

FROM L'AQUILA TO COPENHAGEN: CLIMATE CHANGE AND VULNERABLE SOCIETIES

HEARING BEFORE THE SUBCOMMITTEE ON ASIA, THE PACIFIC AND THE GLOBAL ENVIRONMENT OF THE COMMITTEE ON FOREIGN AFFAIRS HOUSE OF REPRESENTATIVES ONE HUNDRED ELEVENTH CONGRESS

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FROM L'AQUILA TO COPENHAGEN: CLIMATE CHANGE AND VULNERABLE SOCIETIES

THURSDAY, JULY 23, 2009

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ASIA, THE PACIFIC
AND THE GLOBAL ENVIRONMENT,
COMMITTEE ON FOREIGN AFFAIRS,
Washington, DC.

The subcommittee met, pursuant to notice, at 2:04 p.m., in room 2172, Rayburn House Office Building, Hon. Eni F.H. Faleomavaega (chairman of the subcommittee) presiding.

Mr. FALEOMAVAEGA. I appreciate our panelists' patience as we get our subcommittee organized.

The subcommittee hearing will come to order.

This is the Foreign Affairs Subcommittee on Asia, the Pacific and the Global Environment. The topic of the hearing this afternoon is "L'Aquila to Copenhagen: Climate Change and Vulnerable Societies."

We are very happy and honored to have some of our distinguished members of the panel join us this afternoon giving us their sense of expertise and understanding of this serious issue now facing not only our country but other countries and regions of the world.

I think for purposes of expediting our hearing this afternoon, in consultation with my ranking member, my good friend, the gentleman from Illinois, why don't we—we have Dr. Karl with us already, Dr. Derviş, Dr. Janetos, Dr. Wheeler, and Dr. Clark. I think we need one more.

I would like to begin our hearing this afternoon with my opening statement, and prefacing my opening statement with the fact that the subcommittee held a hearing last year, in February. And, of course, at that time, the political climate in our country was very heavy in terms of Presidential elections that were then pending and the issues of what came about in the Bali Conference concerning the issue of climate change. I thought we had a very lively debate with some of the members of our subcommittee, especially my good friend, the gentleman from California, Mr. Rohrabacher, who happens to be a senior member of the Science and Technology Committee. He had expressed some concerns even about the science, if there really is a global warming or climate change occurring in our planet.

We also had the distinction of several members—ambassadors of the Pacific Island Nations credited to both New York and to the United States with a public briefing that was held.

And in view of not knowing with any sense of certainty what would be the political climate and the issues that were raised during the height of the Presidential elections, it is quite obvious that the new administration under President Obama has made climate change one of his top priorities of his administration. And addressing the issue of the fact that for some 8 years, because our country never signed on to the Kyoto Protocol, it became very difficult to really know what the basis of what really is our fundamental foreign policy toward the issue of climate change.

That was clearly manifested in the Bali Conference that I attended when, immediately after the election of Prime Minister Kevin Rudd of Australia, his government immediately signed on to the Kyoto Protocol and left us on a limb. I think we were one of the two or three countries in the world who never did sign on to the Kyoto Protocol.

I will say, in fairness to the Bush administration, there had been efforts during the Bush administration in discussing environmental and climatic issues, maybe not on the scale where the expectations or the whole world was focusing on the Kyoto Protocol and the post-Kyoto Protocol where we are supposed to come out with some resolution to the issue by the year 2012 when the Kyoto Protocol will be terminated. And that some time in January, I believe, in Copenhagen that the countries of the world will again meet and convene on discussing again the issue of climate change.

The chair believes that our country and probably most of the industrialized countries—I don't think I need to dwell on the fact that this issue is lively debated among the industrialized countries. We are talking about China, India, the United States, Brazil, and Indonesia—among the top five most populous nations in the world.

There seems to be a common thread leading on the very issue of climate change. You are talking about population situations. You are talking about whether or not the sciences still hold up to some of the criticisms that have been raised or concerns of whether or not there really is a climate change issue occurring.

So this afternoon, since the time that, we have moved on to the new administration. It was just recently that the Waxman-Markey bill, H.R. 2454, was recently passed in the House. And in that bill contains some attention given to the international recognition of the problem. It isn't just the United States but all countries in the world.

I just want to say that climate change presents an enormous threat to every country and every region of the world. Rising temperatures and sea levels, decreasing supplies of fresh water, and increasing frequency in severity of hurricanes and other weather events have already had a significant negative impact on the physical and the biological environment, and on human health.

In terms of national security, climate change has been termed a threat accelerant, which may turn existing instabilities into open conflicts. The most serious impacts are coming, and sooner than even the most pessimistic predictions made by the world's best scientists.

A recent study entitled, "Humanitarian Implications of Climate Change," based on research conducted by the United Nation's Of-

fice for the Coordination of Humanitarian Affairs and CARE organization—and I quote:

“Climate change is happening with greater speed and intensity than initially predicted. Safe levels of atmospheric greenhouse gases may be far lower than previously thought. We may be closer to an irreversible tipping point than had been anticipated. Meanwhile, global CO₂ emissions are rising at steeper and steeper rates. Emissions reduction efforts have been too little, too late.”

There is no group of people in greater danger than the poor and the vulnerable. Indeed, those living on low-lying coral atolls, coastal areas, and those who depend on subsistence farming will face a threat even under the best of circumstances.

As the State Department Special Envoy for Climate Change, Mr. Todd Stern, said in May, “One of the greatest challenges in climate change is that the developing countries, indeed the poorest of developing countries, are suffering serious impacts. They have done the least to contribute to the problem, and they are set up to be the most badly affected by it.”

There are two ways to address climate change and its impacts. First, we can try to mitigate the greenhouse gas emissions; or, secondly, we can try to adapt by responding to rising sea levels, ocean acidification, coastal erosion, lower crop yields and fisheries productivity, increasing numbers of extreme weather events, lessened access to fresh water and greater health problems resulting from climate-sensitive diseases. Such measures can range from planting mangroves to act as storm barriers in coastal regions to funding research on salinity-resistant rice and drought-resistant crops, as well as financial support to strengthen public health infrastructure.

The recent G-8 summit and the Major Economies Forum (MEF) which represents 17 countries, accounting for 80 percent of the world's greenhouse gas emissions; both meetings held in Italy did move the ball forward when addressing climate change by agreeing to a global, long-term goal of reducing global emissions by at least 50 percent below 1990 levels by 2050, with developing countries making 80 percent reductions by that date.

In terms of adaptation, the MEF declared that financial resources for mitigation and adaptation will need to be scaled up urgently and substantially, and should involve mobilizing resources to support developing countries. Yet the organization failed to make adequate financial or other resource commitments. As the Secretary General of the United Nations, Mr. Ban Ki-moon, said, “The outcome was not sufficient.”

According to the Congressional Research Service report that was submitted to the subcommittee for added information about the issue, there were several pledges made by certain leaders in the country. I believe it was Prime Minister Brown of England who suggested that \$100 billion be allocated to address climate change to the vulnerable societies. Some of the NGOs suggested maybe \$160 billion. China, the Group of 77, suggested that 1 percent of the GDP of developed countries be provided. And the MEF stayed with the bottom line and said it was vague, not very clear in terms of what their commitments were.

African states say there has got to be a direct coalition in discussing the issue with the members of the African states, and I note with interest that they emphasized the whole question that indigenous knowledge of climate changes in that continent has to be taken into account.

And, of course, the sixth suggestion, as stated in H.R. 2454, the Waxman-Markey legislation; I hope the members of the panel will also offer suggestions and maybe we can improve is my sincere hope.

In the coming weeks, the chairman of the committee has announced that we definitely will be working on a reauthorization of the domestic assistance program and hopefully that maybe through that vehicle we may be able to offer some legislation based on the witnesses and whatever data, information they can have and that hopefully working closely with my ranking member we will be able to produce something that will be helpful, especially to those countries and regions that are most vulnerable when it comes to this subject matter.

So, with that, I think I will submit the rest of my statement. It will be made part of the record.

[The prepared statement of Mr. Faleomavaega follows:]

**COMMITTEE ON FOREIGN AFFAIRS
U.S. HOUSE OF REPRESENTATIVES**

**STATEMENT OF
THE HONORABLE ENI F.H. FALEOMAVAEGA
CHAIRMAN**

**before the
SUBCOMMITTEE ON ASIA, THE PACIFIC AND THE
GLOBAL ENVIRONMENT**

From L'Aquila to Copenhagen: Climate Change and Vulnerable Societies

July 23, 2009

Climate change presents an enormous threat to every country and every region of the world. Rising temperatures and sea levels, decreasing supplies of fresh water and increasing frequency and severity of hurricanes and other weather events have already had a significant negative impact on the physical and biological environment as well as on human health. In addition, climate change is a "threat accelerant," which may turn existing local and regional instabilities into open conflicts.

The most serious impacts are coming—and sooner than even the most pessimistic predictions made only a few years ago by the world's best scientists. According to an important report commissioned jointly by the UN Office for the Coordination of Humanitarian Affairs and CARE International, "Climate change is happening with greater speed and intensity than initially predicted. Safe levels of atmospheric greenhouse gases may be far lower than previously thought, and we may be closer to an irreversible tipping point than had been anticipated. Meanwhile, global CO₂ emissions are rising at steeper and steeper rates. Emissions reductions efforts have been too little, too late."

Alarming, the report notes that climate change will likely have a drastic effect on human migration and displacement: "Current and projected estimates vary widely, with figures ranging from 25 to 50 million by the year 2010 to almost 700 million by 2050." Even the mid-range of these estimates would create the largest, fastest and most destabilizing migration of people in the history of the world.

There is no group of people for which climate change poses more threats than the most vulnerable. Indeed, ironically, the poorest countries will disproportionately suffer the consequences of climate change despite the fact that the sum total of their greenhouse gas emissions is insignificant compared to that from the wealthy industrialized countries. Those living on low-lying coral atolls and in coastal areas, and those who depend on

subsistence farming, face a looming existential threat. According to the Intergovernmental Panel on Climate Change, for example, the countries of Africa will see crop yields decline by a staggering 50% within 11 years.

Thus, while limiting the impacts of climate change will require a drastic reduction in greenhouse gas emissions over the long-term, perhaps the more acute need is assisting those who face hardship even under optimistic reduction scenarios. Rising sea levels, increased ocean acidification, greater coastal erosion, lower crop yields and fisheries productivity, greater numbers of extreme weather events, lessened access to fresh water, and spikes in health problems resulting from climate-sensitive diseases are inevitable to some degree. Adaptation to climate change can ameliorate some of these effects, but adaptation comes at a cost, one which the poorest countries often are not in a position to afford.

The disparity between those most responsible for climate change and those most burdened by its effects make adaptation assistance for vulnerable societies a moral obligation. As the State Department's Special Envoy for Climate Change, Todd Stern, said in May, "One of the greatest challenges in climate change is that the developing countries, indeed the poorest of developing countries are suffering serious impacts. They have done the least to contribute to the problem, and they are set up to be the most badly affected by it."

According to Yvo de Boer, head of the UN Framework Convention on Climate Change, the world needs to invest \$50-70 billion immediately to help poor countries adapt to climate change, with much more needed later. Yet, on a bilateral basis, less than one billion dollars has been spent by wealthy nations in helping the most vulnerable adapt, according to an analysis by the Overseas Development Institute. And most of that spending has consisted of reallocations of existing aid budgets rather than new money, leaving less funding for critical health, education and other developmental needs.

On a multilateral basis, rich countries have pledged an additional \$6 billion to two climate investment funds administered by the World Bank. But none of those pledges have been fulfilled. And even if they are, funds will only be available to recipients in the form of loans rather than grants. The UN Global Environment Facility, meanwhile, which distributes about \$250 million annually for climate change projects, has provided only \$100 million to the world's 49 poorest countries, with the rest going to more economically-advanced nations.

In the United States, the Obama Administration has been hard at work trying to address the challenge of climate change in the aftermath of the Bush Administration's inaction. The House just passed critical legislation, the Waxman Markey bill, which would cut greenhouse gas emissions 17 percent by 2020 from 2005 levels, with a mid-century reduction target of 83%. To achieve the decrease, Waxman-Markey would employ a cap and trade mechanism. That mechanism would allocate a small amount of the revenues generated—initially one percent, gradually increasing to four percent by 2027—for adaptation and clean energy for developing countries. Estimates of what those

percentages will mean in actual dollars vary considerably, but according to Oxfam America, they would produce \$750 million on an annual basis initially.

The recent L'Aquila meetings of the G-8 Summit and Major Economies Forum also made some progress in addressing climate change as agreement was reached on a long-term goal of reducing global emissions by 50% by 2050 from 1990 levels, with developed countries making 80% cuts by the middle of the century. In terms of adaptation, the MEF declared that "financial resources for mitigation and adaptation will need to be scaled up urgently and substantially and should involve mobilizing resources to support developing countries." Unfortunately, neither the MEF nor the G-8 made hard financial commitments to assist developing nations.

Thus, while the United States and other industrialized countries recognize the importance of assisting the most vulnerable, the sums actually appropriated have fallen woefully short of the need. The wealthiest countries neglect represents not only a moral failure, but a strategic one as well since poorer nations have come to view the UN climate negotiations with skepticism. And absent their support, the December 2009 Climate Change Conference in Copenhagen may collapse, with negative consequences for every country in the world, rich and poor alike.

Given the grave impacts of unchecked climate change, failure in Copenhagen is not an option. With political will, the challenges of climate change can be addressed and adaption can succeed. As the authors of the "Humanitarian Implications of Climate Change" report noted, "the scope and scale of challenges we face may be unprecedented; but we meet them already having many of the resources—including knowledge, skills and relationships—needed to protect the dignity and basic rights of persons threatened by displacement from environmental change."

Mustering the political will to fund adaption for the most vulnerable requires sustained attention. Unfortunately, that sort of focus has been absent thus far from the international stage. This hearing, which follows a similar one the Subcommittee held last year, is meant to help fill that gap.

Mr. FALEOMAVAEGA. Without objection, all statements made by witnesses this afternoon will also be made part of the record. At this time I would like to ask my ranking member for his opening statement.

Mr. MANZULLO. Well, I thank the chairman.

There is a great story—Eni Faleomavaega has a lot of stories, and some of them are true. One of the great stories was in, I believe, 1993 or 1994, we were sitting on a panel at a hearing and somebody tried to justify the French detonation, underwater nuclear bomb somewhere near Mr. Faleomavaega's region. And this person went on to say that he didn't think there was any damage; there was no problem whatsoever. And the lone question that came from Congressman Faleomavaega was, well, what about the fish? And that was supposed to be funny. He can loosen up a bit because the fish were near the nuclear explosion, but no one seemed to count them.

And what amazed me is that this bomb was detonated and there was very little——

Mr. FALEOMAVAEGA. Will the gentleman yield?

Mr. MANZULLO. Yes.

Mr. FALEOMAVAEGA. Because the French were kicked out of Algeria after conducting their initial nuclear testing at the expense of some 1 million Algerians who lost their lives in their fighting against French colonialism. So De Gaulle decided we will go somewhere else, not in France but to the South Pacific. And this is where they detonated 220 nuclear devices in the atmosphere, in the surface and under the ocean, that they did this for a 20-year period. As a result, over 10,000 Tahitians were subjected to nuclear contamination because of this testing.

Mr. MANZULLO. And the latest test was as recently as 1994.

Mr. FALEOMAVAEGA. In 1995, I was privileged to participate in a worldwide demonstration against the French Government when they broke the moratorium on nuclear tests, and they wanted to explode eight additional nuclear bombs for fear that their national security was at risk, given the fact that they had the fourth largest arsenal of nuclear weapons at that time.

Mr. MANZULLO. The reason I raised that is I thought it not amusing but pretty calloused that, in the explosion of this device, the witness actually said there was no damage; and, of course, you responded, what about the fish?

Well, here we are, not that much later, France, of course, in the European Union; and they have tried a cap-and-trade system that is a miserable failure. And we just got back from northern Africa where the industries are delighted, all the way from Morocco over to Tunisia, that they can compete and sell manufactured goods to Europe because they are not bound by their cap-and-trade system. And even the cap-and-trade system itself is not counting much success.

So what we have to do here is be extraordinarily careful. The issue is not climate change. The issue is global pollution. Climate change really only talks about what is emitted into the atmosphere and not what goes into the seas or what goes into the ground.

I look upon this as a much broader topic, one that jumps over the issue, is there indeed climate change. But even that word has

changed from global warming to climate change. But we don't have to agree on whether or not there is global warming or global cooling or climate change. That is not the issue. The issue is we should be doing everything reasonably that we can in order to stop global pollution. And that is where I fit into this equation and where the chairman and I may not necessarily agree on what is necessary to do that. The bottom line is we want to stop as much pollution as possible.

I will submit my statement to the record.

Before that I want to introduce Dr. Redmond Clark as my constituent from the Illinois 16th Congressional District. He is an expert on climate change and its impact on American businesses. He is an accomplished chief executive whose company produces a product that renders lead paint inert during sandblasting operations. He rode his bicycle all the way from northern Illinois to Washington, but he was planning on doing that anyway and did not do that especially in preparation of this hearing. But I think he brings something refreshing, Chairman. And perhaps you and I can join him or should join him in our exercising.

[The prepared statement of Mr. Manzullo follows:]

COMMITTEE ON FOREIGN AFFAIRS
SUBCOMMITTEE ON ASIA, THE PACIFIC, AND THE GLOBAL ENVIRONMENT
 U.S. HOUSE OF REPRESENTATIVES
 WASHINGTON, D.C. 20515

Donald A. Manzullo (IL-16), Ranking Member
Opening Statement

July 23, 2009

Mr. Chairman, thank you for calling this important hearing on climate change and its impact on vulnerable societies. I understand that certain communities and even countries with significant coastal zones are concerned that the sea level will rise uncontrollably if climate change continues unabated. It is my strong belief that no society can truly face the challenge of climate change on its own, and certainly no society can escape its impact. Thus, it is extremely important that we come together to agree on the best strategy for the future.

Unfortunately, Mr. Chairman, the cap and trade legislation passed in the House of Representatives at the end of June is the wrong way to tackle this issue. The legislation that was railroaded through this body does very little to control global greenhouse gas emissions because it is a self-imposed regulation that does not impact all countries equally. In practice, India, China, Brazil, Russia, and others will continue to pollute just so the U.S. can claim it is “leading by example.” What will we do once our manufacturing sector moves off shore en masse? What will we do when American jobs are not replaced by the promised “green jobs” as our leaders have promised?

What this cap and trade legislation does do well is to put job security at risk for millions of American workers while at the same time offering American intellectual property to countries like China as gifts under the guise of clean technology promotion. The bill actually taxes domestic manufacturers by taking a portion of their emissions allowances to spend overseas in developing nations as part of yet another new foreign assistance program. Even more egregious is the idea that by transferring American technology to China, which is the world’s most prolific violator of IP, it will make the Chinese less willing to pollute. It is absolutely clear that little thought was given to protecting American intellectual property. Thus, I ask again, how will taxing the heart and soul of America’s economic engine help reduce climate change, particularly when the worst offending countries simply refuse to join?

As you know Mr. Chairman, I have long argued in this Subcommittee that the most meaningful way to combat climate change is to work constructively together on practical, technical solutions to reduce pollution on a global scale so that we rid the earth of the truly harmful substances that compromise health and destroys the environment. If the focus is solely on reducing greenhouse gases, then this gives the developing nations around the world an excuse to resist these efforts. The argument of a double standard between developed and developing nations holds much weight in countries such as India and China. The fact is that developed nations, which polluted as much as they wanted for

centuries, are now insisting that other nations follow what they say and not their example.

I submit for the Record an article from the *Wall Street Journal* titled "India Rejects U.S. Proposal of Carbon Limits" published on July 20, 2009 as an example of my sentiments above.

Finally, Mr. Chairman, I want to welcome Dr. Redmond Clark from Illinois' 16th Congressional District, which I have the honor to represent. Dr. Clark is an expert on climate change and its impact on American businesses. He is an accomplished chief executive whose company produces an ingenious product that renders lead paint inert during sand blasting operations. Most importantly, Dr. Clark came to testify at today's hearing on a bicycle all the way from Illinois. Mr. Chairman, how about that for reducing climate change?

Thank you for calling this hearing.

Mr. FALCOMA. I thank the gentleman for introducing Dr. Clark before the subcommittee.

I will just say to our good friend from Illinois that, in fairness to France, the French just simply followed what we did. We decided to do our nuclear testing in the Marshall Islands, and then we detonated 67 nuclear weapons. The first hydrogen bomb that we exploded in the world was in the Marshall Islands. It was 15 megatons, which is about 1,300 times more powerful than the bombs we exploded in Nagasaki and Hiroshima.

What prompted the government from not doing any more nuclear explosions in the Pacific was because the nuclear cloud carried Strontium-90 all the way to Minnesota and Wisconsin, and it was found in milk products. So we decided, no, let's go do it underground. And the poor State of Nevada now became the victim, where we detonated over 800, 900 nuclear bombs underground.

And, of course, that adds on another issue of global pollution, about what do you do with nuclear waste? To this day, after spending billions and billions of dollars and building Yucca Mountain, to think that this is going to be the answer to solving the nuclear waste issue in our country—I just am not an expert on technical and scientific issues like this Congressman, but my suggestion or question is, how do you transfer nuclear waste from Tennessee or Georgia or all these other States to Nevada? By bus? By airplane? By train? By car? What happens if, in that one-in-a-million chance, that goes haywire? Maybe a terrorist group or maybe by accident, that nuclear waste goes out in the public.

So this is where I think even in our own country we have some very serious issues that we have not addressed seriously and for the sake of Nevada's future and safety—and Nevada is simply saying, why us? It seems the most practical solution is, to every State, if you want to use nuclear technology to produce electricity, you take care of your waste. Why ship it to Nevada is my question.

And if you and I were to live in Nevada I don't think we would appreciate having all the nuclear waste products coming from all different States and your State becoming the repository of something that is dangerous and lethal as nuclear waste.

I'm sorry, I didn't mean to detract from your issue.

But, to our friends here, I had the privilege of sailing on a Polynesian voyaging canoe without a sextant or modern navigation. We used it by traditional navigation. And it took us about 27 days to sail on a double-hull Polynesian canoe built by my Hawaiian cousins. And it was a real experience for me because I got to see the environment, the ocean, the air, the water.

Let me tell you, there was a lot of pollution and things floating around in the ocean voyaging from Tahiti to Hawaii for some 27 days. And this was in 1987, Congressman. I suspect now it is even worse.

As you said quite adequately, and I agree with you, maybe not necessarily just to suggest climate change but global pollution caused by man is something that we ought to also address seriously.

So, for today, I do want to personally welcome and invite our distinguished panelists this afternoon for their testimonies.

We have Dr. Thomas Karl, who received his bachelor's degree in meteorology from Northern Illinois University, master's degree from the University Wisconsin, and doctorate from North Carolina State.

Dr. Karl is the director of NOAA's National Climatic Data Center in Asheville, North Carolina, and leads NOAA's Climate Services. He has served and continues to serve on a variety of National Research Council Committees and is a fellow of the American Meteorological Society, currently serving as president. He is also a fellow of the American Geophysical Union and the National Association of the National Research Council.

Dr. Karl has authored many climate atlases and technical reports and has published over 150 peer-reviewed articles in various scientific journals. He has been named one of the most frequently cited earth scientists of the 1990s. His science focuses on climate, climate variability and climate change. He has served as editor and contributing author to a number of textbooks on topics ranging from the 1988 U.S. draught to climate and biodiversity, and currently chairs and is co-editor-in-chief of the 2009 State of Knowledge Report by the United States Global Change Research Program and the Global Climate Change Impacts in the United States.

Also with us is Mr. Kemal Derviş. Until February of this year, Mr. Derviş was the executive head of the United Nations Development Program and chairman of the United Nations Development Group, a committee consisting of the heads of the all U.N. funds, programs and departments working on development issues at the country level.

In 2001 and 2002, as Minister of Economic Affairs and the Treasury in the Republic of Turkey, Mr. Derviş was responsible for launching Turkey's recovery program from the devastating financial crisis.

