

**America's Climate Choices**

Statement of  
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and  
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Congressmen, colleagues: Thank you for inviting me to talk to you today. My name is William Chameides and I am the Dean of the Nicholas School of the Environment and Nicholas Professor of the Environment at Duke University. I am by training an atmospheric scientist, having spent much of my research career studying the chemistry of the lower atmosphere and thinking about the impacts of regional air pollution. In my research, I try to understand the causes of environmental change and identify pathways toward a more sustainable future.

I'm speaking to you today in my role as vice-chair of the report "America's Climate Choices," issued by the National Research Council of the National Academy of Sciences. Our 2012 report was the capstone in a 5-report series carried out at the request of Congress that brought together more than 90 experts from around the country to think collaboratively about the causes and consequences of climate change and the choices that could be made to respond.

I believe the ACC reports hold special credibility because they were prepared according to the stringent NAS guidelines for balance, objectivity, and peer review, and because they were developed by volunteer experts, including top climate, social, and economic scientists, as well as leaders from the private sector, and former office holders at the federal and state level. As a result of this breadth, we were able to address a diverse range of issues.

**KEY MESSAGES**

The ACC report series summarizes what we know about climate change and what kinds of response choices we face as a nation. Some key take home points include:

- Climate change is occurring, is very likely caused primarily by the emission of greenhouse gases from human activities, and poses significant risks for a range of human and natural systems. Emissions are continuing to increase, which will result in further change and greater risks.
- Some projected future impacts of most concern to the United States include more intense and frequent heat waves, risks to coastal communities from sea level rise, greater drying

of the arid Southwest, and increased public health risks. Impacts occurring elsewhere in the world can also deeply affect the United States, given the realities of shared natural resources, linked economic and trade systems, migration of species and disease vectors, and movement of human populations.

- The environmental, economic, and humanitarian risks of climate change and its impacts indicate a pressing need for substantial action to limit the magnitude of climate change and to prepare to adapt to its impacts.
- We can expect always to face some uncertainties about future climate risks, but uncertainty is not a reason for inaction. Indeed uncertainty cuts both ways— while climate change could ultimately prove to be less severe than current best estimates indicate, it could also prove to be more severe. It argues for approaching the problem though a process of iterative risk management.
- Current response efforts of local, state, and private sector actors are significant, but not likely to yield the degree of progress that could be achieved with the addition of strong federal policies that establish coherent national goals and incentives and that promote strong U.S. engagement in international-level response efforts.

#### **WHAT IS KNOWN ABOUT CHANGES IN THE CLIMATE SYSTEM**

As was once quipped by the esteemed Senator Daniel Patrick Moynihan, “Everyone is entitled to his own opinion, but not his own facts.” Much of what we know about the climate and the phenomenon commonly referred to as global warming is the product of more than 100 hundred years of research, founded on the most basic laws of science such as the First Law of Thermodynamics and grounded by observations of the climate system. While climate models play an important role in climate research, it would be incorrect to characterize global warming as conjecture based on climate models or simulations.

There is, of course, much room for debate about what policies might be implemented to respond to climate change and its impacts, and about whether the costs of responding are worth the benefits. But this does not negate the substantial, credible body of scientific evidence about changes in the climate system. As context for today’s discussions, here are some scientifically documented facts about the climate system:

- Thermometer measurements show that Earth’s average surface temperature has risen substantially over the past century, and especially over the last three decades.
- These data are corroborated by a host of independent observations showing warming in other parts of the Earth system, including the oceans, the lower atmosphere, and ice-covered regions. Further corroboration comes from shifting seasonal patterns, melting glaciers and permafrost, and rising atmospheric absolute humidity.

