

THE WHITE HOUSE

Washington, D.C.

WHITE HOUSE CONFERENCE ON CLIMATE CHANGE:

THE CHALLENGE OF GLOBAL WARMING

Monday October 6, 1997

Georgetown University

Washington, D.C.

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10:00 a.m.

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[TRANSCRIPT PREPARED FROM A TAPE RECORDING.]

C O N T E N T S

<u>SPEAKERS</u>	<u>PAGE</u>
Father Leo O'Donovan Georgetown University	5
The Honorable Al Gore Vice President of the United States	9
The Honorable Bill Clinton President of the United States	19
 <u>PANEL I: THE SCIENCE OF GLOBAL WARMING AND CLIMATE CHANGE</u>	
Dr. John Holdren, Harvard University	33
Dr. Thomas Karl, NOAA	48
Dr. Diana Liverman, University of Arizona	54
Dr. Donald Wilhite University of Nebraska	64
Dr. Robert Watson, Chairman, IPCC	70
 <u>PANEL II: THE ROLE OF TECHNOLOGY IN REDUCING GREENHOUSE GAS EMISSIONS</u>	
Federico Pena, Secretary of Energy	88
Tom Casten, Trigen Energy Corporation	97
Kurt Yeager, Electric Power Research Institute	103
Mary Good, Venture Capital Investors	111
Michael Bonsignore, Honeywell Corporation	118
Mason Willrich, EnergyWorks	127

PANEL III: THE KYOTO CONFERENCE AND
U.S. NATIONAL INTERESTS

Madeleine Albright, Secretary of State	165
James D. Wolfensohn, President, The World Bank	173
Richard Schmalensee, Professor, Massachusetts Institute of Technology	179
Daniel Yergin, President, Cambridge Energy Research Associates	183
E. Linn Draper, Chairman, American Electric Power	194
Fred Krupp, Executive Director Environmental Defense Fund	198
Mae Jemison, President, Jemison Group, Inc.	189
Jessica Tuchman Mathews, President, Carnegie Endowment for International Peace	203

PANEL IV: CLIMATE CHANGE POLICY AND
THE U.S. ECONOMY

Larry Summers, Deputy Secretary of the Treasury	215
Robert Repetto, Vice President, World Resources Institute	218
William Nordhaus, Yale University	222
Robert Stavins, Professor, Harvard University	228
John Sweeney, President, AFL-CIO	235
Richard Sandor, Chairman & Chief Executive, Centre Financial Products	238

P R O C E E D I N G S

MODERATOR: Good morning. Welcome to Georgetown University and the White House Conference on Climate Change. Before we start our program this morning, we ask that you please note the nearest emergency exit. In addition to the third and fourth floor main entrances, there are also two emergency exits at the rear of the stage behind the large screen TVs. Also, please exercise extreme care around the lighting equipment upstairs, and be mindful of cables.

Now, please welcome Georgetown University's Women's A Capella Group, The Grace Notes.

[Applause, followed by vocal selections.]

["Hail To The Chief played."]

MODERATOR: Ladies and gentlemen, the President and Vice President of the United States, accompanied by Georgetown University President Father Leo J. O'Donovan.

[Applause. "Hail To The Chief" played.]

MODERATOR: Ladies and gentlemen, please

remain standing for the singing of our national anthem.

[Anthem not on audio.]

FATHER O'DONOVAN: Mr. President, Mr. Vice President, members of the Cabinet. It's a little bit like welcoming an ocean wave as you all sit down. Mr. President, Mr. Vice President, members of the Cabinet, members of Congress, distinguished guests, faculty and students of Georgetown University, good morning and welcome.

Since half the United States Government, or more, is here this morning, I want you to know that I have asked several Jesuits to stay in the chapel to play [sic] for your welfare.

Georgetown is deeply honored to host the White House Conference on Global Warming.

Throughout this day, our President, Vice President, First Lady, Cabinet secretaries, will engage us in their ongoing national dialogue about one of the most significant challenges before us today. We will consider, too, the opportunities inherent in addressing that challenge.

As the President and Vice President have noted since the earliest days of their administration, attention to global warming is imperative. We now know that for the first time in the history of our species, we are changing the environment that supports us more quickly than we are acting to adapt to those changes.

This knowledge brings with it profound implications. If we continue on this course, we face the prospect of a world that does not foster and sustain life but perhaps threatens it.

At the United Nations special session on environment and development this summer, the President exhorted us, Government, universities, business, labor, citizens, to work together to address this problem. He challenged us to direct the same ingenuity and determination that has made the United States the world's leading nation toward developing the technologies that will conserve energy, renew resources, and dramatically reduce the greenhouse emissions that induce global warming.

He has suggested that such efforts can bring both the long-term benefit of preserving our environment and the immediate benefits of creating new jobs, and positioning us as the world's leader in an emerging technological enterprise.

Georgetown has had firsthand experience with this possibility. We are very proud of our ongoing work with the Department of Transportation's Fuel Cell Bus Project, which has resulted in the development of quieter, cleaner, more efficient vehicles.

And we look forward to continuing to contribute to the dialogue on global warming and other pressing environmental issues through the Georgetown Center for the Environment.

To spur further common work toward the goals the President has outlined, he has brought together here industry leaders, scientists and scholars, economists, environmental policy makers, and authorities on international affairs to exchange ideas and to explore solutions.

In anticipation of the international

conference on the reduction of greenhouse gases to be held in Kyoto in December, we will consider not only our potential and obligations as a nation, but also the ways in which we can--and must--join forces with all the nations of the world to find a global solution to this global problem.

Around the world, we must define ourselves more broadly than we may be accustomed to doing--thinking of ourselves not just as individual nations, but truly as part of the human community. And we must accept our collective responsibility as custodians of the earth.

As a Jesuit university, Georgetown has a special interest in today's dialogue. Since the days of Ignatius, Jesuits have "sought God in all things"--in our fellow human beings and the elements of our existence, in the plants giving us life and the creatures of our fields and forests. As Jesuit poet Gerard Manley Hopkins put it, for us "the world is charged with the grandeur of God."

When the Society of Jesus came together at our 34th Congregation in 1995 we, of course,

renewed our commitment to the promotion of justice as a fundamental part of our mission.

In doing so, we thought about some of justice's "new dimensions," such as a concern for the environment arising from a commitment to "preserving the integrity of creation" for the generations to come.

And so, Mr. President, Mr. Vice President, we are deeply grateful to you for your remarkable leadership and vision on this issue. And we are delighted that this extraordinary group gathers in this hall today, named after Georgetown's first student, bringing remarkable specialized knowledge and abilities to our shared interest in the well-being of humankind.

Welcome, again, and it's a very great pleasure, ladies and gentlemen, to introduce to you the Vice President of the United States.

[Applause.]

VICE PRESIDENT GORE: Thank you very much, thank you, thank you.

Thank you very much.

Thank you very much, ladies and gentlemen,
thank you.

And, Leo, thank you, for your kind words,
we are very grateful for the hospitality and for
your leadership on so many important matters. And
on behalf of the President, who I will present to
you in just a moment, I want to acknowledge some of
the distinguished guests who are here and, please,
forgive me in advance for overlooking some because
I look around here and I see that this is an
audience filled with distinguished individuals.

But I want to start by noting that
practically the whole Cabinet is here, with the
Secretary of State, Madeleine Albright and the
Secretary of the Interior, Bruce Babbitt. Secretary
of Agriculture Dan Glickman the Secretary of Energy
Federico Pena, the Secretary of Transportation
Rodney Slater, the Administrator of the
Environmental Protection Agency Carol Browner, the
Director of FEMA James Lee Witt, our UN Ambassador
Bill Richardson.

Also, we are joined by the Chair of the

Council on Environmental Quality Katie McGinty, the head of USAID Brian Atwood, the President of OPIC George Munoz, the head of USIA Joe Duffy and others and some members of Congress, who are here, including Senator Pat Leahy, and Congressman George Miller and Congressman Sam Farr and there may well be others. Again, I apologize for overlooking anyone.

Also, the Chair of the Council for Economic Advisors Janet Yellen; Jack Gibbons, the President's Science Advisor, Tim Wirth at the State Department, a lot of other individuals who are here including leaders of environmental organizations and business groups, and many others.

Well, it is an honor to open this White House Conference on Climate Change and to welcome such a large and diverse and distinguished group to address the challenge of global climate disruption.

I want to begin by thanking President Bill Clinton for conceiving of and hosting this conference, and for his outstanding leadership in shining the public spotlight on the risks of global

warming, and for helping focus national and international attention on this growing problem.

I am not the only one who has come to expect this kind of leadership from a person who, in the last five years, has earned the right to be called the Environmental President. He has led landmark initiatives to protect the quality of our land, and our air and our water and preserve our natural resources. Doing it while, at the same time, launching an American economic renaissance.

No future leader of this country will ever again be able to say to America, we have to choose between building the economy and preserving the environment because this President has proved that you can do both and that both reinforce each other. And we thank you, Mr. President, for that leadership.

[Applause.]

VICE PRESIDENT GORE: Global climate disruption represents one of the single greatest threats to our future. This view, which I have just expressed, is based on a mounting body of data

which establishes beyond any reasonable scientific doubt that emissions of greenhouse gases are changing our climate.

This morning you will hear evidence from some of the world's leading scientific experts on the global climate. You will hear also from experts on other important aspects of climate change who will tell us how technology can help us reduce emissions, how we need to take a global approach and how various policy options have the potential to affect our economy.

My role in these few minutes of welcome is not to summarize or foreshadow their findings but to set this issue in its appropriate historical context. Those who have dealt with the issue of global climate disruption over the years have had to battle the first obstacle which is a feeling on the part of many that since the earth is so large and we are so small, how could we possibly alter the fundamental composition of the global atmosphere?

But, as the facts come rolling in, it is

abundantly obvious that there are new realities we face. We are adding a billion new people every ten years now, a China's worth every decade. That is something fundamentally new in human history. And the powerful new technologies that have come out of the still accelerating scientific and technological revolution have vastly magnified the average ability of each one of those new billions of people to have an impact on the environment.

Those technologies have brought us many blessings, but they have also brought some unintended consequences that we didn't think about very much in advance. If the growth in population had not been accompanied by the advances in technology it might not have changed the fundamental relationship between human kind and the earth but these two factors together, coupled with our approach to them, have now really altered the effect that human kind can have on the earth's environment.

And, of course, the atmosphere is the most vulnerable part of the earth's environment because

it is so thin, relatively speaking, and we are now able to alter its composition.

We cannot turn back; we must look ahead. And in looking ahead we must take steps that can soften our impact on the earth's environment and quicken our progress toward a more prosperous world. And, yet, we must be realistic: Solving this problem will take time. It has been created over a period of time. We are now, of course, accelerating the process by which climate change is being created, but we have to begin to reverse the trends that created and problem and, in doing so, recognize that it will take some time.

If we ignore the scientific warnings and continue stubbornly on our current course we had better begin to prepare what we would like to say to our children and grandchildren. Because if they encounter the terrible consequences the scientific community is saying now come as a result of global climate disruption, and then look back at the evidence that was clearly laid out for us and our generation they might fairly ask, if you knew all

that why didn't you do something about it?

Well, I don't want to hear that question years from now and we can prevent this by taking the right steps now.

Because solving global climate disruption is not only an environmental imperative, it is also an economic imperative. We understand that if we approach the global climate change problem in the wrong way we could hinder economic growth. We will not do that. We want sustainable growth and the kind of progress that can result from approaching the problem in the right way. That means taking concrete steps that reduce emissions without jolting the economy.

We will hear today about some different options and ideas and I am confident that working together we can find a sensible approach. One of the answers will involve new technologies. Already we are developing and accelerating the use of clean energy. We have a Partnership for a New Generation of Vehicles, for example, that will triple the efficiency of today's cars while preserving their

current performance, comfort and safety.

We are working to produce low-cost transportation fuels using new energy crops. We are working with the building industry to build structures that are 50 percent more energy efficient. And, of course, an important part of the longer term answer lies in the more rapid development of low-carbon energy sources such as solar, wind, biomass, hydrogen and fusion.

While these new fuels may, in some instances, sound like they are far-off, some are nearly cost-effective today and all offer tremendous promise for tomorrow.

To make these new technologies a reality for our children requires that we make the right kinds of investments today.

Welcome, then, to the White House Conference on Climate Change. Our purpose is clear: We are facing a global threat that demands a global response. And while no one country can solve the problem on its own, no coalition of countries can solve the problem without the active

participation and leadership of this country.

So, let us launch the great resources of a great country on behalf of the children of our nation and the world. Let us summon America's scientific genius, economic might, commercial ingenuity and history of leading large coalitions against threats to our common future.

Now is the time to cut back emissions, design 21st Century solutions, and begin the steps necessary to return our planet to the stable climate balance that has been enjoyed by our ancestors throughout the entire history of civilization, to preserve the future of life as we know it and as we would like our children to know it.

To all of you, thank you for your participation, and welcome and, please, participate actively throughout the day.

Now, it is my great pleasure and honor to introduce a friend, someone who stands up and provides leadership when it is most needed; a person whose own optimism, inventiveness and

exuberance has helped to give us an expansive and accurate view of America's options and possibilities; a man committed to a surging economy, a stable climate and a healthy environment and a bright future for all of our people, President William Jefferson Clinton.

[Applause.]

PRESIDENT CLINTON Thank you. Thank you very much.

Thank you, Mr. Vice President, for your remarks and your remarkable leadership to help us keep our earth in the balance.

