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BUILDING U.S. RESILIENCE TO GLOBAL WARMING IMPACTS

HEARING

BEFORE THE

SELECT COMMITTEE ON
ENERGY INDEPENDENCE
AND GLOBAL WARMING
HOUSE OF REPRESENTATIVES

ONE HUNDRED ELEVENTH CONGRESS

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BUILDING U.S. RESILIENCE TO GLOBAL WARMING IMPACTS

THURSDAY, OCTOBER 22, 2009

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE ON ENERGY INDEPENDENCE
AND GLOBAL WARMING,
Washington, DC.

The committee met, pursuant to call, at 9:35 a.m., in Room 2175, Rayburn House Office Building, Hon. Edward J. Markey [chairman of the committee] presiding.

Present: Representatives Markey, Blumenauer, Inslee, Cleaver, Hall, Speier, and Sensenbrenner.

Staff present: Jonah Steinbuck and Ana Unruh Cohen.

The CHAIRMAN. This hearing is called to order.

This is the Select Committee on Energy Independence and Global Warming. We welcome you all here this morning.

We all remember the tragic consequences of Hurricane Katrina: the breached levies, water-filled streets and families seeking shelter in the Superdome. While many individuals courageously responded to this disaster, government leadership failed the people of New Orleans when they needed help the most. Katrina foreshadows the consequences of climate change if we do not make the necessary preparations.

Since then, scientists have shown that the warming of our climate system from emissions of heat-trapping gases, from our tailpipes and smokestacks, is unequivocal. We face not only an increasing number of strong storms but also many permanent alterations that will affect people throughout the country. Coastal cities like Boston will be at risk of inundation from sea-level rise, which is accelerating as our oceans warm and our polar icecaps melt. Alaskan villages are finding the land they call home literally melting out from underneath them as the permafrost thaws. In the West our shrinking mountain snow pack strains our water resource system. Throughout this country our farms are threatened by rising temperatures, water scarcity, and pests.

For projected 2.2 degree Fahrenheit rise in temperatures over the next 30 years, we can expect significant declines in the crops that make up the base of our food system. The past is no longer a predictor of the future. We need to develop our resilience in order to safeguard our health, our environment, our economy and our national security. We need to develop a comprehensive strategy to adapt, conduct world-class climate research, and coordinate Federal, State and local action.

Now some will argue that we should not address the root of the problem and only address its symptoms—that we should only adapt to climate change and not address global warming pollution. We cannot just address the symptoms. When someone has a heart attack, the doctor prescribes medication to help prevent another attack and puts the patient on a low-fat diet to improve long-term health. Our country experienced a heart attack in New Orleans, and we must now develop both the institutional medication to manage the impacts of warming and also shift society to a low-carbon energy regiment for a healthy climate. Just as we cannot medicate our way out of a heart problem, we cannot adapt our way out of global warming.

We have taken the first steps to cut carbon pollution and build resilience to global warming impacts. Earlier this year, the House passed the Waxman-Markey American Clean Energy and Security Act, which will set us on a pollution-cutting path and at the same time create millions of new jobs making America the global leader of the clean-energy economy. The act will also create a national climate service that will provide decision-makers with the very best climate information and help Federal agencies and States adapt to the dangerous consequences of climate change.

In a new report that I requested, the Government Accountability Office assesses the current steps our country is taking to address the impacts of global warming. They find that Federal efforts thus far have been largely ad hoc. To effectively address the impacts, we need a strategic plan that sets out priorities, improves the information available to decision-makers and clarifies the roles and responsibilities of Federal, State and local governments. I look forward to the testimony of our witnesses and hearing from them how Congress can help build our resilience to global warming.

Now I would like to recognize the ranking member of the committee, the gentleman from Wisconsin, Mr. Sensenbrenner.

[The prepared statement of Mr. Markey follows:]

Opening Statement for Edward J. Markey (D-MA)
"Building U.S. Resilience to Global Warming Impacts"
Select Committee on Energy Independence and Global Warming
October 22, 2009

We all remember the tragic consequences of Hurricane Katrina – the breached levees, water-filled streets, and families seeking shelter in the Superdome. While many individuals courageously responded to this disaster, government leadership failed the people of New Orleans when they needed help most. Katrina foreshadows the consequences of climate change if we do not make the necessary preparations.

Since then, scientists have shown that the warming of our climate system from emissions of heat-trapping gases – from our tailpipes and smokestacks – is unequivocal.

We face not only an increasing number of strong storms, but also many permanent alterations that will affect people throughout the country. Coastal cities like Boston will be at risk of inundation from sea level rise, which is accelerating as our oceans warm and our polar ice caps melt. Alaskan villages are finding the land they call home literally melting out from underneath them as the permafrost thaws. In the West, our shrinking mountain snowpack strains our water resource systems. Throughout this country, our farms are threatened by rising temperatures, water scarcity, and pests. For a projected 2.2 degree (Fahrenheit) rise in temperatures over the next 30 years, we can expect significant declines in the crops that make up the base of our food system.

The past is no longer a predictor of the future. We need to develop our resilience in order to safeguard our health, our environment, our economy, and our national security. We need to develop a comprehensive strategy to adapt, conduct world-class climate research, and coordinate federal, state, and local action.

Now, some will argue that we should not address the root of the problem and only address its symptoms – that we should only adapt to climate change and not address global warming pollution. We cannot just address the symptoms. When someone has a heart attack, the doctor prescribes medication to help prevent another attack and puts the patient on a low-fat diet to improve long-term health. Our country experienced a heart attack in New Orleans and we must now develop BOTH the institutional medication to manage the impacts of warming AND ALSO shift society to a low-carbon energy regimen for a healthy climate. Just as we cannot medicate our way out of heart problems, we cannot simply adapt our way out of global warming.

We have taken the first steps to cut carbon pollution and build resilience to global warming impacts. Earlier this year, the House passed the Waxman-Markey American Clean Energy and Security Act, which will set us on a pollution cutting path and at the same time create millions of new jobs, making America the global leader of the clean energy economy. The Act will also create a National Climate Service that will provide decision-makers with the very best climate information and help federal agencies and states adapt to the dangerous consequences of climate change.

In a new report that I requested, the Government Accountability Office assesses the current steps our country is taking to address the impacts of global warming. They find that federal efforts thus far have been largely ad hoc. To effectively address the impacts, we need a strategic plan that sets our priorities, improves the information available to decision-makers, and clarifies the roles and responsibilities of federal, state, and local governments.

I look forward to the testimony of our witnesses and hearing from them how Congress can help build our resilience to global warming.

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

Adaptation is an important but overlooked facet of the global warming debate. That is probably why the GAO has concluded that Federal, State and local governments need better coordination on climate change adaptation strategies.

It is a popular misconception that there is scientific consensus about the future impacts of global warming. And there is little agreement in the scientific community about what the specific effects of climate change will be. That is why a strategy that focuses on adaptation and not taxes makes more sense.

Congressional Democrats believe a cap-and-tax plan will cure global warming, but there is little reason to believe that that is true. Unless China and India make similar emission cuts, there won't be any reduction in global temperatures.

Cap-and-tax may not have much impact on global temperatures, but it will have a big impact on the American economy. The Waxman-Markey cap-and-tax bill calls for an 83 percent cut from greenhouse gas emissions by 2050. But a study by the National Association of Manufacturers and the American Council for Capital Formation shows that, by 2030, the economy will already feel the pressure.

Come 2030, cap-and-tax will have shaved as much as 2.4 percent or $571 billion off the U.S. gross domestic product. That is nearly as much as the government spent on Social Security last year. Cumulative GDP lost during the coming decades would be enormous, with projections of more than $3 billion in lost economic output.

This isn't just a problem for business and industry because the government will also be shortchanged. In 2030 alone, Federal and State governments would see nearly $170 billion less in revenue. That is money that would be more wisely spent on adaptation. The GAO report shows that local and State government managers are finding it hard to fit global warming adaptation into their budgets as more pressing concerns over jobs, infrastructure, security and other issues are taking precedent, as they should. By enacting cap-and-tax and reducing economic growth Congress risks cutting the revenues the State and local governments will eventually need to fund climate adaptation projects.

Proponents of the legislation argue that the bill will raise new tax revenues that can be used for adaptation. I would rather not reduce growth in the first place.

The written testimony of one of today's witnesses emphasizes the importance of resilience to climate variability regardless of the cost. Dr. Kenneth Green, a resident scholar at the American Enterprise Institute, will submit testimony that highlights many important decisions for policymakers, such as faulty wisdom behind rapid development in areas prone to natural disaster, the need for investment in new climate technology, and the benefits market-pricing could bring to adaptation preparation.

I welcome his perspectives as part of today's record and yield back the balance of my time.

The CHAIRMAN. The gentleman's time is expired.

The Chair recognizes the gentleman from New York, Mr. Hall.

Mr. HALL. Thank you, Mr. Chairman and Ranking Member Sensenbrenner.

And I share the ranking member's concern about development in areas that are prone to natural disasters. I also congratulate him on getting the word "tax" in a record number of times in his opening statement.

I think it is a very important hearing and look forward to our witnesses' testimony.

Climate change adaptation has been a serious concern of mine for many years. My district is bisected by the Hudson River, one of America's national treasures, which is tidal all the way to Troy, New York, north of Albany. Along each side of the river, nearly at the water level, runs two rail lines; on the west side, a CSX freight line, and on the east side, the Amtrak and metro north passenger lines. Sea-level rise will imperil these lines, which will be incredibly expensive to move or to replace, as will the other infrastructure that we have counted on for years which are threatened along our coast.

Many of the riverside communities in the counties I represent and other Hudson Valley counties have spent a fortune on urban renewal and revitalizing their waterfronts with boardwalks and restaurants and shops that are just barely above the level of the Hudson as it is today, and as a tidal estuary, obviously if the sea level rises, these beautiful new additions to our waterfronts will be possibly under water. Not to mention Hilton Head, Cape Hatteras, Key West and other places that some of us like to at least think about going to.

Duchess County, my home county, has the third highest number of new cases of Lyme Disease of any county in the country. There has been serious speculation that the spread of these diseases, like Lyme and West Nile Virus, are linked to changes in temperature and the increasing range of the insects that carry those diseases.

I will submit the rest of my statement for the record and, Mr. Chairman, yield back the balance of my time.

The CHAIRMAN. I thank the gentleman very much.

STATEMENTS OF JOHN STEPHENSON, DIRECTOR, NATIONAL RESOURCES AND ENVIRONMENT, U.S. GOVERNMENT ACCOUNTABILITY OFFICE; ERIC SCHWAAB, DEPUTY SECRETARY, MARYLAND DEPARTMENT OF NATURAL RESOURCES; STEPHEN SEIDEL, VICE PRESIDENT FOR POLICY ANALYSIS, PEW CENTER ON GLOBAL CLIMATE CHANGE; AND KENNETH P. GREEN, PH.D., RESIDENT SCHOLAR, AMERICAN ENTERPRISE INSTITUTE

The CHAIRMAN. Now we are going to turn to our first witness, Mr. John Stephenson, who is the Director of Natural Resources and Environmental Issues for the U.S. Government Accountability Office. He has testified many times before Congress, and he always produces excellent work.

So we thank you, sir. Welcome back. Whenever you are ready, please begin.

STATEMENT OF JOHN STEPHENSON

Mr. STEPHENSON. Thank you, Mr. Chairman, Mr. Sensenbrenner, Mr. Hall.

I am pleased to be here today to discuss our report on climate change adaptation and the role of the Federal Government.

The world's leading scientists predict that increased concentrations of greenhouse gases could, among other things, threaten coastal areas with rising sea levels; alter agriculture productivity; and increase the intensity and frequency of tropical storms and floods. In recent years, climate change adaptation has begun to receive more attention because the greenhouse gases already in the atmosphere are expected to continue altering the climate system in the future, regardless of efforts to control emissions. However, individuals and institutions whose futures will be affected by climate change are at present unprepared both conceptually and practically for meeting the challenges it presents.

Our report for this committee, which is being publicly released today, addresses three issues: One, what actions Federal, State and local and international authorities are currently taking to adapt to climate change; the challenges that Federal, State and local officials face in their efforts to adapt; and three, actions that Congress and Federal agencies could take to help address these challenges.

In summary, we found that many Federal agencies had begun to take action but that these actions are largely ad hoc and fall into categories, such as information for decision-making and Federal land and natural resource management, among others. There is currently no coordinated or overarching national approach to adaptation, but certain Federal entities have started to fill this gap.

The President's Council on Environmental Quality is leading a new initiative to coordinate the Federal response to climate change in conjunction with the Office of Science and Technology Policy, NOAA and other agencies. Similarly, the U.S. Global Change Research Program, which coordinates and integrates Federal research on climate change, has developed a series of building blocks that outline options for future climate change work, including science to inform adaptation.

While most government authorities have not yet begun to adapt to climate change, there are some shining examples at the State and local level where planning has begun in earnest. We visited three such locales; New York City; King County, Washington; and the State of Maryland, where government officials are making good progress.

Our analysis of these sites suggest key factors that have led these governments to act: First, natural disasters, such as floods, heat waves, droughts or hurricanes, raise public awareness of the cost of potential climate change impacts. Second, leaders in all three sites use legislation, executive orders, local ordinance or action plans to focus attention and resources on climate change adaptation. Third, each of these governments had access to relevant site-specific information through partnerships with local universities and other entities that provided a basis for planning efforts.

Based on our site visits and the results of the survey we sent to over 270 Federal, State and local officials, the challenges faced by adaptation planners fall into three categories: First, attention and available resources are focused on more immediate needs, making it difficult for adaptation efforts to compete for limited funds. Second, insufficient site-specific data, such as local projections of ex-

pected changes, makes it hard to predict the impacts of climate change and, thus, hard for local officials to justify spending resources now for benefits that may be derived in the distant future. Third, adaptation efforts are constrained by a lack of clearly defined roles and responsibilities for Federal, State and local agencies.

Finally, our survey respondents suggested specific Federal actions that are needed to overcome these challenges. First, training and education efforts are needed to increase awareness among government officials and the public about the impacts of climate change and available adaptation strategies. Second, assistance is needed to interpret and develop site-specific information to help officials understand the impacts of climate change at a scale that would enable them to develop response plans. And third, there is a need to clarify roles and responsibilities across Federal agencies and with State and local governments.

Our work suggests that a more coordinated Federal response would demonstrate a Federal commitment to adaptation. To that end, our report recommends the development of a national strategic plan that will guide the Nation's efforts to adapt to a changing climate, one that defines priorities, clarifies roles and responsibilities, facilitates the exchange of information, identifies resource needs and builds on existing adaptation planning efforts.