A native of Turkey and the city of Istanbul, Mr. Derviş earned his bachelor's and master's degrees in economics from the London School of Economics and his doctorate from Princeton University. He also taught economics at Princeton and Middle Eastern Technical University before joining the World Bank, served a 22-year career in the World Bank and became vice president for the Middle East and North Africa in 1996 and also vice president for poverty reduction and economic management.

And if anybody wants to share any languages with Mr. Derviş, he is fluent in English, Turkish, French, and German, and I suspect even Spanish.

Dr. Anthony Janetos is director of the Joint Global Change Research Institute, a joint venture between the Pacific Northwest National Laboratory and the University of Maryland. He has many years experience in managing scientific and policy research programs in a variety of ecological and environmental topics: Pollution effects on forests, climate change impacts, land use change, ecosystem modeling, and the global carbon cycle. Dr. Janetos graduated magna cum laude from Harvard University with a bachelor's degree in biology, and earned both his master's and doctorate degrees in biology from Princeton University.

Dr. David Wheeler is a senior fellow in the Center for Global Development, where he works on issues relating to climate change,

natural resource conservation, African infrastructure development and the allocation of development aid. From 1993 to 2006, as the lead economist in the World Bank's Development Research Group, he directed a team that worked on environmental policy and research issues in collaboration with policymakers and academics in Latin America, in Southeast Asia, just about everywhere else in the world—and Africa as well. He also worked on priority setting for country lending, grants, and technical assistance with the World Bank's vice president for operations policy and country services.

Dr. Wheeler completed his doctorate in economics at the Massachusetts Institute of Technology in 1974, taught for 2 years also at the National University of Zaire in Kinshasa. And, again, a distinguished career of serving with the World Bank and has been a professor and also consulted with various institutes of economics as well; and we are very, happy to have Dr. Wheeler with us.

Dr. Redmond Clark, I think you have already been introduced by my good friend from Illinois.

At this time, I would like to ask Dr. Karl to begin our hearing this afternoon. Please, Dr. Karl.

STATEMENT OF THOMAS KARL, PH.D., DIRECTOR, NATIONAL CLIMATIC DATA CENTER, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Mr. KARL. Good afternoon, Chairman Faleomavaega, Ranking Member Manzullo. Thanks very much for inviting me to talk to you today regarding global climate change.

It is now well established in scientific literature that our climate is changing and that humans are largely responsible. Additional changes are already assured because of the large amounts of heat that have already been absorbed by the ocean, long lifetimes of atmospheric carbon dioxide and other greenhouse gases in the atmosphere.

Changes are already apparent around the globe. For example, last month, the United States Global Change Research Program released a NOAA-led report entitled Global Climate Change Impacts in the United States. The report provides concrete evidence that impacts are not only affecting the contiguous U.S. but other areas around the world, including the Pacific Islands and the Caribbean.

Other scientific assessments have documented a variety of important changes, such as decreases in subtropical and tropical precipitation in Indonesia and southern Asia, increasing ocean acidity, and rising sea levels.

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change identifies coastal and small island communities like those in Asia and the Pacific region as particularly vulnerable to climate change and variability.

I would like to highlight a few climate impacts for which observed and projected changes are relevant to Asia and the Pacific region. Water is an area in which the impacts of global climate change will be increasingly felt in small and large ways, including increased intensity of extreme precipitation events, and drought and changes in the quality and abundance of water resources.

Asia is a region where water distribution is uneven and large areas are under water stress. Even in humid and sub humid areas of Asia, water scarcity is one of the constraints limiting sustainable development. Yet, at the same time, we are seeing evidence of increases in extreme precipitation events, a trend that is expected to grow around the world; and future projections include more dry days as the intensity of precipitation increases when it does actually rain.

In India, Pakistan, Nepal, Bangladesh, water shortages have been attributed to rapid urbanization and inefficient water use. These are all aggravated by a changing climate. In subtropical regions, climate change is expected to reduce water resources on many small islands. By midcentury, these water resources may be insufficient to meet the growing demands during low rainfall periods.

The oceans will feel projected impacts of global climate change, which, in turn, will have negative impacts on the most vulnerable societies. The oceans have absorbed approximately one-third of the human-produced carbon dioxide. This increased absorption has measurable impacts on ocean chemistry. One of these is increased acidification, which leads to the deterioration of and can contribute to the total collapse of coral reef ecosystems, especially when combined with coral bleaching due to high ocean temperatures and other human-caused stresses.

In addition to the food, resources, and biodiversity that coral reefs provide, deterioration in coral reefs is expected to impact the value of these areas as tourist destinations as an important resource of income in some of the coastal areas in the Asia and Pacific Islands.

Another impact on the world's oceans is sea level rise. Sea level rise is expected to amplify the effects of other coastal hazards. These include storm surge, Tsunami, and erosion, as well as the loss of fish and wildlife habitat.

The reduction of fresh water availability due to saltwater intrusion, especially in low-lying areas, is another hazard facing many areas due to sea level rise.

By the end of this century, sea level rise is projected to increase the annual number of people experiencing flooding in coastal populations from 13 million to 94 million; and this is likely to be an underestimate if contributions to sea level from the Greenland ice sheet grow as evidence today suggests. Almost 60 percent of the increase in affected coastal populations will occur in south Asia and about 20 percent will occur in Southeast Asia.

In addition to changes in the ocean over recent decades, there has been a general increase in duration of heat waves along with the increased intensity in rainfall. Additionally, these trends are expected to continue, along with increased year to year variability of the Asian summer monsoon. One impact of this variability and increase in temperature is increased water stress and lower production of rice, maize, and wheat in many parts of Asia during periods of monsoon failures.

This climate change will be further impacted by existing climate variability phenomena such as El Nino and La Nina. We may soon have firsthand experience of this increased stress as in the summer

of 2009 we are embarking on an El Nino episode. The world's ocean surface temperature was the warmest on record for June. NOAA is predicting a strengthening of El Nino over the coming months.

In recognition of the climate challenges already facing many parts of the globe, NOAA has supported efforts to understand and predict environmental change. We are working to provide the tools that will allow for more effective management of resources impacted by climate change. For example, NOAA researchers are working with partners to understand how climate change is altering global ocean conditions. These conditions include water temperature, currents, upwelling, plankton blooms, and others. We seek to understand how these changes affect habitat range and abundance of economically important fish and protected species.

In closing, climate change impacts across the globe are merging as serious challenges for virtually all nations, including our own. NOAA is taking action to assist in improving understanding and predicting of climate change and in providing information tools necessary to improve the management of these critical resources.

Thank you very much for allowing me to testify today. NOAA looks forward to working with you as we address these challenges. I am happy to answer any questions you may have.

[The prepared statement of Mr. Karl follows:]

WRITTEN TESTIMONY OF
DR. THOMAS KARL
DIRECTOR OF NOAA'S NATIONAL CLIMATIC DATA CENTER,
AND LEAD FOR CLIMATE SERVICES
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

HEARING ON
"CLIMATE CHANGE AND IMPACTS ON THE MOST VULNERABLE SOCIETIES"

BEFORE THE
SUBCOMMITTEE ON ASIA, THE PACIFIC, AND THE GLOBAL ENVIRONMENT
COMMITTEE ON FOREIGN AFFAIRS
U.S. HOUSE OF REPRESENTATIVES

July 23, 2009

INTRODUCTION

Chairman Faleomavaega, Ranking Member Manzullo, and other members of the Committee, thank you for inviting me to speak with you today regarding the global impacts of climate change. I am honored to be here as the lead for climate services in the National Oceanic and Atmospheric Administration (NOAA) and as Director of NOAA's National Climatic Data Center.

Over the last 50 years, researchers at NOAA's Mauna Loa Observatory in Hawaii have been measuring the increasing concentrations of carbon dioxide and other greenhouse gases in the Earth's atmosphere. This long-term carbon dioxide record has been instrumental in improving our understanding of global atmospheric change, as well as acting as a catalyst for international policies. It is now well-documented in scientific literature and publicized in the media that our changing climate will have impacts on a global scale. Today, we must now begin to understand and address the impacts of climate change in highly vulnerable locations such as Asia, the Pacific Islands, and small island nations.

A landmark interagency report entitled *Global Climate Change Impacts in the United States* was released in June. NOAA led the development of this report, which is a synthesis of 21 assessments prepared by the 13 agencies that make up the U.S. Global Change Research Program. I have submitted the report for the record as part of my written testimony. This report provides concrete scientific evidence that demonstrates unequivocally that climate is changing and we are seeing its impacts in our own backyards and in every region in our country. While this report is largely focused on observed and anticipated impacts in the U.S., it also provides a summary of global climate impacts. Some of the critical global impacts already observed include: rising global temperatures; changing precipitation patterns, such as decreases in the Mediterranean, most of Africa, and in southern Asia, and widespread increases in heavy precipitation events; increasing impacts of changing ocean chemistry (e.g. ocean acidification) affecting corals and other marine organisms important for preserving ocean food chains; retreat

of mountain glaciers on every continent, including those glaciers essential for local water resources; and rising sea levels, which are of particular concern for low-lying regions and nations, many of which are densely populated, developing, and more vulnerable to natural hazards such as storm-related coastal inundation.

Under a broad range of scenarios that allow greenhouse gas emissions to continue unchecked, warming over this century is projected by the Intergovernmental Panel on Climate Change (IPCC) to be substantially larger than over the past century. Changes in many other components of the climate system (warming patterns being only one example) are also very likely to be larger than those observed in the present century. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC-AR4) and other climate assessment reports identify coastal and small island communities like those in Asia and the Pacific as particularly vulnerable to climate variability and change. Some consistent themes that run through such reports include:

- Climate change is projected to increase demand for water resources;
- Sea level rise is expected to amplify the effects of other coastal hazards, such as hurricanes (including storm surge), flooding, and erosion;
- Invasion of non-native species is expected to occur with rising temperatures; and
- Climate change is expected to exacerbate other existing human influences on fisheries and marine ecosystems, such as over-fishing, habitat destruction, pollution, and excess nutrients.

I will now turn to a more detailed summary of a few selected observed and projected impacts most relevant to Asia and the Pacific based on several of the most recent and rigorous studies to date.

WATER

The quality and abundance of water is a theme that runs through many observed and projected impacts of global climate change including impacts on energy, agriculture, health and others. A recent technical report of the IPCC, attached as part of my written testimony, details regional impacts on water resources across the globe. Of interest to this Subcommittee, Asia is a region where water distribution is uneven and large areas are under water stress. Even in humid and sub-humid areas of Asia, water scarcity is one of the constraints limiting sustainable development. Ability to respond to water stress in this region is exacerbated by additional factors, such as high population growth and low development levels. In the Pacific, climate change is projected to reduce water resources in many small islands to the point where, by mid-century, resources may be insufficient to meet demand during low rainfall periods. Specific examples of challenges associated with climate-related water scarcity include:

- In parts of China, temperature increases and decreases in precipitation, along with increasing water use, have caused water shortages that have led to drying up of lakes and rivers.
- In India, Pakistan, Nepal and Bangladesh, water shortages have been attributed to issues such as rapid urbanization and industrialization, population growth and inefficient water

use, which are all aggravated by changing climate and its adverse impacts on demand, supply and water quality.

- In arid and semi-arid central and west Asia, changes in climate and its variability continue to challenge the ability of countries to meet growing demands for water.

Climate change is expected to further stress water resources in Asia and the Pacific, together with multiple socio-economic stresses.

OCEAN ACIDIFICATION, SEA SURFACE TEMPERATURES, AND CORAL REEFS

The oceans have absorbed approximately one third of the human-produced carbon dioxide and are an important 'sink' for carbon dioxide. However, this process of absorbing carbon from the atmosphere into the ocean has measurable effects on ocean chemistry by increasing acidification, which has an effect on critical and sensitive resources. For example:

- Valuable coral reefs worldwide are among the ecosystems at high risk of extreme degradation due to climate change. According to one estimate, Hawaii's coral reefs, when combining recreational, amenity, fishery, and biodiversity values, were estimated to have direct economic benefits of \$360 million/year.¹
- Cold-water corals are particularly vulnerable to climate change because they are long-lived, slow-growing, and fragile species. They are also economically important because they provide habitat and nursery grounds for a variety of fish species,² thereby contributing to commercial, recreational, and community-based subsistence fisheries. It is estimated that 70 percent of cold-water corals, globally, could be living in unsustainable conditions by the century's end³.
- In addition to the food resources and biodiversity that coral reefs provide, deterioration in coral reef condition is expected to impact the value of these areas as tourist destinations — a critical income source for many island and coastal nations.
- As baseline sea surface temperatures increase, corals are more susceptible to extreme heating events such those often occurring in El Niño conditions. It is apparent in the summer of 2009 that we are embarking on just such an episode with globally-averaged sea surface temperatures emerging as the warmest June on record.

SEA LEVEL RISE

Sea level rise is expected to amplify the effects of other coastal hazards such as inundation, storm surge, tsunami and erosion, as well as the loss of fish and wildlife habitat and the reduction of freshwater availability due to saltwater intrusion, especially in low-lying islands. Even under the most conservative IPCC estimates of sea level rise, by the end of current century sea level

¹ Cesar, H., P. van Beukering, S. Pintz, and J. Dierking, 2002: Economic valuation of Hawaiian reefs. Cesar Environment Economics Consulting, Arnham, The Netherlands, 123 pp.

² Raven, J., K. Caldeira, H. Elderfield, O. Hoegh-Guldberg, P.S. Liss, U. Riebesell, J. Shepard, C. Turley and A.J. Watson. 2005. Ocean acidification due to increasing atmospheric carbon dioxide. Policy Document. The Royal Society, London.

³ Guinotte, J.M. and V.J. Fabry. 2008. Ocean acidification and its potential effects on marine ecosystems. *Annals of the New York Academy of Sciences*. 1134: 320-342.

rise is projected to increase the annual number of people who experience flooding in coastal populations from 13 million to 94 million. Almost 60 percent of this increase will occur in South Asia (along coasts from Pakistan, through India, Sri Lanka and Bangladesh to Burma), while about 20 percent will occur in South-East Asia, specifically from Thailand to Vietnam including Indonesia and the Philippines⁴. Island nations such as the Maldives in the Indian Ocean, and islands in the South Pacific such as parts of Vanuatu, Tuvalu, Kiribati, the Marshall Islands and Fiji, are at risk of permanent inundation from sea level rise. In some cases national governments that are extremely vulnerable to future rises in sea level, such as the Maldives, are exploring options to purchase land in other countries, such as in Australia, so that their people will continue to have a place to live if the island is inundated as is projected. Recent research and reports such as *Global Climate Change Impacts in the United States* suggest that estimates at the higher end of the ranges projected for sea level rise in the IPCC-AR4 might be conservative.

HEAT WAVES AND EXTREME PRECIPITATION

According to the IPCC, over recent decades there has been a general increase in the duration of heat waves and intensity of extreme rainfall in many parts of Asia, with the latter causing more severe floods, landslides, and debris and mud flows. While we have observed an increase in rainfall intensity, at the same time the number of rainy days and the total annual amount of precipitation has decreased in the region overall. This indicates a more variable rainfall pattern has developed across Asia. An increase in occurrence of extreme weather events including heat waves and intense precipitation events is projected to continue in South Asia, East Asia, and South-East Asia along with an increase in the year-to-year variability of daily precipitation in the Asian summer monsoon. One impact of this rainfall variability and increase in temperature is increased water stress and lower production of rice, maize and wheat in many parts of Asia. Freshwater and marine ecosystems will also be affected by warming waters, sedimentation and erosion from floods, and habitat loss and saltwater intrusion from droughts.

It is also virtually certain that Australia will see an increase in heat waves (and wildfires), while floods, landslides, drought and storm surges are also very likely to increase. These events are projected to threaten more infrastructure, as well as crop and forestry production, especially in the South and East parts of Australia. The climate change impacts (described in the previous sections, above) will be further amplified by existing climate variability phenomenon, such as El Nino/La Nina. In both southern Asia and in the South Pacific, the variability of El Nino/La Nina cycles are superimposed on climate change trends. These cycles already stress the capacity of regions and townships to cope with the resulting impacts. Under further climate change, the stress will increase. We may soon have first-hand experience of this increased stress, as in the summer of 2009 we are embarking on just such an episode with globally-averaged sea surface temperature emerging as the warmest June on record. NOAA is predicting a moderate El Nino to develop.

INCREASING RESILIENCE

⁴ Cruz, R.V., H. Harasawa, M. Lal, S. Wu, Y. Anokhin, B. Punsalma, Y. Honda, M. Jafari, C. Li and N. Huu Ninh, 2007: Asia. *Climate Change 2007: Impacts, Adaptation and Vulnerability Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Patutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 469-506

In recognition of the climate challenges already facing many parts of the globe, NOAA has supported, through partnerships and within its own offices, efforts to understand and predict environmental change and provide the tools that will allow more effective management of resources impacted by climate change. For example:

- A NOAA-supported project at the International Research Institute for Climate and Society is assessing climate information necessary to better balance reservoir management to meet water needs for drinking, energy (electricity production) and agriculture in the metro Manila area of the Philippines.
- A network of partners and stakeholders across the Pacific region, known as the Pacific Risk Management 'Ohana, is coordinating development and delivery of risk management-related information, products and services to improve decision-making
- NOAA is also developing forecast tools to better predict coral-bleaching events allowing local communities to prepare for and limit adverse effects on these ecosystems and the resources they provide
- NOAA researchers are working with academic partners to understand how climate change is altering global ocean conditions (e.g., water temperature, currents, upwelling, and plankton blooms), and how the changing ocean conditions will affect changes in habitat range and abundance of economically important fish and protected species.

CONCLUDING REMARKS

In brief summary, climate change impacts across the globe are emerging as serious challenges for virtually all nations, including our own. However, the vulnerability of populations located in coastal, impoverished, or resource-poor nations across the globe is even greater. NOAA is taking action to assist in improving understanding and prediction of climate change. NOAA is also providing information and tools to improve the management of critical resources across the globe to increase resilience and opportunity in the face of climate change impacts.

Thank you very much for the opportunity to testify today. I look forward to answering your questions

ATTACHMENTS

Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds. *Climate and Water*. IPCC Secretariat, Geneva, 210 pp. June 2008

GCRP, 2009: Global Climate Change Impacts in the United States, Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson, (eds.). Cambridge University Press, 2009.

Mr. FALEOMAVAEGA. Thank you, Dr. Karl.
Mr. Derviş.

STATEMENT OF MR. KEMAL DERVIŞ, VICE PRESIDENT AND DIRECTOR, GLOBAL ECONOMY AND DEVELOPMENT, BROOKINGS INSTITUTION (FORMER ADMINISTRATOR, UNITED NATIONS DEVELOPMENT PROGRAMME)

Mr. DERVIŞ. Chairman Faleomavaega, Ranking Member Manzullo, I really appreciate the opportunity to testify today on the subject from L'Aquila to Copenhagen: Climate Change and Vulnerable Societies. I hope this hearing serves as another signpost signaling America's critical role in supporting climate change adaptation in the world's most vulnerable communities and also in dealing with the broader environmental challenges we face, as mentioned by the ranking member.

Let me just try to highlight a few I think important points in this overall debate, which is going to be intensified, of course, as the world's countries prepare for Copenhagen and as the United States prepares for Copenhagen.

The first point I think is that it is true that we do know that climate change is happening. I think there is overwhelming scientific evidence to that effect. We heard Dr. Karl. It is also true that gas emissions—heat trapping gas emissions are playing a critical role.

At the same time, I think it is fair to add there is still a lot of uncertainty on exactly how these processes work, how fast they take place, what the exact impact is on the climate and on various parts of the world.

But here the point I would like to make is the fact that there is such uncertainty cannot be interpreted as allowing inaction. Uncertainty means, yes, we don't know exactly what is going to happen, but we do know that there is potentially catastrophic risk down the road. So in situations like that, I do believe that the wise course is to take insurance, to ensure the world and particularly, of course, also the United States against the potentially catastrophic impacts that may happen 40, 80, 100 years from now.

As we get more information from research and data, we can adjust the exact action we take. But, in the meantime, I do believe that action is urgent. So this is an overall reason I think why policy is so important and why action has become so urgent.

The second point—and this is a point where I think this committee is concentrating on—is the fact that the most vulnerable, the poor societies in the world are hurt the most. I won't repeat what Dr. Karl already eloquently told us about agriculture, about ocean, chemistry, about water level, sea rise levels, and other factors that, unfortunately, impact those who are the least able to protect themselves. The poorest and most vulnerable countries are also those who contribute the least to the accumulation of greenhouse gases. So it is a particularly difficult ethical and political situation where those who have contributed historically the least and who are not contributing now because of the level of their GDP, the level of their development, are going to be those impacted soonest and with the greatest force.

Therefore, helping them adapt, helping them control the impact of climate change is I think an imperative global need that is being increasingly recognized. The amount of resources needed are quite large. Estimates range into tens of billions of dollars a year.

I think what makes these estimates particularly difficult is that it is not easy to separate climate adaptation needs from general development needs. Extreme climate events are much more frequent in parts of the world that are least developed, and even if there wasn't climate change there is a need to help these societies withstand the effects, such as the cyclones, for example, in Bangladesh and the devastating droughts that we have seen in Africa and other parts of the world. But climate change make these things worse, increases their frequency, increases their impact.

I do believe, however, that it is important to approach the issue broadly and not to separate adaptation to climate change from the general fight against poverty, but to integrate these measures and the policy support the developed countries, the international organizations, and the United States provides into a framework that is about fighting poverty and where, within that fight against poverty, climate adaptation is one important component.

The final point I would like to make relates to trade. I think it is very important that the effort against climate change, the effort to protect the world, to ensure the world is widely shared, that particularly the rapidly growing emerging market economies do participate in their own way in this effort. I do, therefore, understand sometimes the debates relating to trade and to the need to have an equal playing field. However, I think it is very, very important to realize that trade measures could hurt the poorest and the most vulnerable countries in very important ways, because trade rules cannot be discriminatory. So when thinking about trade policy, I think it is very, very important to keep in mind also the interest of the most vulnerable in the poorest countries.

Thank you very much for allowing me to share my perspective.
[The prepared statement of Mr. Derviş follows:]

TESTIMONY OF
KEMAL DERVIŞ¹
SUBCOMMITTEE ON ASIA, THE PACIFIC, AND THE GLOBAL ENVIRONMENT
COMMITTEE ON FOREIGN AFFAIRS
U.S. HOUSE OF REPRESENTATIVES
JULY 23, 2009
WASHINGTON, DC

Chairman Faleomavaega, Ranking Member Manzullo, distinguished members of the Subcommittee, I appreciate the opportunity to testify today on the subject of From L'Aquila to Copenhagen: Climate Change and Vulnerable Societies. I hope this hearing serves as another signpost signaling America's critical role in supporting climate change adaptation in the world's most vulnerable communities.

Climate Crisis, Credit Crisis

In the midst of a global economic downturn, the world's climate negotiators will descend on Copenhagen for the 15th Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) with the aim of crafting a post-2012 climate regime.

Since the Intergovernmental Panel on Climate Change's Fourth Assessment Report was released in 2007, a growing number of scientists believe that climate change forecasts may have been too conservative and that the rate of climate change may be closer to the worst-case scenarios. While some of the adverse effects of climate change will unfold over decades, time nonetheless, is of the essence. Carbon emitted in the next decade will stay in the atmosphere for well over hundred years, and power plants

¹ Vice President and Edward M. Bernstein Scholar at Brookings

built in the next decade will determine the carbon intensity of our energy supply for years to come.

As governments struggle to revive their economies, policymakers have taken important steps towards green growth by allocating parts of their fiscal stimulus to key climate change investment themes—including here in the U.S. On the other hand, fear of unemployment and slower growth prospects may undermine the political resolve to tackle climate change in an ambitious way. On balance it is not clear how strong that resolve is—the events ahead will test it in the coming months.

Given the tight timeframe for action, it may be too much to hope for a comprehensive global deal that settles all of the major sticking points. Success will have to mean, however, that decisive progress is made with a clear roadmap for what is to follow, and that contrary to the Kyoto experience, all major players be part of that roadmap.

Why Act Now?