Thank you, Father O'Donovan, for letting me come home to Georgetown one more time to discuss a matter of immense importance to America and its future.

I thank the members of Congress and the members of Cabinet and the administration who are here, all those who have agreed to serve on the panels, and all of you who have come to be a part of this important day.

Six years ago last Friday--I can hardly

believe it, but it was six years ago last Friday that I announced my intention to run for President, challenging America to embrace and to vigorously pursue a vision of our country for the 21st century to make the American dream alive for every person responsible enough to work for it, to keep our country, the world's strongest force, for peace and freedom and prosperity, to bring our people together across all the lines that divide us into one America.

Shortly afterward, I came here to Georgetown to this great hall to outline specific strategies and new policies, to achieve that vision, rooted in our values of opportunity and responsibility, faith and family and community, designed to help Americans seize the opportunities and solve the problems of this new age.

It was clear to me that our new direction had to be rooted in some basic guidepost, that we had to be oriented toward the future, not the past, toward change, not the status quo, toward partnership, not division, toward giving all a

chance, not just a few, and finally toward making sure America leads, not follows.

We tried to develop a new approach to Government where we didn't claim to do everything and we wouldn't tolerate doing nothing, but instead, we focused on giving people the tools to make the most of their own lives and creating the conditions that would allow them to succeed, and we had new policies, economic policies and trade policies, education policy, crime and welfare, policies toward the working poor, policies to bolster families and help them balance work and child-rearing, policies in health care and foreign policy, and, yes, policies in the environment.

In the last four years and eight months, I think it is fair to say that together we have made real progress toward that vision of the 21st century. We stand at the threshold of that century stronger than most people thought was possible back in 1991. With our economy thriving, our social fabric mending, our leadership in the world strong, we have a solid foundation of achievement on which

to stand as we take on the remaining challenges to build that bridge to the 21st century.

We are back here at Georgetown today because global climate change clearly is one of the most important of those challenges, and also one of the most complex, crossing the disciplines of environmental science, economics, technology, business, politics, international development, and global diplomacy, affecting how we and all others on this planet will live, support our families, grow our food, produce our energy and realize our dreams in the new century. That is why we put together this White House Conference on Climate Change, bringing together experts and leaders with a wide range of knowledge and a wide range of views.

People of goodwill bring to this conference many honest disagreements about the nature of the threat we face and how we should respond. That is healthy in a democracy like ours. My hope is that we will take advantage of this forum to actually talk with each other, rather than

past each other, for it is our responsibility to work together to achieve two vital and compatible goals, ensuring the continued vitality of our planet and expanding economic growth and opportunity for our people.

Despite the complexities of these challenges, we have good reason to be optimistic, beginning with our 220-year record of making all manner of difficult problems solvable, and importantly, a very good record in the last generation of environmental progress. In the last generation alone, we came together to heed Rachel Carson's warnings, and ban DDT and other poisons. We cleaned up rivers so filthy, they were catching on fire, phased out lead in gasoline and chemicals that were eating a hole in the ozone layer. We have worked with citizens to conserve the Headwaters Forest of Northern California, restore the Florida Everglades, protect Yellowstone National Park from the assaults of mining, in each case proving that environmental stewardship does not have to hamstring economic growth.

Indeed, in tackling the difficult task of cutting sulfur dioxide emissions with an innovative system of permit trading, the United States is well ahead of the schedule we set for ourselves and well below the projected cost in cleaning the environment. I believe we can find that same common ground as we address the challenge of climate change.

Before we begin our discussion today, I think it is important for me to explain the four principles that will guide my approach to this issue.

First, I am convinced that the science of climate change is real. We will hear more about this today from our first panel, but for me, the bottom line is that although we do not know everything, what we do know is more than enough to warrant responsible action.

A great majority of the world's climate scientists have concluded if we don't cut our emission of greenhouse gases, temperatures will rise and will disrupt the global climate. In fact,

most scientists say this process has already begun. I might add that I had nothing to do with scheduling this conference on the day which is predicted to be the hottest October the 6th that we have ever had in Washington, D.C.

[Laughter.]

PRESIDENT CLINTON: I know not everyone agrees on how to interpret the scientific conclusions. I know not everyone shares my assessment of the risks, but I think we all have to agree that the potential for serious climate disruption is real. It would clearly be a grave mistake to bury our heads in the sand and pretend the issue will go away.

The second principle is that when the nations of the world meet in December in Kyoto, Japan, we must be prepared to commit to realistic and binding goals on our emissions of greenhouse gases. With 4 percent of the world's population, we enjoy more than 20 percent of the world's wealth, which helps to explain why we also produce more than 20 percent of the world's greenhouse

gases. If we expect other nations to act on the problem, we must show leadership.

The third principle is that we must embrace solutions that will allow us to continue to grow our economy as we honor our global responsibilities and our responsibilities to our children. We have worked far too hard to revitalize the American dream to jeopardize our progress now. Therefore, we must emphasize flexible market-based approaches. We must work with business and industry to find the right ways to reduce greenhouse gas emissions. We must promote technologies that make energy production and consumption more efficient.

There are many people here today from companies that are addressing the climate change in innovative ways, taking steps that will save money for American families even as we reduce the threat of global warming.

For example, a number of leading electric utilities, including AEP, Southern Company, Niagara Mohawk, and Norther States Power, are working with

homeowners to promote a new technology called geo-exchange, using geothermal pumps to heat and cool homes far more cheaply than traditional systems, while reducing greenhouse gas emissions by 40 percent or more.

Ballard Power and United Technologies are leading pioneers in developing fuel cells that are so clean, their only exhaust is distilled water.

Right now Ballard is working with Chrysler, Mercedes-Benz and Toyota to introduce fuel cells into new cars. Both of these technologies represent the kind of creative solutions that will make our job much easier.

The fourth principle is that we must expect all nations, both industrialized and developing, to participate in this process in a way that is fair to all. It is encouraging that so many nations in so many parts of the world are developing so rapidly. That is good news for their people, and it is good for America's economic future, but as we have seen right here at home, rising energy demands that accompany economic

development traditionally have meant large increases in greenhouse gas emissions.

In fact, if current trends continue, emissions from the developing world will likely eclipse those from the developed world in the next few decades, but they have an opportunity to pursue a different future without sacrificing economic growth.

The industrialized world alone cannot assume responsibility for reducing emissions. Otherwise, we will wind up with no reduction in emissions within a matter of a few decades. In Kyoto, therefore, we will ask for meaningful, but equitable commitments from all nations.

Second, we must explore new ways for American businesses to help these rapidly growing countries to meet their developmental needs with cleaner and more efficient energy technologies.

Today, I hope we can take a step forward in putting all four of these principles into effect. We have studied this issue long enough to know that there are sensible options for action.

It is our job now to pull them together into a coherent plan.

Nearly three decades ago when the Apollo astronauts first went to the moon, we gained an entirely new perspective on the global challenge we face today. For looking down on earth from the vantage point that revealed no political boundaries or divisions, the astronauts had the same chilling sensation. They were simply awestruck by how tiny and fragile our planet is, protected from the harsh void of space by an atmosphere that looked as thin and delicate as the skin of an onion.

Every astronaut since has experienced the same insight, and they have even given it a name, "the overview effect." It is instilled in each new astronaut a passion to convince people we must work together on earth's behalf.

Rusty Swikert has said, "You realize that on that little blue-and-white thing, there is everything that means anything to you, all history and music and poetry and art and death and birth and love, all of it on that little spot out there

you can cover with your thumb."

To the best of my knowledge, only one person here has actually experienced the overview effect firsthand, Dr. Mae Jemison, a former Shuttle astronaut and current international development expert who will participate in our third panel discussion this afternoon. Nonetheless, I challenge everyone in this room to rise to a vantage point high enough to experience the overview effect. It will enable us to reach common ground.

Let me say when the Vice President was talking and Father O'Donovan was talking, I was looking around this old hall that I have loved for so long, and I found it utterly amazing that I first came here 33 years ago.

I was reading this morning up at Camp David the list of people who were going to be here today, and I found it utterly amazing that a few of you, I first talked to as long as 20 years ago about the need to build an alternative energy future for America. And I found it completely

amazing that five-eighths of my Presidency is behind me.

I make these points for this reason. If you think about the benchmarks in your own life, it does not take long to live your life, and what seems at the beginning of your life a very long time, seems to have passed in the flash of an eye once you have experienced it.

These great developments, such as the one we are here to talk about today, occur over many life spans, and popular democracies are far more well organized to take advantage of opportunities or deal with immediate crises than they are to do the responsible thing which is to take a moderate, but disciplined approach far enough in advance of a train coming down the track to avoid leaving our children and our grandchildren with a catastrophe.

So I ask you to think about that. We do not want the young people who sat on these steps today, for whom 33 years will also pass in the flash of an eye, to have to be burdened or to burden their children with our failure to act.

Thank you.

[Applause.]

VICE PRESIDENT GORE: Mr. President, while they're removing the podium, I'm going to go ahead and begin the introduction of this panel. It gives me great pleasure to introduce some very distinguished individuals who are members of our first panel.

Dr. John Holdren, a professor of Environmental Science and Public Policy at Harvard University, is also a member of the President's Committee of Advisors on Science and Technology, and chair of the Task Force on U.S. Energy Research and Development Needs in the 21st Century.

Tom Karl is a senior scientist at the National Oceanographic and Atmospheric Administration and has recently done some path-breaking work that he will present here.

Dr. Diana Liverman is a professor at the University of Arizona and the chair of the National Academy of Sciences Committee on the Human Dimensions of Climate Change.

Dr. Don Wilhite, the director of the National Drought Mitigation Center, is a climatologist at the University of Nebraska, in Lincoln.

And Dr. Robert Watson, the director of Environment for The World Bank, is also head of the Intergovernmental Panel on Climate Change.

I think that we're going to start with Dr. John Holdren, and then move from there.

DR. HOLDREN: Thank you very much. Mr. President, Mr. Vice President, as you know, there is a growing scientific consensus on three critical points about global climate change. The first point is that the climate is changing in ways that are not explainable by natural causes.

The second point is that emissions of greenhouse gases from human activities, above all, from fossil fuel burning and from deforestation are the main causes of those changes.

And the third point is that the consequences of those changes in climate in the next century are likely to include significant

disruption of human health and well-being over substantial parts of this planet.

In talking about the key elements of this scientific consensus this morning, I'm going to rely rather heavily on the findings of the Intergovernmental Panel on Climate Change which has been mentioned a couple times, here, this morning. It's the international body that has drawn on the expertise of some 2,000 of the world's leading analysts of these matters to develop authoritative assessments to serve as the basis for decision making by policy makers and governments about how to react to this problem.

Dr. Bob Watson, who, as the Vice President just mentioned, is the head of the IPCC, will say a little more about it later this morning.

The problem we're dealing with, of course, is the problem that is popularly called global warming because it does entail raising the average temperature of the Earth's surface.

It also entails a lot more than that, as we're going to talk about, but the place to start

in discussing it is with why the Earth's temperature is what it is.

It turns out that just a few gases, which are naturally present in the Earth's atmosphere in quite small concentrations are responsible for keeping the surface of the Earth about 60 degrees Fahrenheit warmer than it would otherwise be. They're called greenhouse gases because they work in a way analogous to one of the functions of glass in a greenhouse; namely, they let incoming sunlight through but they trap some of the outgoing heat and send it back toward the ground.

The largest contributors to that natural greenhouse effect are water vapor, carbon dioxide, methane, and nitrous oxide. And without those trace greenhouse gases in the atmosphere, the Earth would in fact be too cold for life as we know it.

The problem we're talking about here is that for hundreds of years human activities have been adding greenhouse gases to the atmosphere, mainly, at first, carbon dioxide from deforestation. Later, carbon dioxide from fossil

fuel burning, methane, and nitrous oxide from land use changes, and finally, chlorofluorocarbons and their relatives from a variety of industrial processes, all of them greenhouse gases.

And in the last century, in particular, the huge growth of fossil fuel use as a result of industrialization has been the main factor, the main driver in lifting the carbon dioxide content of the atmosphere to about 30 percent above its pre-industrial value.

The concentrations of the other greenhouse gases have also been growing in this period. On the other hand, the atmospheric concentrations of particles put there by human activities have also been increasing.

Those extra particles in the atmosphere screen out some sunlight. They help form clouds that screen out even more, and so they've partly offset the warming effect of the greenhouse gas additions. But all in all, the net manmade addition to the greenhouse effect, from all of the greenhouse gases combined, minus the effect of the

particles, is about what it would be from the carbon dioxide additions alone.

And that's enough to cause changes in climate that have started to become measurable, and that threaten to grow in the future to levels that are highly disruptive of human well-being.

Now, up until now, the industrialized countries have accounted for most of the human additions of greenhouse gases to the atmosphere. The United States, with about 4 percent of the world's population, has been responsible for more than 25 percent of the emissions of greenhouse gases into the atmosphere over the last 45 years.

The less developed countries altogether, with about 80 percent of the population, have been responsible for less than 25 percent, that is less than the United States alone, of the greenhouse gas emissions into the atmosphere over that period.

Their per capita emissions are typically 1/10th or less the per capita emissions of carbon dioxide in the industrialized nations like the United States.

But 90 percent of the world's population growth over the next several decades is expected to occur in the less developed countries, and much of the economic growth over that period is expected to grow there, too, and that means that their greenhouse gas emissions, along with the fossil fuel use that they plan to use to drive much of that economic growth are going to go up.

