GOALS AND OBJECTIVES OF THE CONFERENCE

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White House Conference

on Science and Economics Research

Related to Global Change

Washington, D.C.

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I would like to add my welcome to those of Secretary Brady and President Bush. Working together with you, we look forward to very real accomplishments over the next two days. In a moment, I will describe what the President views as some of the objectives of the conference.

GLOBAL STEWARDSHIP

But first let me elaborate briefly upon the conferences's theme, that of Global Stewardship. As President Bush has stated, Global Stewardship is not a fixed state. It is a process of continual change that balances environmental and economic values to meet human needs and expand human prospects.

Global Stewardship is a complex, multifaceted concept, yet I believe that it can be summed up in remarkably succinct fashion. On December 22, 1968, as the crew of Apollo 8 became the first humans to leave Earth orbit and head toward the Moon, they turned their frail spacecraft back toward the Earth and took the first photographs of our planet from deep space. I firmly believe that thousands of years in the future perhaps the one most lasting thing for which our age will be remembered will be those photographs. They show the Earth as a beautiful blue and white sphere floating quietly in the immense blackness of space. They emphasize that

this planet is mankind's common heritage. It is ours to cherish; it is ours to destroy. We are all truly in this together.

We will achieve Global Stewardship in the same way that we achieve scientific knowledge -- through careful study of the environment and of ourselves, coupled with effective and timely action. We must come to understand the extent and limits of the resources available to us on this planet. And we must come to understand how humans can use those resources in a sustainable fashion to achieve a more prosperous and productive future.

We are not here to make a global warming policy. That will emerge from the broad array of research and policy reviews now ongoing. Rather, we are here to try to determine what will be required in order that such policies be based on sound scientific understanding and that they be both technologically and economically feasible.

THE LINK BETWEEN SCIENCE AND POLICY

Much has been written and said during the past few months about the scientific understanding of global change and about policy responses to global environmental concerns. But conspicuous by its absence in almost all of these discussions has been a careful and detailed analysis of the economic causes or consequences of global change. For example, we will talk at length over the next two days about various ways of taking out insurance policies against possible adverse

effects of global warming. But there are good insurance policies and bad ones, and we very much need the input and expertise of economists to discriminate between them.

In a very real sense, we should perhaps look on economics as the glue that binds scientific understanding of global change phenomena to the policies -- both national and international -- that we adopt to address this issue.

In general, the social sciences -- economics, psychology, sociology -- must be an integral part of any approach to the understanding of global change. Even when the physical and biological aspects of a problem are understood, all too often agreement is lacking on the underlying social, behavioral, and economic causes and consequences of an action. This conference will focus as much on these aspects of global change as on the purely scientific aspects. In this way, we hope to add a new dimension to the international dialogue on global change.

GOALS OF THE CONFERENCE

As President Bush noted, the foundation of this conference is what we do know and what we do not know about the science and economics of global change. At a more detailed level, we seek to determine which uncertainties might be reducible in the foreseeable future and which are not, and to understand how scientific uncertainties affect our economic modeling and vice versa.

The conference is designed to achieve several other objectives. Among them are the following:

o To increase the mutual understanding and sensitivity of the scientific and economic research communities to each other's needs and to the needs of the policy makers who look to them for guidance.

o To foster a solid and well-implemented international research effort that can address the scientific, economic, and policy questions of global change, drawing on the expertise, experience, and data of all the world's nations.

o To forge a worldwide communications network among the researchers and policymakers concerned with global change.

REVIEW OF THE AGENDA

To achieve these objectives, the conference is organized around three themes.

o The science and economics research challenge.

o Integrating science and economics research in the policy process.

o Building a partnership for science and economics research.

Later this morning, I shall speak on the first of these themes. My cochairmen Michael Boskin and Michael Deland will speak on the second and third.

Following those presentations, the agenda calls for us to divide into three Working Groups that will then meet in four sequential sessions. Each of the Working Groups will have about 25 members, with roughly equal representation from the three disciplines of science, economics, and the environment.

The first three Working Group sessions will be devoted to the three themes of the conference. The fourth will be devoted to integration of the discussions and preparation of a summary report of each Working Group's deliberations.

These summaries will form part of a Cochairmen's report, which we would suggest as the primary product of the conference. In this report, we would expect to outline the deliberations of the conference and set forth agreed-upon common actions designed to expand research and cooperation among nations.

CONCLUSION

This conference is only one of many national and international actions being taken to address issues of global change. We must therefore seek to integrate the accomplishments of the next two days into these ongoing efforts -- and, in particular, into the deliberations of the IPCC, the international research programs of the World Meteorological Organization and International Council of Scientific Unions, and the programs of individual countries focused on the global environment. At the same time, we will work to coordinate the many activities now going on in the United States

and abroad. They will all be stronger if carried forward in a unified, coherent fashion.

We want to emphasize that the President has instructed us from the outset of our planning to design this conference with a primary goal of complementing, strengthening, and supporting the entire IPCC process, which he considers to be the central and appropriate forum for our joint efforts toward understanding of, and responding to, the questions of Global Stewardship.

Louis Pasteur wrote that, "Science knows no country because knowledge belongs to humanity and is the torch which illuminates the world." We will be the carriers of that torch for the next two days. And we must keep it burning as we leave to face the great challenges that lie ahead.

UNCERTAIN CHANGE:

THE SCIENTIFIC AND ECONOMIC RESEARCH CHALLENGE

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The global environment has been changing throughout human history, and indeed throughout the entire history of our planet. At the peak of the last ice age 18,000 years ago -- just a few thousand years before the first substantial human civilizations came together in the river valleys of the Middle and Far East -- a glacier over two kilometers high covered much of the northern United States and Europe. Sea level was 100 meters lower than at present, so that the future sites of many of today's port cities were perched on the edges of deep ravines. Then, rather abruptly about 10,000 years ago, the world warmed, the ice retreated, and sea level rose to about its present level. These natural changes in the Earth's climate have occurred throughout its history, and they will continue to occur in the future.

During the past century, human society has entered into a new and momentous relationship with the global environment. For the first time in history, we have become a geological agent capable of influencing our entire planet. We have altered the face of the Earth by clearing forests, building cities, and converting wild lands to agriculture. We have changed the composition of the Earth's atmosphere by burning fossil fuels, expanding agriculture, and producing and releasing industrial compounds. We have embarked on an enormous, virtually unplanned, planetary experiment that poses unprecedented challenges to our wisdom, our foresight, and our scientific capability.

The first theme of this White House Conference is the scientific and economic research challenge related to global change. Properly speaking, global change

encompasses not only global warming but such issues as ozone depletion, the adequacy of food and water supplies, changes in sea level, deforestation, levels of biodiversity, and population change. Indeed, any of these issues could turn out to be more serious in terms of human impact than global warming. Yet much of the world's attention has focused on the possibility of increased global temperatures, and that will inevitably be the main topic of discussion at this conference.

SCIENTIFIC KNOWNS AND UNKNOWNS

In light of the Earth's daunting complexity, it is easy to be overwhelmed by how much we do not know about the Earth's components and how they interact. But it is always important to keep in mind how much we do know about the Earth and our influence on it.

We know, based on a sophisticated set of chemical measurements, that humans have raised the level of carbon dioxide in the atmosphere by 25 percent since preindustrial times. This is the single largest impact that our species has had on the planet. We know that atmospheric levels of methane have doubled over the same period. We know that chlorofluorocarbons produced by human beings are catalytically destroying ozone in the atmosphere above Antarctica and possibly elsewhere around the globe.

By analyzing sediments and ice cores, geoscientists have traced levels of atmospheric gases and temperatures many thousands of years into the past. Using

large computers, researchers have modeled the complex eddies and flows of the global atmosphere with considerable accuracy. These are all remarkable accomplishments.

Based on this work, scientists now generally agree that continued loading of the atmosphere with greenhouse gases could lead to global warming. However, neither computer models nor paleoclimatic data have been able to specify with any certainty the magnitude, rate, or timing of any future warming.

General circulation models will continue to improve in the future as computer power increases, as the modeling of the Earth system becomes more sophisticated, and as more complete data inputs become available. For example, coupled ocean-atmosphere models will shed more light on the possible regional effects of climate change. Also, an important example of better data inputs is the very recent demonstration that satellite measurements are capable of providing precise temperature data over the entire globe at various levels in the atmosphere.

We will also learn more about Earth's past climates by continuing to study the geological and paleoecological record. But in general we should probably expect incremental rather than revolutionary advances in our understanding of global change over the next 10 years.

Another area of consensus concerns global temperatures: scientists now generally agree that the planet has warmed up by about 0.5 C during the past century. But very few scientists would claim that they are yet able to determine whether any of that warming can be attributed to an enhanced greenhouse effect or whether it represents a natural fluctuation. We are also only beginning to understand what the impacts of a potential warming might be on agricultural productivity, sea

level changes, biological productivity in the oceans, shifting vegetation patterns, storm patterns and severity, droughts, and the like.

Furthermore, we are totally unable, with present models, to make reliable climate predictions on the regional and local bases that are essential to improved understanding of these impacts. This difficulty arises partly from the fact that we have, at present, neither the computer capacity and speed, nor the resources, necessary to reduce the grid size and increase the number of model levels in the atmosphere, both of which are essential to regional predictions. Current grid sizes inevitably average over the climatic effects of mountain ranges and of such oceanic features as the Gulf Stream.

THE SCIENTIFIC RESEARCH CHALLENGE

There are several other outstanding difficulties in understanding and modeling the Earth's climate. Perhaps the most notable involve the Earth's clouds, oceans, and ice. Until recently, geoscientists did not even know whether clouds warm or cool the Earth. It is still uncertain whether the increased cloudiness associated with a warmer Earth would augment or counteract a greenhouse effect. It depends on the nature and altitude of the clouds.

Regarding the oceans, we know that only about half of the carbon dioxide released through fossil fuel combustion and deforestation remains in the atmosphere. For many years, essentially all researchers assumed that the rest was being

sequestered in the oceans, but recent studies indicate that no more than a quarter probably ends up there. Where does the rest go? We appear to have lost 25 percent of our anthropogenic carbon emissions. We still have not located this missing carbon, although some suggest that it is in temperate latitude biomass.

Finally, we still do not fully understand how the world's ice caps and other major bodies of ice would respond to greenhouse forcing. Present models predict that warming should be intensified at high latitudes, leading to some melting of ice and a higher sea level. But recent observations indicate instead an increase in ice accumulations.

It has not escaped notice that six of the hottest years in the last century in the United States occurred in the 1980s, and some have associated this with the greenhouse effect. But over this same decade, precise satellite temperature measurements have shown that away from the actual surface, where a number of perturbations are expected, there was no change whatsoever in global average temperatures. While the northern hemisphere showed a slight increase in temperature, the southern one showed a corresponding decrease, and the major fluctuations globally were associated with the El Nino phenomenon in the Southern Pacific. We need to understand these surface temperature perturbations much better than we do at present.

There is growing suspicion from the paleoecological data -- but as yet no more than that -- that the atmosphere-ocean interface may harbor the possibility of surprises. It bears emphasis that the top 3 meters of the ocean surface contains the same thermal energy as the entire atmosphere. If it should turn out that relatively

small, and not as yet understood, mechanisms could trigger ocean circulation patterns from one stable configuration to another, the potential impacts could be large. We need a careful program of observing and monitoring the Earth to detect any such surprises caused by our emission of greenhouse gases.

In general, we must remain aware of the potential for surprises. The development of the ozone hole over Antarctica was such a surprise. The hole develops through a mechanism that was not included in earlier models of ozone destruction, although scientists quickly came to understand how it formed and have incorporated that understanding into their models.

What the ozone hole has demonstrated beyond question, however, is that, contrary to long-held assumptions, our atmosphere is <u>not</u> so large, nor its inertia so great, that human activities cannot affect it on human time scales. Human release of chlorofluorocarbons, combined with unique meteorological conditions, has indeed created the ozone hole in only a few decades at most.

In recent years, a number of scientists have compared the Earth, in its complexity, to a living organism. The comparison is certainly apt in this regard: as much as we still have to learn about the nature of life, about how it developed and where it is going, we have as much to learn about the nature of the Earth.

THE ECONOMIC RESEARCH CHALLENGE

The comparison is apt in another sense. The behavior of human beings, economically and politically, will be a major determinant of future changes in the global environment. My cochairmen will be speaking in a moment about some of the work that has been done on the economics of global change and about the many economic questions that remain to be answered.

But I would emphasize that in many cases these economic questions are of even greater importance -- and much farther from resolution -- than the scientific questions. Science-based models of global change need economic trends as inputs. Yet these economic inputs are often so uncertain that they hamstring the model results. For example, one recent analysis was able to conclude only that emissions of carbon dioxide in the year 2050 are likely to be between 1.5 and 12 times what they are today. We must find ways to reduce such uncertainties or, if they are unavoidable, to accommodate them in our projections.

A major influence on future economic trends is the state of technology. To take the case of emissions, for example, the development of more efficient power plants, biomass and solar energy, inherently safe nuclear reactors -- even something as mundane as lower cost and more efficient insulation -- could both reduce emissions and increase our flexibility when deciding on policies related to global change. In essence, we can hedge our bets on the possibility of future global warming by investing in these technologies today.

Technology development is also crucial if we are to be fully prepared for the possibility of global change. Basic and applied research on ecosystems, agriculture, water supplies, and other important environmental and societal systems can demonstrate both the ability of society to adapt to different climates and the pressure points where adaptation becomes prohibitively expensive. Furthermore, the technologies that emerge from such research -- such as plants that grow under a wider variety of climatic conditions -- will have great benefits even if the climate does not change.

The future of technology is as difficult to forecast as economic trends. Yet new technologies will inevitably reshape our world in the coming decades -- just as they have throughout the twentieth century -- and we must explore the possible ways in which this will affect the global environment.

One way to increase the reliability of economic and technological forecasts -- and I see this as a major goal of this conference -- is to increase the sensitivity of both scientists and economists to each other's data needs. We must agree upon the uncertainties in our scientific understanding that cause the greatest uncertainties in our economic models, and vice versa. In this way, resources can be focused on reducing the uncertainties of greatest importance.