The scientific evidence that our climate is changing is now overwhelming. The link between greenhouse gas emissions and human activity is also well established. However, there still remains a huge amount of uncertainty regarding the processes that mediate between greenhouse gas (GHG) emissions, their concentration in the atmosphere, the effects of different concentrations on climate, and what changes in climate will mean for biodiversity, agriculture, sea levels, and the many other ‘climate dependent’ characteristics of our planet. There is also uncertainty as to how fast all of these processes will unfold; in some cases it seems the phenomena are happening faster than earlier IPCC reports had predicted.

The nature of this uncertainty is such that the decision to address climate change in the U.S. and the other advanced economies should be viewed as being more about preventing catastrophic risk than attempting to optimize along a “known” growth path. In other words, though we do not know with certainty what will happen and when, we do know that catastrophic outcomes are *possible*. For example, the melting of the Greenland and West Antarctic ice sheets would result in large sea level rises changing the world’s physical and human geography. Changes in the thermohaline circulations (the ‘conveyor belt’ of ocean heat that determines much of the earth’s climate) affecting the Gulf Stream would lead to dramatic changes in global weather patterns. Climate tipping points could be reached, unleashing self-reinforcing multiplier feedback effects—e.g., saturated carbon sinks, releases of methane from arctic permafrost thawing—that could dramatically amplify temperature increases. Given that catastrophic events are possible in the long run and that the damage they can inflict could be devastating for the whole of humanity, acting to abate greenhouse gases should be viewed as insuring against uncertain but potentially catastrophic outcomes. Again, what we do today, will have effects for decades and even centuries.

A second, *conceptually distinct*, argument for urgent and ambitious action is grounded in the fact that the world’s poorest people—those who are least able to cope—are going to suffer the most and soonest from climate change’s adverse effects. Climate stability is in one sense a perfect example of a global public good, because a given quantity of heat trapping gas emitted in Chicago, Beijing or London, or for that matter anywhere in the world, will have the same effect on atmospheric concentrations. The impact, however, these concentrations have on climate experienced in any given location as well as the effect of changes in climate on human well-being will be quite different from one region to another.

For example, according to Yale University economist Robert Mendelsohn, usually cautious in his assessments of global warming, climate-driven changes in global agricultural output will acutely affect poor households in the developing world. Reductions will be especially severe in rain-fed crop farming (as distinct from irrigated farming and livestock management); for example, Chinese farmers on rain-fed farms will likely lose annual net revenue of \$95 per hectare per degree Celsius, while their African counterparts will lose \$28. Meanwhile, William Cline of the Peterson Institute for International Economics predicts that developing countries will suffer an average 10-25 percent decline in agricultural productivity under business-as-usual emissions (discounting carbon fertilization). The poor will also suffer from heightened water stress and scarcity. Changed runoff patterns and continued glacial melting will have significant implications on water availability, interacting with already severe ecological pressures on water systems. According to the IPCC, Central Asia, Northern China, and the northern part of South Asia face serious vulnerabilities associated with the retreat of glaciers whose river systems provide water and sustain food supplies for over two billion people.

Climate change projections also point to intensified tropical storms, more frequent and widespread floods, and drought, where disaster risks are skewed towards developing countries: while 1 in 1,500 people were affected annually by climate disasters in OECD countries between 2000 and 2004, in developing countries as many as 1 in 79 people were affected. Monsoon floods and storms in South Asia during the 2007 season displaced over 14 million people in India and 7 million in Bangladesh. Globally, the one billion people who live in urban slums, on fragile hillsides, or flood-prone river banks are among the most vulnerable to such extreme weather events.

Climate change is also likely to adversely affect the health status of millions of people with low adaptive capacity. An increased prevalence of malnutrition is likely while changing pathogens and vector-borne diseases will extend the reach of malaria and dengue fever.

While the richer parts of the world do not face such negative effects with the same intensity and within the same timeframe, they do potentially face the danger of longer-term catastrophic outcomes. Moreover, the social and political instability that climate change could cause in the poorer parts of the world could have serious consequences for overall peace and stability the world over.

There are, therefore, two fundamental strategic reasons to address climate change. In the near future the consequences of climate change will be felt most acutely by the world's poorest people. In the longer term, the sustainability of development and well-being on our planet as a whole is at stake. On both counts, ambitious and urgent action is required.

Key Elements of a Global Deal for Vulnerable Countries

At the COP14, agreeing "in extremis" to what is known as the "Bali Roadmap" or the "Bali Action Plan," parties to the UNFCCC committed themselves to launching negotiations on strengthened action against climate change. The hope has been that this process would culminate in an ambitious negotiated outcome at the 2009 meeting in Copenhagen, which would enter into force before January 2013.

Yet to meet the political requirements of all participating countries—and the world’s most vulnerable countries in particular—a new global deal must include the following elements:

- **Improve and Broaden the Global Carbon Market**

The need to contain mitigation costs in developed countries and to help finance abatement strategies in the developing world has made carbon markets and offsets central to the post-2012 agreement. Because negotiators broadly agree that developing countries and developed countries have differentiated responsibilities in GHG mitigation, the Kyoto Protocol established hard caps on developed world emissions and allowed for the purchase of offsets in developing countries through the Clean Development Mechanism (CDM). These offsets have the advantage of both facilitating developed world abatement at lower cost in the developing world, while channeling resources to developing countries that build their GHG abatement capacities.

Yet reform is needed in the successor to the Kyoto Protocol’s CDM. Serious concerns have emerged about the current mechanism regarding whether or not credited reductions are additional, real, verifiable, and permanent. A reformed CDM could hold the key to linking regional carbon markets in the future, but much needs to change before that can happen.

Today, half the world’s GHG emissions come from developing nations. But in 2030, carbon dioxide emissions from non-OECD countries are projected in the business as usual scenarios to exceed those from OECD countries by 72 percent. According to the U.S. Energy Information Agency, most of the emissions growth in emerging markets is

likely to come from the consumption of fossil fuels (mainly coal, gas, and petroleum), which are feeding power generation and transportation needs.

Given the importance of having an effective mechanism to help manage abatement costs and create incentives for developing country engagement, changes to the CDM should be included in any new agreement.

- **Reduced Emissions from Deforestation and Forest Degradation in Developing Countries**

Since land-use and land-use-change (mainly through tropical deforestation) accounts for roughly 20 percent of global GHG emissions—a share larger than either the entire global transport or industrial sectors—forestry holds out a deceptively simple answer to abating emissions at lower cost and generating income for forest-dwelling communities and forest-rich developing countries. After all, halting deforestation should be easier than transforming the energy economy. Yet, it has proven remarkably difficult to alter forest conservation incentives.

Tropical forests—which hold most of the world’s forest carbon—are disappearing at an alarming rate of five percent per decade globally. Each year more than 13 million hectares of forest is lost.

With the World Bank estimating a \$5 per ton price for forest carbon, the cost of forest conservation would amount to only one eighth the cost of non-forestry carbon securities today in Europe. The fact that nonetheless today the forest carbon market is less than \$100 million, only 0.16 percent of the \$64 billion worldwide market for carbon-denominated assets points to tremendous efficiency loss. It also points to a missed

source of development funding—scaling up the forest carbon market could yield over \$30 billion annually for developing countries.

For 90 percent of those living on less than a dollar a day, forests can provide food, fuel, and a source of livelihood. Forests tend to soak up rainwater and release it slowly, thereby acting as a natural defense against flooding and drought. Forests can improve water quality by filtering harmful pollutants, pathogens, and sediment that can cause illness in people or livestock.

The international community is in the process of including the forest sector fully in the upcoming global climate agreement. It will be critical that incentives enable emission reductions that are monitored, reported and verified to international standards that are agreed upon by the Conference and that the negotiating capacity of developing countries (including indigenous communities) is increased prior to December.

- **Financing International Adaptation**

Assigning responsibility for meeting adaptation finance needs will likely remain a central obstacle in forging a post-2012 climate change agreement. Although climate change threatens all people, its adverse effects will be felt most acutely in the world's least developed countries and small island states—those countries that are least able to cope. Developed countries have agreed in principle to help developing nations adapt, but the scale of the assistance contemplated so far falls well short of poor country expectations. Developed countries also want to use adaptation finance as an instrument to encourage poorer countries to incorporate mitigation policies into their national development program, introducing conditionality into adaptation aid. The nature of such conditionality as well as the determination of how the burdens are shared, how

revenues are raised, and how funds are governed will likely play a central role in who participates in any post-Kyoto agreement. Success will depend on forging an international consensus and substantial political will on the answers to difficult and politically charged questions:

- *Levels of Funding:*

High degrees of uncertainty make predicting the cost of adaptation extremely difficult for it will depend greatly on the extent of global warming. Compounding difficulties is the near impossibility of disentangling adaptation needs from traditional development challenges. As such, estimates of the level of funding needed to assist developing countries manage the adverse effects of climate change vary widely: the UNDP estimates that additional adaptation finance needs will amount to \$86 billion annually by 2015, while the UNFCCC places the annual cost between \$28-67 billion by 2030.

The UNFCCC currently manages three adaptation funds: the Least Developed Country Fund, the Special Climate Change Fund, and the Adaptation Fund. The Global Environment Facility (GEF) has also started to fund small-scale adaptation projects through its core account. Yet as of June 2008, the \$320 million pledged cumulatively since the GEF received its mandate from the UNFCCC in 2001 to pilot adaptation action under the three financing mechanisms, only \$154 million has been disbursed. Moreover, all are woefully under-funded relative to even the lower register estimates above. Additional funds will be needed to meet the task.

With the G7 Gleneagles aid commitments to Sub-Saharan Africa still \$14.5 billion shy of the \$21.5 billion 2010 target, the prospects for mobilizing an even greater amount on top of that for climate adaptation throughout the developing world is daunting.

- *Mechanisms:*

Given the desire to mobilize substantial resources on an annual basis over a sustained period, resource mobilization mechanisms that have some degree of automaticity, such as an automatic share of carbon revenues or some kind of tax on certain transactions have considerable appeal in principle, although not much of a track record in practice. One long-standing proposal looks to link the creation of the International Monetary Fund's Special Drawing Rights (SDRs) with the financing of global public goods that benefit humanity as a whole, including climate protection as well as protection from infectious disease.

In both the U.S. and the EU policymakers are considering legislation that would create new adaptation funds capitalized by revenues from auctioning emissions rights under national and regional cap-and-trade programs. According to EPA analysis, the Waxman-Markey bill would allocate approximately \$3.4-5.4 billion annually by 2020 for direct climate change assistance from the U.S. government to developing countries (\$476-786 million for clean technology deployment, \$2.4-3.8 billion for international forest conservation, and \$476-768 million for adaptation). In Europe, annual auction revenues from the Emissions Trading Scheme (ETS) are estimated to reach €75 billion (\$105 billion) in 2020, of which 20 percent, or €15 billion (\$21 billion), would be dedicated to climate-change related activities including efforts to facilitate adaptation in developing countries. One problem with allocating a fixed proportion of allowance revenue for adaptation finance is that adaptation funds would be small in the beginning and would grow later as the value of the allowance goes up whereas there is an immediate need for investments in support of adaptation.

Revenues raised from international air travel, bunker fuels, and free allowances under cap-and-trade bills represent potential new sources for adaptation funding that would be more predictable than yearly appropriations, much like cap-and-trade allowances.

- *Governing Funds:*

Since adaptation planning and implementation must be done across sectors at national and local levels, assistance must be provided horizontally and must be integrated with national development planning. Moreover, for recipients to be active stakeholders, they should have considerable say over the allocation of the funds; something developing countries feel strongly about.

Recommendations for Action

Because a relatively small number of large emitters (counting the EU as one actor) account for more than 80 percent of all emissions (with China and the U.S. alone accounting for about 40 percent of GHG emissions), there is a strong case for letting the group of major emitters, and particularly the U.S. and China, play a key and leading role in the global solution. It would be a mistake, however, to abandon or marginalize the UN-led, global UNFCCC framework.

There is something about a universal or close to universal agreement that generates greater legitimacy than a treaty between a limited number of countries, particularly when it relates to the future of the planet. It is not unreasonable to suggest that a universal framework for the protection of climate and of related matters such as biodiversity will benefit from a degree of legitimacy and support that a simple “minilateral” treaty will not be able to attract.

The way forward should be to continue to work within the “universal” UNFCCC framework, but support that process with “minilateralist initiatives” and various practical and flexible approaches, with the aim of putting in place the building blocks of globally accepted and enforceable policies.

- *Continue Bilateral Negotiations Between China and the U.S.*

Reaching consensus on climate change between the world’s two largest greenhouse gas emitters in a manner that serves the interests of both parties will be central to forging a strong agreement in Copenhagen. Echoing recommendations forwarded by my Brookings colleagues Kenneth Lieberthal and David Sandalow (now U.S. assistant secretary of energy for policy and international affairs), China and the U.S. should focus their bilateral negotiations on a number of flagship efforts to promote clean energy. Proposals include creating a new dialogue on climate change and energy to parallel the existing Strategic Economic Dialogue, achieving one or two headline initiatives—such as developing commercial, operational carbon capture and storage projects—and promoting capacity development for monitoring and reporting GHG emissions. These efforts would go a long way towards overcoming issues of mutual mistrust between the two countries and could help significantly in shaping an agreement in Copenhagen. Nonetheless, this should not be presented or interpreted as the emergence of a Climate Change G-2 that would impose its views on the rest of the world. Such a perception would generate political reactions that could undermine a broader agreement. U.S.-China cooperation should be explicitly designed to exert the kind of leadership that will bring other countries into a broader deal, not as something they will resent.

- *Engage at the Major Economies Forum (MEF) on Energy and Climate Change*

Continued engagement at the MEF (which includes Australia, Brazil, Canada, China, the Czech Republic, Denmark, the EU, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, South Africa, South Korea, Sweden, the UK, and the U.S.) could catalyze significant movement on global and individual abatement targets. Mexico's recent commitment to reduce its CO2 emissions by 50 million tons annually has made it the first developing country to make a unilateral commitment and has positioned Mexico to be a key interlocutor in the months preceding Copenhagen. With the majority of developed countries considering abatement targets well short of the 25 to 40 percent reductions (relative to 1990 levels by 2020) called for by developing countries, the MEF might be the appropriate venue (given its smaller size and Mexico's potential to play an outsized role) to broker palpable departures from current negotiating positions and reach a greater consensus in advance of Copenhagen.

- *Re-envision success*

The desire to fully realize the Bali Roadmap and reach a broad and binding agreement in Copenhagen should not lead to an all-or-nothing approach for COP15. While time is not on humanity's side relative to IPCC forecasts, agreement on a broad framework, including 2020, 2030 and 2050 global targets, national targets for all developed countries, agreement to develop national action plans by most large emerging market economies and more detailed consensus on some issues—including reducing emissions from deforestation and degradation in developing countries (which seems likely) and/or technology cooperation—would be welcome progress. Such a “deal” would have to overcome most of the sticking points mentioned in this brief. The exact mechanisms and specific institutional arrangements that will have to govern carbon markets and adaptation finance may require more work, more detailed design and further political compromise. As long as COP15 can craft an initial broad agreement,

strong guidelines and ensure follow-up work on these matters, Copenhagen could still be a historic success.

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Mr. FALEOMAVEGA. Thank you, Mr. Derviş.
Dr. Janetos.

**STATEMENT OF ANTHONY JANETOS, PH.D., DIRECTOR, JOINT
GLOBAL CHANGE RESEARCH INSTITUTE, PACIFIC NORTH-
WEST NATIONAL LABORATORY, UNIVERSITY OF MARYLAND**

Mr. JANETOS. Mr. Chairman and Mr. Manzullo, thank you for the opportunity to talk with you today.

May I have the first slide, please?

The IPCC Fourth Assessment Report was a milestone in terms of presenting our evolving knowledge of climate impacts. It provided documentation of literally thousands of impacts of climate change on natural resources, on coastal regions, on human health, on animal and plant species, and on agricultural productivity. Out of this report emerged a clear consensus that not only are we beginning to see the impact of long-term changes in the climate system but also that we expect such impacts to continue to grow in future decades, especially if greenhouse gas concentrations in the atmosphere continue to rise as they have been doing.

As our scientific knowledge has continued to evolve. Since the IPCC report, many publications indicate, for example, that their projections of sea level rise may have been conservative, raising additional concerns for low-lying island nations, for coastal barrier islands in such parts of the world as our own southeast coast and Gulf regions. We now have a better appreciation of the challenges to marine and coastal resources presented by the acidification of the oceans, which inhibits the abilities of many organisms, including many species of corals, to form their calcium-carbonate-based exoskeletons that we notice from above.

In addition, such reports as the U.S. Government's own assessment of the impacts of climate change on agriculture, land resources, water resources, and biodiversity indicate widespread current impacts on U.S. natural resources.

The recent publication of the U.S. Global Change Research Program's report, *Global Climate Change Impacts on the United States*, demonstrates that concern over both observed and projected impacts extends to the transportation sector, to health and nutrition, to agricultural productivity, and to the energy sector, as well as impacts we already know well and natural resources.

That report also begins to outline how some sectors and regions are responding to climate change as they develop their own adaptation strategies.

Finally, IPCC and subsequent reports have convincingly demonstrated that while no nation or region of the world is immune from the impacts of changes in the climate system, there are systematic additional vulnerabilities in the developing world. And many, although not all, parts of the tropics and subtropics, the impact of even modest climate changes on agricultural productivity are expected to far outweigh those in the productive regions of the United States and Western Europe, for example. The influences of sea level rise in island nations are clearly more problematic than they are for us, although different regions of the U.S. clearly have different vulnerabilities than the overall national picture. More-

over, the supply of fresh water on many islands is clearly affected by rising sea level.

What are some of the factors that determine vulnerabilities of natural resources and societies to changes in climate?

There are many such factors. For the physical world, there are different characteristic responses, for example, in crop plants, both the increases in atmospheric concentrations of carbon dioxide and changes in temperature and rainfall. Even very common crops, such as corn, have characteristic times during the growing season where they are extraordinarily sensitive to high temperatures. We know about the major cereal crops in the temperate zones significantly more than we understand about most tropical crops, although rice is beginning to be particularly well understood.

Societal vulnerabilities, though, are more complicated. Our current understanding indicates that there are a combination of both sensitivities and natural resources in the physical systems, but they also include economic well-being, the distribution of resources, human capital and knowledge, and access to resources that can be mobilized when impacts are beginning to be felt.

In the IPCC, we began to analyze some of these factors and how they may change over time using research published by our own institute and that from other colleagues. What we find in such analyses are some general principles: Poorer countries are, in general, more vulnerable than richer, although within every country there are poorer regions and populations of people that are more vulnerable than the average. Countries in the tropics and subtropics have more apparent vulnerabilities than those in the northern temperate latitudes. Coastal regions, islands, and mountainous regions will suffer from more immediate impacts than other places.

Perhaps the most important insight was the realization that the adaptive capacity of many countries, including our own, is not unlimited and that under scenarios of rapid and large climate change that capacity can be overwhelmed.

How are people beginning to respond?

We now see evidence of people beginning to respond by trying to adapt to change in large part because they feel they must, because we are beginning to experience impacts. There are challenges that continue to face us.

In my own view, it is critically important to begin to develop adaptation strategies that take into account known sensitivities of natural resources and of transportation, energy, and health and to begin to institute programs to build resiliency in particularly vulnerable parts of the world. At the same time, it is crucial to begin collecting information on the cost and effectiveness of such different strategies. We have very little information, although the scientific community has been calling for this type of knowledge for well over a decade.

As we need to begin to understand both this fundamental science and the economics of adaptation for our own resources, our own society, it is equally important that we begin to understand and assist countries less fortunate than our own. Several studies of the national security implications of climate change for the U.S. have concluded that severe climate impacts in the developing world could reduce our own security for many reasons. It has also been

argued that countries such as the U.S. could dramatically improve our collective understanding of these features and that this knowledge could serve the developing world as well as ourselves, if applied appropriately.

I will not pretend to offer prescriptions for success. It is clear that the policy process will have to wrestle with these observations and findings. But it is equally clear that adapting to changes in climate that cannot be avoided is an essential part of an overall strategy of response to climate change and that the most vulnerable parts of the world in general are those countries that are less fortunate than our own.

Thank you; and I, too, will be happy to address any questions you may have.

[The prepared statement of Mr. Janetos follows:]

23 July 2009

STATEMENT TO THE HOUSE OF REPRESENTATIVES COMMITTEE ON FOREIGN
AFFAIRS
SUBCOMMITTEE ON ASIA, THE PACIFIC, AND THE GLOBAL ENVIRONMENT

Dr. Anthony C. Janetos
Director, Joint Global Change Research Institute
Pacific Northwest National Laboratory/University of Maryland

Mr. Chairman and Members of the Committee and Subcommittee, thank you for the opportunity to talk with you today about climate changes, their consequences and impacts for natural resources and communities, our understanding of the vulnerabilities of different parts of the world, and how this understanding might inform the ongoing policy process.

I am the Director of the Joint Global Change Research Institute, a joint venture between the Pacific Northwest National Laboratory and the University of Maryland. I was originally trained as an ecologist. Our Institute has an interdisciplinary approach to understanding climate change and the potential responses to it – we do research and modeling on the energy economy and greenhouse gas emissions, on climate impacts to agricultural productivity and ecosystems, and increasingly on potential adaptation responses and regional vulnerabilities to climate impacts, in addition to our ongoing work on the importance of technology development and emissions scenarios for the important greenhouse gases. I have also been fortunate to be an author in several IPCC reports dealing with climate impacts, adaptation, and vulnerability, as a leader in national assessments of climate change impacts, and as an author in the recently released report from the US Global Change Research Program, *Global Climate Change Impacts on the United States*.

In each topic below, I will try to characterize some of the differences between the concerns we have in our own country with those in the developing world.

I would like to cover four areas briefly in my testimony:

- What do we now know about the impacts of climate change?
- What are the factors that determine the vulnerabilities of natural resources and societies to changes in climate?
- How are people beginning to respond to climate impacts?
- What are some of the challenges that still face us?

What do we now know about the impacts of climate change?

The IPCC Fourth Assessment Report was a milestone in terms of presenting our evolving knowledge of climate impacts. It provided documentation of literally thousands of impacts of climate change on natural resources, on coastal regions, on health status, on animal and plant species, and on agricultural productivity. Out of the IPCC report emerged a clear consensus that not only are we beginning to see the impacts of longer-term changes in the climate system, but also that we expect such manifestations to continue to grow in future decades, especially if greenhouse gas concentrations in the atmosphere continue to rise as they have been doing.

But our scientific knowledge has continued to evolve. Studies and findings since the IPCC report was published indicate, for example, that IPCC's projections of sea-level rise may have been conservative, raising additional concerns for low-lying island nations, for coastal barrier islands in such parts of the world as our own Southeast coast and Gulf regions. We now have a better appreciation of the

challenges to marine and coastal resources presented by the acidification of the oceans, which inhibits the abilities of many organisms, including many species of corals, to form their calcium carbonate exoskeletons. In addition, such reports as the US Government's assessment of the impacts of climate change on agriculture, land resources, water resources, and biodiversity indicate widespread current impacts on US natural resources, with the prospect of accelerated levels and rates of impacts in coming decades.

The recent publication of the new US Global Change Research Program's report, *Global Climate Change Impacts on the United States*, demonstrates that concerns over both observed and projected impacts extends to the transportation sector, to human health and nutrition, to agricultural productivity, and to the energy sector, as well as to natural resources and the living world. That report also begins to outline how some sectors and regions are beginning to respond to climate change, as they develop adaptation strategies.

Finally, the IPCC and subsequent reports have convincingly demonstrated that while no nation or region of the world is immune from the impacts of changes in the climate system, there are systematic additional vulnerabilities that exist in the developing world. In many, although not all, parts of the tropics and sub-tropics, the impact of even modest climate changes on agricultural productivity are expected to far outweigh those in the productive regions of the US and western Europe, for example. The influences of sea-level rise on island nations are clearly more problematic than they are for us, nationally (although different regions of the US clearly have different vulnerabilities than the overall national picture). Moreover, the supply of fresh water on many islands is clearly affected by rising sea level, and the consequent reduction of the size of the freshwater "lens" that often supplies drinking water.

What are the factors that determine the vulnerabilities of natural resources and societies to changes in climate?