In fact over the next century, under business as usual, we would expect the emissions from the less developed countries to pass those of the industrial nations around 2030 or 2035, as this particular graphic shows. Although it is important to note that their per capita emissions at the time they pass us will still be only about 1/6th of ours, and that it will take a considerable time thereafter before their cumulative contributions to the atmospheric build-up of these gases equal ours.

Now, over the last 100 years, while atmosphere carbon dioxide has been increasing, so has the Earth's temperature. The mean global air surface temperature on the planet has increased by

about one degree Fahrenheit over this period.

The surface temperature, this century, is as warm or warmer than in any century since 1400, and the last two decades of this century have been the warmest ones in the century. Eleven of the hottest years in the last 100 years have occurred since 1980, and 1995 was the hottest single year on record.

Those temperature changes have been greater at high latitudes than near the equator. Ocean surface temperatures have increased along with air temperatures over land. Day/night temperature differences have shrunk, and the way temperature varies with height in the atmosphere has also changed in this period.

And the point about all of this is that all of these observed changes are consistent with what basic climate science predicts will result from increasing greenhouse gas concentrations, and they are consistent also with the numerical results of the best computer models of global climate, when those are run with the observed increase in

greenhouse gas concentrations, with the increases in atmospheric particulate matter, and with the estimated variations in the output of the sun.

Now to help think about where this situation is headed in the future, the IPCC has developed a set of scenarios for emissions of greenhouse gases for atmospheric concentrations and for the likely associated temperature changes extending over the next century, out to the year 2100. These are shown on the current graphic.

The carbon dioxide concentrations on the top, the temperatures likely to be associated with that on the bottom, and the lines through the middle of that are the so-called business as usual energy future, where we're headed if we don't change very much from what we're doing now.

Where that is, where that business as usual is taking us is toward atmospheric concentrations of carbon dioxide near 700 parts per million of carbon dioxide by the year 2100. That's about two and a half times the pre-industrial concentration of carbon dioxide.

The accompanying further temperature changes beyond what has already occurred are estimated to be between 2 and 6 degrees Fahrenheit, associated with that carbon dioxide change. And as I mentioned before, those temperature increases would not be uniform because higher latitudes will warm more than the equatorial regions. The United States would face a warming in 2100, and after, of 5 to 10 degrees Fahrenheit, on the average.

Now, let me put this in perspective by showing one of the Vice President's favorite graphics, which shows carbon dioxide and temperature changes over the last 160,000 years, based on analysis of air bubbles trapped in ice cores in the Antarctic ice.

What you see when you look at this picture is that today's atmospheric carbon dioxide concentrations are already well outside the range of natural variations that occurred over the preceding 160,000 years, and by 2100, under business as usual, we'll reach carbon dioxide concentrations that haven't been seen on this

planet in the last 50 million years.

We'll be heading in the business as usual scenario toward a tripling of the pre-industrial concentrations of carbon dioxide, and we will have achieved that in the geological blink of an eye, exposing, as we do it, natural systems to a rate of temperature change faster than at any time in the last 10,000 years.

But of course it's not just the change in temperature that we're worried about. That temperature change is, in a way, just an indicator of a whole array of changes in the conditions that make up the climate. The patterns of hot and cold, of wet and dry, of winds and ocean currents, which, in turn, affect ecological systems and human well-being in a hundred different ways.

Particularly important in that is that global warming causes the planet's cycle of evaporation and precipitation, the so-called hydrologic cycle, to speed up. More heat means more evaporation, which means more water going into the atmosphere, and therefore, more water coming

out as rain and snow.

But the greater evaporation, an earlier snow melt that go with warming, can also mean, almost paradoxically, reduced soil moisture and less water availability in the growing season in regions where that's already a problem.

Warming will also cause sea level to rise, mostly from the thermal expansion of ocean water, but some from melting of the Antarctic and Greenland ice sheets, and from mountain glaciers, and that melting process, by the way, is expected to continue for centuries, even after the atmospheric concentration of carbon dioxide stabilizes.

Now sea level has increased from 4 to 10 inches in the last 100 years. It's expected to increase by another 6 to 40 inches in the next 100 years. The uncertainty in that amount is large. But it should be clear that near the upper end of the range, the damage would be immense.

The map that's on the screen shows that a sea level rise of one meter, 39 inches, would

inundate the whole southern tip of Florida, with it all of the Everglades. Of course a number of low lying island nations would disappear altogether under these circumstances.

It's just clear that these kinds of changes in climate could in fact damage human well-being in a very wide variety of ways. Increased deaths from heat stress on hot summer days and nights could be expected, along with even bigger impacts on human health from expanded geographic range of vector borne diseases like malaria and yellow fever.

Many regions would experience more frequent and more damaging floods and drought. With large efforts to adapt agriculture, world food production might be maintained overall, but reductions in parts of the tropics and subtropics, where food production is already inadequate, are likely.

The impacts are also likely to include increased damage to coastal property by storms as a result of the increase in sea level, as well as the

inundation of low lying wetlands like the Everglades.

And shifts in the ecological life zones, that determine at what latitudes and altitudes different kinds of plants can flourish are going to affect forestry and tourism in a great many different places.

You'll hear more about all of these impacts, shortly, from Drs. Karl, Liverman, and Wilhite.

Now it's important to point out that most of the studies of these potential impacts of global warming are focused for purposes of comparability on the consequences just of doubling the pre-industrial concentrations of carbon dioxide.

But as we've already seen, anything like business as usual and we're not going to stop at a doubling. Quite possibly the concentration will go to triple or even quadruple the pre-industrial levels. To help decide whether to take action to get off of that business as usual emissions path, scientists need to look more carefully, and

citizens and policy makers need to think more about the impacts that would be likely at those higher concentrations.

In this spirit, I want to close by showing you two computer model projections of the evolution of temperature over the next few centuries under twofold and fourfold increases in the pre-industrial carbon dioxide concentration.

The first one that's being shown now is for a doubled carbon dioxide concentration. The greenish colors denote increases of less than 5 degrees Fahrenheit. The yellow colors from 5 to 10 degrees Fahrenheit. The oranges and reds from 10 to 20 degrees Fahrenheit.

You can see in the picture how the warming is greatest at the high latitudes, but the whole United States is in the 5 to 10 degree increase range in this doubling scenario.

Now the next clip, which is showing now, is of a world with four times the pre-industrial carbon dioxide level. Now the whole globe is getting yellow and orange, with increases of more

than 15 degrees Fahrenheit over most of the United States, and a new brown color that denotes increases of more than 25 degrees Fahrenheit showing up over the Arctic.

Soil moisture deficits in the growing season would be in the range of 30 to 50 percent for this fourfold CO2 increase, compared to 10 to 30 percent in the doubled CO2 case.

Now Mr. President, Mr. Vice President, I submit that avoiding climate changes of this magnitude is clearly in our national interest.

[Applause.]

VICE PRESIDENT GORE: Before calling on Tom Karl, let me just ask one brief question.

You talked about the figure of 700 parts per million in CO2 concentrations. A doubling of the pre-industrial level would be 550. Correct?

DR. HOLDREN: That would be 550, and we're going to talk more about that as the morning goes on.

VICE PRESIDENT GORE: Well, somebody said that under the current projections it will reach

550 between 2040 and 2060. Is that correct?

DR. HOLDREN: We'll show all those curves.

VICE PRESIDENT GORE: Okay; all right.
all right.

DR. HOLDREN: That's the ball park, where
we're headed under business as usual. Absolutely.

VICE PRESIDENT GORE: All right.

Well, the reason I asked that is, you
know, I've got a different category of things, for
things that happen in what I hope will be my
lifetime, and--in any event--

[Laughter.]

VICE PRESIDENT GORE: Tom Karl. Tom Karl
is senior scientist with NOAA and has studied
precipitation patterns worldwide. What evidence is
there that changes are taking place, Dr. Karl?

DR. KARL: Thank you, Mr. Vice President.

We've prepared a number of charts to help
guide us in our explanation of these changes. On
the first chart we see what's happened to
precipitation over the course of the 20th Century
across much of the globe, and in this particular

chart you see a number of different colored dots.

The blue dots represent increases of precipitation and the yellow dots or orange dots reflect decreases of precipitation. And what you'll notice is a pattern of change where the mid and high latitudes have increased their precipitation, and the subtropics and tropics have actually decreased their precipitation.

Now the size of these changes are up to and exceeding 50 percent, that is, 50 percent more precipitation now falls in the mid and high latitudes than did earlier in the century.

Seasonally, we're finding more precipitation occurring in mid and high latitudes in the cold part of the year.

Now, what does this mean? Actually, in terms of snow, we actually find that snow in the high latitudes, where it's already cold enough to snow, is also increasing, despite the fact that temperatures have warmed.

Now, all these changes are consistent with model projections that we anticipate to occur with

increased global temperatures.

Now, the changes that we've already seen have already produced a number of important impacts, and I'll just highlight a few for you.

For example, in 1996, China experienced some devastating floods. 20 million people were affected. 2 million people were homeless. Costs were estimated to exceed \$20 billion. Just in the past five years, in Europe, we've had a number of catastrophic floods. Five catastrophic floods in the last five years.

And of course, here, in North America, few of us can forget the Mississippi--I'm sorry--the floods in the Northern Plains, the Ohio River Valley floods, the flood we experienced in the Pacific Northwest.

Now, worldwide, in the last two decades we've had ten times the number of catastrophic floods than we had the previous two decades. So clearly, these changes we're seeing are having an impact, and if we bring it a little closer to home, we have another chart similar to this DOT chart for

the globe, showing changes of precipitation that have occurred in the U.S.

And on average, we've had a 5 to 10 percent increase in precipitation over the course of the 20th Century. But this is significantly greater in some areas because the increase has not been uniform. Actually, there are some areas that have a small decrease.

Now, this 5 to 10 percent increase in precipitation may not seem like much, but that's equivalent to about the annual discharge of water out of the mouth of the Mississippi River every year. That's a lot of water.

And again, these have had important impacts. In the 1980's, we had record levels along the Great Lakes. The Great Salt Lake exceeded its bank in the 1980's. The 1990's, in addition to the events just mentioned a minute ago, we had the Mississippi River Valley floods. In October of '94, Texas was inundated by flood waters. California, in the winter of '95, again a tremendous number of flooding had taken place.

But this is really only half the story. On the next viewgraph we try and articulate our understanding of what happens when we have this excess energy at the surface of the Earth because of the greenhouse effect.

That excess energy can do two things. One, it can go to raise the temperature, but in fact only about 20 percent of that additional energy goes into raising the surface temperature. The other 80 percent goes into evaporating water from the surface.

This then provides more water vapor into the atmosphere and this water vapor is what storms feed on. That's where we end up getting these very heavy and intense precipitation events, and in fact storms actually become more intense when there's ample water available to release the heat to provide the fuel for them.

Now, we've prepared another viewgraph to show you what's happening to intense precipitation events in the U.S.

This particular graph shows that that 5 to

10 percent increase in precipitation we talked about has been disproportionate in a sense that most of that increase is coming from the very heavy and extreme precipitation events, those events that give us these inundating rains in 24 hours.

If we look at the more moderate and light events, we see little or no change. Those are the types of events that we often think of as being fairly beneficial.

Now, actually, storms, when we look at the intensity of storms in the North Pacific and North Atlantic in the last two decades, we do see an increase in storm intensity as well, consistent with that viewgraph we showed you previously.

So, by and large, there's ample evidence for significant climate changes just in the past century, and particularly the last couple of decades.

[Applause.]

PRESIDENT CLINTON: Dr. Liverman, I wonder if you would like to say a little more about how climate change is now, or is likely to affect

average Americans.

DR. LIVERMAN: Well, it's still quite difficult to say exactly what's going to happen at the regional level, because particularly the patterns of how rainfall will change are still a little uncertain. But we know from some of the information that John Holdren and Tom Karl have given us, that temperatures are increasing and are likely to increase.

So what I'd like to do is to talk particularly about how that temperature change might affect ecosystems and human health, and then I think Don Wilhite will talk more about agriculture and water resources.

Now, as most of us know the distribution of plants and animals is largely controlled by climate. In Alaska, For example, the cold, dry climate gives the tundra upon which the large caribou herds graze.

In Florida, the warm, wet climate gives us tropical trees and tropical birds.

In Arizona, where I live, the warm, dry

climate gives us the saguaros that we love to visit.

The increasing temperatures that we're likely to see with climate change are going to cause species in the United States to move northwards and to move upwards in elevation.

Let's take the example of the sugar maples, and I have a couple of graphics here to illustrate it. The sugar maples give us those beautiful fall colors that bring millions of tourists to New England, and of course that breakfast pleasure, maple syrup.

Now, some of the studies that have been done on how sugar maple distributions may change, based on historical pollen analysis, suggests that the sugar maples, as a result of climate change, could move north totally out of New England, where they're so important to tourism and to the regional economy.

In fact, the sugar maples aren't unique. About a third of the world's forests could change as a result of global warming. In the Western

U.S., our models show that gambol [ph] oak, pinyon pine, Douglas fir, and the saguaros could disappear from large regions of the Southwest.

Now, those trees could move somewhere else, but the problem is that we've got a lot of human development out there, we can't tell people, "Oh, sorry, Saguaro National Park has moved. We need to move it up into your area." It's very difficult to do that.

[Laughter.]

I think the Vice President used the term, and I would like to appropriate it: I don't want to live next to the park formerly known as Saguaro National Park.

