, I want to commend you and Senator Lieberman for your efforts to develop legislation that relies on market mechanisms to achieve cost-effective greenhouse gas emissions reductions. My company's experience in emissions markets suggests that the draft bill contains useful provisions that would help to achieve this objective. Continued refinement of key provisions, especially those relating to flexibility, is important to assuring an economically efficient emissions trading program.

Thank you again for the opportunity to testify. I look forward to responding to any questions you or the other Committee Members might have and to providing any insights that the firm has in market design as development of the legislation proceeds.

Senator MCCAIN. Thank you very much, Mr. Cogen.

Mr. Krupp, welcome.

STATEMENT OF FRED KRUPP, PRESIDENT, ENVIRONMENTAL DEFENSE FUND

Mr. KRUPP. Thank you, Mr. Chairman.

Senator McCain, Senator Wyden, my name is Fred Krupp, and I am President of Environmental Defense Fund, a nonprofit group representing more than 300,000 members.

Since 1967, we have used science and economics to find new solutions to the most serious environmental problems. I appreciate the chance to testify today on one of the most urgent of those problems, global climate change. I'm pleased this hearing focused on the impressive proposal, the Climate Stewardship Act of Senator McCain and Senator Lieberman to tackle that problem.

The threat of global warming touches America's bedrock values, including responsible stewardship for the environment and care for future generations. The greenhouse gas emissions we add to the atmosphere today will remain there for decades. Over time, the resulting climate change will range from the undesirable to the catastrophic. Effects like increased storms and droughts, the disappearance of glaciers, and sea-level rise so severe that the entire National Mall here in Washington could be flooded regularly are well within the range of outcomes scientists tell us we might expect. This is a legacy few Americans want to leave for future generations. To avoid such a future, substantial reductions in greenhouse gas emissions must begin now.

Climate change is a man-made problem and can be addressed by people's actions. Fortunately, America has a history of attaining strong environmental protection with continual economic growth. Curbing greenhouse gas emissions is not only imminently affordable, but can also bring a host of benefits. The McCain-Lieberman bill would deliver actual reductions in emissions below current levels by the middle of the next decade.

The world has a narrow time window. Failure to begin reducing emissions within the next decade could foreclose the chance to

avert dangerous global warming. Every year of delay is like playing another round of global climate roulette.

Opponents of mandatory greenhouse gas reductions often claim they would stifle economic growth, but the McCain-Lieberman bill will foster innovation and stimulate lowest-cost reduction thanks to its ambitious use of emissions trading and flexibility. The legislation emulates one of the most successful environmental programs in U.S. history, the Federal Acid Rain Program. And I might point out, in response to Dr. Mahoney, that after that program was passed into law, there was an absolute minimum of either administrative or judicial litigation.

The bill will tap American ingenuity by creating an emissions-trading market that integrates virtually every major economic sector, including transportation, agriculture, and forestry. This breadth is crucial in making the legislation efficient and effective.

Our belief in what this bill can achieve is a reflection of our own experience. Working in a Partnership for Climate Action, Environmental Defense Fund has partnered with eight of the world's largest corporations successfully pursuing their own commitments to reduce and cap their greenhouse gas emissions. For example, DuPont pledged to cut its emissions by 65 percent by 2010. It has reached and surpassed that goal nine years ahead of schedule, enjoying a savings of $1.65 billion.

We believe Senators McCain and Lieberman made the right choice in allowing farmers and landowners to opt to participate in the greenhouse gas reduction market. Investments in the land-use sector can provide a critical supply of cost-effective high-yield emissions-reduction opportunities like carbon sequestration.

We believe the legislation should establish criteria for what will be considered valid carbon sequestration projects and credits. I look forward to working with the sponsors to design those standards.

The bill's use of emissions trading and flexibility will allow even greater and earlier greenhouse gas reductions to be more affordable. Taking advantage of this, and tightening the reduction levels in the time table now in the bill will only enhance its value.

Some will say this bill is unrealistic, that it cannot be done, that we do not know enough to act, that the future is uncertain. For too long, such complaints have stopped us from doing anything. But it most emphatically can be done. It must be done, and it will be done. To accept anything less would be to abandon our responsibility to the environment and to generations yet to come.

Thank you.

[The prepared statement of Mr. Krupp follows:]

PREPARED STATEMENT OF FRED KRUPP, PRESIDENT, ENVIRONMENTAL DEFENSE FUND

Introduction

Mr. Chairman and members of the Committee, my name is Fred Krupp and I am President of Environmental Defense Fund, a national nonprofit organization based in New York, representing more than 300,000 members. Since 1967 we have linked science, economics and law to create innovative, equitable and cost-effective solutions to the most serious environmental problems.

I appreciate the opportunity to testify here today on what Environmental Defense considers one of the most urgent environmental problems of our time—global climate change. I am very pleased, moreover, that the focus of the hearing is the impressive proposal offered by Senators McCain and Lieberman (shared with Environ-

mental Defense in draft form on December 20) to tackle that problem. Finally, I am particularly grateful to this Committee for the previous hearings it has conducted to create a sound, well-balanced record of scientific understanding of global climate change.

Thanks to those hearings, I know that my testimony on the McCain-Lieberman legislation will be considered against a backdrop of increased understanding. First, there is strong scientific consensus that human activities contribute substantially to the buildup of heat-trapping greenhouse gases (GHG) in the atmosphere. Second, if GHG emissions continue to rise, the world will face increasingly devastating environmental disruptions affecting not only our most precious natural ecosystems but also, potentially, the world food supply and human health.

This state of affairs challenges our American values and our American ingenuity. Fortunately, I believe that, taken as a whole, the McCain-Lieberman bill is a serious and credible response.

Later in this testimony, I will address a number of concerns that we have, some quite serious, with particular provisions in the bill. For now, however, I think Senators McCain and Lieberman and their staffs should be congratulated for putting together comprehensive legislation that could form the basis of a successful strategy for addressing global climate change.

Climate Change and American Values

Our success in this endeavor will require responsible environmental stewardship—one of the bedrock values held by Americans.

The GHG emissions produced by the first automobile that rolled off the assembly line in Detroit are still in the atmosphere. Each new ton of greenhouse gases emitted today will reside in the atmosphere for decades. Over time, the resulting warming will change the climate—and the environment—in countless ways. Impacts could range from the die-off of coral reefs and the loss of vital fisheries to sharply increased cycles of storms and drought. Sea level rise could be so severe that the entire National Mall here in Washington would be flooded regularly. That this could be the legacy of our own everyday actions is a notion that few Americans alive today would knowingly tolerate. America's commitment to caring for our natural heritage prompts us to demand that our national leaders take responsible actions to help curb global warming.

Responsible stewardship requires that we take the necessary steps to protect the climate from the harmful effects of GHG emissions. Because greenhouse gases build up incrementally in the atmosphere, stabilizing their *concentrations* will require very significant reductions in *emissions* over the next century. Moreover, most scientists agree that in order to avoid the kind of drastic environmental damage that most would consider unacceptable, substantial reductions in total GHG emissions must begin *now*. Highly respected analyses indicate that world leaders have a narrow time window in which to act. Failure to begin reducing total GHG emissions within the next decade (the period covered by the McCain-Lieberman bill) may foreclose the chance our children and grandchildren have to avert dangerous climate change in the future.

Climate Change and American Ingenuity

Throughout history, American ingenuity has enabled our nation to triumph over adversity. We need to unleash that same can-do spirit today to help curb global warming. The challenge arises from the fact that GHG emissions are the direct result of fundamental economic activities—like producing energy, food and clothing, transporting ourselves and our goods, using our lands and forests and even creating and sharing data. No matter how powerful our commitment to environmental protection is, unless we can ensure our continued economic prosperity, policies seeking to reduce GHG emissions likely will not succeed.

That's where Americans' ability to solve problems comes in. Achieving significant GHG reductions that the economy can afford will require inventiveness and entrepreneurship. The good news is that climate change *is* a man-made problem, and thus can be addressed by human actions. Our nation's record of success in attaining high levels of environmental protection while enjoying continual economic growth suggests that curbing U.S. GHG emissions not only is eminently affordable, but also could bring about a host of benefits to the public. The best GHG policies will be those that set clear emissions reduction targets and explicitly allow businesses and individuals to seek a broad mix of the strategies. Through experimentation and innovation, they will devise new technologies and invest in GHG emissions reductions that deliver the biggest environmental and social payoff at lowest cost. At the same time, it is critical that those policies be as close to all-encompassing as possible, so that energy producers, industrial manufacturers, farmers and landowners and other

key economic actors have a chance to contribute their expertise to the search for the best ways to reduce GHG emissions.

This approach reflects more than just blind faith or naive optimism. Anticipating the eventual need to comply with GHG requirements, many firms and landowners already are experimenting successfully with GHG reduction strategies. Several years ago, DuPont, a charter member of Environmental Defense's Partnership for Climate Action (PCA), announced its intention to cut its GHG emissions by 65 percent by 2010. In 2001, the company reached, and surpassed, that goal, nine years ahead of schedule. Since 1990, DuPont has succeeded in holding its energy use at 1990 levels. In 2000 alone, the program yielded a $325 million savings; overall the company attributes a $1.65 billion savings to its program.

In Washington State, the Pacific Northwest Direct Seed Association, representing 300 farmers owning 500,000 acres, has joined with Entergy, the power company, to promote direct seeding, a practice that enhances soil carbon sequestration and provides a host of other benefits such as improved soil productivity, reduced erosion and better wildlife habitat. In this partnership, Entergy will lease 30,000 tons of carbon offsets over a ten-year period from participating landowners. In addition to the carbon benefits to the atmosphere, the lands affected by the project will contribute less runoff to nearby waterways, helping to improve the habitat for critical steelhead and salmon runs.

Finally, perhaps the best-known example of can-do success in reducing GHG emissions is that of BP, the global petrochemical company. In 1998, the company launched a private initiative to reduce its GHG emissions ten percent below 1990 levels by 2010. Last year, BP announced that it had achieved its target eight years ahead of schedule, and at no net cost to the business, all while achieving steady and robust economic growth.

These are not theoretical models, but real-life actions. In addition to BP, DuPont and Entergy, Environmental Defense has also been working with Alcan, Pechiney, Ontario Power Generation and Shell in the Partnership for Climate Action (*www.pca-online.org*). Each of these firms has established a cap on GHG emissions voluntarily and is undertaking measures to limit emissions to the committed levels. Each company is succeeding in its efforts, while continuing to prosper.

McCain-Lieberman and Environmental Stewardship

Environmental Defense believes that the McCain-Lieberman bill embodies America's core commitment to responsible environmental stewardship. First, it would deliver the single most crucial response to the dangers of climate change—actual reductions in GHG emissions below current levels. The current policy debate on climate change features a host of potential approaches, including voluntary initiatives, technology subsidies and tax-like schemes such as cost safety-valves. None of these, however, would accomplish what this bill would do—guarantee actual reductions in GHG emissions. Again, to curb the unwanted effects of climate change means limiting the *concentrations* of greenhouse gases in the atmosphere. GHG concentrations can be limited *only* by reducing actual emissions. McCain-Lieberman would do just that—mandate the reduction of U.S. GHG emissions.

Second, the bill mandates GHG reductions below current levels by the middle of the next decade. Our best analysis suggests that this requirement could keep open the window of opportunity that policy-makers in the future must have if they are to achieve sufficient reductions for ultimate success in curbing climate change over the balance of the century.

Since GHG emissions build up in the atmosphere, every year of delay in reducing emissions is akin to playing another round of "global climate roulette." The ambitious use of emissions trading and flexibility will increase affordability and spur even greater and earlier GHG reductions than are required in the bill as currently drafted. Tightening the reduction levels and timetable now in the bill will only enhance our legacy to future generations. Again, because of the long-lived nature of greenhouse gases in the atmosphere, by achieving even greater reductions sooner, the bill would make it that much easier for future generations to achieve the reductions needed to solve the climate problem on a long-term basis.

McCain-Lieberman and American Ingenuity—and Economic Prosperity

By requiring GHG emissions reductions across virtually all sectors of the U.S. economy, the McCain-Lieberman bill taps the know-how and inventiveness of the broadest possible swath of economic players. It does so by integrating in a GHG emissions trading market virtually every major economic sector that can contribute to solving this problem, including transportation, agriculture and forestry.

Opponents of mandatory GHG reduction policies often claim that such policies would cost too much and stifle economic growth. They also question whether the

kinds of innovations needed to achieve reductions can be found in the near term. By incorporating emissions trading as its centerpiece (along with a mandatory emissions cap), the McCain-Lieberman legislation emulates one of the most successful environmental programs in U.S. history—the federal Acid Rain Program. Under the McCain-Lieberman approach, companies that achieve more GHG reductions than required can save their extra reductions to use against their own future emissions increases or can trade those reductions to other companies that are having trouble meeting their emissions limits.

Consequently, companies will have a direct financial incentive and unlimited opportunity to make as many low-cost reductions as possible, as soon as possible. That means that the lowest-cost reducers will be acting in a way that will result in overall compliance costs being lower. It also means innovative companies that achieve more reductions than required will be financially rewarded by the emissions trading market. The emissions trading framework provides flexibility for companies to change and grow while meeting their emissions requirements at the same time.

In 1990, Congress used a similar approach to achieve reductions in sulfur dioxide, a chief cause of acid rain. Sulfur dioxide emissions at U.S. power plants were reduced and capped through a program that allowed the plants to save or trade extra emissions reductions. As a result, the acid rain program has achieved more total reductions than required, at lower cost than predicted and through technological innovations not seen under previous air pollution programs. Meanwhile, the power sector has enjoyed steady economic growth. Emissions trading can also be a useful tool for reducing GHG emissions because their environmental effects are not local, but national and global. Thus, it is the quantity of reductions achieved, not their location, that determines the environmental success of the program.

Simply put, the acid rain emissions trading program has done what markets do best—drive down costs. The economic performance of the McCain-Lieberman emissions trading system can be expected to be even more robust than that of the acid rain emissions trading system. The latter covered only the power sector in the United States. The McCain-Lieberman market would embrace a vastly more numerous and more diverse set of economic actors. Standard economic theory suggests that their number and diversity would intensify the search for cost savings by the participants and would more richly reward that search by providing an enormous multiplicity of cost-effective reduction opportunities.

By creating a market, the McCain-Lieberman bill takes the challenge of cost head-on and meets it with the most powerful of cost-savings tools. It is in markets that Americans' relentless ingenuity, the engine of our nation's economy, has always thrived.

Economic and Environmental Performance under McCain-Lieberman

The U.S. Acid Rain Program, thanks to its cap-and-trade framework, has achieved not only full compliance with its emissions reduction requirements at a lower-than-predicted cost but also more reductions than required along with incremental technological innovation. The McCain-Lieberman legislation employs the same framework in an even more ambitious way and can be expected to produce even more dramatic environmental and economic results.

To be effective environmentally, it is essential that the bill impose a cap across all major GHG-emitting sectors of the U.S. economy. The economy-wide framework makes possible the bold innovation at the heart of McCain-Lieberman, i.e., its adoption of an emissions trading system to integrate all sectors into a functioning GHG reduction market. The result is that participants in the market, whether they are subject to reduction mandates or simply seeking to make incremental reductions, can search across the nation—and, to some extent, overseas—for the most productive GHG reduction opportunities. Under the bill, that search can encompass, as it should, the agriculture and forestry sectors as well. Every time it yields a new opportunity, the emissions trading market will reward the GHG reduction investment. For this reason, as illustrated by the success of the Acid Rain Program, the McCain-Lieberman approach promises a suite of benefits including not just lower costs, but accelerated reductions and continual environmental innovation.

In light of this, Environmental Defense believes that Senators McCain and Lieberman were right to include, as part of the emissions trading system, the fuel and automotive segments of the transportation sector, as well as the agricultural and forestry sectors. Again, we are convinced that the broader and more dynamic a GHG-reduction market is, the greater will be its success in reducing costs and delivering enhanced environmental performance along with technological innovation.

The Importance of Forests and Farmland

While climate and energy policies are inextricably linked, climate policy demands more than just a re-tooling of the nation's energy, industrial and transportation sectors. The McCain-Lieberman bill is pioneering a comprehensive and rational climate policy that encompasses the effects of land use as well.

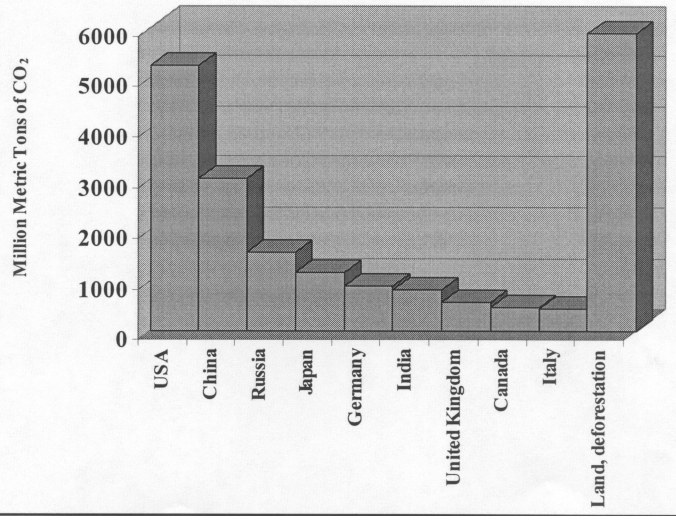
The Earth's climate is warming as a result of increasing concentrations of atmospheric greenhouse gases released not just from energy and industrial sources but also through land-use activities. Most significantly, these activities include forest management and agricultural practices in both croplands and grasslands. As forests grow, they absorb vast amounts of carbon dioxide from the atmosphere through photosynthesis. This carbon is then sequestered in woods, leaves, roots and soils (hence the term "carbon sequestration"). When forests are harvested, burned, or cleared for agriculture, much of the carbon stored in plant matter and soils is emitted into the atmosphere as carbon dioxide, the primary greenhouse gas.

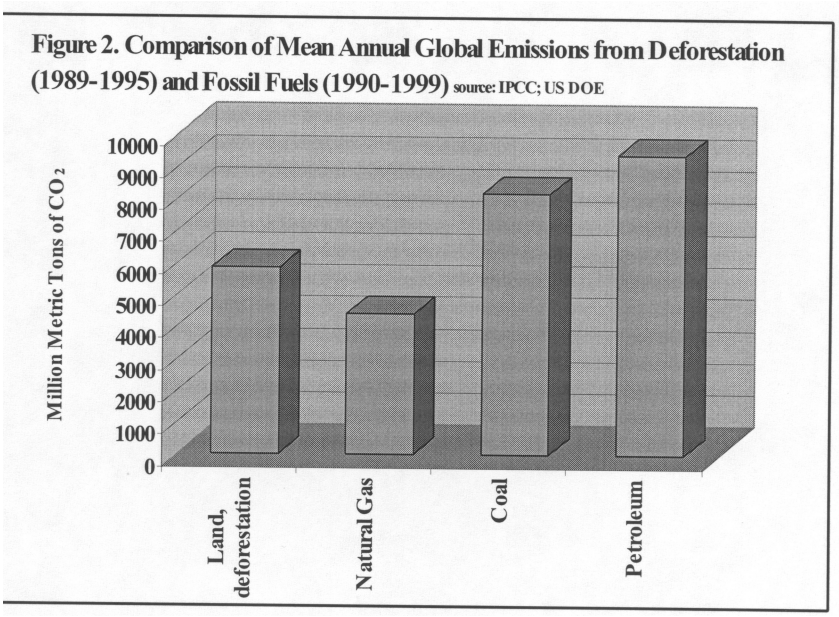
Agricultural activities also play an important role in the global carbon cycle as croplands and grasslands store large amounts of carbon. Practices such as conservation tillage, grassland restoration and use of cover crops enhance carbon storage in agricultural soils. In contrast, land clearing and plowing release carbon dioxide by exposing soils to air and sunlight.

By sequestering carbon, forests and agricultural lands can act as a carbon "sink." The capacity of soils and biomass to remove carbon from the atmosphere depends upon location, soil type, vegetation type, climate, human or natural disturbances, and other factors.