By working together to understand both the scientific and economic aspects of global change, we will be better able to assess the costs not only of action but of inaction. We will enable all nations to respond sooner and more effectively to the possibility of different climates. And we will build a flexibility into our environmental stewardship that will serve us well no matter how climate changes.

U.S. RESEARCH PROGRAMS

Returning for a moment to our scientific understanding, the U.S. government is now engaged in a large-scale, integrated program to develop the scientific knowledge that will guide our future policy decisions and contribute to those of all nations. That program is known as the U.S. Global Change Research Program and was established through a working group of our interagency Committee on Earth Sciences.

As the President noted earlier, his Administration has requested over $1 billion in funding for this program during our next fiscal year. Such a request for what is admittedly a long-term and complex research program demonstrates the President's very real commitment to dealing decisively with the possibility of global change.

CURRENT ACTIONS

It is clear that we and other nations are accelerating research in the face of uncertainty. But what bears emphasis as being even more important is decision making in the face of uncertainty. We are not -- despite our best efforts -- going to achieve scientific certainty about global change in the near future. Yet we must move forward on the basis of the information available to us.

The Bush Administration has already instituted a number of policies that will reduce greenhouse emissions while being fully justified for other reasons. I think of

them as an "insurance policy" against possible adverse effects of global warming. Among these policies are the following:

o The United States is committed to phasing out the manufacturing and use of CFC's by the year 2000 to protect the stratospheric ozone layer -- ahead of the requirements of the Montreal protocol -- provided safe substitutes are available. If not controlled, CFC's would account for as much as 25 percent of the enhanced greenhouse forcing over the next century.

o The Clean Air Act now being debated in Congress will provide for substantial reductions in the emissions of greenhouse gases by fostering more efficient use of energy. It has been estimated that the acid rain provisions of this legislation alone will have an effect comparable to that of removing fully one fifth of the U.S. automotive fleet (22 million automobiles) from our highways for a period of 10 years.

o The U.S. Department of Energy is developing a National Energy Strategy that will focus, in particular, on an aggressive commitment to energy conservation and on the development of non-fossil-fuel sources of energy.

These initiatives address the source component of the greenhouse gas question; turning to the sink component, this country is again taking concrete steps.

o The U.S. Department of Agriculture is proposing to plant a billion trees on private land across America, trees that will eventually absorb 13 million tons of carbon annually.

o Diplomatic discussions are being conducted aimed at protecting the remaining tropical forests through such mechanisms as debt-for-nature swaps.

An underlying theme in all of the United States' policies related to global change is that they be based on the best possible science and that they be technically and economically sound. These are criteria that we will continue to apply as we consider policies in the future. We will do ourselves a great disservice if we adopt premature policies that later prove to be unnecessary or counterproductive.

INTERNATIONAL RESEARCH PROGRAMS

As I mentioned in my opening remarks, the President has instructed us to design this conference to complement and support the Intergovernmental Panel on Climate Change by emphasizing the importance of economic as well as scientific considerations in the development of global change policies. The United States supports the IPCC process as an appropriate international approach to the global understanding and response to a question that knows neither national nor political boundaries.

At the same time, we would like this conference to be a contributing factor to the development of an international research program that can provide us with the knowledge, both scientific and economic, needed to understand and respond to global change. The first of the three Working Group sessions will give us an opportunity to

explore the dimensions of the scientific and economic research challenge and sketch the outlines of an international program of science and economic research related to global change.

CONCLUSION

We face a great challenge in the next two days. We must merge science and economics with policy to a degree that has not been done before. The uncertainties that surround us are daunting. But humans have never been hindered -- at least not for long -- by uncertainties. The explorers who we know from history did not let uncertainties stand in their way. Rather, they saw uncertainties as opportunities, and in following those opportunities they opened new worlds.

Let me close with a brief vignette about one of those explorers. The year after next we will be celebrating the 500th anniversary of Columbus's discovery of the new world, an event of unsurpassed importance in world history. As might be expected, Columbus was an astute observer of the natural world. While he was anchored off the coast of Jamaica, Columbus noted in his journal that it rained for about an hour every afternoon. Columbus also pointed out that the same thing used to occur in the Canary and Azores Islands, but that the rain had stopped since the trees on those islands were cut down. In other words, Columbus was one of the first people to observe the effects of human beings on climate.

I think it very appropriate that Columbus should have done so, because he was engaged on a great voyage of discovery, and today we find ourselves engaged on a similar voyage. We are changing the world in ways that it has never been changed before. And yet human beings, by their very nature, cannot help but change the world.

We have no reason to fear such changes. But we must keep our eyes open, and try to understand where we are going, and change course when we have good reasons to do so. We need not sail blindly into our future. But we must keep moving forward if we are to achieve the complementary goals of an economically healthy and environmentally sound world.

SECOND DRAFT: April 16, 1990

Economics and Global Change: Links to the Policy Process and Science Research

Michael J. Boskin
Chairman
President's Council of Economic Advisers

Good morning. Let me add my own welcome to those you have already received. In my role as Chairman of the President's Council of Economic Advisers, I regularly confront a diverse set of economic issues involving monetary, budget, regulatory, and trade policies. While all of these are important, global change and our response to it may be just as economically significant in the long run. Beginning an international effort to coordinate and enhance science and economics research related to global change, as we hope to do here today, is an essential step toward making the idea of global stewardship a reality. In this area, as in the others each of us confront every day, knowledge and understanding are critical to sound decision-making.

The United States comes to this conference as a leader in environmental action in both the domestic and global arenas. As a long-time California resident, I have a strong personal awareness of the importance of environmental protection to human well-being. The President's recent Clean Air proposal,

which broke a logjam that blocked Congressional action in this critical area for more than a decade, his tree planting initiative, and his support of solar and conservation research and development are examples of his strong commitment to the environment -- a commitment that is shared by the American people. The President is looking forward to signing a Clean Air bill that meets his key environmental objectives without imposing unnecessary adverse impacts on our workers and industries -- even though such a "good" bill would impose costs of about $20 billion annually on the U.S. economy when its provisions are fully phased in.

We have a similar strong commitment to protect the global environment. The United States was the first nation to ban the use of CFCs as aerosol propellants -- over a decade ago -- and we have since been in the vanguard of efforts to implement and strengthen the Montreal Protocol on ozone-depleting substances. We strongly support the integration of environmental concerns into the programs of the international institutions -- including the World Bank.

Many countries have yet to adopt or are only now adopting the stringent environmental controls on automobile and industrial emissions that have been in place in the United

States for many years. The President is continuing this leadership. For example, his Clean Air proposals will dramatically reduce acid rain, even though our most recent scientific studies show much less severe impacts on U.S. forests and lakes than those apparent in other parts of the world. Against this backdrop, attempts to portray our interest in resolving the huge scientific and economic uncertainties that surround debates about global change policy and our concern with the economic and human consequences of proposed mitigation measures as a delaying tactic are clearly misplaced. Rather, these interests and concerns reflect our experience as environmental leaders and the need to seek out and adopt sensible policies which recognize that both economic growth and environmental quality are important to human well-being.

The extensive U.S. experience with environmental regulation has shown clearly -- and sometimes painfully -- that one cannot design policies that will produce both a healthy environment and a sound economy without careful, integrated use of science and economics research. Careful use of all available information is nowhere more important than in the context of possible global warming induced by human activities. The development and evaluation of climate models, an area where much progress has been made but many uncertainties remain,

falls clearly within the purview of the physical sciences. But it is important to recognize that economics plays a critical role in determining the inputs and interpreting the outputs of these climate models, as well as in evaluating the consequences of alternative policy responses.

On the input side, it is axiomatic that model results can be no better than the data and assumptions on which they rest. Emissions of the multiple greenhouse gases associated with human activities depend on the overall level of economic activity, its division across sectors of the economy, and on the choice of technology within each sector. Global emissions forecasts on the time-scale needed here -- several decades -- thus require extraordinarily detailed, long-term economic forecasts for many nations. I know well how hard it is to forecast the GNP of a single nation a year or two ahead, and I share with all economists in the audience the knowledge of how much harder it is to make sector-by-sector forecasts for many nations decades in the future. As a humbling exercise, think back to the early 1970s and ask yourselves whether <u>any</u> forecaster -- economist or not -- predicted that emissions of carbon dioxide by the OECD countries would be stable from 1973 to 1985. Reliable forecasts of future climates certainly require advances in the earth sciences, but they also require

advances in our ability to forecast emissions of greenhouse gases.

Economics also plays a critical role in evaluating the consequences of the output of climate models -- that is, in assessing the costs of adapting to any possible future warming. We know that most of the world's economic activity, certainly well over 90 percent, would not be directly affected by any widely-discussed climate change scenarios. Automobiles can be produced as efficiently in warm weather as in cold weather, after all. Detailed analysis of those sectors that would be affected is necessary for estimation of adaptation costs, but little of this has been done. Preliminary U.S. studies show surprisingly small agricultural impacts of widely-discussed climate change scenarios -- plus or minus a few billion dollars as of the middle of the next century. We are aware of very little systematic work on the impacts of sea level change, human health effects (if any), or the effects of possible climate change on forestry, fisheries, water resources, or biodiversity. Technological progress will likely have a strong effect on the costs of any necessary adaptation, but forecasting the rate and direction of technical change over a half-century or more is extremely difficult.

Finally, economic analysis is essential to the evaluation of the economic costs and human consequences of taking actions to curb net emissions of the main greenhouse gases. Detailed studies support the conclusion that CFCs can be phased out at relatively low cost. At the other end of the analytical spectrum, almost nothing appears to be known about the costs of reducing methane or nitrous oxide emissions from agriculture -- or even about how such reductions might efficiently be obtained. Preliminary studies of the costs of large-scale forestation and its impact on atmospheric carbon dioxide have produced a wide range of estimates.

Perhaps the most-studied aspect of the economics of global change -- at least in the U.S. -- is the economic cost of reducing carbon dioxide emissions. The oil shocks of the 1970s have shown us that these emissions can be stabilized, as they were in the U.S. and the OECD as a whole between 1973 and 1985, or even reduced. But this history also makes plain the cost: slower economic growth and rising unemployment. Maintaining a constant or declining emissions profile on a more permanent basis may well require correspondingly greater economic dislocation. Available studies suggest that it would cost between 1 and 5 percent of annual U.S. GNP to meet widely-discussed CO_2 reduction targets and that economic growth could

slow significantly. Much more work needs to be done to develop and refine energy/economic models and to assess more precisely the possible contributions of new energy technologies. However, the cost estimates to date make clear the importance of doing that work, for other nations as well as ours, so that potentially important economic and human consequences can be adequately considered in decision-making.

It is worth a few minutes, I think, to discuss the importance of costs and economic growth. Those who are most fearful of possible future global warming are often impatient with discussions of mitigation costs. They sometimes contend that no price is too high to pay for actions that might prevent even the slightest potential warming. With respect, my acceptance of the concept of global stewardship is much broader, and does not allow me to agree.

When the costs of a policy are small relative to the size of the overall economy, as a CFC phaseout by the industrialized nations would likely be, it may be adequate to think about those costs in purely monetary terms. But when costs are large enough to be measured in percentages of GNP or in significantly slower economic growth, that simply will not do. Let us remember that half the world's people today still have a life

expectancy of less than 60 years. In much of the world, the reality of infant mortality is grim: ten of every 100 babies born die before they reach their first birthday. In the poorest nations of Africa and parts of Southeast Asia, a healthy life cannot be taken for granted -- not when there is only one physician for nearly 18,000 people.

Current emissions projections suggest that India, China, and other developing countries will become increasingly dominant sources of carbon dioxide and other greenhouse gas emissions over the coming decades. For developing countries, slower economic growth does not mean making do with last year's model car -- rather, it is a goal worth life itself to many. Those of us who have made it to the top of the economic mountain must be careful not to create obstacles that would prevent others from making the same climb. Global stewardship requires us to consider the health and nutrition of the earth's children, not just the temperature of their environment. We must find policies that will bequeath to them both a healthy environment and a sound world economy capable of sustained growth. And we must recognize that these goals are not inevitably in conflict: rising incomes both increase concern for the environment and provide resources that can be used to protect it.

It is also important to recognize that the world economy has grown increasingly integrated. Economic progress in the developing countries depends to a significant extent on the performance of the industrialized economies. Therefore, emissions curbs that slow growth in industrialized nations can damage developing economies even if the developing world is not immediately asked to curb its own greenhouse emissions. International economic linkages and the reality of a changing distribution of emissions must both be carefully considered to insure that we do not inadvertently drift in directions that have little impact on the composition of the world's atmosphere but cause real, human suffering in the developing world.

Please understand -- I am not arguing that we should be unconcerned about possible global warming, or that no actions to limit greenhouse emissions make sense. My point is simply that the stakes are high in terms of the well-being of real human beings, as well as in terms of the global environment. We face difficult decisions with potentially huge consequences. It would be irresponsible to pretend that the huge uncertainties we face do not exist. It would be equally irresponsible not to invest in research that can reduce those uncertainties.

To this point, I have emphasized a division of labor between science and economics. There is also a clear need for cross-fertilization between the disciplines in the setting of research priorities for each of them. Thus, for instance, scientific results regarding the sensitivity of climate model outputs to variation in the level of different emissions inputs scientists can help economists identify what improvements in emissions forecasting should have the highest priority. Conversely, economists can suggest which components of climate change forecasts have the greatest potential human importance.

Technology is another key intersection between science and economics research. New technologies hold the prospect of lowering the costs of both human adaptation to global change and of emissions reductions. Technologies with strong economic potential, such as recent advances in gas turbine technology that significantly increase the efficiency of the conversion from fossil energy to electrical energy are particularly valuable. Such technologies do not require force-feeding, or an enforcement mechanism - we can rely on self-interest to insure their adoption. The world wants real answers, not symbolic commitments. Technology research in science and economics holds the potential to provide such answers.

Science alone can serve to identify technical possibilities, but economics plays a key role in assessing the prospects of individual technologies in the marketplace and their speed of adoption. Both science and economics have a role to play in assigning research priorities among potential technologies that may lower the costs of reducing greenhouse gas emissions and of coping with possible warming -- as well as in forecasting the likely cost and availability of promising future technologies.