Another concern of course is that climate changes much faster than most tree species can move. Climate changes, if you're going to have a 3 degree temperature increase, that's going to move many of these boundaries about 300 miles north. Tree species usually only migrate at about 3 to a 100 miles per century. So it's going to be hard for them to keep up with this climate change.

The second thing I'd like to talk a bit about is human health, that's a concern to all of us, and John Holdren mentioned the problem of heat stress. I'd like to give you one example. In July 1995, 465 people died in Chicago when a heat wave caused 98 degree Fahrenheit temperatures, both day and night.

Now, today, that happens about once every 150 years. As we can see in some of these graphics, this map here that shows how heat stress would change, under a doubled carbon dioxide world, that could be six times more frequent.

Now, with the urban temperature increases you've also got problems with increased air conditioning costs, and I'm sure that most of you don't want to pay the sort of air conditioning bills that we pay in Tucson right now.

Now, there is a flip side to that. We could reach these energy costs in the northern part of the United States. But there are many people in the southern part of the United States who can't afford the air conditioning, particularly--and

there are other populations who are very vulnerable, like the elderly and children, who would be particularly affected by this type of stress.

Now, the other thing about increased temperatures is that it's going to exacerbate air quality problems.

You're going to get higher levels of smog, and there are certain diseases, respiratory diseases, asthma, allergies, that could also increase with higher temperatures.

Here, again, children and the elderly would be particularly vulnerable.

And then, finally, those of us in the Southwest are particularly concerned about the changes in some of these vector borne and water borne tropical type diseases that John Holdren talked about.

Now, we've already made ourselves vulnerable through our irrigation systems that create breeding sites for mosquitoes. But one of the things we're particularly concerned about in

Tucson, and along the border, are possible increases in diseases like dengue fever, cholera, and malaria, as shown on this map, which shows the change in the area that would be subject, or vulnerable to malaria in a warmer world.

PRESIDENT CLINTON: Isn't there some evidence already that malaria, in nations, in areas where it presently exists, is becoming more prevalent and moving to higher climates?

DR. LIVERMAN: Yeah, there is some evidence that, For example, there is more malaria at higher elevations in some developing countries, and certainly, there's some more anecdotal evidence of malaria moving into the United States. That's partly climate, but it's also because we have a much more mobile population today than we had in the past.

PRESIDENT CLINTON: Let me ask you one other question. Let me go back to what I said in the beginning. This is one of the most difficult problems of democracy because if we get a 100 percent of the people to agree that it exists, and

only 10 percent of the people have experienced it, and another 10 percent of the people can imagine it and therefore are willing to deal with it, you still have to have 51 percent in order to develop any kind of political consensus for doing anything, I think, commensurate with the need.

So would you say--I had, and I know this happens to a lot of people--but I had a number of people, I had a young congressman in to see me the other day who's a member of the Republican Party. He said that, "You know, in my state we've had 300 year floods in 10 years."

I met a man over my vacation who said that he was moving away from the place he had lived for a decade because it was a completely different place than it had been just 10 years ago. It was hotter. There were more mosquitoes. It was a very different and difficult place.

Do you believe that these anecdotal experiences are likely related to climate change, or are they just basically people's imagination?

DR. LIVERMAN: No, I actually think

there's a scientific basis for these perceptions of climate change. That's actually an area I do some research in, and you can do--we've done very carefully structured scientific surveys of farmers and of city dwellers, that show that many people do believe that the climate is changing, whether it's a farmer in Mexico or a resident of Los Angeles.

We have a lot of studies where people do believe it's changing, and in many cases it correlates with the type of observed temperature changes that Tom Karl talks about.

So my feeling, from my own work, interviewing people, is that many people in this country do think that the climate is changing and are concerned about it.

PRESIDENT CLINTON: Dr. Karl, you want to say something?

DR. KARL: Yeah. Actually, I think the anecdotal evidence is consistent with the notion that although no single event is the basis for saying global warming's taking place, if you look at many of them--in fact I have a number of

statistics you might find of some interest here.

Just during 1996, we had six states that set their all-time annual precipitation amount. Not to belabor it, but totals like 16 feet of rainfall in Oregon during the year 1996. Over 8 feet of precipitation at Mount Mansfield in Vermont. And there's a number of other records like this. These are the types of things that certainly have an impact, and I think people remember.

VICE PRESIDENT GORE: If I could add a word to this, I noted earlier, James Lee Witt, who's the head of FEMA, is here. He and I have gone out, as he and the President have gone out, frequently, to the sites of these disasters, and the budget for the consequences of the flooding events and the other disaster events as well--it now reaches an average of a billion dollars a week in the United States.

And you mentioned, Doctor, about malaria. One scientist was telling us, recently, about a case of malaria that showed up in Detroit during a

month when the average temperature was a full 6 degrees warmer than the 30 year average, and while of course you can't, again, say that's the cause and that's the effect, the odds of diseases of that kind, as Secretary Donna Shalala, who's here, has told us, increase quite dramatically.

The other thing I wanted to ask, just briefly, is in terms of the effects on human beings.

The weather forecasters who were at the White House last week talked about the heat index, the combination of temperatures and humidity, and your presentation followed right on Dr. Tom Karl's, and somebody was saying that the heat index, here, in Washington, D.C., by the middle of the next century is predicted to go from--do you know the numbers, Dr. Karl?

DR. KARL: I think it's up to 105 or 110. I don't know the exact numbers but significant--

DR. LIVERMAN: It's under a 100 now, and it's going to go to about 105, on average, they think, during the summer months.

VICE PRESIDENT GORE: Well, we'll get some more on that.

PRESIDENT CLINTON: We certainly will.

One reason I believe this is occurring is that James Lee Witt is the only member of my Cabinet who is actually disappointed when his budget goes up, and he's had a lot of disappointment these last five years.

I'd like to now call on Donald Wilhite to talk about the relationship--because we've heard about, increased precipitation--now I'd like to ask him to talk about drought, and the apparent paradox in drought patterns and increased precipitation patterns, and what implications this might have for American agriculture, which is a terribly important part of our economy, and we have all been counting on it being a very important part of our expert economy for the indefinite future.

DR. WILHITE: Thank you, Mr. President, Mr. Vice President. I was asked to talk a little bit about the--give the "dry talk" I guess in this presentation.

[Laughter.]

Each drought event I think is a vivid reminder of our nation's continuing vulnerability to climatic variations. If one can remember the severe droughts of the late 1980's and the early 1990's, those resulted in severe economic and environmental consequences in many parts of the country.

In 1988, For example, nearly 50 percent of this nation was affected by severe drought, and resulted in excesses of \$15 billion in agricultural losses in this country, a very dramatic number.

In 1996, we had a reoccurrence of drought in the southwestern United States, and this also resulted in severe economic and environmental losses, a higher incidence of forest fires, and so forth. This also is of concern.

In the State of Texas, alone, impacts were in excess of \$5 billion.

Now American agriculture, while technologically advanced, is still subject to the sensitivity of weather conditions, or the vagaries

of weather.

The slide that's up on the screen now shows a dramatic upward trend in corn yields since 1950 in the United States, but note the deviations on that trend. Those deviations are largely the result of variations in climate, or extreme weather conditions. Most of those are the result of drought events. Some of those are the result of excessively wet events which delayed or hampered spring planting.

Drought also is of high incidence and a normal part of the climate in virtually all portions of the country.

This next diagram shows the incidence of drought in the United States over the last 10 years. So while it's true, we've had maybe an increase in precipitation, I think it's interesting to note from this slide which shows the number of years experiencing moderate, severe, or extreme drought in the last ten, that while you have a rather surprisingly large area in the western United States that shows a high incidence of

drought, we are also demonstrating the high incidence of drought in the Great Plain States, in the Southwest, in the Midwest, and also along the Eastern coast states.

So drought is clearly a phenomena that affects all portions of the nation, not just the western United States.

So that projected increases in temperature, and a possible accelerated water cycle that we've been hearing about this morning, may lead to changes in both the amount and the seasonable distribution of precipitation which may alter, then, the incidence of drought events and also flood events in this country.

So while we don't know precisely what the regional impacts of climate change may be, as Dr. Liverman was speaking about a few moments ago, we do know the impacts associated with these extreme weather events.

And we also know where our vulnerabilities are as a result of this, and I think it's prudent that we sort of assess what our vulnerabilities

are, and use these as a way to reduce the impacts of drought events and flood events today that will help us in the future.

PRESIDENT CLINTON: I want to ask a question and try to make sure that we are all as clear as we can be based on what is known, about two apparently contradictory things.

That is, that the total volume of precipitation has increased virtually everywhere, and the number and severity of droughts has increased across the country.

Now, Dr. Karl said earlier that part of the explanation is that the precipitation we're getting is coming in bigger bursts. But what I would like to do is to have somebody offer basically a line of explanation that everyone in the audience and hopefully those who will be following these proceedings can understand.

Why did it happen at the same time that we had more droughts and more floods? How could we have more droughts when the aggregate amount of precipitation on an annual basis was increased?

And I think it's important that people kind of get why that happened.

DR. WILHITE: Well, I'll take a first shot at that. First of all, the increased precipitation amount that Tom Karl was referencing earlier, a lot of this increased precipitation is coming in the form of short-term intense precipitation events, which leads to a very high run-off. So there's not a lot of moisture that goes into the soil.

Secondly, increasing temperatures tends to increase evaporation and therefore ,the resulting impact of that is soil drying.

So you have a combination of these things going on that help to explain this paradox.

PRESIDENT CLINTON: And I think that's important. When the temperature is warm, they dry the soil and create the conditions for the floods, simultaneously?

DR. WILHITE: That's correct.

PRESIDENT CLINTON: And because these floods don't wash away the soil, rather than sink down into the soil, you get very little benefit out

of them, and farmers lose a lot of top soil.

DR. WILHITE: Exactly.

VICE PRESIDENT GORE: Well, thank you very much, and now we'll move to Dr. Robert Watson who is the chair of the leading international scientific body on the science of climate change. Dr. Watson, how do you respond to those who say this is not a real problem?

DR. WATSON: Mr. Vice President, Mr. President, let me assure you that the large majority of scientists do believe that global warming is a serious environmental issue. Over 2,500 scientists participated in the second assessment report of the IPCC.

These scientists came from government, industry, environmental organizations, and universities, from nearly a 100 countries around the world.

And indeed, at the second conference of parties, literally all ministers, except from the oil-producing countries, argued that the IPCC was and is the most single comprehensive report on the

state of knowledge, the science, the technology and the economics, and it should be used as the basis for international negotiations in Kyoto this year.

But let me be clear. There are uncertainties in our science. We don't know all the real facts. But these skeptics are in a clear minority. The vast majority of scientists do believe, in spite of the uncertainties, that we need to take heed of our current scientific knowledge.

There are three or four lines of arguments they use to try and undermine the science. First, they argue, are we sure that the increases in atmospheric carbon dioxide are really due to human activities, not changes in nature?

There's three lines of evidence that convinced me, and nearly everybody else, that it's human activities causing these increases. First, the natural variability in carbon dioxide is only a few parts per million. Since the pre-industrial revolution we've seen an increase of 80 parts per million, way outside any natural variability.

Secondly, the atmospheric concentrations have gone up absolutely at the same time that we started to emit these large amounts of carbon dioxide from deforestation and from the burning of fossil fuels--coal, oil, and gas.

And thirdly, when you burn fossil fuels, they have a special fingerprint called the isotopic ratio. We've actually looked at this fingerprint in the atmosphere and we can show quite definitively, that the increase in carbon dioxide is not due to a change in natural variability but due to burning fossil fuels.

Then the skeptics say, "Are we really sure the temperature's increased?" "Isn't our data record contaminated by the so-called urban heat island, in effect?" The answer is no. We've measured temperature three ways. The air above the land, the air above the ocean, and the surface water of the ocean. All three data sets show exactly the same trend.

There's no way all three data sets could be equally contaminated.

The skeptics then argue that in the last 18 years we've got a satellite data record, clearly the best thing around, but it doesn't show a significant increase. What we've got to recognize is the satellite data measures the temperature of the atmosphere from 5,000 feet to 30,000 feet above the Earth's surface. It doesn't measure it where we live, on the Earth's surface.

And the atmospheric temperature is very sensitive to ozone depletion, which is caused by human activities, and natural phenomena such as volcanic activity and changes such as El Nino.

When you allow for the ozone depletion and the natural variability, even the satellite record shows an increase with temperature. It's a little bit less than the ground-based record and it's a little bit less than theory, but it is not really inconsistent.

Secondly, the temperature of record is only 18 years, from the satellite, and it's natural variability in climate which means any short record is very, very difficult to use for a long-term

trend.

Third, the question is, Are we really sure it's due to greenhouse gases, or could it be changes in the sunlight? There's absolutely no question, changes in solar output do affect climate.

But we have very, very few measurements that directly measure the output of the sun. We have satellite records from 1979. They show a very, very small variation in solar output, correspondingly, a very small variation in climate.

The indirect measurements over the last 100 years, or so, are indirect. In IPCC, we try to allow for the change in solar output and how it affected the Earth's climate.

We do believe the Earth's climate has been affected by change in solar output, but only a few percent of the observed change can be attributed to solar output. The large majority must be effectively attributed to greenhouse gases.

And in fact if it's the warming effect of the sun, that affects the Earth's climate,

greenhouse gases have exactly the same fate. They warm the Earth by a small change in the heat content. Hence, if the sun can warm the atmosphere, so can effectively greenhouse gases.