Historically, releases of carbon dioxide from land-use activities have contributed substantially to increased concentrations of atmospheric greenhouse gases. Prior to the surge in human activities, primarily the burning of fossil fuels, atmospheric concentrations of CO_2 were around 280 parts per million (ppm). Today, CO_2 concentrations are approximately 378 ppm. Figures 1 and 2 show the relative contribution of land-use activities, notably deforestation, to global greenhouse gas emissions.

Figure 1. Comparison of Mean Annual Deforestation Emissions (1989-1995) to Fossil Fuel Emissions from Selected Countries (1995) source: IPCC SR-LULUCF; UNFCCC





In view of this, Environmental Defense Fund believes that Senators McCain and Lieberman made the correct fundamental choice in allowing farmers and landowners to opt to participate in the GHG reduction market. Within the framework of a cap-and-trade system, investments in the land-use sector can provide a critical mass of cost-effective, high-yield emissions reduction opportunities. Thus, emissions reductions made through carbon sequestration have the potential to play a valuable role in a broad ensemble of tools to combat climate change.

In our view, both the environmental performance and the economic performance of a GHG reduction market demand that in the search for carbon sequestration and GHG reduction opportunities, farmers and landowners be allowed to act on a level playing field with other emissions sources. To ensure such a level playing field, land-use-generated GHG "credits" must be rigorously proven to represent real, surplus and durable reductions or increments of sequestration to the same degree that surplus GHG emissions allowances or allotments do. This stricture, far more than the imposition of quantitative limits on the use of land-use-generated credits, will be key to ensuring the environmental integrity of a GHG trading system that encompasses sequestration and other land-related crediting.

McCain-Lieberman and Regulatory Innovation

Thanks to its use of the cap-and-trade framework, the McCain-Lieberman bill, like the federal Acid Rain Program, introduces a noteworthy regulatory innovation. Under the bill, it would be businesses and landowners, not governmental officials or regulators, who would be making the pivotal choice in determining the best means of compliance. The bill would establish that GHG sources are legally accountable for achieving a specified level of emissions reductions and to continually monitor and report their actual emissions. The regulators' only job would be to ensure that each source meets its monitoring and reporting requirements and that its actual annual emissions equal its allotment of allowable emissions.

How sources reduce their GHG emissions would be left completely to the discretion of their operators. As a result, it would be up to them to adapt to the continually changing economic and technical circumstances while still meeting their emissions cap. The burden and the opportunity of lowering costs would be placed squarely on the firms. In place of regulatory variances and other cost-relieving methods that entail compromise of standards and forego actual emissions reductions, firms under a cap-and-trade system must turn to emissions banking and trading for cost control. Because of the built-in cap-based structure of the bill, cost savings through emissions trading in no way would lessen the amount of total emissions reductions or their environmental benefit.

Issues of Implementation

For the McCain-Lieberman bill to fulfill its promise, a number of technical issues and concerns need to be addressed and fully resolved.

Targets and Timetables. As mentioned above, Environmental Defense believes that a GHG emissions trading system will deliver cost savings significant enough to make aggressive reduction mandates and deadlines affordable. Environmental Defense believes that the proposed targets and timeframe should be modified so that the U.S. would retain the option of rejoining the global community and participating in the Kyoto Protocol. To achieve this, the bill should bring U.S. emissions to just below 1990 levels by 2012. To date, 100 countries have ratified the Protocol, including the members of the European Union and Japan. Last fall, Russia announced its intention to ratify this year, an action that will bring the Protocol into legal force as the vehicle that much of the world regards as the framework for addressing climate change.

Fuel Economy Standard Credits. Given our support for the bill's efforts to create an economy-wide emissions trading market, Environmental Defense is certainly open to approaches that permit some form of emissions trading between automobile manufacturers and other GHG sources. To some extent, however, the inclusion of petroleum producers in the GHG reduction mandate renders trading of credits generated by automakers redundant; in fact, in the absence of appropriately crafted provisions, such trading could entail in-aggregate double-counting. Beyond that, any attempt to qualify and quantify improvements in CAFE as GHG reduction credits or allowance-equivalents requires a highly specific set of provisions to ensure environmental integrity. Creating such credits through the project-based reduction and crediting provisions included in the draft's registry title, which are inadequate in and of themselves, are not appropriate to apply here.

Terrestrial Carbon Sequestration. Environmental Defense believes that there should be a set of criteria established in the legislation as to what carbon sequestration projects will yield valid credits. The legislation does not yet include these rigorous criteria. Environmental Defense believes that eligible domestic carbon sequestration activities should be limited to forest conservation, grassland conservation and restoration, cropland management and reforestation of native species (where feasible) on lands that have not been in forest use for the previous 10 years. Afforestation and carbon storage in wood products should be ineligible carbon sequestration activities. Terrestrial carbon sequestration, when done properly, can provide a double environmental benefit—by reducing greenhouse gases and by protecting native species.

Incentives for Capital Investment. This "borrowing" provision, though well intended, has no place in a market-driven system. Such a provision is likely to replicate the negative experience of attempts to single out specified investments for tax subsidies. Here, the program would delay reductions, either unnecessarily or in ways that distort investment decisions. This is exactly what market systems aim to avoid. Banking and multi-sector trading are themselves amply sufficient to foster and facilitate capital investments.

Baseline Protection. Companies that have initiated climate policies early and that have begun to reduce their GHG emissions must be treated equitably. As I mentioned, Environmental Defense has been working with some of the world's largest corporations through the Partnership for Climate Action (PCA). Baseline protection is intended to ensure that forward-looking companies such as BP and DuPont, which are acting on the problem in advance of a legal mandate, are not penalized.

The Importance of the 1990 Baseline. The year 1990 has long been considered the appropriate base year for benchmarking GHG emissions performance of countries. When the U.S. ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, the agreement called for all parties (countries) to reduce emissions to 1990 levels by the year 2000. The Berlin Mandate, which was agreed to at the first Conference of parties to the UNFCCC in 1995, called for mandatory and binding targets for emissions relative to the 1990 base year. The Kyoto Protocol also uses a 1990 base year for national commitments. These seminal decisions have paved the way for international recognition of 1990 as the appropriate base year for measuring the GHG emissions performance of nations. Since the economy and individual companies have changed substantially since 1990, it is appropriate to use more contemporaneous data in the establishment of procedures for the allocation of emissions allowances. However, the nation and our GHG reduction goals should be explicitly referenced in 1990 terms in keeping with our international commitments.

Title II National Greenhouse Gas Database. Environmental Defense has a number of concerns with this section of the bill. The language fails to ensure that

credit-generating reductions are real and surplus and thus consistent with environmental integrity. First and foremost, any entity that wants to register reductions must report on an entity-wide basis. Unfortunately, this bill allows for voluntary project reductions, rather than entity-wide reductions, to be eligible for credit. Such a loophole could undermine much of the carefully constructed architecture of the bill. In addition, the references to "direct" and "indirect" emissions raise the specter of double-counting.

Role of Environmental Protection Agency. Ever since its founding, the U.S. Environmental Protection Agency has taken the lead in implementing federal laws designed to protect and improve the environment. That should also be the case for addressing climate change. EPA administers the federal acid rain program, which involves the nation's electric power producers in a cap-and-trade program analogous to what is proposed in this legislation. Thus, EPA has the experience to take the lead role here as well. Clearly though, on an issue as complex and far reaching as climate change, many other agencies in the federal government will have valuable and key roles to play.

Environmental Compensation. Although the draft includes a financial penalty for sources whose emissions exceed their allowances, it fails to provide a mechanism for "making the environment whole"—that is, for restoring the lost emissions reductions. Such a provision is explicitly set forth in the federal acid rain program under which an allowance is deducted from a source's allocation for each ton of excess emissions. This, together with the program's financial penalties, is a key to its success and should be included here.

International Emissions Trading. Environmental Defense appreciates the inclusion of provisions in the draft bill to ensure the environmental integrity of GHG reductions transferred from sources operating under GHG emissions reduction programs in foreign countries. In our view, perfecting these provisions is far more vital to the environmental integrity of the GHG reduction market created by the bill than the imposition of a quantitative limit on the use of such credits. In fact, for sound reasons, the Kyoto Protocol itself imposes no such quantitative limit on international transfers. To the extent that it remains important to keep U.S. political and policy options open over time, domestic climate legislation should seek to be more, rather than less, compatible with the global system likely to develop under the Protocol.

Geologic Sequestration. Sequestering carbon after it is emitted is the subject of much current attention. While Environmental Defense believes these technologies, like terrestrial sequestration, should be explored and tested, the standards must be rigorous, and the legislation does not yet articulate those standards. For example, language should specify that the originating entity (i.e., the entity that emitted the carbon) is responsible for any carbon that is subsequently lost from storage to the atmosphere. This creates the right incentives for entities to pick sound disposal sites and site operators, and to assure the long-term effectiveness and financial viability of storage sites, or to compensate for any failures. There also needs to be language creating a process for obtaining the Administrator's approval of the suitability of geo-storage sites, reviewing both the geology and the capacity of the entity that will manage the site.

Conclusion

For those of us who support meaningful action to combat climate change, the draft bill represents a significant breakthrough. Its comprehensive GHG reduction and trading framework sets the threshold for any serious proposal that purports to tackle the issue of GHG reductions and climate change. For this, its authors deserve the thanks of all Americans.

Senator MCCAIN. Thank you very much, Mr. Krupp.

Mr. Overbey, welcome.

STATEMENT OF RANDY OVERBEY, PRESIDENT, ALCOA POWER GENERATING, INC.

Mr. OVERBEY. Yes, thank you very much, Mr. Chairman.

My name is Randy Overbey. I'm President of ALCOA's energy business. We're grateful for the opportunity to testify before your Committee today.

ALCOA, the company I represent, is the leading producer of primary aluminum, fabricated aluminum, alumina, and is active in all

major sectors of the industry. We serve aerospace, automotive, packaging, building and construction, commercial transportation, and industrial markets. Our company has over $20 billion in sales and operates in over 38 countries in the world. About 50 percent of our employees and our operations are in North America, with substantial other operations in Europe, Australia, South America, and Asia.

ALCOA is a values-based company, and I'm proud to represent our company today because of that. We have a published vision to be the best company in the world, and don't back up from that. In support of this vision and our values, ALCOA has established clear, measurable goals to achieve cleaner air, better use of land and water, and protection of human health. Our environmental goals include reductions of SO_2 by 60 percent by the year 2010, the reduction of NO_X by 30 percent by 2007, and especially relevant to this discussion, the reduction of greenhouse gas emissions by 25 percent by the year 2010.

We have developed a climate change policy in our company. That company—that policy states that rather than further debate the science, we have decided that the risk of significant climate change is an issue of vital importance to requiring action and requires action. We have not waited on others, but we have moved forward.

The policy states that we will continue to improve energy efficiency in all our operations. We will improve our operations by implementing best-practice technologies to reduce greenhouse gases.

ALCOA supports cooperative action by all countries that, one, reduce emission to levels that would prevent dangerous changes to the climate, rely on an open international economic system that would lead to sustainable economic growth and development in all countries, and, thirdly, encourage leadership from developed economies to enable all countries to contribute to effective management of greenhouse gas emissions.

I'm proud to report that we're on target, or ahead of target, on all of our environmental metrics. On Tuesday of this week, Alain Belda, the CEO of ALCOA, announced that we have achieved a 23.5 percent reduction in greenhouse gas emissions since the year 1990.

Aluminum smelters, primary production facilities, periodically emit greenhouse gases known as PFCs. These emissions usually occur when there is an interruption to the electrolytic smelting process, known as an anode effect. ALCOA signed a national agreement called the Voluntary Aluminum Industrial Partnership with EPA to reduce PFC gases from anode effects from our smelters by at least 40 percent in the year 2000, relative to 1990. And similar agreements have been signed with agencies in Australia, Canada, and Norway.

From 1990 to the year 2000, our efforts have reduced PFC emissions by 56 percent, with almost a third of our 26 smelters achieving 80 percent or better. Our new goal with EPA is to reduce these emissions an additional 27 percent by 2005. We're also proud to report that last year, ALCOA received the Climate Protection Award from EPA for progress in reducing these gases.

And beyond PFC emissions, ALCOA just became a charter member of EPA's Climate Leaders Program supporting the registry and

reporting of greenhouse gas emissions from our facilities. We've also signed a memorandum of understanding with DOE in an approach to proactively improve our energy management. And I'm glad to report that that program is making good progress as well.

ALCOA is also engaged currently in developing an internal emission trading mechanism to focus even more strongly on emissions in our company and to prepare for the future.

In light of our visions, values, and internal goals, ALCOA appreciates the opportunity to support this committee's efforts to deal with global climate change and its potential impacts. We recognize and support the broad scope of this draft legislation and encourage you to address, as directly as possible, greenhouse gas emissions from all major sectors of the economy and society. We believe a cap-and-trade system would provide the incentives and rewards necessary for all parties to initiate reductions in greenhouse gases.

But let me offer one caution here. We believe also that caps and allowances are critical in their design. Any design must recognize the economy, our ability to compete, and the impact on emissions. ALCOA recommends that the initial free allocation of emissions certificates for impacted sources be at least 85 percent of the total allowances that the source's effective year needs. As the market develops and full economic impacts of the cap-and-trade program are better understood, the allocation levels could be modified to ensure that the goals of the act are achieved in the least economically disruptive manner. Otherwise, our primary aluminum plants, as well as many other manufacturing facilities that compete with plants outside the U.S., may be put at significant economic risk. We also recommend that ultimate allocations of certificates be on a company-by-company basis to better recognize those companies that have taken early action to reduce greenhouse gases.

We believe other key components of this legislation are, one, the inclusion of the six greenhouses gases recognized under the U.N. framework, credits for reductions occurring after 1990 issued at a comparable rate as the base-year allowances to recognize and reward early and significant greenhouse gas reductions.

As I have mentioned, ALCOA has already made substantial progress since 1990. A 25 percent reduction of greenhouse gases is our goal. We're at 23.5 percent as we report today. And we believe we need to be credited for that early work.

We also support a national greenhouse gas database and registry in support of a cap-and-trade system, and a bonus for accelerated reductions for covered entities who sign agreements to reduce their greenhouse gases below 1990 levels.

ALCOA appreciates the opportunity to make these comments, and we offer to work constructively with the Committee as you move forward. And I'd be happy to try to answer any questions.

Thank you.

[The prepared statement of Mr. Overbey follows:]

PREPARED STATEMENT OF RANDY OVERBEY, PRESIDENT,
ALCOA POWER GENERATING, INC.

Mr. Chairman:

My name is Randy Overbey and I am President of Alcoa's Energy Business. We are grateful for the opportunity to appear before you today as you and Senator Lieberman prepare to address this issue, which is of such importance.

Alcoa is the world's leading producer of primary aluminum, fabricated aluminum and alumina, and is active in all major aspects of the industry. Alcoa serves the aerospace, automotive, packaging, building and construction, commercial transportation and industrial markets.

The company has over $20 billion in sales and operates in 38 countries. Over fifty percent of our operations are in North America with substantial operations in Europe, Australia, South America and Asia.

Alcoa is the leading producer of primary aluminum and fabricated aluminum in the United States. We also manufacture packaging materials, vinyl products and automotive electronic equipment.

Alcoa is a values-based company with a published vision to "be the best company in the world". In support of this vision, and our values, Alcoa has established clear measurable goals to achieve clearer air, better use of land and water, and the protection of human health. Our environmental goals include reducing our:

Sulfur Dioxide emissions 60 percent by 2010
Nitrogen Oxydes 30 percent by 2007
Greenhouse gas emissions 25 percent by 2010

Alcoa has developed a Climate Change Policy. Rather than further debate the science, we have decided that the risk of significant climate change is an issue of vital importance requiring action. We have not waited on others, but we have moved forward.

The policy states that:

- We will continue to improve energy efficiency in all our operations.
- We will improve our operations by implementing best practice technologies to reduce GHG emissions.

Alcoa supports cooperative action by all countries that:

- Reduce emissions to levels that will prevent dangerous changes to the world's climate systems utilizing least-cost global actions
- Rely on an open international economic system that would lead to sustain economic growth and development in all countries; and
- Encourage leadership from developed economies to enable all countries to contribute to effective management of greenhouse gas emissions.

We are on target or ahead of target on all our environmental metrics. On Tuesday of this week Alain Belda, CEO of Alcoa announced that we have achieved a 9.1 percent reduction in SO_2 emissions, a 30 percent reduction in NO_X emissions, and a 23.5 percent reduction in greenhouse gas emissions.

Aluminum smelters periodically emit a GHG known as perfluorocarbon (PFC). These emissions usually occur when there is an interruption to the electrolytic smelting process, known as an "anode effect".

Alcoa signed a national agreement, the Voluntary Aluminum Industrial Partnership with the EPA, to reduce PFC gases from anode effects in our smelters by at least 40 percent in year 2000 relative to emissions in the base year 1990. Similar voluntary agreements have been signed with agencies in Australia, Canada and Norway.

From 1990 to 2000, our efforts have reduced PFC emissions by 56 percent with almost a third of our 26 smelters achieving reduction of 80 percent or better. Our new goal with the EPA is to reduce these emissions an additional 27 percent by 2005. Last year, Alcoa received a Climate Protection Award from the EPA for progress in reducing these gases.

Beyond PFC emissions, Alcoa became a Charter member of the EPA's Climate Leaders Program to make reductions in all other sources of GHG emissions from our facilities and signed a Memorandum of Understanding with the DOE/OIT in a proactive approach to our energy management.

In addition, Alcoa is presently developing an internal emission trading mechanism to focus even more strongly on emissions and to prepare for the future.

In light of our visions, values and internal goals, Alcoa appreciates the opportunity to support this Committee's efforts to deal with Global Climate Change and its potential impacts.

We recognize and support the broad scope of this draft legislation and encourage you to address, as directly as possible, GHG emissions from all major sectors of the economy.

We believe a cap and trade system will provide the incentives and rewards necessary for all parties to initiate reductions in GHG emissions.

We also believe the caps and allowances are critical in their design. Any design must recognize the economy and our ability to compete, as well as the impact on emissions.

Alcoa recommends that the initial free allocation of emission certificates for impacted sources be at least 85 percent of the total allowance that the source's effective year needs. As the market develops and the full economic impacts of the cap and trade program are better understood, the allocation levels can be modified to ensure that the goals of the act are achieved in the least economically disruptive manner possible.

Otherwise, our primary aluminum plants, as well as many other manufacturing facilities that compete with plants located outside the U.S., may be put at significant economic risk. We also recommend that ultimate allocations be on a company-by-company basis to better recognize those companies that have taken early action to reduce GHGs.

We believe other key components of this proposed legislation are:

The inclusion of the six Greenhouse Gases recognized under the UN Framework on Climate Change.

Credits for reductions occurring after 1990 issued at the comparable rate as the base year allowances to recognize and reward early and significant GHG reduction efforts. Alcoa, as I have mentioned, has made substantial progress since 1990 and will continue to do so. We need to be credited for this work.

A National GHG Database and Registry in support of the cap and trade system.

A bonus for accelerated reductions for covered entities who sign agreements to reduce their GHG emissions below 1990 levels.

Alcoa appreciates the opportunity to make these comments and offers to work constructively with the Committee as you move forward. We will try to answer whatever questions you may have.

Senator MCCAIN. Thank you very much, Mr. Overbey.

Ms. Claussen, one of the objections to Kyoto, and there are several, is that developing nations are not included; and, therefore, it is assumed that they will then generate more and more greenhouse gases and even gain some kind of competitive advantage over developed countries, particularly the U.S. What has been your experience with what developing countries have done, and what—how do you view this issue, given—in light of your experience?

Ms. CLAUSSEN. Well, let me start this way. I think you have to look at this issue in terms of concentrations of greenhouse gases in the atmosphere. And I think if you look at what is up there now, the developed world is responsible for most of it. And I think it is quite fair that developed countries take the lead in doing this. That said, you can't really solve this problem unless eventually everybody is a part of it. And so, developing countries do have to play a more and more active role.

Now, if you look right now, there is activity in developing countries. They do have obligations under the Framework Convention on Climate Change. We've done some analysis that shows that they are actually reducing their emissions. So it's not as if there is no activity taking place there.

The argument that we should not do something unless the developing countries do, I think, is not a useful one, and I actually am very disturbed by what the Administration did in the last meeting in Delhi, where, having first said that we should not be a part of

Kyoto because developing countries don't have targets, went to Delhi and said, "Developing countries shouldn't have targets," which just sort of strikes me as a—as a rather bizarre way to approach this.