There are many factors that determine the overall vulnerability of natural resources and societies to changes in climate. For example, different crops have different responses both to the increased concentrations of carbon dioxide in the atmosphere, and increase their growth rates at different levels depending on the specific biochemical pathway of photosynthesis in the plants. At the same time, they also have characteristically different responses to extremes of temperature and rainfall, which in many cases inhibit the growth response to CO₂. For example, even a crop as common as maize goes through a period in its lifecycle where heat waves can significantly reduce pollination success, and therefore the ultimate production of kernels for consumption. The major temperate cereal crops are significantly better understood in these respects than most tropical crops, although the responses of different varieties of rice are also well understood. Different species of trees, of animal wildlife, and of marine species all have characteristic responses to the combination of changes in climate, CO₂ concentrations in the atmosphere (or acidity in the oceans), and to other sorts of disturbances from both natural and human sources.

Societal vulnerabilities, though, are more complicated. Our current scientific understanding indicates that they are a combination of both physical sensitivities (what happens to forest and ecosystem processes), economic well-being, and distribution of resources, human capital and knowledge, and access to resources that can be mobilized when impacts are beginning to be felt. Perhaps the simplest way to think about this is that the overall response to agricultural impacts depends not only on what happens to crops in a particular part of the world, but also what resources are available to import food from other places, whether the institutions to manage those transfers are in place, and whether the knowledge exists to make use of appropriate mechanisms for response. Under one set of conditions, regions and societies could successfully adapt – under another, one has the conditions for famine.

In the IPCC, we began to analyze some of these factors and how they might change over time, as climate itself changes, using research published by our own Institute and that from other colleagues.

Elizabeth Malone and other collaborators at our institute have derived, for example, a set of indicators known as the Vulnerability and Resilience Indicator Model (VRIM), which is a first attempt to systematize indicators of vulnerability that combine ecological, economic, and social factors at a country level. We use VRIM to provide insights into how different countries' capacity for adaptation could change over time in different climate change scenarios, compared to today and to reference baselines.

What we find in such analyses are some general principles – poorer countries are in general more vulnerable than richer, although within every country, there are poorer regions and populations of people that are more vulnerable than the average. Countries in the tropics and subtropics have more apparent vulnerabilities than those in the northern temperate latitudes. Coastal regions, islands, and mountainous regions will suffer from more immediate impacts than other places. But perhaps the most important insight from the IPCC evaluation of this literature was the realization that the adaptive capacity of many countries, including our own, is not unlimited, and under more scenarios of rapid and large climate change, the physical changes in climate can overwhelm adaptive capacity, leading to potential displacement of agriculture, natural resources, damages to the built environment, and the potential displacement of very large numbers of people from sensitive countries and regions around the world.

In more recent research, some of it focusing specifically on Southeast Asia, while we find that the potential for rapid economic growth may ameliorate some of these impacts, it is very unlikely to eliminate them all. Rice agriculture, for example, is extremely sensitive to changes in the hydrologic cycle and the timing of the Asian Monsoon, and while those changes cannot be predicted easily, the consequences of even small reductions in the productivity of this major crop would be extremely severe. Most immediate, however, are the potential vulnerabilities to storm surge and sea-level rise, with the combination of very large, and often very poor populations of people in harm's way. Their options for responding are limited, and this has the potential to significantly affect standards of living and the distribution of large numbers of people.

How are people beginning to respond to climate impacts?

There is an emerging literature on adaptation to climate change, based on the fact that we are already beginning to see climate impacts around the world, and therefore, people are beginning to respond in practice. The scientific and policy communities are also attempting to understand the phenomenon of adaptation better than we currently do, in order to provide our best evaluation of practices that work and those that do not.

In some cases, regions, cities, and even some countries have begun to implement specific programs of adaptation to climate change. For example, several cities in the US have instituted early warning systems for heatwaves in order to ameliorate the human suffering that can be the result of such episodes. There is agricultural research on trying to breed crops that are more resilient to drought and heat waves, or on management techniques for dealing with the impact of heat waves on domestic animals. There has also been the beginnings of applied research on how we might increase the resilience of transportation systems, of reducing the vulnerability of coastal regions to storm surge and sea level rise, and so forth. Some cities in the US, for example New York, have created entire programs devoted to long-term planning of their critical infrastructure and operations, with an eye towards increasing their own adaptive capacity to climate change. The UK has instituted its own national program of adaptation, with a national catalogue of practices that are being tried on all levels.

In other cases, for example, how we choose to deal with vulnerable natural ecosystems, such as coastal marshes, coral reefs, and many aspects of wildlife, it is less clear exactly how to respond, and what actions might be successful for adaptation. This is an important area for research, and the scientific community has called many times over the past decade for more focus on the costs and effectiveness of potential adaptation actions.

In developing countries, however, the situations we face here in the US or in Europe, are magnified. There are many more people at risk, many more are already under severe environmental stress, with insufficient access to drinking water, insufficient security for food, and without easy access to social resources and capital that might be deployed to protect them.

What are some of the challenges that still face us?

In my view, it is critically important to begin to develop adaptation strategies that take into account known sensitivities to climate change of natural resources and of such sectors as transportation, energy, and health, and begin to institute programs to build resiliency in particularly vulnerable parts of the world. There are many aspects of this challenge where scientific research will prove to be invaluable – we need to know much better than we currently do how the combination of climate and other stresses affect crop production, for example, in the most important crops in the developing world. It is equally critical to continue to get a much better handle on the actual regional changes in climate that we might expect over the next several decades, as well as over the century, because there are many investments in infrastructure – water projects, transportation projects and the like – whose design life will coincide with near-term changes in climate and not just century-long projections.

At the same time, it is crucial to begin collecting information on the costs and effectiveness of different adaptation strategies. What is the right balance, for example, of rebuilding coastlines with a combination of hard defenses, like seawalls, levees, and dikes, and softer defenses, like re-constituted coastal marshlands, wetlands, and mangroves? What other ecological services might be provided by ecosystem reconstruction? What are the interactions between adaptation strategies and greenhouse gas mitigation – the sequestration of carbon in agricultural systems and forests, for example? And how might the answers to these questions vary in different countries and under a continually varying and changing climate system?

As we need to begin to understand both the fundamental science and economics of adaption for our own resources, our own society and our own purposes, it is equally important that we begin to understand and assist countries less fortunate than our own. Several studies of the national security implications of climate change for the US have concluded that severe climate impacts in the developing world could reduce our own security, for many reasons that I will not go into here. It has also been argued that countries such as the US could dramatically improve our collective understanding of climate impacts, adaptation, and vulnerability, and that this knowledge could serve the developing world as well as ourselves, if applied appropriately.

I will not pretend to offer prescriptions for success. It is clear that the policy process will have to wrestle with these observations about climate impacts, vulnerability, and adaptation, and will need to find an acceptable balance in discussions among many different countries. But it is equally clear that adapting to changes in climate that cannot be avoided is an essential part of an overall strategy of response to climate change, and that the most vulnerable parts of the world, in general, are those countries that are less fortunate than our own.

Thank you, and I will be happy to address any questions you might have.

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Mr. FALEOMAVAEGA. Thank you.

The chair apologizes. We had earlier a distinguished member of our subcommittee, Mr. Inglis, but I hope he will return for his questions.

Dr. Wheeler.

**STATEMENT OF DAVID WHEELER, PH.D., SENIOR FELLOW,
CENTER FOR GLOBAL DEVELOPMENT**

Mr. WHEELER. Thank you, Chairman Faleomavaega and Congressman Manzullo.

Today, I am going to talk about climate change, but I have spent 15 years in the World Bank worrying about pollution all over the world. So if you have some questions about that, I would be happy to entertain those. And I should say as well, if you would like to talk Husky football, we can talk afterwards. My brother Bob worked at Northern for 20 years, so I know the situation there pretty well. We seem to have a northern Illinois nexus.

Mr. FALEOMAVAEGA. Is this Husky with the University of Washington?

Mr. WHEELER. Northern Illinois. It is a little different. You can talk to the Congressman about that.

Mr. FALEOMAVAEGA. I was just curious. I thought maybe there was only one Husky team. Several of my relatives played for the University of Washington Huskies.

Mr. WHEELER. What I thought I would mention here very briefly today follows what Tony said about the national security of the United States. I thought I would take as my keynote Senator Lugar's remarks yesterday. He really said we should think of the foreign assistance problem and climate change as evoking real national security problems in the United States, and so I want to offer a perspective on that.

There really are two aspects, both of which have been mentioned. One is the potential impact of climate change on the United States. The other is, obviously, the potentially horrific impact on developing countries; and that may well have implications for our security. So both are very important, I think, about the context of U.S. foreign assistance.

I would like to make an assertion here today and then back it up for a few minutes, and that is, in the confrontational climate change worldwide the struggle is going to be won or lost in the developing world. There are really two reasons for that. One has to do with sort of what we might call a direct defense of the United States against climate change and the other has to do with indirect defense through impacts in the developing world.

But, directly, we have got this problem. There is no doubt that climate change is going to impact the United States severely. But there is also very little doubt, when you look at the record, that emissions in developing countries are growing so quickly now. They have already surpassed emissions from developed countries year by year; and by the year 2030, they will probably match emissions from developed countries as a source of global warming.

So the bottom line here is we won't solve this problem without addressing the emissions problem in developing countries. Critical.

Now how do we do that? There are really two ways to address it. One is leveling up by taking punitive measures, trade sanctions, other approaches that would penalize countries that continue to emit carbon without restriction while we restrict ourselves.

My own view is that that is going to backfire. It is not a smart policy. Because we are trying over time to foster development in the world. We are trying to foster good relations with developing countries for the sake of our own security and for the sake of world prosperity. If we enact a number of measures like that in the face of the fact that developing countries really can't afford a lot of measures in the nearer term to finance a rapid transition of low carbon growth, we are basically going to build a backfire that we are going to regret.

I think there is another approach which is smarter and more targeted, and it is being discussed in the context now of the legislation in Congress. The Waxman-Markey bill includes features of both aspects of this. One is promoting the spread of clean technology in developing countries to targeted subsidies. There is a lot to be said about that. I won't dwell on it now, but I think there is a lot of room there for progress. About \$1 billion has been targeted on that by the bill through offsets and direct measures, and the administration has suggested \$400 million be spent through the Global Clean Technology Fund at the World Bank for that. I think it is a start. It is probably not sufficient. One could talk about that further.

The other dimension is deforestation. People in poorer countries are deforesting because the land is worth more in other uses. Now the U.N. Has finally realized that if we are going to stop that we will have to pay people to keep these lands and forests, but that leads to a host of questions about how to administer that and pay for it.

Again, in the Waxman-Markey bill, about \$1 billion has been allocated for the purpose through offsets. I think that is probably not sufficient, but it is at least a start.

But in the final analysis here, the real issue I think for the United States in sustainability and taxpayer support is going to be monitoring these arrangements. Here is a real opportunity for American leadership. It is our ethic to be transparent. We have the technological capability to monitor. I think the U.S. should step up and take the lead in the world movement for public disclosure emissions from deforestation and from industrial sources accessible to all as a way of making sure that when accords are reached they can be monitored effectively. Otherwise, I am afraid credibility will suffer.

Let me say a quick word about adaptation and vulnerability. As my colleagues have said, there is very little doubt that the impacts will be severe.

I think there are two aspects of the problem that are really critical for foreign assistance. One I might call an application of the 80/20 rule. You know that. It says usually 20 percent of the sources of a problem are accountable for 80 percent of the problem. Here it is more like a 90/10 rule. If you look at the impacts that we anticipate for climate change in the developing world, they are going to be very focused on a few unfortunate places. It is true for sea

level rise, and it is also true for bad weather. There is really a disproportionality here. If we are going to do assistance, we need to target it if we are going to be effective. We need at this look very carefully.

Having worked at the World Bank for a long time, I can tell you it goes against the grain to target instead of spreading aid around, but we will not have enough resources here to dissipate the money. We really need to think carefully about where these problems are going to hit and what we can do.

Secondly, in the domain of uncertainty, as my friend Kemal said, I think we have got a real opportunity here. If you look at the history of confrontation with climate variability in the past, this is not new. There have been numberless tragedies in developing countries involving climate events, droughts, floods, thousands of people killed, millions of people affected.

Question: Which countries have confronted this most effectively among developing countries? There is very little doubt about the answer. It is countries that have focused on developing their economic and human resources.

Let me put the plus here on human resources. If you actually look at the evidence, it is quite remarkable how much better on the resilience front countries do if they have focused on empowering and educating women. There are lots of reasons why that is true. There is a very important kind of nexus here.

So, in closing, I guess I would say, even if you are a climate sceptic and even if climate change itself is secondary for you, but you are really interested in promoting development of other countries, it seems to me a win-win here could be found in empowering and educating women. That would have benefits on both sides.

[The prepared statement of Mr. Wheeler follows:]



**Climate Change and Vulnerable Societies:
Achieving Sustainable Security**

Statement before the U.S. House of Representatives
Foreign Affairs Subcommittee
on Asia, the Pacific and the Global Environment

on "From L'Aquila to Copenhagen:
Climate Change and Vulnerable Societies"

David Wheeler

Senior Fellow, Center for Global Development

July 23, 2009

Thank you Chairman Faleomavaega, Congressman Manzullo and distinguished members of the subcommittee for inviting me to participate in today's hearing.

We're here today to talk about climate change and vulnerable societies, so I'd like to begin with one of those societies -- India. As Robert Kaplan and others have recently reported, a steadily-rising sea level has already driven thousands of people off the islands of the coastal Sundarbans region shared by India and Bangladesh. (Kaplan, 2008; Sengupta, 2007). Since 1980, India has suffered huge damage from bad weather: over 1,000 people killed and over 20 million affected annually by floods, and nearly 40 million affected every year by droughts.

It is possible to paint an even grimmer picture for the next forty years. My colleague, Bill Cline, a senior fellow at the Center for Global Development and the Peterson Institute for International Economics, finds that India's agricultural productivity could fall by thirty-five percent or more by 2080 if global warming progresses unabated. (Cline, 2007). And in a study I am completing with colleagues at the World Bank (Wheeler, et al., 2009), we find that India could lose as many as 50,000 lives to flooding, hundreds of millions could be seriously affected by droughts, and the number of drought-related hardship cases could mount into the billions by 2050. But we also find that these numbers have not been cast in stone by fate. If we successfully cap and then start reducing global carbon emissions during the next few years, India's climate-related losses will be lower. And even in the face of some inevitable warming from past global carbon emissions, we find that India's losses can be significantly reduced by measures that India itself can take. Continuing its rapid economic and human development will make India

much more resilient, drastically lowering the incidence of losses from flooding and droughts relative to today's levels, even in the face of significant climate change.

This lesson from India is my primary message today: Even if some climate change is inevitable (and we should do our utmost to slow or halt it), its impact on vulnerable developing countries is largely in their hands – and ours, because many cannot afford to take the needed measures in time unless we're willing to help. Our fate is tied to theirs, because the impact of their unchecked carbon emissions will strike us directly through more destructive floods, droughts, forest fires, violent storms and sea-level rise. Senator Lugar said earlier this week in a hearing on climate change and national security that climate change projections indicate greater risks of drought, famine, disease and mass migration, all of which could lead to conflict and global instability. And the destructive impact of the same forces in developing countries may pose additional threats to our own security, as millions of people become environmental refugees, climate-related stresses create more flash points like Darfur, and the resulting hostility focuses on the U.S. as a major carbon emitter.

CLIMATE VULNERABILITY AND DEVELOPMENT

For clarity in this context, it's useful to distinguish three kinds of vulnerability.¹ The first relates to the destructive impact of climate change itself: more frequent floods in some areas, droughts in others, and more dangerous storm surges as a rising sea level interacts with more powerful hurricanes in coastal areas. On this front, life is simply unfair – new research shows that some places will be hit much harder than others. For example, a one-foot rise in sea level, which we will probably see within thirty years, will

¹ For a more detailed discussion, see Buys, et al. (2007).

start putting a large area of the Nile Delta, Egypt's breadbasket, under water (Dasgupta, et al., 2009b). Millions of people in low-lying areas of Manila will be in critical danger from typhoon storm surges (Dasgupta, et al., 2009a).

A second meaning of vulnerability relates to resilience in the face of adversity. And this kind of vulnerability, unlike random weather events, can be affected by human effort. Last year, Oxfam International published a report titled *Rethinking Disasters: Why Death and Destruction is not Nature's Fault but Human Failure*. At first glance the title may seem cruel or ill-advised, since many thousands of people die every year in floods and droughts. But common-sense observation supports Oxfam. For example, Haiti and the Dominican Republic share an island and experience the same weather conditions. But year-in, year-out, Haitians are more than twice as likely to die from floods as Dominicans. And an examination of the record show that this is no accident. Over time, the Dominican Republic has invested more in flood prevention and disaster preparedness, and the results clearly show. If this difference persists, who can doubt that Haiti will suffer more from climate change than its neighbor?

A third meaning of vulnerability relates to poverty and human development, which affect both carbon emissions and resilience to climate change. On the emissions side, developing countries can ill afford the extra cost of low-carbon technologies, so countries like India, China and South Africa keep burning coal despite plentiful renewable power resources (Buys, et al., 2007). In a similar vein, poverty drives a major part of the forest-burning in Indonesia, Brazil and other rainforest countries.

On the climate impact side, poor families are more vulnerable because they can only afford to live in flood-prone areas where danger makes the rents cheaper. Poor

countries find it harder to fund adequate disaster preparedness, and new research indicates that disaster resilience is much lower in areas with low education levels, particularly for women (Toya and Skidmore, 2007; Wheeler, et al., 2009).

To summarize, in thinking about climate change and development we need to be aware of three facets of vulnerability: worsening weather, investments in preparedness, and the inevitable tradeoffs associated with poverty.

GLOBAL IMPLICATIONS FOR SUSTAINABLE SECURITY

We Will Win or Lose This Struggle in the Developing World

Thanks to research by thousands of climate scientists, we have a reasonably good idea about some things that are going to happen during the next several decades: It will get steadily warmer, the sea level will keep rising, and the climate will exhibit more variability, with more intense rainfall in some places and more intense droughts in others. Sometimes floods and droughts will occur in rapid succession in the same place, as generally-drier conditions are interspersed with periods of intense rainfall (IPCC, 2007). We suspect that coastal storms will also intensify, since the ocean will be warmer. This will interact destructively with sea-level rise, pushing water further inland and creating more potential for damage (Dasgupta, et al., 2009a). Agricultural productivity is also likely to be hard-hit in many areas (Cline, 2007). *All of these effects will strike developing countries more severely than developed countries, for two reasons: They are in higher-risk areas, and they are more vulnerable because they are less developed.*

We also have a reasonably good sense of the probable course of atmospheric emissions during the next several decades. Absent heroic efforts at mitigation which do not seem to be in prospect, the atmospheric concentration of CO₂ will continue to rise for a long time. *Developing countries have already surpassed developed countries in total emissions, and their cumulative emissions will probably account for half of global warming by 2030 (Wheeler and Ummel, 2007).* Before the current recession, global emissions were actually rising faster than the worst-case IPCC projection, and even with the slowdown they are probably tracking the worst-case projection.

To summarize, the global climate struggle will be won or lost in the developing world. For the United States, it immediately follows that a sustainable security strategy means greater development assistance on two fronts: Reducing developing-country carbon emissions as quickly as possible, and countering the impacts of climate change that have already become inevitable.

Where Are We on Emissions Limitation?

The Copenhagen conference on climate change is imminent, and the unfortunate truth is that we have yet to see significant movement toward the needed reductions in greenhouse emissions. Without a credible U.S. commitment to significant emissions reduction, China, India and other major developing-country emitters will not commit to limitations. Even if Congress enacts cap-and-trade legislation this fall, there will be no track record for our negotiating partners to evaluate. So at Copenhagen, developing countries are almost certain to reject commitments to emissions reduction unless they include binding commitments from developed countries to cover the cost. This applies to both fossil-fuel combustion and forest-burning, the two biggest sources of carbon emissions. Accelerating the transition to low-carbon development is within our reach, but it will only happen if rich countries agree to such measures. *And there is no doubt that we need them, since two more decades of emissions growth at the current rate are quite likely to sink us.*

Adapting to Climate Change

In my introduction to this testimony, I noted that the coming decades will hold the prospect of increasing damage from sea level rise in coastal developing countries, and adverse weather in all developing countries. In the preparations for Copenhagen, one of

the liveliest debates focuses on how much it will cost to finance the adaptive measures that will neutralize the effects of expected climate change. Since this debate has major implications for U.S. foreign assistance, it is extremely important to consider a few basic facts. First, as my India example shows, we don't have to wait for the future to witness climate catastrophes. They occur every year, as floods and droughts kill many thousands and seriously affect the welfare of millions in developing countries. But recent research has shown that knowing which countries are potentially vulnerable to these climate disasters tells us very little about the damage they actually suffer. Among developing countries, there are great differences in losses from floods and droughts, even when weather conditions are similar. And thanks to recent research, we're getting a clearer picture of the reasons why (Toya and Skidmore, 2007; Wheeler, et al., 2009).

Part of the difference is clearly due to economic development, since richer countries have greater willingness and ability to pay for protective measures. But a major part of the difference is also attributable to *human* development policies. Countries whose policies have focused on making their people healthier and better-educated suffer much less climate-related damage than otherwise-similar countries whose policies have not been as progressive. Part of the difference in results reflects an underlying commitment to public welfare that translates to better disaster preparedness. But a major part also reflects the resilience and capabilities of people who are healthier and better educated. And, as research and experience have taught us over and over again, this is particularly true for women. Show me a poor country that is educating and empowering its women, and I'll show you a country that is significantly more resilient than its less-progressive neighbors when bad weather strikes.

The Uncertainty Factor

Although we know that global warming will bring more adverse conditions generally, the climate modelers remain very uncertain about specifics. Most of the additional damage from sea-level rise will come from surges during randomly-occurring storms. Away from coastlines, most models agree about rising temperatures, but the future pattern of rainfall is much less certain. There are nearly two dozen global climate models in operation, and they often disagree about whether it will rain more or less in specific areas during the next several decades. This uncertainty is critical, because rainfall has a major impact on water supplies, agriculture, and the incidence of catastrophic flooding or droughts. We must take the high uncertainty level into account when thinking about U.S. foreign assistance policy.

IMPLICATIONS FOR U.S. FOREIGN ASSISTANCE POLICY

To summarize briefly: On the one hand, climate-related conditions are going to get worse, but unpredictably. On the other, climate-related conditions are already very bad in some countries, but vulnerability is much lower for countries whose policies have fostered economic growth and human development, particularly for women. Countries that have adopted these policies have more resources to cope with climate shocks, greater willingness and ability to pay for protection, and a public that is much easier to mobilize because it is healthier, better educated and more empowered.

For U.S. assistance policy, all of these factors point in the same direction: *The best path to sustainable security is sustainable development.* If we act wisely, our assistance policy can make a critical contribution to both reducing greenhouse emissions and increasing resilience to the climate change that is already inevitable. We can also help

with carefully-targeted assistance in two critical areas: clean technology promotion and forest conservation.

Clean Technology Promotion

The goal for clean technology promotion has to be cost parity with coal, as quickly as possible, so that private investors can participate in rapidly reducing the power-sector carbon emissions that account for over 25% of total global emissions. In practice, this means focusing billions of dollars on achieving scale and learning economies in commercially-promising clean energy technologies (Ummel and Wheeler, 2008; Neij, 2009). Donor countries have recently responded to this imperative with a Clean Technology Fund, administered by the World Bank, but its charter remains too unfocused for truly effective action and its resources remain quite limited.² The Obama administration's stated commitment to support for the CTF includes only \$400 million for the next fiscal year. The Waxman-Markey cap-and-trade bill, recently passed by the House, includes provisions for financing clean technology development, but they fall far short of the needed resources.

Transparency is also critical in this context. Taxpayers in the U.S. and other donor countries will only support such programs if their claims are credibly supported by observable progress in reducing carbon emissions. To sustain credibility, we need publicly-accessible systems to monitor developments on the ground. The Center for Global Development (CGD) is contributing to this effort with a prototype public disclosure system, CARMA (Carbon Monitoring for Action)³, which reports CO₂ emissions from power plants and power companies worldwide. CARMA is only a start;

² For the CTF's founding statement, see Paulson, et al. (2008). For my previous testimony to Congress on this issue, see <http://blogs.cgdev.org/globaldevelopment/2008/06/cgds-david-wheeler-outlines-st.php>.