Mr. Chairman, that concludes the summary of my statement. I will be happy to answer questions at the appropriate time.

[The statement of Mr. Stephenson follows:]

United States Government Accountability Office

GAO

Testimony
Before the Select Committee on Energy Independence and Global Warming, House of Representatives

For Release on Delivery
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CLIMATE CHANGE ADAPTATION

Strategic Federal Planning Could Help Officials Make More Informed Decisions

Statement of John B. Stephenson, Director
Natural Resources and Environment

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GAO-10-175T

October 22, 2009

Mr. Chairman and Members of the Committee:

I am pleased to be here today to discuss our report to this committee on climate change adaptation and the role strategic federal planning could play in government decision making. Changes in the climate attributable to increased concentrations of greenhouse gases may have significant impacts in the United States and internationally.[1] For example, climate change could threaten coastal areas with rising sea levels. In recent years, climate change adaptation—adjustments to natural or human systems in response to actual or expected climate change—has begun to receive more attention because the greenhouse gases already in the atmosphere are expected to continue altering the climate system into the future, regardless of efforts to control emissions. According to a recent report by the National Research Council (NRC), however, individuals and institutions whose futures will be affected by climate change are unprepared both conceptually and practically for meeting the challenges and opportunities it presents. In this context, adapting to climate change requires making policy and management decisions that cut across traditional economic sectors, jurisdictional boundaries, and levels of government. My testimony is based on our October 2009 report,[2] which is being publicly released today, and addresses three issues: (1) what actions federal, state, local, and international authorities are taking to adapt to a changing climate; (2) the challenges that federal, state, and local officials face in their efforts to adapt; and (3) the actions that Congress and federal agencies could take to help address these challenges. We also provide information about our prior work on similarly complex, interdisciplinary issues.

We employed a variety of methods to assess these issues. To determine the actions federal, state, local, and international authorities are taking to adapt to a changing climate, we obtained summaries of adaptation-related efforts from a broad range of federal agencies and visited four sites where government officials are taking actions to adapt. The four sites were New

[1]Major greenhouse gases include carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); and such synthetic gases as hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulfur hexafluoride (SF_6).

[2]GAO, *Climate Change Adaptation: Strategic Federal Planning Could Help Government Officials Make More Informed Decisions*, GAO-10-113 (Washington, D.C.: Oct. 7, 2009).

York City; King County, Washington; the state of Maryland; and the United Kingdom, focusing on London and Hampshire County. We gathered information during and after site visits through observation of adaptation efforts, interviews with officials and stakeholders, and a review of documents provided by these officials. To describe challenges that federal, state, and local officials face in their efforts to adapt and the actions that Congress and federal agencies could take to help address these challenges, we developed a Web-based questionnaire, and sent it to 274 federal, state, and local officials knowledgeable about adaptation.[3] Within the questionnaire, we organized questions about challenges and actions into groups related to the following: (1) awareness among governmental officials and the public about climate change impacts and setting priorities with respect to available adaptation strategies; (2) sufficiency of information to help officials understand climate change impacts at a scale that enables them to respond; and (3) the structure and operation of the federal government including whether roles and responsibilities were clear across different levels of government.

We conducted our review from September 2008 to October 2009 in accordance with generally accepted government auditing standards. A more detailed description of our scope and methodology is available in appendix I of our report.

Mr. Chairman, the following summarizes the findings on each of the issues discussed in our report:

- *Federal, state, local, and international efforts to adapt to climate change*: Although there is no coordinated national approach to adaptation, several federal agencies report that they have begun to take action with current and planned adaptation activities. These activities are largely ad hoc and fall into categories such as information for decision making, federal land and natural resource management, and governmentwide adaptation strategies, among others. For example, the National Oceanic and Atmospheric Administration's (NOAA) Regional Integrated Sciences and Assessments program supports climate change research to meet the needs of decision makers and policy planners at the national, regional, and local levels. In addition, several federal agencies have reported beginning to consider measures that would strengthen the resilience of natural resources in the face of climate change. For example, on September 14,

[3]For our questionnaire, 187 of 274 officials responded for a response rate of approximately 68 percent. Not all officials responded to every question.

2009, the Department of the Interior issued an order designed to address the impacts of climate change on the nation's water, land, and other natural and cultural resources.[4] While no single entity is coordinating climate change adaptation efforts across the federal government, several federal entities are beginning to develop governmentwide strategies to adapt to climate change. For example, the President's Council on Environmental Quality (CEQ) is leading a new initiative to coordinate the federal response to climate change in conjunction with the Office of Science and Technology Policy, NOAA, and other agencies. Similarly, the U.S. Global Change Research Program, which coordinates and integrates federal research on climate change, has developed a series of "building blocks" that outline options for future climate change work, including science to inform adaptation.

While many government authorities have not yet begun to adapt to climate change, some at the state and local levels are beginning to plan for and respond to climate change impacts. We visited three U. S. sites—New York City; King County, Washington; and the state of Maryland—where government officials are taking such steps. Our analysis of these sites suggests three major factors have led these governments to act. First, natural disasters such as floods, heat waves, droughts, or hurricanes raised public awareness of the costs of potential climate change impacts. Second, leaders in all three sites used legislation, executive orders, local ordinances, or action plans to focus attention and resources on climate change adaptation. Finally, each of the governments had access to relevant site-specific information to provide a basis for planning and management efforts. This site-specific information arose from partnerships that decision makers at all three sites formed with local universities and other government and nongovernment entities. Limited adaptation efforts are also taking root in other countries around the world. As in the case of the state and local efforts we describe, some of these adaptation efforts have been triggered by the recognition that current weather extremes and seasonal changes will become more frequent in the future. Our review of climate change adaptation efforts in the United Kingdom describes how different levels of government work together to ensure that climate change considerations are incorporated into decision making.

[4]Secretarial Order No. 3289 (Sept. 14, 2009).

- *Government officials face numerous challenges when considering adaptation efforts*: The challenges faced by federal, state, and local officials in their efforts to adapt fall into the following three categories, based on our analysis of questionnaire results, site visits, and available studies:
  - First, available attention and resources are focused on more immediate needs, making it difficult for adaptation efforts to compete for limited funds. For example, about 71 percent (128 of 180) of the officials who responded to our questionnaire rated "non-adaptation activities are higher priorities" as very or extremely challenging when considering climate change adaptation efforts.
  - Second, insufficient site-specific data, such as local projections of expected changes, make it hard to predict the impacts of climate change, and thus hard for officials to justify the current costs of adaptation efforts for potentially less certain future benefits. For example, King County officials said they are not sure how to translate climate change information into effects on salmon recovery efforts.
  - Third, adaptation efforts are constrained by a lack of clear roles and responsibilities among federal, state, and local agencies. Of particular note, about 70 percent (124 of 178) of the respondents rated the "lack of clear roles and responsibilities for addressing adaptation across all levels of government" as very or extremely challenging. Interestingly, local and state respondents rate this as a greater challenge than did federal respondents. About 80 percent (48 of 60) of local officials and about 67 percent (31 of 46) of state officials who responded to the question rated the issue as either very or extremely challenging, compared with about 61 percent (42 of 69) of the responding federal officials.[5]

- *Federal efforts could help government officials make decisions about adaptation*: Potential federal actions for addressing challenges to adaptation efforts fall into the following three areas, based on our analysis of questionnaire results, site visits, and available studies:
  - First, training and education efforts could increase awareness among government officials and the public about the impacts of climate change and available adaptation strategies. A variety of programs are

[5]Differences by level of government (federal, state, and local) that are reported are for illustrative purposes and may not be statistically different. We present selected examples where the difference between federal, state, or local responses is greater than 15 percent and the difference presents useful context for the overall results. There were other differences by level of government that are not presented in our report.

trying to accomplish this goal, such as the Chesapeake Bay National Estuarine Research Reserve (partially funded by NOAA), which provides education and training on climate change to the public and local officials in Maryland.

- Second, actions to provide and interpret site-specific information could help officials understand the impacts of climate change at a scale that would enable them to respond. About 80 percent (147 of 183) of the respondents rated the "development of state and local climate change impact and vulnerability assessments" as very or extremely useful.
- Third, Congress and federal agencies could encourage adaptation by clarifying roles and responsibilities. About 71 percent (129 of 181) of the respondents rated the development of a national adaptation strategy as very or extremely useful. Furthermore, officials we spoke with at our site visits and officials who responded to our questionnaire said that a coordinated federal response would also demonstrate a federal commitment to adaptation.

Our past work on crosscutting issues suggests that governmentwide strategic planning can integrate activities that span a wide array of federal, state, and local entities.[6] As our report and others (such as the National Academy of Sciences and the Intergovernmental Panel on Climate Change) demonstrate, some communities and federal lands are already seeing the effects of climate change, and governments are beginning to respond. However, as our report also illustrates, the federal government's emerging adaptation activities are carried out in an ad hoc manner and are not well coordinated across federal agencies, let alone state and local governments. Multiple federal agencies, as well as state and local governments, will have to work together to address these challenges and implement new initiatives. Yet, our past work on collaboration among federal agencies suggests that they will face a range of barriers in doing so.[7] Top leadership involvement and clear lines of accountability are critical to overcoming natural resistance to change, marshalling needed resources, and building and maintaining the commitment to new ways of

[6]GAO, *A Call For Stewardship: Enhancing the Federal Government's Ability to Address Key Fiscal and Other 21st Century Challenges*, GAO-08-93SP (Washington, D.C.: Dec. 17, 2007).

[7]GAO, *Results-Oriented Government: Practices That Can Help Enhance and Sustain Collaboration among Federal Agencies*, GAO-06-15 (Washington, D.C.: Oct. 21, 2005), and *Managing for Results: Barriers to Interagency Coordination*, GAO/GGD-00-106 (Washington, D.C.: Mar. 29, 2000).

doing business. Given the complexity and potential magnitude of climate change and the lead time needed to adapt, preparing for these impacts now may reduce the need for far more costly steps in the decades to come.

Accordingly, our report released today recommends that the appropriate entities within the Executive Office of the President, such as CEQ and the Office of Science and Technology Policy, in consultation with relevant federal agencies, state and local governments, and key congressional committees of jurisdiction, develop a national strategic plan that will guide the nation's efforts to adapt to a changing climate. The plan should, among other things, (1) define federal priorities related to adaptation; (2) clarify roles, responsibilities, and working relationships among federal, state, and local governments; (3) identify mechanisms to increase the capacity of federal, state, and local agencies to incorporate information about current and potential climate change impacts into government decision making; (4) address how resources will be made available to implement the plan; and (5) build on and integrate ongoing federal planning efforts related to adaptation. CEQ generally agreed with the recommendation, noting that leadership and coordination is necessary within the federal government to ensure an effective and appropriate adaptation response and that such coordination would help to catalyze regional, state, and local activities.

Mr. Chairman, this concludes my statement. I would be pleased to respond to any questions you or other Members of the Committee may have.

Contacts and Acknowledgments

For questions about this statement, please contact John B. Stephenson at (202) 512-3841 or stephensonj@gao.gov. Individuals who made key contributions to this testimony include Steve Elstein (Assistant Director), Charles Bausell, Keya Chateauneuf, Cindy Gilbert, Richard Johnson, Benjamin Shouse, Jeanette Soares, Ruth Solomon, and Joseph Thompson. Camille Adebayo, Holly Dye, Mike Jenkins, and Mark Keenan also made important contributions.

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The CHAIRMAN. Thank you, sir, very much.

At this time, I would like to ask unanimous consent to include in the record a letter from Nancy Sutley, who is the Chair of the Council on Environmental Quality, in which she agrees with the recommendations of the GAO report and lays out some of the steps they have already initiated to coordinate Federal adaptation efforts.

Without objection, it will be included in the record.

[The information follows:]

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
WASHINGTON, D.C. 20503

October 21, 2009

Chairman Edward Markey
United States House of Representatives
2108 Rayburn House Office Building
Washington, DC 20515

Dear Chairman Markey,

Thank you for your interest in the White House Council on Environmental Quality's (CEQ) views on climate change adaptation and, specifically, views on the Government Accountability Office's report, "Climate Change Adaptation: Strategic Federal Planning Could Help Government Officials Make More Informed Decisions." CEQ reviewed the report and coordinated comments from a number of Federal Departments and Agencies.

CEQ agrees that adaptation is a critical area for Federal Government activity and thinks this report provides a timely review of the subject. Overall, CEQ agrees with the main recommendation that leadership and coordination is necessary within the Federal Government to ensure an effective and appropriate adaptation response. Further, CEQ agrees that this will help to catalyze and support the local, state, tribal and regional activities that are so critical to adaptation.

Climate change adaptation is a priority for the Administration, and it is a key part of the work occurring here at CEQ. In fact, CEQ is currently co-chairing, with the Department of Commerce's National Oceanic and Atmospheric Administration and the Office of Science and Technology Policy, an Administration-wide effort to develop a Federal adaptation strategy.

The Climate Change Adaptation Interagency Task Force is looking at what needs to happen to increase the resiliency of the operations of the Federal Government, where the Federal Government might change priorities or activities, or where the government might need to make new investments in order to reduce our vulnerability to climate change. It will also begin to look for opportunities whereby the U.S. government can help and support others who need to adapt, both domestically and internationally.

CEQ is at the beginning of our work on this critical issue. I look forward to briefing you on CEQ's progress in the future.

Sincerely,

Nancy H. Sutley
Chair

Cc: Congressman James Sensenbrenner, Ranking Member

The CHAIRMAN. Our next witness is Mr. Eric Schwaab, who is the Deputy Secretary of the Maryland Department of Natural Resources. He is going to help us to understand what Maryland is doing and what their ongoing work is in dealing with these issues.

Welcome, sir.

STATEMENT OF ERIC SCHWAAB

Mr. SCHWAAB. Thank you, Mr. Chairman, members of the committee. It is a pleasure to be with you here today to share some perspectives regarding Maryland's success in planning for climate change, as well as our ideas with respect to how we might improve the Federal presence and coordination of those activities.

I would also like to mention how pleased we were to work with the GAO in the development of their report and to be featured as one of the local—as one of the States, the State, working on this issue.

Maryland has in fact already recognized that the forces of climate change, particularly with respect to rising sea levels, have been set in motion irreversibly to a large degree; and that, in addition to enhanced focus on mitigation, we must take steps now to plan for implications of climate change as they affect us socially, economically and environmentally. We must fully integrate climate change adaptation planning into many existing State programs and practices. The same, of course, can be done at the Federal level.

We cannot continue to plan and implement programs as if our environment was static from a climate perspective. From efforts to restore Chesapeake Bay, conserve forests, enhance wildlife habitats to local land-use decisions, every one of our actions must be taken with our best understanding of the realities of climate change at the forefront.