Lastly, Mr. President, Mr. Vice President, many people say our general circulation models are not very accurate, and they're not very reliable. They are right; we have uncertainties.

Let me make absolutely clear--we do not know everything. But at the same time, these models simulate most of the large-scale effects that we see.

In fact when we look at the observational record for the last 100 years, and we look at what theory shows, when you take into account both the increases in the greenhouse gases and the increases in the aerosols, there's a very good correspondence between the observed temperatures and the predicted temperatures.

The changes in rainfall that Tom Karl said, are also consistent between theory and observation. The other way of saying it is we

cannot explain the observed changes on natural--

I believe that while the skeptics are right in saying there are uncertainties, there is a lot we do know, and the large majority of scientists do believe this is a very serious environmental issue.

PRESIDENT CLINTON: Let me ask you a follow-up question, and perhaps someone else would like to answer, but I think it's important. Again, I--and forgive--for those of you in the audience who know a lot more about this than I do, you will have to forgive me, but I am also trying to imagine how this is going to be absorbed by our Nation and by people who will be following this.

It appears that we are headed into a powerful El Nino, and I wonder if one of you would just simply, very briefly, explain what that is and whether you believe there is a link between the power of the El Nino and the climate change.

DR. WATSON: Yes. Every two to seven years, we have a phenomenon called the El Nino phenomenon. The ocean temperatures of South

America, in the Pacific, warm up, and they effectively have a large-scale effect on temperature patterns and precipitation patterns throughout the world.

You get heavy rainfall in Peru, a draught in northeast Brazil, a drought in Zimbabwe, and major effects in countries such as Australia.

One of the questions we have to ask ourselves is: Are these El Nino events changing? What we have observed in the last 20 years is we have now had the largest, almost intense El Nino in 1982, and it is looking like the one we have now may well be the most intense of the last 200 years.

The question is: Are we changing the frequency and the magnitude of these so-called El Nino events because of global warming? We don't know, but, just like there are more floods at the moment and more droughts throughout the world, it is interesting to note that as the greenhouse gas concentrations are increasing, it does appear that the frequency and magnitude of these El Nino events also seems to be changing, and they have profound

effects, as I said earlier, both on temperature and precipitation, truly around the globe.

VICE PRESIDENT GORE: I would just like to comment on your remarks concerning the skeptics. I personally believe we have had experience with a form of skepticism that I think is similar to this before.

In 1964, the scientific community, through the Surgeon General's report, said that smoking cigarettes causes lung cancer, and for the last 33 years, up until this summer, the CEOs of the tobacco companies said with a straight face and seemingly no embarrassment, there is no link between smoking cigarettes and lung cancer.

Some scientists say, even today, the exact causal relationship is very difficult to pin down because science can't answer all of the questions, but it is abundantly obvious that it does, and the President has been leading our country's fight on that issue, and thank goodness, eventually, the weight of opinion got to be such that most everybody, except this very, very tiny band, became

embarrassed to parrot that line anymore. And I think that the weight of evidence here is in the same category.

PRESIDENT CLINTON: We have got to wrap up the first panel and get on to the next one, but I'd like to ask--I think I'd like to ask, John, for you to respond to this. If anyone else wishes to, you're welcome to.

I think there's a more sophisticated question to be asked, although the Vice President is right, there still are some people who claim that this scientific case, that I have been completely persuaded by, has not been made.

I think the more difficult argument, John, goes something like this. Look, you put all this stuff in the atmosphere, and it says there for a hundred years at least, and maybe longer. So what's the hurry? And in a democracy, it's very hard to artificially impose things on people they can't tangibly feel, and so why shouldn't we just keep on rocking along with the kind of technological progress we're making now until there

really is both better scientific information and completely painless technological fixes that are apparent to all? Why shouldn't we just wait until all doubt has been resolved and, hopefully, we have even better technology? Because, after all, the full impact of whatever we do, if we start tomorrow, won't be felt for decades, and maybe even for a century.

Number one, is that true? How quickly could we lower the temperature of the planet below what it otherwise would be? And number two, what about the argument on the merits?

DR. HOLDREN: Mr. President, let me take a try at addressing that.

It is clear that the task that you and other policy-makers face in this situation is a tough one. Business as usual is what most people are comfortable with.

The difficulty is that our health and our economic well-being are more dependent on climate than most people think. Human disruption of climate by greenhouse gas emissions is almost

certainly further along than most people think, and directly addressing the point you were just making, reducing greenhouse gas emissions enough to avert much larger disruption than experienced so far is going to be more difficult than most people think.

And the longer we wait, the more we coast up that business-as-usual trajectory, the more old-style technologies are going to be in place in this country and around the world, and the harder it is going to be to get off of that track.

The goal of the framework convention on climate change, to which the United States is a party--it was ratified by the United States Senate in 1992--is to stabilize greenhouse gas concentrations at a level that prevents dangerous human interference in the climate system.

Now, there is no formal agreement yet about what constitutes dangerous interference, but I know a very few analysts who have looked seriously at the impacts side of this question, who think that going beyond twice the pre-industrial carbon dioxide concentration is anything other than

very dangerous. That would be about 550 parts per million, compared to 365 parts per million today, 280 pre-industrial, and you saw earlier a simulation of the considerable temperature changes that that would entail.

Now, the problem is that stopping even at that 550-part-per-million level, twice pre-industrial, it is not going to be easy. The curves that are on the screen now show future world emissions of carbon dioxide under business as usual, which is the reddish line at the top, and then under three trajectories that would stabilize the concentration, at levels ranging from 350 parts per million on the bottom, a little less than today's, to 750 on the top of the line, the highest of the lines that bend over, another orange one, the green one in the middle is the 550-parts-per-million trajectory, the trajectory that stabilizes at twice pre-industrial CO₂.

Now, that lowest trajectory might be the most desirable from the standpoint of giving us the greatest assurance of avoiding climatic changes

that we really won't like, but it is virtually not practical to get to that. We are already past the point where we can get to that trajectory.

In fact, if you could see the scale more clearly, you would see that that one requires the emissions to go negative early in the next century, which is particularly difficult to manage.

Now, the green trajectory that stabilizes at a doubling of pre-industrial carbon dioxide concentrations require that global emissions--global emissions, not U.S., but worldwide, including the developing countries--start to decline already in about the year 2030, and they do that from a peak in which average-per-capita emissions worldwide would be only one-fifth of U.S. per-capita emissions today.

That is going to be very hard to do, and if we are going to do it, we need to start working on it today.

The problem, basically, is that the world energy economic system is a lot like a super-tanker under full power. It's got huge momentum in the

direction it's heading. It's very hard to steer. It's got very bad brakes.

The science that has been summarized here this morning is telling us that the super-tanker is headed for a reef. We can tell the water is getting shallower under the hull, even if we can't say exactly how far we can go before the reef rips the bottom out of that tanker.

Now, in that situation, full speed ahead is clearly the wrong course. We need to start slowing and steering away from the reef of unmanageable degrees of climate change now, and since we are all in the same super-tanker, industrialized and less-developed countries together, we had better find ways to slow and to steer cooperatively, rather than bickering over who is holding the wheel.

We have got a lot of tools available to help us with that steering effort. There are advanced technologies already on the shelf that can help us dramatically increase the efficiency of energy end use and can reduce sharply the emissions

of carbon dioxide from energy supply. We need only some sensible attention to reducing the barriers to the more rapid and widespread diffusion of those advanced technologies already on the shelf, and there are new technologies that could be brought to the point of applicability, with expanded research and development, that would make increased energy efficiency and reduced carbon emissions even more cost effective, but now I am basically getting into parts of the story that other panels are going to deal with later today, and I'll leave that to them.

PRESIDENT CLINTON: But I do want to make the following points. Number one, we can't get to the green line unless there is a global agreement that involves both the developing and the developed countries.

Number two, however, that is not an excuse for us to do nothing because, if we do something, it will be better than it would have been otherwise because we are still the biggest contributor and will be until sometime well into the next century.

And, number three, based on everything we

know, it will be easier in some ways, particularly if they get the financial help they need, for developing countries to choose a different energy future in the first place than it will be for the developed countries to make the adjustments, which is not to say we don't have to make the adjustments, but to say that I have read a lot of the press coverage and people saying, "Oh, well, we are just using this for an excuse," or "We're not being fair to them," or "We don't want them to have a chance to grow." That is not true.

The United States cannot maintain and enhance its own standard of living unless the developing nations grow, and grow rapidly. We support that, but they can choose a different energy future. And that has to be a part of this, but it is not an excuse for us to do nothing because whatever we do, we are going to make it better for ourselves and for the rest of the world than it otherwise would have been.

I think it is important to point out what John showed us there on the green line. The green

line--it requires to reach the green line. We have to have a worldwide action plan.

VICE PRESIDENT GORE: And, Mr. President, if you will allow me to offer a footnote to that, another lesson that I heard from Dr. Holdren's presentation is that not only does the agreement have to include the developing countries in some way, along with the developed nations, but, also, if we wait--if we wait before we start, then we will lose the opportunity to hit that green line for another century or more, and so time is of the essence.

Mr. President, they have asked me to announce that that is the close of Panel I. We are going to stay here while the second panel members come here, but, ladies and gentlemen, if you would, please join the President and me in expressing thanks to the members of this great panel.

[Applause.]

VICE PRESIDENT GORE: [In progress] come here, but ladies and gentlemen, if you would, please join the President and me in expressing

thanks to the members of this great panel.

[Applause.]

MODERATOR: Ladies and gentlemen, please remain seated during the panel change.

[Pause.]

VICE PRESIDENT GORE: Ladies and gentlemen, could you please take your seats? We're going to start the second panel, and on behalf of the President, I'd like to call first on Secretary of Energy Federico Pena, and Mr. Secretary, if you could introduce your colleagues on this panel and kick it off, we'd appreciate it.

SECRETARY PENA: I will, Mr. Vice President. Thank you very much, Mr. President.

This panel will, I hope, make the point that technologies that exist today, or will soon be available, will allow us to have a smooth transition to a new economy where we will see greater energy efficiency help us reduce greenhouse gas emissions. That is the message I hope we can provide in this panel.

Before I introduce the panelists, Mr. Vice

President and Mr. President, let me make a few comments which I hope will put the technology discussion in broader perspective.

Mr. President, a couple a weeks ago, your science advisors, the PCAST Council, issued a report to you, making it very clear that we need to invest more in research and development in the area of energy, and it was interesting that Dr. Holdren, who was on the first panel, chaired that committee for you.

Secondly, there were a group of scientists who come from our five national laboratories, who also issued a report demonstrating that we can apply technologies and reduce greenhouse gas emissions without having a very significant impact on our economy, or the cost to our economy. And that has been one of the big debates raging in this discussion.

Let me put this discussion in context by first referencing Chart No. 1, which is now on the screen. There. If you look at the sources of greenhouse gas emissions, this chart demonstrates

that about one-third of the carbon dioxide emissions come from buildings, and by "buildings" i mean commercial buildings, homes, apartment complexes. About one-third comes from transportation, and I'll talk about that, momentarily. And about one-third comes from industry.

If you consider, as the Vice President said in his opening remarks, that it is fossil fuels which produce energy which are largely the reason for greenhouse gas emissions, we can understand why it is that power plants that produce electricity account for so much of greenhouse gas emissions, particularly when coal or natural gas, in some cases, is being used.

What I think most Americans don't appreciate is the fact that when power plants produce electricity for our homes, it takes three units of energy to produce one unit of energy for electricity.

Let me put that in a different way. If you had three lumps of coal being used to burn in a

power plant, the electricity generated from that power plant would represent only one-third of the energy in those three lumps of coal and two-thirds of it is lost, either in hot water or steam, or other sources. So our challenge is to find a way to make those power plants more efficient with new technologies to reduce greenhouse gas emissions.

Now as respects the three categories that were on the screen, and are still on the screen, let me break that down a little further so we can better understand how technologies will help us address this problem.

If you look at the buildings sector, For example, electricity and natural gas supply most of the energy used in the building sector. Heating and cooling are responsible for more than half of the emissions for buildings.

Appliances, whether they're computers or faxes or other appliances, are responsible for 20 percent, and lighting accounts for 14 percent. So what can we do about that? I brought with me, Mr. President, a technology. This is a solar shingle.

These are available. Over time, we think they'll be more available in terms of cost.

But by putting these in your home, or a building, you can substantially reduce the use of electricity and use the sun to bring power into your home, or your building, and I hope that perhaps we'll have further discussion from our panelists about that.

Secondly, to my far right is a lamp, Mr. President, which I think you may have trouble seeing. It's a torchiere lamp; it's a little dark. But I want to point that out, because, right now, we use halogen lamps, and you can find them in our homes all the time.

But they burn very brightly and they're very hot, and so they use a lot of energy. These new torchiere lamps use fluorescence and are 80 percent more efficient.

And I want to point out that Stanford University is going to be using these in the dorms because the halogen lamps are not only dangerous, because they create fires--

[Laughter.]

--he's paying attention now--and they are more energy efficient.

[Laughter and applause.]

PRESIDENT CLINTON: It was in the parent's instruction manual.

[Laughter.]

SECRETARY PENA: The message is these technologies can make a big difference. If you look at transportation. We know that oil supplies virtually all of the energy used in the transportation sector. In transportation, 35 percent of the emissions come from automobiles, 23 from light trucks, including vans, minivans, and sport utility vehicles, about 13 percent from airplanes, et cetera. What can we do about that?