I think developed countries——

Senator MCCAIN. Tell me that again.

Ms. CLAUSSEN. Yes. I mean, part of the reason we do not like Kyoto is because we have targets, and developed—developing countries do not. But the Administration actually went to Delhi, the last meeting of the conference of the parties, and told developing countries in—you know, in the formal setting, that they should, in fact, not have targets because they should be concerned with poverty and other issues. So it is—it is sort of a difficult thing where they come here and say one thing, and then go abroad and say exactly the opposite.

Senator WYDEN. Don't get logical.

[Laughter.]

Ms. CLAUSSEN. Well, if your—if your goal is not to do anything at all, it is one way to achieve it.

Senator MCCAIN. Mr. Cogen, many people, despite the fact that it seems to be already—or beginning to be in practice, are skeptical about this trading issue of carbon and greenhouse emissions. What's the current trading price for a ton of carbon dioxide?

Mr. COGEN. Carbon dioxide is not a really well-defined commodity. It's a commodity by jurisdiction. We traded a U.K. allowance for one ton of carbon dioxide—but that's a very special system—yesterday at around five pounds. That's seven-and-a-half dollars for a metric ton. The range is from 10 cents a ton up to—the highest trade I think we did was about $15.

Senator MCCAIN. Where do they get this figure that they'll—it'll be a $10 billion business?

Mr. COGEN. That, I don't know.

Senator MCCAIN. What is your——

Mr. COGEN. A lot of the models that people use look at comparatively high prices of carbon, which, in the beginning markets, at least, we just have not seen.

Senator MCCAIN. What is your prognostication? Will this be a pretty going concern, or is it sort of just a sidelight to a——

Mr. COGEN. I think is going to be a large international market. But from a tradeable commodity, it's not the U.S. Treasury market or the gold market. It's more like the copper market. It's a substantial move like——

Senator MCCAIN. That's not too bad.

Mr. COGEN. Not too bad—at all. But, on the other hand, doesn't change the world each day.

Senator MCCAIN. Absent U.S. participation, how long do you think it'll be before it's a pretty robust business?

Mr. COGEN. I'd say over the next two years. Europe is already—has the rules pretty much in place. We're already looking at trading in anticipation of the final rules.

Senator MCCAIN. Mr. Krupp, you've said that since 1990, DuPont has succeeded at holding energy use at 1990 levels without economic loss, saving $325 million alone—$1.65 billion. Why don't

other industries look at DuPont, ALCOA, et cetera? They're the exceptions, rather than the rule, aren't they?

Mr. KRUPP. Yes, well, I think there are more and more companies that are looking at the future of the world and seeing that it's going to be a carbon-constrained future. And to the extent the biggest companies operate in many jurisdictions, in multinational companies, the future of that world is quite imminent, because all the other industrialized countries, except for us and Australia, have signed on.

Senator MCCAIN. But if DuPont and ALCOA have actually saved money, why wouldn't a CEO or a board of directors sit down and say, "Hey, we're—this is a way we can actually increase the—our profits and our business"?

Mr. KRUPP. Well, some of them are. I would say different companies are in different positions. So I wouldn't assert that all companies can save money by reducing their emissions. For some, there will be a cost. But I think more and more companies—as more companies look, there will be a surprising number of companies that find out that there are actually savings from reducing waste.

One of the things, Senator McCain, that one of our other partners, BP, found out was, when they set up an internal trading system like the one that—the sort of system that ALCOA I've just heard is contemplating, they found out that once they gave incentives to the different business units, the 110 business units, that parts of the company that had never bothered to look at installing valves in Houston for methane pipes, they said, "Hey, if I can get a few dollars from another business unit that is going to increase their emissions for us to decrease the leakage of methane, it's worthwhile for us to do it." And as a result of creating a hunt-down emissions-reduction opportunity system, the cap-and-trade system that causes this hunt to go on, when they added up the benefits, they were surprised that they, too, saved several hundred million dollars in the process.

Not every company can do that. I'm not asserting that. But I think if we give incentives for the American businesses to do that, we will not only have far lower costs than the doomsayers are saying, but we will also be innovating and develop this sort of products and processes that the world needs to have a robust economy while meeting this challenge.

Senator MCCAIN. Mr. Overbey, I understand you want to—or ALCOA wants to reduce its greenhouse gas emissions by 25 percent below 1990 levels by 2010. Does that require some new technology?

Mr. OVERBEY. It does not. It requires implementation of process changes in technologies of which we are aware. That's how we've been able to get to 23-and-a-half percent already. And fortunately, we have a technology-exchange network worldwide in ALCOA that allows us to take learnings from one plant and rapidly move them to another plant so that those gains can be quickly achieved. So we believe we can achieve the 25 percent with process management and technology, and without substantial capital to support it.

Senator MCCAIN. Ms. Claussen, you have heard me repeat the statement of the National Academy of Sciences ad nauseam. Do

you believe that there is sufficient evidence that we should begin to act——

Ms. CLAUSSEN. Absolutely.

Senator MCCAIN.—the United States of America should act?

Ms. CLAUSSEN. Absolutely.

Senator MCCAIN. Mr. Krupp?

Mr. KRUPP. Absolutely.

Senator MCCAIN. Mr. Cogen?

Mr. COGEN. I don't know about the science. I know from a business point of view, everyone else is going there.

[Laughter.]

Mr. COGEN. Good elbow, Ms. Claussen.

Senator MCCAIN. Thanks for the straight talk, Mr. Cogen.

Mr. Overbey?

Mr. OVERBEY. Our company, as I said, has already taken a position that we are no longer going to debate the science, but move forward with actions as rapidly as we can.

Senator MCCAIN. Can you divine the reasons why—Ms. Claussen, why, given this overwhelming body of evidence, that there would be a reluctance at least to start beginning to put into place the policies that would reduce the threat of climate change—i.e., reduce the greenhouse gases?

Ms. CLAUSSEN. No, actually, I really don't understand it, because I think you can look at the companies that have already taken action—and there are 40 companies with targets—and most of them have not found it to be very costly in the beginning, because what they're doing is energy efficiency improvements. And those things do not hurt the bottom line. Now, I mean, I think if you look out 20 years, there are going to be real costs here, and I don't think we should shy away from that. But in the early stages, I think virtually everyone has found that there are things that they can do that make a difference that are positive. And why we can't have a system that at least starts to get at some of that is absolutely beyond me. And I just don't understand it.

Senator MCCAIN. I thank the witnesses for being here today.

Senator Wyden?

Senator WYDEN. Thank you. Excellent panel.

Mr. Cogen, your presence in Central Oregon is much appreciated. I know that there has been an interest in our part of the country.

I think the first question I want to ask is about carbon sequestration. I mean, you fly over my part of the world, and you see these beautiful forests—the same is true of a lot of Committee Members here today—beautiful forests, farmland that all is in a position to absorb carbon. It seems to me carbon sequestration is an ideal example of an area where clearly this country can move beyond research. You can talk about a variety of other considerations. But to me, carbon sequestration is now low-hanging fruit. This is something we can do. We can do it in Central Oregon. We can do it across this country in areas where there are forests and where there are farms.

Response to that? We can't get the Administration to move in a serious way even on carbon sequestration where there is bipartisan support in the United States Senate, where you have, all across the country, grassroots groups of industry people, environmental peo-

ple, and others. What plausible reason would there be for not moving ahead aggressively here? Perhaps, Ms. Claussen and Mr. Krupp, you would have a response to that?

Ms. CLAUSSEN. I'm sorry, I'm going to say it again, I don't understand it, either. There is no question there are things you can do to sequester carbon in trees and soils. There is no question that that's a benefit for everyone. It's a benefit for the climate. It's a benefit for bio-diversity. It's not a big-cost item. Why we can't really get moving in a serious way on that, I really—I'm sorry, I really don't——

Senator WYDEN. In Oregon State——

Ms. CLAUSSEN.—I don't understand it.

Senator WYDEN. In Oregon State University, they found that forestry alone might be up to a quarter of the solution to the global warming problem. Just forestry, in a way that, again, brings people together.

Mr. Krupp, do you have a response to this?

Mr. KRUPP. Well, emissions from deforestation are comparable to the emissions globally of the United States, so it's clear that forestry practices now are part of the problem and, therefore, clear that they can be part of the solution.

But I'm glad you asked, Senator Wyden, because I have brought with me a poster of Ochoco Lumber——

Senator WYDEN. And I didn't—I didn't want you to go home without having a chance to show it off. We appreciate your being involved in Central Oregon.

Mr. KRUPP.—which—thank you. The benefits of such a project, here, can be seen on this forest which has been high-graded. The big, healthy trees have all been taken out, leaving the diseased, spindly ones. The company, you know, has offered to replant the area with native trees and do so in a way that would lease out the sequestered carbon for 20 years. This would not only give us a carbon sequestration benefit, but would restore the riparian ecosystem, and would benefit the habitat for endangered salmon species. There would be win-win-wins. And these are projects that we're involved in. Others in Oregon—there are many examples of very good projects in this area that just have all sorts of benefits.

I can't tell you—I can't divine the reasons either for not going forward with this sort of thing. I can tell you that one of the real positives about the legislation, the breakthrough legislation that Senators McCain and Lieberman have introduced is that in this carbon—in this Climate Stewardship Act, they have said that this should be one of the range of options available to businesses that are given a reduction burden. And, boy, if we could get a system going that financed projects like this and lowered the cost of reducing emissions, I think that's the quickest way to meet our obligation to the global environment.

Senator WYDEN. Well, I had a town meeting in Prineville just last weekend in Central Oregon, and they were raving—in fact, timber industry leaders were raving about EDF and your efforts to reach out and bring people together. What you just described is essentially the legislation I've had with Senator Craig and Senator Brownback for several sessions. And of course, it could be utilized

under the McCain-Lieberman legislation through the combination of offsets and banking and the principles in the legislation.

Mr. KRUPP. Yes, I'm aware of your leadership in that area, Senator Wyden. I think that's been a very important initiative to get this subject on the table.

Senator WYDEN. A question for any of you. I think you've heard me talking about the Framework Convention in 1992, and particularly, the requirements there. We looked back over the last decade, and clearly, there was a commitment long before Kyoto to stabilize greenhouse gases, and I've quote this, "at a level that prevents dangerous interference with the climate system." And yet, we've had testimony here saying we're going to face a 43 percent increase between 2000 and 2020. My question to you is—I don't see any strategy to plausibly attain what was set out in 1992 on a voluntary basis. I just don't see it. I don't see how you're going to get there on a voluntary basis to achieve what was set out in 1992.

Now, I want to give you all a chance to respond to that, but that's essentially why I raised it. It's one thing to talk about Kyoto. It's one thing to talk about various steps forward. But it's quite another to talk about how it was in effect under President Bush, then—the current President's father—we set out a commitment and we're still not even in the ballpark of being able to achieve it voluntarily. I would like your assessment as to whether there is a chance to achieve what was set out in 1992 on a voluntary basis. Any of you?

Ms. CLAUSSEN. I could start. The fact is, there have been voluntary programs in effect throughout the 1990s. I don't know if I should be proud of it or ashamed or it, but I actually was responsible for many of them when I was at EPA a long time ago—for those voluntary programs. And I think they did achieve some reductions.

But are they of the magnitude that you need to really address this problem? I think they are not. And the same is true for the excellent work that has been done by many in the private sector to set their own objectives and to put programs in place to meet them. I mean, some of those are truly terrific. Many of them are much more stringent than the U.S. Kyoto target, and those companies will meet them. But the reality is, until you get everyone moving in the right direction at a reasonable speed, I think the chances of meeting the goals of the convention are almost nil. So, that is why we believe we need some kind of a mandatory system.

Senator WYDEN. Mr. Cogen, Mr. Krupp, Mr. Overbey, do any of you want to add to that?

Mr. COGEN. No, I think she said it very well.

Mr. KRUPP. I would say, Senator Wyden, that your analysis is accurate. There is no way we're going to get there with a voluntary system. There is no way we're going to meet what Framework Convention says. That was signed into law by former President Bush. There's no way we're going to do what the world needs on a voluntary system. The voluntary efforts, so far, have been commendable. We encourage them. But it's not realistic to expect that it's going to be enough for the climate.

In fact, we heard just a while ago the testimony of Dr. Mahoney, who basically repeated the Administration's own projections, that

even under their enhanced—so-called "enhanced voluntary program," they are not projecting reductions that would meet the framework that the United States has already signed up for. They are projecting, according to our own analysis, little more than essentially the equivalent to business as usual, what would have happened anyway, in terms of emissions reductions—nowhere near adequate. In fact, they amount to emissions increases.

Senator WYDEN. Mr. Overbey?

Mr. OVERBEY. I had mentioned that in our primary aluminum processes, we have found—and I want to expand on that briefly—we have found technology improvements that reduce our costs, make our process more efficient, and reduce emissions. And so, that's a wonderful win-win for our business and for the environment. And it's attacking those kinds of things through technology and through energy efficiency work that we have found add real value and impact these emissions.

Whether those kinds of process changes and technology changes are available to other processes and other companies, we really don't know that. But we think progress like we've demonstrated here can be made. And as we have said in our testimony, we think some kind of framework will assist the progress, though.

Senator WYDEN. Well, all of you have been excellent. I know, we've been at it over a couple of hours, but I think what has been very useful about having all of you wrap up, is that I think we can use what you've said today to force the Administration and force our Government to abandon this position of denial. If you really think about it, what they are constantly saying is that we just can't get any further than research; we deny, in effect, all of what you all have said, that you can have these positive programs.

In my state, shoot, we put CO_2 limits on new power plants. Western civilization is not going to end as a result of some of these innovative approaches that the four of you have talked about, and are being practiced in various states, in various communities around the country.

The reason that I asked that last question about the commitment we made in 1992 is, I don't see how we're going to achieve what we set out as a goal a decade ago unless we move, and move aggressively, on the kinds of ideas that you're talking about here today.

And Mr. Krupp, if you can make them work in Prineville, Oregon, I think we can build on that around the country.

Chairman McCain and Senator Lieberman have an excellent approach that I think has considerable merit. There are going to be other bills, as well. I have a chance to wear multiple hats, because I sit on this Committee, and I also sit on the Environmental Committee. So you can count on my being in touch with all of you in the days ahead as we try to build a bipartisan support and end the denial about the possibilities of moving forward in a bold way.

Unless any of you have anything to add further, we'll excuse you at this time. The Committee is adjourned.

[Whereupon, at 4:55 p.m., the hearing was adjourned.]

APPENDIX

PREPARED STATEMENT OF HON. JOHN F. KERRY,
U.S. SENATOR FROM MASSACHUSETTS

Thank you, Mr. Chairman, for holding this important hearing today. I can think of no better issue than global climate change to set the stage for the Commerce Committee and the important work that lies ahead of us in this new congressional session. Moreover, I am pleased to see an effort to continue the work that we started in the 107th Session in this Committee to create a sound, science-based record of the current understanding of climate change.

It is now widely accepted by the scientific community that human activities such as the burning of fossil fuels, deforestation, and certain land-use practices are increasing atmospheric concentrations of carbon dioxide, which, along with increasing concentration of other trace gases, affect global climate. Atmospheric amounts of carbon dioxide have increased by 30 percent over the last 200 years, primarily as a result of burning fossil fuels like coal, oil, and natural gas and a result of deforestation.

In response to the growing concern over global climate change, the Bush Administration has adopted a *unique* approach of inaction. President Bush has offered our Nation and allies skepticism about proven science and vague promises rather than genuine leadership on global warming. While the President talks about studying the issue, his Administration continues to pursue a course which will only increase pollution—he broke a promise to cap power plant pollution, rejected the only international agreement to solve the problem, submitted a budget that cuts funding for clean energy technology, and promotes an energy plan that will increase pollution by 35 percent. The President has a policy on global warming—and if you care at all about the environment, it's a dangerous one.

Global warming is one of our toughest environmental challenges, threatening the health of not only the human population, but wildlife and economies worldwide. We have the know-how to start fixing the problem, but we have to start now. The technologies to build cleaner cars and to modernize power plants are readily at hand. We can lean more heavily on renewable energy sources such as wind, sun and hydrogen fuel cells. We know how to make more efficient appliances and to conserve energy whether we're at home, at work, or on the road.

The United States has long been the world's leading developer of new technologies. But we are also the leading global warming polluter: with only 4 percent of the world's population, we produce 25 percent of the carbon dioxide pollution. We have a responsibility, as individuals and as a nation, to lead the world toward slashing emissions of CO_2 and other heat-trapping gases.

It's not going to be easy, but we must rise to the challenge. Since human activities over decades or centuries have contributed to global climate, the problem is not likely to be addressed simply or quickly. Any solution will likely involve a combination of approaches from capping emissions to increasing energy efficiency and conservation to creating market-oriented carbon reduction strategies.

I commend the work of my colleagues, Senators McCain and Lieberman, for stepping up to the plate and essentially filling in for the Bush Administration's lack of vision. It is my hope that our President might gain some insight from their legislative proposal and work with us, rather than against us, to develop a solution worthy of the American people.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. ERNEST F. HOLLINGS TO
DR. JAMES R. MAHONEY PH.D.

Question 1. A number of questions have been raised about the Administration's focus on research, instead of action to reduce global climate change. For example, Dr. Warren Washington, the Chairman of the National Science Board, has stated that " . . .vested interests do not want to take action based on early indicators, and

with climate early indicators is what we have." How do you respond to criticisms that the Administration is focusing on research, instead of taking concrete action?

Answer. I begin by noting that the Administration is actively pursuing a program that already incorporates a wide array of emission reductions actions, as well as research and technology development. The research activities are managed by the Climate Change Science Program; the technology development activities are managed by the Climate Change Technology Program; and the emission reduction actions include a large number of initiatives involving (among others) voluntary industry emission reductions facilitated by government, energy efficiency regulations, tax incentive provisions, tax rebate provisions and carbon sequestration programs, including major land conservation elements. Extensive descriptions of the many emission reduction actions already being taken by the Administration are available in other documents, which we will provide upon your request.

Reducing greenhouse gas intensity requires a portfolio of actions including (1) research and development on a new generation of "breakthrough" greenhouse gas (GHG) emission reduction technologies and (2) active adoption of current technologies where appropriate. Candidate short-term actions to limit the growth of GHG emissions should be evaluated in terms of their environmental benefits and the associated socioeconomic impacts, compared with the option of adopting more effective and efficient new technologies likely to be available at a later time, while maintaining the same cumulative reduction goals and desired levels of environmental protection. Two alternative schedules of emissions reductions can lead to different levels of emissions over time, but the same ultimate level of GHG concentrations and/or the same levels of environmental protection. The choice between paths that differ in near-term versus long-term emissions reductions depends on whether we can reduce overall costs and/or improve environmental benefits by focusing relatively more on research and less on emission reductions now, in order to achieve greater and less costly emission reductions in the future thanks to improved technologies. The near-term versus long-term balance also depends on whether near-term reductions require early retirement of productive assets. Consideration of the appropriate timing of emissions reductions is all the more important because the cost of achieving reductions over a short time horizon increases dramatically with the scale of reductions. One estimate suggests that a 30 percent reduction in emissions in the near term is six times more expensive than a 15 percent reduction. That is, doubling the near-term reduction target increases costs six-fold.[1]

A substantial body of research has examined this issue of balancing current and future emission reductions.[2] It has focused on the key features of the climate change problem—the uncertainty associated with the benefits and costs of addressing climate change; the replacement of existing energy-using equipment, structures, and other physical assets required to reduce emissions; and improvements in technology over time. These features commonly lead to two related conclusions. First, there is significant value associated with better information, suggesting a critical role for climate science. Second, the least expensive way to achieve a particular concentration target involves a gradual approach that avoids drastic changes to the capital stock.

I do not agree with the premise of the question that implies that *research* and *action* are separate and competing objectives in meeting long-term global climate change challenges. "Research" to improve our understanding of global climate change and to reduce the "fundamental uncertainties" identified by the National Research Council in its 2001 report is an entirely prudent "action" for addressing this complex, long-term issue. Moreover, pursuing research that narrows scientific uncertainties will enable a better-informed development of policy objectives for mitigating global greenhouse gas emissions—in the near-, mid- and long-term. The Administration sees research on climate science and advanced energy technologies as integral components of sound policymaking, not as competing or detracting enterprises.

