



## Return to Rio: Reexamining Climate Change Science, Economics, and Policy

*The 1992 Rio Earth Summit produced an important, common sense consensus in favor of avoiding “dangerous interference” with the global climate. Rio, however, led to the Kyoto Protocol, which abandoned the focus on reliable science and effective policy in favor of arbitrary, unrealistic targets and timetables. Kyoto, for all practical purposes, is now dead: the United States and Russia will not participate in the agreement, the European Union is not meeting its commitments to the protocol, and the developing world was never included. Six years after Kyoto, a new approach is needed.*

*Experts gathered at a November 19 AEI conference to restart the climate-change dialogue by returning to the spirit and purpose of the Rio consensus. Panelists discussed the science of climate change, which has grown more politicized in recent years, and public policy issues such as how to spend research money and spur innovation. A return to Rio offered the opportunity to reexamine how dangerous warming is likely to be, what steps should be taken to address it, and what can be done to reestablish the common sense consensus that led to the Framework Convention.*

### Introduction

**Christopher DeMuth**  
AEI

AEI President Christopher DeMuth welcomed participants to the conference, emphasizing AEI's longstanding commitment to open, reasoned debate as an essential element in the search for truth in complex matters. DeMuth expressed regret that one perspective on this issue—the view that recent warming trends are largely or entirely the result of man-made increases in emissions of carbon dioxide (CO<sub>2</sub>) and other greenhouse gases—was not more thoroughly represented at the conference. AEI made extraordinary efforts to include eminent proponents of that perspective in the conference, but most of those invitations were declined, and an accomplished physicist active in the climate change debate accepted and then withdrew at the last minute

under circumstances that indicated he was bowing to political pressure. As a result, the science panel was less balanced than AEI would have preferred.

On climate change issues, AEI scholars have been critics of the Kyoto Protocol, for reasons having nothing to do with the underlying science. On the policy front, AEI scholars have produced important studies proposing robust institutional alternatives to Kyoto should they be necessary or prudent. On the science, AEI scholars believe that inquiry and debate should remain open and that alternative views of causation and consequences should be seriously entertained. In these circumstances, and particularly because of the momentous social, economic, and political stakes presented by the climate change issue, DeMuth is proud of AEI's commitment to the principle of reasoned, non-politicized inquiry and debate, and is grateful to participating panelists for their contribution to that process.

## Panel I: The State of the Science

**Mark Jacobson**  
Stanford University

Jacobson presented data that indicates that the global climate is warming at an unusually rapid pace. Between 1856 and 1999, global climate temperatures increased by .6 to .8 degrees Kelvin. Over the last thirty to forty years, the rate of temperature increase has risen dramatically. Jacobson believes this rate of temperature rise is unprecedented for an interglacial period. He finds strong confirmation of global warming in recent evidence of stratospheric cooling. As greenhouse gases trap infrared radiation in the troposphere, they prevent this radiation from reaching the stratosphere, causing stratospheric cooling.

Although other greenhouse gases contribute to climate change, CO<sub>2</sub> emissions are the primary man-made cause of global warming. Due to CO<sub>2</sub>'s long lifetime (thirty to ninety-five years), Jacobson believes that emissions should be controlled immediately. In addition to CO<sub>2</sub> and other greenhouse gases, black carbon or soot is also a major cause of global warming. Black carbon particles coated in ammonium sulfate (produced by diesel exhaust) absorb sunlight, and in turn, warm the air. Because of its very short lifetime (one week), control of fossil-fuel generated soot may be the fastest method of slowing global warming in the short term. Such controls would also reduce health problems associated with soot emissions.

Jacobson believes there is great untapped potential for wind energy generation in America. If sufficient resources were devoted to large-scale wind energy development, it might be possible to meet a large fraction of America's energy needs with zero-emissions electricity. The direct cost of energy from new, large wind turbines in areas that enjoy mean annual wind speeds greater than 6.9 meters per second is now similar to the cost of energy generated by new natural gas and coal power plants. Almost one-quarter of the United States has mean-annual winds of that strength (including a previously uncharted area along the southeastern and southern coasts). If 225,000 1.5 megawatt windmills were constructed, covering an area approximately the size of South Dakota, it would be possible to replace 60 percent of coal-generated energy in the United States and essentially meet Kyoto Protocol emissions targets.

