

HEARING ON SCIENTIFIC OBJECTIVES FOR
CLIMATE CHANGE LEGISLATION

HEARING
BEFORE THE
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**HEARING ON SCIENTIFIC OBJECTIVES FOR
CLIMATE CHANGE LEGISLATION**

Wednesday, February 25, 2009

U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE ON WAYS AND MEANS,
Washington, D.C.

The Committee met, pursuant to notice, at 10:07 a.m., in room 1100, Longworth House Office Building, Hon. Charles B. Rangel, (Chairman of the Committee) presiding.

ADVISORY

FROM THE COMMITTEE ON WAYS AND MEANS

FOR IMMEDIATE RELEASE
February 18, 2009
FC-1

CONTACT: (202) 225-1721

Chairman Rangel Announces Hearing on Scientific Objectives for Climate Change Legislation

House Ways and Means Committee Chairman Charles B. Rangel today announced that the Committee on Ways and Means will continue its series of hearings on climate change. **The next hearing will take place on Wednesday, February 25, 2009, in 1100 Longworth House Office Building, beginning at 10:00 A.M.**

In view of the limited time available to hear witnesses, oral testimony at this hearing will be from invited witnesses only. However, any individual or organization not scheduled for an oral appearance may submit a written statement for consideration by the Committee and for inclusion in the printed record of the hearing. A list of invited witnesses will follow.

BACKGROUND:

During the 110th Congress, the Committee on Ways and Means began a series of hearings on climate change. In the first hearing, the Committee heard testimony that human greenhouse gas emissions are having an adverse impact on our planet's climate. In the second hearing, the Committee heard testimony from numerous witnesses recommending that Congress implement revenue measures (e.g., auction-based cap-and-trade proposals or carbon taxes) that would reduce human greenhouse gas emissions. In connection with the development of these revenue measures, witnesses at this hearing also encouraged the Committee to (1) promote a comprehensive global effort to address climate change and to ensure a level regulatory playing field for U.S. manufacturers, (2) mitigate higher energy costs borne by consumers, and (3) maximize the impact that climate change legislation will have on growing the U.S. economy.

In announcing this hearing, Chairman Rangel said, **"The development of climate change legislation will be a priority for the Ways and Means Committee during the 111th Congress. The Committee must define the environmental objectives that we hope to achieve with climate change legislation before we can design such legislation. These objectives must be based on science."**

FOCUS OF THE HEARING:

The hearing will focus on a scientific discussion of the objectives that climate change legislation should seek to achieve.

DETAILS FOR SUBMISSION OF WRITTEN COMMENTS:

Please Note: Any person(s) and/or organization(s) wishing to submit for the hearing record must follow the appropriate link on the hearing page of the Committee website and complete the informational forms. From the Committee homepage, <http://waysandmeans.house.gov>, select "Committee Hearings". Select the hearing for which you would like to submit, and click on the link entitled, "*Click here to provide a submission for the record.*" Once you have followed the online instructions, com-

plete all informational forms and click "submit" on the final page. **ATTACH** your submission as a Word or WordPerfect document, in compliance with the formatting requirements listed below, by close of business **Wednesday, March 11, 2009**. Finally, please note that due to the change in House mail policy, the U.S. Capitol Police will refuse sealed-package deliveries to all House Office Buildings. For questions, or if you encounter technical problems, please call (202) 225-1721.

FORMATTING REQUIREMENTS:

The Committee relies on electronic submissions for printing the official hearing record. As always, submissions will be included in the record according to the discretion of the Committee. The Committee will not alter the content of your submission, but we reserve the right to format it according to our guidelines. Any submission provided to the Committee by a witness, any supplementary materials submitted for the printed record, and any written comments in response to a request for written comments must conform to the guidelines listed below. Any submission or supplementary item not in compliance with these guidelines will not be printed, but will be maintained in the Committee files for review and use by the Committee.

1. All submissions and supplementary materials must be provided in Word or WordPerfect format and **MUST NOT** exceed a total of 10 pages, including attachments. Witnesses and submitters are advised that the Committee relies on electronic submissions for printing the official hearing record.

2. Copies of whole documents submitted as exhibit material will not be accepted for printing. Instead, exhibit material should be referenced and quoted or paraphrased. All exhibit material not meeting these specifications will be maintained in the Committee files for review and use by the Committee.

3. All submissions must include a list of all clients, persons, and/or organizations on whose behalf the witness appears. A supplemental sheet must accompany each submission listing the name, company, address, telephone, and fax numbers of each witness.

Note: All Committee advisories and news releases are available on the World Wide Web at <http://waysandmeans.house.gov>.

The Committee seeks to make its facilities accessible to persons with disabilities. If you are in need of special accommodations, please call 202-225-1721 or 202-226-3411 TTD/TTY in advance of the event (four business days notice is requested). Questions with regard to special accommodation needs in general (including availability of Committee materials in alternative formats) may be directed to the Committee as noted above.

Chairman RANGEL. The Committee will come to order. I want to thank the Members that are here. I am certain others will be coming soon.

I want to thank the Committee Members and our witnesses for joining us on what may not be a historic occasion, but certainly indicating that the Congress is prepared to move on this very, very important issue.

Our President has spoken to this issue. The Speaker has. I am certain we all agree that we have a responsibility to continue.

This is the third hearing that we have had on climate change legislation. The whole world is watching, not necessarily this Committee, but certainly the direction in which the Congress is going to go.

We hope that our colleagues on the other side of the aisle will cooperate in trying to set up some type of a taskforce with other Committees of jurisdiction so we can see what, if any differences we had, so we can make certain that we get all the ideas on this very complex subject in line.

We think we have enough scientific evidence to move forward on this, the distribution of resources that will have to be collected is a very complex problem.

I want to first welcome Dr. James Hansen, who has an international reputation for expertise in this area, spending decades bringing this to the attention of the American people and the world, sounding the alarm as early as in 1988 when he was in testimony before the Congress, who raised awareness of global warming issues.

Your leadership has been appreciated. It is invaluable. We are really grateful that all of you have adjusted your schedules to share your very, very important views with us.

I want to welcome Dr. Brenda Ekwurzel, who joins us today representing the Union of Concerned Scientists. It is a science based non-profit organization.

The Union of Concerned Scientists recently released the U.S. scientists and economists' call for a swift and deep cut in greenhouse gas emissions, and we are honored and pleased that you have presented yourself to us as well as 1,700 scientists and economists with expertise in dealing with this, and we thank you again.

I also would want to include in our welcome to Dr. John Christy, who is a distinguished professor of atmospheric science and director of the Earth Science Center at the University of Alabama in Huntsville.

He has served the State since 2000 and brings with him a great resume of experience in this area.

Since you all have been pioneers and recognized the serious nature of this issue, and I hope you are pleased to know that our national leadership has agreed that it is time to stop talking and to move and to continue to call upon your expertise as we prepare a bill to present to the President of these United States.

I would like to yield to Jim Camp on this sensitive subject.

Mr. CAMP. It is Jim McCrery and Dave Camp.

Chairman RANGEL. I am sorry.

Mr. CAMP. Thank you. Thank you, Mr. Chairman. I want to thank you before we get into the substance of this hearing for exerting our jurisdiction over this issue.

This is an important issue. It is an issue with significant revenue ramifications, and the Committee on Ways and Means needs to be very importantly involved in it.

As Dr. Hansen, the witness, notes—I want to thank all the witnesses for being here—he notes in his written testimony, primarily on the cover, that tax and trade is “pseudonymously” and sometimes disingenuously termed “cap and trade.”

I am not sure I could have better stated that fact, that the so-called cap and trade measure is a revenue measure. That should originate in the House, and more specifically, it should originate in this Committee.

The question of this hearing is what are the scientific objectives for climate change legislation, and I would like to take a step back and ask what is the science of climate change, what can it definitely tell us, can it say who is responsible for it, can it tell us what impact we can have on it, and if we can, what are the results both positive and negative.

From what I have read, there remains still a great deal of uncertainty with regard to the scientific evidence about climate change. However, I do think you can find virtually unanimity, and that is in acting alone, the United States can do very little if anything to reduce global greenhouse gases.

Unless larger emitters like China and India agree to binding reductions in their emissions, there will be no benefit, only significant job losses here in the U.S.

Let me repeat that. Unilateral action by the United States will not reduce greenhouse gas emissions in any significant way, but it will reduce U.S. economic growth and destroy millions of American jobs, especially in the manufacturing sector. In a state like Michigan, that is absolutely critical.

Those jobs are the backbone of our economy as well. That is because at its core, any tax and trade plan is designed to increase the cost of energy. Energy that fuels our cars, lights our homes, powers our assembly lines, and ensures an affordable food supply.

Even if we ask the American worker to make this economic sacrifice, there are no guarantees that China and India will follow suit. In fact, the Chinese and Indians have made it very clear that they will not agree to any reductions in emissions but instead expect millions of dollars of U.S. aid and technology.

When asked about capping China's greenhouse gas emissions, Ma Kai, head of the country's National Development and Reform Commission, said and I quote "Our general stance is that China will not commit to any qualified emission reduction targets."

Similarly, Shyam Saran, India's principal negotiator on climate change, when asked about his country's interest in capping its greenhouse gas emissions, said and I quote again "Industrialized countries should meet their own commitments in the fight against climate change rather than asking countries like India and China to cap greenhouse gas emissions. We do not want to announce targets which we have no intention of achieving."

Many of you have heard the Chairman and I discuss the need to work in a bipartisan fashion on this Committee, so before I yield back, I just want to comment that before Members vote to eliminate millions of American jobs, let us find out if an economy-choking solution will actually provide any measurable benefit.

I expect all of our witnesses today will caution that the U.S. acting alone cannot make a bit of difference in actually changing the climate.

With that, I yield back the balance of my time and thank you again, Mr. Chairman.

Chairman RANGEL. Thank you, Mr. Camp. I now have the great honor of calling on Dr. Hansen, who certainly has done a yeoman's job of bringing this serious problem to the attention of our great country and the world, and I hope all three of you will make yourself available as we move forward in trying to get these ideas in a legislative form.

Dr. Hansen, thank you once again. I look forward to your testimony.

**STATEMENT OF JAMES E. HANSEN, ADJUNCT PROFESSOR,
THE EARTH INSTITUTE AT COLUMBIA UNIVERSITY, NEW
YORK**

Mr. HANSEN. Thank you, Chairman Rangel and Mr. Camp.

We have a planet in peril. The President recognizes this. The situation is clear. Evidence from the Earth's history and ongoing global climate changes reveal that the "dangerous level" of atmospheric carbon dioxide is much less than was believed even recently.

The safe level is no higher than 350 parts per million, probably less than that. We just passed 385 ppm.

Climate change threatens everyone, especially our children and grandchildren, the young and the unborn, who will bear the full brunt, through no fault of their own.

It is clear that we cannot burn all fossil fuels releasing the waste products into the air without handing our children a situation in which amplifying feedbacks begin to run out of their control, with severe consequences for nature and humanity.

We have to face the truth. We cannot burn all of the coal, let alone unconventional fossil fuels such as oil shale, unless the combustion products are all captured and disposed of, which is implausible.

The Obama Administration has taken steps that may lead to improved vehicle efficiencies and reduced coal use. These actions are necessary and important but they will be effective only if we address the root cause of the problem.

The root cause is our failure to make polluting fossil fuel energy more expensive than clean energy. We must put a price, a rising price, on carbon emissions.

There are two competing ways to achieve this price. One is tax and 100 percent dividend. Tax carbon emissions but give all of the money back to the public on a per capita basis.

For example, let us start with a tax large enough to affect purchasing decisions, a carbon tax that adds one dollar to the price of a gallon of gas. That is a carbon price of about \$115 per ton of CO₂. That tax rate yields \$670 billion per year.

We return 100 percent of that money to the public, each adult legal resident gets one share, which is \$3,000 per year, \$250 per month deposited in their bank account. Half shares for each child up to a maximum of two children per family, so a tax rate of \$115 per ton yields a dividend of \$9,000 per year for a family with two children, \$750 per month.

The family with carbon footprint less than average will make money. That dividend would exceed their tax.

This tax gives a strong incentive to replace inefficient infrastructure. It spurs the economy and it spurs innovation.

This path can take us to the era beyond fossil fuels, leave most remaining coal in the ground, and avoid the need to go to extreme environments to find every drop of oil.

We must move beyond fossil fuels anyhow, so why not do it sooner for the benefit of our children. Not to do so and knowing the consequences is, I think, immoral.

The tax rate likely must increase in time, but when gas hits \$4 per gallon again, most of that \$4 will stay in the United States as

dividends. Our vehicles will not need as many gallons. We will be well on the way to energy independence.

The alternative to carbon tax and 100 percent dividend is tax and trade foisted on the public under the pseudonym “cap and trade.” A cap increases the price of energy as a tax does. It is wrong and disingenuous to try to hide that fact, to hide the fact that cap is a tax.

Other characteristics of the cap approach include one, unpredictable price volatility. Two, it makes millionaires on Wall Street and other trading floors at the public expense. Three, it is an invitation to blackmail by utilities who threaten blackouts coming to gain increased emission permits. Four, it has overhead costs and complexities inviting lobbyists and delaying the implementation.

The biggest problem with cap tax is that it will not solve the problem. The public will soon learn that it is a tax and because there is no dividend, the public will revolt before the cap tax is large enough to transform society.

There is no way that the cap tax can get us back to 350 parts per million of CO₂. We need a tax with 100 percent dividend to transform our energy systems and rapidly move us beyond fossil fuels.

For the sake of our children and grandchildren, we cannot let the special interests win this fight. Thanks.

[The prepared statement of James E. Hansen follows:]

Prepared Statement of Dr. James Hansen, Adjunct Professor, The Earth Institute at Columbia University, New York, New York Testimony Before the House Committee on Ways and Means February 25, 2009

Our planet is in peril.¹ Climate disruption threatens everyone, but especially the young and the unborn, who will bear the full brunt through no fault of their own. Recent science makes it clear that if we continue to burn most of the fossil fuels we will leave our children a deteriorating situation out of their control.

One scientific conclusion is crystal clear¹: we cannot burn all of the fossil fuels without setting in motion a process of climate disruption that threatens the very existence of many species on our planet. This potential injustice is not limited to the innocent species we exterminate. The greatest injustice is to our own species²—our children, grandchildren and the unborn, and people who live with nature, who we may call ‘undeveloped’, indigenous people who want only to live their lives without bearing burdens that we create.

The President deserves credit for recognizing that our planet is in peril, and his administration deserves credit for initial steps that may lead to increased vehicle fuel efficiencies and constraints on coal emissions. These steps are important. Greater fuel efficiency, e.g., is essential. But it must be recognized that these steps address the symptoms of the problem, not the root cause. Moreover, these steps will fail if the root cause is not addressed.

The root cause is our failure to make polluting fossil-fuel energy more expensive than clean energy. Instead we subsidize fossil fuels!

We must put a price on carbon emissions, a rising price. If we do this promptly we can stabilize the atmosphere and climate, with healthier air, improved agricultural productivity, clean water, an ocean providing fish that are safe to eat, with a reversal of the trend toward increased birth defects and other consequences of fossil fuel pollution in our air and water.

¹ Clarification of the climate threat could usefully be obtained by requesting a report from the National Academy of Sciences. The Academy, established by Abraham Lincoln for the purpose of advising the President and Congress on important technical matters, is widely recognized as the most authoritative scientific body in the world.

² The Sword of Damocles: http://www.columbia.edu/~jeh1/mailings/2009/20090215_Damocles.pdf

Fossil fuels are finite. We must find clean energies to replace them. Why not do that sooner, rather than digging for every scrap of carbon, and in the process destroying the future of our children and grandchildren?

The reason “why not” is this: the fossil fuel industry has enormous power over our governments, through their lobbying and “campaign” contributions. Yet you and other leaders are elected to represent the public. The public expects you to look out after their children, to preserve creation, our children’s heritage. Instead we are robbing money from our children’s pockets and piggybanks, borrowing money from our children to fund subsidies for the fossil fuel industry.

This selfishness is not limited to America. I wrote to government leaders of several countries that are believed to be among the “greenest”, one of them led by a physicist. I thought they would understand the clear scientific rationale that we must phase out coal use and move beyond fossil fuels, if we are to preserve a planet resembling the one we inherited from our elders. But I learned that the fossil fuel industries in those countries have enormous power, as they do here. Those governments are not green—they are black, coal black.

Carbon Tax and 100% Dividend

If we continue to subsidize fossil fuels and do not impose a carbon price, our automobile manufacturers will likely fail—they are being instructed to build fuel-efficient vehicles, which will be in limited demand as long as fossil fuels do not have to pay their true costs. Similarly, “renewable energy portfolios” for utilities will rip off the public (rate-payers), with marginal benefit for the environment. Energy-inefficient buildings will continue to be built. And so on.

The most honest effective way to achieve a carbon price capable of driving our economy and our society to the clean world of the future is “Carbon Tax with 100% Dividend”³ For example, a carbon price equivalent to \$1 gallon of gasoline (about \$115 per ton of CO₂), for 2007 rates of fossil fuel use in the United States, generates \$670B. If we give one share to each legal resident age 22 and over, one half-share to college age youth (18–21), one half-share to the parents of each child up to two children per family, that yields about 224 million shares in 2007 (this could be off by 10%; I could not find optimum census data). So the 100% Dividend for a \$1 gallon tax rate (\$115 per ton of CO₂) is:

Single share: \$3000/year (\$250 per month, deposited monthly in bank account)

Family with 2 children: \$9000/year (\$750 per month, deposited monthly in bank account)

The tax rate and dividend should increase with time.⁴ This approach would reduce demand for fossil fuels, driving down the price of fossil fuels on the open market. The next time the price of gasoline reaches \$4/gallon most of that \$4 should be tax, with 100% of that tax returned to the public as dividend. Instead of our money going to the Middle East and other foreign places, most of it would stay at home.⁵

This tax, and the knowledge that it would continue to increase in the future, would spur innovations in energy efficiency and carbon-free energy sources. The dividend would put money in the hands of the public, allowing them to purchase vehicles and other products that reduce their carbon footprint and thus their taxes. The person doing better than average would obtain more from the dividend than paid in the tax. The tax would affect building designs and serve as an effective enforcer of energy efficient building codes that are now widely ignored. The need to replace inefficient infrastructure would spur the economy. Tax and 100% dividend can drive innovation and economic growth with a snowballing effect. Carbon emissions will plummet far faster than alternative top-down regulations. Our infrastructure will be modernized for the clean energy future. There will be no need to go to the most extreme environments on Earth for the last drop of fossil fuel, to squeeze oil from tar shale, or develop other unconventional fossil fuels.

³http://www.columbia.edu/~jeh1/mailings/2008/20080604_TaxAndDividend.pdf

⁴The tax rate should increase until fossil fuel energy is not competitive with clean energy. The tax gathered, and thus the dividend, will initially increase as more clean energy enters the mix. But the dividend will eventually go down, as clean energy becomes ascendant. That is okay, because, as a result of competition, economies of scale and innovation, clean energy prices will fall. In addition, increased energy efficiency and conservation will reduce energy use per person.

⁵Two years ago I sat next to the Saudi Arabian Ambassador to the United States at a dinner. He became upset, politely, when I mentioned this concept of a carbon tax. Clearly, he understood the implications. He did not seem too concerned that it would be adopted—he probably took it for granted that fossil fuel special interests could overcome any wisdom of our law-makers.

A tax on coal, oil and gas is simple. It can be collected easily and reliably at the first point of sale, at the mine or oil well, or at the port of entry. This approach also implies the fastest most effective way to international agreements. A proportionate duty should be applied to any imported products whose manufacture produced carbon emissions. The system could impose presumptive border taxes, allowing individual firms to prove that a lower rate should apply.⁶

A carbon tax will raise energy prices, but lower and middle income people, especially, will find ways to reduce carbon emissions so as to come out ahead. Effects will permeate society. Food requiring lots of carbon emissions to produce and transport will become more expensive and vice versa. There will be a growing incentive for life style changes needed for sustainable living.

One may ask: is there sufficient technology today, and just around the corner if the economic incentive exists, to allow phase out of coal emissions in the near term and other fossil fuels on a longer time scale? The answer is a clear “yes”, as discussed in a workshop report⁷ (this report is a draft—criticisms would be welcomed). Indeed, Stoft⁸ shows that ‘Tax & Dividend’ supports and makes more effective appliance efficiency standards and renewable portfolio standards. However, in order for energy efficiency and non-fossil energies to rapidly supplant fossil fuels, the carbon price should be substantial and rising.

Tax & Trade (a.k.a., ‘Cap & Trade’, pseudonymously and sometimes disingenuously)

‘Cap & Trade’ increases costs to the public as does ‘Tax & Dividend’, but without the dividend. Thus it should be termed ‘Tax & Trade’.⁹ Part of the reason for the pseudonym is to avoid the stigma of a tax, under the presumption that the public is too gullible to figure it out. Other parties support ‘Cap & Trade’ because they hope to profit—it is a give-away to special interests, who feel, based on extensive empirical evidence, that they will be able to manipulate the program through their lobbyists. Except for its stealth approach to taxing the public, and its attraction to special interests, “Cap & Trade” seems to have little merit.

Of course the proponents of ‘Cap & Trade’ are not all special interests and their lobbyists, or people who hope to make millions on Wall Street from price volatility and manipulations. That is surely right. Many, without looking closely at the details, assume that the successful ‘Cap & Trade’ used to help solve the acid rain problem, might be a good model for the climate problem. Acid rain was much simpler, partly because it was a program that required existing facilities to employ a relatively simple low-cost solution. Unlike climate change, the acid rain problem did not require *massive* investments in new infrastructure *and* innovation. Instead it required a group of existing facilities, with accurate emissions measurement, to make minor burner modifications and use readily available low-cost low sulfur coal. A few new rail lines were built and some facilities purchased more efficient scrubbers.¹⁰

Caps have not generally been applied at the mine or well-head, rather further downstream. Proponents of ‘caps’ say they will try to push them upstream. That would open up consequences that now should be unacceptable to Americans: volatility, manipulation, and trading floor millionaires. Where would the millions come from—the common person, of course, the rate payer, the public.

The abject failure of Cap & Trade was illuminated for all to see by the Kyoto Protocol, the granddaddy of all Cap & Trade schemes. Even countries that accepted the toughest emission reduction targets, such as Japan, saw their emissions actually increase. The problem is the inevitable loopholes in such complex approaches, which take years to negotiate and implement.

The Congressional Budget Office¹¹ provides a comparison of carbon taxes to cap-and-trade. That report concludes that a given emission reduction could be achieved

⁶ Metcalf-Weisback-Design of a Carbon Tax

⁷ P. Kharecha et al. http://www.columbia.edu/~jeh1/2009/ECWorkshop_report.pdf

⁸ S.E. Stoft <http://stoft.com/ebooks/cap-secrets.pdf>

⁹ Much of the support for Cap & Trade stems from the desire to avoid the term “tax” and create a real “cap” or declining limit on emissions. However, as shown in the European Emissions Trading Scheme and the Los Angeles RECLAIM program, among others, weaknesses in the cap-and-trade concept make it inapplicable to the climate crisis. Specifically, over-allocation of credits, lack of accurate measurement, fraudulent outside offsets, and the failure to create true incentives for early investments in clean energy technology and infrastructure will doom the prospects for real emissions reductions.

¹⁰ <http://www.carbontax.org/blogarchives/2009/02/21/what-worked-for-acid-rain-won%e2%80%99t-work-for-climate-change/>

¹¹ Congressional Budget Office, “Policy Options for Reducing CO₂ Emissions,” February 2008, <http://www.cbo.gov/ftpdocs/89xx/doc8934/02-12-Carbon.pdf>

at a fraction of the cost via a carbon tax, as opposed to cap-and-trade. Another useful comparison is also available.¹²

The worst thing about cap-and-trade, from a climate standpoint, is that it will surely be inadequate to achieve the sharp reduction of emissions that is needed. Thus cap-and-trade would practically guarantee disastrous climate change for our children and grandchildren.¹³

The only solution to the climate problem is to leave much of the fossil fuels in the ground. That requires a high enough carbon price that we move on to our energy future beyond fossil fuels.

Summary

The honest approach, the effective approach, for solving the global warming problem would be a tax with 100% dividend. The public is not stupid. They will understand that the hooks and eyes of a less comprehensive more dissembling approach will be put there for some reason other than saving the future for their children.

One of the biggest advantages of the Tax and Dividend approach is its simplicity, which would allow it to be introduced quickly. The Kyoto-like Cap & Trade is notoriously slow to negotiate and implement, as well as being ineffective in the end. A related point is that an effective international accord could be implemented with only a few of the major economies. Import duties on countries not imposing a comparable tax would surely bring broad rapid compliance.