The need for a new generation of cleaner energy technologies is well recognized in the climate specialist community. For example, MIT Professor Henry Jacoby observed in 1998, "The search for cleaner energy technologies is central to any long-term response to the threat of global climate change." President Bush's commitment to accelerated research and development on hydrogen fuel cells, carbon sequestra-

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[1] Numerous estimates of the cost to the United States of different levels of emissions reductions are presented in John Weyant and Jennifer Hill, "Introduction and Overview," *The Energy Journal* (Special Issue, 1999), page *xxxvii*.

[2] A summary of the research on this topic can be found in Michael Toman, "Moving Ahead with Climate Policy." *RFF Climate Change Issues Brief*, 2000. An additional summary of studies on this topic can be found in "Climate Change 2001: Mitigation," Intergovernmental Panel on Climate Change: Working Group Three, Third Assessment Report, pages 544–552. See *http://www.ipcc.ch/pub/wg3spm.pdf*

tion, bioenergy, and fusion energy, for example, represent concrete actions that have the potential of providing cost-effective paths to significant reductions in global greenhouse gas emissions.

In February 2002, President Bush established a national goal of reducing the greenhouse gas intensity of the American economy by 18 percent in the next decade. He stated his philosophy: "Addressing global climate change will require a sustained effort, over many generations. My approach recognizes that sustained economic growth is the solution, not the problem—because a nation that grows its economy is a nation that can afford investments in efficiency, new technologies, and a cleaner environment."

Accompanying the President's policy speech was an array of domestic and international policy initiatives for achieving mitigation of greenhouse gas emissions in the next decade, which have been actively pursued by the Administration. These initiatives are summarized in Appendix 1 attached to these responses.

Question 2. In testimony that has been submitted for the record for this hearing, Dupont has stated that their scientists have been involved in the Intergovernmental Panel on Climate Change (IPCC) efforts since its inception. Based upon its scientific analysis, Dupont began to systematically address its greenhouse gas emissions over a decade ago. Today, Dupont is a considered a leader in the emissions reduction area. What do you believe Dupont's scientists realize that others apparently did not?

Answer. I am aware, and I applaud, that Dupont has made significant commitments to the reduction of greenhouse gas emissions, but I have no specific knowledge of the basis for Dupont's corporate strategy or decisions in the climate change area. I strongly support voluntary emissions reductions by American corporations as important contributions to the Administration's goal of reducing greenhouse gas intensity (the amount of greenhouse gas emissions per unit GDP) by 18 percent by the year 2012.

Question 3. At your recent workshop on the draft strategy plan for federal research, Professor G.O.P. Obasi, the Secretary-General of the World Meteorological Organization stated, " . . .the existence of these uncertainties does not imply that there is total lack of knowledge on the subject. For example, we are certain of the continued increases of the greenhouse gases in the atmosphere. We also know that such increases will lead to a change in radiative properties of the atmosphere-ocean-land-ice-system. These will be accompanied by adjustments that will add to or subtract from the warming. The main difficulty we face is the inability to forecast with the desired degree of accuracy the magnitude, the rate, the time and space distribution, and the consequences of human-induced climate change." Do you agree with Professor Obasi's assessments?

Answer. I agree with Professor Obasi's assessment, and would highlight his conclusion that, "The main difficulty we face is the inability to forecast with the desired degree of accuracy the magnitude, the rate, the time and space distribution, and the consequences of human-induced climate change."

Question 3a. Do you think that the Administration's strategic plan is consistent with his assessment?

Answer. The Administration's Discussion Draft of the Strategic Plan for the Climate Change Science Program is fully consistent with Professor Obasi's assessment. The strategic plan builds on that of which we are certain (*e.g.,* that greenhouse gas concentrations in the atmosphere continue to increase, that such increases will lead to a change in radiative properties of the atmosphere-ocean-land-ice system, and that adjustments, also called feedbacks, will add to or subtract from the resulting warming). The Plan outlines a path forward to reducing key uncertainties in climate change science, and takes very seriously concerns about impacts on the Earth and the need to develop effective, efficient, and scientifically sound means to prevent or reduce dangerous interference with the climate system caused by human activities.

Question 4. It has been stated that the Arctic region will experience the equivalent of 25 years of climate change impacts in a 10-year period. Are there any special efforts to study the Arctic region given its accelerated reaction to climate change?

Answer. Yes, there are special efforts to study the Arctic region because it may serve as an early indicator of quantitative responses to changes in the composition of the atmosphere and because feedbacks from changes in the Arctic to changes in climate may be particularly strong. U.S. Government personnel and financial resources are supporting the Arctic Climate Impact Assessment, an international project under the eight-nation Arctic Council to examine the consequences of climate variability and change, and the effects of increased ultraviolet radiation in the Arctic region. Its scientific findings and policy recommendations will be made public in the first half of 2004. Some studies by U.S. Federal agencies have been underway

for a long time, such as the NOAA Observatory in Barrow, Alaska, and the NSF-sponsored Long Term Ecological Research site at Toolik Lake, Alaska. These sites represent government efforts to obtain long-term environmental data that can be used to document aspects of climate change.

More recently, agencies have jointly planned to undertake the Study of Environmental Arctic Change (SEARCH). SEARCH is intended to provide an organizing framework for scattered existing activities and may lead to new efforts on critical aspects of Arctic climate change. The SEARCH science plan calls for a broad program of physical, biological and social science activities to understand the causes and impacts of Arctic climate change. As an example, the National Science Foundation and NOAA efforts are focused on understanding recent change in the freshwater cycle in the Arctic and in particular on providing circumpolar observations, in association with European partners, of the changes in Arctic sea ice and melt water moving into the North Atlantic.

In other federal programs, NASA recently launched the ICESat (Ice, Cloud, and land Elevation Satellite) to provide high-resolution data on changes in the mass of the Greenland ice sheet. ICESat observations along with data from NASA's Gravity Recovery and Climate Experiment (GRACE) will provide the first comprehensive assessment of how Greenland is growing or shrinking in a changing climate. These observations build on results NASA has already obtained from scatterometer (Quikscat) observations and other space-based and airborne missions. Microwave instruments on NASA, DoD and international satellites have resulted in multi-decadal estimates of changes in Arctic sea ice cover and its interactions with the climate. The Department of Energy also has recently started ecological studies in Alaska to evaluate potential impacts of warming on some Alaskan ecosystems. The Department of the Interior maintains an array of 21 deep boreholes in the National Petroleum Reserve Alaska for monitoring the thermal state of permafrost. Analysis of temperatures from the deep boreholes provided some of the first evidence that the Alaskan Arctic had warmed 2–4 degrees Celsius during the 20th century.

Question 5. What do you believe should be the basis for setting any mandatory targets for emission reductions? Do you think that your research plan can support such requirements or will it just lead to the need for even more research?

Answer. The basis for any long-term approach to address climate change should be the development of a broadly agreed view of what constitutes dangerous anthropogenic interference with the climate system and at what rate that dangerous level may be attained. Currently there is no agreement about a definition of anthropogenic interference; this question involves both scientific issues and value judgments. Potential mitigation and adaptation strategies also involve economic issues and the development of internationally agreed strategies for the short and long term. The research plan is directed at obtaining structured scientific knowledge to facilitate better informed public discussion of these issues. CCSP is not designed to lead to perpetual research. However, I note that climate and global change issues are so complex, and so compellingly important, that I expect important exploratory research and observation programs will be needed over the long term.

Question 6. How does the Administration's strategic research plan examine abrupt climate change?

Answer. The potential for abrupt climatic changes has been addressed in Chapter 6 (Climate Variability and Change) of the Discussion Draft Strategic Plan for the Climate Change Science Program. One of the priority questions identified in this chapter is the potential for climate-induced changes that are significantly more abrupt than expected, such as the collapse of the thermohaline circulation or rapid melting of the major ice sheets.

The Draft Plan specifies that improved paleoclimatic information will be essential for analyzing past abrupt climate change. This research will also require expanded observing and monitoring systems, particularly for key regions or phenomena that may be especially vulnerable or contribute most strongly to abrupt climate change, such as the tropical oceans, the Arctic and Antarctic regions, and the thermohaline circulation of the ocean. The National Science Foundation and partners in the United Kingdom are specifically addressing prospects for abrupt change in the thermohaline circulation through the joint RAPID Climate Change Initiative. Moreover, research into how to better numerically model the full three-dimensional circulation of the ocean will be required in order to accurately project the time scales and potential impacts of abrupt changes in thermohaline circulation.

Question 7. The Climate Change Research Initiative is focused on short time frame research of between two to five years. However, much of the debate concerning global climate change concerns long-range projections, such as the possible reduction in water supplies in western states, including Arizona, by as much as 30

percent by 2050. How much effort does the Administration intend to focus on long-term research to resolve controversy over these projections?

Answer. During much of the first decade of its existence, the dominant emphasis of the U.S. Global Change Research Program (USGCRP) was on supporting research to improve basic scientific understanding of the dynamics of the Earth system and to document, understand, and model global-scale environmental changes. USGCRP-supported research has made significant advances since the inception of the program, and the program will continue to enable the research community to focus on a range of very significant scientific uncertainties about climate and global change as well to achieve a better understanding of the long-term effects of climate change. In recent years, the program has complemented this basic research component with a stronger emphasis on developing the capability to address more effectively the implications of climate and global change for society.

The Climate Change Research Initiative (CCRI) represents a focusing of resources and enhanced interagency coordination of ongoing and planned research on those elements of the USGCRP that can best support improved public discussion and decision making in the near term. A particular goal of the CCRI is to measurably improve the integration of scientific knowledge, including measures of uncertainty, into effective decision support systems and resources. The CCRI programs will incorporate performance metrics that call for deliverable products useful to policymakers in a short time frame (2–4 years) on issues that are both immediate as well as long-term.

Question 8. Dr. Marburger also referred to the scenarios developed under the Intergovernmental Panel on Climate Change (IPCC) as "ad-hoc." Given the extensive work that went in to the development of these scenarios, it is interesting that he reached that conclusion. Do you agree with his assessment and have you used any of the IPCC scenarios in the development of the strategic plan?

Answer. The IPCC has produced several sets of emissions scenarios over the course of its history: the so-called SA–1990 scenarios for its first assessment report; the IS–92 scenarios for the 1995 second assessment report; and a third set of scenarios (known as SRES) developed as part of a Special Report on Emission Scenarios that reviewed factors that contribute to emissions as well as emissions scenarios developed in the research literature. Each set of scenarios has different characteristics. The SRES are based on what seem to a number of analysts to be a highly optimistic set of assumptions in which developing countries attain levels of wealth close to that of developed countries over the course of the coming century. This assumption has unique effects on the emissions trajectories of these countries.

The Discussion Draft Strategic Plan for the Climate Change Science Program (CCSP) is not predicated on any particular emissions scenarios. We fully expect, however, that the CCSP will develop and analyze multiple emission scenarios, incorporating insights gained and lessons learned from IPCC activities. Particular plans for FY 2004 include the development of emissions scenarios by the Department of Energy to provide alternatives to the "SRES" scenarios that were published by the IPCC.

Question 9. Dr. Mahoney, as you may know, this Committee developed the legislation that became the US Global Change Act of 1990. That legislation calls for scientific assessments to be performed and reported to Congress. The law requires that these be conducted every four years, and the last National Assessment was communicated to Congress in 2000. This set of documents presented the most current and comprehensive assessment of the implications of climate change for the United States, and has been an instrumental tool for communicating information on climate change to policymakers, the media, and the general public. What is your opinion of the National Assessments submitted in 2000?

Answer. The document "Climate Change Impacts on the United States—The Potential Consequences of Climate Variability and Change" was the first assessment prepared in response to the 1990 Act, more than ten years after its passage. The National Assessment Synthesis Team, an advisory committee chartered by the Federal Advisory Committee Act, produced it. The document was turned in to the Subcommittee on Global Change Research (SGCR) within the Executive Branch on October 31, 2000, and SGCR transmitted the document to the President and the Congress at a later date. The document was first published in 2001. (This information is contained in the inside title page of the 2001 publication.) Appendix 2 summarizes the status of the first National Assessment, including various reports published in 2001 and 2002, and some never published.

The Assessment was an ambitious undertaking. I commend the contributions of the large group of scientists who worked on the preparation of the assessment. The project was designed and conducted over a period of years before I was confirmed in my position at the Department of Commerce and appointed Director of the Cli-

mate Change Science Program and Chair of the Subcommittee on Global Change Research. Had I been involved, I believe that I might have done a number of things differently. I believe the National Assessment was very ambitious—perhaps overly so—and unduly optimistic about the level of confidence it assigned to a number of its findings, especially at the regional level. The Global Change Research Act of 1990 does not require a specified form of assessment, for example it does not call for a regional focus. I believe we should carefully examine the strengths and limitations of the 2001 report, and we should apply the "lessons learned" in developing a substantially improved analysis in the next assessment. This is the normal progression of research and assessment: we should build on the lessons learned in the pioneering effort and assure that subsequent efforts demonstrate improved credibility as a result of continuing research, measurement and assessment.

Question 10. Why was the 2000 National Assessment *never* mentioned in the Administration's Draft Strategic Plan, when it was the source of much of the information presented Administration's "Climate Action Plan—2002"?

Answer. The Discussion Draft Strategic Plan for the Climate Change Science Program was not designed to reiterate or summarize findings reported in the research and assessment literature. Few previously published documents, assessments or others, were specifically mentioned in the draft plan.

As for the place of the National Assessment in the CCSP strategic planning process, the discussions at the workshop on the Discussion Draft Strategic Plan, held in Washington, D.C., on December 3–5, 2002, and the voluminous review comments we received on the Plan during the subsequent public comment period, brought forth a wide range of views on the National Assessment. These views range from highly laudatory to highly critical. Some of the comments have provided valuable perspectives, and we will address these issues appropriately in revising and finalizing the Strategic Plan. We intend to evaluate the assessment and other approaches for supporting decision making, and to incorporate the lessons from these experiences in CCSP planning for future decision support activities. We fully expect that lessons learned from the conduct of the National Assessment will provide useful insight in designing future CCSP projects.

Question 11. Does this Administration intend to submit the next set of national assessments in 2004 (or before), *as required by the Act*?

Answer. We intend to comply with Sec. 106 of the P.L. 101–606, the Global Change Research Act of 1990, which states:

SEC. 106. SCIENTIFIC ASSESSMENT.

On a periodic basis (not less frequently than every 4 years), the Council, through the Committee, shall prepare and submit to the President and the Congress an assessment which——

1. integrates, evaluates, and interprets the findings of the Program and discusses the scientific uncertainties associated with such findings;

2. analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity; and

3. analyzes current trends in global change, both human- induced and natural, and projects major trends for the subsequent 25 to 100 years.

The document "Climate Change Impacts on the United States—The Potential Consequences of Climate Variability and Change" was the first assessment prepared in response to the 1990 Act more than ten years after its passage. The National Assessment Synthesis Team, an advisory committee chartered by the Federal Advisory Committee Act, produced it. The document was turned in to the Subcommittee on Global Change Research (SGCR) within the Executive Branch on October 31, 2000, and SGCR transmitted the document to the President and the Congress at a later date. The document was first published in 2001.

We note that the agencies that are part of the Climate Change Science Program are currently conducting assessments in a distributed fashion. For example, the Department of Transportation is conducting an assessment of the potential impacts of climate change on transportation systems, while both the Environmental Protection Agency (EPA) and NOAA are conducting regional assessments through ongoing programs. EPA is working with NOAA's Regional Integrated Science and Assessment Program to ensure coordination of the agency's ongoing regional assessment activities.

Moreover, the Administration is also supporting international assessments in support of the UN Framework Convention on Climate Change (through the Intergovernmental Panel on Climate Change), and the Montreal Protocol.

Regarding submission of a "next set of national assessments in 2004," we do not believe that this is precisely what is called for in PL 101–606. However, CCSP is working hard to lay the foundation for a successor interagency assessment. Our work includes an evaluation of the aforementioned national assessment so that we can learn from and improve upon the past. We note that there are several approaches for conducting assessments of the issues highlighted in PL 101–606, and that the question of assessment design is an important one.

A core component of the CCSP is its emphasis on decision support resources to provide information to support national policy and regional/sectoral resource management. The program is making excellent progress in designing activities in this area through its strategic planning process. A plan for both sectoral and comprehensively integrated assessment products is being developed as part of the final version of the CCSP strategic plan.

Question 12. What is NOAA and the Climate Office doing to make this happen?

Answer. NOAA and the other departments and agencies that participate in the Climate Change Science Program have recently established a federal interagency working group on Decision Support Resources. This working group will oversee the planning and implementation of CCSP assessment activities, including the activities required by the Global Change Research Act of 1990. The Climate Change Science Program Office will play an important role in supporting and helping to coordinate these activities. The overall effort will be managed directly by federal scientists and program managers rather than an outside synthesis team as done in the previous assessment.

Question 13. What is the anticipated schedule?

Answer. We expect to publish a schedule for transmittal of the updated synthesis and assessment as part of the final version of the Climate Change Science Program Strategic Plan.

Question 14. NOAA's FY03 budget represented an $18 million "increase" under CCRI—not USGCRP—for aerosols research, climate modeling, carbon cycle, and observations. *All these areas were already funded at NOAA under the USGCRP in previous years. Of this $18 million "increase", how much is actually research that has never been done by NOAA as part of the USGCRP effort?*

Answer. While there are no initiatives in the NOAA FY 2003 Climate Change Research Initiative (CCRI) budget increase request that do not build on activities of the U.S. Global Change Research Program, all of the $18 million will be supporting new activities in those topic areas. The CCRI request represents an effort across the agencies to examine the major uncertainties delaying progress on projections of future climate and focus research effort in these areas.

Question 15. Is any of this research absolutely new?

Answer. In addition to augmentation and expansion of existing research programs, a new climate modeling center will be established within the Geophysical Fluid Dynamics Laboratory (GFDL) at Princeton, New Jersey, which will focus on model product generation for research, assessment and policy applications as its principal activity. GFDL has played a central role in climate research, pioneering stratospheric modeling, seasonal forecasting, ocean modeling and data assimilation. This core capability will be enhanced to enable product generation and policy related research. NOAA and GFDL will develop improved "scenarios" of future human activity as input to climate change projections. CCRI will enable NOAA to conduct an evaluation of the relative likelihood of the scenarios. The capability to assess the plausibility or likelihood of either the individual scenarios, or a range of scenarios is one of the factors to reduce the range of uncertainty in climate change assessments.

Question 16. Wouldn't you agree with scientists and other experts who say this is just "dressing up" old programs in new clothing?

Answer. The CCRI represents a true refocusing of priorities. NOAA's programs build on ongoing USGCRP activities, but we believe it is the best use of taxpayer dollars to focus new activity where the science community believes results will lead to major reductions of uncertainty.

Question 17. Congress has strongly supported global climate change research through the federally coordinated US Global Climate Research Program established in the Global Change Research Act of 1990 to "assist the nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change."

However, this Administration has created a separate CCRI, that creates a separation of "near term" decision support research from "long term" research of the USGCRP. This is contrary to Congress's intent that all federal research be coordinated through USGCRP for use as decision support tools on climate change issues. Why are the CCRI activities not proposed as part of the USGCRP, as in previous years?

Answer. CCRI is a new initiative designed to build on the USGCRP. The CCRI and the USGCRP are not two separate programs. Rather, they are components of an integrated effort, with an integrated management structure, encompassed in a single Strategic Plan. The Administration has identified a need to develop a sharper focus for near-term research efforts and the provision of decision-support information on the issue of climate change—a capstone issue of our time and a central (though not the exclusive) component of the USGCRP research portfolio. The CCRI is a means to accomplish this sharpening of focus, within the overall global change research effort.

Question 18. Does the Administration have concerns about the effectiveness of the USGCRP? If so, please share them with the Committee.

Answer. The Administration is pleased with the effectiveness of the USGCRP. The USGCRP has been, overall, a highly successful program, supporting research that plays a central role in the scientific study of global change. Since its inception the program has received strong bipartisan support and I am confident that it will continue to do so. Moreover, the new cabinet level management structure that President Bush established in February 2002, providing a fully integrated focus for the USGCRP and CCRI activities, has provided a higher level of continuing oversight of the combined Climate Change Science Program as compared to the level of management oversight provided in past years.