³ CARMA is accessible online at www.carma.org.

we believe that the U.S. has an excellent opportunity to lead in this area by promoting an international disclosure system that tracks carbon emissions from power plants, motor vehicles and manufacturing. Such a program is technically feasible, and it would not be costly. It only requires the political will and a few million dollars for implementation.

Forest Conservation

Forest-burning is another enormous source of global warming, contributing about 20% of annual greenhouse gas emissions. Most forest-clearing occurs in developing countries that have limited resources and regulatory capacity. Since these countries also focus on poverty alleviation, their support for forest conservation will be weak as long as forested land has a higher market value in other uses. Under these conditions, many proprietors will continue clearing their forested land unless they are given conservation payments that match or exceed the opportunity cost of the land. This economic insight has led the UN to establish UN-REDD (Reducing Emissions from Deforestation and Forest Degradation in Developing Countries), a program that helps countries prepare for an eventual direct compensation scheme for forest conservation. The first prototype for REDD operations is the World Bank's Forest Carbon Partnership Facility (FCPF), launched at the UN's Bali conference on climate change in December, 2007. Target capitalization for this prototype facility is over \$300 million. However, the UNFCCC estimates that full conservation of remaining forests in the tropics and subtropics will require \$12.2 billion annually.

A compact negotiated this year in Copenhagen may support an expansion of UN-REDD to this scale, because carbon emissions abatement from forest conservation is much lower-cost than abating emissions from fossil fuels (Stern, 2006). The UNFCCC's

estimate of CO₂ emissions from forest-burning (5.8 Gt) implies an average abatement cost of only \$2.10/tonne (at an annual payment of \$12.2 billion).

U.S. contributions to this effort have been modest thus far. The Waxman-Markey bill contains provisions for financing forest conservation at a scale that could reach \$1 billion or greater. It will be critical for the Senate to maintain these provisions, and, if possible, to provide for even more support.

Sustained international support for such large payment flows will hinge on the operational credibility of REDD programs. For accountability, the global community will need access to a monitoring system that provides detailed, accurate and timely identification of deforestation in conservation-payment areas. To assist the international community in meeting this challenge, CGD is building and testing a prototype system called FORMA (Forest Monitoring for Action).⁴ But this is only the beginning; we need to move rapidly to an internationally-supported global monitoring system. With its leadership in satellite-based remote sensing technology and commitment to transparency, the U.S. can play a lead role in this effort. We believe that a fully-operational global system for monitoring tropical rainforest destruction can be maintained for no more than a few million dollars a year. It is not the financial requirement that is holding us back at this point -- just a lack of vision and political will.

Supporting Adaptation to Climate Change

Careful targeting of resources will also be critical for U.S. support of adaptation. Some problems are foreseeable: Large, vulnerable populations in storm-prone, low-lying coastal areas are simply going to get hit harder, and we will need to help. But we need to

⁴ An introductory preview of FORMA is available at <http://www.cgdev.org/content/article/detail/1422370/>.

target carefully on populous areas that are actually the most vulnerable.⁵ Similarly, there are some regions of the world where the global climate models line up consistently behind forecasts of more rain or more drought. Where that is true, it makes sense to plan for new protective infrastructure. But, to reiterate, careful targeting will be necessary. From my own experience of nearly two decades at the World Bank, I can attest that such targeting goes strongly against the grain. Conventional assistance policy leans strongly toward spreading aid around, rather than focusing it cost-effectively on specific targets. On the adaptation front, our limited resources will not be truly effective unless we are willing to target them.

We also need to acknowledge a fundamental truth about vulnerability to dangerous climate change. Wherever and whenever it occurs, we can be sure of one thing: The most resilience will be displayed by countries that have paid serious attention to sustainable economic and human development, particularly for women. When the chips are down, they will need far less help than neighboring states whose suffering from adverse conditions owes more to neglect of institutional and human resources than to relative poverty.

So the ultimate message here is very clear, and very consistent with what we have known for a long time about development: By focusing our assistance on human and institutional development, and particularly on educating women, we will take out very powerful insurance against catastrophes that could otherwise afflict poor countries as inevitable climate change occurs. Rededicating ourselves to these clear, attainable objectives will probably do more to reduce climate vulnerability than anything else we

⁵ For detailed evidence on the relative vulnerability of urban areas in developing countries, see Dasgupta, et al. (2009a).

can do. And it will also be the most cost-effective approach, because it will promote flexibility in the face of future uncertainty. Better to have healthy, well-educated, well-organized communities that can adapt quickly to unforeseen events, rather than large protective structures, the climatic equivalent of the Maginot line, that may be positioned for the wrong battle, against the wrong forces.

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Mr. FALEOMAVAEGA. Thank you, Dr. Wheeler.

I would like to turn the time to my colleague for a better introduction of Dr. Clark. I think I failed in that regard, too.

Mr. MANZULLO. That is okay, Chairman.

It is my pleasure to introduce my constituent, Dr. Redmond Clark. He is the current CEO of CBL Industrial Services. It is a firm that provides environmental products and services to domestic and international manufacturing companies, including the iron and steel industry, metal smelting, iron and steel recycling, et cetera. He has a Ph.D. in environmental sciences, with a specialization in climate change impacts modeling. He brings a unique perspective to our panel today; and thank you, Mr. Chairman, for allowing us to bring him in.

Mr. FALEOMAVAEGA. No problem.

Please, Dr. Clark, proceed.

STATEMENT OF REDMOND CLARK, PH.D., CHIEF EXECUTIVE OFFICER, CBL INDUSTRIAL SERVICES

Mr. CLARK. Thank you.

I have to mention that I did my graduate work at Southern Illinois University, which is the home of the Salukis, which are actually the best football team in the State of Illinois, the running dogs, as they say in Illinois.

At any rate, have that on the record, please.

Mr. FALEOMAVAEGA. Saluki, is that an Indian tribe?

Mr. CLARK. It is an ugly dog that runs fast.

We come at these issues from a different standpoint. I greatly appreciate the opportunity to speak today.

As a corporation, we are a foot soldier in the area of implementation. We are the people that go out and attempt to actually find processes that work to solve problems. That is what we do. And so when we work through all of these policies, the government will steer, policy will steer, treaties will limit, regulations will limit and impact our markets. But, at the end of the day, we will be responsible for developing the markets that solve the problems that we are trying to address. We are extraordinarily focused on that in our business, and we try to look strategically ahead and understand what is coming, not only so we can steer our company but so that we can anticipate the problems that are before us.

I have a long personal history in natural hazards modeling response management, and I agree with a number of things that have been said today. So rather than going through the details of my presentation, I will speak somewhat contemporaneously about some of the thoughts that we bring.

This treaty is an important treaty because it is going to reshape economies in some very significant ways. We are proposing to make the developing nations low carbon developing societies. We really don't know how to do that. We know how to get part of the way there, but we didn't know the rest way. This will be a leap of faith for all of us.

The developing nations, as has been previously indicated, they are vulnerable to climate change. They are very sensitive to climate treaty. Politically, they have got to provide for their citizens. They have to provide economic opportunity for them, and it will be hard-

er to do it if they cannot gain access to energy. They know that if they have access to carbon fuels, cheap carbon fuels in large quantities, they have a better opportunity to bring their citizens forward and live the kind of life that they see experienced in the developed nations.

At the same time, the developing nations are straining their ecosystems in a number of different ways. There are incredible challenges out there. We don't see how they will be resolved in this next treaty cycle, and it is a great challenge with the negotiators to come up with something that will work.

China is acting now on a political agenda. They are moving forward with a number of different things that we see that represent significant issues for us and for some of the other companies that we work with. A sitting government believes the economy has to grow at a 10-percent rate. That means that they are going to have to continue to push large quantities of energy into their industrial operations in order to continue in that growth curve. They are doing so because they have got 400 million people that are in disparate poverty. They do not feel that they are free to simply choose to step back from that growth agenda. They have got to take care of these people, or it is going to destabilize the government.

India is on a slower track, but they are moving in some of the same directions. And with 2.2 or 2.3 billion people between the countries, that means everything in terms of global and environmental security.

China has decentralized a lot of their decision-making process. It is going to be a lot harder to negotiate with them now, but we will speak on that in a moment. Neither of them want to play at Copenhagen. We understand that, and we understand their initial positions have been very clearly put out in the press. They are not going to agree to any carbon caps, and our lead negotiator has indicated he doesn't expect that China will agree to a carbon cap going in. Again, we think that is being driven by their political situation at home.

Now, in terms of key trends and developments, I haven't got enough time to look deeply into the energy markets. I will just simply say there has been a crash in investment in the carbon fuels industry across the world, and although oil and natural gas are plentiful right now, we expect that there are going to be some major price shocks coming at us over the next 5–7 years. Coal is holding its own in part because there is so much growth and external demand or international demand for coal as a secure energy source.

China is buying up massive quantities of energy resources or rights to energy resources. We estimate that China has purchased approximately 20 percent of the excess oil and gas production capacity of the world over the past 6 months, and they are continuing to purchase enormous assets in that area.

Now, in the past they have historically made that energy available outside of their country in normal markets in order to maximize return on their investment, but if we run into a period of shortages because of what has happened in response to the economic downturn, what we are going to end up with here is a situation where China has the ability to steer large quantities of energy

resources away from other developing nations, away from the developed nations and into their own economy.

If we as developed nations agree to cuts, and we do not ask the developing nations to participate, we are going to stimulate trade war. There is one going on right now. It is going to become more pronounced over time.

I am out of time here, I can't go through detailed examples here, but there are plenty of examples here in the U.S. where whole industries are going to disappear simply because we create enough of an energy gradient that we will invite extranational competition into our markets.

China is also expanding their energy-intensive infrastructure. They are hardwired now the way their economy is set up to continue to build, and they are going to continue to burn more and more carbon. They need it in order to grow their economy. India is following along that same path. The developed nations want to step back from that precipice, and here we are. The ramifications of these decisions are going to show up in all kinds of impacts in a number of different areas.

So, what do we do? What do we do when we step forward in these negotiations? And I think it was Dr. Wheeler who indicated that he thought taking a hard line was probably a mistake. My suggestion is that I would agree with him. We need to speak softly, but I think we also need to have a very large stick present in our back pocket should we need to use it, and I think trade restriction is, in fact, one of the major issues that we are going to have to have a serious discussion about. Maybe Dr. Wheeler and I can have a serious discussion at dinner afterwards and get busy about our football teams as well.

But our feeling is that if we are going to go into these negotiations, very simply we need carbon fuel reduction agreements from all of the key players, including the developing nations, whether it is a reduction in rate sector agreements, whatever. No financial support for mitigation without these agreements. Technology transfer, absolutely. I think it is critical. But there has got to be a quid pro quo, and that is an honoring of intellectual property rights by the developing nations. And, of course, the issue of carbon trading, I think, is open, and it is an effective mechanism that could be used to help make these things happen.

One last thought: We need metrics and transparency, of course, but when I was a relatively young man, we formed FEMA here in the United States, and one of the important lessons that FEMA learned was you don't throw good money after bad. You don't keep bailing people out over and over and over again so that they can return to the same floodplain, build their homes and get flooded out again.

The mitigation process we came up with was we will invest, but we will invest as we address the problem, not before we address the problem. And I think the precursor to significant gives on the part of the developed nations for the developing nations is a carbon agreement that is going to limit consumption by the developing as well as by the developed nations.

Thank you. I will be happy to answer questions.

Mr. FALEOMAVEGA. Thank you, Dr. Clark.

[The prepared statement of Mr. Clark follows:]

July 22, 2009

Committee on Foreign Affairs
US House of Representatives
Washington, DC, 20551

Attention: Subcommittee on Asia, the Pacific and the Global Environment

Honorable Congressmen and Congresswomen,

Within the last quarter, the US House of Representatives acted to initiate a new climate and energy policy direction for the US. That policy will attempt to restructure the energy utilization strategy of the US, moving our national economy away from carbon fuels by 2050. Assuming that the Senate and the President concur in concept, the US will approach the Copenhagen Climate Summit with legislative and executive approval to reach agreement on a global climate accord that will move the world economy in a similar direction.

Assuming that such an accord can be reached, the next 40 years will be a period of unprecedented economic, social and environmental change. Under the umbrella of sustainability, we are proposing to transition the developed economies to low carbon utilization societies, and we are proposing to change the developing nation's growth plans to low carbon utilization economies as well. We have lots of theories, but no one knows how to accomplish those goals at this time. We are embarking on a path with very uncertain outcomes, and that realization permeates the political and economic environments that our country faces. Those same concerns drive our corporate strategic planning processes, and many of the thoughts I will share with you today reflect our thinking on climate change and the drive towards global sustainability.

The players in these ongoing negotiations and conflicts can be separated into two groupings: the developed nations and the developing nations. This hearing intends to focus on the societies most vulnerable to climate change, and the committee wishes to know what might be accomplished at COP 15 with regard to those societies. That is a large and complex question, and I know that we cannot do justice to every impacted society and country or region. I would observe that although the expected effects of climate change will vary throughout the world based on physical environmental conditions, but the ability to respond to climate change impacts will be defined by the size of the country and their access to capital and energy resources. In our view, the world's largest developing nations – China and India – also represent some of the world's most vulnerable societies to climate change, and they are also far more vulnerable to the political and economic ramifications flowing from a global response to climate change. China has become a net importer of agricultural goods, is becoming one of the largest consumers of feed grains and is the driest (per capita) country in the world. Critical water resources are being lost to pollution and accelerated melting of ice reservoirs in the Himalayas. India is blessed with sufficient foods, but is already straining the carrying capacity of domestic resources and environmental systems. These two countries represent more than 1/3 of the world population, and both countries face significant domestic political issues because of the vast numbers of economically disadvantaged citizens. Both countries have already committed to a heavy industry and energy-intensive economic development strategy. Both countries face a similar political challenge: improve the economic lot of their poorest populations, or face the real risk of political instability.

China has translated those political realities into a host of economic actions. The sitting government believes that their national economy has to grow at an annual rate in excess of 10% in order to generate enough jobs to satisfy the poorest third of their population. By our estimates, the government needs

approximately 20 years of double-digit growth in order to accomplish those ends. As a part of that growth, China has vastly expanded its energy resource acquisition efforts and energy distribution systems. As another part of that growth agenda, China has become the lead heavy industrial producer in a number of energy-intensive industries. Although the central government pays lip service to sustainability and energy conservation, much of the developmental and environmental control has been ceded to regional and local governments. The expected results of their policies are reflected in Figure 1.

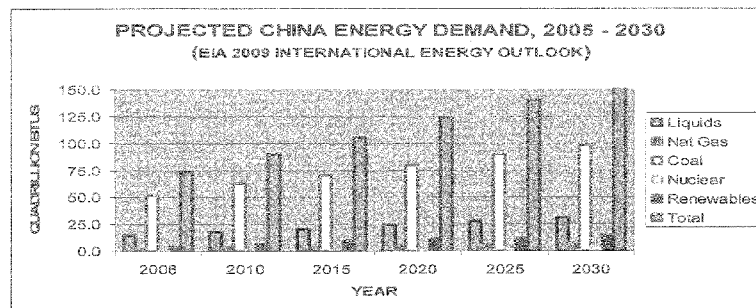


Figure 1: Forecast Changes in China Energy Consumption by Fuel Type

Their energy use is projected to more than double, with a growing reliance on coal combustion, and an index of expected CO₂ emissions – assuming no significant technology changes near-term that would reduce coal use or power plant emissions – shows China alone accounting for 50% of the projected world CO₂ emission increases (See Figure 2)

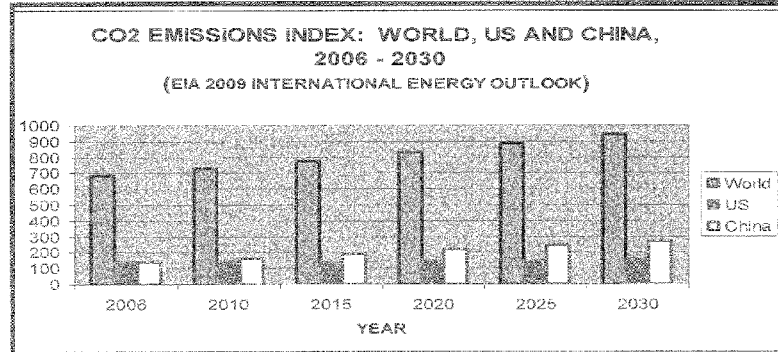


Figure 2: An Index of Expected Changes in World, US and China CO₂ Emissions Through 2030

India is following along a similar trajectory, but lags behind China by a decade or so.

As we approach Copenhagen, the initial positions of the key players are becoming apparent. The developed nations are putting proposals on the table to curb their use of carbon fuels over the next 40 years. Both China and India have indicated that they will commit to energy use reduction in concept,

but they are resisting any specific targets. Their argument is based on two spoken and two unspoken concerns. Their spoken concerns include:

- There is a direct, proven linkage between access to cheap, plentiful energy and personal/national wealth
- Their national per capita consumption of energy is far below the levels of the developed nations. Fairness dictates that we must cut back until there is parity between per capita energy use levels (See Figure 3)

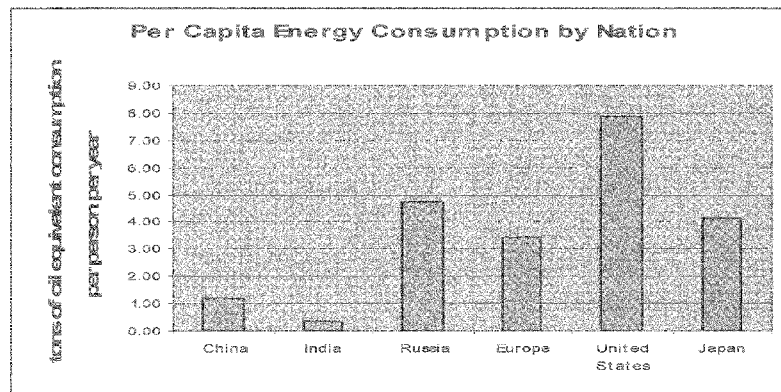


Figure 3: Variances in National Per Capita Energy Consumption Rates

Their unspoken concerns include:

- They will lose control of their national political system if they do not show sufficient progress in addressing the needs of their poorest populations.
- There is no clear path to development without energy

They point out that the developed nations caused the problem of man-induced climate change, and those same nations should bear the burden of repairing the damage they caused. Within the past month, spokespersons for both countries have issued statements indicating hard resistance to significant cutbacks in planned energy consumption. This may be the start of a negotiations process, but the lead developing nations are firmly entrenched. A true success at Copenhagen -- a treaty that commits all of the lead developed and developing nations to a course that will lead to a <2 Degree C increase in temperatures this century as defined by state-of-the-art climate models -- will be a real diplomatic challenge.

We have observed a number of trends and developments that should influence these negotiations. I will list them and include some brief discussion of each item. I am available to discuss them further with the subcommittee, subcommittee members or staff should you desire to do so. Following those points, I would like to make a few suggestions regarding the US negotiation positions going into the Copenhagen negotiations.

KEY TRENDS AND DEVELOPMENTS

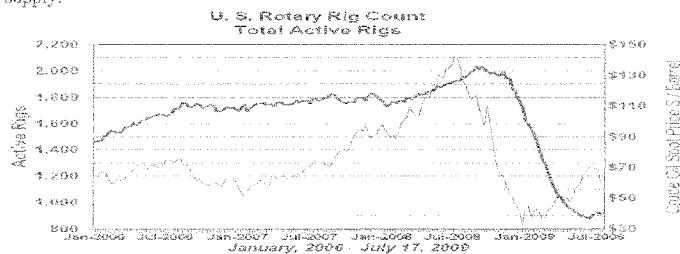
The recent successes and failures at the G8 Summit underscore the complexity of the problems we face. For the first time, the G8 nations agreed on targets and timelines to move towards a low-carbon world economy. At the same time, the G5 nations reiterated their positions that accumulated GHG levels in the atmosphere are the responsibility of the developed nations, and asked that the developed nations accept a target carbon use reduction of 40% by 2020. Those requests/resolutions were not accepted by the G8, and the result was a near-stalemate, which raises concerns about the Copenhagen Summit.

Although our firm is not obligated to track every development in the politics surrounding this policy evolution, we manage toxics and eliminate toxic emissions for a number of national and international businesses, and many of those businesses are energy-intensive manufacturers. We serve clients in developed and in developing nations, and we understand that as governments act to modify the global energy economy, they will cause significant changes in global commerce, and that will certainly influence our own operations. The comments we offer today reflect some of our own strategic view of climate change and government responses to the threats associated with those changes. We offer our thoughts in the hopes that this committee and Congress will be able to use them in order to make policies that are in the best interest of the United States.

We are entering a period of significant energy supply risk

Natural Gas

We are particularly troubled with recent developments in the energy supply sectors of the national and global economies. As members are no doubt aware, falling demand related to the recession has generated national and global oversupplies of natural gas, record storage and record low prices, all well beyond recent commodity forecasts. The drop in gas costs has been beneficial for families struggling during the recession, but the pricing downturn has all but stopped domestic exploration. Rig counts are very low, indicating that significant price recoveries will be required before new exploration and well development is initiated (See Figure 4). Excessive supplies and low price set the stage for price instability during any economic recovery. In addition, both carbon regulation and pricing differentials have already started fuel "switching" in select power generation markets. Finally, capital available for investment has fallen sharply, especially in North America. Any material economic recovery will create a risk that global gas markets will quickly move from an oversupply to an undersupply condition, and it will take a good deal of time for the supply side to right itself. The interim market would likely exhibit significant price instability and/or supply disruption until the market rebalances supply.



Sources: Baker Hughes, EIA (DOE), WIRG Economics

Figure 4: World Oil and Gas Rig Counts and Crude Oil Spot Prices

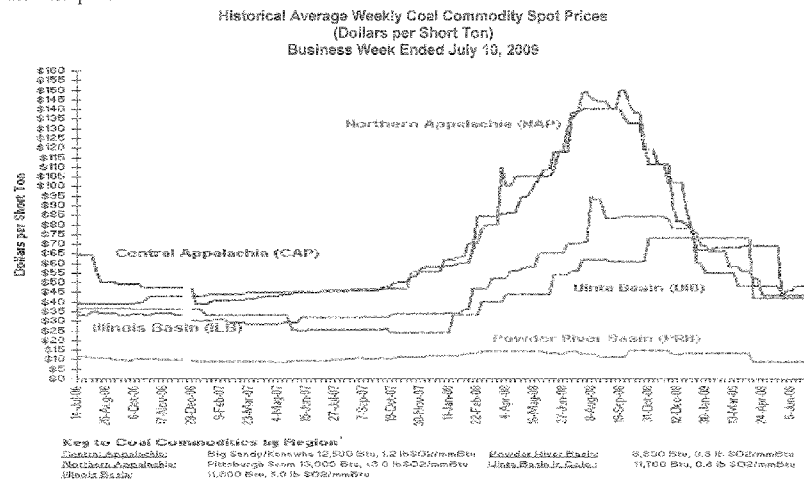
Oil

Oil markets are experiencing similar conditions. The declining demand allowed prices to drop below \$40 per barrel before a modest rebound to the \$50 to \$70 range. Like gas markets, capital investment has pinched out, inventories are growing, and existing fields are falling into disrepair in some parts of the globe because the national governments do not have the capital required to keep their fields in good operating condition. Unconventional liquids investment has also fallen sharply, as soft demand and low prices do not currently justify the high up-front capital required to start new projects.

The spread between demand and production capacity has grown from the mid 2008 low point, but like natural gas, a rapid world economic recovery is likely to drive prices sharply higher, and supply rebalancing is likely to require a great deal of time. Conventional oil market wisdom suggests that the industry will require investments of up to \$1 Trillion annually in order to maintain current levels of production (85 to 90 million bbl/day). Current oil sector global investment is well below that level, and national players like Russia, Mexico and Venezuela are experiencing falling production and an inability to borrow to properly service their fields, which is also fallout from the credit crunch.