Chairman RANGEL. Thank you.

We are now pleased to invite Dr. Brenda Ekwurzel who represents 1,700 climatic scientists, and we are anxious to hear your views. Thank you for being with us this morning.

STATEMENT OF BRENDA EKWURZEL, CLIMATE SCIENTIST, UNION OF CONCERNED SCIENTISTS

Dr. EKWURZEL. Thank you. Mr. Chairman and distinguished Members of the Committee, thank you for this opportunity to speak about climate science and policy as part of the Union of Concerned Scientists.

UCS is a science based non-profit working for a healthy environment and a safer world.

I am a geochemist with years of experience studying the Arctic. Back in September 1991, I was conducting research in the Arctic Ocean. As our ship approached the North Pole station, I expected to find a long and difficult passage through very, very thick ice. Instead, I was astonished to find lots of open water that we passed through easily.

That was 17 years ago. Since then, the Arctic sea ice has shrunk and in 2007, it broke all records.

The most important objective of climate change legislation is to avoid the worst consequences of global warming. There are common sense solutions that have profound benefits for public health, energy security, and our economy.

In May of 2008, I joined with over 1,700 scientists and economists who hail from all 50 states calling on our Nation's leaders to cut heat-trapping emissions swiftly and deeply.

This group also said the near term emission reductions could be done in a way consistent with sound economic policy.

In my testimony, I will lay out reasonable goals that we can meet with the urgent time line that the science demands.

¹²L. Williams and A. Zabel, <http://www.carbonfees.org/home/Cap-and-TradeVsCarbonFees.pdf>

¹³Brattle Group Report, CO₂ Price Volatility: Consequences and Cures, http://www.brattle.com/_documents/UploadLibrary/Upload736.pdf

These include faster than expected increases in sea level rise as shown by the satellite observations and Summer sea ice plummeting in the Arctic.

An important fact that is often overlooked is this: We are diminishing the ocean's ability to absorb carbon dioxide from the atmosphere. We have dumped so much CO₂ into the air that it will take at least 1,000 years for the ocean to absorb most of this excess.

This means that a ton of CO₂ that we emit today will leave more in the air than when we emitted a ton decades ago. Therefore, we cannot afford further delay.

As you consider policies to reduce emissions, the basic questions you must consider are this: how much more of a temperature increase can we tolerate and what does this mean for the United States.

First, an increase in global average temperature above more than two degrees Fahrenheit above today poses severe risks to natural systems, human health and our quality of life.

To even have a 50/50 chance of preventing temperatures from rising above this level, we must stay below 450 parts per million of heat-trapping gases in the atmosphere. Remember, this is an absolute maximum. Recent scientific evidence suggests a lower goal may be even more prudent.

What does the U.S. need to do? In the USC analysis that looked at current industrialized nations' share of global emissions and the U.S. share of that level of emissions, we found that the U.S. would be allotted a budget of 265 gigatons of carbon dioxide heat trapping gases between the years 2000 and 2050.

To stay within that budget would mean that we would have to reduce our emissions at least 80 percent by the year 2050. The earlier we cut emissions, the more flexibility we will have later, but if we delay until 2020, that means we would double our rate of emissions' reductions in order to avoid a crash finish.

Additionally, decisions that industries make today have long lasting consequences. For example, coal plants can last upward of 60 years. Therefore, we must send the market a clear signal now to build energy infrastructure that will avoid dirtier consequences that would lock in irreversible consequences.

The IPCC examined one scenario that had industrialized nations cutting between 35 and 50 percent below today's levels in order to stay below a 450 parts per million goal.

For these reasons, USC thinks it is prudent to reduce U.S. emissions around 35 percent from today's levels, which is about 25 percent below 1990 emission levels, by the year 2020. We project around 10 percent of these reductions can come from tropical forest protection and the rest can come from transport, electric and agricultural sectors of our economy.

We recommend a comprehensive package of climate energy and policies in which a well designed cap-and-invest program is a foundation. The most effective means of limiting emissions sufficiently is to put a cap and set those limits directly in the legislation.

Another benefit of a cap-and-invest program is we always keep the focus on the climate consequences we will avoid, which as a scientist, is very important to me.

We also urge Members of Congress to include a rapid response science review provision in any climate legislation to ensure that government updates policies in light of the latest evidence.

We look forward to working with Congress to help assure policy is designed well to achieve the needed emissions' reductions. Thank you.

[The prepared statement of Brenda Ekwurzel follows:]

**TESTIMONY OF BRENDA EKWURZEL, Ph.D.
CLIMATE SCIENTIST
UNION OF CONCERNED SCIENTISTS**

FEBRUARY 25, 2009

**BEFORE THE
COMMITTEE ON WAYS AND MEANS
U.S. HOUSE OF REPRESENTATIVES**

THE HONORABLE CHARLES B. RANGEL, CHAIRMAN

Honorable Chairman and Members of the House Committee on Ways and Means, I respectfully submit the following testimony in response to your invitation of February 19, 2009.

Legislative hearing on "Scientific Objectives of Climate Change Legislation"

Mr. Chairman and distinguished Members of the Committee, thank you for this opportunity to speak with you today on the scientific objectives of climate change legislation. I appreciate the opportunity to testify before you today on behalf of the Union of Concerned Scientists (UCS). UCS is a leading science-based nonprofit with more than 275,000 activists and members, which has been working for a healthy environment and a safer world for almost 40 years.

I am Dr. Brenda Ekwurzel, a geochemist with a deep understanding of climate science. In September of 1991, I was conducting research aboard an icebreaker in the Arctic Ocean. As our ship approached the North Pole station, I was astonished to find extensive open water that we easily passed through. Ever since, I have been committed to understanding climate change impacts in the Arctic and especially here in the United States. In 2007, the Nobel-prize winning IPCC released a report with the input of more than 1,200 authors and 2,500 scientific expert reviewers from more than 130 countries. This report found that human-induced warming is already having negative effects from rising sea level to more intense storms to severe drought.

For our nation, the most important objective of climate legislation is to cut heat-trapping emissions as quickly and as deeply as possible in order to avoid the worst consequences of global warming. At the same time, climate legislation needs to provide the funding necessary to invest in clean home-grown energy, transition assistance for consumers and affected workers, and climate

adaptation to make our nation more resilient. The good news is that many of the solutions that will curb global warming will also have profound benefits for public health, energy security, and our economy. UCS supports a comprehensive package of climate and energy policies of which cap and trade is a linchpin. If designed well, a cap and trade program sets the emission reductions that are necessary and then allows the market to achieve these reductions in a cost-effective and efficient manner.

In May 2008, more than 1,700 scientists and economists released a joint statement calling on our nation's leaders to swiftly establish and implement policies to bring about deep reductions in heat-trapping emissions. This was the first time in history that U.S. scientists and economists joined together to call for U.S. emission reduction targets. In their call to action they stated:

"The strength of the science on climate change compels us to warn the nation about the growing risk of irreversible consequences as global average temperatures continue to increase over pre-industrial levels (i.e., prior to 1860). As temperatures rise further, the scope and severity of global warming impacts will continue to accelerate."

"We urge U.S. policy makers to put our nation onto a path today to reduce emissions on the order of 80 percent below 2000 levels by 2050. The first step on this path should be reductions on the order of 15-20 percent below 2000 levels by 2020, which is achievable and consistent with sound economic policy."

They also warned that emerging science must be regularly evaluated to assess whether the goals set today are sufficient. In the nine months since the scientists and economists' call to action, the observations we're seeing are increasingly bleak and already may imply that more aggressive near-term emissions reduction targets are imperative. This is why we encourage members of Congress to include a "rapid response" science review provision in any climate legislation to ensure that the government updates policies in light of the latest evidence. In the science update in Appendix 1 of this testimony, we highlight a few of the latest scientific observations. These include sea level rising faster than expected and summer Arctic sea ice area plummeting which in turn places the frozen tundra at risk of releasing vast stores of carbon.

The most relevant fact for today is one that many may not be aware of. It is well documented that human activities have pumped excessive amounts of carbon dioxide (CO₂) into the

atmosphere and studies have also concluded that the processes that absorb CO₂ simply cannot keep up. The ocean is critical to these processes. As it absorbs carbon dioxide, it becomes more acidic. This combined with increasing ocean temperatures, diminishes the ocean's ability to absorb CO₂ and clean the atmosphere which makes global warming worse.

By a simple analogy, my stomach would have no trouble digesting one slice of pizza. If I continued to eat, however, by the 12th slice of pizza my stomach would complain and have immense difficulty digesting one more slice. But I could easily eat those 12 slices over the course of a week. Likewise, the ocean is complaining and is starting to slow down its digestion of the excess CO₂ we have pumped into the atmosphere. Now that the "ocean's stomach" is almost full, it will take at least a thousand years for the ocean to digest the excess CO₂. Hence, a ton of CO₂ emitted to the atmosphere today is worse than a ton emitted decades ago and means we cannot afford further delay. This is why a comprehensive climate solution to reduce emissions swiftly and deeply should be a top priority. The question is how swift and how deep.

Overview: Setting a U.S. Emissions Reduction Target

Establishing an emissions reduction target that avoids the worst consequences of climate change should be the central objective of well-designed climate legislation.

Step 1: Define a Global Temperature Limit & Atmospheric Concentration

Substantial scientific evidence from the IPCC indicates that an increase in the global average temperature of more than two degrees Celsius (°C) above pre-industrial levels (i.e., those that existed prior to 1860) poses severe risks to natural systems and human health and well-being. That's about 2 degrees F above where we are today. Studies indicate that, to have even a 50/50 chance of preventing temperatures from rising above this level, we must stabilize the concentration of heat-trapping gases in the atmosphere at or **below** 450 parts per million CO₂-equivalent (450 ppm CO₂eq—a measurement that expresses the concentration of all heat-trapping gases in terms of CO₂). As you've already heard from Dr. Hansen, a lower concentration may be prudent.

Step 2: Define the Global Emissions Budget

Lingering CO₂ in the atmosphere builds up as we continue to emit global warming pollution. We can only emit so much before we exceed our goals. Just like a spending budget, we have a limited budget of emissions. We must make specific assumptions in order to make the calculations to stick within our budget. For illustrative purposes we are going to focus this example around a 450ppm atmospheric concentration goal, even though that level may not be sufficiently precautionary. We consider this level an absolute minimum in order to avoid the worst consequences of global warming. Studies suggest that in order not to exceed 450ppm, we must limit worldwide cumulative emissions to around 1,700 gigatons (Gt) CO₂eq over the 2000–2050 time period.

Step 3: Define the U.S. Share of Global Emissions Reduction

There are several ways to determine the U.S. share of the overall industrialized nations' emissions budget, such as comparing it with our share of those nations' population, gross domestic product (GDP), or heat-trapping emissions. In this example, over this same 50-year period, let's assume that 40 percent or 700 GtCO₂eq of the global budget is allocated to the industrialized nations based on their emissions share in 2005. For the United States' share of these emissions, this would mean our budget is 265 GtCO₂eq. However, if it were based on U.S. share of population it would be as low as 160 GtCO₂eq. As was stated, a concentration of 450ppm only has a 50 percent chance of staying below 2 degrees C and therefore the top end of this range (265 billion tons) is probably too high. Therefore it may be prudent to recommend a deeper reduction target. Now, how does this cumulative budget translate into percent emissions reductions?

Step 4: Define the U.S. Emission Reduction Targets

To meet the cumulative budget of no more than 265 GtCO₂eq, the United States must reduce its emissions at least 80% by 2050. As we strive to make these reductions, the earlier we start, the more flexibility we will have later. If, however, U.S. emissions continue to increase until 2020

(even on a "low-growth" path projected by the Energy Information Administration (EIA)), we would need to double the rate of reductions to avoid a crash finish. Companies are making decisions today about how to invest in our energy infrastructure. Considering the life of a power plant can be upwards of 60 years, we must send the signal now to build clean energy infrastructure and avoid dirtier choices that will lock in irreversible consequences. That's why we need to set a near-term emissions reduction target for the next ten years. To set a near-term target for U.S. reductions, we must consider the need to:

1. Limit "lock-in" of carbon-intensive technologies;
2. Guarantee we're on track to stay within our long-term cumulative budget; and
3. Maintain options if scientific evidence reveals effects are worse than expected.

Taken together, these considerations suggest that near-term reductions should be as swift and deep as possible. In its most recent report, the IPCC looked at a range of studies on what different countries would have to do to reach 450ppm. The range the IPCC reports for the industrialized nations is 25-40% below 1990 levels by 2020, which is at least 35% below today's levels.

Given the urgency of the science, the danger of carbon lock-in, and the need to hit long-term goals, UCS thinks it is prudent to reduce our U.S. emissions by approximately 35% from today's levels (about 25% below 1990 levels) by 2020. In our analysis approximately 10% of these reductions can come from tropical forest protection and the rest can come from emissions reductions in the electric, transport and agricultural sectors of the economy. To reach this goal we recommend a comprehensive package of climate and energy policies, including a cap and trade program that ensures near-term reductions and includes a mechanism for course correction to respond to new scientific evidence. We look forward to working with Congress on a policy that achieves the needed emissions reductions to ensure a safe climate for us and our children.

Latest Climate Science Underscores Urgent Need to Reduce Heat-trapping Emissions

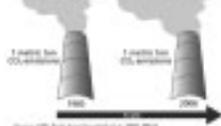
Major developments in climate change science have been reported since the publication of the comprehensive 2007 Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC).¹ Recent publications indicate that the consequences of climate change are already occurring at a faster pace and are of greater magnitude than the climate models used by the IPCC projected. A few of the most compelling findings are summarized below.

More CO₂ Remains in the Atmosphere

Human activities have pumped excessive amounts of carbon dioxide (CO₂) into the atmosphere. Natural processes that absorb CO₂ cannot keep up. As the ocean absorbs carbon dioxide, it becomes more acidic. This combined with increasing ocean temperatures, diminishes its ability to continue absorbing CO₂. As a result, more CO₂ stays in the atmosphere. In 1960, a metric ton (1,000 kilograms; ~2,205 pounds) of CO₂ emissions resulted in around 400 kilograms (~881 pounds) of CO₂ remaining in the atmosphere (Figure 1). In 2006, a metric ton of CO₂ emissions results in around 450 kilograms (~992 pounds) remaining in the atmosphere.² Hence a ton of CO₂ emissions today results in more heat-trapping capacity in the atmosphere than the same ton emitted decades ago.

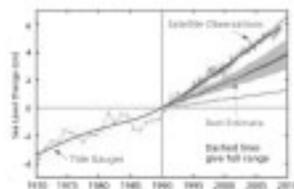
Figure 1 Today's Ton Is Worse Than a Ton Emitted Decades Ago

The natural processes that have helped clean up the excess CO₂ pumped into the atmosphere by human activities have not been able to keep up at the same rate.



Increased Sea Level Rise
Increased contributions from melting mountain glaciers and ice sheets on land, as well as thermal expansion due to continued ocean warming, are resulting in higher sea level rise. The IPCC (AR4) noted that sea level has risen 50 percent faster than projected by models for the 1963–2001 period. Recent observations confirm that sea level rise is in the upper range projected by models used by the IPCC (Figure 2).³

Figure 2 Sea Level Rise in Line with Highest Projection



Changes in sea level since 1973, compared with IPCC scenarios (dashed lines and gray ranges), based on tide gauges (red) and satellites (blue). From Rahmstorf et al. (2007) updated by Rahmstorf (personal communication).

The IPCC (AR4) estimated global average sea level rise for the end of this century (2090–2099) compared with the end of the last century (1980–1999) at between ~0.6–1.9 feet (~0.2–0.6 meter). These projections were based primarily on thermal expansion due to ocean warming with only modest contributions from mountain glaciers, leaving the potential contributions from ice sheets covering Antarctica and Greenland unclear. Because understanding of ice sheet behavior is still evolving, future ice sheet disintegration was not included in models used by the IPCC at that time. Researchers have since examined plausible contributions from ice sheets given current understanding of accelerating ice sheet melt and other factors. New analysis indicates that meltwater from ice on land could lead to a sea level rise increase of ~2.6 feet (0.8 meter) by the end of the century; and although ~6.6 feet (2.0 meters) is less likely, it is still physically possible.⁴ As depicted in Figure 3, when increased contributions from glaciers and ice sheets are taken into account, plausible twenty-first century sea level rise is higher than IPCC estimates.

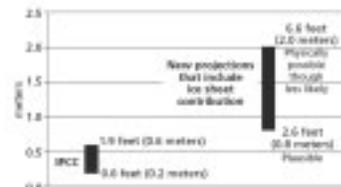
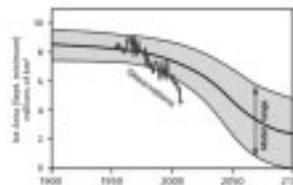


Figure 3 Sea Level Rise by End of This Century
New analysis provides estimates for sea level rise by the end of this century between a plausible level and a physically possible though less likely level. Source (IPCC 2007 and Pfeffer et al. 2008).^{4,5}

Plummeting Arctic Sea Ice

Arctic sea ice area models used by the IPCC are in general agreement with the observed area decrease over the last 50 years and indicate that heat-trapping gases are a major factor in the decline. Current observations show a much steeper drop in ice area than expected. Global warming and natural cycles combine to create the observed Arctic sea ice trend. When sea ice would naturally rebound, global warming limits the full sea ice area achieved. When sea ice naturally would be less extensive in area, global warming exacerbates this natural tendency and contributes to sea ice plummeting. For example, the atmospheric pressure and wind patterns in 2007 have naturally occurred in a similar fashion at various times in decades past. However, this type of weather pattern occurring after several decades of ice thinning combined to create a record breaking lowest summer sea ice area since satellite observations began.⁷ Recent evidence shows that periods of rapid Arctic sea ice loss lead to faster warming over land in the polar region.⁸ As sea ice retreats it exposes dark ocean, which absorbs more of the sun's heat than white ice. Toward the end of summer this ocean heat dissipates to the atmosphere as the region enters winter and the ocean freezes again into sea ice. This warmer air extends over land and allows bacteria more time to decompose thawing plant and other organic matter that had been long frozen.⁹ This process can lead to a release of heat-trapping gases (CO₂ and methane) into the atmosphere, amplifying global warming.

Figure 4 Shrinking Summer Arctic Sea Ice Area



Arctic models of September sea ice area underestimate the rate of observed sea ice retreat. Based on Stroeve et al. 2007. [Source: UCS Newsroom/Hamburg adapted figure from http://www.ucs.org/newsroom/Hamburg/20070927/070927.pdf](http://www.ucs.org/newsroom/Hamburg/adapted_figure_from_http://www.ucs.org/newsroom/Hamburg/20070927/070927.pdf)

CO₂ Effects Will Be Felt for Generations

Studies indicate that even after excess human-caused CO₂ emissions stop, the planet will experience the resulting warming for at least a thousand years. The higher the peak of atmospheric concentrations of CO₂, the greater is the level of irreversible consequences, such as species loss and sea level rise.¹⁰ These and other peer-reviewed studies published since the release of the IPCC AR4 provide ever

more compelling evidence that swift and deep reductions of heat-trapping gasses are needed if we are to avoid catastrophic climate change. United States leadership is essential, and there is no time to waste.

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This summary, drafted by B. Ekwert of the Union of Concerned Scientists (UCS), benefited from helpful reviews by J. Casadell (CSIRO Marine and Atmospheric Research), S. Rahmstorf (Potsdam Institute for Climate Impact Research), W.T. Pfeffer (Institute of Arctic and Alpine Research, University of Colorado at Boulder), J. Harper (University of Montana), J.C. Stroeve (NSIDC University of Colorado), N. Cole, P. Fiedler, A. Huerter, L.M. Peters, L. Shultz, and E. Spangier-Steghler (UCS). The information contained herein is the sole responsibility of UCS.

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AVOIDING DANGEROUS CLIMATE CHANGE

A Target for U.S. Emissions Reductions

Substantial scientific evidence indicates that an increase in the global average temperature of more than two degrees Celsius (°C) above pre-industrial levels (i.e., those that existed prior to 1860) poses severe risks to natural systems and human health and well-being. Sustained warming of this magnitude could, for example, result in the extinction of many species and extensive melting of the Greenland and West Antarctic ice sheets—causing global sea level to rise between 12 and 40 feet. In light of this evidence, policy makers in the European Union have committed their countries to a long-term goal of limiting warming to 2°C above pre-industrial levels.

The United States has agreed in principle to work with more than 180 other nations under the United Nations Framework Convention on Climate Change to bring about the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent

dangerous anthropogenic [human-caused] interference with the climate system." Though the federal government has done little to live up to that agreement thus far, there is now growing momentum to pursue deep reductions in emissions of carbon dioxide (CO₂) and other heat-trapping gases that cause global warming. California, Florida, Hawaii, Minnesota, New Jersey, Oregon, and Washington have all enacted laws or established policies setting global warming pollution reduction targets, while states in both the Northeast and West have signed agreements to achieve regional targets. Now the U.S. Congress is considering several bills that propose a variety of global warming emissions reduction targets.

Setting a Reasonable Target

A proper evaluation of the adequacy of these bills must consider what is needed to avoid the potentially dangerous consequences of temperatures rising more than 2°C. Scientific studies

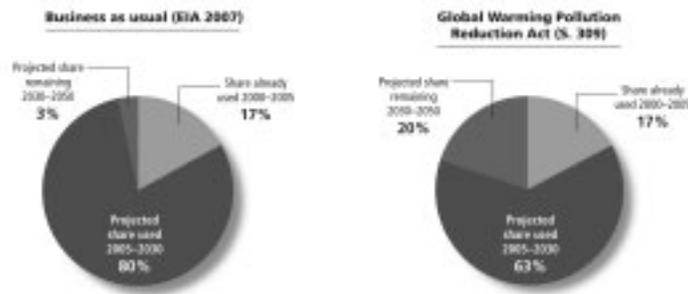
FIGURE 1. Defining the U.S. Share of the Industrialized World's Cumulative Emissions Budget (2000–2050)



*All heat-trapping emissions, including those from land use and land cover changes. The budget assumes industrialized nations' emissions peak in 2010 and developing nations' emissions peak in 2030.



FIGURE 2. Spending the U.S. Cumulative Emissions Budget



Under a "business as usual" scenario projected by the Energy Information Administration, the United States would use nearly all of its emissions budget by 2010, requiring unrealistically drastic cuts thereafter to achieve the 450 ppm CO₂eq stabilization target by 2050. In contrast, the emissions cuts required by S. 309 (the Global Warming Pollution Reduction Act) would allow reductions to proceed in a more gradual fashion, providing greater flexibility in the method and timing of reductions.

indicate that, to have a reasonable chance of preventing temperatures from rising above this level, we must stabilize the concentration of heat-trapping gases in the atmosphere at or below 450 parts per million CO₂-equivalent (450 ppm CO₂eq—a measurement that expresses the concentration of all heat-trapping gases in terms of CO₂). This "stabilization target" would provide a roughly 50 percent chance of keeping the global average temperature from rising more than 2°C, or 3.6 degrees Fahrenheit, above pre-industrial levels, and a 67 percent chance of rising less than 3°C. Therefore, **any policy that seeks to avoid dangerous climate change should set a maximum stabilization target of 450 ppm CO₂eq.**

To meet this target, worldwide cumulative emissions of heat-trapping gases must be limited to approximately 1,700 gigatons (Gt) CO₂eq for the period 2000–2050—of which approximately 330 GtCO₂eq has already been

emitted. Staying within this 1,700 GtCO₂eq "global cumulative emissions budget" will require aggressive reductions in worldwide emissions (i.e., those of industrialized and developing nations combined).

Dividing Up the Work

If we assume the world's developing nations pursue the most aggressive reductions that can reasonably be expected of them, the world's industrialized nations will have to reduce their emissions an average of 70 to 80 percent below 2000 levels by 2050. In addition, industrialized nations' cumulative emissions over this period must be no more than 700 GtCO₂eq (approximately 40 percent of the global budget).

This 70 to 80 percent range for reductions by 2050 assumes that industrialized nations' emissions will peak in 2010 before starting to decline, and that those from developing nations will peak between 2020

and 2025. A delay in the peak of either group would require increasingly steep and unrealistic global reduction rates in order to stay within the cumulative emissions budget for 2000–2050.

Defining the U.S. Share of Global Emissions Reductions

There are several ways to determine the United States' share of the industrialized nations' emissions budget, including allocations based on the current U.S. share (among industrialized countries) of population, gross domestic product (GDP), and heat-trapping emissions. Using these criteria, **the U.S. cumulative emissions budget ranges from 160 to 265 GtCO₂eq for the period 2000–2050, of which approximately 45 GtCO₂eq has already been emitted (Figure 1).**

Given our aggressive assumptions about reductions by other nations and the fact that 450 ppm CO₂eq represents the upper limit needed to avoid a potentially dangerous temperature

increase, the United States should reduce its emissions at least 80 percent below 2000 levels by 2050.