Question 19. If not, explain why the Administration believes that the USGCRP is not the appropriate program to coordinate these research activities.

Answer. Not applicable, in view of the response to Question 18.

Question 20. What is happening to the USGCRP's organization and areas of focus, now that CCRI has been launched?

Answer. The USGCRP's organization and areas of focus have been fully retained and strengthened now that CCRI has been launched. A highly comprehensive interagency inventory of climate and global change research programs was conducted during 2002, and this inventory was provided to majority and minority staff of the relevant committees in both the Senate and House of Representatives. Additional copies of this comprehensive inventory are available from my office, in both CD and hard copy format. This essential stocktaking exercise (the first conducted in several years) enhanced the coordination, efficiency, and effectiveness of the USGCRP. A new interagency working group was established to focus on Decision Support Resources to augment the previously existing research program elements (which are all continuing): Atmospheric Composition, Climate Variability and Change, the Global Water Cycle, the Global Carbon Cycle, Ecosystems, Land Use and Land Cover Change, and Human Contributions and Responses to Global Change.

Question 21. Despite the President's declaration to cut US green house gas intensity by 18 percent in the next ten years, we have heard in previous testimony from Mr. James Connaughton, head of CEQ, that his proposal will result in steadily *increasing* GHG emissions. Is this still the projected timetable?

Answer. The Administration's timetable calls for an 18 percent reduction in U.S. greenhouse gas intensity by the year 2012. This is an ambitious goal, but one to which the Administration is fully committed. A few numbers may put the 18 percent target into perspective. If the U.S. economy grows 30 percent by 2012 and the GHG emission intensity is reduced 18 percent, the GHG emissions would increase a net amount of 6.6 percent. As another data point, an 18 percent reduction in intensity would result in stable emissions if the economy grew 22 percent during the coming decade.

Question 22. Speaking as a scientist, doesn't each decade that we delay in reducing greenhouse gas emissions commit us to enduring greater warming in the future and make it exceedingly difficult to stabilize atmospheric GHG concentrations?

Answer. The following comments from my response to Question 1 are applicable here: Reducing greenhouse gas intensity requires a portfolio of actions including (1) research and development on a new generation of "breakthrough" greenhouse gas (GHG) emission reduction technologies and (2) active adoption of current technologies where appropriate. Candidate short-term actions to limit the growth of GHG emissions should be evaluated in terms of their environmental benefits and the associated socio-economic impacts, compared to the option of adopting more effective and efficient new technologies likely to be available at a later time, while

maintaining the same cumulative reduction goals and desired levels of environmental protection. Two alternative schedules of emissions reductions can lead to different levels of emissions over time, but the same ultimate level of GHG concentrations and/or the same levels of environmental protection. The choice between paths that differ in near-term versus long-term emissions reductions depends on whether we can reduce overall costs and/or improve environmental benefits by focusing relatively more on research and less on emission reductions now, in order to achieve greater and less costly emission reductions in the future thanks to improved technologies. The near-term versus long-term balance also depends on whether near-term reductions require early retirement of productive assets. A substantial body of research has examined the issue of balancing current and future emission reductions.[3] Consideration of the appropriate timing of emissions reductions is all the more important because the cost of achieving reductions over a short time horizon increases dramatically with the scale of reductions. One estimate suggests that a 30 percent reduction in emissions in the near term is six times more expensive than a 15 percent reduction. That is, doubling the near-term reduction target increases costs six-fold.

The Administration's policy can be characterized as a combination of shorter-term and longer-term actions as follows. Shorter-term: implement a broad portfolio of no-cost and relatively low-cost emission reduction incentives and actions that reduce GHG intensity without major adverse economic impacts to the U.S. economy that would hamper our ability to invest in a new generation of breakthrough emission reduction technologies. Longer-term: immediately accelerate investments in major new technologies that have highly favorable benefit-cost ratios, *i.e.*, that have the potential to provide major GHG emission reductions with relatively lower adverse economic impacts. A prominent example is President Bush's renewed commitment, announced in his State of the Union address, to accelerate the research and development of hydrogen fuel cell vehicles in order to allow commercialization by 2020. Another is his January 30 commitment to participate in international negotiations for the construction and operation of a major magnetic fusion project, also known as the International Thermonuclear Experimental Reactor (ITER), to produce commercially available, clean fusion energy by the middle of this century. A third example is his leadership in establishing the Carbon Sequestration Leadership Forum, an international research effort designed to make carbon capture and sequestration a cost-effective reality. And on February 27, the President announced that the United States would sponsor a $1 billion, 10-year demonstration project to create the world's first coal-based, zero-emissions electricity and hydrogen power plant, called "FutureGen." FutureGen will be undertaken with international and private sector partners to dramatically reduce air pollution and capture and store emissions of greenhouse gases.

Question 23. Doesn't this mean that either mitigation or adaptation, or both, will come at a much greater cost to society in the future?

Answer. On the contrary, aggressive investments in breakthrough technologies can yield superior environmental benefits (*e.g.,* removal of carbon based fuels from the transportation system) more cost-effectively than an approach of serial incremental steps that have increasingly greater adverse economic impact as the "bar is raised," risking the forced, premature retirement of existing capital assets.

Question 24. I find it interesting that on February 14, 2002, the Administration simultaneously opposed mandatory measures for controlling CO_2 emissions, and endorsed a "cap and trade" approach for other emissions from power plants, citing the success of the SO_2 Cap and Trade Program from the Clean Air Act.

In fact, the Bush Administration praised the features of this cap and trade program that are just the sorts of features one would want for a CO_2 emissions program:

"Cost Savings"
"Innovation"
"Integrity"
"Guaranteed Results"

[3] A summary of the research on this topic can be found in Michael Toman, "Moving Ahead with Climate Policy." *RFF Climate Change Issues Brief*, 2000. An additional summary of studies on this topic can be found in "Climate Change 2001: Mitigation," Intergovernmental Panel on Climate Change: Working Group Three, Third Assessment Report, pages 544–552. See *http://www.ipcc.ch/pub/wg3spm.pdf.*

Please explain why the Administration believes that an approach that provides potential cost savings, innovation, integrity, and guaranteed results are *not* appropriate for greenhouse gases such as CO_2.

Answer. A national greenhouse gas cap-and-trade system would necessarily be a far more complex, expensive, and intrusive system than the current sulfur emissions trading program, so one should be cautious about drawing conclusions from the experience of the sulfur-trading program. For example, SO_2 permit trading has been limited to one source category (electric power generation plants) and gradually grew from 263 units in 1995 to over 2000 units today. SO_2 regulation in the 1970s and 1980s led to netting (allowing emissions reduction credits earned elsewhere in the plant to offset the increases expected from the expanded more modernized portion), banking (established procedures that allowed firms to store emission reduction credits for subsequent use in the bubble, offset, or netting programs), and bubbling (allowed existing sources to use emission reduction credits to satisfy their State Implementation Plan control responsibilities); each of which provided firms with increased flexibility in reducing emissions. Greenhouse gases, which are generated from numerous sectors, rather than dominated by one sector, are not presently at this stage.

On February 14, 2002, in announcing both the Clear Skies and global climate change initiatives, President Bush explained why a different mitigation approach is needed for greenhouse gas emissions: "[G]lobal climate change presents a different set of challenges and requires a different strategy. The science is more complex, the answers are less certain, and the technology is less developed. So we need a flexible approach that can adjust to new information and new technology."

Prior to that, in his March 13, 2001 letter to four senators, President Bush emphasized these same points and others: " . . . I intend to work with the Congress on a multipollutant strategy to require power plants to reduce emissions of sulfur dioxide, nitrogen oxides, and mercury. . . . I do not believe that the government should impose on power plants mandatory emissions reductions for carbon dioxide, which is not a 'pollutant' under the Clean Air Act. A recently released Department of Energy (DOE) Report, "Analysis of Strategies for Reducing Multiple Emissions from Power Plants," concluded that including caps on carbon dioxide emissions as part of a multiple emissions strategy would lead to an even more dramatic shift from coal to natural gas for electric power generation and significantly higher electricity prices compared to scenarios in which only sulfur dioxide and nitrogen oxides were reduced."

The DOE report referred to by the President also found that emissions reductions of SO_2 and NO_X (reflecting current proposals) would have little impact on the nation's electricity costs. By contrast, including carbon dioxide would result in significant costs for the nation and American energy consumers, including: (1) raising the electricity "resource cost of service" by $20–30 billion annually; (2) increasing national electricity prices by 39 percent to 42 percent by 2010; (3) raising natural gas prices by 55 percent to 62 percent by 2010; and (4) lowering U.S. Gross Domestic Product by $60–84 billion (in 2010 alone). A July 2001 study by the Energy Information Administration revealed similar results, including national average electricity price increases of 25 percent to 40 percent in 2010.

Question 25. Given your personal experience with the very successful SO_2 trading program to address acid rain, why would you not support a cap and trade approach for CO_2?

Answer. A national greenhouse gas cap-and-trade system would necessarily be a far more complex, expensive, and intrusive system than the current sulfur emissions trading program, so one should be cautious about drawing conclusions from the experience of the sulfur-trading program. For example, SO_2 permit trading has been limited to one source category (electric power generation plants) and gradually grew from 263 units in 1995 to over 2000 units today. SO_2 regulation in the 1970s and 1980s led to netting (allowing emissions reduction credits earned elsewhere in the plant to offset the increases expected from the expanded more modernized portion), banking (established procedures that allowed firms to store emission reduction credits for subsequent use in the bubble, offset, or netting programs), and bubbling (allowed existing sources to use emission reduction credits to satisfy their State Implementation Plan control responsibilities); each of which provided firms with increased flexibility in reducing emissions. Greenhouse gases, which are generated from numerous sectors, rather than dominated by one sector, are not presently at this stage.

In the case of SO_2, Title IV of the Clean Air Act Amendments of 1990 provided for mandatory emission reductions of this criteria pollutant by 5 million tons per year compared to 1980 levels by 1995, and by another 5 million tons by 2000. As we anticipated during the negotiations leading up to the passage of the 1990 Amendments, the SO_2 trading program has been very effective in fostering cost ef-

fective compliance with the emission reduction requirements by the electric utility industry (which was the only sector regulated under Title IV).

I note that there are other anthropogenic greenhouse gases, including methane, nitrous oxide, perfluorocarbons, hydrofluorocarbons and sulfur hexafluoride—and aerosol and black carbon emissions—that all contribute, in still uncertain ways, to the buildup of atmospheric greenhouse gases. On this point, I commend the recent study of the Pew Center on Climate Change.[4] Among other things, the Pew Report finds: "Efforts to engage developing countries in climate mitigation will need to give even greater attention to the non-CO_2 greenhouse gases since these gases typically account for a higher percentage of their overall emissions. Non-CO_2 gases currently account for well over one-half of the GHG emissions in Brazil and India, for example, as compared to 20 percent in the United States. . . . Modeling studies indicate that a cost-effective abatement strategy would focus heavily on the non-CO_2 gases in the early years. . . . Including the abatement options available for these gases would reduce the carbon-equivalent price of the policy by two-thirds from that needed if the same level of abatement were achieved only through reductions in CO_2 emissions from fossil fuels."

WRITTEN RESPONSE TO ADDITIONAL VERBAL QUESTIONS FROM JANUARY 8, 2003 HEARING BY DR. JAMES R. MAHONEY, PH.D.

A number of questions arose during the January 8, 2003 Committee Hearing on Climate Change—Greenhouse Gas Reductions and Trading System. The following comments provide my further responses on these questions.

1. European cap-and-trade system. Senator McCain inquired whether a carbon cap-and-trade system is currently active in Europe.

There is not yet a European Union (EU)—wide carbon cap-and-trade system in place. In 2001, the European Commission proposed a European Union-wide greenhouse gas emission trading system. The European Parliament and the Council of European Union Environment Ministers have considered this proposal, but have not yet reached agreement on a legal framework (a Directive) for a cap-and-trade system.

The Council has approved a draft cap-and-trade Directive that would cover carbon dioxide emissions from fixed large point sources starting in 2005 and would encompass about half of all carbon dioxide emissions in the EU. The European Parliament is expected to consider this plan later this year. There are several issues that remain to be worked out between the Parliament and the Council, including issues related to the method of allocation of permits, the inclusion of project-based mechanisms, and opt-in provisions for EU Member States to add additional gases or sectors to the trading regime. Following the issuance of any cap-and-trade Directive, EU Member States would decide on and take additional steps within their own borders to implement the Directive.

Development of technology solutions. Senator McCain inquired about what the Administration is doing to develop technology related to climate change.

The Administration has established a new management structure to integrate climate change science and technology activities across the Federal government. As part of this structure, Secretary Abraham established a supporting office, the Climate Change Technology Program (CCTP), within DOE and appointed a CCTP Director. A series of Interagency Working Groups will provide technical support to the CCTP, focusing on specific technical elements in energy production, energy efficiency, other greenhouse gases, sequestration, measurement and monitoring, and supporting basic research.

The CCTP helps inventory, coordinate, and prioritize climate change technology R&D. The aim of the CCTP is to facilitate, through R&D, the meeting of both near- and long-term climate change goals by advancing technology development and spurring innovation.

The President's FY 2004 Budget includes $1.2 billion in directly relevant climate change technology R&D and an additional $406 million in related R&D spending focused on achieving the President's near- and long-term climate change goals. (The CCTP is currently clarifying and prioritizing the inventory of Federal climate change technology R&D spending.) Much of the Federal funding, when executed, will be augmented by other funds from private sources, perhaps by as much as another $1 billion, through cost-shared R&D contracts. In addition, there are a num-

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[4] "*Climate Impacts and Mitigation Costs of Non-CO_2* Gases," prepared by MIT professors Reilly, Jacoby and Prinn (February 2003)

ber of significant privately funded activities, such as the Stanford University—based Global Climate and Energy Project.

In addition, a Competitive Solicitation Program is planned as a central component of the President's National Climate Change Technology Initiative (NCCTI), operating within the CCTP. If funds are appropriated, the technology solicitations will be aimed at exploring innovative concepts, technologies and technical approaches that could contribute significantly to: (a) future reductions or avoidance of GHG emissions; (b) GHG capture and sequestration; (c) conversion of GHGs to beneficial use; and/or (d) enhanced monitoring and measuring of GHG emissions, inventories and fluxes in a variety of settings. The Program would augment the existing base of Federal R&D. Solicitations supported by this Program will be peer reviewed and optimized for maximum climate change benefit per R&D dollar spent.

President Bush launched his Hydrogen Fuel Initiative in this year's State of the Union address. The goal is to work closely with the private sector to accelerate our transition to a hydrogen economy, both on the technology of hydrogen fuel cells and a fueling infrastructure. The President's Hydrogen Fuel Initiative and the FreedomCAR Partnership launched last year will provide $1.7 billion over the next 5 years to develop hydrogen powered fuel cells, a hydrogen infrastructure, and advanced automobile technologies, allowing for commercialization by 2020.

In February 2003, President Bush announced that the United States would sponsor, with international and private sector partners, a $1 billion, 10-year demonstration project to create the world's first coal-based, zero-emissions electricity and hydrogen power plant. This project is designed to dramatically reduce air pollution and capture and store greenhouse gas emissions.

In January 2003, President Bush committed the United States to participate in the largest and most technologically sophisticated research project in the world to harness the promise of fusion energy, the same form of energy that powers the sun. If successful, this $5 billion, internationally-supported research project will advance progress toward producing clean, renewable, commercially-available fusion energy by the middle of the century. Participating countries include the United Kingdom, Russia, Japan, China, and Canada.

2. Projected CO_2 Emissions. Senator McCain referred to a quote by Deputy Commerce Secretary Samuel W. Bodman in a December 4, 2002, article in the *Wall Street Journal* projecting a 12 percent increase in U.S. CO_2 emissions from 2002 to 2012 under the President's plan. That quotation was inaccurately attributed by the *Wall Street Journal* to Deputy Secretary Bodman; it was a response I made to an inquiry regarding an estimate of how emissions of CO_2 from the United States might change during the coming years.

The Administration has adopted a target of decreasing greenhouse gas (GHG) emission intensity (emissions per unit GDP) by 18 percent from 2002 to 2012. A few numbers may put the 18 percent target into perspective. If the U.S. economy grows 30 percent by 2012 and the GHG emission intensity is reduced 18 percent, the GHG emissions would increase a net amount of only 6.6 percent. As another data point, an 18 percent reduction in intensity would result in stable emissions if the economy grew 22 percent during the coming decade.

3. Examples of international cooperation. Senator Wyden requested that I provide examples of international cooperation with the Administration's climate change program.

Bilateral Agreements

The Department of State has identified a priority set of countries and groups, representing nearly 80 percent of global emissions, with which to engage in strategic bilateral partnerships. The United States has already formalized cooperative bilateral arrangements with the following countries and groups from the priority set: Central America Countries, the European Union, Italy, Japan, China, Australia, New Zealand, Canada, India, Russian Federation, Mexico, and South Korea. For each of these, we are undertaking a range of scientific, technology and policy-related activities. We are working to ensure that these relationships will deliver real results, and demonstrate the U.S. commitment to working internationally to address the problem of climate change. Major bilateral activities over the past 10 months include:

JAPAN: In September 2002, the High Level Consultation Working Group on Science and Technology (S&T) selected 13 projects for priority implementation. These projects focus on priority areas identified by the S&T Working Group. These include: improvements of climate models; impact and adaptation/mitigation policy assessment, employing emission-climate-impact integrated models; observation and international data exchange and quality control; research on GHG sinks including land-use, land-use change and forestry; research on polar regions; and, development

of mitigation and prevention technologies. Experts are also collaborating on issues relating to developing countries and market-based approaches.

AUSTRALIA: In July 2002 Australian Minister for the Environment and Heritage, Dr. David Kemp and Under Secretary of State Dobriansky and other U.S. participants in the US-Australia Climate Action Partnership (CAP) announced 19 projects in five areas: climate change science and monitoring; renewable and reduced emission stationary energy technologies; engagement with business on technology development, and policy design and implementation; capacity building in developing countries; and greenhouse accounting in the forestry and agriculture sectors.

INDIA: The United States and India issued a Joint Statement on Climate Change in May 2002, announcing their intention to enhance ongoing collaborative projects in clean and renewable sources of energy, energy efficiency and energy conservation. India also suggests acceleration of support in fuel cells, photovoltaic technology, weather early warning systems and climate modeling, and research and technology development. This work is building on the extensive cooperation between India and the United States on climate change and clean energy. A working level delegation visited India on February 10–14, 2003 to identify specific cooperative projects and initiatives.

EUROPEAN UNION: In 2002, high-level US–EU representatives considered specific areas for strengthened cooperation, including science and research, measurement, monitoring and verification of greenhouse gas emissions, and market-based incentives. They agreed to enhance cooperation on climate-related science and technology research. U.S. and EC research managers met in Washington in early February to advance these efforts.

CENTRAL AMERICA: The United States and Central American countries have agreed to climate change collaboration under the auspices of the Central America-U.S. sustainable development partnership, CONCAUSA. A meeting for government focal points to explore and agree upon initial areas for cooperation took place in Panama City in January 2003. The first U.S. Government—sponsored programming is already planned in the form of workshops in April and May 2003, in Guatemala and El Salvador, respectively.

CHINA: Following a year of diplomatic effort by the United States, China is showing increased interest in technical collaboration and policy discussion. Senior Climate Change Negotiator and Special Representative Harlan Watson led a delegation to Beijing in January 2003 to discuss policy issues, and to identify collaborative activities on climate change science and technology. A Joint Statement between the United States and China was issued on January 16, 2003, identifying ten areas for cooperative research and analysis, including: non-CO_2 gases, economic/environmental modeling, integrated assessment of potential consequences of climate change, adaptation strategies, hydrogen and fuel cell technology, carbon capture and sequestration, observation/measurement, institutional partnerships, energy/environment project follow-up to the World Summit on Sustainable Development (WSSD), and existing clean energy protocols/annexes. The fourth meeting of the U.S.-China Working Group on Climate Change will take place in June 2003.