Coal

US Coal prices have fallen from their historic highs in 2008, but prices have rebounded from period lows (See Figure 5). Exports fell almost 40%, while domestic demand fell by more than 40% during the first quarter.



Source: US EIA most recent coal report (July 16, 2009)

Figure 5: US Coal Price Trends

Domestic and world coal prices have held up a bit better than natural gas on a price change per btu basis. As a result, some gas switching is occurring at accelerating rates in some sectors of the domestic economy (electrical power generation). Global demands for electricity are off the charts, and expectations for international growth in coal use are all but guaranteed. For example, virtually all of

the new power plant construction in China (about 2 GW per week in new generation capacity) is based on fairly inefficient coal-burning power plant designs. EIA forecasts indicate that coal consumption in the developing nations is expected to substantially increase over the next 20 years (See Figure 6). Even though coal prices and production may show periods of softness, it is the expected global workhorse for energy production for the foreseeable future.

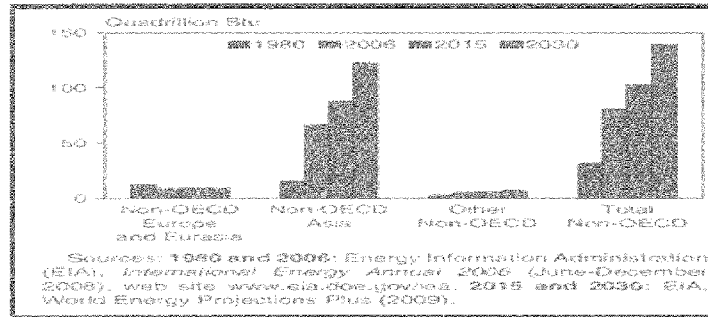


Figure 6: Non OECD Projected Coal Demand

In summary, the global recession has given the energy industry some demand relief, but the credit crunch has significantly reduced investment in existing asset maintenance and new field development. Based on the speed of the global recovery, this is expected to result in significant price instability and potential shortages in oil and gas supplies. The recovery will probably be led by the developing nations. Although we currently see excess supply of both oil and gas, the supply risk and expected price run-ups are driving the developing nations towards greater coal use as an energy source.

China is continuing to buy up global oil assets

In the past six months, China has purchased or contracted for approximately 20% of the world excess oil production capacity (about 1% of current global production). This includes more than \$50 Billion in direct asset purchases and/or loans to nations in return for substantial long-term commitments for oil output. In addition, China continues to deal with marginal oil-producing regimes like Sudan. Although the State Owned Enterprises in China that work the energy space have historically traded such assets on the world markets, they have the ability to withdraw that production for national use at any time. Part of this energy investment effort is a hedge against the current uncertainties with the dollar and an expression of China's desire to reduce its dollar exposure. But in our view, this further underscores our belief that China is serious in their resistance to any binding commitments to reduced carbon fuel use over the next 10 to 20 years.

If the developed nations reduce carbon fuel usage without corresponding cutbacks in developing nation carbon energy consumption growth rates, the developing nations will subsidize greater carbon fuel and energy usage by developing nations.

The projected cutbacks in EU and US carbon fuel usage will have a significant series of impacts on world energy supplies and costs. For example, EU and US reductions of 2% fuel usage annually – the expected average use rate reductions under recent House legislation – will collectively reduce global carbon energy demand by a significant amount. For example, during the recent oil price run-up, consumption of oil peaked at levels about 2% below estimated world production capacity. The

planned developed nation's cutbacks would reduce world oil demand by approximately 1% per year. This would tend to produce near-term softness in pricing and would tend to extend the life of existing oil reserves. Until significant reductions in carbon fuel usage take hold, price instability and potential supply shortfalls threaten both developed and developing national economies. But if use cuts are not allocated across the board, developed nations carbon use reductions will act to insulate the developing nations from the substantial supply and price risks we see today. Over time and absent binding energy use reduction targets, reduced developed nation use of carbon fuels will produce cheaper fuel costs for high energy consuming nations.

By embracing climate change management as a key element in our national environmental, energy and economic policies, we are probably initiating or intensifying a limited form of trade conflict with the developing nations.

If we have truly assumed the policy of avoiding global warming, we cannot resolve the problem without a global reduction in current carbon fuels use. Neither the developed nations nor the developing nations can resolve this problem on their own. Even if the developed nations eliminate the use of carbon fuels altogether in a very short period of time, it is likely that the developing nations will take up the slack. The result: we will not address the human-induced climate change problem. The "solution" will require the developing nations to develop a methodology for low-carbon development, just as the solution will require that the developed nations find a way to maintain economic health with progressively lower amounts of carbon-based fuels. No one has tried such efforts to date, and no one knows if such efforts can succeed. We have proposed an 83% reduction in domestic carbon fuels use over the next 40 years, with a 20% reduction target (2005 basis) by 2020. But the developing nations want a greater reduction rate sooner (40% reduction by 2020) before they will commit to any reductions at all.

The current energy policy changes suggested in the recent House action are based on a combination of reduced access to carbon fuels over time and an increased cost for the fuels that are available. In addition and at this point, alternative sources of energy are significantly more expensive than carbon fuels. Mandated reduced carbon fuel use requires more energy efficiency and/or more renewable energy use. The proposed energy policy will increase the costs of domestic energy use, no matter what the source. Extra-national energy costs will be determined by market forces, applicable regulations and treaty agreements.

A differential energy price and/or varying supply quantities between nations is an invitation to trade conflict. For example, the US foundry industry energy investment per pound of castings averages about \$0.04 per pound. The dry freight rates to ship castings from China to the US are currently about \$0.035 per pound. An 80% increase in domestic energy costs with no increase in foreign energy costs effectively allows foreign manufacturers to compete for US casting markets without a freight cost differential. The expected outcome of such gradients is a relocation of the industry to locations where energy costs are lower and the potential loss of up to 200,000 domestic manufacturing positions. International energy access and price differentials are trade advantages that will hurt or help the US manufacturing community, and should be considered with care.

China continues to expand their energy-intensive industrial infrastructure

Most Chinese industrial development over the last 15 years has been focused on heavy, energy-intensive industrial development, and energy inefficiencies are common in those industries (20 to 40% lower energy efficiencies than similar US and EU operations by some reports). Subsidies for heavy industries are common in China, and their public sector capital markets (state lending to State-Owned Enterprises) fail to meet western standards for transparency or fiscal responsibility (no GAAP). This

encourages interregional construction of excess capacity and biases investment towards heavy industry. In addition, the traditional "top-down" model for communist economic control has changed to a decentralizing model where provinces and cities make capital investment decisions with little heed to the national economy or environment. This further accelerates the construction of energy-intensive and energy inefficient industries. It is a bit ironic, but the national government might actually benefit from a treaty that forces them to act to limit unplanned regional economic expansion.

At the same time, the Chinese economy is moving closer to decoupling with western economies

China has reached a turning point in their own economic expansion, where a substantial fraction of their citizenry are now earning enough money to begin to afford the purchase of a series of energy-intensive machines that are the requisite for a rapidly increasing quality of life and energy intensity. Auto and appliance sales are up sharply and long-term growth is expected. Manufacturing decoupling looms as a real change in the relationship between the developed nations and China. At present, access to the US and EU markets is critical for China. They need our markets to create jobs in China today. In a decade or so, they won't. Our period of economic influence in China is waning.

TREATY NEGOTIATION CONSIDERATIONS

In a recent interview, Lead US climate change negotiator for the US Todd Stern was quoted as saying: "We don't expect China to take a national cap (on greenhouse gas emissions) at this stage." Within the week, India's agriculture minister flatly refused to consider any national limits to carbon fuel consumption. At the recent G5 meeting, developing nations continued to call for substantial commitments of capital from the developed nations for mitigation and adaptation support, as well as technology transfer. The funding support requested is in the .5 to 1% of GDP range from developed nations. This "Green Fund" proposed by Mexico and endorsed by both the G5 and the G8, involved contributions by all nations assessed on the basis of their historical responsibility, current level of development and weighted per capita emissions.

What position should the US bring to the table at Copenhagen? Our involvement in a climate treaty should be contingent on the acceptance of carbon fuel use reductions by Europe, and Japan (highly likely), China (unlikely) and India (unlikely). If China and India do not agree with the analysis that climate change is man-caused and that it threatens their economies, then there will likely be no meaningful, substantive agreements from Copenhagen...just as we saw at Kyoto.

If the countries agree with climate science, then the US and China are the most critical players in crafting an agreement. If we withhold our support, there will be no treaty, as we are the largest carbon fuel consumer in the world. China and India know they face climate change issues, but they are probably better served near-term if they are out of any binding agreement. There needs to be a down side for developing nations if they choose not to participate.

The obvious developed nation tools to compel participation by the developing nations include no access to technologies and mitigation moneys, and limitations on access to developed nation markets (possibly some form of carbon tariffs). As noted earlier, this option will lose value over time. Beijing may need this level of compulsion in order for the central government to re-assert control over regional and local economic development and environmental control. Technical and financial support/technology transfer should be contingent on agreed-upon progress towards specific emission targets. The targets can be actual reductions or slower rates of energy consumption growth. Private sector resources can be harnessed by trading technology transfer support for longer-term carbon

credits. If a nation assists another nation in reduction of carbon emissions, carbon credits should be used as compensation.

Perhaps most importantly, any treaty should include acceptable energy metrics and use reduction verification processes, with meaningful penalties for non-compliance. In order for full technology transfer to occur efficiently, the developed nations will require further enhancements in international intellectual property protection before releasing newer energy conservation processes to developing nations. Finally, the accounting and tracking systems for business and governmental support are typically insufficient in developing nation economies. This allows government intervention – usually financial and/or regulatory in nature – to skew the competitive positioning of companies serving international markets. Financial support and tariff relief should go hand-in-hand with a degree of disclosure consistent with systems used by developed nations.

The upcoming climate negotiations face some extraordinary challenges. Our needs cannot be met if we commit to developed nation carbon fuel use reductions alone. Our domestic economic/energy concerns have been exacerbated by the increasing fragility of the world carbon fuel and finance markets. It would seem that our most likely path to success involves careful diplomacy, but we believe that our diplomacy needs to be supported with a “Roosevelt’s big stick”: continued access to free trade with the largest economies in the world.

Redmond Clark, PhD
Chief Executive Officer
CBL Industrial Services

Mr. FALEOMAVEGA. Congressman Manzullo, first questions.

Mr. MANZULLO. First of all, Chairman, I would like permission to put into the record this article from the Wall Street Journal dated July 20th, “India Rejects U.S. Proposal of Carbon Limits.”

Mr. FALEOMAVEGA. Without objection.

Mr. MANZULLO. Thank you.

[The information referred to follows:]

India Rejects U.S. Proposal of Carbon Limits

Clinton Expresses Hope for Common Ground on Climate Change Despite Disagreement on Capping Greenhouse Gases

By MATTHEW ROSENBERG

NEW DELHI -- India dismissed suggestions that it accept binding limits on carbon emissions, with a top official Sunday delivering a strong rebuke to overtures from U.S. Secretary of State Hillary Clinton for the two countries to work together to combat climate change.

Indian Agriculture minister Sharad Pawar, in white, greets Hillary Clinton as she arrives at the Indian Agricultural Research Institute in New Delhi on Sunday. During her first visit to India as Secretary of State, Mrs. Clinton is focusing on climate change—where India rejected suggestions of emissions limits—as well as nuclear power, defense deals and counterterrorism.

The rejection of the U.S. proposal was made in the middle of Mrs. Clinton's first visit to India as secretary of state and came just as the administration of U.S. President Barack Obama is gearing up to push for a new global pact on climate change.

"There is simply no case for the pressure that we, who have among the lowest emissions per capita, face to actually reduce emissions," Environment Minister Jairam Ramesh told Mrs. Clinton and her delegation.

"And as if this pressure was not enough, we also face the threat of carbon tariffs on our exports to countries such as yours," he said, according to a written account of Mr. Ramesh's remarks to Mrs. Clinton in their meeting. Mr. Ramesh handed out copies of the account to reporters at a news conference afterward with Mrs. Clinton standing nearby.

India, like China, has long refused to accept emissions caps, arguing they could limit its economic growth and that the West, which has pumped a century's worth of greenhouse gas into the atmosphere, didn't have to contend with such rules when it was industrializing.

India's statement is consistent with its longstanding position on the issue, and it isn't likely to affect the more-nuanced diplomatic discussions quietly afoot. Increasingly, developed nations seeking global cooperation are accepting that the idea of hard emission caps for developing nations is a political nonstarter.

Instead, diplomatic thinking is shifting toward a system of carrots rather than sticks that would lead developing nations to see curbing emissions as in their economic interests. Much of the discussion centers on how to transfer affordable, low-carbon technology from the developed world to the developing countries where emissions are rising fastest.

The idea, which is fraught with practical difficulties, is expected to be on the agenda when diplomats meet in December in Copenhagen to work toward a new international agreement to fight climate change.

During the first two days of her India visit, Mrs. Clinton tried to address Indian sensitivities, acknowledging the West's contribution to climate change and saying the U.S. would never try to impose conditions that could limit India's growth.

Instead, she said the two countries should together come up with a plan to fight climate change. She said Sunday that she still believes the two countries can find common ground on climate change. She called Mr. Ramesh's comments a "fair argument" and chalked them up to being "part of a negotiation."

Mrs. Clinton also pointed out that India's absolute level of carbon emissions -- as opposed to the per capita level, which remain relatively low because of the country's vast population -- are "going up and dramatically."

Issues on the visit's agenda include counterterrorism, nuclear power and defense deals valued in the billions of dollars.

On Saturday, Mrs. Clinton expressed optimism in Mumbai that the two countries would seal a pact allowing the U.S. to make sure American weapons sold to India were being used as intended. The pact is needed to allow U.S. firms to bid for an Indian contract to buy 126 fighter jets. The sale is expected to top \$10 billion, making it one of the largest arms deals in the world and a potential windfall for Boeing Co. and Lockheed Martin Corp.

U.S. officials said they hope Indian officials will on Monday announce two sites where American companies will have exclusive rights to build nuclear-power plants. The plants would be the first two projects allowed under an agreement sealed last year that ended a 34-year U.S. moratorium on nuclear trade with India.

Mrs. Clinton chose a highly symbolic backdrop for the opening of her three-day trip, staying Saturday at Mumbai's iconic Taj Mahal Palace & Tower, one of the hotels attacked during November's gun-and-grenade terrorist rampage in the city, which left more than 170 people dead.

Jeffrey Ball contributed to this article.

Mr. MANZULLO. I was watching a special, I think it was National Geographic, about Greenland, and the Danes settled the land because of its lush environment, an area to grow crops, but then they left, most of them left, about 1,000 years ago because the area, instead of being warm and lush, took on almost an ice cap. It became the Greenland that we have known until recently.

Now, the reason I bring that up is we are all concerned about what is going on in the environment. The question is, there were no greenhouse gases 1,000 years ago that made the Danes abandon that area. So what caused the massive cooling 1,000 years ago, and is what climate change we are experiencing now, is it necessarily related to what we are doing on the Earth, or is it just something that occurs naturally? Anybody?

Mr. KARL. I will be happy to take that one.

It is clear that there are natural variations in climate, and particularly on a regional scale, such as the one you just identified.

The issue of whether humans are responsible for the changes that we have seen over the last 50 years, there is no question any longer. We have been able to look at, observe changes, and link them quite convincingly to the patterns of changes we have seen not only in temperatures, but changes in precipitation, changes in water vapor, changes in atmospheric circulation. They all put together a comprehensive picture of human-induced climate change.

Now, that doesn't negate the fact that climate can change on its own due to natural purposes; however, what we are seeing today is clearly linked to human activities, and the projections for the future are such that with unabated increases in greenhouse gases, the rate of changes that we are expecting over the course of this century are beyond anything that we have seen in human mankind civilization. These changes, in fact, will have some really significant impacts, one of which our civilization hasn't yet been able to address, hasn't had to address.

Mr. MANZULLO. Anybody else agree, disagree, or want to comment on that?

Dr. Clark?

Mr. CLARK. In trying to translate the science into something that people can use, we came up with an analogy that may not be completely fair. If you go to Las Vegas and you sit down at the blackjack table and you play 20 hands, it is possible that you can win 20 hands in a row. The odds are very long, but it is possible you can win 20 hands in a row. If they changed the rules so that the dealer takes ties, then it is a lot harder for you to win 20 games in a row. The odds just went up.

The climate science work that has been done, it makes a very, very serious effort to use best possible data to come up with an estimate of how much we are changing the odds, and the work that has been done says that we have changed the odds.

Your point, which is that there is a natural environment fluctuating underneath, is absolutely correct. We have seen similar changes in temperature in similar periods of time in regions all over the world at varying times in their history. As this extends on, we are going to have progressively more and more data to determine just how precise we were right or how precise we were wrong in the forecasts that we put together.

My sense right now—and this is an important political distinction—my sense right now is that, for example, as far as the House is concerned, the House has made a determination that they are going to accept the science, and if we accept that and we run down that policy corridor, what does it mean? And as we drive down that policy corridor, from my personal perspective, many, many issues that we have talked about, differences between nations, are going to be forced up, and they are going to be discussed, and they are going to have to be resolved. Things like intellectual property, the issues are going to be driven by the climate science, because climate science is going to force an economic debate that is going to be healthy, I think ultimately, for the world, and I think very healthy for the United States.

But we have got to have that debate, and when we have that debate, I suspect it needs to be less about the science and more about the economic follow-through that comes from the scientific argument that has been made. And it is a very important distinction. Hopefully it is helpful.

Mr. MANZULLO. Dr. Wheeler?

Mr. WHEELER. Just one comment, I guess. Personally I am convinced that we have a problem, that there is a human origin to that problem, so for me that is not really the issue.

But I think there is a more fundamental issue here, and the way one can address this might circumvent the disagreement. And that is we all agree there is a lot of uncertainty here, and there are differing opinions about where climate change will impact and how much. And the science is not yet certain, for example, on the pattern of rainfall that we may expect over large areas of the world. So it is very difficult to plan ahead in agricultural policy, for example.

But what we do need is resilience, and what we have seen in the past is that societies that have made certain policy-progressive moves have become more resilient. So there is force in that, and if we can orient our policies toward promoting resilience, regardless of climate change, we can only help on the climate front, and at the same time we can benefit from a standard development perspective.

So I think there is an enormous common agenda here that can be promoted progressively without even referring to the onset of climate change, simply as a confrontation to the problems that the world is facing right now. So I would urge that, wherever possible, we seek this common ground and take measures that are progressive from either perspective.

Mr. MANZULLO. Thank you.

Mr. FALEOMAVAEGA. Mr. Derviş?

Mr. DERVIŞ. Thank you. I just wanted to add one more time the issue of uncertainty and insurance. Professor Scott Barrett, a colleague who is going to teach at Columbia next year, makes this kind of comparison. Suppose we were told there is a 5-percent probability of a meteor hitting the Earth and destroying most of it, but a 95-percent probability it won't happen. What would we do? That is an extreme example. There is a lot of uncertainty, but there is enough of a threat, of a possible threat, that I think very serious

action should be taken as insurance, without necessarily being sure of how things will evolve over time.

Of course, taking that action requires a global effort and that is where, I think, we all agree; if the United States takes action and others don't, it won't help. If China takes action and the United States doesn't, it won't help either. So how to do that globally is going to be increasingly at the center of the debate.

Mr. FALEOMAVAEGA. We will have Dr. Wheeler, and then Dr. Clark.

Mr. WHEELER. In thinking about China and India and their stance in negotiations, from many conversations I have had with colleagues in the international community who are working in China and in India and here, I would urge the committee and the Congress to look carefully at what our friends in those countries are doing as opposed to what they may be saying in the run up to Copenhagen, because the measures that they are actually taking are consequential for renewable energy and for climate change, and in some places quite major.

The Chinese arguably right now are moving more quickly to develop renewable energy than we are. It is just they are moving their energy systems so quickly that they are also increasing their use of coal-fired power. But their increased use of wind power and solar power is quite spectacular.

On the Indian front, we look at the question of intellectual property. I would simply cite a recent arrangement between eSolar, which is a U.S. Company, and the Acme Group in India to develop solar thermal power in Rajasthan, in the desert, possibly without any subsidies at all as a business venture. That is going forward. Both sides have agreed to it. The Indian Government likes the idea. They may provide some subsidies for that because they see solar as an important potential part of India's future.

So I hope we won't be too bamboozled by some of the rhetoric running up to Copenhagen here. There are threads of common interest in the world. There are ways in which we can target our assistance progressively on measures that would assist countries to do what they are intending to do anyway better.

Mr. CLARK. One last quick thought, and that is the meteor that is approaching us is not just climate change, whether you agree or disagree with the science. The meteor that is approaching us is the cost and the availability of the energy resources that we use to drive the world economy. It is changing. We are seeing dramatic changes now, and there are significant changes in the future as an economic and environmental challenge.

Again, I think Dr. Wheeler and I are close together in our thoughts. Watch very carefully what they are doing rather than just listening to the rhetoric, because, again, what we see in terms of activity are people that are preparing for a conflict of sorts, and that needs to be incorporated into our negotiating stance.

Thank you.

Mr. FALEOMAVAEGA. As I remember, 8 years ago we had then former Secretary of State Colin Powell appear before this very committee, and one of the issues that I raised with him was the Kyoto Protocol, climate change, and obviously the tremendous impact that will have, especially among the most vulnerable societies or coun-

tries, like Pacific island country atolls. As I recall, he said, well, he has every intention to take up the issue, follow up on what the previous administration, President Clinton, had done; not necessarily to agree with everything that was signed in the Kyoto Protocol.

But quite obviously the Bush administration, at least it was submitted to the Senate, and the Senate killed the Kyoto Protocol Treaty by 95–0, I believe. And I supported that, because it was very unfair, one-sided, and it put the United States in a very, I think, unequal level playing field when you compare it to China, India and other countries about emissions.

But the next thing that transpired, about 2 months later, was the White House response was to have nothing to do with the Kyoto Protocol. And I think this is where I have a little difficulty in agreeing to the administration's then policy, which was just to completely take ourselves off the table and not to continue the negotiation process and letting the Kyoto Protocol members know we have some problems with it.

We completely left ourselves from participating. I think the saying is that if you are not at the table, you will be on the menu. Well, for 8 years, I think we have been lambasted, ridiculed, criticized as anti-global warming or climate change. Just to examine the contents, whether it is the science that we disagree with or the unequalness of distribution of whatever resources, that we were to address the problem.

So now, Johnny-come-lately, 8 years later, the new administration comes up and says we do definitely look at climate change as a very serious issue and a very top priority by this administration.

My question to you gentleman, of course, we are taking the sense now we are the leader of the world, and without us, nothing moves. Well, if you were among the group of 77 countries, or however number, 100, whatever, that signed on to the Kyoto Protocol, that for the last 8 years they have been delivering, they have been discussing, they have been debating the issues. How do you expect the reaction from other countries that say, where have you been?

So India and China make their point of all the years that they have discussed it with the Russians, whatever, the other countries. And we are coming and saying, do what we want you to do, because we know, we have the best scientists, we know the best way to solve the problem.

So far the point of reference now by this country, our country, is the Waxman-Markey bill as the first piece of legislation that is addressing the very issue of climate change. And as all of you eloquently pointed out, there is going to be some sparks flying in Copenhagen.

You take the view that countries like India and China don't consider themselves up to par with Japan, the United States or the European countries as far as development is concerned; they feel that they are still below standard. I know we make a lot of comments about the economic rise of China, and also India, but when you compare relatively, and I am not an economist, we are still very much ahead of the ball compared to these two countries, other than the fact they have tremendous populations. And I think that alone seems to be the driving force as to why they think that they

ought to be given different treatment in Copenhagen, or they just won't play.

Here the question is without these three countries, that I suspect, in my own humble opinion, without China and India's involvement, with whatever we want to propose in Copenhagen, I think we are going to have a very difficult problem here in resolving.

I have 100 other questions, but before doing this, I do want to introduce my dear friend Dr. Watson, the gentlelady from California, our former Ambassador to the Federated States of Micronesia, who is also one of the senior members of our subcommittee and an expert on Pacific issues. I welcome her to our hearing this afternoon and would like to have her give an opening statement, if she would like.