Almost 200 years ago, Thomas Malthus argued that the industrialized nations would be unable to feed a geometrically growing population with a fixed supply of land. Only twenty years ago, the neo-Malthusian notion that worldwide shortages of fuels and materials posed imminent and insurmountable limits to growth was widely discussed. The benefit of hindsight has proven these forecasts to be hollow. New technologies and progress have circumvented what had appeared to be impenetrable barriers to human progress. I am optimistic and confident that human progress will not be halted by global change, or by the sensible policy actions that we take to address it. Instead, I believe we can and will meet this new challenge and that we will give our children a better world than our parents gave us.

But this will not happen automatically. We have much work to do to understand better the choices we face and to develop new technologies to improve those choices. We can do this work most effectively and expeditiously if we work together. There are many challenges awaiting us. There is a wide variance of opinion surrounding the costs and future availability of particular nuclear, solar, and biomass alternatives to fossil fuels. The extent of possibilities for cost-effective conservation are also controversial. Possible adaptation technologies have barely been explored, even though many believe that some degree of global change is inevitable. We can all lament the crudity of current world-scale long run economic forecasts, and the limited depth of our understanding of linkages between the developed and developing economies. And I have not even mentioned the science uncertainties outlined by Dr. Bromley.

Doesn't it make sense to get the research community together to discuss these matters? Of course, consensus will not be immediate. We can start by identifying the key reasons that researchers differs, and then concentrate resources on these areas. In this regard, the establishment of one or more international institutes devoted to a program of science and

economics research on global change might serve to facilitate our efforts.

I look forward to attending future meetings of scientists, economists, and environmentalists, not only to marvel at how much we have all learned, but also to hear scientists, economists, and environmentalists say that our generation met the challenge of global change wisely and that economic growth continued in all the nations of the world.

"BREAKING DOWN THE BARRIERS:
BUILDING PARTNERSHIPS FOR A BETTER FUTURE"

REMARKS OF MICHAEL R. DELAND, CHAIRMAN

PRESIDENT'S COUNCIL ON ENVIRONMENTAL QUALITY

opening the

WHITE HOUSE CONFERENCE ON SCIENCE AND ECONOMICS RESEARCH
RELATED TO GLOBAL CHANGE

Washington, D. C.

April 17, 1990

Good morning and again welcome to the White House conference.

We are meeting here today on very serious business. The popular press often characterizes the possible effects of global change in the most dire terms: rising sea levels, advancing deserts, exposure to harmful solar rays, food and energy shortages, the loss of biological diversity. Man's impact on the global environment has been likened to an enormous "experiment," of uncertain outcome. My two cochairmen have amplified on the scientific uncertainties and the economic doubts associated with that experiment. With a litany like that, one is reminded of the observation of the American film director, Woody Allen, who said... "More than at any time in history, mankind today faces a crossroads. One path leads to despair and utter hopelessness, the other to total extinction. Let us pray that we have the wisdom to choose correctly..." But seriously, the public is worried and the public's worries must be our own.

From my vantage point, as the President's White House environmental advisor, the challenges confronting us are indeed daunting; but our resulting concern is tempered by a full measure of good news.

The facts are plain: While today's environmental challenges are unsurpassed, never before in human history have we been so capable of anticipating and responding to those challenges.

As many of you may know, this Sunday, April 22, is the twentieth anniversary of "Earth Day," a day of national and international reflection on God's gift of nature, and our place in it. Much has changed since Earth Day 1970, and in these changes I see great hope for the future:

- We have seen the growth of the environmental ethic, a sensitivity reaching from the hearts of individual people to the very highest levels of government.

- We have proven that the linkage between economic development and environmental degradation can be broken. It is possible to grow economically and reduce pollution at the same time.

- Finally, and most important, we have begun ~~to~~ redeem the Twentieth Century by rejecting the narrow views of nation-states, in favor of more universal values. We are seeing the beginnings of a global stewardship for global quality of life.

Twenty years ago, we were divided and limited in so many ways. Yet, as our view of the world has grown and matured, so

has our ability to brush away obstacles that divide us from each other.

As our willingness to work together has grown, so too has our ability to act. From computers to telecommunications to satellites capable of measuring the temperature of the entire globe, we have vastly improved our ability to communicate, integrate and understand. Technology alone cannot solve our problems but, married with imagination and will, technology will be a major port of our solutions.

Let me be candid. This conference will not lead to unanimity. We have disagreed on the question of global change, and we will disagree again. But on one point we do agree: the need to work together -- openly, diligently, respectfully -- in our common cause. We must increase our understanding -- both of each other and of our shared problems. And we must act.

There are many common-sense actions we can take -- in fact we are taking actions -- which will perform "double duty" -- improving the quality of life in the near term, while reducing the emissions that might cause global climate change in the future. The kinds of steps I have in mind include pollution prevention, planting trees, cleaning up our air, and offering assistance to developing nations.

Forging ahead requires partnerships. For us, building partnerships should be the easy part. It is our business. We all know full well that we must build coalitions to achieve our goals.

Clearly, no nation, institution or way of thinking can address single-handedly global change. To understand and react to global climate change we must reach across intellectual disciplines, and across national borders.

Just as we are breaking down the physical, economic and political barriers between our nations, meeting the challenge of global change will require breaking down barriers between energy, economics and environmental perspectives. As the President has stated, "global stewardship is not a fixed state but a process of change." Accelerating that process of change is the purpose of this conference.

We already have considerable experience in building and using effective partnerships. For example, Dr. Bromley described the U.S. Global Change Research Program, our country's effort to increase interdisciplinary and interagency cooperation in global change research.

Another effective partnership is the Intergovernmental Panel on Climate Change. Dr. Bert Bolin has helped to make the IPCC

the international forum for assessing the nature, extent and possible responses to global climate change. The IPCC involves scientists and government officials from all over the world, supported by the financial and data management resources of the United Nations Environment Programme, the World Meteorological Organization and the Intergovernmental Oceanographic Commission. Our work at this conference will accelerate the IPCC process, by focusing the research agenda and building mechanisms for working together more effectively.

This conference also will emphasize a constructive role for economic partnerships involving governments and private enterprise.

For example, by harmonizing international trade rules, the 96-nation General Agreement on Trade and Tariffs (GATT) has contributed significantly to a rise in the global standard of living. The World Bank is a major force in global economic development. Economic consultation and coordination has reached new heights within the European Community and among the "G-7" nations. We must find new ways of using such economic partnerships to protect the global environment.

And, consider the extent and growth of non-governmental, private sector partnerships. Non-governmental organizations have grown in number and in size and are now reaching around the globe

to share human and financial resources in creative ways. The very existence of debt for nature swaps is an example of that creativity.

The relations between business and the environment are changing as well. In our country and abroad, businesses are retooling to capitalize on environmentally-induced economic opportunities. Japan's Ministry of International Trade and Industry has established a program funded at $60 million in 1990 for the purpose of developing environmentally-sustainable technologies. American, Japanese and European corporations are scrambling to assist Eastern Europeans with their monumental clean-up challenge. Partnerships among governments, scientists and industry made it possible to achieve agreement on the phase-out of CFC production. All this may be driven by the profit motive, but capitalists believe that private profit can be a tool for public good.

Partnerships in the sharing of technology are especially crucial. Nations with technological and academic resources must find ways to share those resources. For example, the United States is working with Mexico to find alternatives -- cost effective alternatives -- to CFCs and halons that meet the needs of Mexican industry and consumers. In Poland, we are working to ensure that the technology to burn coal more cleanly is made available. And in Hungary, we have begun work on a regional

environmental center that will share knowledge and technology with the public and private sectors.

In any endeavor, it is important not to confuse motion with progress. Make no mistake: the creation of new partnerships is not just aimless motion. Rather, it reflects a more mature understanding of the scope of our problems and how they must be solved.

In the early days of environmental concern, we discovered specific problems in specific places. For example, we saw smoke coming out of a stack, and we controlled that stack. Then we discovered that point-source solutions may disperse pollution from a specific locale to the broader region, or even many hundreds of miles away. And point-source solutions may create unwanted byproducts and shift the problem from air to land.

Recognizing this, we saw the need to address pollution affecting all media -- air, water and land. We recognized the value of <u>preventing</u> pollution, rather than responding to it. We discovered the need to understand the interaction of manmade chemicals with large-scale climatic processes. We began to think about how macro-economic behavior affects these large systems. And then, of course, we began to develop diplomatic efforts to deal with transboundary effects. In short, our policies evolved as our perspectives broadened.

Our work over the next two days must incorporate an even broader perspective. Economic analysis can help us understand the costs of environmental damage, and may show us that adapting to change could cost more than preventing that change. Scientific advances can help us see whether and how fast our technology may evolve -- or where we must focus our efforts to ensure that it does evolve. Dealing with global change may require broader vision and greater integration than any other problem in human history.

But we have a model for that kind of vision and integration and we should not lose sight of it. The Montreal Protocol, signed in September 1987, is the first multi-lateral agreement to control global pollution in anticipation of an environmental problem. It was the outcome of careful, complex discussions, in which we first achieved agreement on the scientific agenda, and then formed crosscutting partnerships to perform and review the science. The scale of uncertainty was gradually reduced. Partnerships sprang up between government bodies, private companies, scientists and environmentalists. A framework convention was negotiated at Vienna to provide a structure for policy actions, and when the scientific and economic realities emerged, a protocol was negotiated with specific targets and provision for future amendments.

That process worked very well. We would be foolish to disregard it.

In the long run, all of us must understand the environmental and economic implications of a changing world, and we must understand how best to respond. In the next two days, we can forge the partnerships that will enhance that understanding. We should strive for agreement on overall goals, for to be effective, our efforts must have a common direction. We need to reinforce our communication mechanisms because shared perspectives and knowledge offer hope for the future. We need to look beyond the borders of our disciplines, for if economists do not understand the needs of scientists, and scientists do not understand the perspectives of economists, and if policymakers do not listen carefully to both, our solutions cannot be complete.

In the final analysis, it is progress that counts. The progress of research, the progress of diplomacy, and the progress of action. Progress that can only emerge from the partnerships that we can build over the next two days. That is our common challenge.

Thank you.

Jan Janowski

Speech

(3 pp)

DRAFT COPY CHECK AGAINST DELIVERY

Mr. President & Ladies Gentlemen:

Allow me to begin by expressing, on behalf of the government of the Republic of Poland, our sincere appreciaton for inviting Polish delegation to participate in this importance conference, for generosity and hospitality of the American government and the American people.

I think that our feelings in this respect are shared by other participants. Poles perceived ties between us and the American people to particularly close. Almost every Polish family has got relatives living in America.

Today, when Poland and other countries of East and Central Europe rejoin the commonwealth of free nations, we look to America with trust and hope.

Recent experiences have confirmed our belief that America was right in her attachment to the ideas of freedom, democracy and human rights and in her conviction that there was a co-dependence between democracy and effective marketi economy.

Moreover, these experiecnes proved that democracy and healthy economy were crucial importance for the protection of the environment.

In not so distant past, previous Polish governments have not encouraged concern for the natural environment. The attitude of our society, which demanded more information and direct participation in the economic decision making, has stimualted our democractic revolution.

The so-called command economy, with its one-sided concept of industrialization, has proven to be damaging, both from the point of view of increasing living standards as well in guaranteeing the quality of life. In the planning process, it did envisage possibilities to provide adequate financial resources for environmental protection and repair of already existing damages. The degradation of our environment and public health is as a sad legacy of that policy.

Today we are a country in transition - from the totalitarian system and command economy to democracy and modern market economy. We are realistic and understand that free market alone is not going to resolve our problems immediately. Free market provides opportunities, which would be unthinkable without it. It is up to us, however, whether we would soon be able to take advantage of the rejection of the old economy system and utilize mighty market forces for the protection of our environment. We are now reconstructing our ecological policy in order to adjust it to new circumstance and global challenges.

DRAFT COPY CHECK AGAINST DELIVERY

In our opinion, the fact that this conference has been convened demonstrates that America feels particularly responsible for the fate and future of the world. This future is clearly our common concern and responsibility.

Mr. President,

I think that your initiative to stage today's conference and ponder upon a question: "How are we to achieve necessary economic development without damaging the earth and life, which are a gift of God to us?" , has come at the right moment.

You have kindly invited us to **reflect jointly** on scientific and economic research connected to the Global Change.

Th e implications of the Green House Effect are clear to everybody. It is also evident that there is a need to protect the ozone layer. Attempts to lower environmentally harmful emissions, however, have encountered certain barriers. One of them are the costs.

Allow me to use the example from my own area of research as a scientist and engineer. It is possible nowadays to dramatically reduce the negative ecological effects of steel production. It is feasible but very costly. The cost of special equipment to protect environment constititutes approximately 25% of the total costs involved in the technological process of steel production. Similar dilemmas exist in other areas.

I think that we should consider how to better utilize the results of basic scientific research for the purposes of enviromental protection engineering. It is possible that such results already exist or will become available in the foreseeable future.

When W. H. Carothers conducted research on molecular structures he had clearly not thought of the invention of nylon. When C. Shannon, working at the Bell Laboratories, advanced his theory of communications, numerous pracitical applications of his abstract ideas were not yet recognized.

Therefore, I think that it would be advisable to carefully examine the results of basic scientific research to determine possibilities of their practical use in constructing totally new equipment and obtaining new technologies, which would serve the purposes of environmental protection at a greatly reduced cost. This is a problem which pervades me and my Polish colleagues **(OMISSION)**

As far as I know, also in other countries of East and Central Europe, there exist a disturbing discrepancies between the results of basic scientific research and the pace and scope of their practical technical implementation.

DRAFT COPY CHECK AGAINST DELIVERY

Due to a difficult economic situation in Poland, a country which has implemented drastic measures aimed at curbing inflation, we are not able at this moment to take up obligations to reduce carbon dioxide emissions, as suggested during the ministerial conference in Noordiwijk in November of last year. CO2 emissions reduction remains, however, one of our major goals and it will be taken into consideration the process of implementing restructurization of our economy.