RUSSIAN FEDERATION: The United States and Russia announced on January 17, 2003 the formation of the US-Russia Inter-Ministerial Climate Change Policy Dialogue. Dr. Watson has the interagency lead; Russia has identified Dr. A.I. Bedritsky, Head of RosHydromet, as their coordinator. Initial technical-level discussions will be held in April 2003, in Moscow and will focus on climate change science and technology research issues.

PLANNED ACTIVITIES: Discussions have been ongoing to establish bilateral relationships with a limited number of other key climate change partner countries, including Mexico. A diplomatic visit to Mexico City took place on March 17, 2003. We will continue to build on our existing partnerships, and are establishing milestones for success, which will include tangible results in addressing climate change. In many cases, cooperation with these countries will help us to pursue significant new science and technology initiatives that will benefit both the United States and our partner countries.

Other International Research Cooperation Programs

The U.S. participates in research in coordination with a great number of international programs and some of those programs are described below.

GLOBAL SCALE PROGRAMS: Four programs address global scale research: (1) World Climate Research Programme (WCRP) for the physics and related chemistry of global change; (2) International Geosphere-Biosphere Programme (IGBP) for biology, chemistry and related geosciences of global change; (3) International Human Dimensions Program (IHDP); and (4) DIVERSITAS for integrative biodiversity science.

REGIONALLY FOCUSED PROGRAMS: Three notable examples include: (1) the Inter-American Institute for Global Climate Change Research (IAI) is building scientific capacity and timely decision support resources in the Americas; (2) the Asia-Pacific Network (APN) promotes global climate change research in the Asia-Pacific region and strengthens the links between the science and policy making communities; and (3) the International Research Institute for Climate Prediction (IRI) issues climate outlooks tonations particularly vulnerable to climate variability phenomena such as El Niño and La Niña.

4. International emissions intensity data. Senator Sununu requested that I provide examples of CO_2 emissions intensity data from other countries.

The table on the next two pages provides CO_2 emissions data for the year 2000 from 44 countries, including the United States. In addition to gross emissions, emissions are given on a per-unit GDP basis using exchange rates, and a per-unit GDP basis using purchasing power parities.

SELECTED ENERGY STATISTICS FOR 2000—CO_2 Emissions from Fuel Combustion

Country* or Region	Emissions Change in (Mt CO_2) emissions per GDP (PPP) 1990–2000	Fraction Rank of Global Total	Emissions Rank per GDP (kg CO_2 per 1995 US$)	Emissions Rank per GDP (PPP*) (kg CO_2 per 1995 US$ PPP)	Change in emissions per GDP 1990–2000
World	23444 -15.2%	100.0%	0.69	0.56	-11.5%
OECD***	12449 -12.5%	53.1%	0.45	0.51	-10.9%
United States	5665 -14.9%	24.2% (1)	0.63	0.56	-14,9%
Argentina	130 -13.9%	0.6%	0.44	0.31	-15.4%
Australia	329 -10.7%	1.4%	0.73	0.70	-10.8%
Azerbaijan	28	0.1	6.94 (3)	1.36 (10)	
Bahrain	14 -29.4%	<0.1%	1.96	1.44 (8)	-29.5%
Brazil	303 +30.0%	1.3%	0.38	0.26	+18.8%
Bulgaria	43 -30.7%	0.2%	3.48 (9)	0.97	-30.8%
Canada	527 -6.8%	2.2% (8)	0.75	0.64	-6.9%
China (PRC)	2997 -49.6%	12.8% (2)	2.88	0.63	-49.4%
Chinese Taipei	215 +4.0%	0.9%	0.63	0.52	+5.0%
France	373 -11.3%	1.6%	0.21	0.28	-10.9%
Germany	833 -27.0%	3.6% (6)	0.31	0.44	-27.1%
Gibraltar	<1 +100.0%	<0.1%	0.92	1.00	+104.4%
India	937 4.5%	4.0% (5)	2.01	0.42	-5.6%
Indonesia	269 +34.3%	1.1%	1.29	0.47	+33.0%
Iran	292 +22.4%	1.2%	2.78	0.82	+23.0%
Iraq	77 +93.5%	0.33%	0.95	2.40 (1)	+93.9%
Italy	426 -9.2%	1.8% (10)	0.35	0.34	-9.0%
Japan	1155 -1.6%	4.9% (4)	0.20	0.37	-1.5%
Kazakhstan	123	0.5%	5.46 (5)	1.59 (7)	
Korea, South	434 +6.1%	1.8% (9)	0.70	0.67	+6.0%

SELECTED ENERGY STATISTICS FOR 2000—CO_2 Emissions from Fuel Combustion—Continued

Country* or Region	Emissions Change in (Mt CO_2) emissions per GDP (PPP) 1990–2000	Fraction Rank of Global Total	Emissions Rank per GDP (kg CO_2 per 1995 US$)	Emissions Rank per GDP (PPP*) (kg CO_2 per 1995 US$ PPP)	Change in emissions per GDP 1990–2000
Korea, North	167	0.7%	20.14 (1)		+20.9%
Kuwait	63	0.3%	2.33	2.13 (3)	+84.9%
	+83.6%				
Libya	39	0.2%	1.14	1.38 (9)	+58.3%
	+58.6%				
Luxembourg	8	<0.1%	0.33	0.43	-56.6%
	-56.6%				
Mexico	360	1.5%	0.96	0.44	-12.8%
	-12.8%				
Netherlands	177	0.8%	0.36	0.45	-16.8%
	-16.7%				
Netherlands Antilles	3	<0.1%	1.21	1.25	+14.2%
	+14.7%				
Poland	293	1.2%	1.79	0.84	-40.6%
	-40.6%				
Qatar	35	0.1%	3.04	2.28 (2)	+55.1%
	+54.1%				
Russia	1506	6.4% (3)	4.21 (7)	1.35	
Saudi Arabia	261	1.1%	1.87	1.20	+23.8%
	+23.7%				
South Africa	296	1.3%	1.73	0.79	-1.7%
	-1.3%				
Spain	285	1.2%	0.40	0.40	+6.9%
	+7.0%				
Syria	52	0.2%	3.85 (8)	1.05	-3.5%
	-3.7%				
Thailand	147	0.6%	0.86	0.40	+22.9%
	+21.2%				
Turkey	204	0.9%	1.00	0.48	+22.9%
	+11.8%				
Turkmenistan	34	0.1%	4.78 (6)	1.86 (5)	
Ukraine	301	1.3%	6.79 (4)	1.72 (6)	
United Arab Emirates	69	0.3%	1.39	1.30	+31.1%
	+31.3%				
United Kingdom	531	2.3% (7)	0.41	0.42	-24.2%
	-24.1%				
Uzbekistan	115	0.5%	9.57 (2)	2.09 (4)	
Venezuela	129	0.5%	1.61	0.96	+2.5%
	2.1%				
Fed Rep of Yugoslavia	43	0.2%	3.27 (10)		
Former USSR	0.5%	4.35	1.36	+4.3%	
	+6.3%				

*The country list includes the top ten CO_2 emitters for each of the four categories (i.e., fracation of global total emissions, emissions per GDP, and emissions per GDP (PPP)) and all countries that emitited more than 125 Mt of CO_2 during 2000.

**PPP is Purchasing Power Parities; other GDP-based values use Exchange Rates.

***OECD (Organization for Economic Co-operation and Development): Australia, Austria, Belgium, Canada, Czech Republic, Denmark, European Communities, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Span, Sweden, Switzerland, Turkey, United Kingdon, United States.

Sources: International Energy Agency (2002) CO_2 ***Emissions from Fuel Combustion***, 1971–2000, 2002 edition. OECD, Paris; ***http://www.iea.org/***.

APPENDIX 1. Examples of GHG Emission Reduction Initiatives of the Administration

Fuel Economy

In December 2002 the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) announced it would seek to increase fuel economy standards for light trucks covering model years (MY) 2005 through 2007, saving approximately 2.5 billion gallons of gas over the life of these trucks. That action

marked the first proposed change to fuel economy standards in many years. The proposed increase of 1.5 mpg (from 20.7 mpg to 22.2 mpg) during this 3-year period more than doubles the increase in the standard that occurred between MYs 1986 and 1996, when it increased from 20.0 mpg to 20.7 mpg. The proposal to establish new fuel economy standards for light trucks is just one component of the Administration's comprehensive approach to improving vehicle fuel economy.

Tax Incentives for Hybrid and Fuel Cell Vehicles and Renewable Energy

To encourage Americans to buy more fuel-efficient vehicles, the President has proposed tax incentives for the purchase of hybrid ($4000 credit) and fuel cell ($8000 credit) vehicles through 2007. To advance and accelerate the development of even more fuel-efficient vehicles in the future, the Administration is also funding and working with partners (research universities and the private sector) to leverage resources for research and development of new vehicle and fuel technologies, including the new hydrogen fuel cell vehicles.

The President's 2004 budget request continues to seek funding to provide incentives for renewable energy sources, as outlined in his May 2001 National Energy Policy. These incentives include tax credits for the purchase of hybrid and fuel cell vehicles, for residential solar heating systems, for energy produced from landfill gas, for electricity produced from alternative energy sources such as wind and closed-loop biomass, and for combined heat and power systems. These incentives are subsidies provided through the tax system that constitute $552 million of the $4.4 billion in expenditures planned for climate change in FY 2004. The five and ten-year projections for these tax expenditures are $4.2 billion and $5.7 billion, respectively.

Voluntary Business and Industry Initiatives

Secretaries Abraham and Veneman, Administrator Whitman and Deputy Secretary Jackson announced the President's Climate VISION program on February 12, 2003. They recognized the significant initiatives that major, energy-intensive sectors of the American economy are now undertaking to meet the President's challenge. These initiatives build upon the progress made by the industrial sector in the past decade; from 1990–2001, while the economy grew by almost 40 percent, greenhouse gas emissions in the industrial sector were constant. This event marked the beginning of a robust partnership between the public and private sector that will assure that these initiatives are effectively implemented and additional strategies are developed to yield cost-effective emissions reductions. Examples of the Climate VISION Program initiatives include:

- The Business Roundtable's (BRT) Climate RESOLVE (Responsible Environmental Steps, Opportunities to Lead by Voluntary Efforts) initiative will mobilize the resources and expertise of its 150 member companies to enhance their voluntary actions to reduce the greenhouse gas intensity of the American economy. The BRT has committed to achieving 100 percent participation of its members in initiatives to reduce, avoid, offset or sequester emissions. These companies collectively generate one-third of the United States' Gross Domestic Product. Climate RESOLVE is one initiative that reaches across industries and sectors to encourage voluntary efforts to manage greenhouse gas emissions by many of the nation's largest companies.
- The American Petroleum Institute (API), whose members represent over 60 percent of U.S. petroleum refining capacity, is committed to increasing aggregate energy efficiency of members' U.S. refinery operations by 10 percent from 2002 to 2012. This goal will be met through reduced gas flaring and other energy efficiency improvements, expanded combined heat and power facilities, increased by-product utilization, and reduced carbon dioxide venting. API will also aim for 100 percent participation in EPA's Natural Gas Star program and in federal Combined Heat and Power (CHP) programs. API members will develop greenhouse gas management plans to identify and pursue opportunities to further reduce emissions.
- The Edison Electric Institute (EEI) and six other power sector groups, representing 100 percent of U.S. electricity generation, formed the Electric Power Industry Climate Initiative (or EPICI) to reduce the sector's carbon intensity. Other EPICI members include the National Rural Electric Cooperative Association, the Nuclear Energy Institute, the American Public Power Association, the Large Public Power Council, the Electric Power Supply Association, and the Tennessee Valley Authority. By May 2003 a formal memorandum of understanding between EPICI and DOE will be signed, pledging the industry to reduce the power sector's carbon impact in this decade by the equivalent of 3 per-

cent to 5 percent, through increased natural gas and clean coal technology, increased nuclear generation, offsets, and expanded investment in wind and biomass projects.

Expected initiatives include reforestation in the lower Mississippi River valley (UtiliTree II), increased use of coal combustion byproducts (C2P2), and expanded use of wind and biomass (Harvesting the Wind, etc.). The Edison Electric Institute is also working with DOE to develop the Power Partners Resource Guide, a Web-based tool to help companies reduce greenhouse gas emissions intensity.

- The National Mining Association (NMA), representing producers of 70 percent of the nation's primary electricity fuels, is committed to achieving a 10 percent increase in the efficiency of those systems that can be further optimized with processes and techniques developed by DOE and made available through the pending NMA-DOE Allied Partnership. The commitment includes steps to recover additional coal mine methane, expansion of land reclamation and carbon sequestration efforts and coal and mining research. For example, technology developed through DOE partnerships is projected to further reduce greenhouse gas emissions by one million metric tons annually by, 2012.
- The Portland Cement Association (PCA), in cooperation with the Department of Energy and the Environmental Protection Agency, has committed to reduce carbon dioxide emissions by 10 percent per ton of cement from a 1990 baseline by 2020. The Association and its members who represent more than 95 percent of U.S. cement production have adopted a three part program to achieve the goal that focuses on enhancements to the production process, the product itself and how the product is applied.
- The American Iron and Steel Institute (AISI) 33 member firms, representing nearly three-quarters of the nation's steel-producing capacity, have committed to achieving a 10 percent increase in sector-wide average energy efficiency by 2012 from 1998 levels. The improvements will come both in steel making efficiency and industry restructuring. In addition, the industry will continue to produce new steel products that enable efficiency gains to industry customers.
- The Semiconductor Industry Association (SIA), in partnership with the Environmental Protection Agency, has committed to reduce a suite of the most potent greenhouse gas emissions by 10 percent from 1995 levels by the end of 2010. The SIA agrees to this goal on behalf of 22 semiconductor manufacturers that account for over 70 percent of this sector's HFC, PFC and SF6 "perfluorocompound" emissions. EPA estimates that this goal will reduce emissions by over 13.5 MMTCE in the year 2010, or the equivalent of eliminating greenhouse gas emissions from 9.6 million cars. Perfluorocompounds are among the most potent and persistent of all global warming gases and are used to clean semiconductor manufacturing equipment and to etch silicon wafers to create circuitry patterns. These perfluorocompounds have, on average, 10,000 times the global warming potential of carbon dioxide over 100 years, plus, they can persist in the atmosphere from 2,000 to 50,000 years
- The Magnesium Coalition and the International Magnesium Association. Partner companies in the Environmental Protection Agency's SF6 Emission Reduction Partnership for the Magnesium Industry have committed to eliminate sulfur hexafluoride (SF6) emissions from their magnesium operations by 2010. SF6 is the most potent greenhouse gas known today; more than 23,000 times as strong as the most common man-made greenhouse gas, carbon dioxide. The partner companies committed to eliminating SF6 emissions represent 100 percent of U.S. primary magnesium production and approximately 80 percent of U.S. magnesium casting and recycling. The industry's action will reduce overall U.S. SF6 emissions in 2010 by an estimated 20 percent and will have a climate benefit equivalent to eliminating greenhouse gas emissions from more than one million cars.
- The American Chemistry Council (ACC), representing 90 percent of the chemical industry production in the US, has agreed to an overall greenhouse gas intensity reduction target of 18 percent by 2012 from 1990 levels. ACC will measure progress based on data collected directly from its members. Activities include increased production efficiencies, promoting coal gasification technology, increasing bio-based processes, and, most importantly, developing efficiency-enabling products for use in other sectors, such as appliance transportation and construction.
- The Aluminum Association, in partnership with the Environmental Protection Agency and the Department of Commerce's National Institute of Standards and Technology, has committed to reduce sector-wide greenhouse gas emissions.

Through one of the first voluntary partnerships with EPA in 1995, the Voluntary Aluminum Industry Partnership (VAIP) reduced perfluorocarbon (PFC) emissions in 2000 by over 45 percent compared to 1990 levels. The VAIP has committed to further reduce PFC emissions by 2005. This year the industry will collaborate with EPA to identify additional greenhouse reductions for multi-gas voluntary reductions. This broadened commitment will enable the industry to make additional reductions through multiple pathways such as energy efficiency and recycling in the most cost-effective and efficient manner.

- The Association of American Railroads (AAR), in consultation with the Department of Transportation, has committed to reducing the transportation-related greenhouse gas intensity of their Class 1railroads by 18 percent in the next decade.
- The Alliance of Automobile Manufacturers (AAM), whose members account for over 90 percent of U.S. vehicle sales, has agreed to reduce greenhouse gas emissions from its members' manufacturing facilities by at least 10 percent by 2012, based on U.S. vehicle production from a 2002 baseline. Activities toward this goal include installing energy efficient lighting, converting facilities' coal and oil power sources to cleaner natural gas, and upgrading ventilation systems.
- The American Forest and Paper Association (AF&PA), in consultation with the United States Department of Agriculture, is committed to reduce their greenhouse gas intensity by 12 percent by 2012 relative to 2000. Specific actions include the enrollment of 114 million acres in the Sustainable Forestry Initiative program, the largest sustainable forestry program in the world. AF&PA members also have a strong commitment to recycling and expect fiber recovery rates of at least 50 percent, avoiding methane emissions in landfills and increasing carbon storage. The industry will continue to lead all manufacturing sectors in on site electricity generation, deriving over half of its energy needs from renewable energy and biofuels and in many cases supplying supplemental electricity to the surrounding power grid.

Of these initiatives, President Bush stated: "I commend these initiatives which will help these businesses and industries continue to improve their energy efficiency and overall productivity, while contributing toward achieving our goal to reduce the greenhouse gas intensity of the American economy. As I said last year, every sector of the economy will need to contribute to our efforts to achieve our ambitious national goal. These initiatives are a first step in what we expect to be an ongoing engagement with these and other sectors of our economy in the years ahead. . . ."

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. JOHN F. KERRY TO EILEEN CLAUSSEN

Question 1. If U.S. companies take steps to reduce greenhouse gas emissions, won't it help them compete in the international marketplace?

Answer. Yes. In the short term, the U.S. withdrawal from Kyoto and the failure to undertake serious emissions reduction in the U.S. may result in a competitive advantage for U.S. firms: they will not face greenhouse gas mitigation costs while their competitors in Europe, Japan and other developed countries will. However, any short-term advantage will likely be far outweighed by the long-term competitive *dis*advantages. First, U.S. firms will not benefit from the improved efficiencies, particularly in energy use, that typically result when a company undertakes to reduce its emissions. Our review of companies with voluntary greenhouse gas targets found that most realized substantial energy and operational efficiency improvements—and, in some cases, significant cost savings. Second, without a strong market signal for emissions reduction, U.S. firms will have little incentive to develop the kinds of technologies we and the rest of the world need to make the long-term transition to a low-carbon economy. Firms in other developed countries, however, will have that incentive and therefore will be much better positioned to capture the growing global market for clean energy technologies. So, both in terms of operational efficiencies and in terms of market positioning, emissions reduction will likely result in significant long-term competitive advantage for U.S. firms.

Question 2. Given our experience in the SO_2 cap and trade program, and the growing interest in international trading, what is the likely effect on the U.S. economy of capping and trading greenhouse gas emissions?

Answer. The emissions trading program for SO_2 under Title IV of the 1990 Clean Air Act Amendments has been the most successful, largest and best known demonstration of emissions trading. Estimates of the savings due to emissions trading compared to traditional command and control regulation have been up to 57 per-

cent, or $20 billion over the 13 years (1995–2007) of the program. Emissions permits prices have ranged from $75–200 per ton, compared to prior estimates of control costs of $500–1000 per ton. Transaction costs have been low (<0.5 percent of the trading price), and there has been a lively market for permits and futures. Emissions trading for greenhouse gases (GHGs) is expected to yield even greater savings due to the greater diversity in abatement costs from various sectors and technologies which could provide even greater gains from trade. In addition, local environmental concerns are also not an issue as they are with SO_2, so there can be greater flexibility to trade greenhouse gases globally, finding the cheapest abatement opportunities. Also, given the long timescale of warming, temporal flexibility (i.e., through banking and borrowing emissions credits) can be incorporated without compromising environmental results and can thus yield lower costs.

The leading economic-climate models estimate considerable gains from GHG trading, with reductions in the marginal abatement cost ($/ton) of 18–50 percent, reduction in overall costs of 15–75 percent, and limited impacts on GDP. Differences between these models include assumptions regarding the baseline emissions (and hence required reductions), the rate of technological change, the use of flexibility mechanisms (non-CO_2 greenhouse gases, trading, sequestration, etc.), estimates of future energy resources, and the economy's flexibility in switching to lower carbon products and services.