This is of particular interest to Maryland. Chesapeake Bay is ranked the third most vulnerable region in the Nation to impact of sea-level rise. This has already been apparent in the loss of land along the Atlantic Coast and the Bay shoreline over the last 100 years. And due to climate change, we expect an acceleration of sea-level rise at least twice as fast as that which occurred during the 20th Century, resulting in potentially 2.7 to 3.4 feet of sea-level rise by the year 2100. Such a rise will cause increased vulnerability to storm events; more frequent and severe coastal flooding; inundation of low-lying lands; submergence of tidal marshes; more shore erosion and salt water intrusion of salt water wells.

Maryland is, of course, equally concerned with other consequences of change in climate. The State's agriculture industry, our forest resources, fisheries, fresh water supply and other aquatic and terrestrial ecosystems and, in addition to that, human health will all be impacted by increasing temperature and changes in precipitation patterns.

All of these caused Maryland to initiate action. In April of 2007, Governor O'Malley signed an executive order establishing the Maryland Climate Change Commission. A year after its formation, the commission released Maryland's climate action plan, setting forth a course of action to stem not only the drivers of climate change but also for how to adapt to those inevitable consequences already set in motion.

Maryland remains one of the few States that have included an adaptation component in State-level climate change action planning. Let me just highlight a few elements of our plan that have already been undertaken. We have made significant progress in acquiring new technology to look at historic shore-line change data and utilize this change data to undertake state-of-the-art sea-level rise mapping and research. We have developed and enacted a Living Shore Line Protection Act and amendments to our Chesapeake and Coastal Bay's Critical Area Act, which will increase shore-line resiliency and limit building in the most vulnerable areas.

Sea-level rise technical planning guidance was crafted for three of our most vulnerable coastal counties. In April of 2009, with the help of our Coastal Zone Program, we hosted the Coast Smart Event, an interactive event to discuss and evaluate local planning strategies for communities to improve their ability to adapt to sea-level rise.

Our transportation department is assessing impacts related to highway system planning. And our wildlife division is assessing climate change vulnerability as it relates to specific species of concern.

We have already kicked off Phase II of development of our strategies, which will be focused on identifying further impacts in six issue-based areas, including water resources, agriculture, aquatic and terrestrial ecosystems, forestry, agriculture, human health and transportation and land use.

We would like to offer just a couple of perspectives with respect to what the Federal Government we think in particular can do. There is much more detail of this in my written testimony.

First, the Nation needs a clear national strategy. This strategy should provide an integrated approach to these challenges. Many programs undertaken in partnership by the State at the Federal level would benefit substantially by building in climate change assessments into program implementation.

Secondly, the key role of the States in climate change adaptation planning must be clearly integrated into a national program.

And finally, action at the Federal level to provide dedicated funding for adaptation is imperative to protect communities, natural resources, and the national interests from the impacts of climate change.

There are additional suggestions in my testimony, Mr. Chairman, and I appreciate, again, the opportunity to be here.

[The statement of Mr. Schwaab follows:]

Martin O'Malley, Governor
Anthony G. Brown, Lt. Governor
John R. Griffin, Secretary
Eric Schwaab, Deputy Secretary

Testimony of
Eric Schwaab, Deputy Secretary
Maryland Department of Natural Resources

Before

The U.S. House of Representatives
Select Committee on Energy Independence and Global Warming

October 22, 2009

Chairman Markey and distinguished members of the Select Committee, it is my pleasure to be here today to outline some of Maryland's successes in planning for climate change and to discuss with you the importance of developing a strategic national approach to adaptation.

Given our more than 4,000 miles of coastline and documented rate of sea level rise nearly twice that of the global average, Maryland has already begun to strategically plan for the impacts of climate change. In April 2007, Governor Martin O'Malley signed an Executive Order establishing the Maryland Climate Change Commission. Approximately a year after its formation, the Commission released Maryland's Climate Action Plan[i], setting forth a course of action to stem not only the drivers of climate change but also for how to adapt and respond to the inevitable consequences.

Historic tide-gauge records show that sea levels are rising along Maryland's coast and have increased one-foot within state waters over the last 100 years. We are currently expecting that sea level may rise at least twice as fast as it did during the 20th century, resulting in potentially 2.7 to 3.4 feet of rise by the year 2100. Such a rise will likely cause increased vulnerability to storm events, more frequent and severe coastal flooding, inundation of low-lying lands, submergence of tidal marshes, more shore erosion, salt-water intrusion, and higher water tables. While Maryland's entire coast will be impacted over the course of time, our state's low-lying coastal areas, to as well as those with large amounts of exposed shoreline are most at risk. The Chesapeake Bay is ranked the third most vulnerable region in the nation to the impact of sea level rise.

Confirming this fact is that the impact of sea level rise is already apparent - Maryland is currently losing approximately 580 acres per year to shore erosion; and alarmingly, thirteen Chesapeake Bay islands once mapped on nautical charts have already disappeared beneath the water's surface. In a 2008 report, the National Wildlife Federation estimated that approximately 400,000 acres of land on the Chesapeake's Eastern Shore could gradually be submerged.[ii] Maryland has thousands of miles of developed waterfront property along its coast, including many historic human settlements such as Smith Island. These coastal areas contain billions of dollars worth of public and private investments that will be adversely impacted by sea level rise and the intensification of coastal storm events.

A key component of Maryland's Climate Action Plan is the Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change. Phase I of this Strategy sets forth the state's vision for protecting Maryland's future economic well-being, environmental heritage and public safety from the already inevitable impacts of climate change-induced sea level rise and coastal storms. The Strategy recommends a suite of 18 specific legislative, policy, and planning actions aimed at the reduction of impact to existing built environments & future growth and development; financial and economic impact avoidance; the protection of human health, safety and welfare; and the protection and restoration of the State's forests, wetlands and beaches as they inherently protect us from the impacts of climate change.

Implementation of the Adaptation Strategy is well underway. In 2008 Maryland passed two pieces of key legislation called for in the Strategy: The Living Shoreline Protection Act and amendments to the Chesapeake and Coastal Bays Critical Area Act. Both will reduce Maryland's vulnerability over time and protect natural resources from the impacts of sea level rise by restoring natural shoreline buffers such as grasses and wetlands and limiting new growth in vulnerable areas.

The work of the Maryland Commission on Climate Change drew national accolades for its focus on adaptation. The U.S. Climate Change Science Program, Synthesis and Assessment Product 4.1, *Coastal Sensitivity to Sea Level Rise: A Focus on the Mid-Atlantic Region*[iii] states that "Maryland has taken a proactive step towards addressing a growing a problem by committing to implementation of its sea level rise response strategy and increasing awareness and consideration of sea level rise issues in both public and governmental arenas."

Aside from sea level rise and coastal storms, Maryland is equally concerned about the likely consequences of a changing climate to the state's agriculture industry, forestry resources, fisheries resources, freshwater supply, aquatic and terrestrial ecosystems, and human health. For example, many marine living resources will likely experience changes in species composition and abundance with warming. Fisheries managers will need to adapt management to account for shifts in productivity, variability and predictability of fish populations due to climate change.

In terms of water quality, a changing climate will have multiple and complex effects on the Chesapeake Bay as well as on Maryland's coastal bays and the nearshore ocean environment. Maryland and the other Bay states are taking aggressive action to accelerate Bay restoration efforts yet are concerned that rising sea levels and changes in precipitation patterns may make restoration more difficult to achieve. The Chesapeake Bay Program's Scientific and Technical Advisory Committee report, *Climate Change and the Chesapeake Bay*[iv] and the Executive Order 13508, Draft Section 202(d) Report, *Chesapeake Bay Watershed Climate Change Impacts*[v], both address this concern and collectively recommend the need for action on planning for adaptation at the regional, state and national level.

Recognizing the critical need to plan for such impacts as just described, the Maryland Commission on Climate Change has initiated development of Phase II of its Adaptation Strategy. This second phase is focused on addressing the impacts of increasing temperature, changes in precipitation patterns and increased storminess to six issue-based sectors: water resources, agriculture, aquatic and terrestrial ecosystems, forestry, agriculture, human health and transportation and land-use. Adaptation strategies for each sector are to be produced by June 2010.

Over the years, Maryland's coastal adaptation efforts have benefited from a variety of federal funding sources, most notably through the Coastal Zone Management Act (CZMA) as administered by the National Oceanic and Atmospheric Administration (NOAA). Maryland receives approximately $3 million annually from NOAA to implement these programs and has used approximately $250,000 of these yearly funds since the year 2000 to fund its sea level rise, coastal hazards and coastal climate change adaptation planning efforts. Thanks to this ongoing federal support, Maryland has a strong Coastal Zone Management and National Estuarine Research Reserve Program, both authorized under the CZMA. CZMA funds have supported climate change-related activities for research and data acquisition, as well as to expand technical, planning, and education activities needed to address key coastal climate change adaptation issues.

Our vulnerability to climate change will ultimately depend upon the magnitude of future impact, as well as how we as a society are able to cope and respond. In Maryland, however, we are continuing to invest, live, and actively manage lands and resources that we know with near certainty will be impacted by climate change. As a result, more and more of Maryland's people, property, public investments and natural resources, including vital fish and wildlife habitat, will soon be at risk.

If states and local governments do not adequately prepare for climate change, we may jeopardize at least a century of land and water conservation success across the country. The billions of dollars of investment in public lands and fish and wildlife habitat by federal and state agencies over the last 100 years is threatened by the anticipated pervasive impacts of climate change. We must protect the integrity of our investment in our nation's natural infrastructure to ensure our security. Federal, state and local governments must move beyond traditional planning and resource management practices and set a course for planning in anticipation of future change.

States are at the front lines of planning for climate change. Despite the absence of a national climate change adaptation program, States like Maryland are already undertaking significant strategic planning efforts. However, the efforts of states across the nation could be improved upon and assisted, by several key actions at the national level.

> First, the key role of states, including the valuable research contribution of state academic institutions, in climate change adaptation planning must be clearly established and supported by federal programs.
>
> Next, to facilitate effective coastal adaptation the nation needs a clear national strategy for intergovernmental coordination on adaptation. This strategy should advocate an integrated national approach to natural resource adaptation that reflects meaningful coordination among the state and federal agencies. In the Chesapeake Bay region alone, at least three separate climate change adaptation strategies have been produced in the last year and half – all by different governmental organizations and all calling for enhanced intergovernmental coordination.
>
> And finally, action at the federal level must provide dedicated funding for adaptation. Federal financial support is imperative to protect coastal communities, natural resources and the national interest from the impacts of climate change.

Along these same lines, some of the barriers to strategic coordination of adaptation efforts across federal, state and local governments can be addressed by the following efforts:

- *Reauthorize and strengthen the Coastal Zone Management Act.* Strengthen the CZMA with authorization for climate change related activities; including funding to develop and implement a coastal adaptation plan that recognizes each state's individual needs while building into a proactive national strategy.

- *Support creation of a permanent ocean trust fund.* Revenues from this trust fund could be used by Maryland to address the impacts of climate change, including maintaining healthy, resilient coastal communities and economics; and protecting and restoring coastal ecosystems, habitats, waters, and unique resources. A potential source of revenue could be funds generated by greenhouse gas cap and trade programs.

- *Improve awareness and understanding of the resources available to states and local governments.* A key component of a national climate change adaptation program should be a new and stronger focus on intergovernmental coordination between federal, state and local agencies.

- *Create a better system of observations at the national level - one that is reliably continuous, strategically targeted, and thoroughly integrated.* There is generally insufficient monitoring of Maryland's climate, environmental conditions and resources to characterize their present state and variability. Reliable observations, interpreted with scientific understanding and innovative models, can dramatically reduce uncertainty about the path of climate change in Maryland and its consequences.

- *Help states effectively respond to changes to aquatic and terrestrial ecosystems.* Federal agencies should work closely with coastal states to assess impacts to coastal, marine and migratory fishery habitats and strategically target funds toward projects which will further adaptation. Coastal wetlands and bay islands are vital natural systems in terms of the ecosystem services they provide in the form of clean water, clear air, storm buffers, and flood attenuation. Climate impacts such as drought, catastrophic fires and desiccation of wetlands will all result in releasing carbon currently sequestered in forests and wetlands. Functioning ecosystems sustain fish and wildlife and support associated fishing, hunting and wildlife-dependent recreation with an approximate national value of $76 billion per year – Maryland's portion of which is a tremendous asset to rural communities throughout the Chesapeake Bay region.

- *Ensure federal adaptation funding for state and private forest lands.* Climate change threatens the ability of the nation's forests - both public and private - to provide clean air and water, carbon sequestration, renewable energy and numerous other ecosystem services. Changes in precipitation, temperature, fire patterns, increased CO_2 concentrations, pest outbreaks and other climate change influences have the potential to transform forest ecosystems. Nearly two-thirds of the nation's forests are held in state and private ownership and will be essential in any wildlife and forest adaptation strategy. Funding adaptation activities on federal forests is essential, but only addresses the needs of a third of the nation's forests.

- *Enhance smart growth programs and policies at the national level.* Action is needed now to protect not only existing human settlements and infrastructure but also to ensure that we avoid future risk by restricting new growth and development in areas we already know are extremely vulnerable. Maryland is working to advocate smart growth practices as a means to accomplish this task and would advocate for the same level of effort at the national level. In the face of climate change, better land-use planning is imperative.

Preparing and planning for the consequences of climate change translates into more green jobs. Maryland's Governor, Martin O'Malley, established a goal of creating at least 100,000 green jobs by 2015. Adapting to climate change is one of the pillars of his Green Jobs Initiative. Numerous green jobs can be created through activities to support climate change adaptation, including marine contractors and landscape architects to design and install living shorelines; foresters to ensure sustainable forest management; biologists to address and remove invasive species, and habitat engineers to restore wetlands.

In conclusion, I want to highlight the need for government to lead by example. Federal, state and local government leadership is imperative if we are to combat and adapt to climate change. Maryland's state government is working to lead by example on the climate front by developing standards to guide the siting and design of state facilities and infrastructure in vulnerable coastal areas; working to reduce our footprint by sequestering carbon; and improving the efficiency of our vehicle fleet.

The issuance of the *Water Resource Policies and Authorities for Incorporating Sea-Level Change Considerations in Civil Works Programs*[vi] by the U.S. Army Corps of Engineers in July 2009 represents a great instance of leading by example at the federal level. As does the Draft Strategic Plan of the U.S. Fish & Wildlife Service, *Rising to the Challenge, Responding to Accelerating Climate Change*[vii]. I commend the federal government for such efforts to lead by example which set the stage for states to follow.

Thank you very much for your time in considering my testimony today.