And I hope Mary Good will address this subject in a second. As you know, we have this Partnership for New Generation Vehicle. This is a lithium ion battery, which can be used in a dual fuel vehicle with electric and natural gas use. We can, with these batteries, take the energy that is

lost when you break your vehicle, capture that energy and use it to accelerate your car.

And so with this new technology we can make our automobiles more efficient. It exists. The last sector is the industrial sector, and there, 80 percent of the emissions come from petroleum refinery, chemicals, paper, forest products, metal production, and you, in your comments, Mr. President, alluded to the fact that a number of industries have voluntarily started to reduce their energy use.

And we're very pleased, For example, that the metal casting industry has set a goal of a 20 percent reduction in energy use over a certain time frame.

So technologies, we believe, can make a significant difference in reducing greenhouse gas emissions, they are good for our economy, good for U.S. companies, and good for our environment.

In closing, Mr. President, when you made your address before the United Nations, you challenged all of the laboratories of the Federal

Government to come together and put together a strategic plan on how we can support, working very closely with the private sector, new technologies to reduce greenhouse gas emissions.

And we are already working with our scientists, they are quickly putting that report together, and we'll present it to you very shortly.

To help us have I think a very good discussion on technology, we have an outstanding group of panelists today.

First, let me introduce Mr. Tom Casten, who is CEO of Trigen Energy Corporation, who understands, very well, how business can more effectively make use of energy that currently is wasted.

Also with us today is Kurt Yeager, to my left, who is the president of the Electric Power Research Institute, an expert on electric utilities, and the potential in that industry for increased efficiencies in generation and transmission.

Over here is Mary Good, former Under

Secretary of Commerce for Technology and now Managing Member of the Venture Capital Investors, who will discuss the new supercar of the new century.

Also with us today is Michael Bonsignore, chairman and CEO of Honeywell, who will discuss how business can adopt cost-effective energy saving technologies in the building and industry sectors.

Also with us is Mason Willrich, CEO of EnergyWorks, an expert in renewable energy sources, who will discuss the potential that renewables such as wind and solar and biomass can be used in reducing greenhouse gas emissions, and then Mr. Larry Papay, a member of your PCAST task force on R&D, who knows a lot about the potential for technologies that are still on the drawing board, but which I think are very exciting for the future.

So Mr. President, Mr. Vice President, these are our panel members, and I think at this point I'll turn it back over to you and the Vice President.

PRESIDENT CLINTON: Thank you.

I'd like to start with Mr. Casten and ask him to describe his company's work in recapturing waste energy to heat houses and buildings, and discuss the potential market for the technology in the country.

MR. CASTEN: Thank you, Mr. President.

The Secretary's given my speech already.

I'd like to focus on where 70 percent of the emissions of CO2 come from, which is in the production of heat and power, and my message is simple.

At present we make heat in one plant and electricity in another plant, and as a result U.S. power plants waste a lot of fuel.

Regulation protects this waste from market forces. Now to reduce CO2 emissions we could leave the monopolies intact, and force the country to deploy some exotic and expensive technologies and maybe force them to switch from coal to natural gas and this would disrupt the economy.

People who think this is the plan respond to your call for climate change mitigation as if

they were told they've got a terminal illness. They want a second opinion. They want to quibble about the science.

But using one power plant to produce electricity and another one to produce heat is just not efficient. As the Secretary said today, when we burn three units of fossil fuel--coal, oil or natural gas--only one ends up as electricity. Two end up as waste up the chimney or out in the harbor. Gone.

That heat could be used for buildings in industry. We have two fires when one would do. The heat that we waste in U.S. electric production alone is equal to the total energy use in Japan. Unfortunately, our outmoded laws forbid competition, thus discourage innovation and efficiency. The result is waste of fuel.

Let me illustrate this with a local example. Two miles south of here, there is a coal-fired electric generating plant. Like hundreds of others, it produces 400 megawatts of electricity and dumps 800 megawatts of heat into the Potomac

River. At the same time, Georgetown, the Pentagon, National Airport, Howard University, and GSA all burn more fuel in order to make the heat that was just thrown away. The electric plants' waste heat could replace all of these boilers, and this would of course reduce CO2 emissions, dramatically, improve Washington, D.C. air quality, and I think save a lot of money.

Using electric plant waste heat is not just theory. Trigen Energy Corporation heats 6,000 buildings and numerous industrial plants in 14 cities with combined heat and power.

We recover normally wasted heat from electric generation to feed our steam and chilled water systems. Customers save money, pollutants drop by 90 percent, and we have the CO2 emissions, and we save money.

Here's three examples of where we're doing that. In Philadelphia, our steam system heats downtown buildings and the University of Pennsylvania.

With partners PECO and NRG [ph], we are

installing a gas turbine that will make 150 megawatts of electricity and 250 megawatts of heat.

In Chicago, we heat and cool the McCormick Place Convention Center with combined heat and power.

In Golden, Colorado, in partnership with Tucson Electric, we burn coal to make electricity and then sell the left-over heat to Coors to make beer, and also to heat the Colorado School of Mines.

The potential for CO2 reduction is huge. Increasing the average U.S. electric generation efficiency to just what we're achieving today would reduce U.S. CO2 emissions by 23 percent, and save money.

Mr. President, doubling U.S. power plant efficiency is feasible, and in my view, essential. America's entrepreneurs will eliminate energy waste if they're given a chance to compete. Then they will sell their efficiency all over the world.

When you go to Kyoto, I hope you'll play to our strength. Tell the other nations that we

will open our electric markets to competition, that we will unleash our entrepreneurial strength to improve power plants worldwide. Thank you.

[Applause.]

PRESIDENT CLINTON: Mr. Casten, for the benefit of--if there's anybody here that doesn't understand the intricacies of the electric utility regulation--and there will doubtless be people out in the country that don't, even people who pay big electric bills--why don't you, just very briefly explain, so we can follow this chain of thought all the way through, the people who are reporting on this, what the present state of the law is, and what the proposals are, and specifically what you think ought to be done by whom.

Just don't assume that everybody knows this. Keep in mind, we're doing this for the general public, too. So just very briefly, say that.

MR. CASTEN: Mr. President, we began in about 1930 to make electric a monopoly, and we set up state laws in every state that said you get a

territory and you get to sell electricity to everybody in that territory, and nobody else can sell it.

We later on added Federal laws that prevented the electric utilities from buying each other or becoming more efficient.

We then wove a tapestry of regulations that--just full of little black threads that stop efficiency. Every place you turn, somebody has, based on this paradigm of electric only, and put a regulation in place that stops it. Our environmental regulations don't really focus on efficiency and reward it.

What needs to happen--it's about the only industry that's left as a protected monopoly--is that we need to end the monopoly, work through a transition. Remember that billions of dollars were invested by our utilities relying on those rules, so we've got to find a way to move through and give them some incentive to move to a more efficient and a modern world, and I think we can do it.

VICE PRESIDENT GORE: Very good. I think

that we're going to Kurt Yeager next, right?

SECRETARY PENA: That's correct, Mr. Vice President.

VICE PRESIDENT GORE: Do you want to-- well, Kurt Yeager is president of the Electric Power Research Institute, which is formed by, funded by electric utilities, and Mr. Yeager, how can we reduce greenhouse gas emissions in facilities like power plants that use so many fossil fuels?

MR. YEAGER: Well, thank you, Mr. President, Mr. Vice President, Mr. Secretary. It's important to begin by recognizing that these plants today produce about two-thirds of the nation's electric power, and the paradox in that is that the electricity that they produce eliminates far more carbon in our economy than the plants themselves emit.

Now within the context of that paradox there are a number of things that we can do, and I would begin by reporting that technological innovation is steadily reducing, not only the U.S.

but the world's carbon diet, by substituting less carbon-intensive energy sources and by steadily promoting the more efficient use of all our energy forms.

This progress is very important because on a worldwide basis, 90 percent of all the energy that the world uses contains carbon.

The challenge we face is continuing that progress by wisely deploying the technology opportunities that are becoming available on a global scale. And a key enabling factor in this sustainability of decarbonization is electricity, and its growing role in our global energy system.

First--and I just underscore three observations in that regard--first, it enables the use of carbon-free energy sources, such as renewable energy, nuclear power.

Second, it enhances the efficiency with which we use energy throughout our economy.

And I'd say third, and most importantly, it is the engine of innovation. It is the basis on which technological progress has evolved in this

last century. Witness the computer revolution today, and the efficiency of productivity that it brings to every part of our economy. And as a result we can realistically envision, as we look forward into the future, creating an energy economy on a global scale that depends on electricity and hydrogen, based on efficiency and free of carbon.

The essential factor in promoting this progress, which is shown in the figure on the board, rather than limiting this global de-carbonization is providing flexibility, and that is the ability to take best advantage of technology progress and knowledge.

And to avoid counterproductive costs which could both prejudice our economic vitality and the very jobs on which sustainable progress also depends.

And in this regard, U.S. technology, I believe, is uniquely positioned for two-pronged leadership in emerging innovations. First, by accelerating global electrification as the essential foundation for de-carbonization, and for

eliminating the poverty and hopelessness that now plagues some 2 billion people on this planet who are now without electricity. And second, by developing and deploying a portfolio of cleaner energy alternatives, using that electricity platform.

And I believe the result would be both environmental progress as well as increased global security and new markets for U.S. goods and services.

And this portfolio would include four primary dimensions. First, clean coal and biomass technologies that we have spent a great deal of effort through the national economy in developing, and to reduce the world's dependence on those fuels. Particularly important is the gassification of those, to move them from high carbon fuels to lower carbon, and also more efficient fuels.

Second, to bring forward solar-based renewable energy, particularly in the developing parts of the world that have low energy requirements today. To expand the use of safe

carbon-free nuclear power, led by U.S. leadership in this area. And finally, new transportation systems which both move away from carbon and imported oil.

In conclusion, I must also stress, however, that this progress will depend on re-energizing what has been our lagging U.S. investment structure, both public and private, domestic and international.

And this urgent investment includes both the R&D engine in which technical progress and innovation depend, and for commercializing and deploying the results on a global scale.

With the end of the Cold War, we're on the brink of a period of great technological opportunity in service to mankind. We must, however, invest wisely and persistently if we're to achieve a truly sustainable energy foundation for the world. This foundation must support both the environmental and economic aspirations of our rapidly growing and increasingly interdependent global society. Thank you.

[Applause.]

PRESIDENT CLINTON: Let me just say before we go on to the transportation sector, these presentations have been quite important. I remember, 20 years ago, more or less--maybe a little less than that, I can't remember exactly when--that the Congress voted, or the Federal Government at least required--it might have been a regulatory action--that the new power plants not use natural gas anymore, and that we phase out of them because we grossly underestimated how much natural gas we had, and we thought we could go to clean coal because we didn't want to build nuclear plants, for all the reasons that were clear.

And one of the biggest problems we face, now, in trying to make a reasoned judgment about how quickly we can reduce greenhouse gas emissions, and by how much, is the need not to be unfair to electric utilities that have billions of dollars invested in government approved power plants that they have not yet fully amortized.

So that it's--now, there are--therefore,

in so far--and this applies both to buildings and to the utilities themselves, about which these two speakers have spoken. You can either conserve more in the production of electricity, or you can have the people who consume it conserve more, or you could change the basis on which the plants work, which is the most expensive way to do it.

Therefore, in so far as we can do more in terms of how much electricity people use, or how much waste heat you recover, either one of those things is a far preferable, far preferable alternative than to change the basis on which plants that have already been built are being amortized, and will generate huge amounts of savings at lower cost, if we can do it.

At the end of this session, we'll get around to the, sort of the skeptical economist take on the technological fix. We'll get around to that later. But I just think it's important that we focus on this specific issue, because if our goal is to minimize economic dislocation, then having conservation by the end-users, the people who have

the buildings, For example, whether they're manufacturers or residential buildings, are other business buildings, and having recovery of waste heat, are clearly, I think, the preferable alternatives, and clearly, the less expensive alternative.

I'd like to call on Mary Good, now, who was the Under Secretary of Commerce for Technology in our administration for four years, and now is the Managing Member of Venture Capital Investors.

I want her to talk a little bit about the potential for technological advances to reduce emissions in the transportation sector, and to focus particularly on the Partnership for New Generation Vehicle that we've been working on with the auto companies and the UAW since this administration took office, and Mary had a lot to do with it.

There is also a huge debate here about how much we can do, how quickly, and we have to make the best judgment about this in determining what to say about it when we are in Kyoto, because

transportation, as Secretary Pena said, occupies such a large part of this whole equation. So Mary, have at it.

DR. GOOD: Thank you very much, Mr. President.

PRESIDENT CLINTON: Tell me what I should say in Japan about this.

DR. GOOD: Well, thank you very much, Mr. President, and Mr. Vice President. You have sort of set the stage for transportation because the infrastructure problem is very big and very real in transportation.

The issue about the use of transportation, of a third of the energy, is real. That means it's a big piece of the whole issue. It is also, at the same time, absolutely vital to have efficient low-cost transportation because the economy depends on it as well.

And then you're saddled with an infrastructure that we poured trillions of dollars into over the last 100 years, in roads and waterways, and railroads, and what have you, which

are there, and we have them.

And so the issue--and not only that. But we've built a whole transportation system based on the use of petroleum products. So you have all of the problems that you put on the table, sort of in one bundle, in a sense, in transportation.