The costs of delay are high. To meet this minimum target, the United States must reduce its emissions an average of 4 percent per year starting in 2010.¹⁶ However, U.S. emissions continue to increase until 2020—even on a “low-growth” path projected by the Energy Information Administration (EIA)—the United States would have to make much steeper cuts later: approximately 8 percent per year on average from 2020 to 2050, or about double the annual reductions that would be required if we started promptly. The earlier we start, the more flexibility we will have later (Figure 2).

FIGURE 3a. U.S. Emissions Reductions under Federal Proposals

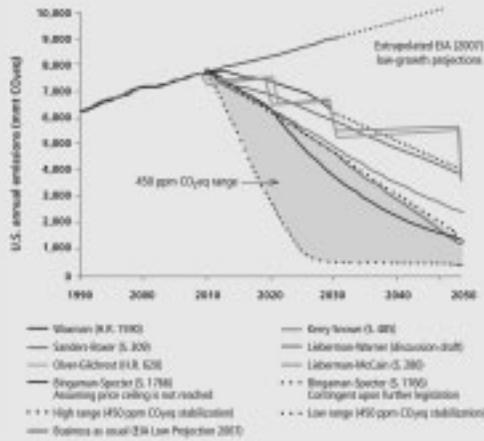
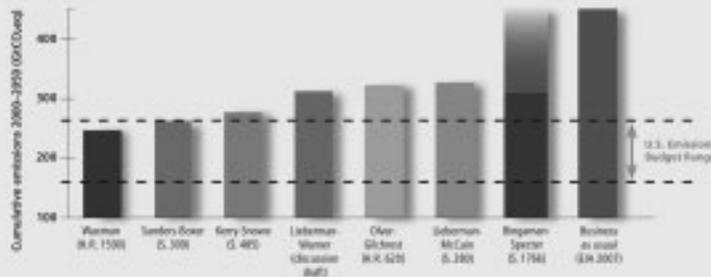


FIGURE 3b. Cumulative U.S. Emissions in 2050 under Federal Proposals



Only two current climate policy proposals (H.R. 1590 and S. 309) would stay within the emissions budget of 160 to 265 GtCO₂eq defined in this analysis, and even these proposals would result in emissions well above the low end of the range. For S. 1766, the potential range of cumulative emissions for 2000–2050 is provided.*

*The lower portion of the bar indicates cumulative emissions for S. 1766 under the best case scenario, in which the bill's price ceiling is never triggered, all emissions reduction targets set by 2020 are met, and all of the conditions needed to achieve the 2050 target are met, including international action, a recommendation by the president to Congress, and additional congressional legislation. The scenario also assumes that the 2050 target reduces total economy-wide U.S. emissions 80 percent below 2000 levels, even though earlier targets reduce emissions for only 85 percent of the economy. The value gradient in the upper portion of the bar represents the uncertainty in the additional cumulative emissions that would occur if the bill's price ceiling were triggered. The higher the value, the more likely it is that total cumulative emissions would reach that level. The gradient in the alternative proposal only and does not represent explicit modeling of the price ceiling's effect on emissions decisions. The range depicted there assumes that if the price cap is triggered, the total cumulative emissions would approach those projected by the EIA under a low-growth "business-as-usual" scenario.

¹⁶Equivalent to an average absolute reduction of 0.76 GtCO₂eq per year (or about 2 percent of current levels).

Evaluating Existing Proposals

Of the current climate policy proposals before the U.S. Congress, only the Global Warming Pollution Reduction Act (S. 309) and the Safe Climate Act (H.R. 1598) would require reductions consistent with staying below the upper limit of the U.S. cumulative emissions budget (265 GtCO₂e) (Figure 3). All of the other bills under consideration—the Lieberman-Warner proposal, the Global Warming Reduction Act (S. 485), the Climate Stewardship Act (H.R. 620), and the Low Carbon Economy Act (S. 1766)—would exceed that limit. The amount by which these bills would go over the budget may not appear to be great, but if every nation went over its budget by a similar amount, the result would be a greatly increased risk of dangerous climate change.

Furthermore, no proposal currently before Congress would come close to the proposed lower end of the U.S. emissions budget (168 GtCO₂e). Several of the proposals do provide for congressional review and periodic reports by the National Academy of Sciences to ensure U.S. targets remain consistent with the goal of preventing the global average temperature from

rising 2°C above pre-industrial levels. These periodic reviews are an essential element of any robust federal climate policy.

The Way Forward

It is clear that the United States must quickly overcome its current impasse on climate policy if we are to avoid the risks of dangerous climate change. Many solutions are already available, including greater energy efficiency, increased use of renewable energy, and reductions in deforestation. These changes can be encouraged by a wide range of market-based and

complementary policies including cap-and-trade programs, renewable electricity standards, efficiency standards for electricity and vehicles, and incentives for cleaner technologies and international cooperation on emissions reductions.

For the United States to be fully engaged in the fight against global warming, however, Congress must support legislation that requires the deep reductions in heat-trapping emissions needed to stay within the emissions budget described here and preserve a climate safe for future generations.



Increased use of renewable energy is one of many existing solutions that can help achieve the proposed emissions reduction target.



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This summary was prepared by the Union of Concerned Scientists (UCS) based on the report *How to Avoid Dangerous Climate Change: A Target for U.S. Emissions Reduction* by Amy L. Loren (UCS), Michael D. Mann (Penn State University), Katherine Hayhoe (Texas Tech University), and Peter C. French (UCS). © 2007 Union of Concerned Scientists.

The Union of Concerned Scientists is the leading science-based nonprofit working for a healthy environment and a safer world.

To read the fully referenced report, including an appendix comparing details of the climate-related bills and proposals currently before Congress, visit:

www.ucsusa.org/emissions/target.html

Chairman RANGEL. Thank you.

Dr. Christy may have a different idea, but we certainly do welcome your input into this very complex subject and look forward to working with you and your ideas as well.

Thank you so much for coming. We are prepared to take your testimony.

STATEMENT OF JOHN R. CHRISTY, ALABAMA STATE CLIMATOLOGIST AND PROFESSOR OF ATMOSPHERIC SCIENCE, UNIVERSITY OF ALABAMA

Mr. CHRISTY. Thank you, Mr. Chairman.

I am John Christy, Alabama State's climatologist and professor of atmospheric science at University of Alabama at Huntsville, and a participant in many national and international climate panels, including the IPCC, as lead author.

I really do appreciate this opportunity to speak. I want to bring some hard metrics to the hearing today.

The first one comes from my testimony in Federal Court about California's proposed auto emissions standards that the EPA may allow to go forward.

I calculated using IPCC climate models that even if the entire country adopts this rule, the net global impact would be at most one hundredth of a degree by 2100, and even if the entire world did the same, the effect would be less than four hundredths of a degree by 2100, an amount so tiny we cannot measure it with instruments or notice it in any way.

The issue here is that the scale of global CO₂ emissions is enormous. I also determined the impact of an enormous construction project of 1,000 nuclear power plants to be operating by 2020, about 10 percent of the world's energy.

The effect on global temperature would be only seven hundredths of a degree by 2050 and 15 hundredths by 2100. Again, we would not notice it, but it is a dent.

I recall that John McCain wanted to build 45 nuclear plants, not 1,000.

The point here is that the proposed actions that we can test to limit emissions will have little effect on whatever the climate will do, even if you assume a relatively high sensitivity of temperature to CO₂.

There is new information about that sensitivity. Current climate models assume that the global temperature is very sensitive to greenhouse gases. We are adding CO₂ to the air. There is no question about that. The real atmosphere has many ways to respond to that change that the extra CO₂ is forcing upon it.

My colleague, Dr. Roy Spencer, has shown with satellite observations that during warming episodes, clouds respond by stepping up their cooling effect counteracting the warming.

Not one climate model could demonstrate this cooling response. Rather, clouds in the models caused the opposite, further warming.

We hypothesize that the poor cloud formulations are causing models to overshoot the observed temperature.

Surface temperatures are often used to demonstrate global warming. I am one of the few in this science who actually builds these climate datasets from scratch.

In several published papers, I have documented two serious problems that strongly suggest the surface warming of the past century is overstated.

First, popular global datasets use only stations with easy to access data. I have published results for North Alabama, Central California, and soon, East Africa, where I went to the hard data to find sources to increase the number of stations tenfold. In each case, I found that the popular stations showed too much warming.

Secondly, we have demonstrated that with the development of agriculture and urbanization, complicated processes are triggered which lead to higher night time temperatures which are not related to CO₂ emissions. Thus, the current land-based mean surface temperature charts overstate the temperature because they include these night time readings.

In closing, we utilize carbon based energy not because we are bad people, but because it is the affordable foundation of our improving standard of living, our health and our welfare.

I was a missionary and science teacher in East Africa and witnessed this simple rule: without energy, life is brutal and short.

Worldwide, carbon-based energy demand will grow as Africans and others continue to experience improving technology, medicine, mobility and agriculture, and reap the benefits of higher standards of living. We will not stop human progress.

Alabama's affordable energy has led to economic development in some of the poorest parts of our Nation, jobs, health care, educational opportunities and tax revenue.

However, paraphrasing what one manufacturer said to me, Alabama is our last stop in the United States. If our energy costs rise, we will be taking these jobs to Mexico and China and manufacture our products with even more emissions than we create here.

From my analysis, the major actions being considered to reduce emissions will one, have an imperceptible impact on whatever the climate will do, and two, make energy more expensive.

We have found that climate models and popular surface temperature records overstate the actual changes that are occurring, and if Congress deems it necessary, the single most effective way to reduce carbon emissions by a small but at least detectable amount is through a massive nuclear power program. Other alternatives simply cannot produce enough power to be noticed. Thank you very much.

[The prepared statement of John R. Christy follows:]

House Ways and Means Committee
25 February 2009
Written Testimony
John R. Christy, University of Alabama in Huntsville

One Page Summary

I am John Christy, Alabama's State Climatologist and Distinguished Professor of Atmospheric Science at the University of Alabama in Huntsville.

Global Temperature Impact of vehicle reductions of CO2 (California AB1493)

The EPA is considering allowing California and other states to determine their own rules for CO2 emissions. I calculated, using IPCC climate models, that if the entire country adopted these rules, the impact would be a minuscule 0.01 °C by 2100. And, if the entire world did the same, the effect would be less than 0.04°C by 2100, an amount so tiny we cannot measure it with instruments, let alone notice it in anyway.

Global Temperature Impact of 1000 Nuclear Power Plants by 2020

The scale of CO2 emissions is simply enormous. Again using IPCC climate models, if 1000 new nuclear power plants could be operating by 2020 (about 10% of the world's energy) this would affect the global temperature by only 0.07°C by 2050 and 0.15°C by 2100. We wouldn't notice it, but this dent could just be detectable by our instruments. However, these values are very likely overstated as they are based on current models.

Overstated warming in current climate models and surface data sets

Current climate model projections assume that climate is very sensitive to CO2. We've found however, that during warming episodes, clouds step up their cooling effect. When model output is tested this way, not one model mimics this cooling effect – in fact the models' clouds lead to further warming, not cooling as seen in nature. We hypothesize that poor cloud properties cause models to overstate warming rates. We've also found that current popular surface temperature datasets indicate more warming than is actually happening in the atmosphere because they are contaminated by surface development.

Energy and Life

We utilize energy from carbon, not because we are bad people, but because it is the affordable foundation on which the profound improvements in our standard of living have been achieved – our progress in health and welfare. I taught science in Kenya, Africa and witnessed first hand this simple rule – without energy life is brutal and short. Global carbon-based energy demand will grow as Africans and others continue to discover the benefits of technology, medicine, mobility and agriculture and start reaping the benefits of higher standards of living, just as we have. If the Congress deems it necessary to reduce CO2, the single most effective way to achieve at least a detectable reduction while growing the economy, is through the massive implementation of a nuclear power program. Other currently available alternatives simply cannot produce enough energy to be significantly noticed at a price and geographic scale that is affordable.

Written Testimony

Introduction

I am John Christy, Alabama's State Climatologist, Distinguished Professor of Atmospheric Science at the University of Alabama in Huntsville, and participant in many national and international climate science panels, including being one of several Lead Authors of the IPCC.

Global Temperature Impact of vehicle reductions of CO2 (California AB1493)

I want to bring a bit of hard-core metrics to the objectives described for the Hearing today. I have testified several times before House and Senate Hearings on climate issues, but also have testified in Federal Court on specific consequences of proposed legislative actions.

For example, the EPA is considering allowing California and other states to determine their own rules for CO2 emissions in which automobile manufacturers must meet a certain fleet-average (43 mpg in this case). This committee's objective is to understand what this auto-emission proposal, and other laws, might mean in terms of its impact on the climate system. I calculated, using IPCC climate models, that even if the entire country adopts these rules, the net impact would be at most one hundredth of a degree by 2100 (Fig. 1). The Federal Court accepted this analysis. And, even if the entire world did the same, the effect would be less than four hundredths of a degree by 2100, an amount so tiny we cannot even measure it with instruments, let alone notice it in anyway. Thus, this undoubtedly expensive proposition has virtually no climate impact. (I do not comment on other reasons for reducing transportation fuel usage.)

Global Temperature Impact of 1000 Nuclear Power Plants by 2020

The issue the Committee must come to grips with is that the scale of current world-wide CO2 emissions is enormous and growing in all parts of the globe. I also calculated, again using IPCC climate models, that if a Herculean construction effort could result in 1000 new nuclear power plants operating by 2020 – representing about 10% of the world's energy - this would affect the global temperature by only seven hundredths of a degree by 2050 and 15 hundredths by 2100 (Fig.1). Again, we wouldn't notice it, but this dent could just be detectable by our instruments. I remind the Congress that Sen. John McCain campaigned on a pledge of only 45 new nuclear plants, not 1000. The point here is that to date, proposed actions to "do something about global warming", all of which appear to make energy much more expensive especially for the poorest among us, will have little effect on whatever the climate will do – even if one assumes, as models today do, a relatively high sensitivity of temperature to CO2.

But there is new information about the climate's sensitivity to CO2 increases.

Overstated warming in current climate models

Current climate model projections of temperature assume that the climate is very sensitive to greenhouse gases. While the thermal properties of the gases are well known (there is no doubt we are adding CO2 to the air) what is usually overlooked is the fact that the atmosphere is much more subtle and complicated than expressed in climate models. The real atmosphere has many ways to respond to the changes that the extra CO2 is forcing upon it.

My colleague Dr. Roy Spencer has shown that in the real world – the world of observations from satellites - that during warming episodes, clouds respond by stepping up their cooling effect (the basic effect of clouds is to cool the climate already). When climate model output calculated in the same way is compared with observations, not one model mimics this cooling effect – in fact the models' clouds lead to further warming, not cooling as it is in nature. We hypothesize that this poor representation of clouds in models is the reason we find the warming rates of model projections to have significantly overshoot what has actually happened. (Christy et al. 2007, Spencer and Braswell, 2008, Christy and Norris 2009, Spencer and Braswell, to be submitted)

Figure 2 demonstrates that the projections made in 1988 of rapid temperature rises, based on a climate model which assumed high sensitivity to CO2, overshoot the actual temperature trend by a significant amount.

Figure 3 indicates the most recent set of climate models is not faring any better. Surface temperature trends for various segment length from the most recent 5 years to 15 years shows that the observations are coming in at the lowest edge of the 95% range of the latest climate model projections, which is consistent with the statement that the mid-range of "best estimate" model simulations is too sensitive to CO2.

Overstated warming in surface temperature datasets

Surface temperatures in the few popular global datasets are often used as a proxy for global warming. Let me say I'm one of the few in this science who actually builds climate datasets from scratch. In several published papers I and others have shown that we have found two serious problems, somewhat related, that strongly suggest the warming of the past century is overstated.

First, the use of a few popular stations for which the data are easy to find, leads to too much warming when the averages are constructed. I have published research for North Alabama, Central California and in a few months East Africa, in which I went back to the original sources of data to augment the number of

stations by roughly a factor of ten – indeed, ten times more stations. This effort requires significant time in searching for and manually digitizing the records for scientific purposes. In each case, I've found that the data sets based on a few popular stations overstate the warming by up to a factor of three. (Christy 2002, Christy et al. 2006, Pielke et al. 2007, Christy et al 2009)

Secondly, we have demonstrated in several publications that as humans develop the surface through agriculture, urbanization and so on, that this leads, by complicated physical processes, to higher nighttime temperatures over time, but which are unrelated to CO2 emissions. Thus, the current, popular land-based mean surface temperature charts, which average the nighttime and daytime temperatures, and which are often shown to demonstrate warming, overstate the actual warming of the basic atmosphere. (Christy 2001, Christy et al. 2006, Christy et al. 2007, Pielke et al. 2007, Christy et al 2009).

Figure 4 shows the very different impact of surface development on daytime and night time temperatures in the example from Central California. Detailed temperature reconstructions were generated for the developed San Joaquin Valley of California as well as the adjacent foothills of the Sierra. The daytime temperatures of both regions show virtually no change over the past 100 years, while the nighttime temperatures indicate the developed Valley has warmed significantly while the undeveloped Sierra foothills have not. The popular land-surface temperature datasets average both day and night temperatures which means the contamination by surface development of the night time temperatures in all likelihood overstates the actual temperature change which is then erroneously attributed to the effects of increased CO2 concentrations. (Christy et al. 2006, 2009).

Energy and Life

Finally, we utilize energy from carbon not because we are bad people, but because it is the affordable foundation on which profound improvements in our standard of living have been achieved – our health and our welfare.

I was a physics and chemistry teacher at Nyeri Baptist High School in Kenya, East Africa and witnessed first hand this simple rule – without energy life is brutal and short. World-wide, carbon-based energy demand will grow as Africans and others continue to discover the benefits of technology, medicine, mobility and agriculture and start reaping the benefits of higher standards of living just as we have. Having lived in Africa, I don't see how one could halt the progress they need and will achieve. In my view, international rules to limit energy production will not halt the expansion of their energy use because of the tremendous benefits provided by energy that the energy-poor crave.

Alabama's affordable energy has led to increased economic development in some of the poorest parts of our nation – jobs, health care, educational

opportunities, and, yes, even tax revenue. However, paraphrasing what one manufacturer said to me, “Alabama is our last stop in the United States. If our energy costs rise, we will be taking all these jobs to Mexico or China – and building our products with even more emissions in less efficient plants than we create here.” The message here is that if energy costs rise, the price the American economy will pay, especially the poorest among us, will be high – yet there will be virtually no impact on emissions or climate.

Summary

From my analysis, the actions being considered to “stop global warming” will have an imperceptible impact on whatever the climate will do, while making energy more expensive, and thus have a negative impact on the economy as a whole. We have found that climate models and popular surface temperature data sets overstate the changes in the real atmosphere and that actual changes are not alarming. And, if the Congress deems it necessary to reduce CO₂ emissions, the single most effective way to do so by a small, but at least detectable, amount is through the massive implementation of a nuclear power program. Other currently available alternatives simply cannot produce enough energy to be significantly noticed at a price and geographic scale that is affordable.

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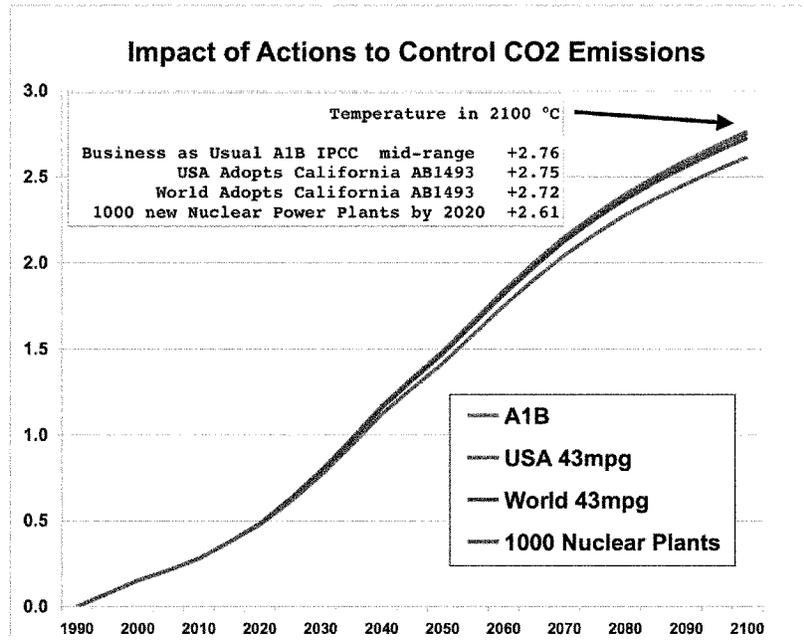


Figure 1

Four realizations of temperature through 2100 from the IPCC best estimate model projections assuming business-as-usual emissions (A1B) and a climate sensitivity to CO₂ of 2.6°C/2xCO₂ (mid-range case). Red: base temperature projection of a warming of +2.76°C with purple being the result if the entire U.S. adopted the California AB1493 rule (43 mpg fleet average), which changes the temperature by only 0.01°C – this is indistinguishable from the Red curve. Blue: net result if entire world adhered to California AB1493 (net change of only 0.035 °C). Finally Green: net effect of replacing 10% of the energy by 2020 with 1000 nuclear power plants (1.4 GWt each) – a cooling of 0.15°C. However, the assumption of the “mid-range” sensitivity of 2.6 is very likely too high, so that actual impacts of these initiatives would be much less than the tiny amounts shown here.

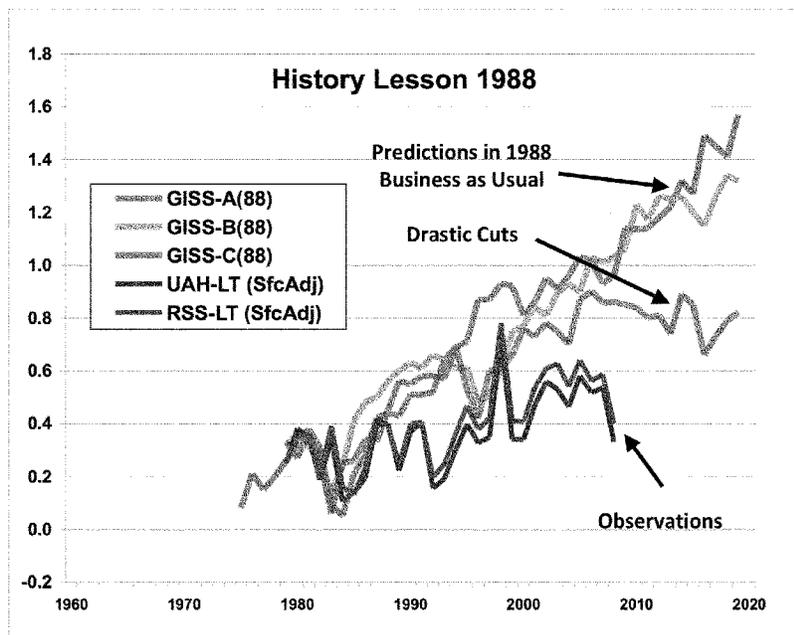


Figure 2

“GISS” A, B, and C are model projections of global surface temperature from James Hansen in Senate testimony in 1988. “A” and “B” are two “business-as-usual” model projections of temperature which assume emissions similar to what has happened (though in actuality these estimates were a bit less than occurred). “C” is a model projection in which drastic CO₂ cuts are assumed. “UAH” and “RSS” are two independent global satellite atmospheric temperature measurements (1979-2008) from the University of Alabama in Huntsville and Remote Sensing Systems adjusted to mimic surface temperature variations for an apples to apples comparison with the model projections (factor of 1.2, CCSP SAP 1.1, note all datasets are based on the 1979-1983 reference period). All model projections show high sensitivity to CO₂ while the actual atmosphere does not. It is noteworthy that the model projection for drastic CO₂ cuts still overshoot the observations. This would be considered a failed hypothesis test for the models from 1988.