The Climate Stewardship Act of 2003 (S. 139) incorporates many important flexibility mechanisms such as trading (among sectors, gases, and countries), credit for early reductions, and banking and borrowing of emission reduction credits. While a comprehensive assessment of projected costs of the bill has not been completed, a recent RFF analysis finds that, based on available cost-effective reductions in the 2010 time frame, the net costs of the program could be less than 1/10th of 1 percent of the GDP. The authors state, "The broad coverage and flexibility of the trading program make this bill one of the most cost-effective domestic proposals to date (even more so than the EU trading system)."

Sources: A. Denny Ellerman, Richard Schmalensee, Paul L. Joskow, Juan Pablo Montero, and Elizabeth Bailey. 2000. *Markets for Clean Air: The U.S. Acid Rain Program*. Cambridge, UK: Cambridge University Press.

Jae Edmonds J., M, Scott, J. Roop and C. MacCracken. *International Emissions Trading and Global Climate Change: Impacts on the Cost of Greenhouse Gas Mitigation*. The Pew Center on Global Climate Change, December 1999.

William Pizer and Ray Kopp. *Summary and Analysis of McCain-Lieberman—Climate Stewardship Act of 2003*. Resources for the Future. January 2003.

Question 3. From your knowledge of international efforts, how have other countries benefited from carrying out greenhouse gas reduction strategies similar to the ones you have outlined in your testimony?

Answer. Most industrialized countries anticipate employing some form of emissions trading as a component of their overall climate change strategies. The most ambitious of the trading systems being implemented or under development is the regional system nearing final approval by the European Union. This system will encompass all the member states of the European Union (including the ten approved for new membership in 2004), which have a combined economy larger than that of the United States. Like other governments, the European Union favors emissions trading because past experience—including the highly successful sulfur dioxide trading program in the United States—demonstrates that a well-designed trading program can substantially reduce the cost of meeting a given emissions target. As the EU trading system is not yet in operation, these benefits are yet to be realized. However, economic analyses performed during the design of the EU system projected that it would reduce the cost to member states of meeting their Kyoto targets by as much as 35 percent. This amounts to a savings to the members states of approximately $1.3 billion euros a year.(1)

Question 4. One of the rationales given by the Bush Administration for rejecting any measures to require actual reductions in greenhouse gas emissions is that these will result in enormous costs to the U.S. economy, to the point that no mandatory requirements are acceptable. James Connaughton's testimony last July stated that compliance with Kyoto would cost the United States $400 billion and 4.9 million jobs. Do you agree with this assessment?

Answer. We do not agree with Mr. Connaughton's estimate of the cost of compliance with the Kyoto Protocol. Furthermore, because the limits and timeframes used by the Climate Stewardship Act are much less stringent than those of the Kyoto Protocol, we would expect the cost of complying with the bill to be much less than that of the Kyoto Protocol.

Mr. Connaughton's assertion of very high compliance costs for the U.S. meeting its Kyoto target was primarily based on a study requested by the U.S. House of Representatives Committee on Science and published by the DOE's Energy Information Administration (EIA)—Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity in October 1998. This analysis relied on the EIA's NEMS model and makes rather draconian assumptions. In comparison with other climate-economic models, the NEMS model is considered to be conservative on a number of key modeling parameters:

- Baseline emissions—NEMS projects relatively high business-as-usual emissions and hence requires a greater reduction effort.
- Technological change—based on experience with other environmental programs, induced technological change is expected to be perhaps the greatest driver of low cost GHG emission reductions and yet NEMS is pessimistic about the rate of cost reductions of new technologies that climate policy will generate through accelerated innovation.
- Substitution of inputs—the U.S. economy is flexible and can respond to changes in input prices. NEMS restricts the substitution capabilities of both producers and consumers in comparison to historical experience, which can increase compliance costs by 100 percent.

In addition to these shortcomings of the NEMS model, the analysis relied upon by Mr. Connaughton omitted several key components of a flexible and cost effective reduction of GHGs:

- International emission trading—a plethora of very inexpensive reduction options are available on a global basis, and Kyoto and any likely domestic program would incorporate trading;
- Non-CO_2 GHGs—due to their high potency and historic lack of control efforts, other GHGs (methane, N_2O, and the range of industrial GHGs (HFC, PFCs and SF_6)), represent considerable low cost reduction opportunities; and
- Sequestration (carbon storage) opportunities are not accounted for.

The EIA analysis also assumes that entities facing steep reductions take no action in anticipation of the policy's start date. It also ignores any benefits of climate change mitigation policy (both monetary and nonmonetary), through avoidance of environmental and health impacts.

Finally, there are additional factors that could also limit or offset the economic impact of GHG reductions:

- Revenue recycling—using proceeds from emissions trading permit revenues to alleviate especially hard-hit sectors (as is done under the Climate Stewardship Act) or to improve the tax system;
- Ancillary benefits such as reduced local air pollution or increased energy security (due to less reliance on foreign energy imports); and
- Reducing non-price barriers to efficiency and technological development,

Considering only the modeling parameters and the omitted flexibility mechanisms, other analyses (EMF, 1999) of the U.S. meeting its Kyoto targets gives carbon prices of between $10–80 / ton carbon, representing costs on the order of $25–80 billion or 0.1–0.8 percent of GDP. Similarly, any impact on employment would be equivalently much less harsh, and even further mitigated by support to the hardest hit sectors. Some commentators (Barrett and Hoerner, 2002) have even suggested that under an emission trading regime the innovative US economy would generate more jobs in new technologies than would be lost in existing technological sectors.

Finally, it is unclear whether cost projections regarding the Kyoto Protocol are even relevant, given the Administration's decision not to pursue ratification. Like the Climate Stewardship Act, any likely domestic program will incorporate less strict targets and timetables and flexibility options that permit more cost-effective reductions over a longer timeframe.

Sources: Weyant J. and Hill J. [Eds] (1999), *The Costs of the Kyoto Protocol: A Multi-Model Evaluation,* Special Edition of the Energy Journal.

James P. Barrett J., A. Hoerner, S. Bernow and B. Dougherty (2002) *Clean Energy and Jobs: A comprehensive approach to climate change and energy policy*, Economic Policy Institute.

Edmonds J., M, Scott, J. Roop and C. MacCracken. 1999, International Emissions Trading and Global Climate Change: Impacts on the Cost of Greenhouse Gas Mitigation. The Pew Center on Global Climate Change, December 1999.

Jaffe A. and R. Stavins (1995) Dynamic Incentives for Environmental Regulations: The Effects of Alternative Policy Instruments on Technology Diffusion, Journal of Environmental Economics and Management, Vol. 29 S43–S63.

Question 4a. Are you aware of any examples where requirements to address pollution either had little negative impact on the economy, or even provided areas for economic growth?

Answer. A number of environmental regulations have been found to be cost-effective, considering the benefits to health and welfare, ecosystems, etc. of reduced pollution. These include regulations cutting back on lead in drinking water and gasoline and several toxic and criteria air pollutants. For welfare (health) and environmental costs, a good example is the SO_2 trading system under Title IV of the 1990 Clean Air Act Amendments. This program has spurred benefits that are 6 times its cost, largely through reductions in health impacts and mortalities. And of course, the SO_2 trading programs has very significant but non-monetized savings from reduction in forest damage from acid rain. In addition, required reporting under EPA's Toxic Release Inventory program yielded dramatic cuts in emissions with little effort or cost.

Studies of states with strong environmental programs have supported the conclusion that strong environmental policies do not come at the expense of a sound economy.

Finally, the experience of many U.S. firms that have undertaken GHG reductions is that they have found significant cost savings from exploitation of efficiency opportunities or redesign of production processes.

Source: Stavins R. (2000), "Experience with Market-Based Environmental Policy Instruments", RFF Discussion Paper 00–09, January 2000, Washington, D.C.

Templet, P.H., The Positive Relationship between Jobs, Environment and the Economy: An Empirical Analysis, Spectrum (Journal of the Council of State Governments), Spring Issue 1995, pp. 37–49.

Question 4b. Are there really no mandatory measures to reduce GHGs that can be undertaken without adverse impact—and potentially with a positive impact—on our economy?

Answer. There are a range of measures to reduce GHGs that would entail zero impact or even benefit the US economy—at least at the level of modest reductions. Many of these revolve around energy efficiency. A major study (Interlaboratory Working Group, 2000) commissioned by the DOE, found a range of public policies that improved energy efficiency with overall economic benefits. The study's key conclusions were:

"Smart public policies can significantly reduce not only carbon dioxide emissions, but also air pollution, petroleum dependence, and inefficiencies in energy production and use. A range of policies exist—including voluntary agreements; efficiency standards; increased research, development, and demonstration (RD&D); electric sector restructuring; and domestic carbon trading—that could move the United States a long way toward returning its carbon dioxide emissions to 1990 levels by 2010. Additional means would be needed to achieve further reductions, such as international carbon trading and stronger domestic policies. The overall economic benefits of these policies appear to be comparable to their overall costs or such policies could produce direct benefits, including energy savings that exceed their direct costs (e.g., technology and policy investments)."

On a company level, firms involved with the Pew Center have found that by simply conducting inventories of their GHG emissions or energy use they have found many opportunities to increase efficiency and save money. At least at the early stages, reduction opportunities appear to be cost-effective or low-cost propositions.

Sources: Interlaboratory Working Group (2000). *Scenarios for a Clean Energy Future* (Oak Ridge, TN; Oak Ridge National Laboratory and Berkeley, CA; Lawrence Berkeley National Laboratory), ORNL/CON–476 and LBNL–44029, November 2000.

Michael Margolick and Doug Russell, *Corporate Greenhouse Gas Reduction Targets*, The Pew Center on Global Climate Change, November 2001.

Question 4c. Won't U.S. industries be at a disadvantage if other countries develop more environmentally efficient technologies?

Answer. Yes, without a market for lower emitting technologies, even generous R&D will not enable the U.S. to remain well positioned in the race to commercialize new energy and GHG emission related technologies. Only with commercial development and use can the powerful forces of incremental innovation and learning-by-using improve the cost and performance of these new technologies. The European Union (EU) finalized the agreement for a Renewable Directive in September 2001. The directive sets goals of doubling the renewable energy share of total energy con-

sumption in the EU to 12 percent by 2010, and increasing the renewable energy share of electricity generation from 14 percent in 2001 to 22 percent in 2010. Individual countries are doing even better. Denmark, for example, has one of the most mature wind power markets in the world and already meets an estimated 12 percent of its total electricity demand with wind energy.

Similarly, in the EU, Japan and Canada, technological improvements are being enabled by price supports and market barrier removal in a host of key technologies. These include fuel cells, hybrid vehicles, combined heat and power, methane recovery from landfills, distributed generation, geological sequestration, agricultural practices, energy sensors and real-time control, and energy efficiency in buildings.

While R&D technology development programs can be helpful, domestic policies that reduce GHGs would be an essential catalyst and ensure the existence of markets for innovative, low-emitting technologies.

Question 5. One area that has received little attention from this Administration is the relationship of automobile emissions and climate change. Yet emissions from cars, trucks and other mobile sources contribute significantly to overall U.S. emissions of carbon dioxide. To what extent must an effective plan to address climate change in the U.S. address mobile source emissions?

Answer. Given its size and rate of growth, it is hard to imagine a serious GHG mitigation strategy that would exempt the U.S. transportation sector. Over the past several decades, transport CO_2 emissions have grown faster than those of any other sector. Today, U.S. transportation accounts for over one quarter of U.S. greenhouse gas emissions, and this share is expected to rise to 36 percent by 2020. U.S. transportation is also a major emitter on a global scale. Each year it produces more CO_2 emissions than any other nation's entire economy, except China.

Question 5a. Would CAFE standards that increased fuel economy be a sound approach? If not, why not?

Answer. One approach for reducing greenhouse gas emissions is to set efficiency standards for products such as cars—as long as the levels and timing of the standards are reasonable. In 2002, the National Academy of Sciences found that passenger car fuel economy could most likely be increased by 12 percent (for subcompacts) to 27 percent (for large cars) and light truck fuel economy by 25 (small SUVs) to 42 percent (large SUVs), using technologies that would not change the size, weight or performance of vehicles. While many of these technologies would increase the vehicle's price, fuel savings would more than pay back their cost over the life of the vehicle. The Academy also concluded that giving auto manufacturers adequate lead time was important. The Academy and others have suggested that the CAFE program could be improved by establishing a fuel economy credit trading program among manufacturers. A company that surpasses the standard could sell fuel economy credits to a company that did not meet the standard. This would allow a standard to be met at the lowest possible cost on an industry wide basis.

Question 5b. What other approaches might the U.S. consider?

Answer. Numerous approaches are possible. The approach taken by the Climate Stewardship Act is to require oil producers to surrender GHG allowances proportional to the carbon content of the fuel they sell. However, it is not clear how effectively such an approach would pull lower-emitting vehicles into the market. Thus the Climate Stewardship Act alsorewards a vehicle manufacturer that exceeds CAFE standards with emission credits it can sell in the market.

Another approach is to establish federal greenhouse gas standards for automobiles. In the context of an economy wide GHG cap and trade program, the CAFE standards or GHG emission standards could be made "tradeable"—auto companies could sell GHG emissions credits if they surpass fuel economy standards, and could buy credits if they were unable or unwilling to meet the standards.

Another option is to replace current fuel economy regulations with a system of fees and rebates to discourage low-mpg and promote high-mpg vehicles. In theory, these feebates should harmonize the interests of car buyers and manufacturers. Other creative pricing policies include "variabilizing" some of the fixed costs of vehicle travel by converting annual fees and charges into surcharges on motor fuels, providing consumers with the opportunity to reduce driving costs by driving less. One such idea is "pay-at-the-pump" auto insurance, where a minimum required amount of insurance (e.g., basic liability) is paid for by all via a surcharge on gasoline or diesel fuel.

There is a whole set of options in the context of the reauthorization of the federal highway bill. In partnership with state and local actions, federal funding could be used to encourage more climate-friendly fuels, vehicles, transportation modes, and "smart growth."

Finally, a major initiative to shift the transportation sector to low carbon fuel—most likely hydrogen—may be the most important solution in the long term. The President's recent announced hydrogen initiative is a positive step and one that should be taken immediately. However, the President's program would complement, not be substitute for, near-term actions to reduce greenhouse gas emissions. In fact, measures that focus economic actors on greenhouse gas reduction will hasten the transition to a hydrogen economy.

Question 5c. How would the draft McCain/Lieberman bill trading and verification procedures work with respect to emissions from mobile sources?

Answer. Trading and verification procedures are relatively simple compared to other forms of environmental regulation. Because the requirement to hold allowances is placed on oil refiners, current reporting of fuel sales would continue, with the added requirement of reporting fuel carbon content, which is relatively straightforward. The option for auto efficiency credits would also be relatively straightforward, given the small number of vehicle manufacturers, the existing requirement that they track and report their fuel economy, and the ease of converting this information into GHG emission estimates.

Question 6. Ms. Claussen, the U.S. is being chastised internationally for repudiating the Kyoto Protocol, in particular, and stepping away from our leadership role in addressing climate change, in general. What should our approach be in the international negotiations over climate change? How would this draft bill fit into that approach?

Answer. The most important step the U.S. can take to establish a leadership role on climate change is to demonstrate to the international community that it is taking concrete action to begin reducing its greenhouse gas emissions. Enactment of this bill would send a very strong signal that the U.S. not only recognizes its responsibilities as the world's largest greenhouse gas emitter but has established a comprehensive national framework that puts it on the path toward meeting that responsibility.

At the same time, the U.S. must make clear to other nations that it is prepared to work with them toward establishing a workable, binding international framework that ensures that all major emitting countries—both developed and developing—do their fair share toward meeting this challenge. It is too late at this point to contemplate U.S. participation in the first commitment period (2008–2012) under the Kyoto Protocol. Rather, the U.S. and other nations should begin discussions now with the goal of modifying Kyoto or arriving at a successor agreement for the period after 2012. When some developed countries tried to initiate such discussions at COP 8 in Delhi, the U.S. was among those opposed. Hopefully, at COP 9 this fall in Italy the U.S. can play a more constructive role.

In short, the two overriding objectives of U.S international policy on climate change should be to demonstrate concrete action to reduce U.S. emissions and to engage in meaningful discussions with other nations to set the stage for the negotiation of a binding long-term agreement that encompasses all major emitting countries.

Question 7. As you may know, the state of Massachusetts was the first state to initiate a mandatory cap on CO_2 emissions from its six highest-emitting power plants, and plans to reduce their emissions further. In addition, Oregon has placed CO_2 limits on new power plants. Given the potential for a patchwork of state carbon cap and trade programs, what role could the federal government play?

Answer. States are acting because of the absence of federal leadership. Enacting a reasonable federal greenhouse gas program, such as the Climate Stewardship Act, in consultation with states, is the best way for the federal government to avoid a patchwork of state carbon cap and trade programs. Provisions for credit for early action, as are included in the Climate Stewardship Act, would give credit to companies who had already taken action under state programs, thereby harmonizing a new federal effort with early state efforts. Nothing in the bill prohibits states from taking additional actions.

Question 7a. What roles are particularly appropriate for the states?

Answer. There is significant overlap between states' energy, economic development, and environmental goals, and states have numerous authorities that are relevant to greenhouse gas emissions and sequestration. Examples include transportation planning and project selection, electric utility siting and performance, conventional air pollution, and rural development. Many states have already begun to exercise these authorities in a climate-friendly manner; it would be appropriate for more states to follow suit.

Question 7b. What would be useful to see in such a system—consistent national criteria, standards, information coordination?

Answer. Ultimately a national economy wide cap and trade system is essential. A useful first step would be national mandatory reporting. This would give each state access to the best available GHG information without having to go through the trouble of setting up its own registry. This would provide states with a solid information base for exercising their authorities in a climate-friendly manner.

Question 7c. What is a good model for such a coordinated state-national system?

Answer. The model found in most major federal environmental laws is a good one: Establish a national program that sets standards below which no states can fall, while allowing states to use their authorities to take additional actions.

RESPONSE TO WRITTEN QUESTIONS FROM HON. JOHN F. KERRY TO FRED KRUPP

Question 1. One of the rationales given by the Bush Administration for rejecting any measures to require actual reductions in green house emissions is that these will result in enormous costs to the U S. economy, to the point that no mandatory requirements are acceptable. James Connaughton's testimony last July stated that compliance with Kyoto would cost the United States $400 billion and 4.9 million jobs. Do you agree with this assessment?