- Carbon dioxide concentrations are higher today than they have been for at least the past 600,000 years and we know from isotopic data that most of the increase over the past century has come from burning fossil fuels.
- Greenhouse gases such as carbon dioxide warm the atmosphere and the full impacts of greenhouse gas emissions on the climate do not fully manifest themselves for decades or centuries after they are added to the atmosphere. Some of the carbon dioxide emitted to the atmosphere from the first Model T remains there today and some the carbon dioxide we will emit into the atmosphere on our way home tonight will be warming the atmosphere of our great-great-grand children.
- Most of the recent warming can be attributed to fossil fuel burning and other human activities that release carbon dioxide and other heat-trapping greenhouse gases into the atmosphere. Changes in solar radiation and volcanic activity can also influence climate, but observations show that they cannot explain the recent warming trend.
- Human activities have also resulted in an increase in small particles in the atmosphere, which on average tend to have a cooling effect, but this cooling is not strong enough to offset the warming associated with greenhouse gas increases.
- Natural climate variability leads to year-to-year and decade-to-decade fluctuations in temperature and other climate variables as well as significant regional differences.
- Human-caused climate changes and impacts will continue for many decades and in some cases for many centuries. The precise nature of these impacts cannot be predicted with great certainty. But the risks for human well-being are considerable and with each additional ton of greenhouse gases we emit we commit to further climate change and greater risks. The magnitude of climate change and the severity of its impacts will depend on the actions that human societies take to respond to these risks.

#### **AN EFFECTIVE NATIONAL RESPONSE**

As I noted earlier, the America's Climate Choices series of reports reviewed a vast array of current research and concluded that climate change is occurring, is very likely caused primarily by the emission of greenhouse gases from human activities, and poses significant risks for a range of human and natural systems. Our report also highlights some motivating factors for why response efforts need to move ahead quickly:

- The faster that emissions are reduced, the lower the risks, and the less pressure to make steeper and potentially more expensive reductions later.
- Current energy infrastructure investments could "lock in" a commitment to substantial new emissions for decades to come. Enacting relevant policies now will provide crucial guidance for investment decisions.
- Policy changes can potentially be reversed or scaled back if needed, whereas adverse changes in the climate system are likely difficult or impossible to "undo."

Our committee concluded that there are strong reasons for acting sooner rather than later, and that the risks of not taking action to deal with climate change seem to far outweigh the risks of taking action. We concluded that it is necessary to pursue both mitigation (meaning actions to limit the emissions of greenhouse gases and thus limit future climate warming) and adaptation (meaning moving ahead in wise ways to plan for how we will live with the impacts of changed climate). We also found that there are many “win-win” opportunities, where actions that would help in climate change mitigation or adaptation will also bring other substantial societal benefits, such as increasing energy independence, mitigating air pollution and the resulting health impacts, and reducing vulnerability to natural weather extremes.

To move ahead, the committee concluded that an effective, comprehensive national response would need to encompass the following five broad areas of action:

- (1) Substantially reduce greenhouse gas emissions.** In order to minimize the risks of climate change and its most adverse impacts, the nation will need to reduce greenhouse gas emissions substantially over the coming decades. The exact magnitude and speed of emissions reduction depends on societal judgments about how much risk is acceptable and at what cost. However, given the long lifetime associated with infrastructure for energy production and use (among other factors), the most effective strategy is to begin ramping down emissions as soon as possible.

The most effective way to amplify and accelerate current state, local, and private sector efforts, and to minimize overall costs of meeting a national emissions reduction target, is with a comprehensive, nationally-uniform price on CO<sub>2</sub> emissions, with a price trajectory sufficient to drive major investments in energy efficiency and low-carbon technologies. In addition, strategically-targeted complementary policies are needed to ensure progress in key areas of opportunity where market failures and institutional barriers can limit the effectiveness of a carbon pricing system.

- (2) Begin mobilizing now for adaptation.** Prudent risk management involves advanced planning to deal with possible adverse outcomes—known and unknown—by increasing the nation’s resilience to both gradual climate changes and abrupt disaster events. Effective adaptation will require the development of new tools and institutions to manage climate-related risks across a broad range of sectors and spatial scales. Adaptation decisions will be made by state and local governments, the private sector, and society at large, but those efforts will be much more effective with national-level coordination, for instance, to share information and technical resources for evaluating vulnerability and adaptation options.

- (3) Invest in science, technology, and information systems.** Scientific research and technology development can expand the range, and improve the effectiveness of, options to respond to climate change. Systems for collecting and sharing information, including

formal and informal education, can help ensure that climate-related decisions are informed by the best available knowledge and analyses, and can help us evaluate the effectiveness of actions taken. Many actors are involved in such efforts. For instance, technological innovation will depend in large part on private sector efforts; while information, education, and stakeholder engagement systems can be advanced by non-governmental organizations and state/local governments, with support from the federal government.