Ms. WATSON. Certainly. Sorry to be late. Thank you, Mr. Chairman, for holding this very timely hearing on climate change as the climate conference in Copenhagen draws near.

As we all know, President Obama recently completed his meeting with the G-8 in Italy to discuss climate change, and though the group made progress, notably pleading \$20 million—pledging \$20 billion in food aid and to prevent a dangerous increase in global temperature, the most vulnerable populations, those who are poor and have limited options, will feel the most repercussions from climate disasters. The floods will destroy their homes, droughts will destroy their farms, and changes in ocean temperature will destroy their fishing businesses.

Thus, as we begin to address the issues, we must keep in mind that climate change is not about just saving the polar bears or the Arctic rabbits and majestic Narwhals. Humans will face many challenges in the coming years. Food, economic productivity and infrastructure will all be negatively affected by an increase in global temperature.

I hope that all of our panelists—and I am sorry to have missed probably the first panel—but our panelists can enlighten us on the strides being made to make developing nations more capable of responding to natural disasters caused by climate change.

There are some among us, Mr. Chairman, as you know, who don't believe that climate change is among us, but all they need to do is go up to the Arctic and see that our polar bears really are disappearing. Their babies cannot find food, and pretty soon we will find that they, too, are extinct.

So I really appreciate this, and I yield back the balance of my time and want to listen to our witnesses at this point. Thank you.

Mr. FALEOMAVEGA. I thank the gentlelady for her comments and her opening statement.

[The prepared statement of Ms. Watson follows:]

Statement
Congresswoman Diane E. Watson
Subcommittee on Asia and Global Environment
Committee on Foreign Affairs
Thursday, July 23, 2009
2172 Rayburn House Office Building
2:00 p.m.

"From L'Aquila to Copenhagen: Climate Change and Vulnerable Societies"

Thank you Mr. Chairman for holding this timely hearing on climate change as the Climate Conference in Copenhagen draws near. As we all know, President Obama recently completed his meeting with the G8 in Italy to discuss climate change. Though the group made progress, notably pleading \$20 billion in food aid, and to prevent a dangerous increase in global temperature.

The most vulnerable populations, those who are poor and have limited options, will feel the most repercussions from climate disasters. The floods will destroy their homes, droughts will destroy their farms,

and changes in ocean temperature will destroy their fishing businesses.

Thus, as we begin to address the issues, we must keep in mind that climate change is not about just saving the polar bears, arctic rabbits, and majestic narwhals. Humans will face many challenges in the coming years. Food, economic productivity, and infrastructure will all be negatively affected by an increase in global temperature.

I hope that our panelist can enlighten us on the strides being made to make developing nations more capable of responding to natural disasters caused by climate change. Thank you Mr. Chairman and I yield back the remainder of my time.

Mr. FALEOMAVEGA. I just wanted to follow up a little bit on what my friend from Illinois had raised concerning Greenland.

I think maybe some of you are experts on geography or topography. I have always looked at Greenland as a huge continent, seemingly. And just recently, if I read the media reports, that Denmark has finally given sovereignty back to the indigenous Inuit Eskimos, who number only 65,000 people through the whole country of Greenland. I think it was probably the same National Geographic television show that Mr. Manzullo and I watched, and the fact that in the 20-, 30- or 50-year period, there have been definite indications of meltdown of the glaciers in Greenland as an indication that there definitely is an impact or changes in the climate as far as this goes.

Ms. WATSON. Mr. Chairman, would you yield?

Mr. FALEOMAVEGA. I am glad to yield to the gentlelady.

Ms. WATSON. Dennis Kucinich was putting a trip to Greenland together, and two people dropped out; therefore he couldn't get the military plane. I think we ought to all come together and just take a very quick trip to Greenland so we can visually attest to what climate change is bringing about. So, you know, he would be ready to put it back together again if members of our committee or subcommittee would agree to go.

Mr. FALEOMAVEGA. I would say to the gentlelady, I would gladly accept an invitation to go to Greenland, even though I am a warm-bodied Polynesian, warm-water Pacific blue. I just don't want to freeze there in a matter of minutes. If you are exposed to the water in that part of the world, in less than 30 minutes, you will be dead. I think I would rather swim in the Pacific Ocean.

Ms. WATSON. He had on his itinerary where we are going and the need for very warm clothes and the fact that we would be well protected from the cold. It was a very well-laid-out trip.

Mr. FALEOMAVEGA. Definitely you will not have polar bear skins to clothe yourself with; is that correct? I am just kidding.

I think Mr. Derviş wanted to comment on your opening statement.

Mr. DERVIŞ. Thank you very much, Mr. Chairman and distinguished members.

I just wanted to stress two points in response to the comments. One is that the climate, the global climate, is this common good we have, and it will be terribly sad if it led to conflict rather than cooperation. In a way it is the ultimate global good, you know. If you don't like globalization, you could possibly close your borders to trade, or you could possibly not accept foreign investment. But even if every country closed their borders, the emissions, the heat-trapping gases would still operate, and the climate change would affect everybody. So it is something that the whole of humanity shares.

And in the discussions and debates, which will be tough, there will be different interests, different countries will argue for resources. Some countries will say there should be equal per capita, per-human-being emissions; others will argue per dollar. All these things can be argued about.

But I think it is extremely important that the world embarks on this in a spirit of cooperation and in discussing and arguing rather than engaging in conflict. And I think Copenhagen is a great oppor-

tunity, and the fact that the United States is taking a strong role now and is fully participating is really welcomed by everybody around the world. That is one important point I wanted to make.

The second point, following on David Wheeler's, we have examples of adaptation of climate-proofing actions in the poorest and most vulnerable countries that have actually worked reasonably well. One example I know is Bangladesh and the cyclones. I can't remember the exact date, but I think it was about 12 years ago there was a devastating cyclone in Bangladesh, and more than 100,000 people were killed. There was another one 3 years ago. In the meantime, in cooperation with many countries and also the United Nations Development Program, Bangladesh had taken measures, early warning systems, a plan what to do when it happened, what to do with people, who would take care of whom.

It was still devastating. It was about of equal strength, but instead of more than 100,000 people dying, I think less than 6,000 died, which is still a huge number, of course, but it shows the kind of progress Bangladesh was able to make with international assistance.

So it is important to focus on the positive. It is important, I think, to realize that we can build more resilient systems, and that that is part of the overall development effort.

Thank you.

Mr. FALEOMAVEGA. I appreciate, Mr. Derviş, your more positive attitude toward the region. I think it is possible to resolve these issues and not in gloom and dire inability on the part of humanity and the countries to adapt and to raise or to resolve some of the issues that have been raised in this hearing.

I think Dr. Janetos and Dr. Wheeler may have some comments.

Mr. JANETOS. Thank you, Mr. Chairman. I would like to build on Mr. Derviş' comments.

In our own research programs at the Joint Institute, we have done a significant amount of modeling of the energy economy and the prospects for global emissions as they relate to the spread of energy technologies and end-use efficiency and a whole range of different actions.

One conclusion of those studies from some of our sister colleagues is the importance of joint actions to reach particular emissions and concentration targets, that no one country or even large groups of countries can hope to act on their own and reach success; that this is, in fact, a problem of common action.

It is also important to recognize that many of the nations we have mentioned this afternoon also have significant vulnerabilities themselves. They know this, of course.

I have been fortunate to participate as an adviser, for example, in a very large environmental assessment of the provinces, the western provinces in China, and the environmental concerns and challenges they face there are severe, ranging from poor soil fertility to increasingly arid regions and a dramatic reduction in the amount of freshwater they are able to access. So they face this tremendous dilemma: How do they continue to satisfy their increasing and legitimate demands for energy and growth while building the resilience they need to combat climate change and its consequences as they continue to occur?

At the end of the day, perhaps here are the elements of common purpose and common goals that we may seek to exploit.

Mr. FALEOMAVEGA. Let me share with you, just before I get to Dr. Wheeler, the Congressional Research Service made this overview for the members of the subcommittee, and I just want to share with the members of the panel for your comment.

“Little dispute remains in peer-reviewed scientific literature that greenhouse gas concentrations in the atmosphere increase global average temperatures, and that most of the observed warming since the late 1970s is very likely due mostly to human-related increases in greenhouse gas concentrations. Between 1970 and 2004, carbon dioxide emissions grew by about 80 percent, according to the Intergovernmental Panel on Climate Change, or IPCC. Scientists also agree that natural forces, such as solar irradiance and volcanoes, contribute to climate variability, as they have throughout history. Scientists, however, have been unable to show that natural forces alone could have driven recent warming and additional climate change patterns. That is, climate models can reproduce patterns of recent climate change only when they include the effects of greenhouse gas emissions from fossil fuel use, land clearing and some agricultural and industrial processes.

“Little scientific dispute remains over the greenhouse effect. Debate, however, is ongoing over how much the climate would change if greenhouse gas concentrations rise unabated, and how adverse the impacts would be. Most climate models project that without strong policies stabilizing greenhouse gas concentrations, global average temperatures during the 21st century are likely to increase above natural variability by at least 1.5 Celsius or 2.7 Fahrenheit compared to 1990, and not by more than 6.4 degrees Celsius or 11.5 degrees Fahrenheit under other assumptions.”

I just want to ask the panelists, would you be in consensus agreement to those statements? Do you all agree that this is real, these are the facts, this is not something that somebody else made up or having an ideological bent because they don't believe that this is a bunch of hocus-pocus, this is real? Everybody agrees to this?

I see some hands already, and I am glad you are getting the attention of this.

As CRS says,

“Greenhouse gas-induced climate change would result in more heat waves and droughts; decreased extreme cold episodes; increased summer warming and dryness in the central portions of continents; more intense precipitation when it occurs, thereby increasing runoff and flooding; accelerated melting and loss of snow and ice, and global sea-level rise over several decades to centuries; slowing of the Meridional Overturning Circulation of the Atlantic Ocean, offsetting warming of the North Atlantic, changing European and eastern North American weather patterns; and natural positive feedbacks of global warming that would reinforce and accelerate the initial human-induced greenhouse gas increases.”

I appreciate the fact that the panel does have a consensus. You agree with what has been stated here as facts. I think all of you had your hands raised. I am trying to follow which line of questioning we had in mind. I think the gentlelady's initial statement posed some interesting issues or statements.

Mr. WHEELER. If I could, just to enforce two of the points that Kemal and Tony made, the first on the question of adaptation and Kemal's excellent point about Bangladesh and the value of early warning there.

What you have is the prospect, if we are smart about it, and if we craft assistance that will be truly helpful there, to arrive at a situation in midcentury where, even despite climate change, we can have fewer losses than we do now. There is tremendous room for improvement there, and that is a development task, and I think we should pursue it in good faith. It will have many benefits.

The second point I wanted to make, just to reinforce again the points they made, everyone is talking about sparks at Copenhagen, but I think that this is actually misplaced. Just to reiterate, let me cite the case of South Africa for a minute.

Now, the South Africans have had a remarkable history in the last few years, as we know. The transformation they have gone through has been extraordinary. They still face tremendous poverty problems, and they are sitting on a huge trove of cheap coal. So for South Africa from a poverty perspective, what makes sense is full steam ahead and burn that coal, and they burned a lot of it. But this year they have made a remarkable commitment to switch to renewable energy as far as they can, because they have a solar belt in their own desert in northern Botswana that can be exploited, and they are willing to sacrifice to attain that, and they are willing to put some of the cost in their rate base.

But they have come to the World Bank, and I am sure they have come to our colleagues in our Government, and they have said, can you help us with this? We have made this commitment. I think they would fight a legal restriction in Copenhagen on their emissions, but they are paying the price themselves.

So I am asking you in good faith, shouldn't we help them with that, and isn't that something we can agree on that involves no sparks and progressive change?

Mr. FALCOMA. I thank Dr. Wheeler. And in line with Mr. Derviş' comment about adaptation, I think that the tsunami showed we did not anticipate the situation of a serious tidal wave emanating from an earthquake where we didn't have—we were not prepared for it. But now we are making every effort to beef up our abilities, whether it be satellites or whatever it is, that we can next time be able to predict or anticipate, if there is an earthquake, producing such a disastrous tidal wave, that affected or killed several thousand people in Indonesia and other countries of the world.

I think your point is well taken about adaptation. It is always good. What is it? An ounce of cure is worth a pound of—am I saying it right? Anyway, something to that effect. Prevention is the best way to do this.

What I recall in my sailing on this double-hull voyaging canoe was the inherent fear that in the middle of the night here, I would be sleeping, and these freak rogue waves that would be traveling

the Pacific coming from nowhere. You are talking about waves about twice the height of telephone poles traveling at about 60 miles an hour, and I was a little worried about something like that happening, because it could go anywhere. Luckily, we just had a bunch of squalls and ministorms, but not something like that of a tidal wave or tsunami that does definitely kill people, if not given proper preparations to prevent people being hurt the way they were at that time.

I think we are going in between the questions. Does the gentlelady have any questions she may want to raise for members of the panel?

Ms. WATSON. I do have some. Coming in so late, they probably have been addressed, but I would like to question Mr. Karl in the center there.

I understand from your testimony that several islands, the Maldives and parts of Fiji, who are at risk of inundation due to sea level rise, and you also mentioned the vulnerability of cold-water coral and changes in fisheries due to climate change. In each of these occurrences, they will have a drastic economic impact.

Can you describe the complexity involved in predicting the rate and the scale of future population flows related to climate change, and do we have sufficient reliable data?

Mr. KARL. Thank you very much, Congresswoman. Basically I want to emphasize that the basic understanding of the fundamental science of greenhouse gases in the atmosphere and how they affect climate has not changed for 40 years.

The National Research Council back in the late 1970s, under a couple reports—one was Dr. Smagarinski; another one was the Charney report—actually used numbers very similar to the numbers that our chairman just repeated in terms of the impacts of greenhouse gases on global temperatures. This has been validated by statements from all the major scientific societies in the world, not only our own National Research Council, but the other world academy of sciences panels and councils, the IPCC and our own U.S. Global Climate Research Program. So that part of the science we understand.

The question you raised is really at the heart of where our uncertainty lies, and that is how well can we predict these very important regional effects? You mentioned a number of them, and I will just expound on some of them.

Coral and the impact of the double whammy of ocean acidification, which we know has a strong impact on cold corals, but in addition they likely affect all corals. And on top of that we have something called coral bleaching when you get very high ocean temperatures, the tendency for corals to lose their coloration and eventually die due to these hot ocean temperatures. Those then can be compounded by other stresses. So you can see it is very difficult to predict exactly where and when specific corals will be threatened.

We do know, in fact NOAA just put out a prediction for the summer, that due to the very high ocean temperatures, the corals are threatened in much of the Caribbean and parts of the Central Pacific. We are in an El Nino situation on top of the global increase in ocean temperatures, so potentially a serious situation could be

unfolding later on this summer, and as the El Nino continues to strengthen, we may see more impacts.

With respect to sea level, one of the major uncertainties we have is just what the contribution will be from the Greenland ice sheet to the rise in sea level. Present measurements suggest that Greenland is melting faster than what we have expected, and because of this, just a recent report that the U.S. Global Climate Change Research Program put out, the numbers for the expectations on global sea level rise have increased to somewhere between 3 to 4 feet under the higher emission scenarios, and right now we are on track to even exceed the higher emission scenarios based on the amount of carbon that has been emitted over the past 10 years.

So the real science today that has much, much importance is to try to better understand these regional intricacies, what are going to happen to those typhoons in the Pacific, the hurricanes in the Atlantic, how much more intense are they going to become. These are areas where we don't have 100 percent confidence, and this is where we need to improve our observational set and improve our modeling capability and our understanding to be able to provide that information so that when we try to adapt—because clearly we are going to have to adapt, because we already are committed to warming of another degree Celsius because the ocean heat and the lifetime of carbon in the atmosphere—we are going to have to better understand what we want to adapt to, and it is important to understand those regional changes.

Ms. WATSON. I am just reminded in my term out in the North Pacific very close to where our chair—well, the area that he represents, there was a 45-minute warning of a tsunami coming down to Micronesia. Well, what failed us was the equipment that the State Department had brought us. We could not contact our Peace Corps volunteers on the outer islands that are at sea level, and we panicked. We kept running out to watch the water level. Finally they announced that it had just fizzled out somewhere in the North Pacific. But we put everything to test, and we failed the test. So had that tsunami hit, we would have lost lives.

So that leads me into what kind of information do we need to plan for future disasters? And they are going to come if we don't take care of the global warming patterns that we know exist. So can you help on just recommending?

Mr. KARL. Yes. I can tell you, I think an important part, and you hit on it, is an engagement with partners and stakeholders. So sometimes, I don't want to say it is a little thing, but it is the part you might not think about is do we have the proper communications in those remote areas to get the warnings out?

What I think is very important and what NOAA is trying to do is engage our partners in these various programs. There is a major education component to try to identify what the system has in terms of resiliency and vulnerabilities. We do have a number of programs in place to try and improve that capability, and I will be happy to submit that for the record, if so desired.

[The information referred to follows:]

Attachment A

NOAA is partnering with and supporting several programs and projects to better prepare residents and institutions in the Pacific region manage their responses to climate change in both adaptation and mitigation-related decisions.

NOAA's partnership and support of the International Research Institute (IRI) for Climate and Society is leading to many products and services to manage risk in key economic sectors especially in developing regions. For example:

- A focus on agriculture and effective climate risk management, through anticipation and monitoring of climate, is allowing farmers in marginal, high risk environments to better prepare for adverse conditions – adopting appropriate technology, restoring soil nutrients, intensifying production etc – to engage in sustainable and profitable farming
- A project to improve fire forecasting in Central Kalimantan, Indonesia. These fires, associated with the El Nino/La Nina cycle have become an increasing problem in the area and have led to billions of dollars of economic losses.
- A project to create resilient strategies for urban water supply in metro Manila, Philippines. The reservoir that supplies Manila is increasingly vulnerable to variability in both droughts and floods. The IRI is working to assist in better preparation for crises and to manage allocation decisions so as to limit the incidence of critical supply scarcity.

NOAA's Pacific Region is engaged in a number of ways to help the Pacific Islands plan for, mitigate against, and adapt to climate change. NOAA's Pacific Region will continue to work with our island communities to develop tools, products, and services to move towards realizing NOAA's vision of, "An informed society that uses a comprehensive understanding of the role of the oceans, coasts and atmosphere in the global ecosystem to make the best social and economic decisions." Highlighted below are some prominent efforts:

The Pacific Risk Management 'Ohana

The Pacific Risk Management 'Ohana (PRiMO) is a network of partners and stakeholders involved in the development and delivery of risk management-related information, products, and services in the Pacific, and is led by the NOAA Pacific Services Center. Established in 2003, this multi-agency, multi-organizational, multi-national group brings together representatives from agencies, institutions, and organizations involved in Pacific risk management-related projects and activities with the overall goal of enhancing communication, coordination, and collaboration among the 'ohana (family) of partners and stakeholders involved in this work. As a result of this collaboration, several ideas that emerged over the years have led to the development of decision-support and community planning tools that aid a cross section from managers to the general public in better understanding risks and in making the best possible socio-economic decisions. Examples of these collaborations include:

Decision Support Tools

- Hazard Assessment Tools have been developed in partnership with NOAA's Pacific Region, local governments in American Samoa, Guam, and Hawaii (County of Kauai). These tools use Geographic Information Systems maps to integrate hazard risk information, such as sea level rise projections, along with local information on

infrastructure, natural resources, and administrative boundaries to improve both short and long term decision making.

- The Hazard Education and Awareness Tool is a template which allows any organization the ability to create a simple website which provides public access to local hazard maps for their community. Additional information on appropriate response and preparedness actions are also included.
- The Nonpoint Source Pollution and Erosion Comparison Tool is a decision support tool which allows coastal managers to compare potential water quality impacts of land cover change that may occur from changes in climate.

Data

- The Coastal Change Analysis Program (C-CAP) is a nationally standardized database of land cover and land change information, developed using remotely sensed imagery, for the coastal regions of the United States. C-CAP products inventory coastal intertidal areas, wetlands, and adjacent uplands with the goal of monitoring these habitats by updating the land cover maps every five years. Its primary objective is to improve scientific understanding of the linkages between coastal wetland habitats, adjacent uplands, and living marine resources. Land cover data from C-CAP has been developed for Hawaii from satellite images acquired in both 2000 and 2005. High resolution elevation data for Hawaii was collected in 2005 using Interferometric Synthetic Aperture Radar. This elevation data provides resource managers with the highest resolution elevation data currently available for Hawaii. This data is invaluable for determining potential impacts of changes in climate, such as sea level rise, in areas where higher resolution data may not be available.

Community Planning Tools

- The Coastal Community Resilience Guide presents a framework for assessing resilience of communities to coastal hazards. The work was the result of a partnership funded through the Indian Ocean Tsunami Warning System Program and is being piloted for application in Hawaii. The framework, developed in concert with over 140 international partners, encourages integration of coastal resource management, community development, and disaster management for enhancing resilience to hazards, including those that may occur as a result of climate change.

The Pacific ENSO Application Center

Pacific Island communities continually deal with dramatic seasonal and year-to-year changes in rainfall, temperature, water levels and tropical cyclone patterns associated with the El Niño-Southern Oscillation (ENSO) cycle in the Pacific. This dynamic system involving the Pacific Ocean and the atmosphere above it can bring droughts, floods, landslides, and changes in exposure to tropical storms. Fourteen years ago, NOAA joined forces with the University of Hawaii, the University of Guam, and the Pacific Basin Development Council to begin a small research pilot project designed to develop, deliver, and use forecasts of El Niño-based changes in temperature, rainfall, and storms to support decision making in the American Flag and U.S.-Affiliated Pacific Islands. That pilot project – the Pacific ENSO Applications Center (PEAC) – continues its work today as part of the operational National Weather Service programs in the

Pacific. The PEAC experience has demonstrated the practical value of climate information for water resource management, disaster management, coastal resource planning, agriculture, and public health.

The Pacific Climate Information System

The experience gained from PEAC and the Pacific RISA has helped inform the emergence of a comprehensive Pacific Climate Information System (PaCIS). As an integrated organization that brings together NOAA's regional assets as well as those of its partners, PaCIS provides, on a regional scale, a programmatic framework to integrate ongoing and future climate observations, operational forecasting services, and climate projections, research, assessment, data management, communication, outreach and education that will address the needs of American Flag and U.S.-Affiliated Pacific Islands. Within this structure, PaCIS will also serve as a United States' contribution to the World Meteorological Organization's Regional Climate Centre for Oceania and represents the first integrated, regional climate service in the context of emerging planning for a National Climate Service.

Scientists and decision-makers in Pacific Island communities are now engaged in individual and collaborative efforts to understand the nature of the climate change impacts described in IPCC-AR4 and explore our options for both mitigation and adaptation. This shared effort involves NOAA, other federal programs, state agencies, university scientists, community leaders and non-governmental organizations. Together these groups are focusing their unique insights and capabilities on a number of critical climate programs and activities including: contributions to global and regional climate and ocean observing systems; operational forecasts of seasonal-to-inter-annual climate variability; development and analysis of improved models that provide long-term projections of climate change; multi-disciplinary assessments of climate vulnerability, climate data stewardship, the development of new products and services to support adaptation and mitigation in the Pacific; and education and outreach programs to increase the climate (and environmental literacy) of Pacific Island communities, governments, and businesses.

Future planning for a number of climate programs in the Pacific will be organized in the context of PaCIS including building upon the PEAC, the Pacific Islands Regional Integrated Science and Assessment (Pacific) program and other related climate activities in the region. In addition to meeting the specific needs of U.S. affiliated jurisdictions in the Pacific, PaCIS will also provide a venue in which to discuss the role of U.S. contributions to other climate-related activities in the Pacific including, for example, observing system programs in the region, such as the Pacific Islands Global Climate Observing System (PI-GCOS) and the Pacific Islands Global Ocean Observing System, as part of an integrated climate information system.

In order to further define the roles and capabilities of PaCIS, a steering committee has been established, made up of representatives of institutions and programs working in the fields of climate observations, science, assessment, and services in the Pacific (including PEAC, the Pacific RISA, PI-GCOS, and the National Weather Service), as well as selected individuals with expertise in similar regional climate science and service programs in other regions. The PaCIS Steering Committee will provide a forum for sharing knowledge and experience and guide the development and implementation of this integrated, regional climate information program.