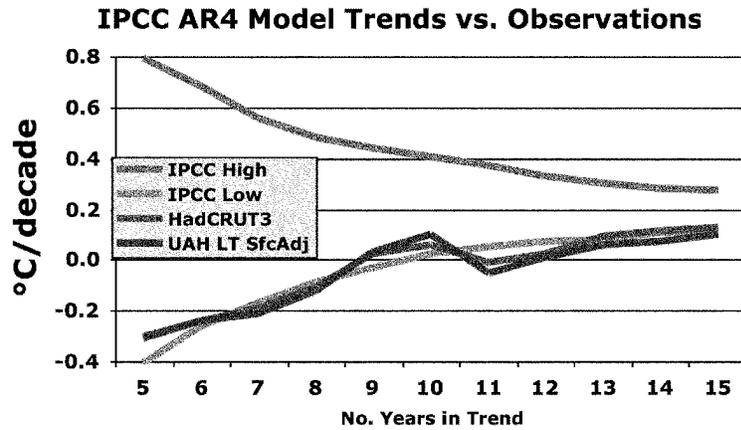


Figure 3.

Red and Orange: the upper and lower significant range (95% of model runs are between the red and orange lines) of global temperature trends calculated from 21 IPCC AR4 climate models for multi-year segments ending in the model year of 2020. Thus, at unit "10" this is the trend from model year 2011 to 2020, or the 10 years ending in 2020 which among the models produced a 95% range between +0.02 and +0.40 °C/decade. Blue and Green: Global temperature trends calculated from observations for segments ending in 2008 from satellites (blue – University of Alabama in Huntsville) and green (surface – Hadley Centre for Climate Change). Chart adapted from Dr. Pat Michaels U.S. Senate Testimony, 12 Feb 2009. The two main points here are (1) the observations are much cooler than the mid-range of the model spread and are at the minimum of the model simulations and (2) the satellite adjustment for surface comparisons is exceptionally good. The implication of (1) is that the best estimates of temperature trends of the IPCC models are too warm, or that they are too sensitive to CO2 emissions.

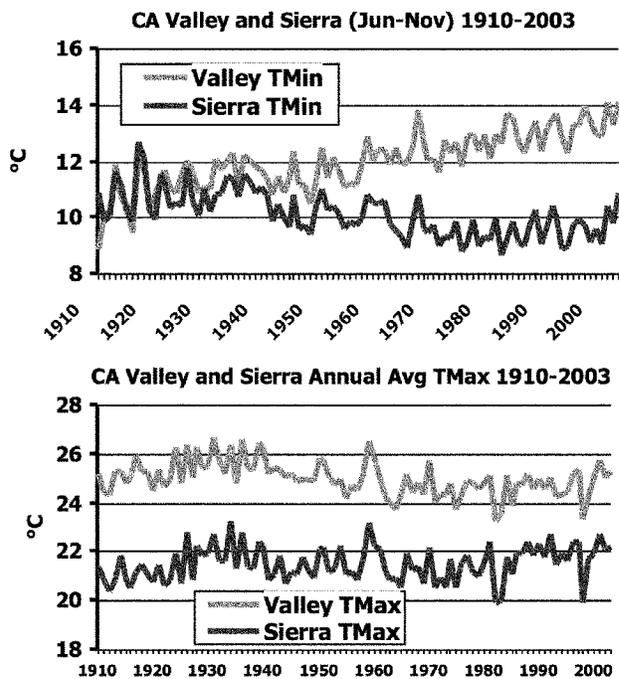


Figure 4

Top: Temperature change in Central California for the nighttime (TMin) temperatures in the developed Valley (orange) and the adjacent undeveloped Sierra (blue). Note the rapid rise in nighttime temperatures in the Valley as agriculture and urbanization occurred. Bottom: Daytime (TMax) temperatures in the Valley (orange) and Sierra (blue) showing almost identical trends near zero change. This study shows that using nighttime temperatures from stations where development has occurred leads to a spurious warming signal. The popular surface datasets today use the average of the day and night temperatures, thus are influenced by this warming that is unrelated to CO₂. If daytime temperatures, which are much more representative of the atmosphere as a whole, are used then there has been no warming in Central California since 1910 according to these results (nor in Alabama nor East Africa). (Christy 2002, Christy et al. 2006, Christy et al. 2009)

Chairman RANGEL. Thank you so much.

Dr. Hansen, whether we talk about a carbon tax or cap and trade, enormous amounts of moneys are to be raised as some type of deterrent or penalty on the energy producing company, which means, of course, that for the consumer, there will be a tremendous increase in costs.

Could you share with us how you would suggest that the moneys raised be used to cushion the increase in costs, especially for lower income people?

Mr. HANSEN. Yes. I think it is essential that we give back 100 percent of the money that we take in the tax.

Chairman RANGEL. How?

Mr. HANSEN. With a dividend, with a monthly deposit in their bank accounts.

Chairman RANGEL. If they do not have a bank?

Mr. HANSEN. Then they get a check. That may have to be annual. It probably could be monthly by check also. Legal residents would get the dividend. As I pointed out, it is large. For example, at the rate of \$115 per ton of CO₂ for a family with two children, it would be \$9,000 a year.

That would give them the money to invest in the technologies that would allow them to reduce their emissions. It would be a strong incentive to reduce their emissions, buy the most fuel efficient vehicles, insulate their homes, buy appliances that are more energy efficient.

You have to give all the money back to the public or they are not going to allow such a high tax, but the low income person in particular is going to pay very close attention to this, and he will end up with more dividend, more return to money than he is paying in the tax.

The whole idea is you have to affect—you apply the tax at the well head or at the mine, at the port of entry in the case of imported fossil fuels, but it has to cover coal, oil and gas entirely, with an uniform tax. That is the fair way to do it and affect the way the economic system works.

Economists agree that is the way to do it. In fact, there was a study by the Congressional Budget Office that said it is five times more efficient than a cap, and it is much easier to implement. It is much simpler. It is much more honest.

Chairman RANGEL. Dr. Ekwurzel, have the scientists given any thought of the redistribution of the revenue?

Dr. EKWURZEL. Yes. Again, I am not an economist but economists that have been looking closely at this, in my conversations with them, they really emphasize the benefit of a cap and invest program is really a one-two punch.

First, you actually set a limit on the emissions, which is the ultimate goal. We have to keep track of the goal. That ratchets down over time.

The second step is it generates resources to transition to a clean energy economy which is for consumers, workers and low income communities, and a well designed cap and invest program would invest and buffer low income communities from the inevitable price changes that would happen as we transition, but also what is more important is it provides choices for those longer investments.

We need to have cars that are getting us further down the road on a gallon of fuel. We need to have weatherization programs to buffer people, to have more energy efficiency, which is the low hanging fruit we have to deploy right away.

If we do not reinvest into some of the rapid research and development and deployment of the new technologies while we are rolling out the stuff that is already off the shelf, I do not see how you get that without a cap and invest program where you can reinvest in a targeted and smart way.

Chairman RANGEL. Thank you. Dr. Christy, I know you do not see this as a crisis, but do you see any problems in this area that we should be aware of at all?

Mr. CHRISTY. I agree with one statement of Dr. Hansen. Well, a number of them actually, that taxing is more transparent than cap and trade. I am worried about that Alabama trucker who is an independent trucker and he pays thousands and thousands of dollars into that thing and only gets \$3,000 back.

Yes, I do not see it as a crisis. I happen to think it is still politically correct to manufacture the cars we drive and appliances we use and grow the food we eat right here.

Other considerations might be useful here, more useful for the security of our nation to produce its energy locally, here, so there are a lot of ways by which you can go there.

It certainly helps the balance of trade. It certainly keeps dollars within the country.

How can we do that without making energy costs go up so that the jobs leave? That is really more of a question for your Committee, I think, than anything.

Chairman RANGEL. Thank you. I yield to Mr. Camp.

Mr. CAMP. Thank you, Mr. Chairman. Dr. Christy, I would just like to ask you, given the complexity of the global climate system, which all of you have testified to frankly, and given those factors, can you tell us what the impact would be on the global climate system if the United States alone were to completely eliminate all greenhouse gas emissions?

Mr. CHRISTY. If the United States alone were to eliminate all greenhouse gas emissions, that would be equivalent to building 2,000 nuclear power plants. In 100 years, that would be about three-tenths of a degree, something we could measure with our instruments but we probably would not notice it at all in terms of what goes on in the climate system otherwise.

Mr. CAMP. That is less than half of a degree by 2100?

Mr. CHRISTY. That is correct; yes.

Mr. CAMP. Is losing three million jobs worth half a degree by 2100?

Mr. CHRISTY. I can just say from the State of Alabama's standpoint, we do not want to lose one job.

Mr. CAMP. In your testimony, you have analyzed the rate of warming is less than what has been predicted by climate models. You talked about the research you have done.

In contrast, Dr. Ekwurzel has said that the measure is really the amount of Arctic ice. That cover has changed dramatically, and that is showing that climate change is actually occurring faster than predicted.

Can you explain this difference for those of us who are not scientists?

Mr. CHRISTY. In the Arctic—there is a bigger question. We do create datasets that specifically test model projections. In virtually every case, we find the models are overshooting almost everything.

In the ice case, it is a bit different. That is a very complicated system that climate models do not do well at describing at all. In fact, I just taught Monday on ice theology, on the dynamics of ice, to our graduate class in climate dynamics. Models do not have ice done well.

There is high variability of that quantity. It goes up. It goes down. A thousand years ago, 5,000 years ago, there was less ice than there is now in the Arctic.

I noticed that left out of this discussion was what happened in Antarctica, two weeks after the Arctic sea ice reached its “record minimum,” the Antarctic sea ice on the South Pole reached its all-time record maximum.

Globally, right at that point, if you were to average it, we would have average sea ice. Right now, it is a bit below on the global average.

The Arctic ice is a complicated thing. It has been missing before. It has melted before. This is something that has high variability in that part of the world.

Mr. CAMP. Are factors causing that—are there factors other than CO₂ that would result in that? Obviously, if this has occurred over a 5,000 year period, and I presume that—

Mr. CHRISTY. The climate system has so many degrees or so many loose handles to it, so to speak. No one really knows everything about the climate system so they can predict what it is going to do in the future.

Let me just say yes, there are natural forces that have huge variations or cause huge variations in the Arctic ice.

By the way, through this whole period, when the ice was much less and it was much warmer up there, the polar bears survived.

Mr. CAMP. I think Dr. Hansen has written that global greenhouse gas emissions should be reduced to no more than 350 parts per million. I asked you a question about total elimination of greenhouse gases.

If they were reduced to that level, what would be the impact on the global climate system, in your opinion?

Mr. CHRISTY. By what time at 350?

Mr. CAMP. You name the timeframe, whether it is 100 years.

Mr. CHRISTY. It is something I have not calculated because that is fewer emissions—that is a lower concentration than there is right now. I do not know how to get to there in reality.

Mr. CAMP. Thank you. Thank you, Mr. Chairman.

Chairman RANGEL. The Chair expects a vote soon. For the witnesses, we will be inconveniencing you because we expect to be on the Floor for several votes, which will take approximately 30 minutes.

At this point in time, I would like to yield the Chair to my friend, Mr. Levin, who will proceed to call the witnesses until such time as the bells ring, and then we will resume the hearing as soon as the last vote takes place. I do not want to put any more inconven-

ience on these outstanding witnesses than our legislative agenda has.

I do hope that each and every one of you recognize that we are only leaving and recessing because of the call of the Chair in legislating and voting.

We want you to know both Mr. Camp and I are pleased you have inconvenienced yourselves to share the basis of your research over the years with us as we move forward on this very complicated but important legislation.

I will be returning with the rest of the Members of this Committee. At this time, I yield to Mr. Levin from Michigan.

Mr. LEVIN [presiding.] Thank you very much. Welcome.

I want to ask the three of you to comment on Dr. Christy's testimony, so we get to the basic issue of whether there is a problem, and then others will question how we best solve it.

Let me say to my colleague from Michigan, no one is talking about doing this thing alone. I think while it is not easy to carry that out, it is really a bit of a straw person to say we are going to do this alone.

Secondly, I do not think any of us have to be told about the importance of manufacturing in this country. I just do not think that using that as an excuse to do nothing is tenable.

The real challenge is how we combine our emphasis on manufacturing and other sources of jobs with addressing this issue of global warming.

I must say that I think this division that is embodied in this testimony really is a threat to bipartisanship because if we start from opposite assumptions, we will never work out something together.

I just to want to ask the two of you who disagree with Dr. Christy to comment on his two basic statements, and we have to resolve this if we are going to move on a bipartisan basis.

He says actions being considered to stop global warming will have an imperceptible impact on whatever the climate will do.

Each of you will have at best a minute, but be very pointed. Do not pull your punches because you are sitting there together.

The second is we have found that climate models in popular surface temperature datasets overstate the changes in the real atmosphere and that actual changes are not alarming.

We will start with you, Dr. Hansen, down the row, and then maybe Dr. Christy will have a chance to respond within my 5 minutes. Maybe not. Others can carry that on.

On those two statements, be very succinct.

Mr. HANSEN. It is a tactic of those who want to do nothing to make it sound like there is a debate. In fact, I think that is the wrong road to go down. I think if there is any question about the reality of this, which scientifically, there is not, then you should ask, Congress should ask the National Academy of Sciences, which is the most authoritative scientific body in the world, to deliver a report back to Congress or the President should ask for that.

The science has become crystal clear. There is an issue and we can see it happening. It is not based on climate models. It is looking at what is happening in the real world. Arctic sea ice is decreasing. The tundra regions at high latitudes are beginning to re-

lease methane. The ice sheets are now unstable and are losing mass at the rate of a couple of hundred cubic kilometers per year.

The science is clear.

Mr. LEVIN. Let me just go down the row. That green light will change to red soon. Dr. Ekwurzel?

Dr. EKWURZEL. Thank you. Very quickly addressing one issue. It is very well known that we have driven the climate beyond all reasonable doubt, that it is a greater than 90 percent likelihood humans have caused global warming, the warming we have seen, above natural cycles since 1950.

The models are in fact under-predicting the changes that we are observing on the ground, in the Arctic, and in Dr. Hansen's and many other temperature records that are out there, as well as many other changes that we are seeing with species migrations and so on, but, the models are not getting the pace of change because models tend to be conservative.

They are not exactly accurate and they are not accurate in the wrong way for us, which means the urgency of action is even more prudent and we have to have the National Academy of Sciences reporting back so that Congress can know the latest science. Thank you.

Mr. LEVIN. My time is up. Dr. Christy, maybe another will ask you to respond. I hope you might answer the question what happens if you are wrong.

I think, Mr. Herger, you are next. I do not have the list.

Mr. HERGER. Thank you, Mr. Chairman.

I represent a rural northern California district with some nine national forests in it. We have experienced some very severe fires in the past year.

It is my understanding that wild fires emit an average of 105 million tons of greenhouse gases every year. Putting this number in perspective, it is about 40 percent more than the total emissions of all the cars in the State of California.

As you noted in a 2004 article in "Southwest Hydrology", poor management practices have led to an excess of underbrush in western forests which contributes to the size and intensity of wild fires. This excess growth could be removed from the forests, thus reducing emissions from fires and used to produce renewable carbon-neutral biomass energy.

Would you and your organization agree that one part of our effort to reduce greenhouse gas emissions should be responsible forest management to banned excess growth and if the risk of climate change is as severe as you have stated today, would you agree that the Committee should consider incentives for the production of clean energy from excess forest biomass?

Dr. EKWURZEL. Thank you. You bring up a very important feedback mechanism that is amplifying global warming, and in contrast to that study, that article I wrote in "Southwest Hydrology", there have been since studies that also have looked at unmanaged forests at high elevation in the western states.

What they found is when we have global warming amplifying the drying out of the soils of these high alpine systems, that by the time you get to the end of the summer, if there is a lightning

strike, you can start a fire naturally but the extent of the damage can be quite immense.

Without that managed forest system—these are natural systems, so we are seeing the global warming making it more likely that we are turning our forests into a tinder box, sending that precious stored carbon back into the air, making it harder for us.

This is another mechanism in addition to the ocean slowing down its absorption of carbon dioxide, that it is getting harder for us to manage this system that we have unleashed by our excess carbon dioxide.

Mr. HERGER. Again, my question is would your organization support our going in and thinning these forests, which we are not able to do right now, and also an incentive to do so?

Dr. EKWURZEL. I am not a forest manager but I do understand that very smart forest management systems to adapt to the climate change that is happening would be prudent, but also we need to do mitigation of the climate change itself so that all of our good effort to preserve a forest does not go up in smoke.

Mr. HERGER. Does that mean you would support this?

Dr. EKWURZEL. I would have to see the details of what the management design—

Mr. HERGER. Thinning these forests and getting at the problem that you have very accurately pointed out—

Dr. EKWURZEL. I am not a forest manager. We need healthy forests and that means a biodiverse forest. It depends on what you mean by “thinning.” If you thin a forest so much, it could be an unhealthy environment and there are also pests such as the bark beetle that take advantage of the increased temperatures.

It is a very difficult problem and it is out of my area of expertise.

Mr. HERGER. You agree that they are far too dense now?

Dr. EKWURZEL. I am not a forest manager. Thank you.

Mr. HERGER. That is what your article referred to.

Dr. Hansen, on December 29, 2008, you wrote on your website “It is essential that dogmatic environmentalists opposed to all nuclear power not be allowed to delay the research and development on fourth generation nuclear power.”

Could you elaborate further on your views on nuclear power as part of the effort to address climate change?

Mr. HANSEN. Yes. I think everyone hopes that increased energy efficiency—and that would be encouraged by a higher price on carbon emissions, and renewable energies—could do the job.

Most energy experts are skeptical about that. They think we need base load power, and it cannot be coal if we are going to avoid climate catastrophes.

I think we should do the research and development on an urgent basis to see what is the potential of fourth generation nuclear power. Fourth generation nuclear power could burn nuclear waste and help us solve the nuclear waste problem.

We had our Argonne National Laboratory in the nineties ready to make a demonstration plant, but the Clinton Administration decided to stop the research on that, and I think that was a mistake.

I am not sure that we need the nuclear power, but it looks like—China and India, it is a little difficult to see them using wind and solar to provide all of their energy. They are using mostly coal.

If we are going to phase that out, which we have to do, then next generation nuclear power is a candidate that should be looked at. That is all I am saying. I am not saying we are ready to begin to implement it, but we should not be afraid to do the research and development and see what its potential is.

Mr. HERGER. I could not agree more. Thank you very much.

Mr. LEVIN. Mr. McDermott?

Mr. MCDERMOTT. Thank you, Mr. Chairman.

I put on the monitors the volatility in the cap and trade system in the European system. I really think our issue here is to decide between a carbon tax and a cap and trade system. To do nothing as Dr. Christy suggests or allow ourselves to be bullied or blackmailed by the industrialists of Alabama is not an option.

What I would like the two of you to talk about between yourselves is why your system is better. My understanding is that the environmentalists would like to have an absolute cap and industry would like to have absolute certainty in the cost. Those seem to be the polar things that this Committee is going to have to balance off in any system.

I would like to hear the two of you talk about why you are falling on one side and you are falling on the other.

Dr. Hansen.

Mr. HANSEN. Caps have several disadvantages, as I mentioned. They worked in the case of sulfur dioxide because you had a single source and you had relatively easy solutions to it.

The Kyoto protocol is a perfect attempt. That is a cap system. It did not work at all, even the countries that claimed they were meeting their target, in fact, their emissions went up because there are escape valves.

Cap and trade is good for lobbyists and speculators.

Mr. MCDERMOTT. It looks like from that chart that is really what we are seeing.

Mr. HANSEN. Yes; exactly.

Mr. MCDERMOTT. The stock market makes a lot of money out of a system and there is nothing to put back into the system.

Mr. HANSEN. Right. The tax is much more honest. Unfortunately, the main reason for a cap is for the sake of pretending that it is not a tax. In fact, either one increases the price of energy for the user. Either one is a tax. We should insist that the cap people call it a cap tax because that is what it is.

Mr. MCDERMOTT. Dr. Ekwurzel?

Dr. EKWURZEL. Thank you. I think we can draw upon the lessons from the European Union and their cap and invest program, as well as in the northeastern U.S. That is why we advocate for 100 percent auction that sufficiently has tight limits on emissions.

The reason is that the European Union originally gave away free allowances. We saw this collapse of the price. It was not an assurance for someone at British Petroleum or the oil industry to be investing long term infrastructure decisions or a coal power plant designer to design next generation power plants.

You cannot make that decision without some 40 year certainty, which a cap and invest program gives you because we are ratcheting down the cap over 40 years. That is a 40-year economic frame that business can work within, which is very attractive.

Also, there is no guarantee that the use of funds in the dividend situation will go toward activities that will reduce emissions. Especially because we have not reinvested in a targeted way, we do not provide a guarantee that people will have choices available to them to purchase energy efficient homes, cars, and consumer goods through standards and investment and research to try to get more choices on the car dealership floor, for example.

Mr. MCDERMOTT. In a cap and trade system, how do you deal with the impact on the lower income people in society who get hit with the cost of increased energy or fluctuating energy prices?

Dr. EKWURZEL. Exactly. An attractive thing with the fluctuating prices is when you have a down turn in the economy, the price is going down, it is mimicking the economy. If we set a level, then you might have an undue burden across the board during the down turn in the economy, so the price following the economy is somewhat attractive.

Also, my economist colleagues tell me that when you reinvest a well-designed cap-and-invest program, you buffer low income residents from the price spikes because we know we can have programs for weatherization of homes. We can have cash and dividends that are set out in a targeted way to those who are most vulnerable to the price change.

Mr. MCDERMOTT. How do you give the oil or the energy entrepreneurs the ability to know what the price they are competing against is going to be?

If you are going to build a solar plant, if you are going to build a wind plant, whatever, and the thing is jumping up and down, how do you know as an investor or a venture capitalist how you are going to put your money into that?

Dr. EKWURZEL. Yes. I see we are running out of time. I am not an economist but what I understand, my colleagues tell me if, for example, on the acid rain program, the prices were the most efficient and low cost way to go because the market adjusted to the cap on sulfur emissions from that successful program. The prices were lower, and it was a much more efficient system and the acid rain problem was solved.

Mr. MCDERMOTT. Thank you, Mr. Chairman.

Mr. LEVIN. Five/six minutes. Mr. Brady, do you want to take three of those or do you want to wait?

Mr. BRADY. That would be real quick, Mr. Chairman. I would like to submit a statement for the record dealing with this issue and its trade implications as well.

Most of the legislation introduced in the last Congress that composed a cap and trade scheme on the U.S. include provisions to impose additional tariffs on imports from countries that do not have similar policies.

This has significant trade implications for the United States, as well as developed and developing countries, which could result in violations of WTO obligations or inviting retaliatory measures.

My belief, Mr. Chairman, is these consequences deserve a thorough and comprehensive examination by the Committee.

I would submit that for the record.

Mr. LEVIN. Without objection.

[The prepared statement of the Hon. Kevin Brady follows:]

Statement for the record

Committee on Ways and Means

Hearing on Scientific Objectives for Climate Change Legislation

U.S. CONGRESSMAN KEVIN BRADY (TX-8)

February 25, 2009

Today the Committee will hear testimony on what policies the United States should consider to address concerns about climate change.

All variances of “cap and trade” legislation proposed in Congress have significant trade implications for the United States, which could result in serious job losses. These consequences deserve a thorough and comprehensive examination by the Committee on Ways & Means prior to any future action.

One witness before the panel today, Dr. Hansen, argues that the United States should impose a carbon tax and impose that tax on imports from countries that do not impose a carbon tax. Most of the legislation introduced in the last Congress to impose a cap and tax scheme on the United States included provisions to impose additional tariffs on imports from countries that do not have similar policies.

Risky and Counterproductive

Legislative provisions that require the United States to unilaterally impose new trade barriers in the name of environmentalism are risky and are likely to be counterproductive.

- 1) There is considerable debate as to whether such artificial “carbon curtains” are consistent with the U.S. obligations in the World Trade Organization or with free trade agreements. If these trade barriers are found to be in violation of the U.S. obligations, the affected countries would be permitted to retaliate against the United States – with damaging economic results.
- 2) Even if these trade barriers are not found to violate the WTO, given the near-term global economy, many countries will view the action as legal protectionism, which invites reciprocal retaliatory actions. What is to stop other countries, such as China and India, from imposing trade barriers on U.S. exports because per capita emissions in the United States are higher than those in China or India? It is certainly plausible that poorly thought-out climate change legislation could spawn a competing web of trade barriers that would prolong the global recession and harm both developed and developing countries.
- 3) Moreover, there is considerable debate as to whether these carbon curtains would be effective in achieving their environmental goal of preventing “leakage” – the fear of American manufacturing jobs moving offshore to avoid the reach of

unrealistic U.S. environmental laws. Given the precarious economic climate around the world, the United States runs the risk of setting off a global trade battle while simultaneously failing to achieve reductions in global emissions. This would be the worst of all possible outcomes.

In summary, Congress – led by the Committee on Ways & Means – should carefully study both the possible consequences of trade retaliation as a result of climate change legislation as well as the potential loss in U.S. sales and jobs as a result of making American exports non-competitive through higher cap and trade costs.