**Sallie Baliunas**  
Harvard-Smithsonian Center for  
Astrophysics

Baliunas stresses that we must first understand all aspects of natural variability before we can understand human impacts on the atmosphere. Her remarks focused on a key aspect of natural variability: the sun. The sun's energy warms the earth, and variations in the sun's output affect the climate. Changing solar cycles affect Earth's atmosphere, but current science cannot clearly model how the Earth's climate is altered by solar cycles.

We do know that solar magnetic cycles affect the earth's magnetic field, and the magnetic strength of the sun has increased over the past four hundred years. Solar temperature varies on eleven-year cycles, a pattern that is seen in various environmental and temperature records on Earth. Baliunas discussed several examples of environmental data that indicate a relationship between eleven-year solar cycles and patterns in climate change. She continued to emphasize, however, that we do not understand the solar cycle well enough to incorporate its effects into climate change models. Without models that can fully incorporate fundamental elements of the global climate cycle such as the sun's influence, our ability to understand changes in the global climate and the influence of human actions is inherently limited.

**Arthur Green**  
Exxon Mobil

Green, drawing on his extensive experience as an earth scientist, discussed the solar-earth climate system. The sun-earth relationship is an always changing, highly complex system of interconnected, non-linear relationships. We do not yet understand the complex processes of the climate system well enough to construct rigorous models of climate change predictions.

Climate science is developing rapidly today, and climate change science must integrate atmospheric science with the other pertinent scientific disciplines. New sensors and satellites are being deployed to collect vast amounts of global environmental data. The massive data sets and rapidly evolving concepts of climate change will spark public debate at an increasing rate. Mutual respect and honest debate are critical to the advancement of the science.

**David Legates**  
**University of Delaware**

Legates emphasized the uncertainty of climate change science by examining projections of the expected effects of global warming on the hydrologic cycle. Much of the climate science community has predicted that the hydrologic cycle will be enhanced as a result of an increase in climate temperatures. Global climate models (GCMs) are used to predict the hydrologic cycle enhancement. Legates demonstrated, however, that precipitation science is very uncertain and should not, therefore, be used in GCMs.

The enhancement of the hydrologic cycle is presumably causing an increase of severe droughts, floods, and extreme storm patterns. Legates observed, however, that according to the peer-reviewed data, this is simply not the case. Sources indicate that an overall increase in precipitation is occurring but that over the last century, storm intensity and frequency have not changed. This illustrates the limitations of predictive models that attempt to predict highly complex climate systems.

**Keynote Address**

**Paula Dobriansky**  
**Under Secretary of State for Global Affairs**

Under Secretary Dobriansky's remarks outlined the Bush administration's approach to global climate change, which is guided by a belief that government regulation is often less effective in producing environmental solutions than private sector innovation and technological development.

The United States recognizes that global climate change is a serious issue. Dobriansky stated, however, that the issue must be dealt with in a way that addresses an array of other concerns, such as energy security, sustainable economic growth, economic competitiveness, and other change environmental initiatives. Because the human impact on global temperatures remains uncertain, it is difficult to predict what its long-term effects will be.

As a result, the United States has championed a more flexible and realistic approach to achieving the goal set out at the Framework Convention—one that relies on markets, technological innovation, increasing energy efficiency, public-private partnerships, and voluntary, incentive-based actions by the private sector. This approach differs dramatically from the Kyoto Protocol

by considering the costs of action, not just the benefits of the solution.

In February 2002, President Bush committed the United States to a strategy to reduce greenhouse gas emissions relative to economic output by 18 percent by 2012. The president's budget proposal for next year seeks a 15 percent increase in funding for climate-change-related programs, bringing total federal spending this year on climate related programs to \$4.3 billion. The administration has proposed initiatives to develop hydrogen-fueled vehicles and the fueling infrastructure they will need. Over the next five years, the president proposes spending \$1.7 billion on this initiative, which seeks to commercialize hydrogen-fueled automobiles by 2020.

The United States is working with the world on various aspects of global climate change, from basic scientific research to clean energy technology development. In February 2003, President Bush announced that the United States, with international and private-sector partners, would sponsor FutureGen—a \$1 billion, ten-year demonstration project to create the world's first coal-based, zero-emissions electricity and hydrogen power plant. Several countries have joined the United States in a \$5 billion project to harness the promise of fusion energy. The United States, along with thirty other nations, participated in the first-ever Earth Observation Summit, seeking to improve the world's ability to collect data to monitor and diagnose changes in the global environment. Since 1990, the United States has spent three times as much as any other country on climate research—a total of \$18 billion. This reflects America's commitment to leadership on this important issue. And Under Secretary Dobriansky believes President Bush's "intensity"-based approach to climate change is gaining acceptance in the developing world, because of its focus on promoting sustainable economic growth, as opposed to constraining growth. At the World Summit on Sustainable Development and the Eighth Conference of the Parties to the Framework Convention on Climate Change, support for the administration's approach began to take hold in the developing world.