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[v] Dept. of Commerce and Dept. of Interior. 2009. September 9, 2009 Draft Report on Chesapeake Bay Watershed Climate Change Impacts: A Draft Report fulfilling Section 202(d) of Executive Order 13508. Washington, D.C.
[vi] Department of the Army, U.S. Army Corps of Engineers. 2009. Water Resource Policies and Authorities for Incorporating Sea-Level Change Considerations in Civil Works Programs. Circular No. 1165-2-211.
[vii] U.S. Fish & Wildlife Service. 2009. September 21, 2009 Draft Rising to the Challenge: Strategic Plan for Responding to Accelerating Climate Change. Reston, VA.

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To download a copy of Maryland's Climate Action Plan, please visit http://www.mde.state.md.us/Air/climatechange/index.asp.

Additional information on Maryland's climate change adaptation planning efforts can be found at: http://www.dnr.state.md.us/dnrnews/infocus/climatechange.html.

The CHAIRMAN. Thank you, sir. I appreciate it.

Our next witness is Mr. Stephen Seidel. He is the Vice President for Policy Analysis at the Pew Center on Global Climate Change. We welcome you, sir.

STATEMENT OF STEPHEN SEIDEL

Mr. SEIDEL. Thank you, Mr. Chairman.

I am delighted to be here today and pleased that you have focused this hearing on what we need to do to adapt to climate change. Adapting to climate change is clearly necessary but should not in any way detract from efforts to reduce greenhouse gas emissions. Such reductions are the first and best line of defense against the risks of climate change.

Why, then, should we also be focusing on adaptation? Because the science community has made it clear that our climate has already begun to change. We have experienced warmer temperatures, more extreme weather events and sea-level rise. Even with our best efforts to reduce future emissions, substantial amounts of climate change are unavoidable. Confronted with that reality, it no longer makes sense to assume that future climate will be the same as that of the past. We should be making every effort to adapt to these unavoidable changes in climate as we redouble our efforts to reduce future greenhouse gas emissions.

The title of a recent U.N. report aptly captures what we need to do: Avoid the Unmanageable and Manage the Unavoidable. My written testimony provides some concrete examples of how the Federal Government can and must lead this effort to build greater resiliency into our economy.

I want to focus on three ways this can be accomplished. First, adaptation must be mainstreamed across all relevant Federal programs. As the Nation's largest landholder, and the Federal Government owns about 29 percent of our Nation's lands. Many Federal assets are at risk from changes in climate. DOD alone has thousands of facilities located in coastal areas. Throughout our government and its programs, climate change impacts will be pervasive.

To begin addressing the Federal role in adaptation, we recommend that all relevant Federal agencies undertake a strategic plan. This plan should identify an agency's programs, regulations and facilities that are affected by climate change; identify barriers to making these more climate resilient; and develop a plan of action and priorities for implementation. Our work on adaptation suggests that this strategic planning process can most effectively be coordinated through the Council on Environmental Quality, and we are encouraged that they have recently taken steps down this path by creating an interagency working group.

We would recommend agency strategies as a first step, followed by sector plans to address critical crosscutting issues and to assure coordination among agencies. Once an initial round of agency and sector plans have been completed, we would then recommend a national strategy that was informed by these efforts and that sets priorities and goals.

As part of mainstreaming adaptation, we also recommend that CEQ amend its existing regulations to clarify that climate change

impacts and possible adaptation measures should be evaluated for all major Federal actions.

Our second recommendation is the creation, through legislation, of a national climate change adaptation program. This would be a sister program to the two existing interagency climate change programs; the Global Change Research Program and the Climate Change Technology Program. Both have been established through legislation. The national climate change adaptation program could be created as an interagency program along the lines of GCRP, but its goal would be to facilitate development of high-level policy direction, coordinate Federal activities, and ensure proper integration across agencies.

Our third suggestion relates to the need for the Federal Government to play a critical role in providing technical support to help State and local governments and the private sector to meet their adaptation challenges. Before any entity can respond to climate change, they first need information on what those changes are likely to be. We suggest the creation of a national climate service to fill this function and recommend that NOAA lead this effort. But we also recommend that other Federal agencies have important roles to play as sector leads for the purpose of effectively engaging State and local stakeholders.

Finally, we are pleased that the House bill includes a substantial section on adaptation. We believe that what is in the bill can be improved though in three ways: First, by requiring all Federal agencies to undertake comprehensive adaptation plans rather than by limiting the scope of those plans to natural resources and public health issues, as is currently in the bill. It is critically important that other agencies, like the Department of Transportation, Department of Energy, Department of Defense, also undertake strategic plans.

Second, while the bill creates a national adaptation program, it locates it within the Global Change Research Program and focuses its activities on research. We believe that, as currently drafted and passed by the House, it places too great an emphasis on the research side and shortchanges the critical needs to mainstream adaptation across all Federal programs.

And finally, we believe the bill could clarify the structure of a national climate service and make it more focused on the needs of the users by identifying a critical role for other agencies to play.

I would be glad to answer questions at the appropriate time.

[The statement of Mr. Seidel follows:]

The Federal Government's Role in Building Resilience to Climate Change

Testimony of
Stephen Seidel, Vice President for Policy Analysis
Pew Center on Global Climate Change

Submitted to
Select Committee on Energy Independence and Global Warming
U.S. House of Representatives

October 22, 2009

Mr. Chairman, Mr. Sensenbrenner, members of the Select Committee, thank you for the opportunity to testify on the topic of what the federal government should be doing to adapt to climate change. My name is Stephen Seidel and I am Vice-President for Policy Analysis at the Pew Center on Global Climate Change.

OUR CHANGING CLIMATE

Responding to the risks of climate change represents one of the major challenges facing our nation and the global community. Most of the attention to date has appropriately been placed on actions to reduce emissions of greenhouse gases. This is obviously the first and best line of defense against the risks associated with global warming. But as our scientific understanding of climate change has improved, we also have come to realize that our past emissions have already begun to affect our current climate. Climate change isn't some distant concern that will impact our children or grandchildren. There is clear and convincing evidence that we have already experienced the following changes:

- U.S. temperatures have increased by more than 2 degrees F. over the past 50 years.
- Average global sea level has risen by 8 inches over the last century.
- The amount of rain falling in the heaviest downpours (the heaviest 1%) has increased by 20 percent over the last century.
- Arctic sea ice is declining dramatically – end of summer ice losses have averaged 11% per decade over the past three decades.[1]

The changes we've experienced to date are likely to increase dramatically over time. In fact, one of the unfortunate aspects of our climate system (due to built-in lags such as absorption of heat by the oceans) is that even if we could wave a magic wand and totally stop emissions of greenhouse gases immediately, global average temperatures would increase by another 1 degree F. If we continue on our current path and global greenhouse gas emissions continue to

[1] Global Change Impacts in the United States, Thomas Karl, Jerry M. Melillo, and Thomas C. Pederson, (eds.) Cambridge University Press, 2009

increase, temperatures would further rise, for a total increase on the order of 7-11 degrees F. by 2100.

To reduce the damages associated with changes of this magnitude, two imperatives must be addressed:

1) We must take action to reduce greenhouse gas emissions to limit both the rate of climate change and the ultimate magnitude of that change.

2) We must take actions to minimize the costs associated with the unavoidable climate change that is already underway and will continue for many decades.

The second point is the focus of this hearing and of a study that the Pew Center[2] undertook to explore what the federal government should do to provide leadership to our nation in its effort to more effectively adapt to climate change.

OUR VULNERABILITY TO CLIMATE CHANGE

Climate is something we generally take for granted until it does something unexpected. Many key aspects of our economy are based on the critical assumption that our future climate will be similar to what we have experienced in the past. For example,

- Agriculture – what, where, and when we plant depends on temperature, length of growing season and water availability.
- Community development – what we build and where we locate structures and development depend on such factors as the availability of water, temperatures, risks of wildfires and coastal impacts.
- Energy development – many sources of electricity require large amounts of water for cooling, and different types of renewable energy depend critically on the availability of stream flows, sunlight or wind.
- Public health systems – are designed to anticipate and treat different types of diseases whose geographic ranges and seasonal occurrence may be influenced by climatic conditions.
- Emergency response systems – are designed around the likelihood and magnitude of extreme weather events (e.g., storms, floods, drought, and heat waves).
- National security – growing recognition among security experts that climate change, such as extreme weather events, scarcity of food, coastal flooding, etc. can contribute to increased tensions.

[2] The Pew Center on Global Climate Change will be issuing a report before the end of the year detailing its analysis of the federal role in adaptation. Supporting the Pew Center in this research has been Stratus Consulting and Terri Cruce, an independent contractor.

- Natural resources – the habitat for plants and animals, the viability of forests and the health of wetlands are all affected by temperature and the availability of water.

It should be clear that the impacts of changing our climate cut across a broad swath of our economy from food to energy production, to where and in what we live and how we travel, to the wellbeing of our natural resources and even to our national security. And that critical assumption – that future climatic conditions will be similar to the past – moves further and further away from reality with each ton of carbon dioxide we add to the atmosphere.

Damages from climate change are often discussed in terms of the impact that an average change in temperature or precipitation could cause. Yet we know from real life experience that the occurrence of extreme events (such as heat waves, floods, and intense storms) is what drives economic losses. We also know that one of the insidious aspects of climate change is that the number of extreme events is expected to increase dramatically. For example, under a scenario where emissions continue to grow uncontrolled, the number of days over 90 degrees in the Southern United States would increase from 60 per year to 150 per year by the end of the century.[3] With a one-half meter rise in sea level, the maximum level of flooding that New York City used to experience once every one hundred years would occur once every 25 years.

Role of the Federal Government

It is sometimes said that "all adaptation is local." This expression makes good sense in that climate impacts occur at a particular time and place and therefore are indeed local. Nonetheless, we believe that for our nation to build an economy more resilient to climate change, the federal government's role is critical for the following reasons:

1. Federally owned assets are at risk

The federal government owns 29% of all lands in the country. It owns 476,000 public structures including bridges, tunnels, and flood control structures that are valued at $723 billion. The Department of Defense alone has vast holdings many of which are in coastal areas. Naval bases are of course at sea level, but so are many Air Force bases and training bases such as Camps Pendleton in southern California and LeJeune in coastal North Carolina. Many of our prized national parks are also vulnerable to the impacts of climate change and key features of some such as the Everglades and Glacier National Park could mostly disappear or be substantially changed. To properly manage these assets it is critical that the federal government understand the risks posed by climate change and the opportunities to adapt in a timely and cost-effective manner.

2. Federal guidelines, standards, and regulations are used across the economy

[3] Karl, Melillo, and Pederson (eds.), Climate Change Impacts in the United States, pg. 34.

The federal government influences many decisions made by state and local governments and the private sector. The federal government is involved, directly or indirectly, in setting air and water pollution control regulations, in transportation and water infrastructure planning and design, and in design and siting of hydroelectric and other energy facilities. Other federal programs, such as the national flood and crop insurance programs, also play a major role in decisions that are affected by climate change.

3. Federal technical support is critical

The federal government provides critical information and technical support in areas related to climate and its impact. Weather information and hazardous conditions advisories are part of the daily fabric of our lives. The federal government's technical expertise is also made widely available through such mechanisms as the National Climatic Data Center, the Agricultural Cooperative Extension Service, the National Institute of Standards and Technology, federal land and forestry managers, and the Public Health Service.

Federal leadership in each of these areas is critical. If properly directed these and similar resources across the federal government can become important cogs in a national effort to adapt to climate change. Moreover, these same resources could play a significant role in both assisting state and local governments and the private sector in their adaptation activities.

We recommend a comprehensive review of federal activities aimed first at identifying assets, programs and activities most at risk from climate change and then making the necessary changes to enhance resiliency. Above all, we recommend that recognition of our changing climate be "mainstreamed" across all relevant federal programs. Nowhere should the federal government continue to assume that our future climate will be the same as the past.

Mainstreaming Adaptation

In analyzing how to structure a federal adaptation program it quickly became clear that one frequently used approach would not work. Adaptation is not the type of new issue where it would make sense to set up a new office or department and charge it with tackling the problem. It must be integrated into the everyday decisions of program managers across a wide spectrum of climate-related activities. Coastal zone managers must begin taking sea level rise into account when planning new development or shoreline protection. Agricultural agents must begin thinking about changes in growing seasons, temperatures, and water availability when deciding on seed selection or crop rotations. Land managers must consider fire risk changes resulting from shifts in precipitation, or damage to forests due to pest infestations (such as bark beetle infestations). Transportation planners must consider flood hazards when designing and locating new roads or bridges. None of these are new decisions, but each must be viewed with a new perspective – that future climate will be altered. Only by "mainstreaming" adaptation considerations across all relevant programs will our nation be in a position to meet the challenges of unavoidable climate change.

Based on a review of adaptation programs initiated by other countries and by state and local governments in the United States, we have developed the following recommendations.

1. Federal Agency Strategic Plans

We believe that a critical starting point is that each agency should develop its own strategic plan for what it needs to do to build greater resilience to climate change into its programs and mission. Agencies should begin by looking at their own programs because these will be the easiest to address and will also help them identify areas that need to be coordinated with other agencies or entities. Each agency's strategic plan should include the following:

* Identify and assess climate-sensitive assets, programs, policies, regulations and projects;
* Engage key stakeholders as part of the planning process;
* Identify barriers to incorporating climate change into agency decision-making and resource needs for implementation;
* Identify and develop priorities among the most vulnerable areas and response actions;
* Establish plans to monitor and evaluate implementation;
* Define areas requiring coordination with other agencies and partners; and
* Identify future research needs.

The good news is that several agencies have taken the first step down this path. In January 2009, the Secretary of Interior issued an order requiring bureaus and offices to "consider and analyze potential climate change impacts when undertaking long-range planning exercises, setting priorities for scientific research and investigations, developing multiyear management plans, and making major decisions regarding potential use of resources under the Department's purview." The order goes on to require that offices identify legal barriers, resource needs and recommended actions to respond to potential climatic impacts. In September 2009, this order was supplemented by the creation of Climate Change Response Councils and regional response centers to facilitate information sharing and response strategies across the Department. Within the Department of Interior, the U.S. Fish and Wildlife Service released its climate change strategy and five-year action plan in September of 2009. EPA's Office of Water has also has issued a strategic plan to address the impacts of climate change on its programs.