At a time when U.S. exports have been the one consistent bright spot in the economy and have been the largest contributor to U.S. economic growth, policies that threaten U.S. exports and the jobs they support are particularly unwise.

* * *

Mr. BRADY. Mr. Hansen, very quickly, how do you measure the amount of carbon—you are calling on a carbon tax on imports from other countries. How big would that tax be? How do you measure what the amount of carbon is in an import?

Mr. HANSEN. The tax has to be large enough to affect people's decisions. I gave you an example of quite a large tax. You would impose presumptive import duty on any country that does not have comparable tax rate. That would allow them if they could show that their manufacturing did not use carbon, then you would allow them that option of proving that and then you remove that duty.

Otherwise, you assume that the standard amount of carbon that is used in making that product has been used in their country.

It is an easy way to make this international. While cap and trade, we negotiated 10 years and could not get everybody to agree to the Kyoto protocol. If you have a tax, all you need is a few major countries to agree to this and then they will say we will put an import duty on you if you do not have a similar tax.

Very quickly they will realize you are collecting the money instead of us, so they will put a tax on it. That is the fastest way.

Mr. BRADY. Would the EU and Australia that has cap and trade schemes be excluded from this carbon tax or included?

Mr. HANSEN. A cap can be included amongst a system that has a tax and dividend. You can have internal to that some limited caps and trade on a given industry, for example.

Mr. BRADY. Thanks, Dr. Hansen.

Mr. LEVIN. Mr. Lewis had hoped to inquire. Do you want to be very brief so we can escape to vote?

Mr. LEWIS OF GEORGIA. I will try to get it in, Mr. Chairman. Thank you very much, Mr. Chairman.

Dr. Christy, are you suggesting that we do not do anything, that we do not use the Tax Code to do something about climate change, global warming?

Mr. CHRISTY. I think what you are getting into here is changing behavior of people who have a fairly high standard of living, and that is going to be a very tough sell.

Scientifically, the carbon dioxide is not a toxic gas. It does not harm anything in that way. Plants love it. They grow better with carbon dioxide.

Its effect on the climate is the only thing at issue, and our studies show when we go and create the numbers and test these hypotheses, that these dramatic changes just are not occurring at the rate climate models say they are.

I have the numbers right in the testimony.

Mr. LEWIS OF GEORGIA. I do not want to cut you off but time is short and we have to go vote.

Dr. Hansen said in his statement not to act is immoral. I notice you are a scientist but you also have a divinity degree. Does that not say something about what type of planet, what type of piece of real estate we are going to leave for the unborn generation?

Mr. CHRISTY. I can say this, I have gone to a village like Kimahordery to tell the parents of a child that the child has died because they live in a place of very low standards of living. They will not stand for that because they love their children as much as we do and they are experiencing grief inconsolably. They need to increase their standard of living.

Mr. LEWIS OF GEORGIA. Are you buying this line well, maybe China would not act or India would not act, so we will not act? Is this not something that says something is good in itself, to save the planet, that people have a right to know what is in the food we eat, what is in the water we drink, the air we breathe?

Mr. CHRISTY. Carbon dioxide does not affect those things you just talked about. Yes, there are many reasons to find alternative energies than carbon based; many reasons. I mentioned some about the balance of trade or creating energy locally.

We are Americans. We innovate. I think we will find new ways to create energy.

Mr. LEWIS OF GEORGIA. We will threaten the planet, Dr. Christy.

Mr. CHRISTY. In the datasets we create to test those very hypotheses, we do not see the planet threatened.

Mr. LEWIS OF GEORGIA. I think Dr. Hansen will probably disagree with you.

Mr. HANSEN. It is clear that we see things happening. The ocean is becoming more acid. That is not good for the life in the ocean. This is very clear. We are pushing the system well beyond limits which are going to have major consequences and already beginning to do so.

Mr. LEVIN. We will stand in recess for about 20 minutes or so.

[Recess.]

Chairman RANGEL [presiding.] The Committee will resume the hearing. Again, I apologize to our distinguished guests. It is unavoidable.

The Chair will recognize Mr. Ryan. He is not here. Mr. Linder of Georgia.

Mr. LINDER. Thank you, Mr. Chairman.

I think it is strange that we are sitting here today talking about making trillion dollar decisions based on computer models and what we have just been dealing with for the past 6 months as a trillion dollar collapse based on computer models.

For 30 years, Wall Street got rid of their risk managers and replaced them with mathematicians and computer experts, and they gauged risk by algorithms. It appears that those computer models did not have a place for fear and greed, so it failed.

Of the 20 or so climate computer models, none of them take into account natural impulses by nature. For example, Dr. Christy referred to the iris effect observed some years ago over the Equator with the natural release of heat, but not any of the computer models take into consideration the iris effect.

We are told that the science is clear. I think Dr. Hansen said the science is clear. Others say the science is settled. In my 50 plus years observing science and being a part of it, I have never seen settled science. I do not believe there is such a thing, only settled scientists. Galileo would understand that. So, would Einstein.

In fact, if the science was settled, not by observation in some instances, but by pencil and paper, it has been noted that the 1995 IPC report highlighted key phrases by the scientists who did the work.

None of the studies said by clear evidence, we contribute it to humans, and five different ways were stated. All five of those statements were removed from the report and replaced by one, "The biostatistical evidence in chapter eight when examined in the context of our physical understanding of the climate system, now points to a discernable human influence on the global climate."

When the bureaucrat was asked under oath why that change was made, he said immense pressure from the top of the Federal Government.

I do not know what the ideal carbon dioxide level in the environment is. I think, Dr. Ekwurzel, said it should be 450 parts per million max. I think Dr. Hansen said 350 parts per million.

Either of you should then explain to us the experience 542 million years ago, when in a very short period of time, all of plant and animal life that we have ever known came to be found in the fossil evidence within five to ten million years, in a blink of an eye in a four and a half billion year old planet.

CO₂ levels were 7,000 parts per million. The planet not only survived, it thrived. 300 million years ago, the CO₂ levels were 2,000 parts per million. The planet did fine. It seems to me you need to explain that.

It has been said here who is going to get hurt if we try this. Only the 1.6 billion most vulnerable people in the world. The people who are starving and consigned by this to a life of poverty and hunger because they need CO₂ to grow the plants to live. They need power.

We have enjoyed it for 100 years. China and India are enjoying it now. The Sub-Sahara area in the African region desperately needs CO₂ to plant their farms, to feed their families.

This is a huge mistake based on faulty computer modeling.

Dr. Ekwurzel, you were astonished to sail into the Arctic and find very little ice there. That is what Emerson said in 1903 when he sailed it in a sailboat. As Dr. Christy has pointed out many times here, these things change back and forth.

This is based on computer modeling, not observation, because if it was based on empirical observation, you would note that the evi-

dence of a hot spot over the Equator is absent, although on the 20 plus computer models, it is necessary.

Dr. Christy, would you just comment on that?

Mr. CHRISTY. Yes, the experiment was very simple or the paper we published. If a climate model has the same surface temperature record as the real observations, what happens in the upper air, and then we found a significant difference between observations and climate model estimates.

Mr. LINDER. Thank you very much. I yield back.

Chairman RANGEL. The Chair would like to recognize Richard Neal for 5 minutes.

Mr. NEAL. Thank you, Mr. Chairman. I want to thank the panelists as well and thank the Chairman for scheduling this hearing.

One of the verdicts that emerged from the last election was that we ought to proceed with our faith in science and how important that is to the debate on climate change.

I have had a number of meetings in recent weeks with a lot of people who have wanted to discuss the Massachusetts' model as it relates to health care reform.

I am pretty happy with the fact that Massachusetts has kind of led the way on how to proceed in the health care debate, and your presence today is helpful to this argument as well.

If we use Massachusetts as the model of what we might do, Dr. Hansen, what would you suggest in terms of criticism of what some other countries have or have not done on the global warming front?

Mr. HANSEN. Well, the principal criticism, what I have learned is that even the countries that seem to be the greenest where the politicians say they understand there is a global warming problem and they will take action, it turns out that the actions are inconsistent with that.

In Germany, for example, I wrote a letter to the Chancellor and they asked me to come over and talk to them. They are saying they will have a cap on their emissions, but they are going to build 20 new coal fired power plants. You cannot do that and have any chance of getting CO₂ back to a safe level.

There is a finite amount of carbon in oil, gas and coal. What we can see is oil and gas, which we are going to use, readily available oil and gas, it is going to get us well into the dangerous zone.

The only way we can solve the problem is phasing out coal. I think the way to do that is with a price on the carbon emissions, but I do not think the governments have yet faced up to what is going to be needed in order to get us to a safe level of CO₂.

Mr. NEAL. Thank you, Mr. Chairman.

Chairman RANGEL. The Chair now recognizes Mr. Tiberi.

Mr. TIBERI. Thank you, Mr. Chairman. I guess the question for all three of you to answer starting with Dr. Hansen, probably a follow up to what Mr. Neal talked about, you have developed countries, you have developing countries in the world today, and China is one country that obviously is using more and more coal operating or opening new coal power plants every year, many.

In my hometown of Columbus, Ohio, we did an analysis and said in less than ten years, emissions from developing countries will exceed the total amount of emissions from all currently developed countries.

In such a scenario, you could argue that if the United States goes to zero, abandons your point, coal, we could still see a scenario where countries that we are competing with economically are creating more global warming.

What is your response to that, Dr. Hansen?

Mr. HANSEN. These developing countries have very strong incentives for wanting to reduce the emissions and the air pollution and water pollution that goes with it. China is very concerned about that. They are beginning investments in many ways aimed at clean energy.

That is why a carbon price is so important. Once the major countries—our few major trading partners, Europe and China, agree to a carbon price, then because you can impose import duties on those countries that do not make products that do not have a carbon tax, you can in the most efficient way phase out the carbon emissions.

The developing countries have as much or more incentive to do that as we do.

Mr. TIBERI. Doctor?

Ms. Ekwurzel. Thank you. I think because the U.S. actions alone will not be enough further underscores the need for the U.S. leadership in the international agreements.

The U.S. accounts for around 20 percent of the worldwide emissions, and also the tropical deforestation accounts for another 20 percent.

If you were to add up European Union and the United States, that is almost 55 percent of the world's emissions.

We know that the world has already chosen a market based cap and invest system we currently limit our ability to compete within that market. I think it is very important that we engage in the carbon trading that is already going on and including in our own United States, because we have a northeast carbon trading cap and invest system as well.

Mr. TIBERI. Dr. Christy?

Mr. CHRISTY. This is where it becomes a moral issue. The third world will develop with affordable energy. Making energy more expensive for them will limit their ability to grow and develop.

As I said before, without energy, life is brutal and short, and I saw it.

Chairman RANGEL. The Chair recognizes Mr. Doggett.

Mr. DOGGETT. Mr. Chairman, with your permission, can I follow Mr. Larson? He has a conflict.

Chairman RANGEL. Mr. Larson.

Mr. LARSON. Thank you, Mr. Chairman. I want to thank the witnesses as well. I especially want to say from the outset how we all share the fierce urgency of now with respect to addressing this issue.

The Friends of Earth did a study that said a carbon or greenhouse gas auction would create the world's largest new derivatives market. In fact, the Commodities Future and Trading Commissioner, Art Children, called carbon futures the biggest of any derivatives' product.

Many of my colleagues, including Mr. Etheridge and Mr. Van Hollen, have worked for years to introduce oversight into the commodities futures markets to little avail.

There is still the over the counter dark unregulated markets, which in a recent 60 Minutes' investigation claimed was on the scale of 40 to \$60 trillion.

My question is what makes you think that an auction for carbon emissions where the market sets the price would not turn into the unregulated speculative mess that we have witnessed in other markets?

Mr. HANSEN. I think that is one of the dangers. I think you are bound to get—it is really hard to avoid speculators from getting involved. That is why you want a simple, honest tax and dividend, I think.

Dr. EKWURZEL. I would argue that with a well designed cap and trade, we can buffer the prices through banking and borrowing. Also, what is more important with the cap and invest system is that in that type of system, all actors who can contribute, such as farmers, forest managers, and tropical forest protection, can be part of the market cap and invest system.

Mr. LARSON. I realize you said in your testimony that you are not an economist. I respect that. I am not trying to put you on the hook for that.

I have a difficult time explaining to constituents at Augie & Ray's what an "auction is," and it will actually take place and who benefits.

I think a number of people on the Committee starting certainly with Mr. McDermott raised valid points in terms of volatility, and how will volatility impact the constituents we are all sworn to serve, and what will be the cost savings that is passed along as Mr. Hansen indicated. How will constituents benefit from this as opposed to the obvious benefactors on Wall Street.

Dr. EKWURZEL. I would cite the Center for Budget and Policy Priorities. They have recommended that about 14 percent of the auction revenues would go directly into a low income credit, a credit card, for energy prices, to buffer them from that price volatility, as well as making sure that the revenues that are generated—

Mr. LARSON. Fourteen percent of trillions of dollars, that is what would trickle down to the ultimate end user and the person that is going to have to bear the brunt of the price increases that will come?

Ms. Ekwurzel. One advantage is that when you reinvest in creating more choices, especially in energy efficiency, the costs of energy are going to go down.

Mr. LARSON. How will China and India in a not so transparent system, and as we look, as some of the questions of Mr. Levin and others have raised with respect to trade, be able to brought along in a system that is not transparent and accountable and direct?

I think it masks itself in many respects as opposed to this straightforward leveling with the American people what the sacrifice will be, but also what the benefit of their participation will be in terms of either lowering their payroll taxes or getting a direct dividend as Mr. Hansen and others have suggested.

Dr. EKWURZEL. I would say that my top priority is solving the climate crisis. Having a cap directly addresses that.

Mr. LARSON. Are you open to something other than a cap? Are you open to not falling into the trap that we saw with the deriva-

tives market and the less than transparent means of collecting this money and then passing it on to the people who will be truly impacted?

Are you open to it, at least?

Dr. EKWURZEL. I think there has to be a suite of policies and cap and invest is a part of it. We also need to have incentives. We need to have standards to make sure that our plasma TV's are not emitting and using as much energy as they currently do. When you replace a TV. with a plasma TV., we are taking many steps backward.

These types of incentives and carrot and stick methods will have to be across all sectors, but with cap and invest, we can bring in the agricultural sector.

Mr. LARSON. Thank you, Doctor. I agree with your scientific goals. I hope you are open to achieving some of the economic results downstream on our constituents who will be impacted.

Mr. DOGETT. Mr. Chairman?

Chairman RANGEL. Mr. Boustany is recognized.

Mr. BOUSTANY. Thank you, Mr. Chairman.

None of the three of you are politicians or economists. You are scientists. For a moment, I want to just focus on the context of what has been said here in the hearing.

Dr. Hansen, you said the science is crystal clear based on a lot of empirical findings with the diminishment in the Arctic ice and other findings that have been observed.

Dr. Ekwurzel, you stated that models have actually under stated the actual pace of change.

Dr. Christy has talked about models, planet models overstating average temperature.

There is a lot of difference of opinion right here, just in the context of this hearing.

Could each of you point out to me what you see as flaws in the current scientific modeling, and what needs to be improved, what steps need to be taken to bring these models up to speed to give us a better indication of what is going on empirically?

Dr. Hansen.

Mr. HANSEN. First of all, I did not mention models. I think by far, our best indication of how the Earth responds to changes in its boundary conditions and its atmospheric composition is based on the history of the earth. That is what has improved enormously in recent years, the paleoclimate information.

Also, we see what is happening with the changes that are occurring now.

Mr. BOUSTANY. Is not the causality or the assumption of causality between emissions and global warming based on models?

Mr. HANSEN. No. Our knowledge of climate sensitivity to changes in atmospheric composition is far more precise based on the Earth's history, based on how the Earth has responded in the past. Then that automatically includes every physical mechanism that exists in the real world, while models are always deficient. You never know whether you have all the processes in there or whether you have the physics right.

Indeed, by setting different scientists up at a table, you will always get differences of opinion. That is why I strongly recommend,

if you want to have the best assessment or summary of our knowledge, that you ask the National Academy of Sciences. Then we can stop debating things which are already in fact quite clear.

I do not mean to imply that every detail of the science is settled, but the broad picture—you need to look at the forest, not just the individual trees. The best body to help us look at the forest, I think, would be the National Academy of Sciences.

Mr. BOUSTANY. Thank you. Dr. Ekwurzel?

Dr. EKWURZEL. I think it was very clear we all agree that the climate is warming. We are a big part of the problem. That gives me hope. That means we can be part of the solution. Otherwise, we would be at the vagaries of natural processes, and the Earth's history has taught us a lot, how sensitive the climate is.

Where the science is leading now is to try to figure out what are going to be the local impacts, how fast are the changes going to be, and how can we adapt.

That is where the science is. The broad reason behind it and factors that we have understood for many years, indeed some of the concepts were proven over 200 years ago and still remain robust.

Mr. BOUSTANY. I understand that. Does not the modeling give us some sort of an indication of how we should intervene?

Dr. EKWURZEL. We have plenty of evidence just based on what has happened in the past and observations, especially very high quality scientific records, especially over the last century.

Mr. BOUSTANY. Try to explain the fact that the models based on emissions do not account for the rapid pace of warming, what are the other factors?

Mr. HANSEN. What has become clear is there are amplifying feedbacks in the climate system. One of them is in the Arctic where as the sea ice melts, it exposes a darker ocean that then absorbs more sunlight and it speeds the melting of ice there.

Even slow feedback, things that we thought were slow, like ice sheet disintegration and like melting tundra and release of methane, we did not include that in the models, but in fact we are seeing it begin to happen, still modest in its size.

When we look at the Earth's history, we see that when those things got started in the past, they sometimes then began to grow quite rapidly. Ice sheets disintegrated at a rate that had sea level going up one meter every 20 years.

Those kind of processes are not really included in the models. In that sense, the models are less dynamic than the real world.

Mr. BOUSTANY. Thank you.

Chairman RANGEL. The Chair recognizes Mr. Doggett.

Mr. DOGGETT. Thank you, Mr. Chairman. Thank you for conducting this hearing and involving this Committee in finding a solution to this critical issue.

It is timely particularly because as you recall, last night in his address, President Obama asked "Congress to send him legislation that places a market based cap on carbon pollution and drives the production of more renewable energy in America."

I think it is not too much to say that this President is committed to changing the White House into a greenhouse, not just an efficient house as a model for the country, but a greenhouse in the sense of cultivating, of creating, of applying science based ap-

proaches to how we solve the critical national security issue of climate change.

I think our President gets it. We need to help him get the progress that we seek by moving forward in the very near future, in the next few months, in offering legislation to address this issue.

The time to act was really long ago and it is with the economic crisis that only swift bold action can help us be pulled back from the abyss that you have described this morning.

Fortunately, the world climate, while it is worsening, the climate here on the Hill for change is greatly improving. Last Congress, I introduced the Climate Matters Act cosponsored by a majority of the Democratic Members of this Committee, almost 100 cosponsors, that set limits on greenhouse gas pollutants.

Now, with Chairman Henry Waxman at the helm of the Energy and Commerce Committee, I believe our two Committees can work together as partners to lead a Congressional response in reaction to President Obama's leadership.

While disagreeing with your conclusions on the best remedy, I particularly applaud the years of commitment of Dr. Hansen, and I share, Dr. Hansen, your zeal for action and the need to have acted yesterday.

Most Americans, I think, understand that it is not whether we respond to the crisis of climate change, but how quickly we respond to it.

I am very pleased that Dr. Ekwurzel is here. The Union of Concerned Scientists was one of a large number of groups that appeared in this room last Summer when we had hotter weather and when we also had a broad consensus in favor of climate legislation, and I appreciate the role the Union has played in exploring this and certainly in the supportive comments it has offered on the climate change bill.

Any time you have a problem that is this massive but where the benefits of solving it are felt years down the road and the difficulty and pain of coming up with a solution is felt now, there will be many excuses for inaction that are very appealing from a political standpoint.

The economic crisis is the latest excuse for doing nothing. In fact, I believe, as your testimony indicates, that the crisis that we have now is directly linked to our over dependence on fossil fuels and fossilized thinking, and that we need to be creating green jobs now to get us out of that crisis.

Another excuse that we have heard this morning is that what we need to do is let India and China dictate our policy in this country. You know, it is not so many years ago that Exxon Mobil, one of the current advocates for a carbon tax, was over telling the Chinese and the Indians that they needed to not be concerned about this problem and not participate in helping us to find the solution.

I believe that you have outlined the fact that we need all of these countries cooperating, of course, to solve the climate change. It is a false discussion to say let us just look at what the United States could do to contribute. We can do a great deal.

My state of Texas, the biggest emitter of greenhouse gas emissions in the country that is either number one or number two with

the Chinese in greenhouse emissions, can do a great deal to solve this problem.

We have to do it through cooperation and also through the kind of trade mechanisms that we outlined in the Climate Matters bill. Secretary of State Clinton has been there placing this at the top of the foreign policy agenda.

One of the things, Dr. Ekwurzel, that you referred to that I think is so central to the Climate Matters Bill, is we have to have a rapid response in terms of scientific review, periodic review.

As we get into this, we learn even more and more and we may see an even more rapid deterioration and the fact that the worse case scenario we have heard about is maybe not as far reaching as the facts dictate.

Let me ask you, Dr. Ekwurzel, as far as the cap and invest approach, if you believe that an investment of some of these revenues that would be gained is critical to helping us resolve the problem and provide additional resources for energy efficiency, clean transportation and green energy technology?

Dr. EKWURZEL. Yes, I think it is absolutely critical as well as buffering low income constituents that are so critical in this path forward. We need that one-two punch of the early cap and also ratcheting down in the second punch of reinvestment so we can have the longer term solutions when the cap is so low and the price goes up.

We need those better technologies down the road over the next 40 years. Thank you.

Mr. DOGGETT. Thank you very much.

Chairman RANGEL. The gentleman from North Carolina, Mr. Etheridge.

Mr. ETHERIDGE. Thank you, Mr. Chairman. Let me thank each of you and thanks for this hearing, Mr. Chairman.

Dr. Hansen, some have criticized carbon tax proposals because they say they do not provide certain reductions in emissions. How would you address this criticism?

Mr. HANSEN. I think in fact, carbon tax is your root to the fastest reductions. What the science has told us is that we need to make reductions as fast as we can.

The cap, the problem is attempts to define caps then result in escape hatches, and we see in the Kyoto protocol that in fact, we did not get reductions, even the countries that accepted the targets of large reductions did not achieve them. Instead, they would use some escape hatch and plant a tree in some country or something.

The most effective way is to put a price on the emissions and that will give a big incentive to develop those technologies that do not emit carbon and move us in that direction as fast as possible. We can adjust that rate by changing or increasing the tax rate.

If we are giving back 100 percent of the money to the public, the public will not object to a higher rate.

Mr. ETHERIDGE. I met with a group this morning, and obviously, different groups have different issues as it relates to whether it is capping trade or tax, and certainly, the agricultural industry in this country, depending on whether it be people who grow animals or whatever, there is a different degree of where you are, and you will have a certain group that will love capping trade because

they are going to make money at it, because they can have offsets from industry.

Otherwise, one issue was raised this morning. Dr. Ekwurzel, I would be interested in your comment. The issue they raised was not so much getting there, they were willing to do certain things, but fertilizer and a lot of the components in agriculture is really tied to natural gas, has a significant impact on the input costs and the fluctuations that take place.

If within the process of what we are doing we have adequate natural gas in place, then you have a level playingfield over the long run, but if not, and this gets to other areas, you are going to have tremendous peaks in the cost of food, et cetera.

Would you feel comfortable in commenting on that? I have a follow up question I really want to get to.

Dr. EKWURZEL. I think the price volatility would be something that a well designed cap and invest program would have to address. Your point to other actors, for example, a farmer, a dairy farmer, who can get power from the methane emissions or the nitrous oxide that comes from the farming practices that can last in the atmosphere for about a century, these types of issues can be well addressed with a well designed cap and invest program.

We could bring more actors that can help solve the problem of climate change, which is what I am most interested in.

I cannot speak to your natural gas issue.

Mr. ETHERIDGE. I will save that for a later day.

Your proposal focuses on preventing a greater than two degree change in temperature. My question is what are the risks associated with allowing a two degree change in temperature, and secondly, what is the level—why is that acceptable when three degrees would not be or one degree?

What is that break point? I have heard the consequences but I would like to get it on the record.

Dr. EKWURZEL. I would just caution that with the understanding of the science, for example, some projections of disintegration of some of the ice sheet, contributions to sea level rise, some of those range from between 1.5 degrees Celsius above pre-industrial up to higher, so perhaps two degrees Celsius above pre-industrial might not save the worse case of the scenario's of some of the models for ice sheets, but many of the impacts—what we are saying is that two degrees is an absolute maximum.