Mr. President,

International cooperation is of fundamental importance for effective response to Global Change. Therefore, we welcome by lateral efforts in this area, such as Polish/American project to improve environmental conditions in Krakow and other projects in which countries like Sweden, United Kingdom, Federal Republic of Germany, as well as EEC and other partners participate.

The Polish side can provide significant contribution to the research conducted on the international scale, by the: (1) International Institute for Applied System Analysis, (2) The International Panel on Climatic Change and others.

Bearing in mind Polish experiences, I would like to advance the following message to other countries, which find themselves at the comparable level of development:

- Wherever there is economic growth, environmental protection is possible

- Wherever there is poverty, competititon for resources is much greater

- ********** .....economical growth and environmental protection

- Leaders of developing countries should promote economic growth through most effective means of market economies and should include ecological considerations in their economic policy decisions

Ladies and Gentlemen,

I think that we can expect this conference to promote our common interest in economic development, so that we can:

- further the growth of welfare of all nations,

- provide the protection of our global resources,

- lay down a common program of research that would serve the purposes of the previously stated goals,

Thank you for your attention,

WHITE HOUSE CONFERENCE
ON
SCIENCE AND ECONOMICS RESEARCH RELATED TO GLOBAL CHANGE
APRIL 16 - 18, 1990
WASHINGTON, D.C.

WORKING GROUP OPERATIONS
HANDBOOK FOR CO-CHAIRS
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WHITE HOUSE CONFERENCE
ON
SCIENCE AND ECONOMICS RESEARCH RELATED TO GLOBAL CHANGE

SUMMARY OF WORKING GROUP OPERATIONS

GOALS AND OBJECTIVES OF THE CONFERENCE

President George Bush is hosting the White House Conference on Science and Economics Research Related to Global Change in order to bring together government leaders in science, economics, energy and the environment in an effort to: advance understanding of global change phenomena, enhance international cooperation, and build the basis for future efforts among nations to integrate more fully science and economics research into the policy process. The Conference is designed to add a new dimension to the international dialogue on global change – the proposition that economics, both analysis and research on economic policy and economic consequences, is an essential link between the science of global change and policy alternatives.

Designed as an integral part of the ongoing international process to understand the science of and policy options relating to global environmental issues, the Conference is expected to:

- o Focus on science and economics research issues relevant to global change;
- o Address important next steps to substantially enhance and broaden international understanding of science and economics research issues that relate to global change;
- o Highlight the special role that economics plays in integrating the science of global change with the policy process;
- o Demonstrate linkages between science and economics research and domestic and international policy processes; and
- o Seek to take initial steps to implement joint international science and economics research efforts.

The Conference is expected to produce a Co-Chairmen's Report, which will outline the deliberations of the Conference and set forth any specific actions identified during the Conference to expand global change science and economics research and cooperation among nations. A draft Outline of such a Co-Chairmen's Report is included as Attachment A.

Throughout the Conference, President Bush hopes that the delegates will consider how best the nations of the world can position ourselves to fulfill our shared responsibility for GLOBAL STEWARDSHIP of the Earth and its natural resources. It is hoped that Working Group sessions, like the Plenary presentations, will allow the Conference participants to address ways in which government leaders can use global change science and economics research to lay the groundwork for policy deliberations that allow the nations of the world to meet

the needs of the present generation while expanding opportunities for future generations.

CONFERENCE APPROACH

The Conference has been organized around three Integrating Themes which will serve as the focus for discussion throughout the meeting:

- o UNCERTAIN CHANGE: THE SCIENTIFIC AND ECONOMICS RESEARCH CHALLENGE
- o INTEGRATING SCIENTIFIC AND ECONOMICS RESEARCH IN THE POLICY PROCESS
- o BUILDING PARTNERSHIPS FOR SCIENTIFIC AND ECONOMICS RESEARCH.

The Conference will include an opening Plenary Session of formal presentations on the three Integrating Themes followed by discussion of the Themes in three concurrent working groups on Tuesday afternoon and Wednesday morning. Working Group assignments have been designed to reflect the broad range of Conference participation both in terms of geographic representation and a balance of science, environment and energy ministers. The Conference will conclude on Wednesday afternoon with a Review of the Co-Chairmen's Report and Closing Remarks by President George Bush. The final Agenda for the Conference and copies of the Co-Chairmen's presentations on the Integrating Themes are included as Attachments B and C.

WORKING GROUP STRUCTURE

Beginning at 1:45 p.m. on Tuesday, April 17, Conference participants will begin deliberations of the Integrating Themes in three concurrent Working Groups, each co-chaired by representatives of two foreign delegations (Working Groups "A", "B", and "C"). A U.S. Scientist and Economist have been assigned to assist each set of co-chairs in stimulating discussions and reviewing Working Group deliberations at the end of each session. Each Working Group will be supported throughout their deliberations by a three-person rapporteur teams. Working Group assignments will remain stable throughout the Conference (i.e., the Delegates, Scientist, Economist, and Rapporteur team which starts Session I in Working Group "A" will continue with Working Group "A" through Sessions II, III, and IV as well). Working Group leadership and support responsibilities are displayed in Attachment D.

WORKING GROUP PROCEDURES

Working Group deliberations are expected to proceed according to the following outline:

WORKING GROUP SESSION I/THEME I

- o **Opening Remarks from Co-Chairs** (no more than 10 minutes each).
- o **Outline of Significant Issues** from Working Group Scientist (no more than 10 minutes).
- o **General Discussion** (about 60 minutes); speakers must be recognized by Co-Chairs; individual presentations limited to five minutes which will permit about **half** of the Working Group delegates to speak.
- o Review of Deliberations/Session Wrap-up (led by Working Group Scientist--10 minutes).

Saturday
April 14, 1990
9:46 am

WORKING GROUP SESSION II/THEME II

- o **Opening Remarks from Co-Chairs** (no more than 10 minutes each).
- o **Outline of Significant Issues from Working Group Economist** (no more than 10 minutes).
- o **General Discussion** (about 60 minutes; speakers must be recognized by Co-Chairs; individual presentations limited to five minutes which will permit about half of the Working Group delegates to speak.
- o Review of Deliberations/Session Wrap-up (led by Working Group Economist--10 minutes).

WORKING GROUP SESSION III/THEME III

- o **Opening Remarks from Co-Chairs** (no more than 10 minutes each).
- o **General Discussion** (about 60 minutes); speakers must be recognized by Co-Chairs; individual presentations limited to five minutes which will permit about half of the Working Group delegates to speak.
- o Review of Deliberations/Session Wrap-up (led by Working Group Scientist and Economist--10 minutes).

WORKING GROUP SESSION IV/WORKING GROUP CONCLUSIONS

- o **Opening Remarks by U.S. Working Group Chair** (5-10 minutes).
- o **General Discussion;** speakers must be recognized by Chair; individual presentations limited to five minutes.
- o Review of Working Group Input to Co-Chairmen's Report.

A brief outline of the significant issues to be addressed by the assigned Scientist(s) and Economist(s) in Sessions I and II are provided as Attachment E. This material has been prepared to assist the Co-Chairs in guiding Working Group discussions. Also included as additional reference material is a special background paper on climate change (Attachment F).

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Draft: April 10, 1990 at 8 pm

Climate Change

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The Climate System:

The Earth's climate is controlled by the radiative balance of the atmosphere and by internal processes within the climate system. The radiative balance depends upon the input of solar radiation and the atmospheric concentrations of radiatively active trace gases (i.e., greenhouse gases), clouds and aerosols. To predict changes in the climate system requires an understanding of future changes in the atmospheric concentrations of greenhouse gases and aerosols and the processes that control the response of the climate system to natural and human-influenced changes in the radiation balance.

Changes in the Forcing of the Climate System:

Natural greenhouse gases, primarily water vapor and carbon dioxide, and to a lesser extent methane, nitrous oxide and ozone, keep the Earth much warmer than it would otherwise be. It is well documented that since the industrial revolution the atmospheric concentrations of carbon dioxide, methane, nitrous oxide and industrially produced chlorofluorocarbons (strong greenhouse gases) have been increasing primarily due to human activities. However, there are many uncertainties concerning the magnitudes of the sources and sinks of these greenhouse gases, hence their residence time in the atmosphere. In particular, the magnitude of the uptake and release of carbon dioxide by the oceans and terrestrial biosphere, and strengths of the individual sources of methane and nitrous oxide are quite uncertain. These uncertainties limit our ability to understand the quantitative consequences of particular emissions control strategies, e.g., it is difficult to relate future emissions of carbon dioxide to growth in its atmospheric concentration. It should be noted, however, that the time taken for atmospheric carbon dioxide to adjust to changes in sources is of order 50-200 years, determined by the slow exchange of carbon between surface waters and deeper layers of the ocean and the response of the terrestrial biosphere. Consequently, carbon dioxide emitted into the atmosphere today will influence the atmospheric abundance of carbon dioxide for centuries into the future, and the atmospheric concentration of carbon dioxide will only respond slowly to changes in emission rates.

Predictions of Climate Change:

General Circulation Models (GCM's) are currently the best tools with which to predict changes in the Earth's climate in response to a change in the atmospheric concentrations of trace gases or aerosols, solar activity, or surface albedo. However, it must be recognized that the current GCM's have certain limitations. In particular, the prediction of global climate change is very sensitive to the treatment of cloud-radiation interactions. Different cloud-radiation parameterizations in GCM models lead to significant differences, up to a factor of three, in the magnitude of the predicted global warming. Prediction of regional climate changes are very uncertain and are particularly sensitive to the treatment of ocean dynamics and ocean-atmosphere interactions (the exchange of energy and chemicals between the atmosphere and the surface waters, and between the surface waters and the deep oceans controls the rate of predicted warming), and to the terrestrial vegetation-atmosphere interactions (the transfer of energy and moisture between land surfaces and the atmosphere). In addition to our current lack of understanding of several key processes, today's computer capabilities severely limit the spatial resolution of the GCMs. Consequently, while the current GCMs represent the overall climatology of the

present climate system quite well and all predict that the Earth's climate will warm in response to an increase in the atmospheric abundance of greenhouse gases. It is clear that the predictions of the magnitude and timing of climate changes, especially at the regional level, are somewhat uncertain. In particular, accurate regional predictions of changes in the mean state and variability of climatic parameters needed to assess the impact of climatic change on agriculture, natural ecosystems, coastal regions, and water resources, such as temperature, precipitation, evaporation, soil moisture and the occurrence of severe storms at sub-continental scales, are not possible at this time. Other potentially important uncertainties concern feedbacks between climate change and biogeochemical cycling, and possible non-linear feedbacks within the climate system itself, i.e., a change in ocean circulation.

A key question is what do the GCM's predict for future climate changes based on trace gas emission, recognizing that there are significant scientific uncertainties, and assuming that there will be no long-term changes in solar irradiance or atmospheric aerosol concentrations. Rather than discuss a number of complex emission scenarios it is reasonable to believe that the atmospheric concentrations of carbon dioxide and the other greenhouse gases will continue to increase at a rate such that there will be a radiative equivalent of a carbon dioxide doubling sometime during the middle of the next century. If this occurs then the GCM's predictions that are considered to be most likely are that: (i) the equilibrium increase in global mean surface temperature should lie between 1.5 and 4.5 degrees centigrade (highly sensitive to modelling the feedback between clouds and climate change; recent models with more sophisticated treatments of clouds have tended to predict temperature changes at the lower end of this range); (ii) between 60 and 80% of the equilibrium warming should be realized at the time of "equivalent doubling" (sensitive to the treatment of ocean circulation); (iii) global mean precipitation should increase; (iv) sea-ice extent should decrease; and (v) the predicted warming in the northern polar winter should be greater than the global mean.

There are some consistent GCM predictions of climate change at the continental scale (but not sub-continental scale) such as, (i) land areas are predicted to warm more rapidly than oceans, and (ii) mid-latitude land masses in the northern hemisphere will warm more than the global mean and be accompanied by a decrease in summer precipitation. These results carry important implications, but must be stated with lower scientific confidence than those presented above.

Observations of Temperature Changes:

The instrumental record of surface temperatures suggests an increase of between 0.3 and 0.6 degrees centigrade since the mid-nineteenth century, with a yet undetermined, but probably small (less than 0.15 degrees centigrade) artificial component due to urbanization. The observation of a marked retreat of mountain glaciers in all parts of the world since the end of the nineteenth century tends to support the notion that temperatures have increased globally over the last one hundred years. However, temperatures have not increased smoothly with time, nor uniformly throughout the world. Several points should be noted: (i) the majority of the temperature increase occurred before 1940, prior to most of the anthropogenic increase in the atmospheric concentrations of greenhouse gases; (ii) there is little evidence that the continental U.S. has warmed since 1900; (iii) the northern hemisphere cooled between 1940 and the early 1970s, while the southern hemisphere continued to warm, albeit at a very slow rate; (iv) there have been significant differences in regional changes, especially in the northern hemisphere since 1950; and (v) from 1975 to 1982 a more general warming occurred, followed by little global warming since 1982. It is

important to recognize, however, that coupled ocean-atmosphere GCM's predict a highly variable global warming signal, moreover, substantial regional variations are expected.

Detection of the "Anthropogenic Greenhouse" Signal:

The Earth's climate is inherently variable on all timescales, both regionally and globally. Hence, the challenge is to detect an "anthropogenic greenhouse" signal amidst the natural variability of the system. While it can be stated that the observed global mean temperature increase over the past 100 years is broadly consistent with theoretical predictions of climate change, it should be noted that the implied climate sensitivity of the actual system would then be in the lower one-third to one-half of the range predicted by GCM's. In addition, natural variability of the climate system may be as large as the observed changes to date, hence the observed changes could be wholly attributable to natural variability or possibly natural variability could have masked (due to natural variability causing a decrease in temperatures) a larger "anthropogenic greenhouse" signal. Consequently, the current observations cannot confirm the presence or absence of an "anthropogenic greenhouse" signal. Detection of an "anthropogenic greenhouse" signal will require determining trends in both forcing functions and several climatically important parameters, coupled with a quantified understanding of natural variability, and the use of time-dependent coupled ocean-atmosphere GCMs.