Answer. No. Mr. Connaughton's testimony last July contained no specific citations for his estimate of $400 billion in costs and a loss of 4.9 million, so I cannot respond to that claim directly. I would point out, however, that the background materials accompanying Mr. Connaughton's testimony contain similarly high cost estimates, and these do carry citations that in fact undercut his claims of astronomical costs. All cost estimates in the "Book Accompanying Presidential Statement (June 11, 2001)"—tab C in his testimony—note that they assume a world "without emissions trading." Almost by definition, then, these cost estimates are bound to be very high. The paragraphs below explain why:

The economic affects of complying with the Kyoto Protocol have been extensively studied and cost estimates have ranged widely from a net economic gain to significant cost depending on the set of assumptions and analytical technique. Macroeconomic computer models tend to give the most pessimistic estimates, and the Administration relies on this type of analysis. It has been shown, however, that the output from these models is largely determined by a small set of variable factors, which can be manipulated in such a way that a modeling run can generate either positive or negative costs. Therefore, based solely on macroeconomic computer modeling, there is no reason to conclude that the costs would in fact be severe. Moreover, these models do not incorporate a number of very important cost-reducing factors, such as inexpensive reductions in non-CO_2 gases, ancillary benefits from attendant reductions in other forms of air pollution (*e.g.,* particulate matter), *and—perhaps the most dramatic cost-reducing variable—emissions trading.*

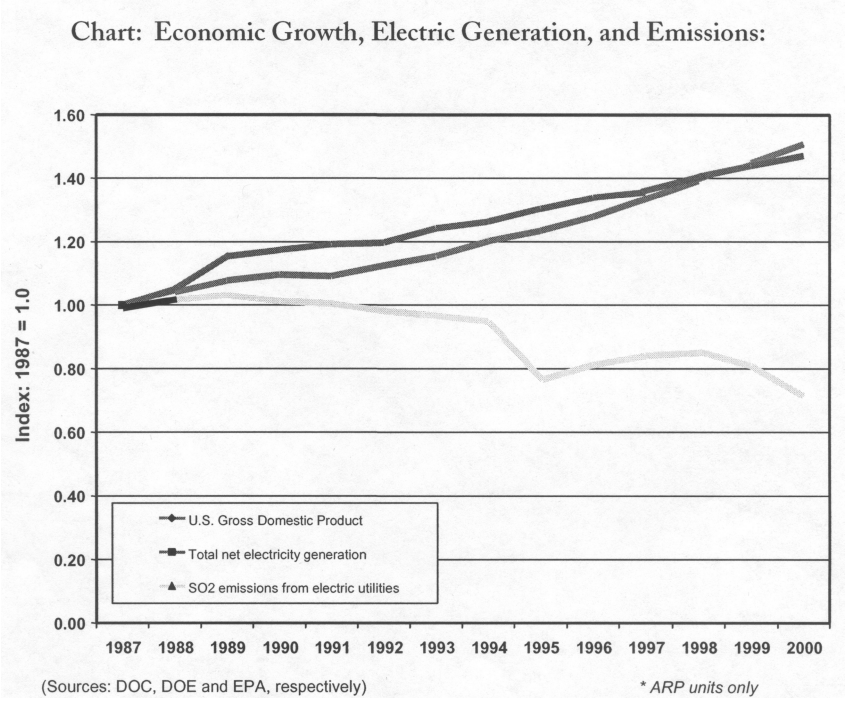
Importantly, we have seen significant, peer-reviewed literature that directly contradicts the cost estimates from some economic modeling. The U.S. Department of Energy funded a major engineering study that concluded that CO_2 emissions could be greatly reduced at little to no cost owing largely to efficiency gains and fuel savings. Technology studies tend to be more optimistic and need to be considered alongside macroeconomic analyses. In addition, real-world experience is sending a strong signal that the cost to reduce greenhouse gas emissions will be relatively low and manageable. Large energy-intensive companies have made significant reductions in GHG emissions at costs on the order of $5 or $10 per tonne. The first ever intersectoral GHG emissions trading program was launched in the UK in 2002 and costs have generally been in the range of $8–$14 per tonne. These real-world price signals are a minute fraction of the costs being estimated by the Administration. There is a precedent for this type of discrepancy. In 1990 there were many pessimistic estimates of the cost to reduce sulfur dioxide emissions, but the emissions trading program established in the U.S. achieved compliance at a fraction of those estimates. Given that the Kyoto Protocol has a market-based emissions trading framework, there is evidence to suggest that the Protocol will minimize costs and keep them in a range consistent with the experience being gained in the UK and other countries.

Question 2. Are you aware of any examples where requirements to address pollution either had little negative impact on the economy, or even provided areas for economic growth?

Answer. Certainly. One of the most relevant examples in the field of emissions control is the innovation and economic growth seen under the US Acid Rain Program. That program employs a cap and trade system very much like that contemplated by the Climate Stewardship Act, and its provisions not only allowed sub-

stantial growth in the electric generation sector, but also provided for innovation in the field of emissions control technology.

Though some experts predicted of extraordinarily high compliance costs, the Acid Rain Program's cap and trade structure in fact delivered environmental benefits in excess of legal requirements at costs far below expert predictions. Both the electric generation sector and the environment benefited from this outcome, as shown in the chart below:



The cap and trade system employed for acid rain—like the cap and trade system contemplated under the Climate Stewardship Act—avoids technology specifications, allowing regulated parties freedom to choose the package of emissions reduction methods most appropriate to their operations. The result has been innovation in emissions-reduction technologies and economic growth in this sector. A major study published in 2000 noted that, "the striking contrast between technological stagnation in scrubber technology before 1992, under a regulatory regime of direct emission controls, and technological progress since then, under a regulatory regime with tradable permits is hard to ignore."[1] Scrubber manufacturers, for example, have been marketing scrubbers for Phase II of this program at about half the cost of Phase I scrubbers.[2] This innovation has taken place not only because of increased competition directly between manufacturers of technologies like scrubbers, but as well because all compliance options—from scrubbers to fuel switching to energy efficiency—now compete with one another in the marketplace of compliance options. Unlike a command-and-control scenario, no one compliance technology holds a monopoly in the cap and trade system.

Question 3. Are there really no mandatory measures to reduce GHGs that can be undertaken without adverse impact—and potentially with a positive impact—on our economy?

Answer. Absolutely not. In fact, we have seen good examples of companies growing and succeeding under greenhouse gas caps. Dupont, for example, is a company

[1] A. Denny Ellerman, Richard Schmalensee, Elizabeth M. Bailey, Paul L. Joskow, and Juan-Pablo Montero, *Markets of Clean Air: The U.S. Acid Rain Program* (New York Cambridge University Press, 2000), pp. 242.

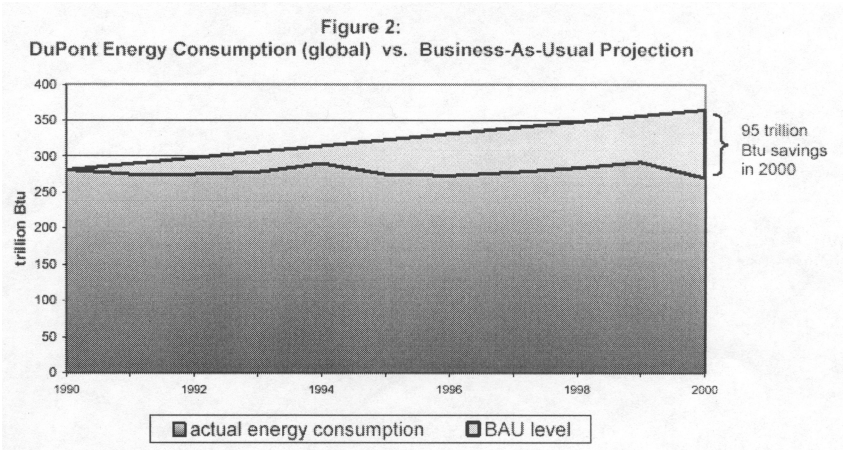
[2] Ibid., 240.

that has taken on a voluntary cap on emissions—a cap that could easily have been imposed by a mandatory system—and under it dramatically reduced greenhouse gas emissions while experiencing major economic growth. Consider the following report on Dupont's success, drawn from publicly available materials produced through our Partnership for Climate Action:

> DuPont is a science company that manufactures a variety of chemical products and operates in 70 countries. In 2001 revenues were $24.7 billion, and the capital expenditure budget was $1.5 billion. In the early 1990s, DuPont established two goals related to emissions of greenhouse gases (GHGs). The first was to reduce its GHGs 40 percent compared to 1990 levels by 2000. In calculating its GHG emissions, DuPont included gases released directly from its facilities (carbon dioxide, fluorocarbons, nitrous oxide, and others) as well as carbon dioxide released indirectly by power generators that provide electricity and steam to DuPont's facilities. A second goal was to reduce global energy use per pound of production by 15 percent compared to 1991 levels. In 1999 DuPont supplanted these goals with more aggressive targets to be achieved by 2010, namely to reduce GHG emissions by 65 percent versus 1990 levels and to hold energy use flat at 1990 levels. In addition, DuPont pledged to supply 10 percent of its energy needs from renewable resources at a cost competitive with best available fossil-derived alternatives...
>
> By 2000, DuPont had reduced GHG emissions across the company by 63 percent from the base year of 1990, for a reduction equaling 56.2 million metric tonnes (on a CO_2-equivalent basis). In a hypothetical market for emissions credits, assuming that: (a) DuPont was awarded a tradable allocation amounting to 90 percent of its 1990 emissions, and (b) an average market price of $10 per metric tonne of CO_2, then the GHG reductions as of 2000 have a potential market value of $472 million per year[3]—an extraordinary return on investment. Even without a regulated market, DuPont has already sold some reductions to other companies on a voluntary basis, thereby recouping part of its costs.[4]
>
> Following these early successes, a new slate of projects was prepared, and by the end of 2001 DuPont exceeded its 65 percent reduction goal, nine years ahead of schedule. To reduce energy consumption, DuPont implemented an equally impressive investment strategy. The current DuPont goal is to hold total energy consumption flat at 1990 levels through 2010. With DuPont, as with most companies, the opportunity to reduce energy consumption and consequent CO_2 emissions exists at practically every facility. This allows for many project options. While DuPont expects that some business units will increase energy consumption due to production increases to meet market demand, the breadth of reduction opportunities provides ample energy savings at other business units, so the net effect is flat energy use. The energy program and CEP project-selection process spurred a variety of actions throughout the operations at DuPont. Energy efficiency improved because of product portfolio changes, cogeneration, yield improvements, capacity utilization, better uptime, and conservation measures. As shown in Figure 2, overall energy consumption remained flat throughout the 1990s at a time when production grew 35 percent.

[3] Under a typical "cap-and-trade" emissions trading system, a company receives from a regulating agency an annual allocation of tradable credits. It must keep enough credits to cover its annual emissions, but if emissions have been reduced below the allocation, then the company has a surplus that it can sell. An allocation of credits is generally pegged to some base year, such as 1990 in the case of the Kyoto Protocol on climate change. If the U.S. were to accept the Kyoto Protocol, its previously negotiated commitment is to reduce national emissions to 7 percent below 1990 levels. Thus, in this hypothetical example, we assume that the U.S. commitment has been devolved to individual companies, minus some type of withholding, leading to an annual allocation of 10 percent below 1990 emissions, or 90 percent of the 1990 baseline.

[4] See "DuPont-Entergy Greenhouse Gas Trade" at *www.pca-online.org*.



Converting the energy savings into barrels of crude oil, DuPont avoided the consumption of 16.2 million barrels in 2000 alone. Further, using the cost of oil as a rough indicator of average energy cost, and assuming $20 per barrel of crude oil, then cost savings for DuPont in 2000 were approximately $325 million. Cumulative cost savings over the ten-year period (the upper layer in Figure 2) amount to $1.65 billion.[5]

But internal emission reductions are of course not the only aspect of a mandatory GHG emissions reduction program. Congress could choose, as the authors of the Climate Stewardship Act have, to allow external emissions offsets such as carbon sequestration projects. 'We know that engaging farmers and foresters in carbon sequestration activities can benefit the regulated emitter by reducing the cost of compliance with a cap on greenhouse gases, but less well appreciated are the benefits that accrue to the landowner engaging in a carbon sequestration project. Farmers engaging in conservation tillage, for example, tend to find that their crop yields increase over time, that they are better able to weather drought conditions, that their fields produce less of the runoff that harms fish species and impinges on water quality, and that they make less of a contribution to harmful local air quality conditions. Foresters who manage their timber stands for carbon as well as timber create healthier managed forests, and this benefits wildlife and water conditions as well as the atmosphere. A comprehensive cost-benefit analysis that includes the co-benefits obtained through carbon sequestration will show a substantial boost in benefits associated with carbon-sequestering activities on the land. And as the Climate Stewardship Act shows, it's absolutely feasible to incorporate these provisions within the cost-efficient cap and trade framework.

Question 4. Won't U.S. industries be at a disadvantage if other countries develop more efficient technologies?

Answer. As greater numbers of countries adopt hard caps on their emissions, the marketplace of ideas for controlling GHG emissions will only grow. The countries of Europe, for example, have agreed to an EU-wide emissions trading program under which diverse sectors of the European community will be engaged in the efficiency-seeking behavior encouraged by the cap and trade system. That investments in new technologies to control emissions—and innovation within the technology field—will occur is indisputable. It's important to understand that the caps on emissions adopted by each of the countries of Europe are driving this innovation. The emissions caps create a demand for emissions-controlling technology that simply doesn't exist under a voluntary system of emissions control. As new products and technologies are developed, they will be designed by and for countries other than the U.S. Our native talent and entrepreneurial spirit will, most certainly, rise to the challenge when ultimately called upon to innovate. However, each day we delay in starting our creative engines is a day in which foreign industries extend their lead in technology development.

[5] Excerpts from, "Positive Returns on Greenhouse Gas Investments: The DuPont Experience with Advancing Environmental Goals," available at *www.pca-online.org*.

Question 5. To what extent must an effective plan to address climate change in the U.S. address mobile source emissions?

Answer. A plan to address climate change in the U.S. must address mobile source emissions to be effective. Transportation is responsible for about ⅓ of U.S. greenhouse gas emissions and cars and light duty trucks (passenger vehicles) are responsible for the majority of this, about 20 percent of our Nation's total emissions. The emissions from U.S. automobiles exceed the total emissions of every other country except China, Russia, and Japan. Further, transportation is the Nation's fastest growing source of greenhouse gas emissions. According to DOE's latest Annual Energy Outlook, transportation sector CO_2 emissions are projected to grow at a 2.0 percent per year compound rate over the next two decades, while other sectors' growth rates range from 1.0–1.6 percent per year. Between 1990 and 2000, carbon emissions from passenger vehicles rose by nearly ⅓ as vehicle miles traveled increased, and larger and more powerful vehicles turned the clock back 20 years on the fleetwide fuel economy of new vehicles.

Question 6. Would CAFE standards that increased fuel economy be a sound approach?

Answer. CAFE standards have a proven track record of improving the fuel economy of the fleet while allowing automakers flexibility regarding how they comply. Stronger CAFE standards would ensure substantial near-term oil savings and reduction of greenhouse gas emissions, a key component of any sensible energy policy. There are a plethora of automotive technologies and design options that automakers could use to affordably and safely increase fuel economy.

On a very short term basis, we recommend that you focus on closing loopholes that hamper the ability of the CAFE program to achieve its goals. This includes harmonizing car and light truck standards and, in the meantime, eliminating gaming of the light truck definition to include vehicles that function as cars. Vehicles weighing between 8,500 and 10,000 pounds (gross vehicle weight) also should be included in the program, and testing protocol should reflect real world driving conditions. Tightening the program will create a stronger foundation for using the CAFE program to drive greenhouse gas reductions for the automotive sector.

Question 7. What other approaches might the U.S. consider?

Answer. The bottom line is that there is an urgent need to reduce oil dependence and greenhouse gas emissions from the automotive sector. The administration's focus on fuel cell research and development fails to deal with the pressing need for solutions by shifting the focus to a speculative, long-term technology goal without the accountability for emissions or oil use that could make increased research into new technologies a credible piece of a larger overall strategy. CAFE could complement and provide a bridge to a variety of future policies that will track and create incentives for progress on emissions reductions. California demonstrated leadership last year in passing a bill calling for maximum feasible reductions in greenhouse gas emissions from automobiles. Regulatory mandates could be supplemented with incentive and information programs that help consumers contribute to greenhouse gas and oil use reductions, including greenhouse gas emission labels on vehicles, tax credits for ultra-clean and super-efficient vehicles, and fleet policies that track and motivate greenhouse gas reductions.

Question 8. How would the draft McCain/Lieberman bill trading and verification procedures work with respect to emissions from mobile sources?

Answer. Given our support for the bill's efforts to create an economy-wide emissions trading market, Environmental Defense is certainly open to approaches that permit some form of emissions trading between automobile manufacturers and other greenhouse gas sources. To some extent, however, the inclusion of petroleum producers in the greenhouse gas reduction mandate renders trading of credits generated by automakers redundant; in fact, in the absence of appropriately crafted provisions, such trading could result in double-counting. Beyond that, any attempt to qualify and quantify improvements in CAFE as greenhouse gas reduction credits or allowance-equivalents requires a highly specific set of provisions to ensure environmental integrity. Creating such credits through the project-based reduction and crediting provisions included in the draft's registry title, which are inadequate in and of themselves, are not appropriate to apply here.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. JOHN F. KERRY TO RANDY OVERBEY

Question 1. One of the rationales given by the Bush Administration for rejecting any measures to require actual reductions in greenhouse gas emissions is that these will result in enormous costs to the U.S. economy, to the point that no mandatory requirements are acceptable. James Connaughton's testimony last July stated that compliance with Kyoto would cost the United States $400 billion and 4.9 million jobs. Do you agree with this assessment?

Answer. We have not made an assessment of the national impact of Kyoto. Our view is that any program must estimate the true impact on the economy, industry's ability to compete in the world markets, and the impact on the environment.

Question 2. Are you aware of any examples where requirements to address pollution either had little negative impact on the economy, or even provided areas for economic growth?

Answer. As we said in our testimony, we were able to improve our aluminum reduction process resulting in lower cost, reduced emissions of PFCs, more stable operation, and in some cases, with limited capital. We cannot comment other companies' abilities to make these kinds of changes.

Question 3. Are there really no mandatory measures to reduce GHGs that can be undertaken without adverse impact—and potentially with a positive impact—on our economy?

Answer. We believe that a cap and trade mechanism can be balanced and effective. The details of the cap, the breadth of society to which it is applied, and the allocation methods are all critical factors. A cap and trade mechanism which does not carefully take these into account could be damaging to the economy and the ability for companies like ours to compete on a worldwide basis.

Question 4. Won't U.S. industries be at a disadvantage if other countries develop more environmentally efficient technologies?

Answer. From our perspective, a great deal of work is underway on developing environmentally friendly technologies. Our own pursuit of a non-carbon anode for aluminum production is a good example.

Question 5. As you may know, the State of Massachusetts was the first state to initiate a mandatory cap on CO_2 emissions from its six highest-emitting power plants, and plans to reduce their emissions further. In addition, Oregon has placed CO_2 limits on new power plants. Given the potential for a patchwork of state carbon cap and trade programs, what role could the federal government play?

Answer. The Federal Government could assimilate the "good and bad" from state activities, as well as those around the world, asking what has worked and what has not worked. This could help with the design of a nation-wide mechanism. Further, the federal government can assess the impact on business and industry by working closely with those which are most affected. Finally, we believe the government could assure a broad-based approach, not one which targets limited segments of society

Question 6. What roles are particularly appropriate for the states?

Answer. The states can assist by working closely with business and industry to assess impacts.

Question 7. What would be useful to see in such a system—consistent national criteria, standards, information coordination?

Answer. We believe, given the science of global warming, that a national approach, which fits into the international picture, is the right strategy. Further we believe that a single, national GHG inventory and registry with clear, internationally accepted accounting rules would reduce multiple reporting costs, ensure consistency, and facilitate policy and market mechanisms. Simply put, national criteria (and not a myriad of state and agency rules) is needed to ensure that a ton of GHG emissions should be counted consistency as a ton of GHG emitted within any state, by every agency, and recognized internationally.

For corporate entities such as Alcoa, "The Greenhouse Gas Protocol—A Corporate Accounting and Reporting Standard" is a good basis for these national criteria. This protocol was developed jointly by the World Resources Institute and the World Business Council for Sustainable Development. It represents a fair balance of stakeholder interests and has been pilot tested and utilized by a number of corporate entities such as Alcoa. Specific accounting details related to the aluminum, cement, forest products and oil and gas sectors have been written and endorsed by WRI/WBCSD.

Question 8. What is a good model for such a coordinated state—national system?

Answer. Other than the protocols mentioned above, we are not aware of a good, specific model. Our company is working on our internal goals and, should we find or develop beneficial approaches, we will be happy to share those with the Committee.

Question 9. James Rogers, the CEO of Cinergy, Inc., testified before this Committee that his utility company supported placing a carbon commitment in any power plant legislation because "without some sense of what our carbon commitment might be over the next 10, 15, or 20 years, how can I or any other utility CEO think we have a complete picture of what major requirements our plants may face?" In addition, American Electric Power has made a similar statement before this Committee. Would you agree with this statement? If carbon emissions levels are set, will that add further impetus to developing a diversified energy portfolio, such as renewables?

Answer. As we have mentioned, a global warming emissions cap can be effective—the proof is in the design. Other incentives, such as tax relief, can spur the development of renewable energy, so, a carbon cap is not the only potential answer.

Question 10. How can even a small utility make future plans, like building a new facility, without knowing what carbon emissions levels need to be achieved?

Answer. We concur that clarity of the future is important for investment. However, this can be an integrated strategy involving a broad segment of society and does not necessarily have to rest only on specific facilities.

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