The atmospheric concentrations that go along with a good temperature, it may be more prudent to go even lower. Some issues for example, you can lose are species that are sitting at the top of mountain tops or at the polar regions that do not have other places to escape, as well as our own coastal infrastructure.

We developed our economy, our agricultural system over the past 2,000 years with a relatively benign situation. We knew the sea levels, where they were, and that type of rapid change is something that would be an immense cost to us as well as threats to many people around the world for food supply, water resources, flooding and destruction, and more extreme weather events.

These are some of the impacts we would like to avoid.

Mr. ETHERIDGE. Thank you, Mr. Chairman. I yield back.

Chairman RANGEL. Mr. Pomeroy.

Mr. POMEROY. I thank the Chairman. Thank you for this important hearing, Mr. Chairman. I commend the panel. I think each of you have been extremely interesting and quite clear in discussing a complex scientific matter.

I represent the State of North Dakota. We farm up there. We have a substantial coal industry, lignite coal. We use it to generate power, another major source of economic activity. We heat our homes through long cold winters. We drive long distances between our towns.

We are anxious about this. On the other hand, we care more than anything about the world we will pass on to our children and our grandchildren.

We are trying to find our way here. A course that I think Congress needs to pursue is we have to keep a mind on ultimate political sustainability of changing course and beginning to address this issue.

What would be the impact of what you think might be an optimal answer in a place like North Dakota?

Mr. HANSEN. I think North Dakota, as the price on carbon emissions goes up, the coal industry is going to go down. North Dakota has an abundance of wind resources. It also could be a contributor to well designed biofuels programs, not corn based ethanol, but there is a role for biofuels in our future energy supplies.

I think that it is not going to be necessarily detrimental to even a state like North Dakota.

Mr. POMEROY. Dr. Hansen, coal is the most abundant, most affordable energy source in the world. I flew out coincidentally Monday from Bismarck with an engineer working for North American Coal heading to India, where he is going to spend the next 3 months assisting them in the construction of a power plant. They are building a pile of them. He's on the mining side. He did not think there was a heck of a lot of investment going in on the environmental side of that plant, which will be four times larger than any plant in North Dakota.

Talk about extraordinary air deprivation, deterioration already, per capita energy consumption at about one-sixth of what we have in this country there, full speed ahead in terms of expanding power.

What about coal? If our Nation decides—are we truly going to shift the cost to the consumer, going without this energy resource, and even if we would, what about the rest of the world which is unlikely to follow this example?

Mr. HANSEN. Yes. It is not a trivial problem. The science has really made clear we cannot burn all of that coal without sending us back to where the planet was when that carbon dioxide was in the atmosphere before. Where it was, there was no ice on the planet. Seventy meter sea level rise.

It would not happen instantly. We would set in motion processes that would be affecting our children and grandchildren for many generations.

We simply cannot do it. We have to figure out a way. Coal could be part of it if you really developed a carbon capture and sequestration.

My guess is—I do recommend there should be real effort to do that. Not the imaginary one we had over the last seven or 8 years where we pretended we were doing it and then did not do it.

That is a possibility. I would compare that to fourth generation nuclear power. I would work on both of those and figure out which one is more effective. Maybe both. My suspicion is we do need base-load electrical power and I doubt that the renewables will do that.

Mr. POMEROY. Not to interrupt, I see my time is running. We have a very substantial coal sequestration initiative in North Dakota that enhances all recovery in Canada. It does not capture 50 percent of emissions, but it was not even constructed for that purpose. I think we can do much better.

Would you say as part of the approach a substantial investment in clean coal to see what we can achieve needs to be part of a sustainable political answer?

Mr. HANSEN. I think that is a role that a government should be expected to play. The carbon price will then encourage private investment if it looks like that is a viable way.

I think on a really big issue like that, which is a decade long type thing, that the government should contribute to that and also to nuclear power.

Mr. POMEROY. Thank you. I did not have time to include the other panelists, but thank you.

Chairman RANGEL. The Chair would like to recognize Mr. Davis of Alabama.

Mr. DAVIS of Alabama. Thank you, Mr. Chairman.

Let me tell you, lady and gentlemen, at the outset, I think I am in the camp that Mr. Pomeroy represents, my very learned colleague from North Dakota.

We are searching for—the phrase “middle ground” is tried, it is over used. For lack of a better term, both of us, and I think Mr. Etheridge, are searching for some sort of a path in the middle.

I want to use my time to tell you, Dr. Hansen, what I find unsatisfying about your testimony, and then Dr. Christy, I will tell you frankly what I find unsatisfying about your testimony.

Beginning with Dr. Hansen, when Mr. Pomeroy asked you questions about what the impact would be if we were to have a dramatic departure from coal based sources of energy, your answer essentially was well, we would certainly lose coal based sources of energy under your scenario, but there are numerous other ways that North Dakota could pick up the slack.

This is my concern with that answer. It is not a theoretical abstract issue. If coal based sources of energy were to deteriorate in major portions of this country, you would lose whole mining communities, you would lose whole job sources for people, and the average age of people in the mining industry is not young. These are individuals often, I think, in their late 40s/early fifties.

It is not uncommon for people to be at that age and working very productively in the mining industry. They are not going to be retrained in this phase of their career to do something. There will not be a seamless transition at all.

Mr. Etheridge, I think, may have voiced some concerns about some of the impact of some of the renewable electricity standards on southern states.

That is a genuine concern that some of us have, that you could see acute impacts on particular regions, on particular sectors of the economy, those impacts will be magnified by the effects of globalization in many ways, and they are also magnified by the now 26 year deterioration in the manufacturing sector in this economy, and again, the costs are not academic. They are real families that are not likely to be retrofitted for different kinds of work.

Having said all of that, Dr. Christy, I had a chance to review your written testimony. I am going to tell you what I find unsatisfactory about your approach.

Number one, I am not a scientist and will not play one on close circuit TV. here today, but I am not overly sympathetic of the science and the scientific argument you have advanced, but I do not want to dwell on that.

Frankly, I was more bothered by another observation you made in your written testimony. You say that you are paraphrasing, but there is a quote from you based on a conversation you had with a manufacturer, "Alabama is our last stop in the United States. If energy costs rise, we will be taking all these jobs to Mexico or China and building our products, leaving more emissions and less efficient plants than we create here."

That is some version of an argument that I hear a lot as a Member of Congress from Alabama. This is how a typical week often goes. On Monday, I will hear someone in the business community say unions are bad for my state and we have been selling Alabama on the grounds that we do not have a lot of unions, so if we bring in unions, we will lose that competitive edge.

On Tuesday, someone will say in the context of the stimulus package that just passed, this will make us expand our unemployment insurance, and we have been selling Alabama on the grounds that we do not require very much in the way of unemployment insurance, that is a competitive edge that we have had.

On Wednesday, particularly until last August, someone would come to me and say yes, it is true, we are 49th in the country in our water protection standards when it comes to the amount of carcinogens we tolerate in the water supply, but we use that to get a competitive edge over other states.

Now I hear from you well, the particular energy profile that we have in our state is a competitive advantage that we have on other states.

I am waiting for, I guess, the Friday when somebody comes in and says maybe the competitive edge that we ought to be developing in Alabama and states like it is that we are producing very good workers, developing very high quality schools, and developing very good comprehensive workforce development programs.

I just want to hear that as the solution advanced by people one of these days. I have a hunch that if we are serious about where your state and my state is going to be 10 years from now, 15 years from now, it is going to require that we frankly, yes, invest in nuclear. Yes, we invest in alternative sources of energy.

It is also going to require a focus on education, on job creation. I just do not like hearing this argument that Alabama's competitive advantage is that we protect our workers less and we protect our

environment less and demand less of industry and the people around us.

I imagine the states that surround us want jobs as much as we do. I imagine they want a strong economy as much as we do, but they seem to be choosing different courses than the ones that some policy makers in Alabama are encouraging.

My time has run out. If any of you want to respond to what I said and the Chairman will allow it, that is fine.

Mr. HANSEN. You are certainly right. If we phase out coal, the coal mining jobs are gone. The studies have shown that the jobs created by the alternative energies actually are more labor intensive and will produce more jobs than the coal mining.

Of course, the coal miner—the United States has always moved fairly quickly from one thing to another, and that does create a hardship if a person is not retrainable.

You will need to take some steps to try to minimize that impact. I think overall for the country, it will not be a reduction in number of jobs.

Chairman RANGEL. Mr. Van Hollen is recognized.

Mr. VAN HOLLEN. Thank you, Mr. Chairman. Let me thank all of our witnesses for their testimony.

Dr. Hansen, if I could start with you. Dr. Ekwurzel has argued for an initial target of 25-percent reductions off the 1990 levels by the year 2020. Consistent with both meeting the science and the evidence with respect to global warming and also not doing undue harm to the economy, does that path make sense to you? Is that something you think is an appropriate target?

Mr. HANSEN. That would be reasonably consistent with phasing out coal as rapidly as practical. In order to actually achieve that, when we set goals before, it has not been a very effective approach. We have to identify where the main source is and the one that we are going to have to cut back, and that is coal, and we will need, I think, in order to achieve that, to have a price that encourages it to happen.

Mr. VAN HOLLEN. You anticipated my next question, which is really for both of you. Let us assume that is the path we want to reductions on that schedule. What would be the effective price for carbon in order to hit that goal and any schedule in terms of price increases?

I understand you mentioned the number of \$115 per metric ton of carbon. Is that the kind of price we are talking about and at what point in this schedule. These are obviously the real considerations for the Committee.

Mr. HANSEN. It is difficult to set that. That is why I like the carbon price as the tuning knob because it is a stable one with a linear, while in the case of caps, there is too much volatility.

The price has to be high enough that the consumer feels the impact and it affects their choices in vehicles they buy and it encourages them to weatherize their home and things like that. It has to be a substantial price. That is where the discussions on the cap have really been, I think, inadequate, to really get the major changes that we are going to need.

I am saying I cannot tell you exactly. By the way, the \$115 is per ton of CO₂, not carbon.

Mr. VAN HOLLEN. CO₂. I am sorry. Doctor, do you have a sense of what the price would have to be if you do a cap or a tax?

Dr. EKWURZEL. Certainly, as the cap ratchets down, theoretically the price is going to go up. We have limited allowances. I would not be able to say what the price would end up being.

Mr. VAN HOLLEN. For you, Dr. Ekwurzel, Dr. Hansen has proposed that in order to address the price impact on the consumer, you essentially have a rebate, a 100 percent rebate. As we all know, one of the impacts of this will be to increase the price of carbon products.

I know you have said we should use some of the revenue for some of these purposes in clean technologies.

I guess the question on the minds of many consumers is not Dr. Hansen's approach a more direct approach to ameliorating that cost impact on a consumer, and does it not also allow them to draw a more direct connection between increase in prices but also the relief that they will feel in terms of the additional costs through a rebate?

Dr. EKWURZEL. In some senses, it could be seen as regressive in that one rebate across the board per capita is for everyone, whereas if you directly target the investments toward those who have low income, you might be able to give even more money than what the rebate is.

There is also no guarantee that what they are buying is necessarily reaching our goal. That is from my perspective of wanting to reduce the cap on emissions. I am not so sure you get there with the dividend.

What is important is you really need to provide more choices for the American consumer so that when they do spend their money or if they have energy credits, depending on if it is a well designed program, then we want to have more choices that are very energy efficient and allow them to weatherize their homes and get windows and have wonderful new options when they buy appliances and have new standards on plasma TV.'s that are really climate friendly products that are out there, so that requires a suite of programs.

I do not know how a dividend would necessarily provide similar guarantees. If you send the money over to other countries that are producing consumer products, I am not sure how that incentivizes climate friendly products.

Mr. VAN HOLLEN. Mr. Chairman, a brief follow up on that. I think we should all agree the primary mechanism we are using here to try and drive investments in alternative energy sources, non-carbon based sources, is by setting the price on carbon, and that will drive investments in these other technologies because consumers will want to buy them.

I could not agree with you more on weatherization as a good investment. As you know, we have a major investment in the economic recovery plan.

Just in terms of consumers understanding that we are going to offset some of the increased costs they are going to incur through a rebate, I think there is probably a good argument to be made, that that is a more visible and direct impact.

Thank you, Mr. Chairman.

Chairman RANGEL. Thank you. Mr. Kind?

Mr. KIND. Thank you, Mr. Chairman. I just want to thank the guests for your patience. You have given us a lot of time today. I apologize if you have already addressed the issue I want to delve into briefly with you. I have had to run in and out.

Dr. Ekwurzel, let me start with you because I was looking over your PowerPoint first thing when I came in, and noticed that in the share of the emissions' pie, you have it broken down between industrial and developing nations, where the industrial, as far as projected nations' emissions, comprises about 40 percent impact on the globe, and developing nations, roughly 60 percent.

My question for you and anyone else on the panel here today is how do we create a system to incentivize the full participation of the developing world in what we are doing?

Even if we try to make the right decisions and get everything right here at home, if we do not get that buy in from the rest of the world, especially China and India, we may be just tilting at windmills here.

I do not know if you have an opportunity to think about what we can do in working in concert with the developing world and some of the faster emerging nations that are emitting a lot. In fact, China just surpassed us recently as the number one emitter in the globe.

Dr. EKWURZEL. Those were 2005 numbers. It was just an illustration really to show how deep our emissions would be, even if we based it on our current emissions, which are quite high. In fact, China and India—China has surpassed us. We are number two. India is coming fast along, and Russia.

What I see is that in fact if we were to create cheaper forms of energy from many different sources all on the table and we developed the products here and engaged in that, instead of Germany selling the products to the rest of the world, I would like us to be selling energy efficient products to the rest of the world.

If we can generate revenues and invest it in our companies here at home to create the new energy infrastructure and the jobs of the future, we can have instead of a person going over there building a new coal plant, we could have a person over building a plant that perhaps is much more climate friendly, and that would be really beneficial to our economy as well as the climate. I like both happening at the same time.

Mr. KIND. It is certainly what the President was alluding to in his speech last night, how we need to ramp up our investment in clean technology, clean energy sources. Of course, what we were trying to accomplish in the recovery package as Mr. Van Hollen just pointed out as well, how do we ramp this up capacity wise in this country so we can lead the world and share with the rest of the world.

Mr. Hansen, do you have any thoughts?

Mr. HANSEN. With regard to China and India and the likelihood that they would cooperate, it should be pointed out they will suffer more from climate change than we will. They have a few hundred million people living near sea level. They are already suffering from coal pollution, a few hundred thousand people per year are dying of air pollution.

They will have strong incentives to go in the same direction as we do. I have had workshops with Chinese and Indian scientists. I find they are eager to move in these directions. We just have to have the incentives there to make sure it happens.

That is why I think the price incentive with the tax and 100 percent dividend gives that kind of push.

Mr. KIND. Dr. Hansen, do you feel with your contacts with the scientists in India and China that they are basically where established science is today or do they have a raging debate in their own society?

Mr. HANSEN. No, this raging debate is not unique to the U.S. It is certainly occurring in other countries, in Europe now also. Not to the degree that it is here.

That is why I really think that we should ask the National Academy of Sciences. I know what you see on television is not representative of where the science really stands.

Mr. KIND. Mr. Christy?

Mr. CHRISTY. Yes. I object to that comment. I am one of those few people that actually builds these climate datasets. If we could show number three up there, I just want to show one thing to dispel some of the things you have heard here today.

The climate is not changing or more sensitive than what models say it is. This is the range of climate model trends in temperature for the planet.

The red is the highest range. The orange is the low range. The blue and the green lines are where the real world is. In other words, the real world is responding in the climate system at the very lowest of the sensitivity, the mean sensitivity is not being achieved by the real world.

These are numbers that we build and we know they can be repeated. That is the point I am trying to make. We are not changing at the rates that are being promoted primarily by the media, I think.

Mr. KIND. Right. I want to thank you all again. You were very generous with your time and testimony. Thank you, Mr. Chairman.

Chairman RANGEL. Thank you. Let me thank the three of you on behalf of the Committee and share with you the thinking of the Chair and the Committee.

As you know, the President has accelerated our hearings in getting something done, the leadership of the House and Senate have indicated a priority, and we intend to meet with the other Members of the Committees of jurisdiction to see how we can consolidate our thinking and get a consensus on the direction.

I do hope that you would continue to be generous with your time, advice and direction, and we will try to make certain that we can avoid all of the Committees calling you down to say the same things. I will try to consolidate your time if you would be kind enough to continue to give us the benefit of your research and advice.

You have been very, very helpful. I suspect that we have the capabilities as we certainly have the willingness to do this and perhaps that would be your rewards for a lifetime of research that your country has finally responded.

Thank you very, very much.

[Whereupon, at 12:42 p.m., the hearing was adjourned.]
 [Submissions for the Record follow:]

Statement by Laurie Williams and Allen Zabel of www.carbonfees.org

The single biggest obstacle to solving the climate crisis is the fact that the cost of fossil fuel energy remains relatively low, creating little incentive for conservation or for the scale-up of clean energy. While prices for clean energy have fallen, clean energy remains significantly more expensive than fossil fuel energy. For instance, fossil fuel-generated electricity currently averages between 6 and 10 cents per kilowatt hour, while, depending on its design and location, solar currently averages 2 to 3 times that amount. As we explain here, a cap-and-trade approach (*the Acid Rain template*), widely presumed to be an appropriate tool for addressing climate change, has several fatal flaws, including the fact that it will not insure a competitive price advantage for clean energy over fossil fuel energy in the near future. As a result, cap-and-trade will not create the incentives for investment in a rapid scale-up of clean energy substitutes. Cap-and-trade keeps our eyes focused on the wrong ball—on maintaining low costs for fossil fuel energy. Instead, our eyes need to be focused on a very different ball (*the CFC-tax template*)—on changing the relative cost of fossil fuel energy and clean energy, while keeping the energy needed for everyday life and in everyday products affordable for everyone and minimizing economic disruption. Carbon fees with a 100% rebate, delivered monthly in equal payments to all, is the tool that can swiftly and effectively accomplish this goal.

Illustration 1: Fossil fuel energy provided approximately 86% of U.S. energy in 2006.

The Role of Fossil Fuels and Renewable Energy in the Nation's Energy Supply, 2006

(See http://www.eia.doe.gov/cneaf/solar.renewables/page/prelim_trends/rea_prereport.html)

1. *What is Cap-and-Trade and How Did It Become the Leading Proposal to Address Climate Change?*

Cap-and-trade is a program that sets a collective declining emissions limit (“cap”) for particular pollutants from all sources within the program. The idea is to gradually lower the total amount of pollutants emitted from these sources until the environmental goal is achieved (in this case massive reductions in greenhouse gas emissions). The trade portion of the program allows participating sources to lower the cost of reducing their emissions by purchasing permits to pollute from others who may be able to cut back more cheaply, thereby helping to keep the overall costs of the commodities manufactured, in this case fossil fuel energy, as low as possible.

Outside Offsets: An additional concept that has been part of most cap-and-trade proposals for climate change is the idea of outside offsets. Outside offsets mean allowing additional pollution above the cap for sources within the program, if they are able to pay for decreases in the pollutant outside the program. For instance, a coal-fired power plant (a source within the program) could continue emitting CO₂ above the levels that would otherwise be permitted, if the owners of the facility have purchased an offset, such as a reforestation project expected to capture CO₂, i.e., a carbon “sink,” outside the capped sources. In most cases, cap-and-trade proposals for climate change suggest allowing “offset” projects in other countries.

Support for Cap-and-Trade: Many prominent people and organizations have supported cap-and-trade as a next step for addressing climate change. President Obama has said that his administration will seek enactment of a cap-and-trade program to reduce greenhouse gases to 80% of their 1990 levels by 2050. Although individual state programs may be preempted by a future federal program, the trend toward cap-and-trade is also shown by the California Air Resources Board's 2008 decision to rely heavily on cap-and-trade for reducing California's greenhouse gas emissions. The Western Climate Initiative, a group of western U.S. states and Canadian provinces, anticipates collaboration among its members on a cap-and-trade program. Robert F. Kennedy Jr., of the Natural Resources Defense Council (“NRDC”) has said that adopting cap-and-trade to address climate change is a “no brainer” in his for-

¹ We have written this paper as concerned citizens and parents. Our educational background includes undergraduate degrees from Yale College (Laurie) and the University of California, Santa Cruz (Allan) and J.D.'s from Boalt Hall School of Law at the University of California, Berkeley. We are employees of the United States Environmental Protection Agency (“EPA”), Region 9, in San Francisco, however, we are writing only in our personal capacities, and nothing in this paper is an attempt to present the views of EPA or the Administration.

ward to “The Green Collar Economy” by Van Jones. In addition, using cap-and-trade for climate change is endorsed by an array of U.S. organizations, including oil companies (BP America, ConocoPhillips and Shell) and environmental groups (Environmental Defense, NRDC and World Wildlife Fund), many of whom joined an industry/environmental coalition called “USCAP,” the stated purpose of which is to bring about enactment of a greenhouse gas cap-and-trade program. See USCAP’s proposed program at www.us-cap.org.

Given the high profile of the cap-and-trade idea, it is somewhat shocking to many to find that the analysis supporting this approach is seriously flawed and is rejected by many prominent economists.² A combination of factors led to this disconnect:

- (1) *The Acid Rain Myth*: Cap-and-trade advocates have claimed that the success of EPA’s Acid Rain program has proved that cap-and-trade will work for climate change, failing to appreciate the critical differences between the climate change challenge and the acid rain problem. As discussed below, the U.S. chlorofluorocarbon (“CFC”) tax to address ozone depletion under the Montreal Protocol provides a much more applicable analogy.
- (2) *No New Taxes*: Many analysts, including Peter Orszag, Director of the U.S. Congressional Budget Office (“CBO”), have recognized that carbon taxes (or fees) would be a more efficient method of reducing greenhouse gas emissions. See Orszag, Nov. 2007, <http://www.cbo.gov/ftpdocs/87xx/doc8769/11-01-CO2Emissions.pdf>. However, many politicians have viewed any new taxes as politically unacceptable to voters, even before the economic collapse of 2008. These evaluations fail to consider the possibility of 100% rebate, the economic advantages of fees with rebates over cap-and-trade for most individuals, and the potential of public education on the policy choice to address this concern; and
- (3) *Urgency*: Favorable analyses of the applicability of cap-and-trade to climate change originated when scientists believed we might have several more decades to achieve an 80% reduction in CO₂. However, recent studies indicate that the current level of greenhouse gases in the atmosphere (385 parts per million (“ppm”) CO₂) will lead to dangerous climate change, even if no additional increases occur. Since CO₂ levels have been increasing at approximately 2 ppm per year over the last eight years, many scientists have concluded that the climate problem is much more urgent than they believed it to be earlier in this decade. This evidence suggests we have a much shorter time to a transition away from fossil fuels, especially coal, in order to reduce the risk of runaway climate change and ecological disaster. See the 2008 discussion of climate evidence by James Hansen, *et al* at http://www.columbia.edu/~jeh1/2008/TargetCO2_20080407.pdf. Specifically, Dr. Hansen and his team found: “Continued growth of greenhouse gas emissions, for just another decade, practically eliminates the possibility of near-term return of atmospheric composition beneath the tipping level for catastrophic effects.” (Emphasis added.) Given growing demand for energy world-wide, only strong incentives for conservation and a rapid scale-up of clean energy can stem the continued growth of emissions that Hansen and his team have determined are likely to spell disaster.

While people we admire, people of good faith, great intelligence and real integrity, have supported cap-and-trade, our hope is to explain why moving forward with a cap-and-trade approach creates an unacceptable risk of catastrophic global warming and why there is a much more effective alternative that could become politically feasible with appropriate public education and leadership from President Obama.