Sea Level:

Although the data are difficult to interpret, the best scientific assessment is that over the past 100 years, sea level has risen at an average rate of rise of 1.0-2.0 mm/yr. The uncertainties are large, but the principal causes of this rise are consistent with the expected thermal expansion of the oceans and the melting of mountain glaciers. Regional values differ considerably from global values and predicting future conditions is even more uncertain. If the global mean surface temperature increases, then sea level is predicted to rise, primarily due to to the thermal expansion of the oceans and to a melting of some land-ice. The current predicted range of sea-level increase, at the time of a radiative equivalent of a carbon dioxide doubling (sometime during the middle of the next century), lies between about 10 and 30 cm. Accurate predictions remain difficult, and somewhat controversial, because of the predicted increased snow accumulation over the Antarctic continent.

Ecological Systems:

Biological Productivity: Where temperature is limiting, warming of soils would increase nutrient availability to plants with potential for increased productivity. Increased temperature will affect respiration more than photosynthesis, possibly reducing carbon stored in terrestrial ecosystems resulting in a positive feedback on atmospheric carbon dioxide concentrations. Higher atmospheric carbon dioxide concentrations can increase photosynthesis with potential increases in net production, but the duration of "carbon dioxide fertilization effects" is unknown. However, while there is some knowledge of the responses of biological production processes to changes in parameters of the physical environment, how these integrate over the life cycle of even one species interacting in a complex of other species is unknown.

Ecosystem Composition: Species will respond differently to changes in temperature, precipitation, and atmospheric carbon dioxide, either singly or in some combination.

However exactly what these responses will be is not known. Also unknown are the changes that will occur among species, including plant-animal and plant-microbe interactions– both beneficial symbioses as well as insect and fungal pathogens, that affect the structure of ecosystems. GCM's predict that global mean surface temperatures may change much more rapidly in response to an increase in greenhouse gases, up to a factor of 100, than they did during ice age cycles. If this were to occur some species will not be able to migrate or otherwise adapt to the changing climate and become extinct. Offsetting this will be the possible genetic differentiation and expansion that might occur as habitat boundaries are altered, with creation of new barriers to reproduction and dissolution of some old barriers. However, extinction is likely to be more frequent than speciation, further decreasing biological diversity.

Marine Ecosystems: The historic record leaves little doubt that global warming will have an impact on marine planktonic organisms. The structure and productivity of marine ecosystems are strongly influenced by ocean circulation and mixing, physical parameters tightly linked with climate. In high latitudes, the distribution of sea ice is especially important both for plankton and marine mammals and birds. In sub-polar and temperate regions, physical, chemical and biological parameters are highly variable and the system behavior consequently unpredictable. Thus, effects of warming or other changes are similarly uncertain. Warming affects vertical mixing and in turn nutrient supply, a major determinant of ocean productivity. Again, while there is considerable knowledge of specific processes and specific parts of the global oceans, the integration of this knowledge is incomplete and significant gaps in understanding exist.

Scientific Research Needed to Reduce Scientific Uncertainties:

To improve our current understanding of: (i) the natural and human-influenced processes that control the Earth's climate, and (ii) the impacts of climate change at the regional scale, will require an internationally coordinated program of space-based and ground-based research. This research program will need to: (i) establish an integrated long-term program of systematic observations of the Earth's system; (ii) improve our understanding of the physical, chemical, biological, geological, and social processes that influence the Earth's environment and its responses; and (iii) develop integrated predictive models. In particular, we need to document the natural variability of the Earth's climate, and to improve our understanding and modeling of: (i) cloud-radiation feedbacks; (ii) the exchange of energy between the atmosphere and the surface waters of the ocean, and between the surface and deep waters of the ocean; (iii) the cycling of carbon and other key elements between the atmosphere, land and oceans; (iv) the exchange of water and energy between land surfaces and the atmosphere; and (v) the current structure and functioning of ecosystems and their response to environmental changes.

Draft: April [illegible] 1990 at 8 pm

Summary of Areas of Scientific Uncertainty

a. *Hydrologic cycle:* primarily cloud-radiation and land surface-atmosphere interactions. These uncertainties affect the predicted rate (magnitude at a given time) of "climate change".

b. *Role of the oceans:* the exchange of energy between the ocean and the atmosphere and between the upper layers of the ocean and the deep ocean. These uncertainties affect the predicted rate of climate change, especially at the regional scale.

c. *Trace Gases:* quantification of the uptake and release of carbon dioxide by the oceans and terrestrial biosphere, and quantification of the individual sources of methane and nitrous oxide. These uncertainties affect our understanding of how the climate system will be "forced", hence the rate of predicted climate change. These uncertainties also limit the formation of control strategies.

d. *Prediction of regional climate change:* limitations in computer resources (spatial resolution and physical sophistication), coupled with an inadequate understanding of several key processes (e.g., the exchange of water and energy between vegetative surface and the atmosphere) limit the accuracy of regional climate change predictions at the scale required for impact assessments to be performed (sub-continental).

e. *Detection of global change:* trends in a number of climatically important parameters, coupled with a quantified understanding of natural variability, is needed to differentiate between human-induced changes in the environment from those that occur naturally. This will require long-term observations of climatically important parameters and forcing functions, as well as careful development of time-dependent coupled ocean-atmosphere GCMs.

SUMMARY OF THEME 1 PRESENTATIONS

Theme 1: Primary emphasis of the Theme I sessions will be on a discussion of the scientific and economic understanding and uncertainties associated with three different aspects of the climate system and the consequences of climate change. Each panel will discuss scientific issues in a framework useful for economic analyses and policy formulation. Specifically the panels will focus their discussions on the current understanding of:

Working Group A:

How well do our current models predict climate change. Are they good enough to be able to predict climate change at the regional scale in order to understand the ecological and economic consequences. What is needed to improve our confidence in the ability of models to predict climate change at the regional scale. How good is the evidence that the global mean temperature of the Earth has increased over the last 100 years. Is it possible to attribute observed changes in the Earth's climate to anthropogenic causes.

Working group A will focus its discussions on the current understanding of:

(i) the reliability of General Circulation Models (GCMs) to predict the magnitude and timing of global climate change:
- * the treatment of cloud formation, dissipation, and radiative properties, which impacts the predicted magnitude of global warming
- * the treatment of the exchange of energy and chemicals between the atmosphere and the surface waters, and between the surface waters and the deep oceans, which controls the rate of predicted global and regional warming

(ii) the ability of GCMs to predict accurately regional changes in the mean state and variability of climatic parameters needed to assess the impact of climatic change on agriculture, natural ecosystems, coastal regions, and water resources (such as temperature, precipitation, evaporation, soil moisture and the occurrence of severe storms at sub-continental scales) - all of central importance to the modeling of economic impacts of global warming.
- * inadequacy of spatial resolution in GCMs
- * inadequate understanding of several key processes

(iii) the observational evidence that suggests that the global mean surface temperatures have increased by between 0.3 and 0.6 degrees centigrade within the last one hundred years.

(iv) whether the observational temperature record can be used to confirm or refute the presence of an "anthropogenic greenhouse" signal.

Working Group B:

How do human activities (e.g., combustion of fossil fuels, land-change practices, cattle breeding, rice cultivation, biomass burning) and natural processes (solar variations) influence the Earth's climate. What is the evidence that human activities have increased the atmospheric concentrations of greenhouse gases. Are current economic models adequate to accurately project future greenhouse gas emissions. Do we understand how changes in climate will influence natural emissions of greenhouse gases. Do we understand the emissions and atmospheric removal mechanisms of the greenhouse gases well enough to formulate effective control strategies.

Working group B will focus its discussions on the current understanding of:

(i) how may climate be changed by anthropogenic activities (increased abundances of trace gases and aerosols) in relationship to natural phenomenon (solar variability, volcanic activity, etc.).

(ii) the evidence that human activities have increased the atmospheric abundances of greenhouse gases, i.e., carbon dioxide, methane, chlorofluorocarbons, nitrous oxide, and tropospheric ozone since the pre-industrial era.

(iii) the uncertainties associated with quantification of the uptake and release of carbon dioxide by the oceans and terrestrial biosphere, and quantification of the individual sources of methane and nitrous oxide, and how these uncertainties limit the formation of effective control strategies.

(iv) the limitations of trace gas emission projections without a good understanding of population growth, and economic and technology development.

(v) how uncertainties in trace gas emissions affect our projections of climate change.

(vi) how changes in climate might change the biogeochemical cycling of carbon and other key nutrients, thus changing the "natural" emissions rates of greenhouse gases into the atmosphere.

Working Group C:

How well do we understand the consequences of the predicted "anthropogenic greenhouse warming and other environmental changes" on the mosaic of ecosystems, ranging from marine plankton to tropical rainforests, which provide food, habitat and water resources. Specifically, what is the predicted rate of change of sea level; how will agricultural productivity change regionally and globally; can individual species migrate

fast enough or will they become extinct; can we quantify the beneficial effects of enhanced atmospheric concentrations of carbon dioxide on ecosystem productivity.

Working group C will focus its discussions on the current understanding of the consequences of predicted changes in climate and other environmental parameters (e.g., increased atmospheric concentrations of carbon dioxide):

(i) the biological productivity of managed and unmanaged ecosystems

(ii) the response of biological species that have adapted over millions of years to naturally occurring physical and biological conditions. Will species be able to migrate or otherwise adapt to the predicted rapid changes or become extinct?

(iii) the impact on terrestrial ecosystem composition (changes that will occur among species, including plant-animal and plant-microbe interactions)

(iv) the response of sea level and its potential consequences for coastal wetlands and habitats

(v) the impact on the structure and productivity of marine ecosystems because of potential changes in the interplay between biological, chemical and ocean processes.

(vi) the impact of land-use changes on biological productivity and diversity, carbon storage, fluxes of carbon compounds to the atmosphere, hydrologic cycle and climate

April 12, 1990

Economics of Global Climate Change:
Uncertainties and Research Challenges

- Serious economic research can contribute to reducing the uncertainty that now surrounds the answers to three questions that must be answered in order to make intelligent policy:
  - How will emissions of "greenhouse gases" change in coming decades if no actions are taken to curb those emissions?
  - What would be the effects of plausible climate change scenarios? What would be the costs of adaptation?
  - What would be the effects of slowing or stopping future growth in "greenhouse gas" emissions? What would be the costs of various levels of mitigation?
- While economic research in this area is still in the early stages, studies to date generally provide support for the following points:
  - The share of greenhouse emissions emanating from the OECD countries is expected to decline substantially as developing countries grow and industrialize over the coming decades.
  - Any coordinated policy to achieve an absolute reduction in carbon dioxide emissions that would otherwise be growing would require both a substantial reduction in energy use and a shift from fossil fuels to more costly substitutes. Economic growth in both developing and developed countries is likely to be affected.
  - More than 90 percent of world economic activity falls outside of sectors that would be directly affected under plausible climate change scenarios. This figure has been increasing in the past and will continue to increase as the developing world industrializes.
  - Most studies find relatively high costs of curbing the projected growth in carbon dioxide emissions; those costs would begin today and would amount to 1-5 percent of GNP annually under plausible scenarios.

Uncertainties

- o Emissions Forecasting: Forecasts of "greenhouse gas" emissions are a key input to climate models. Forecasting emissions over coming decades in the absence of serious mitigation efforts is very difficult; published forecasts thus vary substantially.

  - In general, forecasts of emissions over the relevant time period (several decades) depend on future population growth, economic growth, and the development and deployment of new technologies.

  - Forecasts of carbon dioxide emissions depend on long-run forecasts of

    -- GNP growth in developed and developing nations;

    -- changes in the sectoral composition (industrial, utility, transportation, agriculture, services) of GNP in each nation;

    -- changes in the efficiency of energy use, the role of non-fossil energy sources, and in the extent of CFC use; and

    -- deforestation.

  - A key uncertainty in forecasting carbon dioxide emissions is the pace at which coal reserves are consumed.

  - An important uncertainty in CFC emission forecasts has to do with how the Montreal Protocol will be strengthened and the extent to which it will be followed internationally.

  - Forecasts of methane and nitrous oxide emissions also depend importantly on long-run forecasts of

    -- agricultural activity at a disaggregated level (rice paddies, animal husbandry, grains, etc.);

    -- changes in agricultural practices (grain vs. grass as cattle food, use of nitrogen fertilizers);

  - It is difficult to forecast GNP for a single nation over a few years; accurate forecasts at a high level of sectoral detail over a half-century or more for many nations are nearly impossible at present.

- o Adaptation Cost Forecasts: Even if one assumes for the purpose of analysis that one particular climate change scenario among the many that are advanced will occur, it is exceptionally difficult at present to forecast the implied adaptation costs.

  - The problem can be bounded by the fact that well over 90 percent of world economic activity will be unaffected under plausible climate change scenarios.

  - Detailed analysis of affected sectors is necessary for estimation of adaptation cost, and little of this has been done.

    -- Preliminary studies that allow for world trade in agriculture find total world-wide effects at mid-century of plus or minus a few billion dollars.

    -- Very little systematic work has been done on the impacts of sea level change, human health effects (if any), or on the effects of climate change on forestry, fisheries, water resources, or biodiversity

  - Technological progress will likely play a key role in adaptation (particularly in agriculture), but forecasting the rate and direction of technical change over a half-century is very difficult.

- o Mitigation Costs Existing studies show high costs of reducing greenhouse emissions sharply in the near term, but substantial uncertainty remains.

  - It appears that CFC emissions can be cut dramatically at relatively low cost.

  - At the other end of the spectrum, almost nothing is known about the costs of reducing methane or nitrous oxide emissions.

  - Estimates of costs and benefits of forestation, which can provide comparatively short-term mitigation, vary widely. (Forests in steady-state are neither sources nor sinks; sequestration occurs only during forest growth.)

  - There is two-sided uncertainty regarding the usefulness the experience of the 1970s oil shock (reduced carbon dioxide emissions growth, with stabilization in the US and the OECD, was achieved over 1973-85 -- but with slower growth and generally higher unemployment) as a reference point in global change policy discussions.

    -- On one hand, policy errors of that period will probably not be repeated.