The Pacific Region Integrated Coastal Climatology Program

Over the past decade, discussions with disaster management agencies and coastal managers in the Pacific Islands have highlighted concerns about sea level rise, and the associated coastal inundation, as one of the most significant climate-related issues facing coastal communities in the Pacific. In light of this need, NOAA, through its IDEA Center, with support from the Pacific Services Center, and working with colleagues throughout NOAA, the U.S. Army Corps of Engineers, U.S. Geological Survey and university scientists in Hawaii, Guam, Alaska, and Oregon, initiated the Pacific Region Integrated Coastal Climatology Program (PRICIP). PRICIP recognizes that coastal storms and the strong winds, heavy rains, and high seas that accompany them pose a threat to the lives and livelihoods of the people of the Pacific. To reduce their vulnerability, decision-makers in Pacific Island governments, communities, and businesses need timely access to accurate information that affords them an opportunity to plan and respond accordingly. The PRICIP project is helping to improve our understanding of patterns and trends of storm frequency and intensity within the Pacific Region, and develop a suite of integrated information products that can be used by emergency managers, mitigation planners, government agencies, and decision-makers in key sectors including water and natural resource management, agriculture, fisheries, transportation, communications, recreation, and tourism.

As part of the initial build-out, a PRICIP web portal is serving a set of historical storm “event anatomies.” These event anatomies include a summary of sector-specific socio-economic impacts associated with a particular extreme event as well as its historical context climatologically. The intent is to convey the impacts associated with extreme events and the causes of them in a way that enables users to easily understand them. The event anatomies are also intended to familiarize users with *in situ* and remotely-sensed products typically employed to track and forecast weather and climate.

Hawaiian Archipelagic Marine Ecosystem Research

The Hawaiian Archipelagic Marine Ecosystem Research Plan is a collaborative planning process to develop sustainable conservation and management throughout Hawaii’s marine ecosystem through improved understanding of the unique physical and biological attributes of the Hawaiian archipelagic marine ecosystem, their interconnected dynamics, and their interactions with human beings. By using Hawaii as a large-scale archipelagic laboratory for the investigation of biophysical processes, comparing the protected Northwestern Hawaiian Islands to the heavily used Main Hawaiian Islands and integrating socioeconomic information, Hawaii and comparable marine ecosystems worldwide should realize improvements in resource management and community response to changes in climate.

While this project is in its formative stages, the information generated by this projected 10-year multi-agency, collaborative program will:

- Fill critical and important research gaps in the underlying science of marine ecosystem dynamics;
- Complement national, international, and state ecosystem research initiatives;

- Improve understanding of the behavior of humans in a marine ecosystem approach to conservation and management;
- Formulate predictive theory of ecosystem dynamics relative to physical and biological variables; and
- Generate useful information for conservation managers.

Ms. WATSON. If I just may go on for a minute, what we did was we taught the local populations how to survive if they are aboard ship and so on. But what we need to do is help them cope when these natural disasters occur.

Let me also move on to, I am resident of southern California. I represent Los Angeles, Culver City, Hollywood, and I am very aware how difficult it can be to deal with water crises. You know, we are in the desert. We got all our water up north, 6,000 miles of delta, and no water in the south. So political tensions increase when the areas with adequate water supplies and those without start bickering about their respective needs and the rights. We have three States in one.

You noted, as I understand, in your testimony that Asia is a region of uneven water distribution and scarcity, and this region has seen rapid urbanization, and it is a hotbed of political uneasiness, especially in India, Pakistan and China.

How can the United States Government encourage these nations to mitigate climate change, reduce pollution and increase the resilience in their localities and still remain politically friendly and not hinder development? That is a little bit of magic thrown in, too. But can you give us some suggestions?

Mr. KARL. Well, I think clearly it is a ground up approach, boots on the ground. I know that we work with our International Research Institute that we fund, and they actually go to areas. For example, they are working on urban water supply problems in Manila, and again it is working with the local population and helping them understand what their resilience is and what their adaptation capacities are; similar things with fire forecasting and agriculture. And it really does take this engagement.

We have this body of knowledge that is extremely important to be conveyed to folks who actually have to use it. That is quite a challenging task, and I think it is going to require, as we say, boots on the ground to encourage that dialogue and discussion.

Ms. WATSON. Thank you.

I see I have 1 more minute and a few seconds. If I could continue, I would like to direct this to Mr. Derviş.

I understand in your testimony you said that the fixed proportion of allowance revenue for adaptation financing is small in the beginning and will grow as the value of the allowance goes up. The U.N. and USAID have been known to provide aid that is specifically marked for certain uses. For example, in increasing the ability of small islands to provide electricity to their residents, aid money has provided for the expensive and polluting transport of diesel.

Would isolated communities, be they in the middle of an ocean or in the plains of Africa, be better off predominantly using solar or wind energy sources? I have got more to that, but if you can just address that first part.

Mr. DERVIŞ. Thank you, Congresswoman.

I think the quality of any kind of foreign aid, but particularly this adaptation aid, is, of course, going to be very important. There have been mistakes made in the past by various actors. I would think that there is tremendous opportunity for renewables and nonconventional sources of energy, including wind and solar. Of course, it depends on the particular climate, the particular area one is talking about.

Nonetheless, there is a problem for all these sources worldwide, and that is the extreme variability in the cost of various sources of energy. I know many countries where wind energy would become very competitive, provided the cost of fossil fuels is not subsidized, or provided it doesn't go below a certain level. So the pricing of various sources of energy, including oil and gas, is an important component of this whole problem.

We, of course, have faced extreme ups and downs in the price of oil. Last year around this time it was \$145 a barrel. People were predicting it was going to be \$200, and then it collapsed to \$35. And now it is up to between \$60 and \$70. So this extreme variability makes it hard to choose the best mix.

But coming back to your particular question, I think it is very important to look at the particular place, to use whatever resources that place has in the best possible way, and to have long-term approaches to these problems, because people can't switch their investments and their behavior overnight. So one has to have sustainable solutions.

Ms. WATSON. We are right now in one of our committees looking at how to particularly restructure USAID. So I would hope that you would go to Copenhagen with some of the suggestions that you are mentioning now. We need to restructure how we use resources for the best outcome.

Thank you very much. I will yield back my time.

Mr. FALEOMAVAEGA. I thank the gentlelady for her questions.

Again, I appreciate, gentlemen, your patience in going through the line of questions that we have. I think some of the points that you made, and I thought Mr. Derviş' statement here to the most vulnerable societies, gives a real serious sense of ethical and moral challenges to those countries that have the opportunities that they have in sharing their resources for those countries that are poor.

I also note with interest, Mr. Derviş, your statement that uncertainty shouldn't allow inaction, and I think you hit it right on the nail in terms of this issue should not be taken aback or just to think we are going to put it on the back burner, and it is going to go away.

I do want to offer my apologies to the members of the panel for myself and for the staff to give you a little head notice in terms of we are now. I think we have a point of reference clearly stated by the passage recently of the Waxman-Markey bill, H.R. 2454, that specifically under Title IV of this bill, which provides for an international adaptation program creating a fund to carry out the

program; consultations with USAID, Treasury and EPA; and the two mechanisms that are also outlined in this particular section of the bill.

I am going to be writing to each of you specifically for your comments and for your input on the substance of this proposed bill, because this is the only reference that we now have in the Congress on how we are going to address this issue of climate change and what we should be doing to help the most vulnerable societies as has been the basis of this hearing.

It is not so much that I don't care about the rich countries, because they already have the experts, they have all the people to confront and be able to debate and discuss the issues. But it is the poor countries, the most vulnerable, who don't have the resources, who don't have the means, who don't have the financial capabilities and the resources to address these issues. And I think we ought not to miss this point of making sure that they are just as important in our deliberative process when it comes before Copenhagen in the meeting coming up in January.

So if it is all right with you gentlemen, I will be writing to you specifically. And I do want to say that I do value very much your input and comments on this very important issue. I cannot thank you enough for your taking the time to come and to share your expertise and your understanding of this very important issue.

It is my hope that in the coming weeks, as I will be consulting with my colleagues on the subcommittee and also with Chairman Berman, that we will move this forward and to see that maybe we could finesse and make the legislation better than what it is now, what has been proposed.

Of course, the other matter is the fact that we don't know what the Senate is going to do with the bill. But at least we have a starting point, and this is where I would deeply appreciate your suggestions on how we can maybe make improvements to the proposed legislation that is now before the Congress and, of course, will be before the Senate.

As I said earlier, I will specifically be writing to each of you for your comments and help on this.

All other added data or information that you wish to support or to add into the record, without opposition, it will be allowed, specifically this very thin report that Mr. Derviş has requested that it be made part of the record. It is by the Intergovernmental Panel on Climate Change, Technical Paper No. VI. It will be made part of the record. This is going to be quite a record.

[NOTE: The information referred to, "Climate Change and Water," IPCC Technical Paper VI, June 2008, is not reprinted here but is available in committee records and on the Internet at: <http://www.ipcc.ch/pdf/technical-papers/climate-change-water-en.pdf> (accessed 11/18/09).]

Mr. FALEOMAVAEGA. This is the basis of how our democratic system operates, gentlemen. This is the opportunity that Congress has to hold oversight hearings, and hopefully by getting the truth, data and information that is important, that we can then craft legislation that will address the issues that are needed, especially the question of climate change.

Gentlemen, I have no further questions. I would like to give each of you a chance for further comments before we close.

One closing question: There seems to be some concern about China in terms of my understanding that China for the last 8 years has been moving aggressively in addressing emission standards, in addressing pollution and the problems that they face, probably even a lot more than what we have done in our own country. To my understanding, almost 50 percent of the energy resources from our country comes from coal. And the supply of coal that we have in the United States, I think, is about for 500 years or even more. We have enough coal to supply our energy needs for the next 500 or 1,000 years. Then you have shale oil, then you have natural gas and all these other things. We have the natural resources.

But it is the question of environment, it is the question of fairness or sense of equity by those who develop against those who think that maybe to the extremes, which I think is what we are trying to prevent here. I always get that stereotype of corporate greed, that they don't care about environmental needs, just as much as the opposite extreme of environmentalists who never even go to see for themselves the real serious needs of that given community or that given issue that people in that specific area know more about than those who think that they know what is best for the others.

I think the statement from the African countries makes that quite clear about indigenous knowledge about climate conditions for something that the so-called technologies of the modern world are not able to address properly.

So, I would like to pose just one last question. Give me the good and the bad about China and why you seem to have some concern about China's involvement with Copenhagen. Let us start from the right, Dr. Wheeler. We will go right down.

Mr. WHEELER. I had substantial involvement with China when I was at the World Bank, Mr. Chairman, and I have to say that they are quite concerned about their own pollution problems, and they have actually moved quite aggressively on those.

I am personally aware of legislative reform in China as of 2 years ago. They passed a national law requiring that all major polluting facilities disclose their pollution to the people in the communities, which was, in China, in that context, a pretty revolutionary change.

The party is behind that. The Communist Party itself is no monolith. They have different factions. They have an environmentalist faction. And my colleagues in the academic community in China and the research communities are very aware of the potential impact of climate change on China. They argue the case very strongly in the internal councils in China, and I think they have been heard.

So the Chinese are actually taking a lot of very active measures along these lines. We need to respect that and acknowledge that, and that should be part of our dialogue with China.

Mr. FALEOMAVAEGA. Before Dr. Janetos says something, this is something I always have to remind my colleagues on the committee. When China became an independent country in 1949, there were 400 million Chinese living at the time. After some 220 years,

we barely reached 323 million people in the United States. I don't care what kind of government, whether it is Communist, Socialist, democracy or what, 400 million people were living in China in 1949. So now it is 1.3 billion.

I think sometimes we seem to lose perspective when you see the tremendous challenges for any government to address and why it is so serious that the leaders are trying so hard. I must say that Deng Xiaoping's historical decision in 1978 to change China's economic policy to be involved in the free-market system is the very reason why China now has come so tremendously in advance, even though 800 million people in China still live below the poverty level.

So, seriously, this is not as something that always creates a sense of fear as if China is moving ahead of us and not realizing they have got social and economic issues that are far beyond what any of us here could well imagine or appreciate and understand.

Dr. Janetos.

Mr. JANETOS. Thank you, Mr. Chairman.

I completely agree with Dr. Wheeler. We in our own institute have research programs in two different cities in China working on the importance of building codes for increased energy efficiency.

China is not a monolith. It is important because it is so large, just as we are important because we are so large.

Thank you.

Mr. FALEOMAVAEGA. Dr. Karl.

Thank you, Dr. Janetos.

Mr. KARL. I would comment similarly along the lines of Dr. Janetos, we have a number of important exchange programs with China, bilateral programs, where we share both data, observations, observing systems. They are a critical component for us to better understand what we discussed earlier with respect to those important regional impacts, and we have had some good relationships with them over the course of years.

Mr. FALEOMAVAEGA. Mr. Derviş.

Mr. DERVIŞ. Well, Mr. Chairman, I think you summarized yourself extremely well, and one can add or summarize it following your words, that never in history have so many poor people been lifted out of poverty. But there are still many, many that need to progress a lot. I do believe that one has to keep that in mind.

One has to be particularly careful on the trade issues, which have the greatest potential for very tough behavior and conflict that could hurt everybody, because while obviously the United States market is extremely important for China, we also have seen just 3 days ago that their reserves have now surpassed \$2 trillion, of which almost \$1 trillion is in U.S. Treasury bills. So there are points on both sides to be very careful about.

But I would like to say also with the growth, with the importance, with the strength that China has achieved, now also does come the time that China has to join the international community in a very constructive way; that gradually it has to take greater responsibility for the state of the world in a way. And I hope that it will do that and that we all—the world community will encourage them in that direction.

Thank you.

Mr. FALEOMAVAEGA. Dr. Clark.

Mr. CLARK. China currently generates about 70 percent of their energy from coal. They are walking a tightrope from between trying to manage their economy, trying to control the impacts that they are having on the local, the regional and the world environment now, and at the same time trying to balance their relationships with other nations. They are throwing almost all the resources they can at their energy problem because they have bought into the idea that energy access is key to their solution in terms of addressing poverty. I think they are building 2 gigawatts of coal-burning electrical capacity. Every week now they are turning on a plant. And I think annually their construction rate exceeds all of the existing electrical-generation capacity of the continent of Africa.

So China is of concern, first, because it is so large, and because they are attempting to build and they have been attempting to build a carbon-intensive infrastructure for energy provision. Now, I am not suggesting that that is something where they made a decision to do something that was going to harm the planet. Those were simply the choices that they had before them. They are aggressively trying to put renewable energy in, but they can't throw enough renewable energy into their system fast enough to deal with the peaking demands they are seeing across the board.

They are also very aggressive economic competitors, and they are rising to the level of the U.S. in terms of their ability to influence manufacturing marketplaces throughout the world. And for the first time, 2 of the 13 provinces in China have now reached the point where their citizens are making enough money so that they can go out and they can buy cars, refrigerators, washing machines, microwaves, televisions, everything that we take for granted here.

As the economy continues to evolve, more of the provinces will pass over the threshold. We will see more and more internalized consumer spending. And we see an economic process of decoupling that people have talked about for probably decades now that is really beginning to take root and take hold.

And the reason that I think I am the source of some negative energy here today about China because of the comments that I made, I am very sympathetic of the situation that they face. I am also very sympathetic to the needs of our economy as well. We are reaching a period where our influence is going to continue to wane. And our ability to encourage them to move more rapidly in the direction of a lower carbon footprint for their nation, our ability is going to go away, and I don't want to see this climate negotiation go through. You mentioned that the United States didn't participate in Kyoto. Well, to be honest, neither did India or China. They had no binding targets to make. They made no substantive commitments.

Would I would like to see personally is something where we would get some form of binding commitments and participation by all the players, as you indicated before. I think that is absolutely critical.

So China is important in that regard. So it is a growing industrial superpower. They have set their government system up now. Even though their national government is pushing for renewable energy and pushing harder on environmental impacts, they have

lost a degree of control in their economic development plans that have devolved down to the provincial and to the city levels. That is why they have so much access, have the industrial capacity that has been built and continues to be built.

They also have a problem with transparency that is our culture as far as business is concerned, and we can't necessarily understand just how the government is involved with many of the state-owned enterprises. These are all challenges, and they all need to be worked out.

The comment I made to Ranking Member Manzullo a few moments ago was these economic issues, these are the underpinnings of the foundation of the Copenhagen negotiations. It is not just climate change. This is going to be a negotiation about the economic future of the developed and developing nations and how they are going to coexist not only environmentally, but economically. I think that is going to begin to show up within the negotiations that we see once they get underway.

Mr. FALCONE. I think the symptoms are already in place. What I mean by this is that what happened recently with our own economic recession, our own so-called experts on economic policies and theories. My sense is now there seems to be a regional response to say that the West has failed by its own economic policies and causing the global and economic environment in a worst way. There seems to be now issues raised in China, Brazil, non-Western countries suggesting that there needs to be a change in economic policies for 50 years or maybe even 100 years. Again I am not an economist.

The whole world is always dependent on the dollar as the basis of determining what would be the best decisions, or evaluations, or policies affecting the economies of various countries of the world. China is now questioning the validity of how we have gone about in addressing the very issues as a result of Wall Street, what lack of regulation, I guess you might say. And correct me if I am wrong, but China and Canada are probably among the few countries in the world economically that are stable because they took regulatory measures to make sure that banks don't run the derivatives and all these fancy theories and things that we, the best economists or financial people in Wall Street, ended up doing and find ourselves now in economic chaos, if you want to put it in those terms. And we are having to pay for this.

So I think in line with that we need to look at—and I am talking about the big, big picture—not just putting our economic situation into more stable conditions, but to say, is the Western model really the best way to follow as a result of what we have produced? And then causing whatever the economic problems that we have created, it has serious implications in world markets and other countries that are also affected by this seriously.

So I am not criticizing, just suggesting that. Again, I am not an economist, but I am just simply saying our failure as a Western country in not getting our own economic policies in the best way is now leaving some very serious questions by other countries of the world that we need to take corrective action and make sure that these things don't happen again.

Dr. Wheeler.

Mr. WHEELER. Mr. Chairman, if I could suggest one area which is related to your remarks that might bear scrutiny by you and your committee. As you think about Waxman-Markey and improvements, it goes to the way in which the resources to be allocated to clean technology development and so forth will be allocated in this world, because there are two models. One is a multilateral model, and the other is a bilateral model. And I think that is under active discussion.

Along the lines of the point you just made, I would cite the case of the Clean Technology Fund at the World Bank which has now been chartered with 20 members representing the G-20 basically. So it is a new model of governance. It is not like the old model in the World Bank. And that could be an important channel for the funds that will be needed to address some of these problems.

But I think for the Congress it is a very important issue to resolve there on bilateral versus multilateral, and whether or not and how much should be committed to these new multilateral, broadly governed channels, because it is a progressive new force in the world. It is something to be taken seriously, I think.

Mr. FALEOMAVAEGA. Do you think that also by way of our own national policies, given the fact that I think somewhere between 25 and 30 percent of the assets in the World Bank, the Asian Development Bank and International Monetary Fund are from the United States, that maybe we could use that as a source of influence on how we could better allocate the billions and billions of dollars that these regionalist banking institutions supposedly are to serve and to give assistance to the needs of the world?

Again, I am not an economist. I just notice that all of you practically have had experience, serious experience, in dealing with these regional banks. And I just wonder have we asserted our 25 percent ownership of these banks in such a way that maybe addressing the very issue that we are discussing this afternoon?

Mr. WHEELER. Sir, I would defer to my colleague, Kemal Derviş. We have here today the ranking expert on this issue.

Mr. FALEOMAVAEGA. Mr. Derviş, would you care to comment? I was going to say I had only one more question, but I can't help it, I am really enjoying this dialogue.

Mr. DERVİŞ. Well, I think the fact that these issues are so global and involve so many countries in the world, I think it is a good argument for strongly involving the multilateral institutions, the World Bank, on energy in particular, because it has long-term ability to lend and to discuss policy frameworks, projects, sectors and so on.

At the same time I do believe bilateral efforts also have their role to play. I think the strengthening of the U.S. aid mechanism of USAID is important. For the next two or three decades, we will have both channels, the national channels, the bilateral channels and the multilateral ones. I have, of course, lived in the multilateral ones for a good part of my life, and I do believe they are quite useful. But also taxpayers like to see their own country act, not always just multilaterals, so it is a question of equilibrium. One has to use both.

I do believe the very fact that the World Bank is in Washington, just very close, makes it an institution that is close to American

policymakers. It is easy to talk, to discuss things. And at the same time it is multilateral, the whole world is there, and therefore it is an instrument that can be used very effectively.

Thank you.

Mr. FALEOMAVAEGA. Gentlemen, I think I have held you here too long here this afternoon. Again, I really, really appreciate your participation and the comments that you have made. It is going to be a tremendous help to the subcommittee.

Again, you will be getting a letter from me in the very near future to see how we can better attack the Waxman-Markey version of how we can be helpful to these vulnerable societies dealing with climate change.

Thank you very, very much. The hearing is adjourned.

[Whereupon, at 4:17 p.m., the subcommittee was adjourned.]

A P P E N D I X

MATERIAL SUBMITTED FOR THE HEARING RECORD

SUBCOMMITTEE HEARING NOTICE
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**SUBCOMMITTEE ON ASIA, THE PACIFIC AND THE GLOBAL
ENVIRONMENT**
Eni F. H. Faleomavaega (D-AS), Chairman

July 16, 2009

TO: MEMBERS OF THE COMMITTEE ON FOREIGN AFFAIRS

You are respectfully requested to attend an OPEN hearing of the Subcommittee on Asia, the Pacific and the Global Environment, to be held in Room 2172 of the Rayburn House Office Building:

DATE: Thursday, July 23, 2009

TIME: 2:00 p.m.

SUBJECT: From L'Aquila to Copenhagen: Climate Change and Vulnerable Societies

WITNESSES:

Panel I

Thomas Karl, Ph.D.
Director, National Climatic Data Center
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

Panel II

Mr. Kemal Derviş
Vice President and Director
Global Economy and Development
Brookings Institution
(Former Administrator, United Nations Development Programme)

Anthony Janetos, Ph.D.
Director, Joint Global Change Research Institute
Pacific Northwest National Laboratory
University of Maryland

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By Direction of the Chairman

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COMMITTEE ON FOREIGN AFFAIRS

MINUTES OF SUBCOMMITTEE ON ASIA, THE PACIFIC AND THE GLOBAL ENVIRONMENT

Day: Thursday
 Date: July 23, 2009
 Room: 2172 Rayburn House Office Bldg.
 Start Time: 2:03 p.m.
 End Time: 4:13 p.m.

Recesses:

Presiding Member(s): Chairman Eni F.H. Faleomavaega

CHECK ALL OF THE FOLLOWING THAT APPLY:

Open Session ☒
 Executive (closed) Session ☒
 Televised ☒
 Electronically Recorded (taped) ☒
 Stenographic Record ☒

TITLE OF HEARING: "From L'Aquila to Copenhagen: Climate Change and Vulnerable Societies"

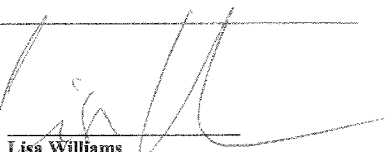
COMMITTEE MEMBERS PRESENT: Rep. Manzullo, Rep. Watson, Rep. Inglis

NONCOMMITTEE MEMBERS PRESENT:

WITNESSES: Same as meeting notice attached? Yes ☒ No ☐ (If "no", please list below and include title, agency, department, or organization.)

ACCOMPANYING WITNESSES: (Include title, agency, department, or organization, and which witness the person accompanied.)

STATEMENTS FOR THE RECORD: (List any statements submitted for the record)
 Chairman Faleomavaega, Ranking Member Manzullo, Rep. Watson, Dr. Thomas Karl (witness)
 Mr. Kemal Dervis (witness), Dr. Anthony Janetos (witness), Dr. David Wheeler (witness), Dr.
 Redmond Clark (witness)


 Lisa Williams
 Staff Director