2. Why is Cap and Trade the Wrong Tool?

The Acid Rain Myth: As noted above, those who champion using cap-and-trade to address climate change claim that it has been “proven” to work in the U.S. Acid Rain program. See e.g., Bill Chameides of Environmental Defense at <http://gristmill.grist.org/story/2007/2/12/102851/837>. However, this assertion ignores crucial distinctions between the challenges we faced in 1990 with Acid Rain and the challenges we face today with global warming. Most importantly, the success of the Acid Rain program did not depend on replacing the vast majority of our existing energy infrastructure with new infrastructure in a relatively short time. Nor did it depend on spurring major innovation. Rather, the Acid Rain program was successful as a mechanism to guide existing facilities to undertake a fuel switch to a readily available substitute, the low sulfur coal in Wyoming’s Powder River Basin. Existing fa-

²See Harvard economist, Greg Mankiw’s blog at <http://www.nytimes.com/2007/09/16/business/16view.html>.

ilities needed only the addition of a few new railway lines, burner modifications to accommodate lower sulfur fuel, and, in some cases, new or more efficient scrubbers. Little new technology or infrastructure was needed and little was created.³ The goal of the Acid Rain program was to reduce sulfur dioxide emissions, while keeping the cost of energy from coal low. To be effective, climate change legislation must do the opposite; it must gradually increase the relative price of energy from coal and other fossil fuels to create the appropriate incentives for both conservation and the scale-up of clean energy.⁴

Further, the Acid Rain program did not allow any outside offsets and so provides no basis for the widespread assumption that an offset program will help with climate change. In addition, the success of the program was aided by the low, competitive price of low-sulfur coal. According to Professor Don Munton, author of “Dispelling the Myths of the Acid Rain Story” the impact of the program has been overstated:

The potential for a massive switch to low sulfur coal was no secret. Such coal was cheap and available, and it became cheaper and more available throughout the 1980s. Indeed, low-sulfur coal became very competitive with high-sulfur supplied well before the Clean Air Act became law.

See <http://www.bookrags.com/highbeam/dispelling-the-myths-of-the-acid-rain-hb/>.

Accurate Measurement: In addition to cap-and-trade’s focus on keeping the cost of fossil fuel energy low, the program is vulnerable to inaccurate measurements. Unless all cap-and-trade elements, including outside offsets, are limited to systems with accurate emissions measurement, the cap on total emissions is likely to be inflated and claimed reductions exaggerated. While the emissions of large electrical generating facilities with continuous emission monitoring systems can be accurately tracked (the Acid Rain program was limited to such sources), many other sources of emissions and offsets cannot be as closely monitored or quantified. Where these less-accurately-measured sources participate, the integrity of the cap-and-trade program is undermined, as is the certainty of the reductions sought and claimed. Most recently proposed cap-and-trade programs do not limit their proposals to sources with accurate measurement.

Fraudulent Outside Offsets: Most U.S. proposals and the European Union are planning to make extensive use of outside offsets in their cap-and-trade program. The idea is to use outside offsets as a mechanism for keeping fossil fuel energy inexpensive and for encouraging “additional” projects that reduce carbon emissions in the developing world. Research to date on these projects indicates they will be subject to extensive fraud and will undermine pressure for reductions within the capped economies. First, the underlying concept of “additionality” (i.e., the reductions would not have happened without offset funding) is flawed because this key component of the program cannot be proven. The definition of additionality is therefore subjective, inviting intense lobbying by sophisticated,

profit-seeking market participants and their consultants, and defeating program integrity in terms of net emissions reductions. Further, since people (and profit-motivated corporations) will always seek the cheapest offsets that they can purchase, there is a race to the bottom, through selection of the most flawed (least additional and measurable) projects, as documented by two Stanford researchers, David Victor and Michael Wara in their research paper available at: http://pesd.stanford.edu/publications/a_realistic_policy_on_international_carbon_offsets/. In addition, offsets have become a source of negative unintended consequences, such as the production in China of HCFC 23, a potent greenhouse gas which is a by-product of manufacturing HCFC 22. Research indicates that manufacturing of these products may be occurring solely for the purpose of destroying HCFC 23’s and selling this activity as a carbon offset. (See http://www.sourcewatch.org/index.php?title=Clean_Development_Mechanism_and_HCFC-23_destruction.) Finally, an investigation into expenditures by the U.S. Congress of carbon offsets indicated that most of the projects were already completed at the time of the purchase, i.e., not additional. See: <http://www.washingtonpost.com/wp-yn/content/story/2008/01/8/ST2008012800764.html>

Rationing, Manipulation and Price Volatility: Even if the cap-and-trade market were limited to facilities with continuous emission monitors and no outside offsets, the program would essentially be a form of rationing. Unlike a fee or tax, a cap requires Soviet-style preplanning. Program managers would try to choose a level of reductions in fossil fuel emissions that the economy could adjust to without energy

³ See <http://www.bookrags.com/highbeam/dispelling-the-myths-of-the-acid-rain-hb/>.

⁴ While the coal industry has lobbied for support for “clean coal,” sequestration of greenhouse gas emissions from burning coal has not been demonstrated to be safe or permanent and is expected to be costly.

shortages. Rolling blackouts/gas station lines could become a reality if demand for fossil fuels exceeds the supply and appropriate clean energy alternatives have not yet been built to fill in for reduced availability of fossil fuel energy. This type of problem occurred in a Los Angeles cap-and-trade program called RECLAIM in 2000 (described below). The program was put on hold for a period of time because, if the cap had been enforced, it would have resulted in a lengthy period of rolling blackouts.

Permits to pollute can easily be subject to gaming and manipulation, creating artificial scarcity that is likely to result in disruptions and unfairness, as initial and future allocations of the right to emit are distributed (whether by auction or other means) and traded. A preview of such disruptions was provided by the market manipulations that created the California energy crisis early in this decade. This potential was also demonstrated in a 2008 simulation at the University of California at Berkeley's Haas School of Business, in which students gamed a carbon-trading market for individual gain, leading to scarcity and high prices. (See, article on the UC Berkeley simulation: <http://www.npr.org/templates/story/story.php?storyId=91625716>.)

This potential for market manipulation is likely to contribute to undesirable price volatility. The resulting lack of price predictability in a cap-and-trade system (specifically, the lack of certainty concerning when the price of energy from fossil fuels will exceed the price of clean energy) reduces the incentive for the substantial investments in the new infrastructure and innovation necessary to provide alternative energy at affordable prices. (For additional information on price volatility and the resulting delay in clean energy investment, see the January 2009 study by the Brattle Group described at <http://www.brattle.com/NewsEvents/NewsDetail.asp?RecordID=589>.)

Complex Bureaucracy, Lack of Enforceability and Inertia: In addition, setting up a cap-and-trade system will be very complex and time consuming. Once begun, a cap-and-trade program would have a great deal of inertia. It would be difficult to dismantle and would create a variety of interest groups with investments in maintaining the program, however ineffective it proved to be for addressing climate change. Further, the complex system of permits and offsets would be extremely difficult to police. A lack of effective enforcement (virtually impossible for offsets given the murky standards for additionality and plans to allow international trading) will encourage fraud and make the program a sham, while interest groups with a stake in the program fight to maintain and to "fix" it.

RECLAIM and Over-allocation: In contrast to Acid Rain, the Los Angeles cap-and-trade program known as RECLAIM (the Regional Clean Air Incentives Market) failed spectacularly. The program was aimed at reducing ground level ozone. In RECLAIM, despite the presence of accurate monitors and sophisticated regulators, the initial cap was inflated (set too high,

also called "over-allocation"), which delayed most emission reductions for approximately seven years. At the end of that time, companies were accustomed to artificially low credit prices and almost no one had invested in emission control. As a result, the market collapsed when prices soared because the gradually declining number of permits no longer exceeded actual emissions. Following market collapse, the necessary control technology was required by regulation. <http://www.law.duke.edu/journals/cite.php?9+Duke+Envtl.+L.+&+Pol'y+F.+231>

European Trading Scheme ("ETS"): Similarly, attempts to design an effective carbon cap-and-trade system have failed in Europe under the Kyoto Protocol—a 1997 international accord to cut greenhouse gas emissions which the U.S. never ratified. In a demonstration of the many flaws of the cap-and-trade approach, utilities and other sources have underreported their emissions, purchased flawed offsets, driven up prices, reaped billions in undeserved profits and generally failed to produce promised emission reductions or any significant scale-up of clean energy. While Europe has indicated it can fix the problems it experienced in the first phase of its program, there are many indications that this is a flawed assertion. See analysis of problems with ETS at <http://www.openeurope.org.uk/research/etsp2.pdf> and in a November 2008 GAO report at <http://www.gao.gov/products/GAO-09-151>.

Conclusion on Cap-and-Trade: A cap-and-trade program for climate change focuses on keeping the price of fossil fuel energy low. Even a cap-and-trade program that did not include offsets or facilities without accurate monitoring (most plans include both of these components) will only have an indirect impact on the relative price of fossil fuel and clean energy. This lack of price predictability makes analyses of when clean energy investments will become profitable very uncertain, thereby delaying crucial investments in clean energy technology research, development and infrastructure scale-up. In addition, the integrity of cap-and-trade programs is vulner-

able to over-allocation, poor quantification of emissions, invalid offsets, market manipulation and a lack of enforceability. In a cap-and-trade system, prices are raised and resources are drained by the profits and costs of brokers, traders, certifiers, lawyers and investors in carbon offsets, all of whom develop a vested financial interest in maintaining the program. Cap-and-trade will also require a huge oversight bureaucracy whose efforts will be thwarted by the inherent flaws in the program.

3. What are Carbon Fees with 100% Monthly Per Capita Rebate?

Even if you accept our conclusion that cap-and-trade is virtually certain to fail, you may reasonably wonder whether there is a better alternative. Many economists, former EPA Administrator Ruckelshaus, the former Director of the Congressional Budget Office Peter Orszag and the CEO of ExxonMobil agree that carbon tax (or as we prefer to call it “carbon fees”⁵) is a better alternative, with many advantages in transparency, fairness and likelihood of effectively reducing emissions. See Congressional Budget Office report dated February 2008 at p.VIII, (“A tax on emissions would be the most efficient incentive-based option for reducing emissions and could be relatively easy to implement”) <http://www.cbo.gov/ftpdocs/89xx/doc8934/02-12-Carbon.pdf>.

What are Carbon Fees? Carbon fees are amounts that would be paid when fossil fuels enter the economy. These fees would be charged when oil, gas or coal are imported or extracted from the ground. We think that the term “fees” rather than the “tax” is most applicable because this is not a charge on income or property, but rather a targeted charge on a substance that is doing a major environmental damage. Since other taxes and fees are often applied at the point of importation or extraction, the additional cost of tracking and imposing carbon fees on fossil fuels should be relatively low.

What is the Purpose of Carbon Fees? The purpose of carbon fees is to insure that, within a set time period, the price of fossil fuel energy exceeds the price of clean energy from sources such as wind and the sun. Only an absolute commitment to insuring that the price of fossil fuel energy will exceed the price of today’s clean energy alternatives will insure the substantial level of investments in the panoply of possible clean energy technologies that are needed to rapidly transition away from fossil fuels and to do so in a way that is fair to all.

Over What Period of Time Would Carbon Fees Be Phased In? In our example below (Illustration 2, provided as Attachment 1), we show carbon fees being phased in over a period of ten (10) years. This is a time frame that has been mentioned by Al Gore and other leaders as workable for weaning the U.S. economy from fossil fuels. However, fully phasing in carbon fees does not require a cessation in fossil fuel use. (See article “Gore Pitches 10-year plan” <http://www.msnbc.msn.com/id/25718230/>.) It would only be the time within which even costly solar projects would have a price advantage over fossil fuels. Citizens would continue to receive monthly payments for the average amount of fossil fuel fees paid in the prior month, allowing them to continue to afford the average amount of fossil fuel fees paid by everyone.

What Would Carbon Fees Be Used For? Our proposal is that one hundred percent (100%) of all carbon fees collected when fossil fuels are first introduced into the U.S. economy would be returned in equal monthly payments to all adults (a smaller share for children). The purpose of returning the entire amount to all adults is twofold. First, this rebate would ensure that everyone could afford the average amount of fossil fuels introduced into the economy and that no one would suffer unfairly during the transition to a clean energy economy. Second, the monthly payments would create an incentive for conservation, as everyone would be very aware of the amount of their monthly payment and would be working to insure that they spent no more than that amount on fossil fuels. Because low-income people generally use less energy (but spend a bigger proportion of their income on energy), equal rebates would insure that lower income families would still be able to afford the fossil fuel energy they need. Finally, receiving equal monthly payments would help reinforce a collaborative spirit, a sense that all of us are working together to reduce the risks of damage to our climate from fossil fuels.

Some people may believe that a portion of carbon fees should be used for the other critical measures described below. We are not strongly opposed to this but believe

⁵ While the debate has not been framed this way to date, we use the term “fees” and “rebate” rather than the terminology of “taxes” and “dividend,” because we believe these terms may more accurately convey two important points to the general public. First, a “fee” is generally a charge for doing a specific activity (here using destructive fossil fuels), and when fees are collected, they are generally used for a specific purpose, not just dumped into the general revenue fund. Similarly, a “rebate” is more familiar to the general public as a return of funds previously spent than the concept of a “dividend.”

that the goal of cushioning the transition away from fossil fuels for individuals should not be compromised. In addition, we believe that regional adjustments in the amount of the fossil fuel rebate may be appropriate to reflect greater dependence on fossil fuels in certain regions at this time and, as a result, greater stress during the transition.

How would Carbon Fees help Clean Energy Development? Carbon Fees would help clean-energy development by giving prospective investors certainty in two areas. First, investors would be confident that every unit of clean energy available at the end of the ten-year time period would be more affordable to consumers than any unit of fossil fuel energy. This would mean that, while investors would not know which clean energy technology or firm would be most successful, they would know for sure that any firm able to actually produce such energy would be able to compete successfully with all existing fossil fuel energy products. Carbon Fees would also insure that there is little additional investment in fossil fuel projects, such as new coal-fired power plants or new exploration to develop shale oil.

What Historical Example Demonstrates that Carbon Fees Would Be an Effective Market Mechanism for Climate Change?

The Montreal Protocol—William Reilly: At the same time that the Acid Rain program was enacted, in 1990, the United States used a very different approach to create additional economic incentives for the scale-up of substitutes for ozone depleting CFC's pursuant to the Montreal Protocol. William Reilly, the EPA Administrator, noted the crucial facts in his opening statement at the second meeting of parties to the Montreal Protocol:

“On January 1, 1990, a new tax went into effect in the United States, a tax on the manufacture of CFCs. This tax exceeds in value the cost of CFCs themselves and it will rise steeply in the years ahead, raising \$400 million in new revenues this year, and raising \$5 billion over the next five years. **This added cost of CFCs sends a powerful signal: it says bring on the substitutes fast! And it reduces the comparative economic advantage CFCs would otherwise enjoy over the more expensive substitutes.** *This tax on CFCs has already caused the United States to reach the agreed targets for reduction earlier than required.*” (<http://www.epa.gov/history/topics/montreal/04.htm>) (Emphasis added.)

As this experience with the CFC tax demonstrates, a carbon fee or tax can help reach agreed targets for reductions quickly. The entire economy will be stimulated by the rush to develop the most cost-effective substitutes for fossil fuels. This CFC tax example, rather than the Acid Rain example, is the appropriate model for the problem we face today with climate change. The difference is that, given the enormous cost and scope of the transition to clean energy, a monthly per capita 100% rebate will be needed to keep energy affordable for everyone, while still sending the critical message with respect to the relative price of damaging as opposed to non-damaging sources of energy.

Thank you!

Please reference our longer discussion paper at
<http://www.carbonfees.org/home/Cap-and-TradeVsCarbonFees.pdf>

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** Attached for the record is testimony that was previously submitted to the House Intelligence Committee. Many of the environmental and ecosystem impacts of climate change could significantly affect national security issues. We hope that you will take these aspects into consideration when establishing environmental objectives and ultimately in crafting your climate change legislation.

Paul G. Gaffney II (Vice Admiral, U.S. Navy (Ret.))
President, Monmouth University,
Before a Joint Hearing of the

**House Permanent Select Committee on Intelligence
Subcommittee on Intelligence Community Management
and**

House Committee on Energy Independence and Global Warming

U.S. House of Representatives
Washington, DC

Dear Chairwoman Eshoo, Chairman Markey, Congressman Rush Holt (my Representative) and Members of the Committees:

Thank you for the opportunity to appear this morning at this joint hearing of your Committees. I am honored by your invitation to briefly discuss the national security implications of climate change, and to provide you with thoughts about some steps that the Federal Government can take to more specifically measure climate change indicators.

In sum, my recommendations to the Committees are two-fold: The Federal Government must plan seriously for the potential impact of environmental effects on both the nation's security and the security of regions around the world; and, To help ensure that environmental threats are properly understood, we should focus our national investments and technical capabilities to measure specifically, when we can, the most critical physical processes of our planet.

These issues are, in my opinion, intertwined and mutually supportive. I have come to these conclusions as a result of my work since 1991. Since that time, I have served as: Commander of the Naval Research Laboratory; Commander of the Naval Meteorology and Oceanography Command; Chief of Naval Research; member of *MEDEA* and its U.S. Environmental Task Force (ETF) and its related Environmental Working Group (EWG) within the "Gore-Chernomyrdin Program;" member of the Military Advisory Board of the 2007 CNA Study "National Security and the Threat of Climate Change (hereinafter the "2007 CNA Report);" President of the National Defense University; Commissioner on the U.S. Ocean Policy Commission; member of the Joint Ocean Commissions Initiative; and presently as Vice Chair of the statutory Ocean Research/Resources Advisory Panel (ORRAP) and President of Monmouth University.

The need to focus the proper attention on environmental threats and studying the Earth's critical physical processes has only become more urgent by the climate change discussion. To explain my reasoning behind my recommendations, I would like to discuss briefly the findings of the 2007 CNA Report and, then, the power of leveraging defense and intelligence data to both better measure the progress (or even the non-progress) of global climate change and inform climate change policy.

I was a member of the Military Advisory Board (a group of eleven retired three- and four-star generals and admirals for all the military branches) that sat with CNA as it developed its Report on the national security implications of climate change. I support the Report's discussion, findings and recommendations and present my own narrow view of one aspect of the report as recorded on the Report's 23rd page. Further, I applaud CNA for its timely attention to this heretofore largely unaddressed aspect of climate change.

The Report, like the recent draft NIA on security and climate change, does not judge whether climate change is occurring, whether mankind is responsible for it or whether humans can turn it around. Rather, it points to the international and regional security consequences of climate change if the disturbing environmental signals measured in recent years continue unabated.

The CNA Report likens the threat of climate change to that of the strategic threats we endured during the Cold War. That is: while the probability of disastrous climate change cannot be determined certainly, the effects of climate change (if current trends continue) on international security are so great that one must prepare to deal with severe security consequences. First principle: whether one believes climate change will happen or not, the effects if it does happen are dangerous enough that security forces must plan for it.

Within the Report, we cite water and water-related issues (such as: drought, famine, flooding and disease and resultant migration of rather desperate peoples) as major threats to regional security, globally.

The CNA Report finds that the least developed nations of the world as most likely to be affected by climate change phenomena and are least likely to be able to cope with them.

In the Report we call for deliberate planning by U.S. security organizations including the Defense, Intelligence and diplomatic communities. I personally think it is most useful if the climate science community, both from inside Government and outside, can be as specific as possible about regional effects. Global climate change may prove to show an overall average warming of global air and sea temperatures, but global climate change is far from average. In some regions it can be warmer, others much colder (especially if an *abrupt* climate change scenario occurs in the

North Atlantic). Some areas could witness more rain or sea level rise; both imply flooding. In still other areas, we could see drought and inevitable famine.

I think the CNA Report correctly wraps its findings in a gloomy theme: adverse environmental conditions created by climate change, if unabated, affect undeveloped nations first, and whether it is too much water or too little, the intermediate results will be trans-national migrations of desperate peoples who are trying to survive which leads, finally, to regional strife.

The question is: *where* will the effects of climate change be seen and what will be those changes be so that U.S. security leaders can deliberately include expected effects in their regional plans? Second principle: Understand more specifically, through better measurements, what is going on with climate change especially in key natural environments (such as: the Arctic, desert fringe environments, low lying coastal areas, historical breadbasket regions and glaciers) and geopolitically sensitive areas (such as: the Subcontinent, sub-Saharan Africa, Middle East and China).

I have recently heard that the National Academies, with the personal leadership of its President, Dr. Ralph Cicerone, is working to establish indices and metrics to inform future long term requirements for measurements of change on our planet.

I mentioned earlier, the *U.S. security community*, specifically, needs to understand *where* climate change effects have the highest potential to affect regional security. The *nation*, generally, needs to understand if climate change is progressing. And, if the nation takes any policy steps to stem perceived climate change, it needs to know whether those steps (policy, lifestyle or investment changes) are having any impact.

To this end I remain confident that the Defense and Intelligence communities can and should be leveraged by the civil U.S. climate science community to better understand perceived climate change signals.

I have seen the value of leveraging the talent, sensor/analysis/computation capabilities, global presence, and data collected (or to be collected) and archived by these government agencies. I saw it during the period 1991–2000 while *MEDEA* and its related groups were in action. Two general benefits derive for such undertakings:

- a) previously un-released data and information from national security systems may help civil scientists get a fuller or clearer picture of what is going on in nature, and
- b) government scientists and decision makers from the security community may get a better insight into their own mission-related challenges by conferring with top civil scientists who have received security clearances.

The following is a sample list of techniques that could be (have been) used in civil-government collaborations that are designed to cross security boundaries:

Data can be simply released if deemed no longer classified; it may never have been classified or outlived its classification and just never been released.

Raw data can be reclassified, after very deliberate review following carefully structured processes.

Useful unclassified information can be derived from classified, un-releasable data

Defense and Intelligence scientists can confer continually with appropriately (and rigorously) cleared civil climate scientists so both sides can benefit.

Future space, ship, submarine, aircraft, human and *in situ* sensor collections can consider both mission-agency and environmental needs in system design, operational employment decisions and data distribution.

“Fiducial sites” (geographic sites predetermined as scientifically important to observe) can set up at which measurements from every possible civil, commercial and classified sensor can be made, repeatedly, over long time periods—allowing climate change to be actually measured, not just estimated. An example is recently released sea ice imagery from the Arctic.

Certainly, the deliberate acts of releasing data or deriving unclassified products from un-releasable data sets will require additional security processing and actual environmental analysis work, but such costs will be *considerably* less than replicating data collection missions, perhaps too late.

This cost-benefit point is more important when one considers the stakes involved in either underestimating the effects of or over-reacting to global climate change or their security-jeopardizing regional effects. I would make the same comment about costs to appropriately clear and keep updated a few dozen of the nation’s top climate scientists who would work with government scientists with all data and all talent available to both.

If national security leaders are to make actionable regional security plans that consider climate change, then they need climate change effects *specificity* for their respective regions/theaters. Even the best scientists cooperating with government

planners, but *without* access to the best scale or time-series data, will not be able to help enough. In those trouble parts of the world about which we worry most, indigenous populations and governments are not prepared (not willing) to collect sophisticated, long-time-series data necessary for measuring climate change speed, magnitude or direction. We can get more precise data, incidental to other mission-related collection efforts, in the regions where it has been least collectable by open source means, if we leverage existing and planned Defense and Intelligence assets more fully. Yes, the successes of MEDEA are about a decade old and many new sensor systems have come into being in the civil and commercial world. I have recently seen a comprehensive unclassified compilation of open source “collectors” that can help us monitor the environment. Yes, again, we do have access to more “open” information, but the national security communities may have different flexibilities in satellite orbits, undersea access and resolution, for example. The Defense and Intelligence community may also have useful archives going back generations and regional specialists who can add to specificity determinations and understanding.

I would like to close with a general comment about potential U.S. national policies and investments to stem perceived climate change. Climate change is probably occurring, as it has so many times over the geologic history scale. Man may have created it or may be contributing to it. Man may be able to turn it around. Maybe, maybe, maybe. But, if our government makes substantive policy decisions that substantially consume our wealth or substantially change our life quality, then we have an obligation to use every asset at our disposal to determine if those “substantive (perhaps uncomfortable) policies” are bearing fruit. We cannot say that today. New efforts including sufficient investments in fundamental research, development of an integrated ocean observing system (IOOS) and the leveraging of Defense and Intelligence capabilities—to measure the efficacy of our huge investments are warranted.

Statement of Richard Pauli

It does not have a name like treason or treachery, but the effects are just as bad—or worse.

Our purposeful ignorance and deliberate scientific deception at the service of branding and market share is no less than treason to our civilization. Call them deniers, or denialists, skeptics, deniasaurs: be they professional PR firms, pundits or pseudo scientists who deny Global warming or that humans have caused it. I accuse them of helping to cripple our future. **Purposefully promoting confusion by the corporation, the state or any organization is a horrible crime.** This clearly harms our children and our future. It is a serious crime, only the punishment is undefined.

The by-product of our carbon industry is a greenhouse gas assault on atmosphere and oceans. We know of this damage now, so with purposeful diversion from this danger, this is causing harm.

To pick one of many accused: Since 1998 ExxonMobil has spent over \$23 million in publicly declared funding to support denialist organizations campaigning to disrupt public understanding of global warming. Exxon’s stated goal was to fund a campaign where “average citizens understand” (recognise) uncertainties in climate science; recognition of uncertainties become part of conventional wisdom”. Their PR campaign was to present “scientific uncertainties in language that the media and public can understand”—to confuse people. They have recently halted this funding, saying it diverts attention from addressing energy in an “environmentally responsible manner”.