    -- On the other hand, nuclear power, which grew significantly in the oil shock era, now faces significant obstacles in many countries.

  - The links between developed and developing country economies, and their importance for policy design are a ripe area for future research. Current IMF estimates suggest that a 1 percentage point decrease in industrialized country growth translates into about a 1/2 percentage point decrease in developing country growth.

    -- Through economic linkages, unilateral actions by the industrialized nations, whose share of these emissions is about 40 percent and falling, could damage developing economies while having relatively little impact on the global atmosphere.

  - Costs of reducing carbon dioxide emissions are uncertain for a variety of reasons:

    -- As discussed above, the no-action baseline against which reductions are measured is uncertain. It is thus hard to know how stringent policies must be to yield stabilization, for instance.

-- The future availability and cost of new energy technologies is inevitably uncertain.

-- The impact of removing existing imperfections in energy markets (which might lead cost-effective conservation opportunities to be ignored) is highly uncertain.

-- The policies that would be used to make emissions reductions are uncertain, but different policies can have vastly different impacts on the economies of developing and industrialized countries. Where action is justified, economic dislocation and its attendant human consequences can be held to a minimum through the use of flexible policies that operate through, rather than against, market incentives.

-- Mitigation costs are inherently easier to estimate than adaptation costs, since mitigation costs would largely (particularly in a present value sense) be incurred in the near future, while adaptation costs would largely be incurred decades hence--in the context of a world economy and technological possibilities that we can at best dimly perceive now.

3rd DRAFT
(Incorporating Rick Davis' comments)
APRIL 16, 1990

GLOBAL CHANGE: A COMMITMENT TO ACTION

Remarks by

WILLIAM K. REILLY

Administrator
U.S. Environmental Protection Agency

WHITE HOUSE CONFERENCE ON SCIENCE AND ECONOMICS RESEARCH RELATED TO GLOBAL CHANGE

J.W. Mariott Hotel
Washington, DC
April 17, 1990

O INTRODUCTORY REMARKS (**MARK TWAIN JOKE?**)

O YOU HAVE HEARD THIS MORNING ABOUT RESEARCH NEEDS -- SCIENTIFIC RESEARCH AND ECONOMIC RESEARCH

-- I AM HERE TO TALK ABOUT SOMETHING ELSE

-- I AM HERE TO TALK ABOUT <u>ACTION:</u> ACTION IN THE FACE OF INCONCLUSIVE INFORMATION; POLICY-MAKING IN THE FACE OF UNCERTAINTY

-- NEITHER WE IN THE UNITED STATES NOR YOU IN OTHER COUNTRIES WILL BE ABLE TO WAIT FOR TOTAL ENLIGHTENMENT TO INFORM OUR POLICY CHOICES

-- SO LET ME DESCRIBE SOME OF THE IMPORTANT ACTIONS WE CAN TAKE -- AND ARE TAKING -- RIGHT NOW, EVEN AS WE AGGRESSIVELY PURSUE THE SEARCH FOR CONCLUSIVE ANSWERS TO CLIMATE QUESTIONS

O FIRST, IT'S CLEAR THAT WE MUST WORK TOGETHER; NO ONE OF OUR COUNTRIES IS ALONE, AND NONE CAN EFFECTIVELY ADDRESS GLOBAL CLIMATE PROBLEMS APART FROM THE OTHERS

-- ACCORDINGLY, WE ATTACH GREAT VALUE TO OUR INTERNATIONAL COLLABORATION

-- THE VEHICLE FOR THAT COLLABORATION IS THE IPCC -- THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

-- THE IPCC IS ASKING THE RIGHT QUESTIONS, IT IS PULLING TOGETHER (MUCH) RELEVANT INFORMATION, AND WE IN THE UNITED STATES ARE PLAYING A KEY ROLE AS CHAIR OF THE RESPONSE STRATEGIES WORKING GROUP

-- AMONG THE U.S. CONTRIBUTIONS TO THE IPCC PROCESS HAVE BEEN TWO IMPORTANT REPORTS TO CONGRESS BY MY OWN AGENCY: ONE ON EFFECTS, AND ANOTHER, STILL IN DRAFT, ON STABILIZATION

-- WE WILL CONTINUE TO DO THIS KIND OF TECHNICAL WORK AND ANALYSIS TO HELP LAY THE GROUNDWORK FOR THE NEXT PHASE OF THE IPCC PROCESS -- CLIMATE CHANGE TREATY NEGOTIATIONS

-- AND WE ENCOURAGE OTHER COUNTRIES, AS WELL, TO CONTINUE TO CONTRIBUTE TO THIS GROWING BODY OF KNOWLEDGE AND INFORMATION

-- DOING OUR HOMEWORK ON THE RANGE OF RESPONSE STRATEGIES AVAILABLE -- AND THE COST OF THESE OPTIONS -- IS CRITICAL

-- IT IS CRITICAL TO ENSURING THAT THE FRAMEWORK CONVENTION DISCUSSIONS WHICH WILL BEGIN AT THE END OF THE YEAR ARE PURPOSEFUL

-- **(IT IS CRITICAL TO ENSURING THAT THE MANY HUMAN CONSEQUENCES ASSOCIATED WITH GLOBAL CHANGE ARE FULLY UNDERSTOOD AND ACCOUNTED FOR)**

-- (IT IS CRITICAL TO ENSURING THAT THE POLICIES AND PROGRAMS WHICH ARE ULTIMATELY DEEMED NECESSARY -- ESPECIALLY IF THEY ENTAIL SIGNIFICANT ECONOMIC DISRUPTIONS -- WILL BE POLITICALLY ACCEPTABLE)

-- IN SHORT, LAYING PROPER GROUNDWORK TODAY WILL SAVE TIME IN THE LONG RUN

O SECOND, WE MUST DEVOTE SUBSTANTIAL RESOURCES TO STRENGTHENING THE SCIENCE OF CLIMATE CHANGE, (AS WELL AS OUR KNOWLEDGE OF THE ECONOMIC IMPACTS)

-- SOUND SCIENCE IS CRITICAL TO CONSENSUS-BUILDING; WITHOUT IT, WE WILL HAVE ONLY CONTROVERSY AND CONFUSION

-- PRESIDENT BUSH HAS PROPOSED A 57 PERCENT INCREASE IN FUNDING FOR GLOBAL CHANGE RESEARCH FOR THE NEXT FISCAL YEAR

-- THIS INCLUDES A SUBSTANTIAL BOOST IN THE FUNDING FOR ATMOSPHERIC MONITORING BY THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION'S SATELLITES

-- IT IS, IN FACT, U.S. SCIENCE THAT IS POWERING THE DEBATE ON GLOBAL CLIMATE CHANGE

-- AND A LONG-TERM COMMITMENT TO RESEARCH AND DEVELOPMENT CAN BRING DOWN THE COST OF EXISTING OPTIONS, AND DEVELOP NEW OPTIONS AS WELL

O THIRD, **WE HAVE LEARNED MANY VALUABLE LESSONS ABOUT HOW TO PUT TOGETHER AN INTERNATIONAL RESPONSE TO A GLOBAL ENVIRONMENTAL ISSUE THROUGH** OUR EFFORTS TO PROTECT THE STRATOSPHERIC OZONE LAYER

-- THE UNITED STATES FIRST ACTED TO REDUCE EMISSIONS OF OZONE-DEPLETING CHLOROFLUOROCARBONS IN 1978

-- NINE YEARS LATER, THE MONTREAL PROTOCOL ESTABLISHED AN INTERNATIONAL REGIME REQUIRING A 50 PERCENT REDUCTION IN CFC PRODUCTION AND USE BY 1998

-- MEANWHILE, THE DEVELOPMENT OF SUBSTITUTES IS PROCEEDING MUCH MORE RAPIDLY THAN WE HAD ANTICIPATED

-- ALL OF THIS HAS COME ABOUT BECAUSE OF UNPRECEDENTED INTERNATIONAL AND BUSINESS-GOVERNMENT COOPERATION TO ADDRESS WHAT SCIENCE TELLS US IS A CLEAR AND PRESENT THREAT TO THE WELL-BEING OF OUR PLANET

-- THE IMPORTANCE OF INTERNATIONAL AND INTERSECTORAL COOPERATION IS ONLY ONE OF THE LESSONS WE ARE LEARNING FROM THE OZONE DEPLETION MODEL. HERE ARE SOME OTHERS:

-- FIRST, PERIODIC ASSESSMENT AND REVISION IS IMPORTANT WHEN DEALING WITH ISSUES ON THE CUTTING EDGE OF SCIENCE

-- SINCE THE PROTOCOL WAS SIGNED, THE LINK BETWEEN CFCS AND THE OZONE HOLE HAS BEEN CONFIRMED; AND NEW EVIDENCE INDICATES THAT OZONE DEPLETION IS MORE SEVERE AND OCCURRING AT A FASTER RATE THAN WAS ORIGINALLY THOUGHT

-- AS A RESULT, WHEN THE PROTOCOL IS RENEGOTIATED THIS JUNE, IT PROBABLY WILL BE STRENGTHENED TO REQUIRE A FULL PHASE-OUT OF CFCS BY THE END OF THE CENTURY

-- SECOND, <u>IT'S SMART TO TAKE ONLY WHAT SCIENCE GIVES YOU:</u> A RESPONSE THAT IS SUPPORTED BY EXISTING KNOWLEDGE, AND THUS ABLE TO GENERATE A CONSENSUS, IS PREFERABLE TO ONE THAT GOES BEYOND ACCEPTED SCIENCE AND GAINS ONLY LIMITED PARTICIPATION

-- BY ADOPTING AN (**DELETE:** INCREMENTAL) APPROACH BASED ON PERIODIC ASSESSMENT AND REVIEW, THE MONTREAL PROTOCOL HAS GATHERED WIDE INTERNATIONAL PARTICIPATION AND SUPPORT -- NOT ONLY FOR THE ORIGINAL AGREEMENT BUT ALSO FOR CURRENT EFFORTS TO STRENGTHEN THE TERMS OF THE AGREEMENT

-- AND THIRD, <u>THE CONCERNS OF THE DEVELOPING NATIONS MUST BE ADDRESSED:</u> INTERNATIONAL ENVIRONMENTAL PROBLEMS CANNOT BE SOLVED WITHOUT THEIR PARTICIPATION

-- DEVELOPING COUNTRIES TODAY ACCOUNT FOR LESS THAN 15 PERCENT OF TOTAL CFC CONSUMPTION

-- YET THEIR CONTINUED USE OF THESE CHEMICALS WOULD OFFSET EVEN A COMPLETE ELIMINATION OF OZONE-DEPLETING CHEMICALS IN THE DEVELOPED WORLD

-- ALTHOUGH 23 DEVELOPING NATIONS HAVE SIGNED THE MONTREAL PROTOCOL, MANY OTHERS HAVE NOT, INCLUDING CHINA AND INDIA

-- THE POOR COUNTRIES OF THE WORLD ARE DESPERATELY LOOKING FOR A WAY OUT OF POVERTY, AND THEY ARE UNDERSTANDABLY WARY OF ANYTHING THAT SMACKS OF RESTRAINTS ON ECONOMIC EXPANSION OR ON THEIR DEVELOPMENT ASPIRATIONS

-- THE MONTREAL PROTOCOL ADDRESSES THESE CONCERNS BY GIVING DEVELOPING COUNTRIES A TEN-YEAR GRACE PERIOD BEFORE THEY MUST BEGIN REDUCING CFC USE; AND BY COMMITTING THE DEVELOPED WORLD TO PROVIDING ASSISTANCE TO DEVELOPING NATIONS THAT JOIN THE PROTOCOL

-- NOW, WHILE THE RESPONSE TO OZONE DEPLETION HAS BEEN BOTH ENLIGHTENING AND HEARTENING, I AM NOT SUGGESTING IT IS A PERFECT MODEL FOR ADDRESSING GLOBAL CHANGE

-- COMPARED TO THE COMPLEXITIES OF GLOBAL CLIMATE CHANGE, OZONE DEPLETION SEEMS RELATIVELY SIMPLE AND STRAIGHTFORWARD

-- THE NUMBER OF MANUFACTURERS OF CFCS IS SMALL, AND THEY ARE LARGELY CONCENTRATED IN THE DEVELOPED WORLD; WHILE THE SOURCES OF HEAT-TRAPPING GASES THAT CONTRIBUTE TO CLIMATE CHANGE -- PRIMARILY FOSSIL-FUEL COMBUSTION AND AGRICULTURE -- ARE UBIQUITOUS

-- IN ADDITION, DEVELOPING COUNTRIES ARE NOT NEARLY AS DEPENDENT ON CFCS AS THEY ARE ON THE SOURCES OF CARBON DIOXIDE AND METHANE

O THE FOURTH ACTION I WANT TO MENTION IS PRESIDENT BUSH'S PROPOSAL FOR A MAJOR REFORESTATION INITIATIVE CALLED "AMERICA THE BEAUTIFUL," CALLING FOR THE PLANTING OF ONE BILLION TREES A YEAR OVER THE NEXT 10 TO 15 YEARS

-- WE ESTIMATE THAT THE TREES PLANTED UNDER THIS PROGRAM WILL ABSORB TWO TO FOUR PERCENT OF THE CARBON DIOXIDE NOW BEING EMITTED INTO THE ATMOSPHERE BY THE UNITED STATES

-- OTHER NATIONS MAY WANT TO CONSIDER SIMILAR INITIATIVES; REFORESTATION HAS MANY BENEFITS BESIDES CARBON DIOXIDE ABSORPTION, INCLUDING REDUCED SOIL EROSION, IMPROVED AIR QUALITY, ENHANCED WILDLIFE HABITAT, AND NEW RECREATION AREAS.