So if you look at that, the short-term fixes have to be focused on efficiency. We've got to get better efficiency out of the systems, and programs like the Partnership for a New Generation Vehicle are clearly the way to go.

Not only that, but it's the way to go for lots of reasons. The goal here was to reduce the ability of the fleet of automobiles to use a third of the fuel they presently use. That's a huge reduction.

But it was a partnership between the government and between the private industry and it required a lot of trust on both sides, still does, and one of the biggest issues of trying to get it done is to keep that trust going on both sides, to really move it and to do it well.

But this was an example of where you've involved not only the Big Three auto companies, but we've also involved a lot of people out of the universities and the technology there. We've involved over 300 other industry partners, which people really don't understand.

These are all of the suppliers to the automobile industry. The people who make the low weight materials, the people who make flywheels, that will hopefully make some of these hybrid cars possible.

So you've involved a lot of people on a very focused program to get it in a relatively short time frame, because we asked them to have a manufacturable prototype in ten years. That is really asking a lot in an industry which makes incremental improvements over fairly large periods of time.

I think they've made a lot of progress. It remains to be seen whether they're actually meet that goal, but that model for getting the industry to work on these efficiencies, I think, clearly,

has to happen, and has to happen in a much more focused way, and much more rapidly than we've done in the past.

For example, let me just talk about a couple of other things in my couple of minutes. We need also to begin to look at some new technologies in the rail industry as well. The railroads today, if you want to understand the problem, if you looked at the news last week on this problem with the railroad right now, where they are so confused they can't get products to where they need to be, this really has a huge negative impact on the economy.

And you look at what we have done in research on new efforts in railroads, and I look at what the Japanese announced last week. They just announced, last week, a new demonstration of their levitated train that runs 295 miles an hour with the kind of energy efficiency you wouldn't believe. We have no research program, even, anymore, in levitation.

So those are the kinds of things, on the

longer range, we need to look at as well.

And one last piece. With respect to the fuel issue, to change from petroleum based, the only other source we have is biomass, frankly, when you really look at all the other options.

And the problem is we've been talking about biomass, using up useable farmland, and in today's world, across the world, that's not very feasible, frankly. To grow enough biomass to phase out petroleum for transportation is just not very feasible. We need that for something else.

But we've learned a lot about plant biology in the last 20 years. We've put a lot of money in basic research.

We know now how to actually translate plants that can be much more CO2 absorption efficient. One of these turns out to be algae, and there's some technology right now that's ready for demonstration, which is ocean-grown algae, where you actually farm the ocean, grow these things most people don't want because they grow fast, and they use up so much CO2. You could harvest those,

process them on the ocean, make methanol and tank it like we do all other liquid fuels.

So there's really major opportunities. The short term is efficiency. The longer term has to be willing to look at some really new ways of looking at how to get fuel. Thank you; appreciate it very much.

PRESIDENT CLINTON: I just might add that--yeah, give her a hand.

[Applause.]

PRESIDENT CLINTON: I just want to make two brief points. The leaders of the Big Three auto companies and the UAW came in to see us last week, and they said they're going to meet their Partnership for the Next Generation Vehicle goal.

The real problem is once they develop a prototype, how quickly can it be mass produced and how will people buy it? And will they buy it at present fuel prices?

We'll come back to that in the end, but, you know, one related question to that is given Americans' buying habits and consumer preferences,

don't we have to include these light trucks, and even heavy trucks in this Partnership for the Next Generation Vehicle? Don't we have to achieve significant fuel efficiencies there as well, if we have any hope of succeeding here?

The only other point I want to make, Mary, is, you know, I'm big on all kinds of fast rail research, but I hope tomorrow's headline isn't "Clinton Advocates More Research On Levitation."

[Laughter.]

PRESIDENT CLINTON: Oh, yeah. I don't need that!

DR. GOOD: We'll have to explain it to them better.

PRESIDENT CLINTON: I'd like to call on Michael Bonsignore, now, to talk about the energy savings available through the use of more high-efficiency products and systems, and also the potential for environmental technology exports.

What he has to say about how applicable and expandable you believe it is, has a lot to do with whether this transition we're going through

will be an economic plus, a drag, or a wash. I personally have always believed it would be a plus, if we did it right. But I'd like to ask Michael to talk about that.

MR. BONSIGNORE: Thank you, Mr. President, Mr. Vice President, Mr. Secretary. It's an honor for Honeywell to be a part of this discussion on global warming and the application of technology to mitigate it.

We do see a very healthy climate, worldwide, for the export of these energy efficiency technologies.

Honeywell's point of relevance here, and point of reference is we've been in the energy efficiency business for 112 years. We operate in 95 countries around the world and about 40 percent of our sales come from outside the United States.

So we see this energy efficiency issue up close in the developed and the developing world, really, across the globe.

The first point I would like to stress is that there are many existing technologies that

could be deployed immediately to reduce energy use and the related emissions that come along with it.

There's no question that the United States leads in environmental technology and this is really a time in the world when the demand for that technology is growing every day.

There's a great social awareness in the developing world for the quality of life, for the quality of the atmosphere, for what the industrial infrastructure increase is going to do, ultimately, to the quality of life in these developing countries.

I would also like to say that energy efficiency is currently the cheapest and the fastest to deploy and that provides us with a tremendous export opportunity as a function of the technology leadership that we demonstrate in so many different areas.

You talked about some of the automotive innovation in your comments this morning, and the low wattage lighting we talk about, lighting controls. Simple things like insulation, that can

make a tremendous difference in terms of energy loss. Air quality control. Programmable thermostats that can make a big difference in terms of reducing energy consumption over a 24 hour period. Energy recovery systems that allow ventilation to occur without the waste of the energy that's been applied to either heat the air or cool the air, before the air is exchanged in the building.

Real time pricing controls that allow large hotels, For example, to schedule their energy consumption at a time when it is the least expensive as a function of the power generation available. Doing the laundry at 2:00 in the morning as opposed to doing it at 6:00 o'clock in the evening when there's high demand.

There is software available now for us to be able to manage the consumption of the energy on a demand profile which makes it most cost-efficient.

The boiler controls we talked about earlier. Process controls to allow us to produce

gasoline, pulp and paper, chemicals, steel and aluminum products with less energy. I think all examples of technology that can be exported.

The second point I'd like to stress is that the developing world is a major element in this overall global warming equation and it must be included in whatever policy gets made, ultimately.

We're talking about two-thirds of the world's population here, and soon, 50 percent of the emissions that will be produced in the world will be produced from the developing countries.

They have the most to gain from the technical assistance and the related financial support that the developed countries can provide, and I'd like to use one very vivid example that I followed personally, since it came to pass. This was in the city of Cracow, in Poland, where the city was quite concerned about the cost of energy, the inefficiency of the energy use, and the impact of that inefficiency on the atmospheric conditions in the city.

Without the assistance of the Department

of Energy to put together a seed demonstration project, this project would probably never have occurred because the city of Cracow was clearly unqualified for any kind of standard commercial financial terms.

And by getting this seed money available from the Department of Energy, we were able to get the Cracow city modernized. It was very significant, a 23 percent reduction in the energy requirements, the emissions in the city, significant reductions in CO2, and other related emissions.

And I think it was a really good example of the need to look for clever and creative ways to bring financing support into the developed world as well as the energy efficiency technology themselves.

I'd like to make just two other points before I close. One is that I think we should do everything possible to develop some kind of a system of credits that encourages people to make these energy efficiency investments early rather

than late.

When one looks at these curves, and sees these curves constantly getting higher and higher in terms of the demand, there may be a resistance to invest now because the future would just require even more investment.

And I think there needs to be a system of credit for these people who are willing to take early initiative to reduce emissions.

And the second point, and last point I'd like to make is the Federal Government really needs to "walk the talk" and take the leadership here. It's the largest consumer of energy in the United States. I think the Alliance To Save Energy demonstrated that the Federal Government wastes one-quarter of the energy it purchases.

That relates to about a billion dollars in annual savings to the Treasury, and millions of tons of CO2 emissions avoided, and I think in the spirit of this whole debate, it's really an opportunity for the Federal Government to step up and take a real position of leadership in this

whole area of energy efficiency.

[Applause.]

VICE PRESIDENT GORE: Let me ask a brief question, if I could, Mr. Bonsignore.

What you've said makes it clear that when there's waste in the form of pollution and waste in the form of CO₂, that that almost always represents economic waste as well. If you're burning raw materials to produce your product, plus a waste stream, if you can figure out a way to reduce the waste stream, whether it's CO₂ or some other form of pollution, and put a higher percentage of your raw materials into the production of your product, that's going to benefit you, economically, at the same time it benefits the environment. Correct?

MR. BONSIGNORE: Correct.

VICE PRESIDENT GORE: Now a lot of economics analysts will say, you know, if it's as easy as you say, then since this information about this opportunity is available to people, why haven't they done it already? You've been in the business of trying to turn on the light bulb for

potential customers and tell them this. Why hasn't it happened more quickly already?

We heard earlier from Mr. Casten about the role monopolies have played in holding it back, but what are some of the other obstacles?

MR. BONSIGNORE: Well, I think, my sense is in the United States that we still have not been able to raise the level of awareness for the consumer of the real cost of energy--the real cost of energy in its total dimension.

One only has to go into a gas pump in Belgium--and I lived in Europe for five years--and pay \$4 a gallon for gasoline, to really understand the real cost of energy.

So I think there's a public awareness issue in the United States that needs to be dealt with and my feeling is that this whole debate about global warming, regardless of where it goes, ultimately, may serve to heighten the awareness in the American public of what the real cost of energy in its total dimension is.

But I would also say that we're quite

encouraged by the degree to which this energy efficiency technology is being embraced now.

A very poignant example in Beijing, where, as the quality of life in Beijing comes up as the Chinese economy accelerates, the Chinese people living in Beijing don't want to breathe dirty air, and they apply a tremendous amount of pressure on their officials and on the government to do something about the quality of air in Beijing. And so there's a real social motivation, far beyond the economic motivation, to really do something with some of these technologies.

And I think at the end of the day, those are the incremental steps that will help us embrace these opportunities.

VICE PRESIDENT GORE: Thank you very much. I think next on our program is Mason Willrich. Have I pronounced your name correctly?

MR. WILLRICH: That's right.

VICE PRESIDENT GORE: And he is the CEO of EnergyWorks, which is a joint venture involving Bechtel, the famous international engineering firm,

and Pacific Corp., a major electric utility of course. And EnergyWorks develops alternative energy projects, domestically, and internationally.

What do you see as the potential for these new alternative energy sources?

MR. WILLRICH: Mr. Vice President, Mr. President, it's a pleasure for me to be here, and to talk to you a bit about renewable energy sources.

Let me start with just reminding ourselves that fossil fuels do, today, account for 85 percent of world energy consumption, and unless we change dramatically, as the amount of energy consumed overall in the world goes up, we are going to have that same fraction for the indefinite future.

I think a major alternative is to expand our use of renewable energy from a few percent today to a large fraction of the world's energy consumption in the 21st century. Let me give some examples of expansion.

Take wind, where there are now an array of modern turbines available, we have large wind farms

in California. One of the best resources in the United States for wind energy on a large scale is in the Middle West. Outside the United States, there are excellent wind regimes in Europe, in Spain, off of Germany and the North Sea, also in China and Argentina. So we needed to expand wind.

We need to expand the use of solar energy. Solar photovoltaic panels, Mr. President, these convert sunlight directly into electricity. They are now used for telecommunications from remote areas, also telecommunications from our freeways. We need to expand, wherever cost effective, the use of solar photovoltaics, not just 1 million roofs in the United States, but, rather, throughout the world, and I believe that this would enable us for the first time to play a major role in bringing electricity to the 2 billion people out there that do not have access to electricity, and in a form that would not contribute to greenhouse gas emissions, and this is in the continents of Asia, Latin America, and, of course, Africa.

Thirdly, biomass. We are using,

increasingly, the waste products from agricultural for our forest products industry, sugar cane, walnut shells, wood chips. We need to move through the adoption of gassification technologies into a more efficient use of our biomass resources, and we can at that point establish energy plantations on the marginal agricultural lands in the U.S. and also bring in biomass in several developing countries such as South China, India, and Brazil.

To begin a transition, I would suggest a goal of 10 percent annual additions to electricity generation coming from renewable energy technologies, aside from large hydro projects, and I suggest we reach that goal within the next 10 years. We should do it by providing our consumers in the United States, electricity consumers, with a choice of who they wish to buy their electricity from in a more competitive industry. I believe that that will create a circumstance where our consumers will pay premiums prices for energy derived from so-called green energy resources, and it will provide a market-driven renewable energy

industry.

In the developing countries, I suggest that we need to continue to support the restructuring of the electricity industries in those countries. That will provide an opportunity to lay the basis for the kind of leapfrog in the developing countries where they can put in the infrastructure in the first instance in an efficient way and in a way in which it will have small modular electric generation and ultimately the basis for moving heavily into the renewable energy area.

Finally, Mr. President, I am not running for office. I have no intention of running for office. However, I believe that we should reform energy prices through charges on carbon emissions. The use of various forms of fossil energy now imposes large health and environmental costs on all societies, and these are not reflected in the prices that consumers currently pay. So we are underpricing fossil energy, and that is perhaps the largest barrier to a transition to these

alternatives that we all want to achieve.

I think that these that are initially low should be part of the proposal that we carry with us as a leader in the Kyoto conference.

Thank you, Mr. Chairman.

[Applause.]