The White House, working through its Council on Environmental Quality, could play an important role in advancing the development of an effective federal program for adaptation. It

took an important step in that direction recently as part of its Executive Order on "Federal Leadership in Environmental, Energy and Economic Performance." (October 5, 2009) This order requires each agency to develop an Agency Strategic Sustainability Performance Plan. As part of that plan each agency is required to

> "(i) evaluate agency climate-change risks and vulnerabilities to manage the effects of climate change on the agency's operations and mission in both the short and long term;"

This requirement could serve as a lynchpin for initiating an effective strategic planning process within agencies. Even before the executive order was issued, CEQ had been working with an interagency group identifying actions that could be taken to begin developing both agency and sector-specific strategic plans. These are encouraging initial signs of executive office leadership, but follow-up will be critical to ensure that agencies are committed to pursuing the internal engagement required for an effective planning and implementation process.

We fully recognize that in developing their strategic plans, agencies are likely to identify a number of key areas where program responsibility is shared with other agencies and with state and local entities. We believe that an important next step in the planning process is to identify areas where sector-specific plans are required. Such areas as water resources, land management, human health, ecosystem protection, and coastal protection are examples where multiagency efforts with strong stakeholder participation will be required. Finally, we believe that over time it would be useful and possible to combine agency and sector plans as key building blocks in the development of a national strategic plan. The national plan can help provide strategic direction, set priorities, and identify key milestones. This can best be done based on the content of more detailed plans (bottom-up) rather than be developed first (top down).

2. Creating a National Climate Service

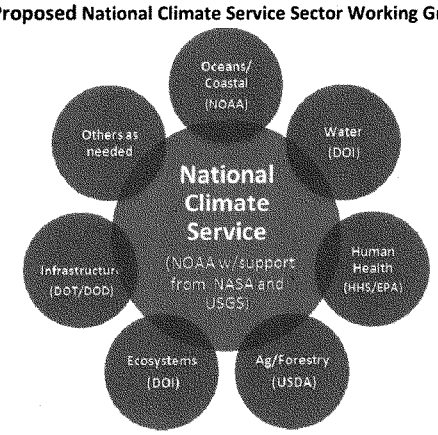
A key requirement for adapting to climate change is the availability of information detailing what those changes are likely to be. In addition, technical support in how to use such information in decision making on adaptation will be critical. A national climate service would be the entity responsible for developing and communicating credible and actionable climate scenarios and projections for use in adaptation planning purposes. In every case study we examined, one of the first questions asked was what temperature change, sea level increase, or change in precipitation should we assume as the basis for our adaptation planning. Given the local scale at which these questions are being asked and the uncertainty about important aspects of predicting future climate change, particularly at that scale, providing useful information is not a trivial matter. Many state and local entities have turned to nearby university experts as a source for climate scenarios. This has worked well in many cases, but the idea of making useful and consistent climate information widely available on a national basis has attracted attention for many years.

The leading proponent of a national climate service has been the National Oceanic and Atmospheric Administration (NOAA). As a lead federal agency in developing climate observing systems, data analysis and predictions, NOAA has the scientific foundation upon which a national climate services could be constructed. It has undertaken an extensive process examining different ways to structure such an entity and has begun moving forward in its development.

In our review of how a climate services might be structured we divided the function into two key parts: the development and provision of the climate data and the support required by the user community (such as coastal managers, water planners, agricultural agents, and transportation planners) to effectively identify their needs and use the information provided. We found that NOAA could most effectively lead the first element but not necessarily the outreach and user community engagement.

To effectively engage the critical and diverse user communities, we believe a national climate services should involve other key federal agencies as sector working group leads. Figure 1 shows the proposed organizational structure. For example, the Department of Agriculture could lead a sector working group for the farm community and the Department of Interior could lead a sector working group on natural resources. The sector working groups would be responsible for fully engaging state and local entities, the private sector and other stakeholders in identifying the needs for information and decision support tools specific to their sector, in setting priorities and in communicating information to the sector.

FIGURE 1: Proposed National Climate Service Sector Working Group Structure



3. Structuring a Federal Adaptation Program

Our analysis focused on how to integrate an adaptation program into other climate related program activities across the federal government. We examined the two programs that currently exist – the Global Change Research Program (GCRP) and the Climate Change Technology Program (CCTP). Both are established by statute and we would recommend that a national adaptation program also be established by legislation. Because of the desirability of executive office leadership, we recommend that the national adaptation program be chaired or co-chaired by CEQ or the Office of Science and Technology Policy. The program should be managed by a coordinating committee that is made up of senior policy officials from each of the relevant agencies. We also recommend the creation of a small program office (along the lines of the office created under GCRP) to coordinate the agency and sector strategic planning activities.

4. Mandating Adaptation Considerations under the National Environment Policy Act (NEPA)

To ensure that adaptation is considered in all major federal actions, we recommend issuing clarifying regulations under NEPA. These regulations would make it clear that climate change needs to be considered in the planning stage of any major federal action. CEQ is responsible for NEPA's implementation, while EPA's Office of Federal Activities reviews environmental impact statements. We suggest establishing an interagency working group to prepare the proposed regulatory changes and to develop guidance for agencies in preparing EISs.

Adaptation Provisions in the American Clean Energy and Security Act (H.R. 2454)

The American Clean Energy and Security (ACES) Act passed by the House of Representatives in June of this year contains several provisions to address the issue of domestic climate change adaptation. While we we were pleased to see an adaptation section in the bill, we believe there are at least two important improvements that should be considered. First, the development of adaptation strategic plans for all relevant federal agencies is a key component of improving our nation's resiliency to climate change. As currently written, the ACES Act only contains provisions for natural resource agency adaptation plans and a public health strategic plan. Second, although the ACES Act does contain provisions establishing a national climate service within NOAA, we would recommend a structure similar to the one outlined above that both provides for a central role for NOAA, but also more effectively engages other key agencies as sector working group leads.

Conclusion

In conclusion, I would like to thank the Chairman, Mr. Sensenbrenner, and the members of the Select Committee for their time and attention to the important matter of furthering the U.S. government's efforts to address climate change adaptation.

The CHAIRMAN. Thank you, Mr. Seidel, very much.

And our final witness is Dr. Kenneth Green, who is Resident Scholar at the American Enterprise Institute.

We welcome you, sir. Whenever you are ready, please begin.

STATEMENT OF KENNETH P. GREEN, Ph.D.

Mr. GREEN. Thank you, Chairman Markey, Mr. Sensenbrenner, members of the committee.

Thank you for inviting me to testify today on this important topic.

Along with these remarks, I have submitted for the record a policy study that I recently completed, entitled "Climate Change: The Resilience Option."

My testimony here today represents my personal views and should not be construed as the official position of any other institution or people.

Before I get into the meat of my remarks, I would like to start with my three Bs; the background, biases and beliefs.

As to background, I am a biologist and environmental scientist by training, an economist by exposure, and a policy analyst by vocation. I have been doing environmental policy analysis for 15 years now in the U.S. and Canada.

My bias is for solving environmental problems wherever possible with more instruments that maximize freedom, opportunity, enterprise and personal responsibility. Thus, I strongly favor true market-based remedies for environmental problems over command-and-control regulation. I will observe here, with no offense intended, that cap-and-trade is not a true market-based instrument, as the government sets a limit on emissions rather than having the limit, quantity or price set by voluntary consumers in a free marketplace.

Finally, my scientific beliefs are based on reading the literature as well as the IPCC climate science reports. And while I do believe greenhouse gases retain heat in the atmosphere, or we would not have a habitable planet, the heat retention ability of additional anthropogenic gases, I believe, is modest.

I certainly do not believe in predictive modeling. And anyone who has looked at their 401(k) lately should take predictive models with a huge grain of salt.

That said, I do believe climate science has taught us something very important, which is we have learned the earth climate system is not the plastic thing we had originally thought it was. It is prone to sharp shifts in temperature that can last between years to decades. So we should be changing the way we do things with regard to responding to our climate.

How best can we ensure resilience? First, I believe we should shift our focus for mitigation of greenhouse gas emissions. Toward that adaptation agenda, we don't at present have the technologies needed to significantly curb greenhouse gas emissions without causing major economic disruption and without preventing the developing countries from developing, lifting their billions out of poverty and squalor. Even if we were to shut the United States and the EU off, the emissions from China and India would undo any environmental benefit in a matter of years. All that jacking up en-

ergy prices will do is deprive us of economic productivity, which is the ultimate wellspring of our resilience and well-being.

Second, I believe we should stop making things worse. That is, we should remove the misguided incentives that have people living in climatically fragile areas, such as the water's edge, drought-prone locations, flood-prone locations and so on.

Currently our Federal and State governments exacerbate this risk-taking by acting as the insurer of last resort. When people who live at the water's edge or in a flood plain are hit by storms and floods, governments intervene not only to rescue them but also to allow them to build right back where they were, so that they can be rescued again. We are doing this in New Orleans, and we will probably do this in California, putting people right back in the area they were burned out of this year.

As Charles Perrow observes in his book "Our Next Catastrophe," State-mandated pools have been established to serve as the market of last resort for those unable to get insurance, but the premiums are low, and thus, those have the perverse effect of subsidizing people who choose to live in risky areas, imposing excessive costs on people living elsewhere. Programs that subsidize climatic risk-taking should be phased out as quickly as possible in favor of fully priced insurance regimes.

Rebuilding after disasters in climatically fragile areas should be discouraged. Eliminating risk subsidies would show people some of the true cost of living in climatically risky areas and would, over time, lead them to move to climatically safer places where they can afford to insure their property and safety.

Third, we must look to our infrastructure. Another government action that leaves people to live in harm's way is the failure to build and price infrastructure so that it is sustainable and resilient to change. Governments build highways but generally without pricing mechanisms, thus no revenue stream is created to allow for the highway to be elevated or levies built if local flooding becomes a problem. There is also no price signal related to the users of the highway that reflect the climatic risk that their transportation choices face.

The same is true of freshwater infrastructure, wastewater infrastructure, electricity and other infrastructure. Politicians enjoy cutting ribbons on new free infrastructure. They are less prone toward having the cost of that infrastructure show up in terms of tolls or user fees. Establishing market pricing of infrastructure would quickly steer people away from fragile areas, dramatically reducing the cost of dealing with climate variability.

For example, consider our electricity supply, as long as governments distort the prices consumers pay for energy with subsidies, fuel mandates, renewable power mandates and the like, electricity markets cannot effectively adapt to change in climate conditions. If the markets were deregulated and the full cost passed along, price signals would be created for electricity providers to expand or reduce capacity in areas prone to heat waves or cold snaps and would also encourage consumers to adopt more efficient ways of using electricity.

Finally, I would suggest we trust in resilience but tie up our camel. In the event that climate change does tend toward higher

estimates put out by the United Nations and other groups, it is reasonable to consider insurance options that might help deal with such changes, including government R&D into geoengineering research and the removal of greenhouse gases directly from the atmosphere. Climate variability poses a risk to our population, and we should take steps to face that.

Thank you for allowing me to speak. I look forward to your questions.

[The statement of Mr. Green follows:]

TESTIMONY OF DR.KENNETH P. GREEN

BEFORE THE

HOUSE SELECT COMMITTEE ON ENERGY INDEPENDENCE
AND GLOBAL WARMING

"BUILDING U.S. RESILIENCE TO GLOBAL WARMING IMPACTS"

OCTOBER 22, 2009

Chairman Markey, Congressman Sensenbrenner, Members of the Committee:

Thank you for inviting me to testify today on this important topic. Along with these remarks, I have submitted, for the record, a policy study that I recently completed, entitled "Climate Change: The Resilience Option." My testimony here today represents my personal views, and should not be construed as the official position of the American Enterprise Institute, or any other persons or organizations.

Before I begin my remarks, I always like to list my three B's, my background, biases, and beliefs.

As to background, I am a biologist and environmental scientist by training, an economist by exposure, and a policy analyst by vocation: I've spent the last 15 years analyzing environmental policy in think tanks in the U.S. and Canada.

My biases are for solving environmental problems, whenever possible, with instruments that maximize freedom, opportunity, enterprise, and personal responsibility. Thus, I strongly favor true market-based remedies for environmental problems over command-and-control regulation. (I will observe here that cap-and-trade legislation is not truly market-based, as government sets a limit on emissions, rather than allowing a market to determine that level. Cap-and-trade is more akin to rationing than it is to markets).

Finally, my beliefs are based on reading the scientific literature as well as the IPCC climate science reports, and I believe that while greenhouse gases do retain heat in the atmosphere (making Earth habitable), the heat-retention capability of additional anthropogenic greenhouse gases is modest. I do not believe in predictive climate models, or most other forms of forecasting other than simple extrapolation for very modest periods of time.

That being said, I do believe that climate science has taught us something important that merits action. We have learned the Earth's climate is not the slow-moving system we thought it was. Rather, the climate is prone to sharp shifts into cooler and warmer conditions that can depart significantly from "average" temperatures for decades at a time. Acting to enhance climate resilience is an important task.

So, to the issue at hand: how can we best build U.S. resilience to global warming impacts?

First, I believe that we should shift our focus from mitigation of greenhouse gas emissions toward an adaptation agenda. We do not, at present, have the technologies needed to significantly curb greenhouse gas emissions without causing massive economic disruption, and without preventing the developing countries from developing, and lifting their billions of people out of squalor and poverty. The money and attention that we are spending on mitigation efforts is largely wasted – even if we shut the U.S. and the EU off completely, the trajectory of emissions from China and India will negate the environmental benefit of our self-sacrifice completely in only a few years. All that jacking up energy costs will do is deprive of us economic productivity which is the ultimate wellspring of our resilience and well-being.

Second, I believe that we should stop making things worse. That is, we should remove the misguided incentives that lead people to live in climatically fragile areas such as the water's edge, drought-prone locations, flood-prone locations, and so on.

At present, our federal and state governments exacerbate this risk-taking by acting as the insurer of last resort. When people who live at water's edge or in a flood plain are hit by storms or floods, governments intervene not only to rescue them and their property if possible, but then to provide rebuilding funds to let the people build right back where they are at risk. We are currently doing this in New Orleans, where people are re-building in an area that is still at risk from storm surges and levee failure. Undoubtedly, we'll do this in California, putting people right back into fire-prone areas they were burned out of last year.

As Charles Perrow observes in his book *Our Next Catastrophe*: "State-mandated pools have been established to serve as a market of last resort for those unable to get insurance, but the premiums are low and thus these have the perverse effect of subsidizing those who choose to live in risky areas and imposing excess costs on people living elsewhere. In addition, the private insurers are liable for the net losses of these pools, on a market-share basis. The more insurance they sell, the larger their liability for the uninsured. Naturally, they are inclined to stop writing policies where there may be catastrophic losses. The Florida and California coastlines are very desirable places to live and their populations have grown rapidly, but these handsome lifestyles are subsidized by residents living in the less desirable inland areas in the state, and, to some limited extent, by everyone in the nation."