- (4) **Participate in international climate change response efforts.** America's climate choices affect and are affected by the choices made throughout the world. U.S. emissions reductions alone will not be adequate to avert dangerous climate change risks, but strong U.S. efforts will enhance the nation's ability to influence other countries to do the same. Also, the United States can be greatly affected by impacts of climate change occurring elsewhere in the world, so it is in the country's interest to help enhance the adaptive capacity of other nations, particularly developing countries that lack the needed resources and expertise. Effectively addressing climate change requires both contributing to and learning from other countries' efforts.
- (5) **Coordinate national response efforts.** An effective strategy requires coordination among a wide array of actors. This includes balancing rights and responsibilities among different levels of government (vertical coordination), assuring clear delineation of roles among many different federal agencies and other types of organizations (horizontal coordination), and promoting effective integration among the different components of a comprehensive climate change response strategy (e.g., all of the various types of efforts discussed in the previous recommendations).

The ACC reports offer detailed analysis of many different options (including technologies, policies, and strategies) that one could potentially pursue in each of these areas of action.

#### FINAL THOUGHTS

An important feature of our report is the recommendation that America's climate choices be driven by an iterative risk management approach. We are unable to prescribe a response to climate change today that we know will be optimal for decades to come. Instead, we need a process of systematically identifying risks and possible response options, advancing a portfolio of actions that emphasize risk reduction and are robust across a range of possible futures, and revising responses over time to take advantage of new knowledge, information, and technological capabilities. Flexibility and adaptability are key.

America's climate choices are about the decisions we as a nation need to make in the face of risks that are growing with every new ton of greenhouse gases emitted into the atmosphere. The risks of climate change are great, but we will never be able to predict the future with absolute certainty. Because emissions added to the atmosphere today will influence climate for hundreds of years to come, we believe it is imperative to act now to limit and adapt to climate change; it would not be prudent to wait for greater certainty about future climate change. But because of the lack of certainty, we recommend a flexible approach that continuously assesses new information and knowledge and adjusts responses accordingly.

Thank you for your attention. I would be happy to answer your questions.

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\*\* The information summarized in this testimony primarily reflects the 2012 report "America's Climate Choices" published by the National Academies Press. Committee Members included: Albert Carnesale (*Chair*), University of California, Los Angeles; William Chameides (*Vice-Chair*), Duke University, VA; Donald F. Boesch, University of Maryland Center for Environmental Science, Cambridge; Marilyn A. Brown, Georgia Institute of Technology; Jonathan Cannon, University of Virginia; Thomas Dietz, Michigan State University; George C. Eads, CRA Charles River Associates, Washington, DC; Robert W. Fri, Resources for the Future, Washington, D.C.; James E. Geringer, Environmental Systems Research Institute, Cheyenne, WY; Dennis L. Hartmann, University of Washington, Seattle; Charles O. Holliday, Jr., DuPont (Ret.), Nashville, TN; Diana M. Liverman, University of Arizona and University of Oxford, UK; Pamela A. Matson, Stanford University, CA; Peter H. Raven, Missouri Botanical Garden, St. Louis; Richard Schmalensee, Massachusetts Institute of Technology; Philip R. Sharp, Resources for the Future, Washington, DC; Peggy M. Shepard, WE ACT for Environmental Justice, New York, NY; Robert H. Socolow, Princeton University, NJ; Susan Solomon, National Oceanic and Atmospheric Administration, Boulder, CO; Bjorn Stigson, World Business Council for Sustainable Development, Geneva, Switzerland; Thomas J. Wilbanks, Oak Ridge National Laboratory, TN; Peter Zandan, Public Strategies, Inc., Austin, TX; Laurie Geller (*Study Director*), National Research Council.

Some material from other reports in the America's Climate Choices series is also included (Advancing the Science of Climate Change, Limiting the Effects of Future Climate Change, Adapting to the Impacts of Climate Change, and Informing an Effective Response to Climate Change) were requested by Congress and funded by NOAA. Copies of the reports are available from the National Academies Press, 500 Fifth Street NW, Washington, D.C. 20001; (800) 624 6242; [www.nap.edu](http://www.nap.edu)