In conclusion, Under Secretary Dobriansky emphasized that the answer to climate change (and other global environmental problems) will not be found in setting rigid or arbitrary regulations or limits, but rather through policies that promote economic growth and technological development.

## **Panel II: A European Perspective on Climate Change**

### **Gerd-Rainer Weber**

**German Coal Mining Association**

Weber's remarks focused on the challenges of meeting Europe's commitment to the Kyoto Protocol and its required 8 percent reduction in emissions. The European Climate Change Program allocated responsibility for the necessary emissions reductions among various sectors of the economy, with the industrial sector required to accomplish 50 to 60 percent of the necessary reductions.

The system of emissions allowances is commonly described as "market based," but Weber believes this is a misnomer. Rationing a scarce commodity is not the equivalent of freely trading goods and services. The stringent regulation of emission allocation to stakeholders in a set time frame (2005–2012) is reminiscent of a centrally planned economy and is structured very little like a free market. Weber suggested that if Europe continues to implement emission reductions under the current program, they will fail in reaching their objectives and create significant problems for the European economy.

Weber concluded that the adoption of short-term reduction objectives such as those in Kyoto is ineffective because climate change is a long-term issue. Instead, investment of resources should be funneled into research and development to allow technology to develop ways of increasing energy efficiency down the road.

## **Panel III: Public Policy**

### **Robert Shackleton**

**Congressional Budget Office**

Shackleton opened the panel by providing an overview of policy options and clarifying some fundamental climate change issues. He explained that much of the projected change in the climate is irreversible at this point, although we have experienced less than half the predicted effects of warming thus far. Some of these effects are seen as negative, some as positive. Because of this uncertainty, we cannot determine how significant the problem will be. Additionally, because climate change is an externality imposed by everyone on everyone, but with differing benefits and costs

distributed across generations and throughout the world, the problem cannot be easily solved by a conventional balancing between costs and benefits. This makes it difficult to discern the optimal solution to this complex and costly problem.

Without Kyoto, we are back at the drawing board. Addressing climate change will require world action, but without U.S. leadership, any plan of international action will likely fail. Who will bear the burden? Environmentalists advocate a property rights approach, but many economists, in light of mass uncertainty, defer to price mechanisms (taxes) as the only effective method.

### **Thomas Schelling**

**University of Maryland**

Schelling considers global climate change a very serious issue. He also believes there is great complexity and uncertainty involved in many aspects of the issue. There are multiple natural systems that cause warming and cooling of the planet. The challenge is to distinguish signs of man-made climate change from natural variations.

One issue of obvious concern to policymakers is the uncertainty of warming predictions. In 1977, the National Academy of Sciences predicted that a doubling of greenhouse gas concentrations in the atmosphere would produce warming of 1.5 to 4.5 degrees Celsius, or on average, 3 degrees. To develop that estimate, the academy simply picked an average of the plausible estimates that had been made to date—a somewhat rough calculation, inevitably. Remarkably, in the twenty-five years since then, no one has come up with any better estimate, despite the expenditure of billions of dollars of research money. The more we study the problem, the more we realize how complex the global climate system is—and yet, although our appreciation for the complexity mounts, overall predictions of warming remain unchanged.

Schelling does not expect global climate change to have a significant effect on the American economy. Agriculture, forests, and fisheries—the sectors of our economy most susceptible to climate change—total only 3 percent of our GNP. So motivating Americans to act will require either a false sense of alarm or an enhanced concern for the potential effects of climate change on the developing world. But the impact of global warming will not really be felt until the second half of the century, by which point the developing world will be much wealthier than it is today. This gives us reason to hope that the developing

world will be far more prepared to respond effectively to climate change by the time its effects are pronounced.

The Kyoto Protocol would never have been successful for a variety of reasons. The question of binding commitments is one interesting aspect of the climate change problem. The United States is not likely to agree to pay penalties for failure to meet greenhouse gas emissions targets, and the Europeans don't enforce such sanctions against themselves. Are sanctions—true incentives—essential to compel this type of action? Schelling says no, and points to the success of NATO as an example of effective collective action without coercive incentives. From the onset, members of NATO went through a burden-sharing exercise and identified a reasonable response from each country. Penalties or sanctions were not set for those who did not follow through. Clear and attainable goals were set and left up to each member country to do their part. After Vice President Gore signed the Kyoto Protocol, three years went by without any action to implement it, making the protocol's targets and timetables even more implausible. By the time President Bush took office, there was no option but to abandon the treaty. The question now is whether voluntary action can replace the failed Kyoto process.