Global citizens assaulted by floods, heat waves, storms have begun to feel the changes, but somebody continues to manufacture uncertainty. Now well-funded denialists begrudgingly accept climate change but will insist that human industry has no influence on CO₂ levels in the atmosphere. Even though all sane and sober climatologists say humans caused global warming—certainly caused the problem. Denialists are foisting a message that humans cannot possibly understand the problem, hence not understand the solution required. Denialists seize the smallest errant factoid and nurture and amplify those doubts as worthy of dismissing all.

This same tactic applied to tobacco wars, “nicotine is not addictive” delayed for 50 years . . . to many deaths. And for the anti darwinist intelligent designers, this now moves into our textbooks and curriculum. the harm is difficult to calculate.

Pushing this message of deception and confusion is as treacherous as any other way of lying to children, worse since this robs their future, and denies the hope for facing problems.

For over 2 decades thousands of scientists world-wide have been combining research for United Nations IPCC reports on global warming. Using compromising language of consensus—the group of IPCC scientists say that AGW is highly likely with over 90% assurance. By contrast, Exxon’s tactical brief asked denialists to: “Develop a global climate science information kit for media including peer-reviewed papers that undercut the “conventional wisdom” on climate science.”

Global warming is radically dangerous for humans, we face huge changes. Statistically small odds for implausible outcomes deserve small consideration—but the demand for attention is diversionary. In the early days of automobile seat belt deployment [there was a seatbelt free age], the public resisted with a notion that if a car ended upside down, we would not want to be trapped by our seatbelt, or if hurtling off a cliff—we want to be unrestrained by a seat belt so to be thrown clear unharmed. Certainly this was possible, but completely implausible. And humans may miraculously avoid significant global warming, it is just not plausible.

Humans can respond heroically to clear displays of danger—So another PR and denialist tactic is to label scientific warnings as “alarmist” As if all hysterical or alarmist speech is false. This forces responsible climatologists other scientist into using tame, milque-toast language. THE IPCC report was forced to use the terms “likely” , unlikely and the most serious warning allowed “highly likely”. Does your fire alarm or smoke detector say “It is highly likely this smoke suggests a fire may be near” If other famous danger warnings were delivered as carefully as today’s convoluted messages what might have happened? Paul Revere: “It is highly likely the British are coming!” Can we see past the mask of tame phrasing to act appropriately? Is this speech wrong. Illegal?

Or with the Titanic, “There is a 90% chance there is an iceberg dead ahead, highly likely we will impact” So how should we act with a 90% assurance of the outcome?

Who is telling us otherwise, and why? The press has abrogated support of democracy by giving air and ink to the anti science and industrial PR. Tame, confusing language has worked to stifle public policy, prevent government from regulating these toxins

Somehow because a few Carbon industrialists whine or complain—this somehow constitutes a serious challenge to the science? And no, nicotine is not addictive. And perhaps they will find Iraqi WMDs too. And carefully polite scientists fail to rise up to that PR fight. Business supported by cheap carbon does little to restrain the rope-making that forms nooses around our necks. I see no science here, only pure business interests pushing muddled thinking.

With the recent Exxon *mea culpa*, we see denialists begrudgingly accept that global warming is happening, but stridently claim that humans had no role in causing it and even Anthropogenic Global Warming (human caused) is a hoax. This allows their conclusion: “Since humans did not cause it, humans cannot possibly fix it” And works nicely to reinforce the false notion that humans are powerless and should instead continue carbon consumption. So the fossil fuelers deliver the message: “Do not dare interfere with coal, oil, or any other carbon consumption”.

This is a PR campaign. And it is global carbon industries—unconstrained by ethics or science—that has helped cause this problem.

Anthropogenic Global Warming denialists may seem tragic and make us angry, and may even have business motives—but where is the crime? We should charge them with global ecological treason, being an enemy of the people, fostering rapacious greed, accelerating the destruction of civilization and robbing the future from our children. This issue concerns all beings on the planet. No one has the right to ask us to die before we fully pursue a life. Do they?

If denialists believed in a flat earth—I could regard this as charmingly eccentric—unless they demand we change navigation principles in our travels. Or, if some folks believe the lunar landing was a hoax; what do I care? unless it restricts real space exploration. Some still believe in phlogiston, or Bigfoot. **But advocating scientific suppression by confusion and the clouding of conclusions regarding our dangerous future; Asking me to live in the danger that you create—This is an undefined criminal act that I cannot accept.**

The IPCC says there is a 90% chance of real danger is ahead. If someone said it is highly likely that you will fall through thin ice and drown, or a 90% consensus that your beach-front property will be flooded within 20 years—how will you act differently with that information? With this warning, I know I have to act differently.

These dangers are real. We see them clearly, and we know more change is coming. I want to know of dangers ahead.

I speak directly to denialists with these words:

If you fail to see danger ahead, failing to help defend, then just wake up and open your eyes and ears. If you see danger ahead, and you are quiet, failing to say anything about it, staying silent—well shame on you.

Some think that unethical.

When you try to tell me, using mass media to tell me that real and serious dangers ahead are just hallucinations, if you divert attention and falsely challenge the science, and you act to deceive, and you try to sew doubt, and you cancel further studies, you manipulate public policy, and you deny the entire problem—then damn you as evil.

Whether you are delusional, a fool or a paid stooge of business interests, that is treachery amounting to global treason on the human race and all beings. Beyond shame, may you descend to that special place in hell.

If it is OK to yell “Fire!” in a crowded theater, do you think the opposite is OK? In a crowded theater that is burning, we feel heat and smell smoke, we move toward the exits—are you telling me is it OK for the usher to yell “There is no fire!, sit down?” or even “There is no fire, sit down and lets have a debate.”

Nothing illegal about expressing your thoughts.

You know you are talking about politics, not science

You know the data refutes you,

Your tactics have nothing to do with open discussion,

Everything to do with diversion and delay.

And nothing to do with science.

We know how you have emerged victorious from the tobacco industry PR campaigns. You helped extend tobacco product sales for decades beyond their proper life—all by a professionally unified denial campaign. You kept a toxic drug delivery mechanism out of the FDA and deflected legislation that properly should have banned nicotine. And you cemented the flow of profit. Now the very same PR agency and individuals are deep into the climate change denialist movement—this time paid for by the carbon fuel industries.

Could it be that all the big carbon fuel companies fully realize the decades of unrestrained carbon dioxide pollution has actually caused climate instability?

Could it be that all this subsidized deceit and purposeful denialism is here just to prevent any interference to their business operations? Are your words intentionally designed to detract science and delay responsible legislation?

It is sleazy, immoral, it ought to be illegal, and pretty soon the courts may find you liable. Eventually you will be shunned and reviled for your words and actions.

We are not talking about a little tobacco and cancer here. The stakes are the ultimate: the very survival of our civilization. Call it Climaticide We need lots of science focused on knowing the extent of the problem. We don't need paid obstructionists, willful skeptics, and professional denialists distracting the quest for more information. We need to be making adaptation and mitigation plans. First off, carbon fuel companies should stop these PR campaigns. And we have contempt for your ignorant followers that you trick into academic suicide just to sabotage research and cripple public policy.

Your actions are close to criminal because your words act to inflict potential harm to the innocent. If you don't see that then try these common analogies:

Let's say we all commute in a car where the driver says the brakes are bad and maybe we should not ride, but one passenger insists the brakes are fine and we should keep going in fast traffic. The driver is worried and wants to slow down and check the brakes. Any skeptic that denies danger and tries to stifle more information should shut-up and let the driver decide.

Or say your carload is driving fast in heavy fog on a darkened highway; the radio reports the bridge ahead has just collapsed. You start to slow down so as to carefully see the road ahead, but one of your passengers insists that you keep driving the speed limit. He claims that he can see perfectly well, and insists that everything is OK, and he did not hear any warnings. Nope again, in my car, I would say Shut Up.

Or consider the common story of a successful small town tourist spa that finds it has poison water that kills people—all the townspeople violently deny the facts, just to keep their commerce going. The difference here is that EVERYONE on the planet will suffer in some way. No matter how many want it to be OK, if there is even suspicion then everyone needs to find out what is wrong. Don't fight these correct acts.

Remember that just prior to Pearl Harbor the impending attack was seen on radar. Seeing more planes on a screen than anyone had ever seen before, someone was skeptical, and doubted what they saw. They said it must have been a flock of birds, or friendly flights. But they certainly did not cling to that skepticism after

seeing the smoke and fire of the attack. They did not persist in denial; I am not sure how a denialist of today would have been regarded back then.

We are on a warming planet, the climate is destabilizing, we are getting in trouble and people are dying. You are pandering to human denial and cultivating human weakness for self-deception. Then you try to redirect public attention with debates about the shape of the arguments instead of the substance. Stop it.

And you know, with HUMAN CAUSED, CLIMATE DESTABILIZATION, the stakes are higher than Pearl Harbor or 9-11 or even Katrina. Until someone is brave enough to call you out as saboteurs to our future, or to haul you into court, or to win a lawsuit—and that may happen soon—until then, just shut-up.

We are looking for solutions, we first have to know just how bad the problem is, and you don't want to help, you don't want to do research. You just want to promote delay and engage in ideological squabbling. Well, you can think your own thoughts, but don't obstruct the important progress of science and government and industry and community. We will not award false importance to your delusions by merely examining the process of a phony debate. There's important work to do.

Many have served or now serve in the military, Army, Navy or AirForce. And right now we all serve in the global survival campaign. And each of us is on guard duty observing changes and learning the science and calling out errors and blunders, stupidity and folly.

We are looking to know the enemy so we may better act.

If someone can't do guard duty, that's OK, we give them a shovel because everyone pitches in—there is plenty to do. If we're on guard duty and we fall asleep and miss seeing the enemy, then our buddies may cover for us; we quickly learn the consequences and we promise never to do that again. And we keep that promise. If we misperceive and cannot identify the enemy then we will need more training to better see the dangers. We learn and we change.

But if the soldier on guard duty deliberately turns away from the danger, closes eyes, turns away from the watch, mis-reports, misdirects our defenses, and lies about the crisis ahead, and then works to sew doubt in the troops—then that is treachery.

All soldiers know this.

Neither fellow soldiers nor generals will tolerate this.

There is no confusion about sabotage.

Warriors will accept no less than loyalty.

The first action is to halt the behavior that amounts to treachery and treason.

Richard Pauli

Seattle

February 2009

Statement of Wayne Pacelle

Dear Chairman Rangel:

On behalf of The Humane Society of the United States (HSUS), the nation's largest animal protection organization, and our global division, Humane Society International (HSI), representing nearly 11 million members and constituents, I welcome the opportunity to submit comments to the Ways and Means Committee regarding scientific objectives for climate change legislation.

The HSUS/HSI are encouraged that Congress is seeking input on the future of climate change legislation. We are hopeful that recent scientific evidence from the United Nations Food and Agriculture Organization (FAO), as well as the U.S. Environmental Protection Agency, regarding the role of animal agriculture in climate change will be taken into account as legislation to mitigate the effects of global warming is implemented.

We have provided a number of recommendations to help achieve this goal.

Background

Agriculture is both a driver of climate change and is also influenced by climactic fluctuations, such as increases in temperature and rainfall that result from a changing climate. Although experts disagree on the precise totals, agriculture and its related land-use changes, such as deforestation for feed crop cultivation, are respon-

sible for at least one-third of global greenhouse gas (GHG) emissions.¹ As well, agriculture is the human endeavor that will likely be the most affected by climate change or global warming.

Animal agriculture, in particular, contributes significantly to GHG emissions—more than 50% of emissions from agriculture and its associated land-use changes.

An FAO report in 2006 found that the farmed animal sector is responsible for 18% of global GHGs measured in carbon dioxide (CO₂) equivalent, more than the entire transportation sector.² In addition, FAO estimates that a cow/calf pair on a beef farm is responsible for more GHG emissions than a person traveling 8,000 miles in a mid-sized car.³

Globally, animal agriculture is responsible for 9% of CO₂ emissions,⁴ accounting for sources such as on-farm fossil-fuel use for lighting, temperature control, automated machinery, and ventilation (90 million tonnes per year);⁵ the packaging, transportation, and application of nitrogen fertilizer for feed crops (more than 40 million tonnes per year);⁶ and deforestation for grazing (2.4 billion tonnes per year).⁷

Furthermore, animal agriculture is responsible for 40% of global methane emissions and 65% of global nitrous oxide emissions.⁸

GHG Emissions from Industrial Farm Animal Production

In the United States, a substantial portion of the GHGs emitted from agriculture come from concentrated animal feeding operations (CAFOs). Specifically, the EPA noted in 2006 that the primary reason for the overall increase in methane emissions is the shift towards confining pigs and cows used for milk production in larger facilities that use liquid manure management systems.⁹ In addition, according to the EPA, the overall increase in nitrous oxide emissions is largely due to the concentration and industrialization of the poultry industries, namely the shift toward litter-based manure management systems, confinement in high-rise houses, and an overall increase in the U.S. poultry population.¹⁰

Because of their size and production levels, each CAFO is capable of emitting hundreds or thousands of tons of pollutants into the ambient air annually. CAFOs are responsible for 47–60%¹¹ of the 500 million tons of manure produced by animal feeding operations each year, more than three times the amount of waste produced by humans in the United States each year.¹²

At least two-thirds of all arable land in the world is used to grow annual grains, such as corn and soybeans, which depend heavily on chemical inputs, as well as mechanical tilling of the soil. Nearly half of all that grain—some 40% of the global corn crop and up to 80% of the global soybean crop—is used to feed farm animals, not people.¹³

¹Paustian K, Antle J, Sheehan J, et al. 2006. Agriculture's role in greenhouse gas mitigation. Pew Center on Global Climate Change, p. 18. www.pewclimate.org/docUploads/Agriculture%27s%20Role%20in%20GHG%20Mitigation.pdf.

²Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and De Haan C. 2006. Livestock's long shadow: environmental issues and options (Rome: Food and Agriculture Organization of the United Nations, p. xxi).

³Scherr S and Sthapit S. 2009. Farming and land use to cool the planet. In: State of the World 2009 (New York: W.W. Norton, 2009) citing Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and De Haan C. 2006. Livestock's long shadow: environmental issues and options (Rome: Food and Agriculture Organization of the United Nations).

⁴Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and De Haan C. 2006. Livestock's long shadow: environmental issues and options (Rome: Food and Agriculture Organization of the United Nations, p. xxi).

⁵*Id.* at 88–9.

⁶*Id.*

⁷*Id.* at 90.

⁸*Id.*

⁹U.S. Environmental Protection Agency. 2007. Inventory of U.S. greenhouse gas emissions and sinks: 1990–2005. Draft for public review, p. 6–7. February 20. www.epa.gov/climatechange/emissions/downloads07/07CR.pdf.

¹⁰U.S. Environmental Protection Agency. 2007. Inventory of U.S. greenhouse gas emissions and sinks: 1990–2005. Draft for public review, p. 6–7. February 20. www.epa.gov/climatechange/emissions/downloads07/07CR.pdf.

¹¹U.S. Environmental Protection Agency. 2006. Fact sheet: concentrated animal feeding operations proposed rulemaking. June. www.epa.gov/npdes/regulations/cafo_revisedrule_factsheet.pdf.

¹²U.S. Environmental Protection Agency, National Pollutant Discharge Elimination System permit regulation and effluent limitation guidelines and standards for concentrated animal feeding operations (CAFOs); Final Rule, 68 Fed. Reg. 7176, 7180 (February 12, 2003).

¹³Smil V. Distinguished Professor University of Manitoba. 2008. Personal communication with Danielle Nierenberg.

Recommendations

Reducing GHG emissions through improved management strategies: The GHG emissions from animal agriculture can be reduced. Simple work-practice changes, such as reducing the time between surface application of manure and incorporation into soil, ensuring proper soil drainage, ensuring adequate oxygen exposure to stockpiles, ensuring proper nutrition for animals, or irrigating directly after application, for example, can significantly reduce emissions.

Reducing GHG emissions through more natural animal feeding practices: The transition from farm animal production systems reliant on feed crops, like grain and soy, to pasture-raised, organic, or other extensive farming systems can result in less methane, ammonia, and nitrous oxide, and is potentially more cost-effective as these extensive farming methods require less inputs, maintenance, and energy on-farm.¹⁴ Typically, cattle confined in feedlots or in intensive confinement dairy operations are fed an unnatural diet of concentrated high-protein feed consisting of corn and soybeans. Although cattle may gain weight rapidly when fed this diet,¹⁵ thereby reaching slaughter weight in a shorter period of time, such concentrated diets may also lead to increased methane emissions from the animals.¹⁶ The standard diet fed to cattle raised for beef confined in feedlots contributes to manure with a “high methane producing capacity.”¹⁷ In contrast, cattle raised on pasture, eating a more natural, low-energy diet composed of grasses and other forages, may produce manure with about half of the potential to generate methane.¹⁸

Increasing carbon sequestration through pasture-based production: In addition, well-managed and rotational grazing systems can likely sequester more carbon than feedlots where animals are raised on energy-intensive corn and soybeans. Soils and pastures can act as “carbon sinks,” soaking up carbon from the atmosphere. A 2005 study found that not only do pasture-raised animals require less operational fuel and less feed than do confined animals, but pasture-based farming systems could “tie up 14 million to 21 million metric tons of CO₂ and 5.2 million to 7.8 million metric tons of N₂O in the organic matter of pasture soils.”¹⁹

Reducing fossil-fuel dependency and on-farm GHG emissions through organic farming methods: Organic meat production typically uses less fossil-fuel energy, in part because thousands of transport miles for shipping feed may be eliminated,²⁰ and can also significantly reduce on-farm GHG emissions. A 2006 life cycle analysis of three modes of Irish beef production—conventional, agri-environmental, and organic—found that both types of extensive systems (i.e., agri-environmental and organic) generate less GHGs than the conventional system, with the organic system producing the least GHGs (17% less than conventional). The difference would likely be even more dramatic in comparison to U.S. conventional beef production, since Irish beef cattle are primarily finished on grass rather than on grain.²¹ Specifically examining nitrous oxide outputs, organic farming has reduced emissions compared with conventional production systems. The organic production method avoids overproduction of manure due to its practice of limiting animal stocking densities to the land available for manure application—i.e., on an organic farm, farm animal populations usually do not exceed the land’s ability to responsibly absorb and utilize nutrients from their manure.²²

Investing in scientific analysis and research of the impacts of farm animal production systems on GHG emissions: Although preliminary studies have been published, there is a continued and urgent need for more analysis and research

¹⁴ Gurian-Sherman, D. 2008. CAFOs Uncovered. Union of Concerned Scientists, pp. 3, 54.

¹⁵ Radostits O, Gay C, Blood D, et al. 2000. Veterinary Medicine: A Textbook of the Diseases of Cattle, Sheep, Pigs, Goats and Horses, 9th Edition, p. 285.

¹⁶ Paustian K, Antle J, Sheehan J, et al. 2006. Agriculture’s role in greenhouse gas mitigation. Pew Center on Global Climate Change, p. 18. www.pewclimate.org/docUploads/Agriculture%20Role%20in%20GHG%20Mitigation.pdf.

¹⁷ U.S. Environmental Protection Agency. 1998. Inventory of U.S. greenhouse gas emissions and sinks: 1990–1996, 5–5. www.epa.gov/climatechange/emissions/downloads06/98CR.pdf.

¹⁸ U.S. Environmental Protection Agency. 1998. Inventory of U.S. greenhouse gas emissions and sinks: 1990–1996, 5–5. www.epa.gov/climatechange/emissions/downloads06/98CR.pdf.

¹⁹ Boody G, Vondracek B, Andow D, et al. 2005. Multifunctional agriculture in the United States. *BioScience* 55(1):27–38.

²⁰ Kotschi J and Miller-Semann K. 2004. The Role of Organic Agriculture in Mitigating Climate Change: A Scoping Study. Bonn, Germany: International Federation of Organic Agriculture Movements.

²¹ Casey JW and Holden NM. 2006. Greenhouse gas emissions from conventional, agri-environmental scheme, and organic Irish suckler-beef units. *Journal of Environmental Quality* 35:231–239.

²² Kotschi J and Miller-Semann K. 2004. The Role of Organic Agriculture in Mitigating Climate Change: A Scoping Study. Bonn, Germany: International Federation of Organic Agriculture Movements.

regarding GHG emissions from different farm animal production systems, as well as different mitigation strategies. Later this year, the Leopold Center for Sustainable Agriculture at the University of Iowa will release a study comparing beef feedlot systems to pasture-based cattle production and the University of California Davis will publish a study analyzing the GHGs emitted by beef cattle, dairy cow, and pig CAFOs. This type of research will be crucial for stakeholders, including farmers, lawmakers, businesses, and consumers, to better identify which kind of production systems will reduce GHGs, as well as understand the impact food choices can have on both personal health and climate change.

Protecting valuable carbon sinks: Another area of needed additional study is the role of forests in mitigating climate change. Keeping tropical and domestic forests, which are increasingly threatened by feed crop cultivation and unsustainable grazing practices for animal agriculture industries, and other carbon sinks intact may be one of the best ways for fast, cost-effective GHG mitigation. At the same time, protecting forests has the added advantage of protecting wildlife, as these animals depend on healthy, functioning forests for habitat and survival.

Assessing climate change-induced impacts on wildlife: Federal legislation on climate change should also direct more funding toward research on the impacts of changes in temperature and more extreme weather events as a result of climate change on endangered species, the monitoring of species populations, and the development of potential climate change mitigation/adaptation strategies for wildlife.

Evaluating the potential risks of large-scale anaerobic digesters and performing a cost/benefit analysis: In addition, the GHG-reducing potential of mitigation technologies—such as the installation of large-scale anaerobic digesters at CAFOs or the production of biofuels from farm animals' waste and fat—should be more thoroughly investigated. Despite some of the potential environmental advantages of the production and use of different kinds of biofuels under certain circumstances and with strict oversight, these technologies can allow large-scale, industrial farmed animal production operators to profit from the huge amounts of waste they create—millions of tons of poultry litter and the manure from pig and cattle facilities. Bioenergy production from farmed animal waste has the potential to perpetuate the environmental problems²³ created by producing and storing massive quantities of manure, while giving animal agribusiness the opportunity to greenwash its unsustainable practices that jeopardize the welfare of animals in the meat, egg, and dairy production industries. These farmed animal-based biofuels are not currently reducing consumption of fossil fuel because biodiesel and the construction and operation of anaerobic digesters require electricity use from the burning of coal or petroleum. In addition, unlike the waste created on smaller, more environmentally sustainable farms raising both crops and animals, where manure and urine can be utilized effectively for fertilizer, factory-farm waste is produced in extremely large quantities, making it all but impossible to use on farmland. Furthermore, the manure excreted by animals in factory farms often has a range of toxins including antibiotic-resistant residue,²⁴ endocrine-disrupting chemicals,^{25,26} and other pollutants that not only impair environmental integrity, but negatively impact communities surrounding industrial farm animal production facilities.²⁷

Requiring CAFOs to measure and reduce their GHG emissions: Finally, Congress should require CAFOs to measure their emissions and institute plans to reduce GHGs from their facilities. Currently, these operations are not required to reduce GHGs, despite their excessive emissions.

As the impacts of climate change become more evident, the need to transition from industrial farm animal production systems to more sustainable, responsible

²³ For more information, see “An HSUS Report: The Impact of Industrialized Animal Agriculture on the Environment” at www.hsus.org/farm/resources/research/enviro/industrial_animal_ag_environment.html.

²⁴ Chee-Sanford J, Aminov R, Krapac I, Garrigues-Jeanjean N, and Mackie R. 2001. Occurrence and diversity of tetracycline resistance genes in lagoons and groundwater underlying two swine production facilities. *Applied and Environmental Microbiology* 4(67): 1494–1502.

²⁵ Colburn T, vom Saal F, and Soto A. 1993. Developmental effects of endocrine disrupting chemicals on wildlife and humans. *Environmental Health Perspectives* 101:378–83.

²⁶ Soto A, Calabro J, Prechtal N, et al. 2004. Androgenic and estrogenic activity in water bodies receiving cattle feedlot effluent in Eastern Nebraska, USA. *Environmental Health Perspectives* 112:346.

²⁷ For more information, see “Factory Farming in America: The True Cost of Animal Agribusiness for Rural Communities, Public Health, Families, Farmers, the Environment, and Animals” at www.hsus.org/farm/resources/research/enviro/factory_farming_in_america.html.

farming methods that provide benefits to the environment, public health, and animal welfare becomes more time-sensitive. Thank you for your consideration.

Sincerely,
Wayne Pacelle
President and CEO