Programs that subsidize climatic risk-taking should be phased out as quickly as possible, in favor of fully-priced insurance regimes. Rebuilding after disasters in climatically fragile areas should be discouraged. Eliminating risk subsidies would show people some of the true cost of living in climatically risky areas, and would, over time, lead them to move to climatically safer places where they can afford to insure their property and safety.

Third, we must look to our infrastructure. Another government action that leads people to live in harm's way is the failure to build and price infrastructure so that it is both sustainable, and resilient to change. Governments build highways, but generally without a pricing mechanism. Thus, no revenue stream is created to allow, for example, for the highway to be elevated if local flooding becomes a problem. There is also no price signal relayed to the users of the highway

that reflects the climatic risk that their transportation system faces. The same is true of fresh-water infrastructure, wastewater infrastructure, electricity, and other infrastructure. Politicians love cutting ribbons on new "free" infrastructure. They're less prone toward having the cost of that infrastructure show up in terms of tolls or user fees.

Establishing market pricing of infrastructure would quickly steer people away from climatically fragile areas, dramatically reducing the costs of dealing with climate variability.

For example, let's consider our electricity supply. As long as governments distort the prices consumers pay for energy with subsidies, fuel mandates, renewable power mandates, and the like, electricity markets cannot effectively adapt to changing climatic conditions. If electricity markets were fully deregulated, and if full costs were passed onto consumers, price signals would be created for the electricity provider in terms of expanding or decreasing capacity and for the consumer in terms of the real cost of living in an environment subject to energy-consuming heat waves (or cold snaps). Privatization would create incentives for electricity conservation and for the acquisition of energy-efficient appliances and devices without any need for specific governmental efficiency standards. Further, electric companies would be driven to connect with one another to ensure reliability to their customers rather than doing the minimum possible to satisfy regulators.

And consider our water supply. Full pricing of water and full privatization of the water supply, drinking water plants, and wastewater treatment plants would ameliorate many climatic risks incrementally over time, including flooding, seawater intrusion, and coastal and river pollution from storm runoff. Charging the full price for water, from supply to disposal, would create a price signal for consumers regarding the real risks they face living in hydrologically sensitive areas and create incentives for conservation while producing a revenue stream to allow for expanded capability or the securing of alternative supplies. At some point, again, high prices could simply lead people to move away from areas that are hydrologically costly, such as cities dependent on a single winter snow pack that shrinks or a single major river that suffers reduced flow.

Finally, I would suggest that we trust in resilience, but tie up our camel. In the event that climate change does tend toward higher estimates put forward by the United Nations and other groups, it is reasonable to consider insurance options that might help deal with such climate changes. Such options might include government investment in geoengineering research, investment in research and development to advance technologies allowing the removal of greenhouse gases from the atmosphere

Climate variability, whether natural or man-made, does pose significant challenges to the health of our population, the maintenance of our infrastructure, and to our economic growth. Taking steps to make our society resilient in the face of climate variability is an important endeavor, and I applaud your hearing on the matter today.

Thank you for allowing me to speak to you today on this timely and important issue.

The CHAIRMAN. If we ever need a speed reader, we are bringing you back. You got a 7-minute statement in 5 minutes.

Mr. GREEN. When you have one of those 800-page bills.

The CHAIRMAN. 1,500 pages, Thank you.

The Chair recognizes the gentleman from New York, Mr. Hall.

Mr. HALL. Thank you, Mr. Chairman.

And thank you to all of our witnesses.

I gather there is some rough consensus that there needs to be a Federal strategy for dealing with the effects of climate change. And several of you have talked about the need for strategy to coordinate Federal efforts with government-wide strategic planning or perhaps a working group akin to or under the auspices of the Council on Environmental Quality.

In my relatively brief time here in Congress, I have seen problems that have been studied to death or seem to have been, shelves and shelves of reports from commissions and Blue Ribbon Panels, studies upon studies, studies of studies, that are gathering dust in offices around the Capitol with no enforcement mechanisms in place. Working groups rarely have a parent agency that is going to enforce implementation once the consensus, assuming that consensus, is reached.

So my first question is, to each of you, is, what are your recommendations for making sure that whatever strategy is developed at the Federal level to coordinate these resources and efforts of the Federal Government will be effectively implemented and enforced, and what can we in Congress do to assist in that effort?

Mr. STEPHENSON. I will start out. We think that is part of the reason that there needs to be an overarching strategy to decide where best to put that. We agree that it may not work within an existing agency. Many agencies can fulfill viable functions as part of that overarching strategy. However, we haven't looked at the need, for example, for an independent climate program officer or an independent agency or anything like that. But I agree with your concern that if there isn't a central authority to guide this and to enforce this, it may not work.

Mr. SEIDEL. If I may just add to that, and I think I have had the misfortune of writing one or two of those reports that sat on a shelf. What we have seen in the case studies that we looked at was executive leadership is really critical. So when you have Governor Schwarzenegger, when you have Mayor Bloomberg, when you have Governor O'Malley saying through executive order this will be done and really charging the political leadership of those organizations to carry forward, it has gone a long way to ensuring follow-up action. But I wouldn't stop there. And that is in part why we also recommend changes to regulations requiring adaptation be taken into consideration in all major Federal actions through the NEPA EIS process.

Mr. HALL. I notice in Mr. Schwaab's testimony that Maryland has already lost a number of islands in the Chesapeake that used to be islands and now are under water. We have seen changes in the acidification of the ocean due to absorption of carbon dioxide and so on.

I am just curious, Dr. Green, whether you can tell me of any market forces so far that you are aware of that have come into play to stop those kinds of things from happening.

Mr. GREEN. Well, thank you very much.

I agree the acidification of the ocean is a potentially troubling side-effect of greenhouse gas emissions. It remains to be seen exactly how troubling.

In the past periods, when shell animals actually ruled the oceans, CO_2 levels were considerably higher than they are today. So the idea that we will not have shell areas because CO_2 levels increase the acidification of the ocean has yet to be demonstrated.

Will market mechanisms fix that, the acidification question? Probably not. The localization or the adjacency to water areas, yes. You could move people away from areas that are very highly prone to flooding. As my hydrology teacher used to tell us, you know why they call them flood plains, don't you? Because they flood, and so people should not be living in them. And to the extent that we subsidize their living there, we should cease doing so.

Mr. HALL. I am in agreement.

The question is how to get from here to there. For instance, people living on the barrier islands anywhere along the East Coast or the Gulf Coast.

But to change the subject slightly, in the Hudson River, the salt wedge at high tide is drawn up to just south of the Chelsea Pumping Station, which is just south of Poughkeepsie. That is the backup water intake for New York City's drinking water in case the reservoirs fail or are sabotaged or in case the aqueduct fails. There is already concern that sea-level rise is projected, even just from the greenhouse gases that have already been emitted, may be sufficient to push that salt wedge up high enough to require desalinization of the water supply to New York City if they need to rely on the Chelsea Pumping Station.

That is another question where, you know, I have yet to see a market force or hear one described that would either prevent that from happening by restraining the emissions that seem to be causing it, according to many scientists, or that would solve the problem. I think it is going to take, in my opinion, a governmental action or actions either to mitigate or to try to restrain the scenario. And with that question, I will yield back.

The CHAIRMAN. A brief answer.

Mr. HALL. It could be a comment.

Mr. SEIDEL. It may be a comment, but if I may respond. Just classic markets work when all the cost and benefits are taken into consideration. When there are externalities, when external costs are not taken into consideration, markets don't work. And that is when government needs to step in and make those markets work more effectively. I think that is the classic case that you are describing.

The CHAIRMAN. Mr. Green.

Mr. GREEN. Yes, in fact, I agree with my colleague here. The right thing to do if you have an externality is to internalize the externality. There are indeed economic approaches that would solve the problem, such as instead of relying only on that water as your back-up, there could be other back-up systems established.

Through the full cost pricing of water, people could use much less water, putting less strain on your existing water infrastructure. There are any number of things you could do to make your water system more resilient to change.

If I believed we could actually take control of the global climate and push sea levels at whichever way we directed without going economically into complete disruption, I wouldn't have a problem with it. But I don't believe we have the technology to take over control of the global climate, and therefore, we have to adapt.

The CHAIRMAN. The gentleman's time is expired.

The Chair recognizes the gentleman from Wisconsin.

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

I think we all know that the computerized projections on what is going to happen to climate can result in widely varying results 10, 15, 20, 50 years out if there is almost an infinitesimal change in the data which is put into the computer.

Now, since 2000, according to Dr. Green's paper, which I believe to be scientifically valid, it has determined that the rate of our planet's warming has flattened out and begun to decline. And as a result, what has been talked about at the time of Kyoto before this flattening out of the temperatures and the slight declining of the temperatures will probably be significantly different by 2020, 2030 and definitely by 2050.

When we are talking about resiliency and adaptation, if the premises upon which decisions are to be made are off and will result in the wide variation what the projections will be, how do we do it? I am going to start with you, Mr. Seidel.

Mr. SEIDEL. Thank you, Mr. Sensenbrenner.

Basically we are seeing this experiment unfold before our very eyes. We have seen temperatures rise. We have seen sea-level rise. We have seen the loss of islands in Maryland so we are not just basing this on projections of computer models.

The second point you raise is about the recent changes, the recent sort of flattening out of the temperature record since the year 2000. And every analysis I have seen expects that there will be—there is still natural variability in the climate system, there will be years that are warmer; there will be years that are colder. And the last couple of years have been relatively warm compared to the record. In fact, last year was the coldest year of this century, but the tenth warmest year I believe in the 150-year record. This decade, which you are referring to as climate has stabilized, will still be the warmest decade on the 150-year record.

Mr. SENSENBRENNER. Well, using the language of the left, I think, Mr. Seidel, that answer makes you a denier. Because if you look at the trend, there has been an at least flattening out of the warming trend or maybe a slight cooling trend since the year 2000. And I guess what I am saying is that the inconvenient truth of 2 years ago might not be either inconvenient or truthful today because of these types of changes.

Now, what we are talking about here is an adaptation policy that is supposed to last for a while. And there will be certain economic and financial commitments that will have to be made in order to implement the adaptation policy. Given the fact that the projections of a decade ago that the temperatures will continue to rise

and maybe even increase, how as policymakers are we to be able to decide in a manner that we won't be embarrassed later on by saying we were wrong in what the prescription was to deal with this issue?

Mr. SEIDEL. In terms of adaptation itself, I think it is critical that the types of changes that we can make to our economic systems that are dependent on climate will create benefits. And those benefits are true whether there is rapid climate change, as the vast majority of scientists predict, or because of the climate variability, as my colleague here would suggest.

Mr. SENSENBRENNER. With all due respect, what I am saying is that you all are saying we ought to adapt, but you, Mr. Seidel, aren't adapting to new figures.

I yield back the balance of my time.

The CHAIRMAN. The gentleman's time has expired.

The Chair recognizes the gentlelady from California, Ms. Speier.

Ms. SPEIER. Thank you, Mr. Chairman.

Regardless of whether we believe climate change is real or not, it appears that the panelists agree that adaptation is a key component. So let's start there.

Director Stephenson, in your GAO report, your third point was that basically, of the respondents, 71 percent of them believed it was the national role to come up with adaptation policies. Could you explore that with us a little bit more? What are the States looking for? What are the counties and cities looking for? What kind of direction are they expecting to come from the Federal Government?

Mr. STEPHENSON. I think the biggest single need is probably localized information. Everybody has read the IPCC and what they think is going to happen in general as a result of climate change. But there needs to be a body of research and scientists that can help people translate those into what it means to my local community. And irregardless if you believe whether sea level is going to rise 2 feet or 8 feet, it is not an excuse for not planning an adaptation policy.

For example, one of the case studies we looked at in King County, Washington, they are looking at the effects on our wastewater facility that is close to the Puget Sound. If they ignored the fact that sea level may rise 2 feet and inundate some of the pumps associated with that wastewater facility, they would be negligent.

And planning is not going to be static either. You have to—the adaptation plan is going to be a moving target as the science gets better and better. It is just like anything else.

So I think the localized information will be the starting point for local communities beginning to plan an adaptation program but has to be anchored in some sort of statistics on what will happen with the rivers and the oceans and et cetera.

Ms. SPEIER. So knowing how strapped localities are right now, are you suggesting that the Federal Government should offer grants to localities to do this evaluation?

Mr. STEPHENSON. We haven't looked at that specifically, but that is always a good incentive. And I believe, in the current House bill, that is proposed, to give States adaptation money. Nobody knows

how much revenue the sale of carbon is going to produce, but that would be a good use of the money certainly.

Ms. SPEIER. Does anyone else have comments on that?

In California, and particularly in my district, there are some alarming statistics already and data that suggest San Francisco International Airport would be flooded, many of my communities would have tens of thousands of people that would be no longer—would be homeless, in effect.

I, frankly, don't think insurance is the answer, Mr. Green—Dr. Green, excuse me, because I have seen all too well in California in terms of earthquake insurance that, at a point, the insurers no longer have enough money to respond to claims, and the State, in the case of North Ridge, was left holding the bag.

So I guess my question to all of you, and Dr. Green, you could comment as well, is—I am not a fan of more studies as my colleague from New York has already stated. One of the things in California they are looking at is something called coastal armor, which I presume is levies. Why not take that kind of attack where you don't have to study anymore, you can just—on the coastal regions in this country—just incentivize localities to build up these levies?

Mr. GREEN. May I comment?

I also grew up in Los Angeles, by the way. I had the privilege of being there for the Elmore quake and the Northridge quake, so I understand the fragility of that particular part of the world.

With regard to whether insurance works, I mean, if you reach a point where you have people living in an area that cannot be privately insured, that is a de facto problem by itself. I mean, that shows you that people are not willing to pay the full cost of living in the area, based on its fragility or its particular tendencies toward disruption.

But I agree with you, there is no reason why, and I mentioned this in my paper, there is no reason why you can't install coastal armor, why you can't build sea walls as well. My suggestion though is rather than make the mistakes of the past by having the State governments build them, those should be done in public-private partnerships and based on the utility where people pay a certain share of the protective aspect of that levy.

And again, the price signal will determine whether or not people are really willing to live there and how they want to protect themselves or if they need to move inland a bit. And we are talking—let's not forget, sea level is not simply going to go up 2 feet tomorrow. We are talking over 100 years, assuming it continues to rise at the rate it has since the last Ice Age. That is a lot of time for people to be able to creep back and adapt and build. We built systems much more quickly than that. We built the entire National Highway System in only 50 years. So there is time to adapt, and it is worth the effort of thinking through how to do it sustainably.

Thank you.

Ms. SPEIER. I see my time has expired, Mr. Chairman.

I yield back.

The CHAIRMAN. The gentlelady's time has expired.

The Chair recognizes the gentleman from Oregon, Mr. Blumenauer.

Mr. BLUMENAUER. Thank you.