Schelling identifies three major flaws of the Kyoto approach: there was no enforcement of binding commitments; most countries had no idea what it would take to achieve the emissions targets; and the protocol only presented a short-term solution to long-term problem.

Although many will agree that we have to commit to some reasonably attainable level of greenhouse gas emissions, the question is what? Since neither the IPCC nor any other credible body has even proposed a maximum allowable atmospheric greenhouse gas concentration, it will be impossible to establish a rational emissions trading system, which would require the distribution and trading of trillions of dollars worth of emissions credits. In order to be effective, support must come from developed countries, since they have the resources necessary to act. But what about China, which will soon be the largest greenhouse gas emitting nation in the world? A decade of American leadership could persuade them to act—perhaps a foreign aid program to encourage them to build a natural gas pipeline from Siberia, or produce nuclear reactors. First we must act, however, and countries like China and the rest of the world will follow.

Schelling closed his remarks by offering some provocative thoughts on what he considers a suppressed topic—the potential for geo-engineering as a response

to climate change. One option might be to study the atmospheric dust that cools the climate. If we could figure out just how much dust to put up into the atmosphere to block the right amount of sunlight, we could potentially counteract the effects of elevated greenhouse gas concentrations. This potentially offers a way to stop warming without requiring eight or nine billion people to change their lifestyles.

## **William Pizer** **Resources for the Future**

Pizer suggested one way to approach climate change is to see it as a matter of risk management. Although the risk of warming is uncertain, we can all agree that there is some risk. Action to address climate change, therefore, can be thought of as a form of insurance policy. The question, in Pizer's mind, is not so much what kind of insurance, but rather how much. Three types of action that should be addressed are: technology, partnerships with developing countries, and mitigation.

Since technological advances will be key to addressing climate change, the private sector should be given strong incentives to invest in climate related research and development. Creating a working relationship with developing countries is crucial. The economies of countries such as China and India are rapidly investing in their industrial infrastructure. These infrastructures will last a long time and therefore have an impact on climate far into the future. An effective mitigation policy is also essential. Pizer believes that it makes little sense to devote resources to technological development now without also acting to reduce risks through some form of mitigation.

Because the power to innovate is found in the market, government policies should create market incentives to act. A cap-and-trade system allows companies to achieve reductions in the most efficient way. Targets must be set at a modest level and costs must be kept low to keep momentum moving forward. Intensity-based targets, such as those proposed by the Bush administration, can be structured to remain gradual, while absolute caps, such as those proposed in the McCain-Lieberman climate change bill, can be extremely hard to reach, and thwart efficiency. Pizer's focus is on demonstrating the feasibility of some action, rather than insisting on overly ambitious and unrealistic plans for dramatic action. One such approach would establish a modest emissions trading program with a "safety valve" on price, whereby

the government would release additional credits into the market if prices rose above a certain threshold. This would encourage some action to reduce emissions while also limiting the economic consequences of those actions.

**Margo Thorning**  
**American Council for Capital Formation**

Thorning's remarks focused on the impact of economic models on climate change policy in the United States and the European Union. Much of the debate and confusion in the 1990s were driven by the use of several different economic models to estimate the costs of complying with the Kyoto Protocol. Thorning reviewed the range of predicted impacts on the American economy from implementing the Kyoto Protocol—a range that spans from the 4.2 percent reduction in the GDP reported by the Energy Information Administration to a -0.01 percent impact projected by the Clinton

administration's Council of Economic Advisers. Thorning also presented data to demonstrate that economic models used by Europeans understate the costs of reducing greenhouse gas emissions, which may help explain the conflict between Europe and the United States over climate issues.

Nevertheless, based on her observations, Thorning predicts that both in the European Union and the United States there will be a growing realization that the emissions levels set by the Kyoto Protocol (and similar proposals) cannot be met. Thorning hopes the European Union will come around to a more gradual approach, similar to the approach the Bush administration is pursuing, and in turn, place more emphasis on addressing more pressing global environmental concerns such as water sanitation. To build upon the Bush administration's approach, reforms of the corporate tax rates would promote greater innovation in the private sector.

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This summary was prepared by AEI research assistant Ryan Stowers.