O FIFTH, THE PRESIDENT HAS PROPOSED -- AND OUR CONGRESS IS ON THE VERGE OF ADOPTING -- A SIGNIFICANT STRENGTHENING OF OUR CLEAN AIR ACT

-- THESE AMENDMENTS WILL REDUCE THIS NATION'S SULFUR DIOXIDE EMISSIONS FROM UTILITIES BY ABOUT HALF AND STABILIZE THEM AT THAT LEVEL; REDUCE NITROGEN OXIDE EMISSIONS BY AT LEAST TWO MILLION TONS A YEAR; REDUCE HYDROCARBON EMISSIONS FROM VEHICLES BY 40 PERCENT; **VOCS FROM INDUSTRIAL FACILITIES BY 34 PERCENT** (?); AND TOXIC AIR EMISSIONS BY 75 TO 90 PERCENT

-- THE PRESIDENT'S PROPOSALS ALSO ENCOURAGE THE DEVELOPMENT OF LESS-POLLUTING FUELS, SUCH AS COMPRESSED NATURAL GAS IN AUTOMOBILE FLEETS AND ETHANOL AND METHANOL FUELS IN PRIVATE AUTOMOBILES

-- MANY OF THESE PROVISIONS WILL BRING ABOUT REDUCTIONS IN CARBON DIOXIDE AND OTHER GASES THAT CONTRIBUTE TO CLIMATE CHANGE

-- FOR EXAMPLE, THE PROPOSED CAP ON TOTAL SO2 EMISSIONS ENCOURAGES UTILITIES TO UNDERTAKE MORE ENERGY EFFICIENCY; IT ALSO CREATES INCENTIVES FOR INDUSTRY TO BE MORE EFFICIENT

-- THE PROPOSED CHANGES REDUCE CARBON MONOXIDE EMISSIONS, WHICH DECREASES THE LIFETIME OF METHANE; AND REDUCTIONS IN NOX AND VOCS GENERALLY REDUCE TROPOSPHERIC OZONE, ANOTHER GREENHOUSE GAS

O AND SIXTH, WE ARE PURSUING A VARIETY OF ENERGY CONSERVATION INITIATIVES, ALL OF WHICH ARE IMPORTANT IN COMBATTING CLIMATE CHANGE:

-- THE DEPARTMENT OF ENERGY IS IMPLEMENTING EFFICIENCY STANDARDS FOR MAJOR HOUSEHOLD APPLIANCES, SUCH AS DISHWASHERS, CLOTHES WASHERS AND CLOTHES DRYERS

-- OUR STATES ARE LOOKING AT WAYS TO GIVE UTILITIES INCENTIVES TO PROMOTE ENERGY EFFICIENCY, BY ALLOWING THEM TO PROFIT FROM CONSERVING ENERGY AS WELL AS SELLING ENERGY

-- THE ELECTRIC POWER RESEARCH INSTITUTE ESTIMATES THAT THESE PROGRAMS COULD CUT OUR ELECTRICITY NEEDS BY 20 PERCENT IN THE YEAR 2010

-- SOME STATES, SUCH AS CALIFORNIA, ARE ALSO CHANGING THEIR BUILDING CODES TO INCREASE ENERGY EFFICIENCY IN NEW CONSTRUCTION; THE CALIFORNIA ENERGY COMMISSION ESTIMATES THAT ITS BUILDING STANDARDS WILL REDUCE ELECTRICITY USE BY SIX PERCENT IN THE YEAR 2007

-- WE'RE ALSO VIGOROUSLY PURSUING AUTOMOBILE FUEL EFFICIENCY: THE ENERGY POLICY AND CONSERVATION ACT OF 1976 HAS INCREASED NEW CAR FUEL EFFICIENCY BY ABOUT 80 PERCENT IN THE LAST 13 YEARS

-- FINALLY, WE ARE CONDUCTING RESEARCH ON VARIOUS FORMS OF NONFOSSIL ENERGY, INCLUDING RENEWABLES AND NUCLEAR; THE ADMINISTRATION HAS REQUESTED A 27 PERCENT INCREASE IN THE 1991 BUDGET FOR RENEWABLE ENERGY

-- WE STILL HAVE A LONG WAY TO GO ON ENERGY CONSERVATION; AND WE <u>WILL</u> GO A LONG WAY

O WE HAVE LEARNED A GREAT DEAL FROM OUR EXPERIENCE OVER THE PAST 20 YEARS, SINCE EARTH DAY 1970 USHERED IN THE ENVIRONMENTAL REVOLUTION

-- MANY OF THESE LESSONS CAN BE APPLIED NOW TO ISSUES OF GLOBAL CLIMATE CHANGE

-- FOR ONE THING, WE HAVE LEARNED THAT GREAT IMPROVEMENTS ARE POSSIBLE WITH COMMITMENT AND SUSTAINED INVESTMENT

-- THE GAINS WE HAVE MADE IN REDUCING AIR AND WATER POLLUTION IN THIS COUNTRY ARE QUANTIFIABLE, THEY ARE MEASURABLE, THEY ARE SIGNIFICANT, AND THEY ARE INDISPUTABLE

-- IN EVERY MAJOR CATEGORY OF AIR POLLUTION EXCEPT NITROGEN OXIDES, EMISSIONS ON A NATIONAL BASIS HAVE EITHER LEVELED OFF OR DECLINED SINCE 1970

-- EMISSIONS OF PARTICULATES ARE DOWN 64 PERCENT; SULFUR OXIDES, DOWN 25 PERCENT; VOCS, DOWN 29 PERCENT; CARBON MONOXIDE, DOWN 38 PERCENT; AND LEAD, A MAJOR SUCCESS STORY THANKS TO OUR SWITCH TO UNLEADED GASOLINE, DOWN 96 PERCENT

-- OVERALL WATER POLLUTION TRENDS ARE MORE MIXED BECAUSE OF POPULATION AND INDUSTRIAL GROWTH; BUT WE HAVE HAD SUBSTANTIAL SUCCESS IN REDUCING POLLUTANTS IN MANY SPECIFIC AREAS

-- IN THE GREAT LAKES, FOR EXAMPLE, FECAL COLIFORM IS DOWN, NUTRIENTS ARE DOWN, ALGAE ARE DOWN, BIOLOGICAL OXYGEN DEMAND IS DOWN

-- TWENTY YEARS AGO IT LOOKED DOUBTFUL THERE WOULD BE ANY FISH AT ALL IN LAKE ERIE; NOW THERE ARE PLENTY. OUR OWN POTOMAC RIVER, ONCE SO POLLUTED THAT PEOPLE WERE ADVISED TO AVOID EVEN WADING IN IT, IS WELL ON THE PATH TO RECOVERY

-- **(IF WE WORK TOGETHER, I AM CONFIDENT THAT OUR REMAINING ENVIRONMENTAL PROBLEMS, WHETHER LOCAL, NATIONAL, OR GLOBAL, CAN ALSO BE BROUGHT UNDER CONTROL)**

-- (I BELIEVE THAT WE CAN ACHIEVE SIMILAR RESULTS AS WE COME TO GRIPS WITH CLIMATE CHANGE)

-- WE ALSO HAVE LEARNED THAT WE NEED TO **(BRING ABOUT A MARRIAGE BETWEEN ENVIRONMENTAL AND ECONOMIC CONSIDERATIONS**

-- **(ECONOMICS CAN HELP US DETERMINE THE HUMAN CONSEQUENCES OF BOTH CLIMATE CHANGE AND POLICY ACTIONS TAKEN TO ADDRESS IT)**

-- WE NEED TO INTEGRATE ECONOMIC POLICY WITH ENERGY POLICY WITH ENVIRONMENTAL POLICY

-- WE HAVE ALSO LEARNED THAT WE NEED TO PROVIDE THE RIGHT ECONOMIC INCENTIVES TO PROMOTE ENVIRONMENTAL PROTECTION

-- **THE SAME FLEXIBLE, MARKET-BASED SYSTEMS THAT HAVE PROVEN TO BE THE MOST EFFECTIVE IN PRODUCING GOODS AND SERVICES CAN ALSO BE THE MOST EFFECTIVE IN PROTECTING THE ENVIRONMENT**

-- THE ACID RAIN PROVISIONS OF THE PRESIDENT'S CLEAN AIR ACT PROPOSALS ARE AN EXAMPLE OF THE USE OF MARKET INCENTIVES TO ACHIEVE ENVIRONMENTAL GAINS AT THE LOWEST COST.

-- THE COMMAND-AND-CONTROL APPROACH OF THE ORIGINAL CLEAN AIR ACT WAS SUCCESSFUL UP TO A POINT -- AS INDICATED BY THE IMPROVEMENTS IN AIR QUALITY I JUST MENTIONED

-- BUT THIS APPROACH IS MUCH MORE DIFFICULT TO APPLY TO DIFFUSE, DIVERSE SOURCES OF POLLUTION -- SUCH AS MANY OF THOSE THAT CONTRIBUTE TO CLIMATE CHANGE

-- TO GET AT THESE SOURCES, WE SAW THE NEED TO INCORPORATE MARKET INCENTIVES INTO THE LAW -- TO SEND A SIGNAL TO THE MARKETPLACE THAT "THE ENVIRONMENT IS AN ISSUE THAT WON'T GO AWAY; YOU'D BE WISE TO ADDRESS IT"

-- UNDER THE NEW LAW, ELECTRIC UTILITIES EMITTING HIGH AMOUNTS OF SULFUR DIOXIDES WILL BE GIVEN EMISSION ALLOWANCES DESIGNED TO REDUCE THEIR SULFUR DIOXIDE EMISSIONS BY ABOUT HALF; THEY WILL BE FREE TO BUY EMISSION ALLOWANCES FROM OTHERS IF CUTTING BACK ON EMISSIONS WOULD COST MORE THAN THE ALLOWANCES DO

-- ON THE OTHER HAND, THE COMPANIES COULD REDUCE EMISSIONS SO FAR THAT THEY WOULD BE ABLE TO BANK OR SELL THEIR EXTRA ALLOWANCES; AND THEY'LL BE FREE TO PURSUE THE CHEAPEST METHOD OF POLLUTION CONTROL -- ENERGY CONSERVATION, DIFFERENT FUELS, NEW TECHNOLOGY -- PROVIDED ONLY THAT THEY GET THE POLLUTION REDUCTIONS THE COUNTRY WANTS

-- A THIRD LESSON IS THAT THERE IS A POTENTIALLY CRITICAL ROLE FOR TAX POLICY IN ENVIRONMENTAL PROTECTION

-- MANY NATIONS HAVE BEEN EXPERIMENTING WITH TAX INCENTIVES AND DISINCENTIVES TO REDUCE EMISSIONS RELATED TO CLIMATE CHANGE

-- IN THIS COUNTRY, WE ARE TAXING CFC'S, AND WE WILL TAKE IN $400 MILLION FROM THIS TAX THIS YEAR, $5 BILLION OVER THE NEXT FIVE YEARS

-- FOURTH, AS I MENTIONED WITH RESPECT TO CFCS, WE HAVE LEARNED THAT THE SPECIAL NEEDS OF DEVELOPING COUNTRIES MUST BE ADDRESSED

-- WE IN THE UNITED STATES WILL HELP TO DO THIS, AND SO MUST THE MULTILATERAL AID AND LENDING INSTITUTIONS

-- WE WILL CONTINUE AND STRENGTHEN OUR PROGRAMS OF TECHNOLOGY TRANSFER, AND WE WILL STRONGLY SUPPORT THE WORK OF THE INTERNATIONAL ENVIRONMENTAL TECHNICAL TRANSFER ADVISORY BOARD

-- TECHNOLOGY TRANSFER AND TECHNICAL ASSISTANCE PROGRAMS TO DEVELOPING COUNTRIES ARE IMPORTANT OPTIONS FOR ENCOURAGING THE ADOPTION OF ENERGY EFFICIENCY AND RENEWABLE ENERGY TECHNOLOGIES

-- BUT THE DEVELOPING NATIONS THEMSELVES MUST BE WILLING TO PARTICIPATE; THEY CANNOT HAVE A PASS -- THEY MUST BE PART OF THE SOLUTION

-- THEIR FOREST POLICIES AND THEIR ENERGY POLICIES MUST CHANGE; THEY MUST BE WILLING TO PURSUE DEVELOPMENT THAT IS SUSTAINABLE AND ENVIRONMENTALLY SOUND

-- AND FINALLY, WE MUST BE FLEXIBLE IN OUR SEARCH FOR SOLUTIONS

-- RATHER THAN INSISTING ON TIGHTLY PRESCRIBED, "QUICK-FIX" REMEDIES TO IMMEDIATELY PERCEIVED PROBLEMS, WE MUST SET LONG-TERM GOALS AND ALLOW NATIONS AND INDUSTRIES THE SPACE TO WORK OUT SOLUTIONS BEST SUITED TO THE PARTICULAR SITUATION IN EACH COUNTRY

(DISPUTED PASSAGE:)

-- (FROM OUR EXPERIENCE WITH THE CLEAN AIR ACT, WE KNOW THAT IMPOSING TECHNICAL "FIXES" ON SHORT-TERM TIME HORIZONS IS COUNTERPRODUCTIVE; ALL IT DOES IS IMPEDE PROGRESS BY REMOVING THE INCENTIVE FOR INTRODUCING MORE FUNDAMENTAL, LONG-LASTING CHANGES IN TECHNOLOGY

-- (THE BEST EXAMPLE WAS THE STEP-BY-STEP REDUCTIONS IN MOTOR VEHICLE EMISSIONS IN THE 1970S, WHICH AS A PRACTICAL MATTER FORECLOSED THE DEVELOPMENT OF MORE FUNDAMENTAL AND BENEFICIAL CHANGES TO THE INTERNAL COMBUSTION ENGINE)

-- THE IPCC PROCESS WILL LET US TAKE A LONGER-TERM PERSPECTIVE ON CLIMATE CHANGE, THROUGH ITS EXCHANGE OF INFORMATION ON THE SCIENCE, THE ECONOMICS AND THE ENVIRONMENTAL EFFECTS

O IN SUMMARY, THEN, MY CENTRAL MESSAGE TO YOU TODAY IS THIS:

-- WHILE THE IPCC PROCESS IS DOING ITS WORK, MANY OTHER THINGS CAN BE DONE TO REDUCE EMISSIONS RELATED TO CLIMATE CHANGE THAT ARE GOOD PUBLIC POLICY REGARDLESS OF ANY ASSUMPTIONS WE MIGHT MAKE ABOUT THE DEGREE OR TIMING OF CLIMATE WARMING