I cringe a little bit thinking about armoring the sea coast. I mean, you have a third of your—of coastal areas in southern California already armored. And we are watching what happens. As we deflect tidal action, we make it possible—impossible to renourish beaches. We accelerate erosion elsewhere. And ultimately, we are ending up—I mean, it is a finger in the dike.

So I know that there are some communities that do this repeatedly with artificial beach construction. But it brings me to an area where I actually agree with Dr. Green about the Federal Government subsidizing people living in places where nature indicates that it is really not a good idea.

I have been extraordinarily frustrated having spent 7 years working on flood insurance reform, watching how hard it is to make that happen.

Our colleague, the ranking minority member, Mr. Sensenbrenner, was concerned about our not being embarrassed in the future. Well, putting aside for a moment the scientific consensus about what is likely to be happening over 20 and 40 and 60 years, I think the likelihood of embarrassment is much greater if we don't act than if we do.

But it seems to me, for reasons that the panel has been touching on, this is something we should be doing even if we didn't believe that climate change was upon us, that sea levels were rising, that we were going to have more extreme weather events.

We have already seen an increase in wildfires, in flooding, in storm events, insurance losses. And it would seem to me that we ought to listen to you and make our Federal policies consistent with strengthening these partnerships. Flood insurance reform, I think, would be one. The Coastal Barriers Protection Act, CBPA, resources, since I have been here, people come in and they try and nibble away at it because they want another area to be added. And there was a mapping error; there was new evidence. Basically, this was one of the most profound environmental pieces of legislation of the Reagan administration and something that we ought all to get behind and expand rather than minimize.

I would just make an observation about market-driven solutions that Dr. Green is interested in, which I am very interested in pursuing. But I think, at core, our climate change legislation that a number of our colleagues here have been working on so heavily is a market-based solution. Cap-and-trade injects an opportunity to create a market for carbon pollution and be able to make adjustments in a variety of markets at home and around the world. I am particularly interested, though, in some specific areas where we might be able to do a better job.

Mr. Schwaab, you talked about what Maryland has done to try and protect development in sensitive areas. I come from a State that has a comprehensive plan that actually mandates that they be—that we are sensitive to natural hazards. And as our statewide land-use planning has taken effect over the course of the last 20 years, we are actually seeing a reduction in flood damage, for instance, at a time when we are seeing more of it nationally. Do you have a sense of what Federal policies we ought to be implementing

that could strengthen Maryland's ability and other States to be able to protect these vulnerable places?

Mr. SCHWAAB. Thank you.

Let me just first say, generally, I think there are two levels of—two ways that we need to coordinate. One is better horizontally across the agencies. An example of that that I think has been very successful recently is in President Obama's executive order relating to coordination amongst Federal agencies in implementing the Chesapeake Restoration Program. And we have seen tremendous progress in a very short time as a result of that executive leadership and mandating horizontal coordination across the Federal agencies.

The other way is what I would term perhaps more vertically oriented, and that is where there would be coordination, recognition, and implementation of adaptation perspectives in the implementation of programs that the States enact in partnership with the Federal Government. And that ranges from—you know, that runs the gamut from highway planning and resource deployment to things like wildlife habitat action planning and forest conservation. And there are a number of sort of vertical opportunities where coordination down from the Federal agency with a specific implementation responsibility in cooperation with the State can do a better job.

I think both of those generally have a lot to offer. There are some specific recommendations that are included in my testimony. I will give—the Coastal Zone Program has been an incredibly important force for us in allowing us to study and implement some of these adaptation strategies. And reauthorization of the Coastal Zone Act with a more explicit climate adaptation responsibility and role is something in particular that we highlighted in our testimony.

The CHAIRMAN. The gentleman's time is expired.

The Chair recognizes the gentleman from Missouri, Mr. Cleaver.

Mr. CLEAVER. Thank you, Mr. Chairman.

Thank you for being here.

Editorially, in my real life, I am a Methodist minister, and one of the least joyful parts of what I do is sitting by beds as people are dying. And one of the strangest things is that, in all the years I have been doing it, 30 years, I have never heard anyone say to me as they are moving toward sunset, you know, I really regret having taken such good care of my body. I have never heard anybody say, you know, I am embarrassed because I didn't smoke and I didn't get cancer; it is just so embarrassing, I don't know what to do. Maybe in the future, somebody will do it, but so far, I have never heard it.

The testimony of Mr. Stephenson and Mr. Schwaab, if I understand it correctly, both of you are I think suggesting that we need this national strategy adaptation, whereas it seems, Mr. Seidel, that you are saying, you are suggesting that we ought to begin in the departments and develop the strategy. So there is—I think there is a difference here.

I am on the housing committee. HUD, for example, is essentially doing that. But the impact won't be as great because there are instances where HUD, the activities of the Department of HUD interact with the Department—you know HHS or the Department of

Justice. I am trying to reconcile the differences. Can you help me please?

Mr. SEIDEL. I think it is a question of timing and staging. I think we all agree there needs to be a Federal-wide program and strategy. But we thought, based on our discussions with experts and what we have seen done in the past, that the agencies need to take it on first. And I would say the Department of the Interior is a great example of moving forward and looking through each of their program areas and coming up with what needs to be done to deal with the types of changes that have been discussed this morning. Then that, we believe, feeds into a national strategy. It is sort of the classic bottom-up/top-down type of, but in the end, you sort of want to end up in the same place.

Mr. STEPHENSON. If I can comment. I think what we have seen is there has been a lot of activity at the individual agency level with climate change adaptation planning. In our report we are going to appendicize a summary of all the 15 or so agencies that have undertaken this. But what we are seeing and what we mean by ad hoc is there is no overarching national strategy. As part of that development of that strategy, we would see what the government structure would look like to implement that. Interagency task forces don't often work for the same reasons you have mentioned. If it is not the Department of Labor's issue, they don't worry about it. So they are of limited effectiveness.

So we think that the part that needs to be studied in developing an overarching strategy is, who is going to do what assigning roles and responsibilities, certainly to get the Federal agencies coordinated but also to look downwards at the State and local governments as well.

Mr. CLEAVER. Mr. Schwaab.

Mr. SCHWAAB. Thank you.

We also don't believe it is an either/or circumstance. And I think Mr. Seidel is exactly right; there are some sequencing questions at play here. We have already seen some very important efforts come out of the Federal agencies. The Corps of Engineers in July of this year issued a report on sea-level change considerations for civil works projects. We have seen similar work in the Department of the Interior with the Fish and Wildlife Service, as was mentioned. Those things have been very important to us as a State.

Thank you.

Mr. CLEAVER. This may be more philosophical, but in a free society, do you think people have the right to do bad things to themselves? Anybody.

Mr. GREEN. May I? To themselves?

Mr. CLEAVER. Yes.

Mr. GREEN. Generally speaking, yes. As long as they are not exporting the cost of their action to other people, I believe they have the right to do things that others may consider a bad tradeoff. I have heard people express regrets for not having traveled more as they get later in their life, or not having experienced things such as skydiving and taking risks. So I do believe that that is the case.

I would also just like to contribute that what hasn't been mentioned here is the role that the military can play in looking at adaptation responses. And I know they are very interested in this. I

have spoken at a military forum before where they need to plan for the adaptation of their bases. They need to plan for the adaptation of their structures, and they need to do that in conjunction with the other agencies, as well as the discussion of establishment of the north-south wilderness corridors and changing the way that we establish protective areas in the United States.

Right now we do it by drawing circles on a map and putting someone's name on there as a park, which is not how the animals are going to need to respond if the climate changes and they need to move north and south. So those are the kind of changes that agencies can look at right away, agencies of the Federal Government can look at right away to increase our adaptivity, both ours and the ecosystems adapting to this.

The CHAIRMAN. The gentleman from Washington State, Mr. Inslee.

Mr. INSLEE. I want to express a little concern about the subject we are talking about, which is how we respond to this problem. And I have a little bit of concern that talking about the problem of climate change and ocean acidification in these terms could somehow siphon off energy for trying to stop the disease in the first place.

You see a little bit tone of that in this book Freakonomics that came out the other day, Freakonomics 2. And the author sort of said, well, you know, we don't have to stop CO_2 going into the atmosphere; we will just mitigate it somehow by putting a shield of sulfur dioxide. Now, in the book, I am told they have grievously misstated the scientists' positions, who now are absolutely in open rebellion against the two authors, who think they were grievously quoted wrong. But it shows this kind of syphoning off of energy if we start saying, we will just solve the problem by putting a big wall around us, you know, we will just isolate ourself from this problem, and that is how we will deal with it rather than really putting our energies into stopping CO_2 pollution.

Should that be a concern at all, and if so, how do we make sure that while we are thinking about how to prevent or respond to the change that is already baked into the system, doesn't syphon off any of our energy, political or financial, to stop CO_2 pollution?

Mr. STEPHENSON. From our perspective, all aspects are important. Emission reduction is important. We can't just expect to work our way out of this problem with just looking at an adaptation alone or emission reduction alone. Energy efficiency is a huge component as is renewables. The whole arsenal of things that we need to do to address this problem are important.

Mr. SEIDEL. Congressman Inslee, my feeling is that the people who are on the ground experiencing the climate change that we are already having, the land managers, the coastal zone planners, they are the group that know what is happening, know the dangers that climate change is creating. And we need to enlist their support in efforts to mitigate and that mitigation is our first and best line of defense. But they can become allies in this effort, and it is not an either/or situation.

Mr. GREEN. I believe that we have in fact—this attitude that you expressed has in fact kept adaptation off of the agenda for about 10 years or more since Kyoto to the detriment of these places that

have experienced harms from climate variability. Having had a heart attack, I can tell you that we can't actually cure them. They don't know the causes of all of them. Even if you follow their advice, you still have them and you do treat the symptoms. And if you don't treat the symptoms, they get progressively worse. So you can't simply say, well, we are not going to treat your symptoms until we know every cause of coronary artery disease; you treat the symptoms while you look.

Mr. INSLEE. Well, we are doing that in my neck of the woods. King County, as you may have read in the GAO reports, have done some great work trying to respond to this problem. But I have—in talking to Federal agencies, I have been impressed by the lack of sort of institutional structure to make sure we do plan for the climate change that is already baked into the system.

I was talking to someone in the Army Corps of Engineers whose responsibility is flood control. And I asked him, do you have a specific change in hydrological cycles that you build in your planning process? And the answer was uncertain at best. What should we do to try to make sure Federal agencies make this part of their regular planning process that hasn't been done?

Mr. SEIDEL. We certainly think that it needs to be incorporated. And the first step is really for agencies to go back in and analyze what programs and activities they are responsible for where climate needs to be factored in and hasn't been up until now.

Mr. INSLEE. So, institutionally, how do we do that? I mean, do we have a climate change box they have got to check on every contract, that they have looked at those numbers? I mean, how do we institutionally do it? I am particularly thinking of the Corps at the moment I guess.

Mr. SEIDEL. I think the executive order that was recently issued by the Secretary of the Department of the Interior mandates this requirement throughout Interior. And I think that is an important first step, but clearly, it needs to be followed up on, and it needs to be done, not just in Interior but in Department of Defense, as you suggested, and across many other agencies where climate impacts are going to be critical to the well being of their programs and activities.

Mr. INSLEE. Thank you.

The CHAIRMAN. The gentleman's time has expired.

And by the way, if members want to ask additional questions, they can do so.

What I have done, and perhaps members—I wish that Congressman Cleaver was here because he actually gave me a tour of the Negro Baseball Hall of Fame that he actually helped to establish out in Kansas City. So what I decided to do is just to deal with this question.

You already responded to it, Mr. Seidel.

It is the question of where are we in the history of temperatures in terms of the planet and in terms of the United States. So I don't know if you can see this, but I have got a—and I probably should put this in higher—in a larger form. But this is a picture of the world, and it is temperature differences from the average 1880 to 2008. And you can see that the temperature just continues to rise as industrialization really starts to hit in 1970, 1992, 2008.

But for about a 10-year period, as you are saying, there is a new normal. And the new normal is way up here. And you are right, it hasn't really spiked higher than the new normal, but it is very, very, very high. And so what I did was I asked them to compare that to the number of 40 home-run hitters per season in the Major League Baseball. And as you can see, it tracks very, very closely to the temperature for the planet, except you get, as you do with a dramatic increase in CO_2 in the atmosphere, as soon as steroids starts getting injected into the system the number of home-run hitters of 40 or more spikes dramatically beginning in about 1996, 1997 until testing for steroids begins about 3 years ago. And then there is a dramatic decline in the number of 40 home-run hitters. Now we have yet to have, as we know, an interjection of public policy to deal with CO_2 in the atmosphere. So the average temperature kind of mirrors the height of 40 home-run hitters did before we had a new regime put in to test for artificial substances being put kind of an anthropogenic impact on the number of 40 home-run hitters. But once it is taken out of the system, it is amazing how it returned to the norm that existed before steroids were introduced.

So I just believe that this artificial substance correlation is almost undeniable. And unless you want to believe, which I think Major League Baseball did, that when people started hitting 72 and 73 home runs, that that was the new normal, and then we adjust to the new normal in the same way that people want to adjust to the new normal for temperatures.

Well, it hasn't gone any higher. That is okay. It has leveled off, and so why don't we just live with that? Kind of like saying to a kid, well, you have had 102 degree temperature for the last 10 days; that is the new normal. Don't worry about 98.6, Mrs. O'Brien, you know, your boy will be okay; that is the new normal for Joey.

Well, it is hard for parents or baseball fans or fans of the planet to kind of get used to having dramatic changes that are recurring that you are being told by doctors of the planet or of individuals or of baseball that there is nothing to worry about because that is the new normal. But then you begin to see changes in the physiology of baseball players. And originally—and there can be contrary theories, too. You can say, well, you know, maybe the bats are better. Maybe the ball parks are smaller. Maybe the baseball players are doing more weightlifting than they used to do. And you keep trying to find other reasons. But yet that new normal is so much higher than Babe Ruth or Hank Aaron or Willie Mays or Ted Williams that you kind of wonder, can they be that much better? Can it just be kind of, you know, all these other circumstances and not the artificial substances going in?

So it is kind of the rise of science here as used by man, mankind, to affect important systems. So I just thought I would throw that in and hope that maybe we could—you know, Major League Baseball at its highest level was kind of in denial because they really loved all the fans that were coming into the ballpark to see these home runs, you know. It was almost like using a baseball bat to hit a golf ball, it went so far. But it was normal, you know, all of a sudden. And then it stopped being normal again, and we went back down to the average that existed in 1964 and 1953. And that

is what happened this year, you know, the home run leader only has like 39 home runs, 40 home runs. I wonder why? I wonder if the bats aren't as good or the balls aren't tied together as tight or the players aren't lifting weights as much. But I think most baseball fans kind of get what went on.