PRESIDENT CLINTON: I want to respond to that, but, first, I want Larry Papay to talk about some of the long-range technologies that are on the drawing board now and what he thinks the Government's role should be, what else should we do, how much more should we spend on R&D, how should we spend it, how should we target it, and what are the likely returns going to be, and what contribution can they make to any--to fulfilling any commitment we might make in Kyoto.

MR. PAPAY: Thank you, Mr. Vice President and Mr. President.

Back in January when you asked your Council of Advisors on Science and Technology to look at energy R&D, specifically looking to the 21st century, a panel was formed, and as was

mentioned, John Holdren chaired that, 21 people on the panel, people from industry, people from the national labs and other parts of Government, people from academia, people on sort of the hard side of technology and the soft side.

There are several energy challenges in the slide that is up that lists these, and, of course, we are here today speaking about global warming, but it should be pointed out that in solving one problem, you can solve several.

Take energy security, for example. In an unconstrained oil economy, going from about 8-1/2 million barrels per day of imports probably to about 16 million barrels per day in 2030, if you were to introduce the technologies which also reduce carbon emissions, as well as reduce the importation of oil, you could probably cut that by more than half. And one of the projections in the PCAST report talks about reducing it by more than 10 million barrels of oil.

There is a point up there on U.S. science and technology leadership, which is also extremely

important. About 7 or 8 percent of the gross economy, not only in this country, but around the world, deals with energy, and as mentioned by prior speakers, there is an awful lot of growth occurring because energy drives the economic engine in these countries.

Over several hundred billions of dollars annually are spent for the introduction of energy technologies in countries around the world, and there is no reason why the United States can't have a leadership position in that. And it also will go to help stabilize these economies.

The next slide speaks about--a little bit about the technologies that we examined in the PCAST panel review. We looked at efficiency renewables, fossil and nuclear. We talked about a PMGV-2, to push the limits there even further. We talked about heavy trucks. We talked about light trucks. We have got programs in there for photovoltaics and wind, and zero-net-energy houses.

On the fossil side, we have got a Vision 21, which the Department has come up with for coal,

because coal is a resource that is going to be used around the world simply because it is a resource that exists around the world, and the point there is, make it as efficient as possible and use it in a cogeneration application, as Michael has mentioned earlier.

And in nuclear, both on the fission and the fusion side, we talk about aggressive programs. Fusion has got a longer time frame, but, even with fission, we need to look about--we need to look at advanced systems, systems which are proliferation-resistant because, let's face it, fission reactors are zero carbon emitters.

There is one last point about how you complement the program, and the program that is in the PCAST report talks about an increase of about a billion dollars annually in the R&D budget, small potatoes from an insurance policy point of view, but there is a complement to that, and that is the commercialization aspect.

Most R&D programs have a little triangle in the lower right which says it has now been

proven, now just go out and commercialize. There is still a small hill to climb there, whether it is by Federal buy-down, cap and trade systems, auctions, renewable portfolio standards, things of these sorts, which will help buy down that initial high-priced energy technology and bring it into the commercial marketplace.

The last slide talks about what some of the impacts could be in the mid to long term for selected energy technologies that we examined in the PCAST report.

I apologize to all of you. You need to get a copy of the PCAST report, which will help reduce budget deficits, and you can look at in detail what we are talking about.

What we have here on the bottom are what the costs would be on a net-present-value basis for selected technologies. The wedge is going up. Look at the potential impact, and it is a rather simplistic approach, but the potential impact in savings that could be realized by the introduction of those technologies, it is simplistic because it

doesn't look at cross-competition from one technology to another. But it does show you that there can be significant reductions in CO2 emissions by the introduction of these advanced technologies.

It is an exciting time. Energy technology is an exciting area, and for the students in the audience, look forward to it as a career.

Thank you.

[Applause.]

PRESIDENT CLINTON: Let me--we need to wrap up. We are running a little bit late, but I wanted to just give everyone an opportunity to comment on this.

Mason was the only person who I think explicitly said that, in order to make this transition, we need to raise the price of carbon-based products.

One of the difficulties we are having within the administration in reaching a proper judgment about what position to stake out in Kyoto relates to how various people are responding,

frankly, to the recommendations and the findings of the people coming out of the energy labs because they say, hey, look, what we know already shows you that we have readily available technologies and courses of action, which would take a huge hunk out of--right now, with no great increased cost--a huge hunk out of any attempt to, let's say, flatten our greenhouse gas emissions at 1990 levels.

We just head about it today. Look at what you can do. The powerplants, you can recapture the waste, two-thirds of that. You can make buildings and manufacturing facilities and residences much more energy efficient. You can make transportation much more energy efficient. Besides that, we have got all of these alternative sources of fuel for electricity and transportation. I mean, it is all out there. This is what we know now. Then, sooner or later, we are going to have the Partnership for a Next Generation Vehicle.

So the question is always, though, who will buy this stuff. I mean, right now you can buy light bulbs. Every one of us could have every

light bulb in our home right now, every single one of them. We would have to pay 60-percent more for the light bulb, but it would have three times the useful life. Therefore, you just work it out. It would literally--we'd pay more up front. We'd save more money in the long run, and we'd use a whole lot less carbon.

And why don't we do it? Why do we have any other kind of light bulbs in our home? And that is the simplest example of the nature of the debate we are now having. That is, in order to get from here to where we want to go, do we have to either raise the price of the product--there are only three or four things you can do. You can raise the price of the product to the consumers. You can lower the price of the alternative thing you wish to be bought by the consumers. You can create some new business opportunity through some market-permit-trading, other market option, or otherwise change the business environment, the way we do electric deregulation, for example, or you can somehow increase the awareness of consumers of

what their options are and the consequences of that and hope that they will behave in a different way.

I think those are the four categories of possibilities, and if you choose an ambitious target, then if the requirement is almost--to reach the target, it is almost exclusively on the front end, that is, you have to raise the price to the consumer or to the business involved--the businesses may be a consumer--if it happens too quickly, you're going to do economic damage on the one hand, and on the other hand, there's no way in the world this Senate will ratify our participation in Kyoto. So it will be out there to create it. It will be a grand gesture, but it won't happen.

Therefore, we have got to know how much we can do through a combination of price. You might be able to get some price changes, particularly going back--Mike said this, too, on the real price of energy--particularly if it was not a net tax increase. You wouldn't have to have a net. There are a lot of other ways to do this, but we have to be able to get something out of either lowering the

cost to the alternative, creating new business markets, or increasing consumer awareness of what is right there for them now and what the consequences are.

We can't do it all on the front end and expect realistically--if all we do on the consumer price index, raising the price of coal, raising the price of oil to the real consumer, and that is all we do, we are not going to get what we want to do in the time allotted to get it because it either won't pass the Senate or it won't pass muster with the American people.

So we have to be able to access what the Energy Department tells us is there for all to see in other ways, and I don't know if any of you want to comment on that, but this is not a question of whether you are brave or not. It is really a question of what we can get done and what realistically is going to happen in America, but I am plagued by the example of the light bulb I have in my living room at the White House that I read under at night, and I ask myself why isn't every

light bulb in the White House like this.

I use this one. I am pleased. I get so ticketed. I go in and turn it on, and I measure how much longer it takes to really light up, but I know it's going to be there long gone, you know.

[Laughter.]

PRESIDENT CLINTON: All of a sudden, it's a great thing, and I say why am I so irresponsible that I have not put this in every light bulb. Why are we not all doing this?

So, when you get right down to it, now, this is where the rubber meets the road. We have to make a decision, a commitment. It has to be meaningful. I am convinced that the Energy Department and lab people are absolutely right, but the skeptics on my economic team said there will not be perfect substitution. They are not going to do it.

So, if you want to say anything about that, you can, but, when you get right down to it, that's where all of these decisions are going to be made, based on our best judgment about what kind of

markets we can create for the private sectors, what kind of substitution there is, and whether we can--how quickly we can move to alternative energy sources that people will actually access.

So you commented, and, Michael, you did. Does anybody else want to say anything else about this?

MR. WILLRICH: [In progress] dollars and it created a whole market to figure out how to do it.

I think we can come up with a way to say no more carbon and it's going to ratchet down. Then just let the market figure out ways to trade permits to get there. The model worked with sulfur. I think it can work here.

PRESIDENT CLINTON: It worked superbly with sulfur.

What do you say to the people who--we had a great debate. We argued this for an hour and a half in the Oval Office the other day. I probably shouldn't admit that. We did.

[Laughter.]

PRESIDENT CLINTON: Anyway, you should feel good that we argue these things in good faith. That should give you confidence. You should feel good about this.

[Applause.]

PRESIDENT CLINTON: What is your answer to the attack on that or, at least, the counter that, sulfur was this big a problem and carbon was this big a problem and you're talking about a huge section of the economy and it will be much more difficult to construct and administer and see it work, a marketing system, a permeating system with carbon than it was with sulfur?

MR. CASTEN: As an entrepreneur, Mr. President, I'm delighted because it's such a much bigger sector, that there's many more opportunities to find ways to block it.

[Applause and laughter.]

PRESIDENT CLINTON: That's what I said. I wish you had been there with us.

[Laughter.]

PRESIDENT CLINTON: Anybody else want to

comment on this?

DR. PAPAY: No, I tend to agree with what Tom said. It does not have to be that large. I think the fear is that, you need hundreds and hundreds of dollars per ton of carbon. Actually, in fact, if you introduce it, you begin to send a signal and the fact is, the market will, although imperfect, will begin to work. You begin to see these advance technologies begin to come in behind.

If there is no signal given, the market will be indifferent to it.

VICE PRESIDENT GORE: If I could just add a brief point.

We have all been struck by what has happened in the information industries with the introduction of microprocessors and the better understanding of how systems operate with the cost of microchips being cut in half and the power of microchips doubling every 18 months. And, of course, there was an announcement a few weeks ago where they now say, well, they think maybe it will go faster than that.

There are lots of companies where large groups of people who were organized just for the purpose of moving information around have been greatly affected by the fact that, now, with microprocessors, we can use information so much more efficiently that everything is different.

Why isn't the same thing going to happen with energy that has happened with information? With the better understanding of systems, with the use of microprocessors in the flows of fuel and the flows of electricity--yes, sir?

DR. PAPAY: The problem--and John mentioned it in the first panel. There is such an infrastructure built out there, buildings and industries and power plants and et cetera, even automobiles, what is the lifetime? We change out the information infrastructure in a three to five-year period. The energy infrastructure tends to work on a much longer time frame. So, if you don't affect it today, the ability to affect it in the future will be impeded simply because it becomes much more massive with time. It takes time to do

it. So, if you don't start now, if you delay, you delay and you're dealing with a larger problem because the rest of the world will continue to build using existing technologies.

DR. YEAGER: If I might just add that, I think in what has been noted as an increasingly competitive environment, we need incentives or the prompt turnover of this capital stock rather than to necessarily let it run on indefinitely. Right now, the incentives are to run it indefinitely rather than to turn it over.

Secondly, I think he have to remember that this problem needs to be done in a global context. We are really trying to solve what I call the trilemma of population, poverty and pollution on a global scale. It is a joint implementation, the ability to invest what are always going to be limited resources where we get the biggest bang for the buck, make the biggest difference in terms of improving quality of life create markets on a global scale. In short, to do well by doing good seems to me to be an important principle that we

ought to be carrying to the world.

PRESIDENT CLINTON: I strongly agree with that and we're pushing that. Again, I say that does not let us off the hook to do things here at home. It just makes good sense. It's easier for these other--we should give these other countries a chance to choose an alternative path.

I never will forget. A couple of years ago--and I know we have to wrap up. I had a fascinating conversation with the President of China a couple of years ago and we were discussing what our future would be and whether we wished to contain China. I said, I don't wish to contain China. I said, the biggest security threat that China presents to the United States is that you will insist on getting rich the same way we did.

[Laughter.]

PRESIDENT CLINTON: He looked at me and I could tell that he had never thought of that. I said, you have to choose a different future and we have to help. We have to support you. That does not in any way let us off the hook, but it just

means that we have to do this together.

Well, this has been fascinating. You guys have been great and I thank you a lot.

[Applause.]

MODERATOR: Ladies and gentlemen, the breakout sessions will begin immediately in the Leary Center. Ushers will be downstairs and outside to direct you to the center. Your individual breakout groups are listed in your program. We will resume the afternoon session here, in Gaston Hall, at 2:10 p.m.

[Recess.]

MODERATOR: Ladies and gentlemen, please take your seats at this time.

Ladies and gentlemen, the First Lady of the United States, accompanied by Ambassador Robert Gallucci, Dean of Georgetown's School of Foreign Service.

[Applause.]

MR. GALLUCCI: Mrs. Clinton, distinguished guests, distinguished panelists, ladies and gentlemen, good afternoon. I'm Bob Gallucci, Dean

of the Edmond A. Walsh School of Foreign Service at Georgetown University. On behalf of the faculty and the staff and the students, I'd like to welcome you this afternoon to Georgetown for the second session of the White House Conference on Global Climate Change.

It is fitting, I think, that this conference would take place at Georgetown. An issue of this importance demands research, education, dialogue and that is what this university is all about. The school of Foreign Service is particularly about interdisciplinary study and the application of theory to practical problems, to the world of policy.

Our Science and Technology in International Affairs Program seeks to prepare our students for the challenges and opportunities that await the next generation of leaders in the global community. Some of those students are here today and some of them, no doubt, will be called upon to confront the issues we are here today to discuss.

If this morning's first panelist, John