-- AS I HAVE MENTIONED, THE UNITED STATES IS TAKING MANY SUCH "CLIMATE CONSCIOUS" STEPS; THE MEASURES ALREADY UNDERWAY, INCLUDING THE PHASEOUT OF CFCS, REFORESTATION AND CONSERVATION, WILL REDUCE THE U.S. CONTRIBUTION OF CLIMATE-ALTERING GASES BY MORE THAN 15 PERCENT BY THE YEAR 2000

-- MEANWHILE RESEARCH ON GLOBAL CHANGE, ON THE LIKELY EFFECTS OF SUCH CHANGE, AND ON THE COSTS AND HUMAN CONSEQUENCES OF POLICY MEASURES IS NECESSARY TO GUIDE FUTURE ACTIONS; WE ARE INTENSELY PURSUING SUCH RESEARCH AND ENCOURAGE OTHER NATIONS TO JOIN US

-- THE IPCC HAS SET A MODEL FOR SUCH COOPERATION; LET'S GIVE IT A CHANCE TO COMPLETE ITS WORK

-- CLEARLY, THE GLOBAL CLIMATE IS A MATTER OF PROFOUND IMPORTANCE

-- THE ENVELOPE THAT SUSTAINS LIFE IS VERY THIN AND, AS WE HAVE LEARNED FROM THE ANTARCTIC OZONE HOLE, FRAGILE AND VULNERABLE TO DESTABILIZATION BY HUMAN ACTIVITY

-- MORE THAN AT ANY PREVIOUS MOMENT IN HUMAN HISTORY, NATURE AND NATURAL SYSTEMS ARE IN HUMAN HANDS, DEPENDENT ON HUMAN EFFORTS

-- OUR SITUATION TODAY GIVES A NEW MEANING TO STEWARDSHIP, AND A NEW SIGNIFICANCE TO THE CONCEPT OF GLOBAL ENVIRONMENTAL COOPERATION

-- WE ARE COMMITTED TO ACTION TO ADDRESS THE PROBLEM OF CLIMATE CHANGE

-- THE UNITED STATES HAS LONG BEEN A LEADER ON ENVIRONMENTAL ISSUES -- AND WE INTEND TO CONTINUE TO BE A LEADER

-- WE ARE LOOKING FORWARD TO WORKING WITH YOU -- AND THE ENTIRE INTERNATIONAL COMMUNITY -- ON THE CHALLENGES THAT LIE AHEAD

-- THANK YOU

Speech of Admiral James D. Watkins, U.S. Navy (Retired)
U.S. Secretary of Energy
before
The White House Conference
on
Science and Economics Research Related
to Global Change
Wednesday, April 18, 1990

Good afternoon, ladies and gentlemen. It is a pleasure to have the opportunity to talk to you about my views on developing an international consensus to protect our environment. As President Bush said in his State of the Union Address two months ago, we have a special responsibility, which he called "global stewardship," to pass on to our children a world rich in natural wonder and capable of supporting economic growth for all regions.

The record of international responses to regional and global environmental concerns is limited -- it is only over the last 10 years that nations have agreed worldwide to cooperate to solve environmental problems. While the U.S. has had tough legislation to protect the Nation's waterways and air since 1972, and first developed legislation to study how to protect these resources in the 1950's, concerted international responses did not begin until the end of the 1970's. In 1979, for example, the United Nations Economic Commission of Europe (ECE) developed the Long Range Transboundary Air Pollution Convention, the world's first framework for coordinating responses to regional industrial pollution.

In the early 1980's, the U.N. Environmental Programme attempted to reach a global agreement on the protection of the stratospheric ozone layer. The U.S. and other countries sought both a framework convention and a control protocol as one single step. But that effort failed, primarily because no global consensus had been developed on the extent of the problem and on the appropriate response. We learned our lesson from this failure -- the lesson of the pitfalls of premature action. Then in 1985, the Vienna Convention established a process to develop a consensus that was previously lacking. Negotiations began in December 1986 in Geneva and a mere nine months later culminated in the Montreal Protocol. The same process is expected to lead to a phasing out of primary ozone depletion substances, with agreement expected by this June.

The Intergovernmental Panel on Climate Change (IPCC) was established in November 1988 with a clear mandate to conduct the science and impact assessments crucial to forming consensus. These studies, to be completed this summer, will lay the basis for a framework convention. In fact, many heads of state have already committed to this convention. The U.S. has proposed that it host the initial negotiating session for the convention.

We are continuously gaining new insights into the complex phenomenon of global climate change. Our estimates of

temperature increase and sea level rise expected from a doubling of atmospheric carbon dioxide are constantly under revision.

For example, scientists in the United Kingdom recently introduced better simulation of cloud processes in their climate change model. For an effective doubling of carbon dioxide, their estimate of average global surface warming dropped from 5.2 degrees Celsius to 1.9 degrees Celsius. Another forecast, using models with improved representation of ocean heat uptake and circulation has predicted that the Southern Hemisphere will not warm at the rate of the Northern Hemisphere -- in fact, parts of the southern regions may actually cool.

These forecasts are based on data from the General Circulation Models (GCMs). These models simulate the physical results of climate change on powerful supercomputers. Unfortunately, the GCMs are inadequate in predicting the role of clouds in reradiating heat, and the role our oceans play in absorbing heat and removing carbon dioxide from the atmosphere.

A major component of the U.S. climate research program is aimed at improving the predictability of the GCM's within the next five-to-ten years. We recognize the pivotal role that clouds play in the climate feedback balance and have launched research activities to better include them in the climate models. Satellite data will be compared with data collected from the

earth's surface to solve the puzzle of cloud interactions. We have also realized the importance of the oceans in climate change and have joined with other nations in studies of both ocean circulation and biology.

Processing vast amounts of climate data acquired by both satellite and ground-based observing systems requires greatly expanded data processing systems. We are aggressively pushing forward the frontiers of scientific computing with innovative computer architectures and advanced software systems.

To achieve our overall research goals, we are proposing to spend more than $1 billion in FY 1991. The NASA Mission to Planet Earth will be the centerpiece of an integrated international satellite program for monitoring global change.

Although the detail from the GCMs is inadequate, they will influence the assessments made by the IPCC working groups. Impacts of potential change cannot be measured currently, although there have been efforts to estimate the impacts assuming that certain ranges of regional climate change occur. Response strategies involve both limitation of change in the form of reduced emissions, and adaptation to climate change. Adaptation is particularly sensitive to the lack of regional detail and the uncertainty surrounding the timing, the magnitude, and even the direction of climate change. The IPCC assessments will provide

valuable guides for future negotiations and future research directions, both internationally and nationally.

The completion of the IPCC report is not a goal unto itself, but in fact it is only the beginning.

An environmental era is beginning. An era in which environmental goals can be integrated with our economic policies, our energy policies, and our international financial and technology assistance programs. This era will come to be only if we understand that economic growth and environmental integrity are not contradictory. A sound environmental policy and a strong economy are hand-in-hand -- both are key to environmental stewardship. The economy is not sound if the environment is in ruins and the environment won't be healthy if a nation's economy is depressed or underdeveloped.

For that reason I believe we must usher in a new era of global cooperation: for environmental protection and economic growth; for intelligent management of industrial and natural resources; and above all, for sustainable development -- around the world.

We cannot afford to embark on this era unwisely or rashly. We must have the knowledge, the technological expertise and the

economic tools to ensure that we head down the best paths to sustainable economic development.

I am concerned that some just do not believe this. Some are suggesting that we must act now without credible scientific or economic analysis. They believe that there is enough evidence to take action and impose international sanctions to significantly reduce greenhouse gases. Some are suggesting that we must impose a heavy tax on coal use. These taxes, which are intended to stabilize and then reduce emissions of carbon dioxides by as much as 20 percent, are being estimated to cost as much as one percent to five percent of a nation's gross domestic product each year. Actions that impose such a heavy economic penalty will not only delay our ability to negotiate an international agreement -- but acting without knowing the magnitude and dimensions of the costs will ultimately doom this effort to failure.

Likewise, it is equally unsound for some countries to continue to use declarations from international meetings to manipulate action before the IPCC assessment is complete. Can scientific evidence really be ignored in addressing this problem?

It is time to put emotion, politics, convenient assumptions and trendy beliefs aside; and to look objectively at scientific data. Time and time again, we have allowed unsubstantiated hypotheses to result in public policy stampedes.

One example is the recent Alar scare in the United States. The Alar scare began with a TV report that warned that 6,000 children would eventually get cancer from apples treated with Alar. Apple sales nosedived. Schools pulled apples from their lunch programs. Parents poured apple juice down the drain. Even those growers who did not use Alar and did not sell apples treated with Alar, saw customers switch from their red apples to green apples. Orchards in the country lost an estimated $250 million.

Shortly after the report aired, the National Research Council released a three-year study reporting no evidence that pesticides or natural toxins in food contribute significantly to cancer risks in the U.S. According to the Food and Drug Administration, cancer risks posed by diet mostly result from naturally occurring substances, not man-made contributions to the food chain.

Then there's the asbestos saga. Science magazine recently published the results of a study finding that the available data does not support the notion that low-level exposure to asbestos in buildings and schools is a health risk.

Although asbestos has caused disease in the work place, recent epidemiological data suggest that exposure to chrysotile

at the current occupational standards does not increase the risk of asbestos-associated diseases.

Yet, asbestos engenders fear and panic in U.S. society. Extensions of EPA requirements to approximately 733,000 public and commercial buildings containing asbestos will cost $53 billion in today's dollars over the next 30 years.

We must work to ensure that similar stories are not told of us and how we interpreted -- or misinterpreted -- the often conflicting information on the understanding of the science and impacts of climate change.

Despite these scientific uncertainties, we should not ignore the warnings that climate change may someday occur. We should respond today in a sound and reasonable manner to this potential threat. In areas where it makes sense, we should take action now as an insurance policy while we verify the scientific uncertainties. In the U.S. and in many of your countries, these steps are being taken now.

Let me provide some examples of initiatives we have taken:

- To reduce demand for new power plants and additional pollutants, we are employing new energy efficiency programs and more stringent standards for:

-- refrigerators, freezers and residential furnaces; and commercial buildings;
-- more efficient lighting in Federal Government buildings; and
-- through better Utility Resource Planning, we are also reducing energy demand through encouraging greater load management and conservation investments.

- We are also joining many of you in the Montreal Protocol by phasing out CFC's and reducing halons to stop the depletion of the ozone layer.

- We will be implementing a revised Clean Air Act that will curtail acid rain, urban ozone and toxic pollutants. Because the programs allow market choices to meet the emissions reductions, we believe that as much as 10 percent of electricity emission reductions will occur due to conservation measures.

- We will plant one billion trees a year as sinks for carbon dioxide from the atmosphere. This program alone could capture close to one-half billion tons of atmospheric carbon dioxide by the year 2000.

- We are considering legislation that encourages the use of alternatives to gasoline as a way to reduce CO2 emissions from automobile fuels.

- We have deregulated the use of natural gas to promote greater use not only for the home, but for transportation fuel and for generating electricity. Natural gas is safe and cost-effective and emits less CO2.

- We are spending $5 billion on clean coal technologies. These new technologies reduce CO2 emissions by 20 to 40 percent compared to existing technologies.

- We are spending $138 million in 1990 on renewable energy, such as solar energy, biomass, wind, hydro and geothermal, that emit no CO2.

- We are developing safer, more cost-effective nuclear power plants that also emit no CO2.

- We are developing a National Energy Strategy that will, among other objectives, provide the Nation with a focused, long-range approach for reducing pollution, including greenhouse gases, in the most economic way possible.

- Finally, we announced this week we will upgrade 1.4 million public housing units to reduce their energy usage and reduce CO2 by over 3 million tons each year.

If successful, these actions related to energy use could reduce emissions of CO2 by as much as 300 million tons per year by 2000 from current projections. The U.S. tree planting initiative would capture another half-billion tons by the year 2000. Although we are currently emitting 4.5 billion tons of CO2, these steps and the promise of clean coal, increased use of natural gas, safer nuclear power, and expanded use of renewable energy, can increase our potential to limit CO2 emissions into the next century.

No one nation, nor even all the industrial countries together, can resolve the climate change issue. For example, if Eastern Europe were to stabilize emissions at 1987 levels, and if developing countries were to continue current emissions trends, achieving a 20 percent reduction in global CO2 emission by 2005, this would mean that even if the Organization for Economic Cooperation and Developed (OECD) countries totally reduced their emissions, it would not be enough.

Obviously, the solution must involve all nations -- and nations at all levels of development. For each nation has a

right to expect legitimate development. We must work together to develop effective steps for all of us to participate in economic development by transferring our emission technologies -- in energy, industry and agriculture -- to other countries.

In the U.S. we are taking steps to transfer clean coal technology and greater energy efficiency to other countries. Specifically, through the Support for Emerging European Democracy (SEED) Act of 1989, we will be providing valuable assistance to Poland and Hungary, in support for their efforts to promote more environmentally sound energy production. For example, in FY 1991, the President has proposed that $20 million be authorized to help Poland burn fossil fuels cleanly.

In some countries, there are immediate opportunities for expanding the use of renewable energy options. The U.S. is actively involved in transferring such technologies to other countries through various government programs. These efforts are coordinated by the Committee on Renewable Energy Commerce and Trade. We call it CORECT.

By employing greater energy efficiency, investing in new, less polluting energy technology and sharing that technology with emerging nations, we can begin today to build consensus on the appropriate, sustainable steps to curb greenhouse gases.

To that end, the international community must focus its efforts on the IPCC process. All other international efforts need to serve the IPCC process and be judged in that light. The basic question for other international meetings is: Do they support the IPCC process which is directed at a common understanding of the dimensions of climate changes and its possible responses? If not, then these other efforts will not contribute to solving the problem for the long-term.

When President Bush, in his State of the Union Address, spoke of stewardship, he meant that we owe our children and our grandchildren a world well-cared for -- because the planet we inhabit is only borrowed, never owned.

Stewardship means just that. It means caretaking, remembering that our environment is fragile and we are temporary. As Emerson said, "We do not inherit the Earth from our ancestors, we borrow it from our children."

Thank you.