And that is what the polling kind of says about CO_2. They kind of get it, you know. They know that there is something going on that is being created by man.

So let me ask you this, Mr. Schwaab, when you were looking at Maryland in the same way that we look at Massachusetts—and as you know, the Supreme Court case of Massachusetts v. EPA was based upon the impact that CO_2 had upon our coastline. Why did you look at the coastline? Do you have a feeling that that is the most serious danger to the State of Maryland and, as a consequence, perhaps to Massachusetts as well?

Mr. SCHWAAB. Thank you, Mr. Chairman.

I think there were probably two factors at play. One was that heightened awareness of our threat. And I have spoken already about some of the evidence of vulnerabilities in Maryland, obviously, both on the Atlantic Coast as well as both sides of the Chesapeake Bay. But in addition to that, I think it is important to note that, while there was a heightened sense of awareness of that vulnerability, that our positioning to address this issue first was aided substantially by the availability of coastal zone, Federal coastal zone management funding. So, in fact, when Governor O'Malley tasked the climate commission, we had 10 years worth of data that had been gathered largely through the support of our Coastal Zone Program and through Federal funding that came in that way.

By way of contrast, some of the other areas that we have concern about, that I mentioned that we will be dealing with in Phase II, impacts on rainfall patterns, agriculture, some of the forest concerns, were not areas where we had the wealth of data, so that we were positioned to make immediate changes. So Phase II is now to spend the time, the energy and the money to get the data related to some of those other issue areas so that we can be better positioned to make some, to develop some action plans.

The CHAIRMAN. Thank you, Mr. Schwaab.

Mr. Stephenson, in Mr. Schwaab's written testimony, he mentioned that three separate climate change adaptation strategies in the Chesapeake Bay region in the last year and a half have been put in place. From your experience with other complex environmental issues, do you have suggestions for the coordination efforts across Federal, State and local governments?

Mr. STEPHENSON. Well, specifically, the overarching strategy is the starting point for pulling all that together. But what we noticed when we did our nationwide survey is that there is a huge lack of information out there about what is available. There is a lot of climate change information, adaptation information, scientific information about what could happen, but there are no information clearinghouses, for example, where all that resides. We had trouble finding people out in the State and local governments that were even aware of what was possible at adaptation, how to get started. So there is an information need out there as well.

The CHAIRMAN. How would you address, what recommendations would you make in terms of balancing the short term versus the long term in dealing with climate change?

Mr. STEPHENSON. Well, there just needs to be an organizational construct. I mean, there doesn't have to be a big bureaucracy to address Mr. Hall's concern, on the one hand. But right now, all the agencies are sort of doing their own thing. There is not this integration across the government; there is not good coordination from the Federal to the State and the local government. And that is the thinking that we think needs to go into this overarching strategy that hasn't happened yet.

The CHAIRMAN. Mr. Seidel, it is clear that we need more resources to support site-specific data so that policymakers can plan for the impacts of global warming, and we are never going to get perfect information. How do we optimize our efforts, absent perfect information, which, of course, ultimately is unachievable?

Mr. SEIDEL. And in fact, decisions now are being made on the basis of the one thing that we know is not true, and that is that the climate will not change. So any better information in terms of the direction the climate will change will improve those decisions.

I want to come back to just the costs that are involved here, because the costs of not adapting, the costs of not making land-use decisions based on a changing climate, the costs of not designing bridges, intake valves for wastewater treatment plants or water-quality treatment plants, the cost of not doing that now is going to come back and really knock our society for a loop down the road. So that is why it is critical that this starts sooner rather than later.

The CHAIRMAN. Can you give me your numbers again in terms of the 10 hottest days in history, 10 hottest years in history for the planet?

Mr. SEIDEL. I don't have those right off the top of my head, but I will get them and put them on the record.

The CHAIRMAN. But you said something like the last——

Mr. SEIDEL. What I said was this last year was the coolest year of this century but I believe was the 10th warmest year among the record that dates back to the 1880s.

The CHAIRMAN. And weren't the other nine since 1998?

Mr. SEIDEL. I believe that is correct, yes.

The CHAIRMAN. And so you heard my correlation in terms of years in which baseball players hit more than 40 home runs and the number of them. Do you think that there is any validity to the comparison I am making with steroids and CO_2.

Mr. SEIDEL. I think it is a wonderful analogy. The one aspect of it that I am concerned about is that when the players stopped taking steroids, you had an immediate drop-off. Unfortunately, one of the aspects of our climate system is that climate will continue to warm even once—if it were possible to reduce CO_2 emissions completely. So, unfortunately, we are committed to the not only increase we have seen but further increase, and not just for years but for decades and even centuries.

The CHAIRMAN. That is actually very helpful, so it makes it even more urgent because the steroids in the planet system don't wash out.

Mr. SEIDEL. They don't wash out, exactly.

The CHAIRMAN. In a 6-month period. It takes a lot longer to get it out of the system and to begin to return it to some semblance of normality.

Let me turn again and recognize the gentleman from New York.

Mr. HALL. Thank you, Mr. Chairman.

I just wanted to ask one more question. First of all, talk about the new normal, for a second, that you mentioned. Orange County, one of the five counties I represent, has some wonderful onion farmers who work the black dirt, as they call it. And they have been hit with repeated storms that are three 50-year storms in the last 5 years. There have been several days this year alone when there have been tornadoes in Orange County, New York and other Hudson Valley counties. The Hudson valley isn't usually thought of as tornado alley.

Last year, Cedar Rapids, Ohio—the city slogan was "the city that never floods"—was under 12 feet of water, I believe. Three hundred miles of the Mississippi River were closed to shipping because the water level, the flood level, was higher than the locks and the mechanism had to be removed from the locks to keep permanent damage from being done to them. The boring beetles in the western—the Rockies and Sierras have been moving forward and drying out the trees by boring into them. And satellite photographs, aerial photographs, show brown swaths of forest just waiting for a lightning strike to set off one of these increasingly common and disastrous wildfires.

So the question is, as far as this new normal is concerned, A, how hard are we as a country or as a society among other societies in the world willing to work to keep it from getting worse, to keep from the worst-case scenario? And B, how bad is that, and how hard should we be working to prepare for middle case or worst case? I don't think we can, that we can achieve the best-case scenario based on what I have seen so far. I spent a bunch of time last year at NOAA in Boulder and at the NREL and NCAR laboratories out there. And the predictions of NOAA, of the scientists, these aren't political people, they are scientists out there, show the growing latitudes for grain and other crops moving north. And I said, well, are we in danger of becoming a net importer of food rather than a net exporter of food? And they said, yes, that is possible. And the problem is that the alluvial plain in Canada doesn't allow for soil depth to, if it gets—you know, if you push the growing latitude for corn and soy and other grains, wheat and so on, far enough north, you run out of top soil to do it on. So more than or as much as coastal preservation or any of the other infrastructure and so on adaptations that we might look at, I am curious, maybe starting with Mr. Stephenson, what you foresee in terms of what we need to do to preserve our agricultural productivity and the land and climate necessary to have it.

Mr. STEPHENSON. Well, let me just say, we are not a scientific organization, but the IPCC certainly is a symbol of the world's leading scientist in this area. And you are right, I think sea-level rise is the most talked about and the probably best understood of climate change impacts. But I don't think we fully understand the effect on storms, the effect on migration strategies, droughts. And

as all that is crystalized, I think we will come up with different kinds of adaptation strategies for those. But I certainly don't have a silver bullet or a solution as to what we might do about that.

Mr. HALL. Mr. Seidel, do you have a comment?

Mr. SEIDEL. In terms of the range of impacts that we face, sea-level rise does get a lot of the attention, but it just really depends on where you are. Someone mentioned earlier melting of the permafrost in Alaska is critically important and something that is already being experienced. Droughts throughout the Southwest, I think, are critically important and certainly are what these projections would forecast. So it is really a wide range of issues.

It is possible, though, to begin to plan for these now. Making more efficient use of water makes sense. It made sense yesterday. It makes sense tomorrow. It is going to make even more sense in the future. And we really can't waste any time in getting better programs in place to begin doing those things.

Mr. HALL. Dr. Green, you looked like you wanted to comment.

Mr. GREEN. Two things. One I wanted to talk about is the science element. We talked about a new normal. There is no such thing as a climate normal. We have got a climate that is billions of years old. It goes up, and it goes down in temperatures. Climate is, in fact, an average of 30 years of weather. Each individual dot, we would call a climate block. When you talk about climate, you are talking about 30 years of average weather.

So 10 years, the fact that it has leveled off I don't construe to mean things are changing direction. However, the models at a certain point don't allow for that to continue, and so it does cast doubt on the forecasting ability.

But with regard to your specific question, again, water subsidies and farm subsidies, obstacles to the deployment and development of genetically modified crops, these are all things that the Federal Government can affect that can make our agricultural base more resilient to climate variability, whether it is natural or anthropogenic. Thank you.

Mr. HALL. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you so much.

The importance of this hearing cannot be overstated, and we thank you so much for being here. There is an old saying: Sometimes you can be right but too soon. A lot of people just don't want to deal with the facts yet. And it can happen in a lot of things, including if a player on your team happens to jump from a 20 home run average to 50 all of a sudden, you don't want to ask too many questions. So it is kind of the same thing is true here.

We have this conference that is going to occur in Copenhagen in December. The world has basically accepted the science. The National Academy of Sciences of every country in the world has signed off on the science. The world is waiting for the United States to be the leader and not the lagger. The consequences are obviously greater in the short run for developing countries around the world in terms of the impact of global warming. But inevitably, inextricably, it will hit us as well.

And the Chesapeake Bay is a good example of warning to us that we are not immune. And adaptation will be very costly and, in some instances, very difficult to implement, but nonetheless, we

have to start thinking about it. Otherwise, we will just be engaging in the kind of denial that ultimately turns the problem into something much worse. A stitch in time saves nine, so I think it is important for us to have this hearing because the GAO report, and we thank you so much, Mr. Stephenson, for it, will be a working document for the Select Committee on Global Warming as we make our recommendations to the Speaker and to the administration and to the American people.

And all of the rest of your testimony is very helpful to us, including yours, Mr. Green.

So why don't we give everybody a 1-minute summary, opportunity to make a 1-minute summary to us of what it is that you want us to keep in our minds six weeks out from Copenhagen as the world gathers and what the implications are of the GAO report and the testimony that we heard today? So we will give each one of you 1 minute to make your summary.

We will begin with you, Mr. Green, which under the Green formula actually turns out to be 2 minutes worth of written testimony delivered in 1 minute.

Mr. GREEN. Thank you. I will try not to rush through this. Thank you, Mr. Chairman.

I think the key point I would raise for this is that, first of all, the technologies to reduce greenhouse gas emissions in the near term are very, very expensive and very limited. Unilateral action by the United States would lead to serious economic disruption.

Nonetheless, the fact that we know the climate is a variable system leads us—should lead us to take actions to make ourselves more resilient to the face of change, whether that change is natural or anthropogenic.

Therefore, I would suggest then refocusing our attention on finding ways to make ourselves more resilient at the Federal and State level. And I think a great deal of that involves removing incentives we have currently in place that lead people to live in harm's way in climatically fragile areas, in areas prone to drought, flood, fire, sea-level rise and salt-water intrusion. And if we address those things first, we would find the cost of adapting down the road to be considerably less than if we don't adapt—than if we don't address those things right up front.

Thank you.

The CHAIRMAN. Thank you, Dr. Green.

Mr. Seidel.

Mr. SEIDEL. Thank you, Mr. Chairman. And I do hope you are going to enter your graphs into the official record.

The CHAIRMAN. It will be entered. It has to be perfected. This won't come out of your time. I am still working on completing the analogy. And I like the fact that I came up with a temperature for children analogy as well in terms of what is normal that the family has to adjust to. It is just too difficult for a doctor to figure out what is causing it, so we will just accept a new normal. So I am working on all of these analogies to deal with the preposterousness of saying that 10 of the warmest years in history have occurred since 1998, but that is the new normal, and so just get used to it, and it won't go any higher than that ever again in the future. It just doesn't really make a lot of sense to me.

So your 1 minute begins now.

Mr. SEIDEL. Thank you.

I think it is critical to look at adaptation policy as good economic policy and that these are costs that society is going to incur down the road. We heard about the San Francisco airport, the railroad lines in your district.

I mean, if we don't begin adjusting our thinking, adjusting the way we plan, taking the types of actions that Maryland has begun to take, the economic costs are going to be so severe down the road that we will rue the day that we did not start adapting sooner.

Thank you, sir.

The CHAIRMAN. Thank you, sir.

Mr. Schwaab.

Mr. SCHWAAB. Thank you, Mr. Chairman.

Let me just first emphasize some discussion about the concept of adaptation versus mitigation. While we are focused here today on adaptation, the concept of mitigation has also been prominent in Maryland. I wanted to emphasize that as sort of a two-pronged approach.

The second thing that I wanted to emphasize is, again, the need for national coordination. And very specifically, that includes both Federal coordination among the agencies as well as leadership at the Federal level, but coordination between the Federal agencies and the State and local governments. So when we speak of national coordination, we speak implicitly about inclusion of the States and the local governments prominently in that discussion.

We think it is absolutely imperative that government lead by example. We are doing that in Maryland. We see some of the Federal agencies doing that already, and we just need to build on that and get more strategic from a broader perspective.

The CHAIRMAN. Thank you, Mr. Schwaab.

And Mr. Stephenson.

Mr. STEPHENSON. Mr. Chairman, I think that our biggest contribution in our report is the survey that we did of State and local officials. Those are the folks that are out there on the front lines of trying to do adaptation planning. And so I would just reiterate what they pointed out to us, that the need for training and education to increase awareness, they need more site-specific information. They need to know where to go to get that information, and they believe in clarifying roles and responsibilities.

We think that strategic planning is needed to better integrate the Federal response to adaptation, and that is why we are recommending this need for a national framework or strategy in order to do that. We think CEQ and OSTP, who are leading those efforts right now, are off to a good start, and we will be watching anxiously to see how they proceed towards the development of that national strategy.

Thanks.

The CHAIRMAN. Thank you, sir.

And what we would like, if it would be possible, is for our staff to work with you in terms of what a national framework should look like so that we can receive your expert advice on what makes the most sense for doing that. And we would appreciate that continued cooperation with us moving forward.

Mr. STEPHENSON. I would be happy to do that.

The CHAIRMAN. Thank you. And we thank each of our witnesses for your testimony today. And with that, unless there are any questions, this hearing is adjourned.

Thank you.

[Whereupon, at 11:12 a.m., the committee was adjourned.]

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